Draft

Environmental Impact Statement /

Overseas Environmental Impact Statement

GUAM AND CNMI MILITARY RELOCATION

Relocating Marines from Okinawa,
Visiting Aircraft Carrier Berthing, and
Army Air and Missile Defense Task Force

Volume 4: Aircraft Carrier Berthing

November 2009

Comments may be submitted to:

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Guam and CNMI Military Relocation EIS/OEIS

Volume 4: Aircraft Carrier Berthing

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CHAPTER 1.
PURPOSE OF AND NEED FOR ACTION

1.1 INTRODUCTION

1.1.1 Introduction to Proposed Action

Volume 4 focuses on the proposed construction of a new deep-draft wharf with shoreside infrastructure improvements, creating the capability to support a transient nuclear powered aircraft carrier in Apra Harbor, Guam.

The aircraft carrier is manned by over 5,600 military personnel and is accompanied by aircraft and escort ships, collectively referred to as a Carrier Strike Group (CSG). The number of port visits and duration of visits to Apra Harbor by an aircraft carrier has varied throughout the past 10 years because of operational requirements. For example, in 2008, the schedule included four visits for 4 days each (Port Operations 2008). Apra Harbor currently supports an average of two CSG port calls for an average of up to 7 days in duration per year, though actual port visits and durations are subject to change based upon Fleet operational requirements.

Under the proposed action with a transient-capable port, the aircraft carrier would visit for a cumulative total of up to 63 visit days per year, with an anticipated length of 21 days or less per visit. This capability is required to support increased aircraft carrier operational requirements in the Western Pacific and Indian Oceans. Previous nuclear powered aircraft carrier berthing has been at Kilo Wharf. However, the longer transient visits would interfere with existing munitions operations and therefore require a new deep-draft wharf that can accommodate the transient aircraft carrier. Additionally, due to the length of a transient visit, shoreside infrastructure for utilities (i.e., power, wastewater management, potable water supply) must be improved to minimize or eliminate reliance on shipboard systems while in port.

This Volume is organized as follows.

- *Chapter 1:* Purpose of and Need for Action. This chapter states the purpose of and need for the proposed action and presents background information about the proposed action.
- *Chapter 2:* Proposed Action and Alternatives. This chapter describes the siting criteria and the screening process to evaluate and identify the reasonable alternatives, the proposed action and reasonable alternatives, and the no-action alternative.
- *Chapters 3-19:* Resource Sections. These chapters describe existing conditions and identify potential impacts to the respective resources:
  - Chapter 3: Geological and Soil Resources
  - Chapter 4: Water Resources
  - Chapter 5: Air Quality
  - Chapter 6: Noise
  - Chapter 7: Airspace
  - Chapter 8: Land and Submerged Lands Use
  - Chapter 9: Recreational Resources
  - Chapter 10: Terrestrial Biological Resources
  - Chapter 11: Marine Biological Resources

- Chapter 12: Cultural Resources
- Chapter 13: Visual Resources
- Chapter 14: Marine Transportation. (Volume 6 covers roadway transportation)
- Chapter 15: Utilities
- Chapter 16: Socioeconomics and General Services
- Chapter 17: Hazardous Materials and Waste
- Chapter 18: Public Health and Safety
- Chapter 19: Environmental Justice and the Protection of Children
- Chapter 20: References

1.1.2 Purpose and Need

As discussed in Volume 1, the overarching purpose for the proposed actions is to locate United States (U.S.) military forces to meet international agreement and treaty requirements and to fulfill U.S. national security policy requirements to provide mutual defense, deter aggression, and dissuade coercion in the Western Pacific Region. The need for the proposed actions is to meet the following criteria based on U.S. policy, international agreements, and treaties:

- Position U.S. forces to defend the homeland including the U.S. Pacific territories
- Provide a location within a timely response range
- Maintain regional stability, peace and security
- Maintain flexibility to respond to regional threats
- Provide a powerful U.S. presence in the Pacific region
- Increase aircraft carrier presence in the Western Pacific
- Defend U.S., Japan, and other allies' interests
- Provide capabilities that enhance global mobility to meet contingencies around the world
- Have a strong local command and control structure

The proposed action creating a capability in Guam to support a transient nuclear powered aircraft carrier would provide greater aircraft carrier presence in the Pacific region through enhanced rotational presence and would meet the overarching purpose and need.

1.1.3 Global Perspective

Aircraft carriers are deployed worldwide in support of U.S. interests and commitments. Aircraft carriers are generally the first to respond to a crisis (Navy 2009). They can respond to global crises in ways ranging from deterrence through their presence in peacetime to launching operations in support of armed conflict. Together with their on-board air wing (including a mixture of different aircraft, air logistics, weapons, maintenance support and administrative functions) the carriers have vital roles across the full spectrum of conflict. U.S. aircraft carriers and other warships are recognized as sovereign U.S. territory. While the U.S. military would have to make special arrangements with a foreign nation to set up a land military base or airfield, it can move a carrier and its CSG all over the globe to project power from the sea in accordance with the Navy's "Sea Power 21" vision (Navy 2002). Naval aircraft, including bombers and fighters, can fly a variety of missions into enemy territory and then return to the carrier. In most cases, the Navy can continually replenish (resupply) the CSG, allowing it to maintain its position for extended periods of time. Eventually, however, the ships must return to a port for maintenance and crew rest.

1.1.3.1 Background

The employment of an aircraft carrier and its associated CSG are integral to supporting U.S. interests and meeting treaty and alliance requirements, both globally and regionally. The aircraft carrier's mission is to:

- Provide a credible, sustainable, independent presence and conventional deterrence in peacetime
- Operate as the cornerstone of joint/allied maritime expeditionary forces in times of crisis
- Launch and support aircraft attacks on enemies, protect friendly forces, and engage in sustained independent operations in war (Navy 2009)

As discussed in Volume 1, the Navy's proposed action is based upon treaty and alliance requirements and the Department of Defense's (DoD) Quadrennial Defense Review (QDR). One of the QDR conceptual policy initiatives is that the U.S. should strive to position strike forces, which include aircraft carrier and airwing capabilities, in forward locations that support flexibility and speed of response to anywhere in an unpredictable environment. The Pentagon's strategic QDR of 2006 stated the following:

> *"The Fleet will have a greater presence in the Pacific Ocean consistent with the global shift of trade and transport. Accordingly, the Navy plans to adjust its force posture and basing to position at least 6 operationally available and sustainable carriers and 60% of its submarines in the Pacific to support engagement presence and deterrence."*

This guidance reflected a need to supplement existing ship deployments and the aircraft carrier base (homeport) in the Pacific. The policy initiative of the QDR was to provide a near continuous presence of multiple carrier strike groups in the Western Pacific and/or Indian Ocean. Accordingly, the Navy began to identify how to meet: 1) treaty and alliance requirements, as well as the QDR, 2) freedom of action (use of a base without restrictions, including implementation of force protection measures to deter/avoid terrorist attacks), and 3) response times to potential areas of conflict. Starting in 2005 the U.S. Navy began exercising this concept of operations by developing a series of multi-carrier strike group exercises commonly known as "Valiant Shield" in the Marianas Islands. Traditional thinking had been, to assure continuous military presence in an area, a ship or forces needed to have a forward homeport or base from which to operate. The U.S. Navy, however, validated the concept of continuous rotation of strike groups to increase presence in the region as desired by the QDR. To support the continual rotational presence, a new concept was developed: a transient-capable port that would provide maintenance and logistics support for aircraft carriers close to the area of responsibility (AOR). The proposed transient port capability in Guam, as discussed below, fulfills the operational requirement for continuous strike capability without the financial, political, and environmental issues associated with a forward homeport.

The Navy currently bases (homeports) six aircraft carriers in the Pacific AOR: three in San Diego, California; two in Washington State; and one in Yokosuka, Japan (Figure 1.1-1). A homeport provides the full plethora of support services to the ship and airwing and the dependent families of personnel assigned to the carrier strike group. These services include full depot level maintenance, quality of life support services for dependents, and other related services. When ships deploy they visit other harbors. The length of stay, reasons for stay and other factors determine whether the visit is characterized as a "port" visit or "transient" visit. The length of stay and purpose of a visit are dictated by military mission requirements. Port visits are brief and may be determined by international political concerns, operational requirements and other factors.

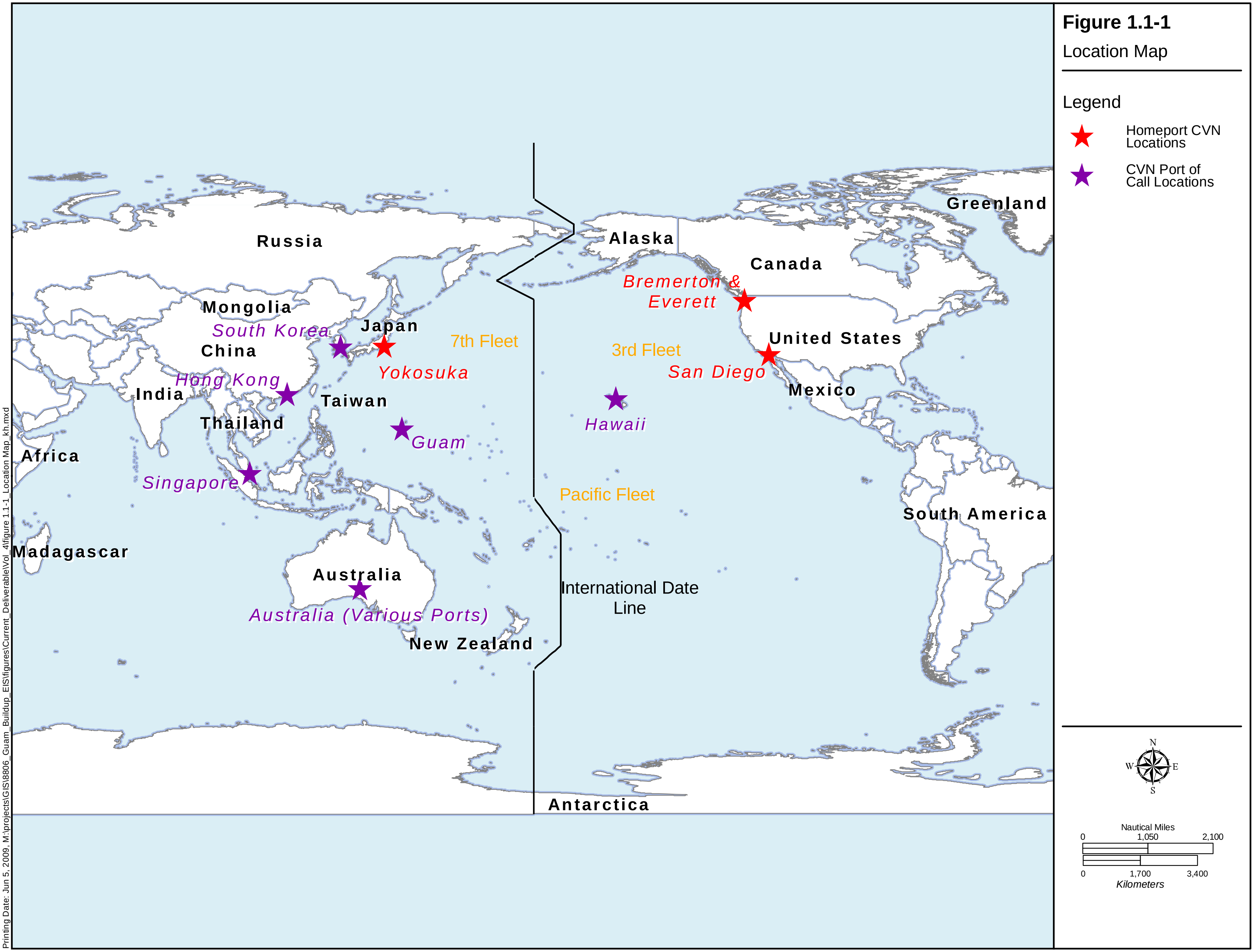

Figure 1.1-1
Location Map

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Port visits require minimal or no shoreside support and do not necessarily require a berth. When port visits are made to locations without an available berth (anchorages), there is limited time and capability for ship maintenance and crew rest. Because a port visit is brief and independent of shoreside utility support, the aircraft carrier has the ability to get underway with minimal delay. This ability to mobilize quickly is an important force protection consideration, allowing CSG port visits to take place in foreign locations.

In contrast to port visits, the Navy proposes to develop a transient berthing capability which provides the ship and carrier airwing operational support requirements, including emergent (unscheduled) repair and maintenance capabilities and crew quality of life. There would be no dependent quality of life support nor full depot maintenance as this support is provided at the ship's homeport. To accomplish a transient capability, a berth is required with full "hotel services" for the ship and the ability to ensure quality of life and safety for the crew and ship for a duration of stay longer than is normal for a port visit. These longer stays with a ship relying on shoreside utilities increase force protection concerns; however, the advantage of a transient port capability is that a ship can be re-supplied or maintained without returning to its homeport. Development of a transient-capable port close to the AOR increases aircraft carrier presence, as required by the QDR, by reducing the non-availability that occurs when a carrier must perform a long transit to its homeport. The creation of a transient-capable port comes without the expense, political or environmental concerns raised by creation of a forward homeport. It also maintains adequate response times to potential conflicts.

1.1.3.2 Treaty and Alliance Requirements

Five of the seven U.S. Mutual Defense Treaties are with countries in the Western Pacific: the Philippines, Australia/New Zealand (joint treaty), Korea, Japan, and Thailand. For example, the U.S.–Japan (1960) treaty, known as the *Treaty of Mutual Cooperation and Security*, contains general provisions on the further development of international cooperation and on improved future economic cooperation. Both parties assumed an obligation to maintain and develop their capacities to resist armed attack and assist each other in the event of an armed attack on Japanese territories. This provision is carefully crafted to be consistent with Japan's Constitution that limits its military capabilities to defensive capabilities only. U.S. treaty commitments with the other nations listed above also require a timely response to incidents and a consistent U.S. presence of force as a deterrent in the Pacific region.

The Pacific Fleet's AOR extends from the west coast of the contiguous U.S. to the eastern shore of Africa. The AOR includes the world's five largest foreign armed forces: People's Republic of China, Russia, India, North Korea and Korea. More than half of the world's population lives within the AOR. In addition, more than 80% of the population within the Fleet's AOR lives within 500 miles of the oceans and more than 70% of the world's natural disasters occur in this region (Navy 2008).

When the Navy examined potential locations to support a greater carrier presence in the Pacific, it was mindful of the critical precept of the Integrated Global Presence and Basing Strategy to place visiting U.S. forces only where those U.S. forces are wanted and welcomed by the host government. Accordingly, because some countries within the region have indicated their hesitancy and inability to host more U.S. forces on their lands, the U.S. military shifted its focus to basing on U.S. sovereign soil.

1.1.3.3 Freedom of Action and Force Protection

In the context of creating a transient-capable port, as discussed above, a crucial factor is freedom of action. Freedom of action is the ability of the U.S. to use ports, training facilities, and bases (including the ability to re-supply and conduct mid-level maintenance), freely and without restriction at a particular locale, as well as affording the U.S. the ability to engage in force protection, rapid force posture movements, and contingency response. U.S. relations in the Pacific and Indian Ocean regions are based upon multiple bilateral treaties and international law. Within this legal framework, the U.S. and its Pacific allies have mutual defense commitments; however, access and level of support varies for like operations throughout the region. In short, U.S. forces responding to contingencies still have greater freedom of action when responding from U.S. territory.

The reliance on shoreside utility support for a transient-capable port reduces the aircraft carrier's ability to get underway quickly. Compared to port visits, the longer berthing times and the delay in getting underway are important considerations for force protection. The CSG concentrates a large contingent of military personnel (greater than 7,000) along with hundreds of millions of dollars of military assets when it is in a transient port, so force protection is critical. In assessing possible locations for transient-capable ports, the unique requirements for emergent (unscheduled) repairs, full shoreside utility support, and the increased force protection and security requirements that accompany the longer duration of visits make U.S. sovereign locations for the transient-capable port preferable.

Force protection concerns increase as the duration of the visit increases. Given the importance of the CSG, the Navy determined that it must have maximum flexibility to protect the CSG. While force protection concerns are met in foreign ports, accomplishment of this requirement is more feasible in U.S. territory. Under these criteria, force protection can be more easily met in Guam, Hawaii, Washington, and California; therefore, these areas are preferred over other countries because they provide the most flexibility in the combined requirements for force protection and freedom of action.

1.1.3.4 Response Times

To meet the QDR stated policy initiatives, a comparative analysis of the potential response times from existing homeports and traditional port visit locations was conducted. The travel distances depicted in Figure 1.1-2 and the response times in Table 1.1-1 show the challenge of siting a transient-capable port to ensure that aircraft carriers can rapidly respond to a crisis in the Western Pacific while providing for the critical freedom of action and force protection requirements this asset requires. Ports in the region that have previously accommodated U.S. aircraft carriers for brief port visits were considered as potential locations for a transient port. Non-U.S. ports that have had port visits in the Western Pacific are located in Australia, Singapore, Hong Kong, and Japan. U.S. port locations that already support aircraft carriers include Hawaii, Guam, Washington, and California. Hawaii is located approximately 3,300 nautical miles (nm) (6,160 kilometers [km]) northeast of Guam in the opposite direction of the Western Pacific/Indian Ocean AOR. Hawaii is also outside of the AOR for Western Pacific operations. Transit times from the AOR to the West Coast are even longer. The transit time nearly doubles from Guam to Hawaii and again from Hawaii to California. Because of this additional transit time, restriction of transient-capable ports to Hawaii or California would significantly strain the capability to rapidly respond to a crisis in the Western Pacific or Indian Ocean. Accordingly, these locations were eliminated from further consideration based on their inability to meet the purpose of and need for the proposed action. Australia, Singapore, Hong Kong, Japan, and Guam are much closer to potential crises areas and the response times would be significantly shorter; therefore, they were retained as potential locations for development of extended aircraft carrier transient capabilities.

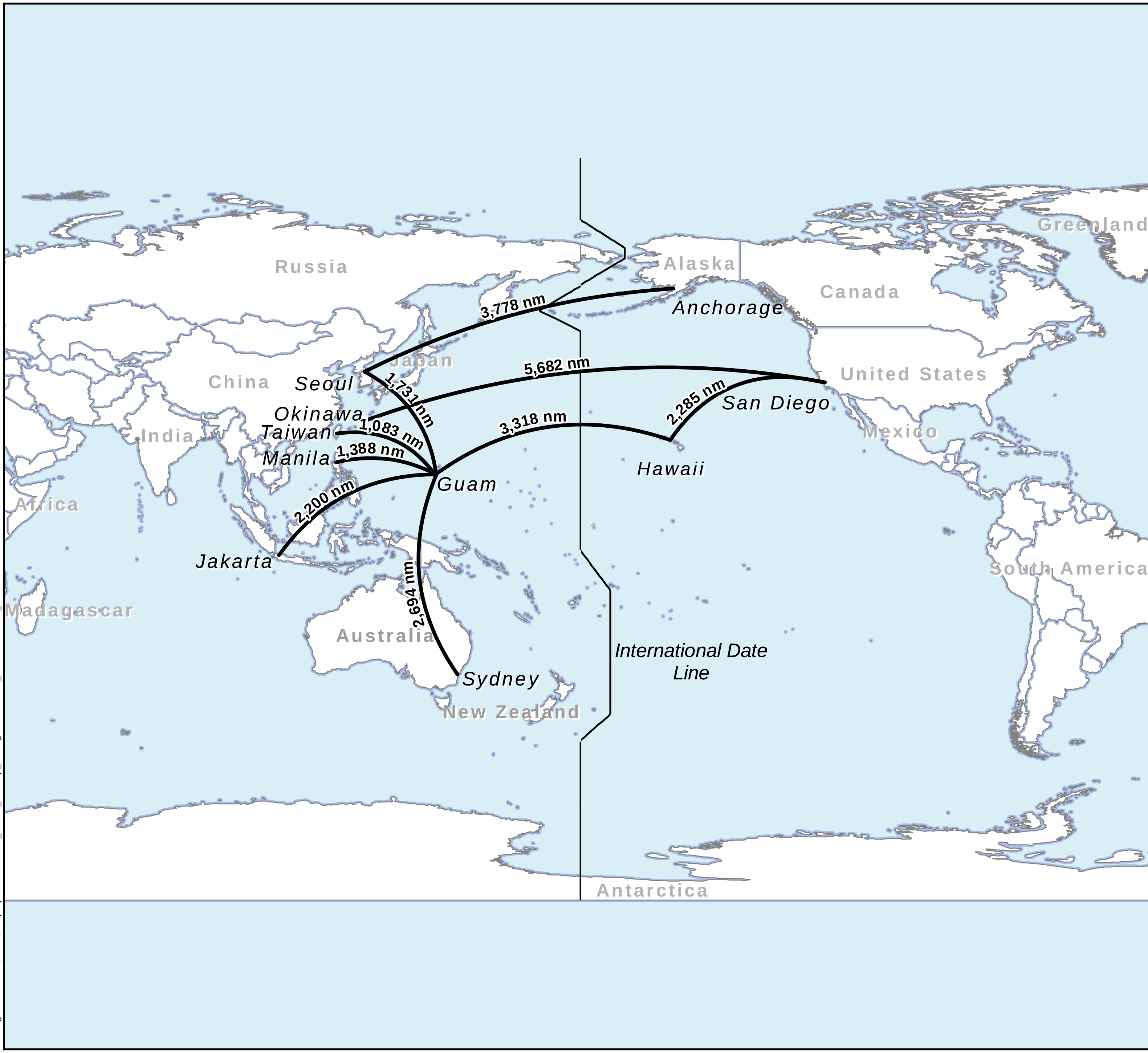

Figure 1.1-2
Travel Distances within the Pacific Region

Source: Navy 2009

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Table 1.1-1. Representative Response Times to Southeast Asia by Sea

	Hawaii	*Alaska*	*California*	*Guam*
Sea Deployment [1]				
Okinawa	8.5 days	N/A[2]	15 days	3.8 days
Taiwan	9.6 days	N/A[2]	16 days	5 days

Notes:
[1] Sea deployment times are based on ship speed of 20 knots (23 mph).
[2] There are no seaports in Alaska capable of CSG deployment.
Source: Navy 2008.

Utilization of a location in the Western Pacific would satisfy the QDR given that maintenance and supplies would be obtained closer to the area of operations, in effect, increasing the availability and presence of carriers in the Pacific due to the reduction in transits to other locations outside of the Western Pacific AOR. The greater availability and presence would enable quick responses to potential crises due to short travel times and distances to our allied nations and potential hot spots within the region.

1.1.3.5 Summary of Global Alternatives Analysis for Proposed Transient-Capable Port

Overall, Guam, Hawaii, California, and Washington pose no limitation on freedom of action, and all have some available infrastructure to support an aircraft carrier visit. None, however, except for California and Washington, which are presently aircraft carrier homeport locations, have an aircraft carrier transient-capable pier. California, Washington, and Hawaii locations, however, would increase response times compared with locations within the Western Pacific AOR and constrain the U.S. ability to uphold treaty obligations. Those treaty obligations require that certain forces be within range to project power, to deter aggression and dissuade coercion in the Western Pacific. The aircraft carrier homeport in Japan is within the desired range; however, this pier is a dedicated homeported nuclear powered aircraft carrier pier and there is no additional capability to meet the needs of a transient nuclear powered aircraft carrier as specified by the QDR. Guam is close enough to many of the likely contingency areas in the region and potential threats to ensure rapid response, comply with treaty obligations, and assure the deterrent presence that U.S. forces bring to the region. Development of a transient port capability in Guam, because of the proximity of Guam to the Western Pacific/Indian Ocean AOR, would enable multiple CSGs to maximize time in the Western Pacific/Indian Ocean AOR. Transient port capability meets the defense and national security policy initiatives of the QDR. Finally, because Guam is U.S. sovereign territory, the combined requirements of freedom of action and force protection can be met while meeting the required operational flexibility.

Guam is a suitable base for a transient-capable berth for the following additional reasons.

- Guam maintains adequate infrastructure for shoreside utilities.
- Naval Base Guam already possesses emergent nuclear repair, radiation response and radioactive waste management capabilities.
- Guam has an existing logistics support network through the Defense Logistics Agency that is co-located on Naval Base Guam. While in port, the aircraft carrier continues to support the on-board military personnel while continuing its daily operations and maintenance of the ship and its aircraft. Food and other supplies must be reliably available for the ship.
- Guam provides adequate quality of life amenities. One of the primary reasons for the extended transient port visits is to provide for quality of life for Sailors and airmen deployed for extended periods of time to the Western Pacific associated with enhanced rotational presence. Studies have shown that extended deployments at sea may have detrimental effects on individual readiness unless adequate shoreside quality of life amenities are available for

rest and relaxation when the ship is in port. Morale and quality of life of individual Sailors is important to maintain a combat ready unit.

- Guam provides existing transient aircraft capabilities at Andersen Air Force Base (AFB) for visiting air wings.

In summary, the fundamental requirements to support the treaties and alliances, which ensure peace and stability in the region, as well as Guam's unique geography and port infrastructure, make it the best and only location to create a transient-capable carrier port to increase aircraft carrier presence in the Western Pacific.

1.1.3.6 Transient Berthing Capability and Operation in Guam

The Navy plans to have six operationally available and sustainable aircraft carriers in the Pacific Fleet AOR, with the majority deployed in the Western Pacific and Indian Oceans, including the referenced transient carrier. To maximize operational availability, the carriers would remain deployed for longer periods of time and utilize the proposed wharf for unscheduled repairs. This can only be accomplished if the carrier docks in Apra Harbor for crew changes, logistics support, and crew recreation.

The present projected operational requirements indicate a proposed schedule for aircraft carrier transient visits with a cumulative total of up to 63 visit days per year, with an anticipated length of 21 days or less per visit. Schedules are subject to operational, contingency, and geopolitical considerations. The aircraft would continue to be accommodated at Andersen AFB on a space available basis. The aircraft carrier escort ships would be accommodated at Inner Apra Harbor, as is current practice.

The number of Guam transient port days would be directly related to the treaty and alliance requirements, operational requirements including contingency operations, geopolitical considerations, and the QDR as periodically updated. Aircraft carrier port visits are currently accommodated at Kilo Wharf, as it is the only Navy wharf in Guam that meets operational water depth requirements (-49.5 feet [ft], -15 meters [m] mean lower low water [MLLW]). During current port visits, the aircraft carriers do not require shoreside utility support. During these brief stays, the aircraft carriers rely entirely on their own shipboard utilities while pier side.

Kilo Wharf is also DoD's only dedicated munitions wharf in the AOR serving the 12 to 14 ammunitions ships in the AOR. Navy Munitions Command Detachment Guam (NMC-DET Guam) provides munitions logistics support to the operational forces of the 5th and 7th Fleets. Access to the wharf and vicinity is restricted during munitions operations for safety reasons. There is a Department of Defense and Explosive Safety Board (DDESB) approved explosive safety arc delineating the area of restricted access. When there are no munitions operations at the wharf, other types of ships can berth at Kilo Wharf at the discretion of Port Operations.

On average, ammunition operations occur at Kilo Wharf 275 days per year (COMNAV Marianas 2007). These operations include loading or unloading ammunition to or from a ship and staging the ammunition on Kilo Wharf after it has been unloaded from a ship or in preparation of an ammunition ship arrival. Kilo Wharf is unavailable during unfavorable weather (tropical storms) or high seas, which occur an estimated 40 to 50 non-consecutive days per year (COMNAV Marianas 2007).

In addition to the days the wharf is unavailable due to munitions operations (275 days) and ocean or weather conditions (average 45 days), there are an estimated 40 to 45 days per year that the wharf is unavailable for use by the aircraft carrier due to maintenance work aboard cargo munitions ships that are docked at Kilo Wharf. Unscheduled repairs to these ships while loaded are restricted to Kilo Wharf because of the explosive safety considerations. If they require maintenance and are carrying munitions, Kilo Wharf is the only wharf in Apra Harbor that has a DDESB approval for large quantities of munitions. A waiver is required from DDESB and Naval Ordnance Safety and Security Activity for ships carrying ammunition to berth in Inner Apra Harbor. These waivers are not readily granted because the large quantities of explosives berthed at a wharf that is unauthorized for large net explosive weights would represent an increased safety risk to nearby populations (NMC-DET Guam 2009).

Kilo Wharf usage is near capacity (estimated 275 days per year of use) without considering the aircraft carrier visits estimated at approximately 63 total days per year (NMC-DET Guam 2009). The aircraft carrier visits are managed through scheduling, but are disruptive to munitions operations and limit flexibility in carrier scheduling. Fleet and Military Sealift Command customers have been turned away due to the unavailability of Kilo Wharf (Commander Navy Installations Command 2006).

There are other challenges associated with an aircraft carrier berthing at Kilo Wharf that are manageable for the recent short duration port visits, but would be untenable for longer transient berthing requirements that include logistics, maintenance, and Morale Welfare and Recreation (MWR) support. Dependents, vendors, commercial delivery vehicles and non-DoD personnel are prohibited from entering the explosive safety arcs around Kilo Wharf. There is limited space for MWR activities at Kilo Wharf (NMC-DET Guam 2009).

Beginning in 2014, the munitions operations are projected to increase from 275 to 315 days per year at Kilo Wharf to support the programmed Navy, Marine Corps and Air Force missions (Commander Navy Installations Command 2006). The additional estimated 90 days of wharf unavailability due to ocean conditions, weather, and ship maintenance would exceed the Kilo Wharf annual capacity by an estimated 40 days per year. Adding the anticipated 63 visit days per year for the proposed action would exceed the Kilo Wharf annual capacity by an estimated 103 days. Regularly requesting waivers from DDESB to allow munitions cargo ships into Inner Apra Harbor is not a viable option. No other wharves in Apra Harbor meet the depth and security requirements associated with an aircraft carrier; consequently, a new wharf and shoreside infrastructure improvements are proposed.

CHAPTER 2. PROPOSED ACTION AND ALTERNATIVES

Chapter 2 provides an overview of the proposed action and alternatives evaluated in this EIS/OEIS for the proposed aircraft carrier berthing. The chapter begins with a description of operation, facilities and design standards that are common to both action alternatives. Then the chapter summarizes the alternatives that were considered and dismissed, and continues with a detailed description of the alternatives carried forward for analysis in this EIS/OEIS. The chapter ends with a description of the no-action alternative.

2.1 OVERVIEW

The Navy proposes to construct a new deep-draft wharf with shoreside infrastructure improvements in Apra Harbor, Guam to provide for a transient nuclear powered aircraft carrier. The nuclear powered aircraft carrier is the largest ship in the Navy's fleet. The environmental planning and preliminary design of the wharf, support infrastructure, and harbor accommodations are projected to meet the requirements of both the USS Nimitz Class (CVN 68) as well as the next generation of carrier, the Gerald R. Ford Class (CVN 78) that is anticipated to be operational in 2015.

The transient capability would increase the number of in-port days for the aircraft carrier from approximately 16 to a cumulative total of up to 63 visit days per year. The anticipated increase in the duration of visits along with the additional support requirements needed for transient capability requires 100% shoreside utility capability. The visiting transient carrier does not require housing for crew, new training or maintenance facilities but may require limited shoreside facilities for recreation, laundry, support for transportation shuttle services, and food and beverage sales. Up to 59 aircraft including strike, surveillance, control, and other logistic and combat aircraft, would either remain onboard the ship or fly to Andersen Air Force Base (AFB) where they would be assigned airfield space on a space-available basis. No airfield facility improvements are proposed. Training requirements for the carrier and its associated air wing would be fully met by existing training ranges and covered by appropriate environmental compliance documentation including the Mariana Islands Range Complex (MIRC) Draft EIS (Navy 2009) and Establishment and Operation of an Intelligence, Surveillance, Reconnaissance, (ISR) and Strike Capability EIS (PACAF 2006). Maintenance requirements can be met with existing shoreside maintenance support.

Two locations for siting the new wharf are considered under the proposed action: 1) Polaris Point (preferred), and 2) the Former Ship Repair Facility (SRF). The alternative sites are both located at the entrance to the Inner Apra Harbor channel and the navigational approach to both is similar. Both wharves would be aligned with one edge along the coastline. In addition to these two action alternatives, the no-action alternative is described in this chapter.

2.2 ELEMENTS COMMON TO BOTH ACTION ALTERNATIVES

2.2.1 Operation

To support forward operations, Commander, United States (U.S.) Pacific Fleet plans to conduct aircraft carrier transient visits throughout the year. The present projected operational requirements indicate a proposed schedule for aircraft carrier transient visits with a cumulative of up to 63 visit days per year, with an anticipated length of 21 days or less per visit. Schedules are subject to operational, contingency, and geopolitical considerations.

Assumptions regarding operational concepts would be the same for both action alternatives and include the following.

- Aircraft carriers that would visit Guam are Nimitz Class, such as CVN 68 (currently visits Guam) and Ford Class (the next generation aircraft carrier), such as CVN 78 (see Section 2.2 for aircraft carrier specifications).
- Up to 59 aircraft (including strike, surveillance, control, and other logistic and combat aircraft) could fly off from the aircraft carrier and beddown (park) at Andersen AFB on a space-available basis, where they would follow all transient operational requirements, as is the current practice.
- A typical air wing might include:
  - 2 Hornet squadrons – 10 aircraft each
  - 2 Super Hornet squadrons – 5 aircraft each
  - 1 EA-6B squadron – 5 aircraft (EA-6B to be replaced by F-18 G in 2014)
  - E-2C – 4 aircraft
  - SH-60 – 6 aircraft
- Aircraft carrier escort vessels would be accommodated at existing Apra Harbor wharves on a space available basis, as is the current practice for port visits. For information concerning improvements and increased usage of Apra Harbor, refer to Volume 2 of this Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). For long term and cumulative impacts for increased usage of Apra Harbor, refer to Volume 7.
- Pilots may need aircraft carrier landing practice during extended visits of approximately 21 days at a time. This landing practice and any other increased fixed wing aircraft operations associated with the visiting aircraft carrier are accounted for in Volume 2, Chapter 6, Noise. All other training activities, including use of Farallon de Medinilla for aerial bombing, associated with aircraft carrier activities is captured in existing documentation including the Mariana Islands Range Complex (MIRC) EIS (Navy 2009) and Establishment and Operation of an Intelligence, Surveillance, Reconnaissance, (ISR) and Strike Capability EIS (PACAF 2006).
- Aircraft carrier munitions transfers are anticipated to occur at sea.
- Nuclear reactor re-fueling operations would not occur in Apra Harbor.

- Aircraft carrier scheduled maintenance and repairs would not be done on Guam. Scheduled maintenance and repairs refers to those maintenance operations that are regularly scheduled throughout the life a ship. Scheduled maintenance includes high-level maintenance on aircraft carriers that occurs approximately every 8 years in a dry dock for a 2-year period, as well as depot-level maintenance that occurs usually at the ship's homeport approximately every 2 years for a 6-month period.
- Emergent, or unscheduled, repairs and emergency maintenance would be provided by repair teams from Hawaii or the west coast of the U.S. mainland and use existing maintenance facilities on Guam.
- It is anticipated that transient aircraft carriers potentially would rely on shoreside utility infrastructure only after 2015.
- Aircraft carrier crew is estimated to be 5,680 people:
  - Ship's company: 3,200 people
  - Air wing: 2,480 people
- Morale, Welfare, and Recreation (MWR) services would be provided using existing base facilities. Additionally, there would be some temporary pier-side Sailor support services at the wharf that could include tent facilities for portable laundromats, telephones, and/or food vendors.
- Shuttle services would be provided during port calls to support movement within the base, as well as to off-base locations.
- Operations at the wharf would be available 24 hours per day during aircraft carrier visits.
- Up to four tugboats would be required to assist in navigating the aircraft carrier through the harbor, as is the current practice.
- All nuclear powered aircraft carriers require a minimum of 6 ft (2 m) beneath the keel to ensure cooling and firefighting system intakes do not get clogged or damaged by mud and debris from the seafloor. A water depth of -49.5 feet (ft) (-15 meters [m]) is required for nuclear powered aircraft carriers to meet this requirement under all ship loading and tidal conditions.

Daily operations at the wharf would include people arriving or waiting to depart the wharf area via bus or car, personnel congregating around the wharf's temporary facilities, and shoreside and in-water security patrols. There would be shuttle buses provided to Naval Base Guam as well as to other Guam recreation and shopping areas. Traffic would also include taxis and private vehicles.

Periodically, there would be truck traffic to the wharf to re-supply the ship. The trucks may be from Navy supply or direct from commercial vendors. The cargo movement would likely require mobile cranes or other material handling equipment, such as forklifts, to load the ship. This equipment would be brought to the wharf as needed. The frequency of deliveries would be dependent on the status of supplies on board.

There also would be temporary solid and hazardous waste storage areas provided at the site that would be managed in accordance with current Naval Base Guam practices.

All alternatives include electronic surveillance (closed circuit television), associated alarms, surface craft or swimmer detection, and underwater detection defined as electronic security systems on the landside and electronic harbor security systems on the waterside.

When the aircraft carrier is not in port, the proposed on-site Port Operations Support Building would be used for storage, including the security barriers that are deployed when the ship is docked. There would likely be other storage or administrative uses of the building when the aircraft carrier is not visiting.

2.2.1.1 Aircraft Carrier Specifications

Specifications for the nuclear powered aircraft carriers CVN 68 (Nimitz Class) and CVN 78 (Ford Class) are similar, as shown in Table 2.2-1. The specifications are based on various Navy documents and summarized in the *CVN-Capable Berthing Study* (NAVFAC Pacific 2008).

Table 2.2-1. Vessel Characteristics

Vessel Characteristic	*CVN 68 ft (m) (Nimitz Class)*	*CVN 78 ft (m) (Ford Class)*
LOA	1,123 (372.77)	1,092 (332.84)
Length at waterline	1,040 (316.99)	1,040 (316.99)
Beam, with removable appurtenances	280 (85.34)	280 (85.34)
Beam, without appurtenances	256 (78.03)	256 (78.03)
Beam at waterline	134 (40.84)	134 (40.84)
Draft, maximum	40.8 (12.44)	40.8 (12.44)
Displacement[a]	104,200 LT	104,200 LT
Height at light load (air draft)	215 (65.53)	215 (65.53)

Legend: LOA = length overall; LT = long ton

[a] The weight of the volume of water that is displaced by the underwater portion of the hull is equal to the weight of the ship. This is known as a ship's displacement. The unit of measurement for displacement is the Long Ton (1 LT = 2,240 pounds [lbs]).

Source: NAVFAC Pacific 2008.

2.2.2 Support Facilities for Each Alternative

This section summarizes facilities and structures that would be required under either action alternative. The facilities not addressed here are the staging area and access; security; aids to navigation; and MWR facilities. While these facilities are common to both alternatives, there are differences that warrant separate treatment under the respective alternative discussions (see Section 2.5 and Section 2.6).

2.2.2.1 Structures

Facility requirements for the Nimitz Class (CVN 68) and Ford Class (CVN 78) aircraft carriers would be the same for both action alternatives. The requirements were compiled from various sources and described in the *CVN-Capable Berthing Study* (NAVFAC Pacific 2008).

Onshore requirements for either class of aircraft carrier are as follows:

- Wharf
    - Up to 1,325 ft) (404 meters [m]) in length
    - 90 ft (27 m) wide
    - Deck height: +12 ft (+7 m) mean lower low water (MLLW)
    - Pier strength: 800 pounds per square foot
    - Mobile crane load: 2,140 ton
    - Bollards: 100 ton posts, 100 ft (30 m) intervals along length of wharf to attach mooring lines
    - Storm bollards: four 200 ton bollards at each end of wharf
    - Port Operations Support Building: 10,000 square feet (ft^2) (929 square meters [m^2]); a permanent, all concrete, unoccupied, storage shed with shelves and restrooms

  - Air Compressor Building: 1,195 ft^2 (185 m^2); storage for compressed air for aircraft carrier requirements
  - Water Treatment Building: 1,249 ft^2 (116 m^2); a permanent structure for taking potable water from the existing infrastructure system and treating it to Grade A quality dedicated to the aircraft carrier
  - Boiler House: 1,120 ft^2 (104 m^2); a permanent facility to house two marine oil fired boilers to provide steam to the aircraft carrier while in berth
  - 13,210 Gallon Fuel Tank: 968 ft^2 (90 m^2) (surrounded by a containment berm)
  - Electrical Substation: 10,125 ft^2 (941 m^2)
  - Bilge and Oily Wastewater (BOW) Pump Station: 625 ft^2 (58 m^2) and Bilge and Oily Wastewater Treatment System (BOWTS): 5,000 ft^2 (465 m^2); system used to treat the bilge water from the hull of the ship to remove oils, grease, and other pollutants prior to discharge into the domestic wastewater system
  - Security watch towers: 797 ft^2 (74 m^2), 30–50 ft (9–15 m) in height
  - Guard Booth: 3,100 ft^2 (288 m^2); provides security at the entrance to the pier area
  - MWR area (3-inch [in] [7.6-centimeter {cm}] asphalt with utility tie-ins for temporary MWR structures); this area would provide services such as tent facilities for portable laundromats, telephones, and/or food vendors
  - Security measures: landside and waterside
- In-water requirements for either class of aircraft carrier are as follows:
  - 600 ft (183 m) of clearance in front of wharf; (Alternative 1 Polaris Point) provides only 442 ft [135 m]) but this clearance has been approved for safe navigation
  - Minimum dredged depth: - 49.5 ft (-15 m) MLLW
  - Turning basin (minimal): 1,092 ft (333 m) radius
  - Channel width: 600 ft (183 m)
  - Navigational aids
  - Security

2.2.2.2 Design Standards

All buildings would be designed to the current Guam building code and modified by the applicable Unified Facilities Code (UFC). Buildings would be designed to meet criteria for typhoon winds, seismic events, anti-terrorism force protection, sustainability, and other issues in accordance with UFC 1-200-01. Foundations can be shallow if soil improvement methods are utilized to consolidate the fill materials and native soils beneath to prevent liquefaction. Buildings would be all concrete construction. Leadership in Energy and Environmental Design (LEED) Silver criteria would be met for proposed facilities.

2.3 ALTERNATIVES CONSIDERED AND DISMISSED

Selection of wharf location alternatives in Apra Harbor involved evaluation of multiple parameters. The key parameters are described in this section. They are:

- Wharf alignment
- Turning basin
- Access through the channel
- Wharf structural design
- Dredging methods
- Dredge disposal sites

Selecting reasonable alternatives for the wharf locations to be carried forward in the EIS/OEIS analysis was based on consideration of the following criteria. A brief description of the criteria is provided below.

- Practicability (with sub-criteria)
  - Meets security/force protection requirements
  - Meets operational/navigational characteristics
  - Cost, technology, and logistics
- Avoids/minimizes environmental impacts to the extent practicable

Security/Force Protection

The suicide bombing attack against the U.S. Navy guided missile destroyer USS Cole (DDG 67) in Yemen on October 12, 2000 elevated security as a primary criterion for all ship berthing, including aircraft carriers. Security/force protection is related to the distance between Department of Defense (DoD) assets and potential sources of threats (non-DoD lands and ships). UFC 4-025-01 (*Waterfront Security Design*) describes the required security clearance zone on the water around ships in port. These areas are delineated by deployable floating port security barriers. The minimum buffer distance between a security threat and a potential naval target is 450 ft (137 m), although the minimum could be greater depending on the force protection conditions. In addition to the specified minimum distances, the Commander, U.S. Pacific Fleet has discretionary authority to determine separation distances based on site-specific assessments of potential threats. Wharf locations that did not meet security/force protection requirements were not considered feasible.

Operational/Navigational

Apra Harbor is an active commercial and military harbor. Potential aircraft carrier berthing locations that would compromise or interfere with ongoing DoD or Guam Commercial Port operations were not considered feasible. Navigational considerations refer to the ability to safely maneuver the aircraft carrier into position during berthing and departure. Any wharf location that could not accommodate safe maneuvering of the aircraft carrier was eliminated from further analysis.

Cost, technology, and logistics

Cost, technology, and logistics refers to how expensive the project would be, whether or not there would be technological limitations to project execution, or whether logistically, the project is not feasible due to distance from support facilities, for example. Factors associated with higher project costs could include construction techniques and/or labor or materials. Wharf locations that did not meet the cost, technology, and logistics criterion were dismissed from further analysis.

Environmental

Environmental factors, such as the amount of fill and dredging and related impacts to coral reefs, were used to identify and screen potential wharf locations, wharf alignments, turning basin options, and channel alignments. The Navy identified the options that would minimize impacts to the environment to the extent practicable.

2.3.1 Wharf Location Alternatives Considered

There are no other harbors in Guam, aside from Apra Harbor, capable of supporting Naval vessels for the proposed action. Other small boat harbor locations within Guam are not feasible, as Apra Harbor is the only harbor that provides the necessary security, potential channel capability, and potential wharf locations to support the aircraft carrier berthing. Aircraft carrier port visits are currently accommodated in Apra Harbor at Kilo Wharf, as it is the only Navy wharf that meets aircraft carrier draft (depth) requirements. However, for the reasons previously discussed in Chapter 1 and below, Kilo Wharf is not a feasible option and alternative wharf locations had to be considered.

Figure 2.3-1 and Table 2.3-1 show the wharf locations in Apra Harbor that were considered. This section also describes the reasons why certain wharf locations in Apra Harbor were dismissed from further analysis and identifies the screening criteria that were used to dismiss the individual wharf locations. Table 2.3-1 also summarizes wharf alignments (Section 2.3.2), turning basin and channel alignments (Section 2.3.3), wharf structural design (Section 2.3.4), and dredging methods and disposal options (Section 2.3.5) considered and dismissed in the noted sections below.

Guam Commercial Port

The Guam Commercial Port is located on the northern side of Apra Harbor. Several locations at the Guam Commercial Port were assessed. One location, shown by number (**3**) on Figure 2.3-1 would be a new deep-draft wharf. Initial planning has been conducted for construction of this wharf by the Port Authority of Guam. Other locations that were assessed were located within the port across the channel from Delta/Echo Wharves. These locations were dismissed for the reasons discussed below.

Security/Force Protection

Location number (**3**) was dismissed as a potential aircraft carrier berthing option because it would be vulnerable to attack from ships in the Philippine Sea and difficult to defend.

Operational/Navigational

Locations at the port proximal to the channel were dismissed because the required buffer zones around the aircraft carrier would effectively close harbor access to the majority of the available commercial port operations including cargo handling. This is an untenable situation for Guam, which relies on receiving over 95% of its commodities by sea.

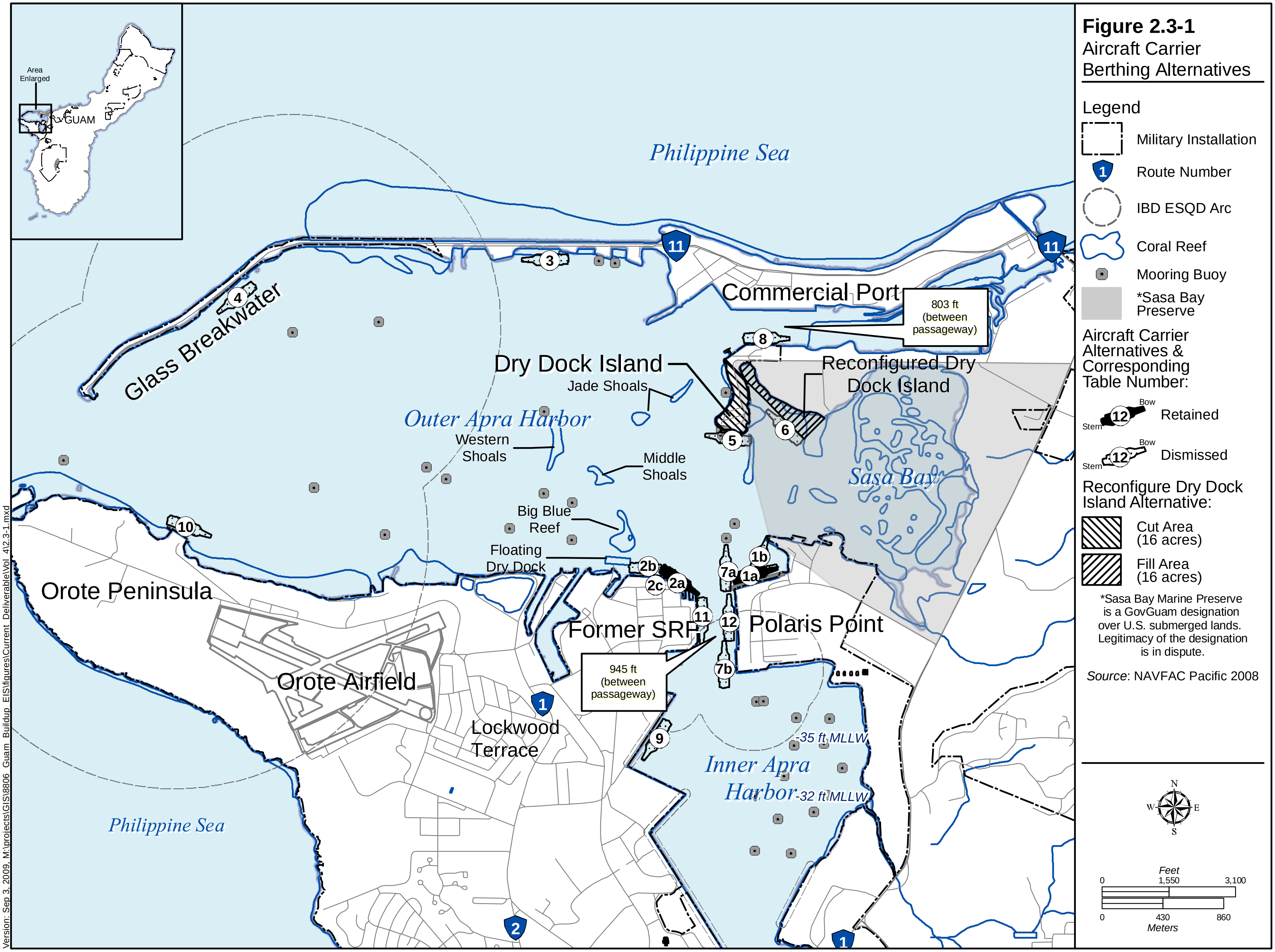

Figure 2.3-1
Aircraft Carrier Berthing Alternatives

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Table 2.3-1. Alternative Analysis Summary

Component	*Alternatives **(Key to Figure 2.3-1)***	*Dismiss/Retain in EIS/OEIS Impact Analysis*	*Reasons for Dismissal or Retention*
Wharf Location			
New Wharf	Polaris Point (northern coast) **(1a)**	Retain	Meets all practicability criteria
	Former Ship Repair Facility (SRF) (northern coast) **(2a)**	Retain	Meets all practicability criteria
	Commercial Port **(3)**	Dismiss	Security/Force Protection Operationally/Navigationally not practicable
	Glass Breakwater **(4)**	Dismiss	Security/Force Protection Cost, technology, and logistics Environmental impact
	Dry Dock Island **(5)** and **(6)**	Dismiss	Security/Force Protection, Environmental impact Cost, technology, and logistics
	Bravo Wharf –North **(7a)** and South **(7b)**	Dismiss	Operationally/Navigationally not practicable
Existing Wharf	Delta/Echo Wharf **(8)**	Dismiss	Operationally/Navigationally not practicable
	Sierra Wharf (or other Inner Harbor Wharves) **(9)**	Dismiss	Security/Force Protection Operationally/Navigationally not practicable
	Kilo Wharf **(10)**	Dismiss	Operationally not practicable
	Lima Wharf **(11)**	Dismiss	Operationally/Navigationally not practicable
	Bravo Wharf **(12)**	Dismiss	Operationally/Navigationally not practicable
Wharf Alignment			
Polaris Point	Parallel to coast, full 600 ft clearance **(1a)**	Dismiss	Environmental impact
	Parallel to coast, reduced clearance at east end (not shown)	Retain	**Avoids environmental impact of full clearance alternative**
	Diagonal **(1b)**	Dismiss	Environmental impact Cost and technology for structural support due to wave impacts
Former SRF	Parallel to shore at coastline **(2b)**	Dismiss	Environmental & Dry Dock operation impacts
	Parallel to shore & recessed **(2c)**	Dismiss	Environmental impact of excavation
	Parallel to coast but angled through finger piers **(2a)**	Retain	**Minimizes environmental impacts**
Turning Basin			
	Optimal radius	Dismiss	Environmental impact
	Minimal radius	Retain	**Minimizes environmental impact**
Channel Alternatives			
	Optimal-straight	Dismiss	Environmental impact
	Slight bend	Dismiss	Environmental impact

Component	*Alternatives* ***(Key to Figure 2.3-1)***	*Dismiss/Retain in EIS/OEIS Impact Analysis*	*Reasons for Dismissal or Retention*
	54 degree bend	Retain	**Minimizes environmental impacts**
Wharf Structural Design (subject to modification on final design)			
	Vertical steel or concrete pile	Retain	Cost effectiveness based on oceanographic conditions
	Steel sheet pile bulkhead	Dismiss	Poor performance, historically, in seismic events
	Concrete caisson	Dismiss	Environmental impact associated with cut and fill and poor performance during seismic events
Dredging Methods (subject to modification on final design)			
	Mechanical	Retain	EIS/OEIS analysis is conservatively based on this dredge method alternative with greater potential environmental impact
	Hydraulic	Dismiss	Potentially less environmental impact than mechanical
Dredged Material Disposal (likely a combination of all three alternatives)			
	ODMDS	Retain	Viable option
	Upland placement	Retain	Viable option
	Beneficial reuse	Dismiss (viable option; but reuse project-specific details are not available for impact analysis)	Viable option; but reuse project-specific details are not available for impact analysis

Legend: **BOLD text =** potential mitigation
BOLD numbering corresponds to wharf location/alignments presented in Figure 2.3-1

Glass Breakwater

Glass Breakwater is a narrow strip of man-made land that separates the Philippine Sea to the north and Outer Apra Harbor to the south (see number [**4**] on Figure 2.3-1). There are no existing wharves or piers on the breakwater. This location was dismissed for reasons discussed below.

Security/Force Protection

- A wharf at this location would be vulnerable to attack from ships in the Philippine Sea and difficult to defend. Also, access to the site would be through non-DoD lands representing an additional force protection issue.

Environmental

- Extensive fill would be required to provide the amount of shoreside land area for activities and accommodate the movement of more than 5,600 personnel on and off the ship.
- Cost, Technology, and Logistics.
- There are no existing utilities in the vicinity of the remote site, and providing these utilities at the level an aircraft carrier requires would be cost prohibitive.
- The area is subject to wind and wave events that would require significant costs to meet structural design requirements.
- The single lane access road would require structural improvements to support two lanes for truck and bus traffic.
- The site is a great distance from the base, which is problematic for personnel quality of life activities and supply replenishment. Personnel would have to rely on bus service to access

base amenities. The Navy Supply Wharf is X-Ray, which is at the southernmost point of Inner Apra Harbor.

<u>Dry Dock Island</u>

Dry Dock Island is located south of the Guam Commercial Port, near the Sasa Bay Preserve. Dry Dock Island (see numbers [**5**] and [**6**] on Figure 2.3-1) was dismissed as described below.

Security/Force Protection

Access to the site would be through non-DoD land, representing a force protection issue.

Environmental

- Extensive fill would be required to provide the amount of shoreside land area for activities and to accommodate the movement of more than 5,600 personnel on and off the ship. Also, as presented in Section 2.3.3.1, the required turning basin for this location would not avoid or minimize coral loss.

Cost, Technology, and Logistics

- The site is a great distance from the base, which is problematic for personnel quality of life activities and supply replenishment.
- The emergency response, unscheduled (emergent) repair, and radioactive waste management facilities are located on Polaris Point.
- The utilities on Dry Dock Island that support Echo and Delta Wharves do not have the capacity to support a carrier.
- The access road, which is a service road for the parallel petroleum, oil, and lubricants (POL) pipeline, and the pipeline itself would require structural improvements, and possibly relocation to support two lanes for truck and bus traffic.
- The site would create incompatible uses with existing recreational use of parts of Dry Dock Island.

<u>Bravo and Lima Wharves</u>

Bravo and Lima Wharves were dismissed because of operational/navigational reasons, as discussed below. Bravo Wharf locations are shown as numbers (**7a**), (**7b**), and (**12**) on Figure 2.3-1. Lima Wharf is shown as number (**11**) on Figure 2.3-1.

Operational/Navigational

Bravo and Lima Wharves are located within the Inner Apra Harbor channel. The Inner Apra Harbor channel is difficult to navigate in high cross-wind conditions. In addition, the carrier presence in the channel with the required floating security barriers would interfere with ship traffic to and from Inner Apra Harbor wharves and restrict submarine access to Polaris Point Wharves. Another operational limitation to using these locations is that nuclear submarines are already utilizing Alpha and Bravo Wharves.

<u>Delta/Echo Wharves</u>

Delta/Echo Wharves are located south of the Guam Commercial Port, within a channel that is 803 ft (245 m) wide. Please see number (**8**) on Figure 2.3-1 for the location of these wharves.

Operational/Navigational

Delta/Echo Wharves were dismissed because the required buffer zones around the aircraft carrier would obstruct harbor traffic.

Sierra Wharf (and all Inner Apra Harbor Locations)

In order to access Sierra Wharf and other Inner Apra Harbor locations, a narrow channel must be navigated. The narrow channel entrance to Inner Apra Harbor is 945 ft (288 m) across. Sierra Wharf is identified as number (**9**) on Figure 2.3-1. These locations were dismissed as discussed below.

Security/Force Protection

The narrow channel that provides access to these locations could be obstructed by a disabled or sunken ship, and potentially trap the aircraft carrier if it were berthed at any of the Inner Apra Harbor Wharves. Mobility and responsiveness are critical and the time required to remove an obstruction from the Inner Apra Harbor Channel would be unacceptable.

Operational/Navigational

The width of the narrow channel leading to Inner Apra Harbor would not allow for the minimum buffer distance around an aircraft carrier to be met without obstructing harbor traffic.

Kilo Wharf

Kilo Wharf is located on the western edge of Apra Harbor on Orote Peninsula. Kilo Wharf is indicated as number (**10**) on Figure 2.3-1 and was dismissed, as discussed below.

Operational/Navigational

This wharf is DoD's only dedicated munitions wharf in the Western Pacific Region. For planning purposes, Apra Harbor currently supports an average of 16 days in port per year for carrier and CSG port calls (however, as described in Chapter 1, this schedule varies based on Fleet operational requirements). Currently, the visits are disruptive to munitions operations, but manageable. The proposed increased frequency and duration of carrier visits (a maximum of 63 days in port per year) coupled with expected increased ammunition ship operations would result in a significant negative impact on the ability of the Navy to meet their munitions mission, as described in Chapter 1 of this Volume.

In conclusion, only the Polaris Point and Former SRF sites meet the criteria described in Section 2.3, and consequently these alternatives were retained and carried forward for detailed impact analysis in this EIS/OEIS.

2.3.2 Wharf Alignment

Wharf alignment describes the position of the wharf relative to the coastline. For example, the alignment can be parallel to the shore (marginal wharf) where the back edge of the wharf is land based. A wharf can also be aligned at an angle to the coastline where one terminus is land based and the other three edges are facing the water. Structural engineers were tasked with developing the best alignment options at the Polaris Point and Former SRF sites (NAVFAC Pacific 2008). These wharf alignment options were evaluated based on coastal engineering considerations, avoiding or minimizing environmental impacts, and minimizing impacts on harbor operations.

Polaris Point

Two wharf alignments were assessed for Polaris Point: parallel to shore (east-west) and a diagonal alignment from Polaris Point across the bay (southwest to northeast) (see Figure 2.3-1, **1a** and **1b**). For the parallel to shore (east-west) alignment, two options for aircraft carrier approach clearance were considered. The difference between the two options has to do with the clearance area provided in front of the wharf at the eastern end. The specifications for an aircraft carrier require an approach clearance area of 600 ft (183 m) extending from the edge of the entire length of the wharf. This area must be free of obstacles. To achieve the standard clearance distance for the parallel alignment, the land outcrop north of Polaris Point would have to be removed. Survey data indicated there is coral along the outcrop that would have to be removed to provide the 600 ft (183 m) of clearance in front of the wharf at the eastern end. To minimize impacts to coral, a reduced clearance option was proposed specifically to avoid the environmental impact associated with excavating this outcrop of land with coral cover. Port operations and harbor pilots were consulted and provided concurrence that this reduction in the berth was acceptable from a navigation perspective. Additionally, verbal concurrence was provided from Commander, U.S. Pacific Fleet and Naval Sea Systems Command (NAVSEA) with respect to this modification for the aircraft carrier berth.

In addition to minimizing environmental impacts, the parallel to shore (east-west) alignment minimizes the impact to navigation along the channel leading into Inner Apra Harbor. There would be security barriers associated with the aircraft carrier when in port that would have to be adjusted to allow for channel traffic as necessary. The new wharf and operations at the wharf would not interfere with harbor operations at the adjacent Bravo Wharf.

From a coastal engineering perspective, this wharf alignment is preferred over the diagonal Polaris Point option, as the likelihood of deck overtopping from waves would be reduced.

The diagonal alignment also would require removal of the land outcrop north of Polaris Point but to a greater extent. A harbor control tower located at the point would have to be relocated. By dismissing this alternative, a potential direct impact to coral is avoided. The diagonal alignment alternative has the primary storm wave energy perpendicular to the wharf structure rather than along the shore. Of all the alignment alternatives, the diagonal alignment is the one that would be most exposed to storm waves. A more substantial structure would be required to prevent buckling in deep water when subjected to wave forces. There would be additional construction costs to achieve the stability required. The diagonal alignment has the additional disadvantage of poor aesthetics. The nearby bay and beach are potential family recreational areas with planned amenities for the Polaris Point Field and recreation area. The massive wharf structure would obstruct views from the beach.

Therefore, for the reasons discussed above, the parallel to coast (reduced clearance) option was retained as the preferred wharf alignment option for Polaris Point.

Former SRF

Three berth alignments were studied at the Former SRF. The alignments considered were all parallel to shore. Two wharf alignments were considered but eliminated from further consideration in this EIS/OEIS. The first, an east-west alignment along the existing coastline was dismissed because this alignment would permanently block access to the dry dock operations even when an aircraft carrier was not present. Figure 2.3-1 shows this alignment located closest to the dry dock and parallel to the coastline (shown as [**2b**]). The second dismissed alignment would also be aligned east-west, but would be recessed into the existing shoreline allowing the dry dock traffic to pass, but this option would excavate significant amounts of existing land area. This recessed alternative would be located south of the first east-west alternative described (shown as [**2c**] on Figure 2.3-1).

The wharf alignment alternative retained for further consideration in this EIS/OEIS follows the current shoreline as it extends from the end of the finger pier at Lima Wharf in a north-westerly direction toward the current location of the floating dry dock (AFDB-8) (see [**2a**] on Figure 2.3-1). The precise final location in the onshore-offshore direction is subject to minor adjustment during final engineering design. The berth face runs approximately along the -50 ft (-15 m) MLLW contour, which meets the aircraft carrier requirement and minimizes the amount of dredging/excavation required at the shoreline. When the aircraft carrier is in port, there would be no access to the dry dock by other ships. The wharf alone would not interfere with dry dock access.

Based on the consideration of the various wharf alignment options, it was determined that the parallel to shore wharf alternatives at both the Former SRF and Polaris Point would be retained.

2.3.3 Channel Options

The *CVN-Capable Berthing Study* (NAVFAC Pacific 2008) assessed three channel alignment options that are applicable to both alternative wharf locations as follows and as shown on Figure 2.3-2. These alignments include:

- Sharp bend (54 degrees)
- Straight channel
- Slight bend

In that study, a high priority was placed on reducing dredging impacts to coral while still complying with published design criteria for nuclear powered aircraft carrier navigation. Where there was a choice, high quality coral (high in biodiversity and percent cover) was protected over low quality coral (low in biodiversity and percent coverage) (see Chapter 11, Marine Biological Resources for more information). As shown in Figure 2.3-2, the sharp bend option follows the same location as the existing navigational channel, but the channel would be widened to 600 ft (183 m) to meet the UFC channel width requirements for a nuclear powered aircraft carrier. Commercial shipping traffic would continue to use this existing navigational channel. To minimize and avoid impacts to coral, there would be a 54 degree angle bend in the vicinity of Jade and Western Shoals. Of the three channel alignment options, this is the least favorable for navigation but the least environmentally damaging. Tugboats would be required to assist an aircraft carrier through the channel and into the berth. No dredging would be required to accommodate ship movement around the bend, but additional navigational aids may be required. The sharp bend channel option, while meeting operational requirements, is carried forward in the EIS/OEIS because it also minimizes impacts to coral.

The other two channel options considered, but dismissed, are located south of the sharp bend alignment and provide a more direct approach (Figure 2.3-2). These two channel options would require dredging through coral shoals and significantly increase the dredging volume and direct impact to coral. These two channel options were dismissed from further consideration in the EIS/OEIS because of the direct impact to high quality coral.

2.3.3.1 Turning Basin

Because of ship design, aircraft carriers are always berthed starboard (right side of carrier) to the wharf. To enable berthing of the carrier on the starboard side and its departure, a turning basin is required in front of Polaris Point or the Former SRF Wharves. A turning basin is a circular area free of obstruction

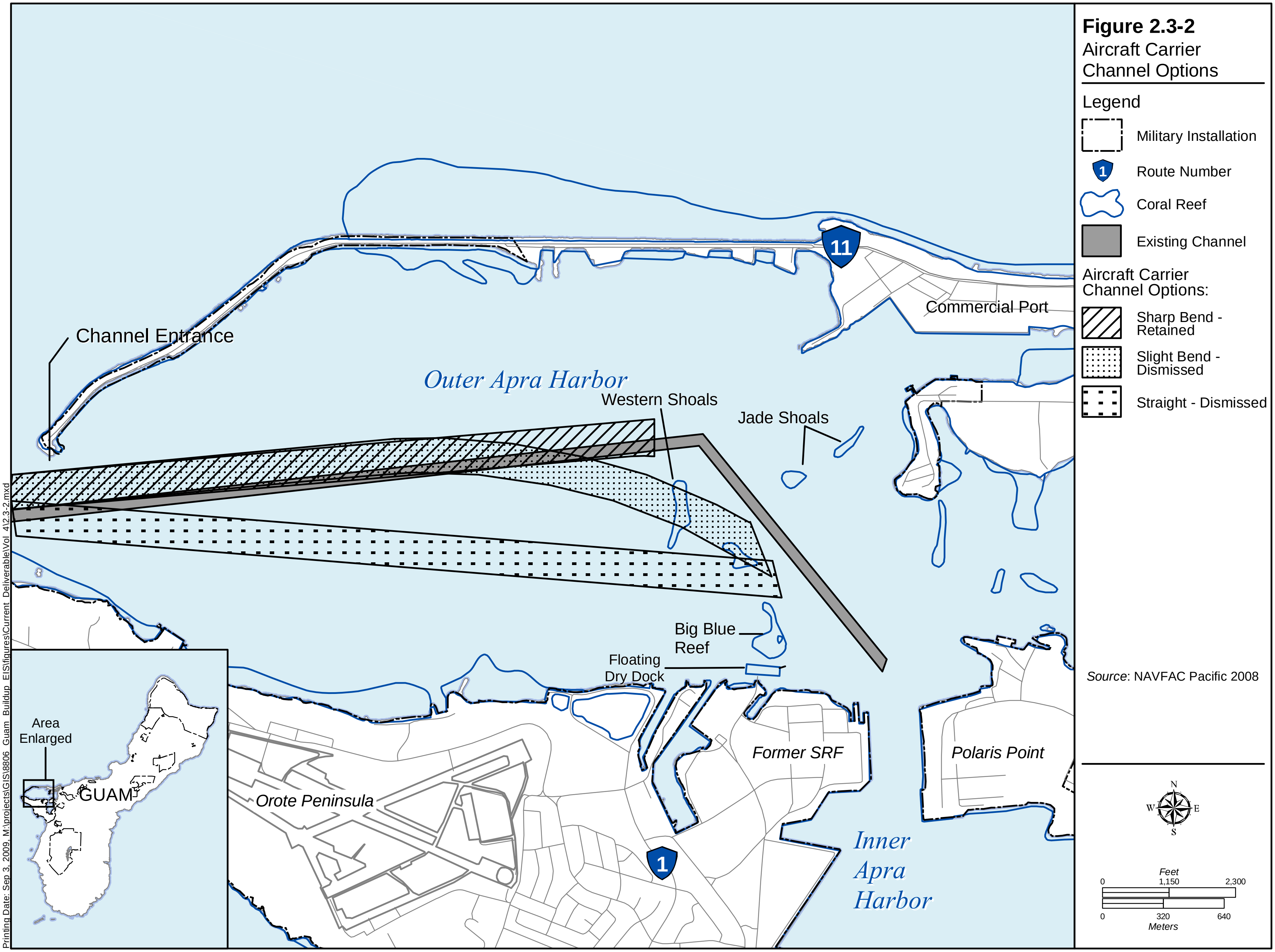
Figure 2.3-2
Aircraft Carrier Channel Options
Legend
Military Installation
Route Number
Coral Reef
Existing Channel
Aircraft Carrier Channel Options:
Sharp Bend - Retained
Slight Bend - Dismissed
Straight - Dismissed
Source: NAVFAC Pacific 2008
Channel Entrance
Outer Apra Harbor
Western Shoals
Jade Shoals
Commercial Port
Big Blue Reef
Floating Dry Dock
Former SRF
Polaris Point
Orote Peninsula
Inner Apra Harbor
11
1
Area Enlarged
GUAM
N
W
E
S
Feet
0
1,150
2,300
0
320
640
Meters
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that provides sufficient maneuver area for an aircraft carrier to be pivoted and then berthed on its starboard side. Because wind and waves exert uncontrolled additional forces on aircraft carrier movement in a harbor, tugboats are required to guide the aircraft carrier into a starboard position parallel to the wharf as well as assist during its departure. Because of the water depth requirements of an aircraft carrier, the turning basin would be dredged to a depth of -49.5 ft (-15.0 m) MLLW.

There are specifications (minimum and optimum) for establishing turning basins. The *CVN-Capable Berthing Study* (NAVFAC Pacific 2008) recommends the optimal radius of 2,200 ft (671 m) for an aircraft carrier; that is double the length overall of the ship. However, to reduce dredging and impact to coral, the minimal radius of 1,092 ft (333 m) for the turning basin was retained. Because of advanced navigational aids, Commander, U.S. Pacific Fleet has determined the minimum radius would allow the transient aircraft carrier with its tug escorts to be safely maneuvered in a 360 degree circle with appropriate margins of navigational safety. Further reductions of the turning basin radius were proposed and dismissed by the Navy because the radius retained is the minimum acceptable radius for navigational safety.

As shown on Figure 2.3-3, the optimal radius turning basins considered but dismissed are shown as red circles. The retained turning basin radii are shown as green circles on the same figure. Figure 2.3-4 shows the positions of the aircraft carrier under the two action alternatives as well as the location of the turning basin in Inner Apra Harbor that was dismissed, as discussed below.

The following turning basin options were also considered but dismissed:

- *Relocate the turning basin to deeper water in Outer Apra Harbor and move the carrier in reverse when leaving the berth.* All ships are more difficult to control (speed and direction) in reverse and the risks increase with the length of the ship. A carrier may need to leave the berth under emergency conditions and reversing the ship in a hurry would be difficult. This option does not meet the criteria for practicability (including requirements for security/force protection and operational/navigational characteristics).
- *Relocate the turning basin to Inner Apra Harbor, while maintaining one of the proposed Outer Apra Harbor berths (Polaris Point or Former SRF).* As a replacement for an Outer Apra Harbor turning basin, an Inner Apra Harbor turning basin would reduce the volume of direct impact to coral. However, the Inner Apra Harbor turning basin would not eliminate the need for an Outer Apra Harbor turning basin. After making the 180 degree turn in Inner Apra Harbor, the ship bow would be facing north as it exits the channel. Once it clears the channel, it must be pivoted 90 degrees before being guided into either Polaris Point or the Former SRF berths. A full 360 degree turning basin is required for safe navigation. This option is dismissed because of practicability (operational/navigational) and environmental criteria.
- Use of Dry Dock Island as a carrier berth location instead of Polaris Point or the Former SRF to eliminate the need for a turning basin. Reasons for dismissal of Dry Dock Island from full impact analysis have been previously described. Two options were proposed for Dry Dock Island: the current configuration and a reconfigured land mass that relocates the western shoreline to the northeast. The second option would require dredging and fill within the Sasa Bay Preserve, but it would provide a larger area for aircraft carrier movement. The second option was subsequently dismissed.

The Dry Dock Island options were also dismissed because they do not eliminate the need for a turning basin, would not avoid or minimize coral loss, and there is insufficient area to negotiate the sharp turns

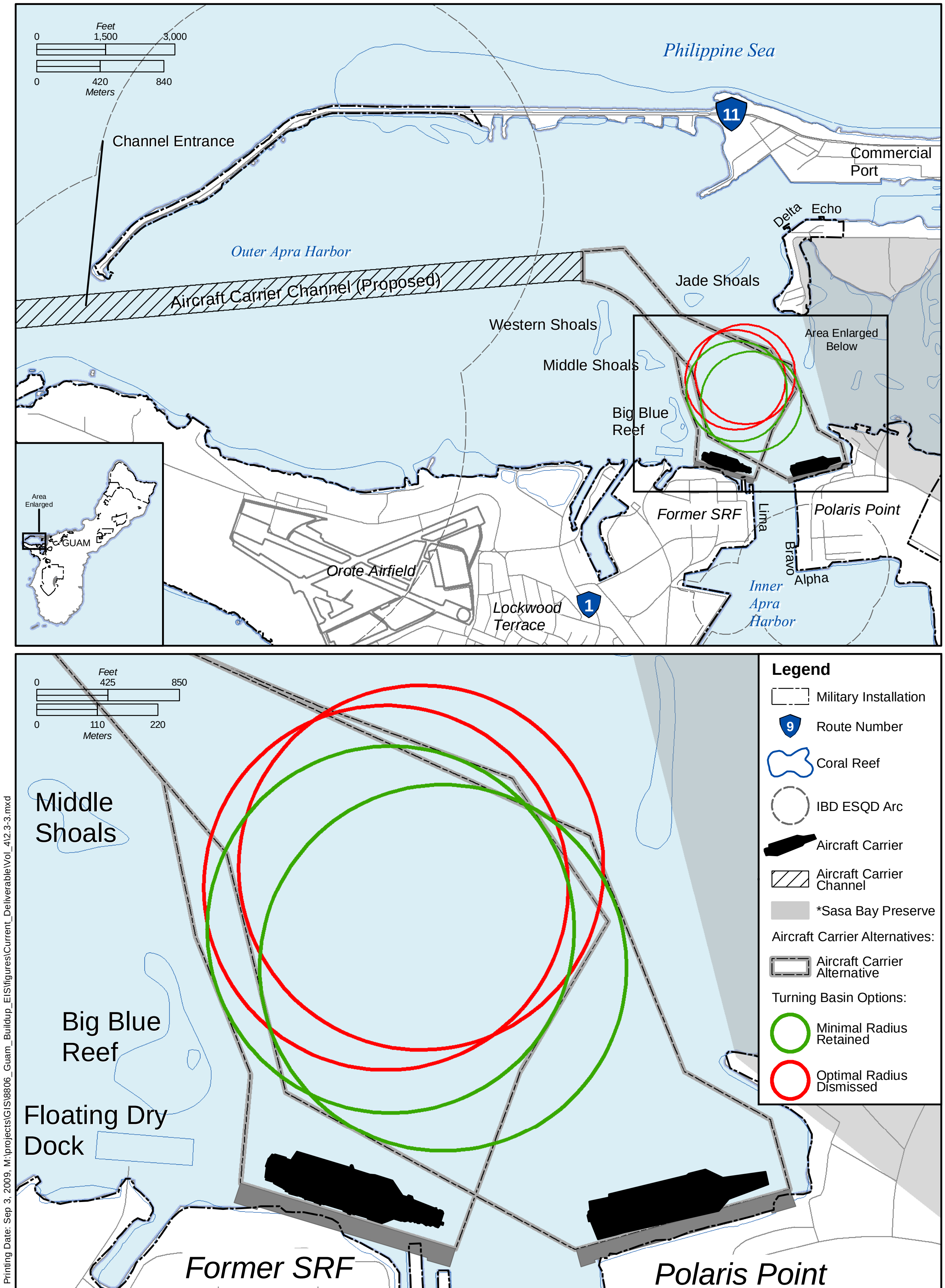


Figure 2.3-3
Aircraft Carrier Berthing Channel & Turning Basin

*Sasa Bay Marine Preserve is a GovGuam designation over U.S. submerged lands. Legitimacy of the designation is in dispute.

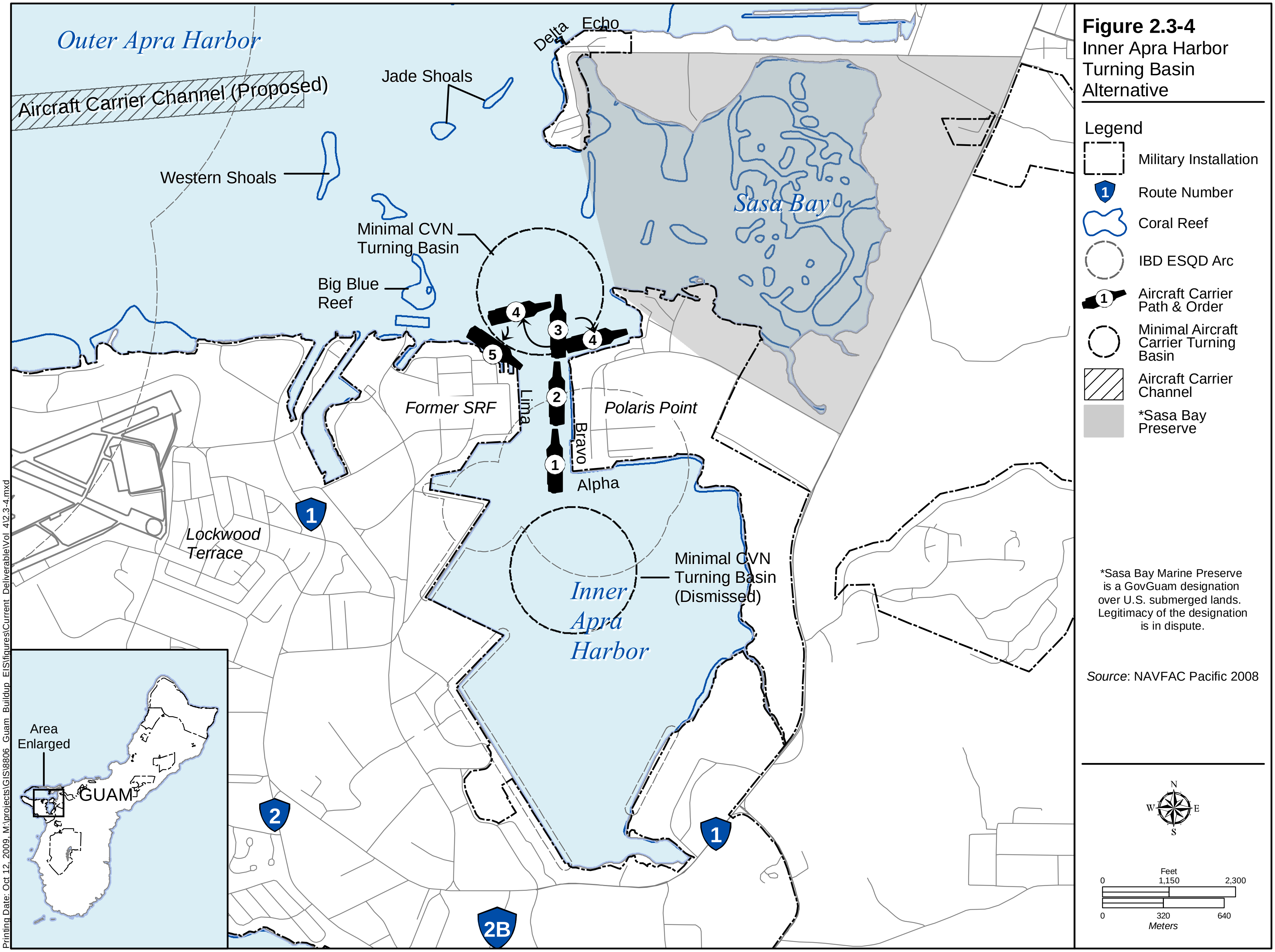


Figure 2.3-4
Inner Apra Harbor Turning Basin Alternative
Legend
Military Installation
Route Number
Coral Reef
IBD ESQD Arc
Aircraft Carrier Path & Order
Minimal Aircraft Carrier Turning Basin
Aircraft Carrier Channel
*Sasa Bay Preserve
*Sasa Bay Marine Preserve is a GovGuam designation over U.S. submerged lands. Legitimacy of the designation is in dispute.
Source: NAVFAC Pacific 2008
Outer Apra Harbor
Aircraft Carrier Channel (Proposed)
Jade Shoals
Western Shoals
Delta
Echo
Sasa Bay
Minimal CVN Turning Basin
Big Blue Reef
Former SRF
Lima
Polaris Point
Bravo
Alpha
Lockwood Terrace
Minimal CVN Turning Basin (Dismissed)
Inner Apra Harbor
Area Enlarged
GUAM
Feet
0
1,150
2,300
0
320
640
Meters
Printing Date: Oct 12, 2009, M:\projects\GIS\8806_Guam_Buildup_EIS\figures\Current_Deliverable\Vol_4\2.3-4.mxd

without a turning basin (Figure 2.3-5). In summary, the Dry Dock Island options were eliminated from further analysis under the cost, logistics, and technology and environmental criteria.

2.3.4 Structural Design

The *CVN-Capable Berthing Study* (NAVFAC Pacific 2008) evaluated wharf structural design options for general site compatibility, constructability, costs, and seismic performance. Structural design alternatives included:

1. Vertical-pile-supported wharf on armored sloped embankment
2. Tied-back steel sheet pile bulkhead
3. Concrete caissons

While both the sheet pile bulkhead and concrete caissons are used in Apra Harbor, it was determined that a pile supported wharf for this proposed action is preferable for several reasons, including superior seismic performance, less dredging, and less cost.

All design options would disturb the same area and have comparable impacts, but there are structural advantages to a steel pile supported wharf as described below. Therefore, steel pile construction is retained as a wharf design option for consideration in this EIS/OEIS. A brief summary of each design option is presented below.

2.3.4.1 Steel Pile Supported Wharf

This structural design alternative would result in a concrete deck superstructure 90-ft (27-m) wide by up to 1,325-ft (404-m) long, supported by all vertical piling. When all piles are installed vertically, the deck and piles resist lateral loads as a ductile moment resisting frame. This allows the wharf to flex slightly during an earthquake without serious damage. Piling is driven through the superficial soil and into underlying rock.

Both pre-stressed concrete piling and steel piling were considered for the structure. Generally, pre-stressed concrete piles are preferred in a marine environment due to their inherent corrosion resistance capacity. These piles can be installed at sites with sands and bay mud, and even very dense sands with the aid of jetting. However, at sites with limestone, rock, or similar materials, concrete piles require difficult and expensive pre-drilling to penetrate the rock. Steel piles were selected due to the highly variable soil strata expected at the site. Given that either type of pile would be imported into Guam, steel lends itself better to on-site lengthening/shortening to match the variability in the bearing depth and embedment. During final design, and after additional site subsurface investigations have determined the actual bearing elevations, the steel versus concrete issue would be revisited. Concrete could then be selected if cost savings are apparent. With modern coatings and suitably maintained protection systems, steel piles can easily obtain a 50-year or more life.

A flat plate concrete deck structure was recommended in the *CVN-Capable Berthing Study* (NAVFAC Pacific 2008). In addition to excellent seismic performance, the concrete flat slab is very durable in the marine environment and can support a variety of loads.

The underlying embankment slopes upward from -49.5 ft (-15 m) MLLW to +7 ft (+2 m) MLLW. Placement of quarry stone and riprap stone for a marine revetment for shoreline protection would be necessary along the slope of the shoreline beneath where the wharf would be constructed. Some dressing of the existing slope would be required to prepare the slope for the rock. The slope would be protected with large armor rock over a filter course of quarry run. Approximately 42,000 cubic yards (cy) (32,111

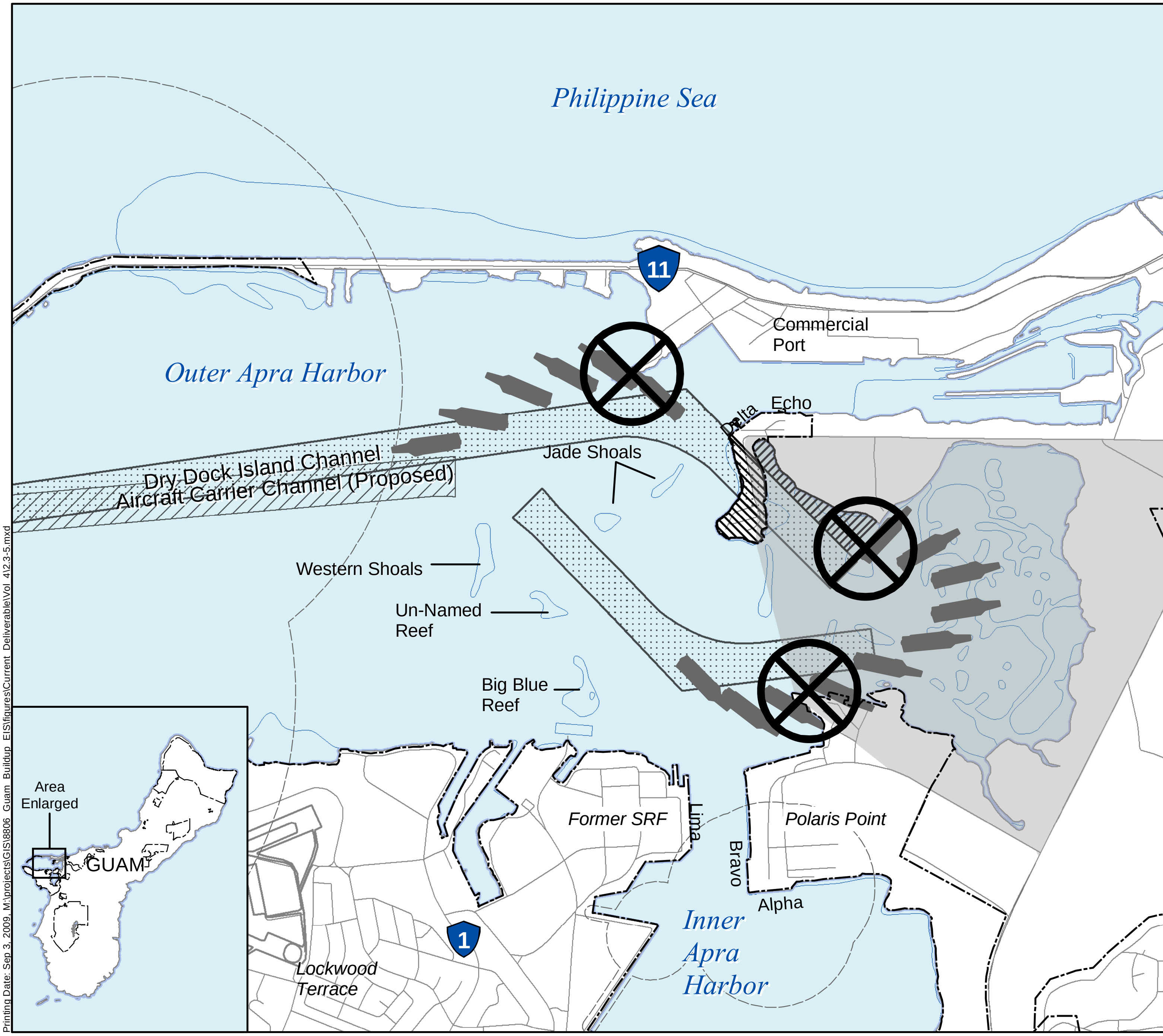


Figure 2.3-5
Dry Dock Island Carrier Location Alternatives

Legend

- Military Installation
- Route Number
- Coral Reef
- IBD ESQD Arc
- Aircraft Carrier Notional Path
- *Sasa Bay Preserve

Notional Dry Dock Island Alternative:

- Cut Area
- Fill Area
- Aircraft Carrier Channel
- Dry Dock Island Channel
- Point of Failure

*Sasa Bay Marine Preserve is a GovGuam designation over U.S. submerged lands. Legitimacy of the designation is in dispute.

Assumes Path

N W E S

Feet 0 1,150 2,300
0 320 640 Meters

m^3) of quarry stone would be placed as fill and 19,815 cy of riprap stone (15,150 m^3) placed as fill. The surface area that would be affected along the slope of the shoreline is approximately 3.6 ac (1.5 ha).

The sloped embankment and armor rock would also provide lateral support for the piling against seismic, mooring, and berthing forces. The rock and sloped embankment would be an integral part of the entire structure. A similar structure was constructed for the two aircraft carrier berths at North Island, San Diego. As the seismic conditions for San Diego and Guam are very similar, and that structure meets current aircraft carrier requirements, it has been used for planning purposes at this site with modifications to reflect the needs of this project and advances in seismic engineering since the construction of the San Diego wharves.

2.3.4.2 Sheet Pile Bulkhead

Sheet pile bulkhead construction has long been considered economical in many ports and military harbors due to its simplicity, ease and speed of construction, available U.S. suppliers, and costs, when considered for non-seismic berths to 30 or 35 ft (9 or 11 m) depth. Unfortunately, many times these systems were installed without adequate protection (coatings and/or cathodic protection) and thus earned a bad reputation for durability. However, with proper modern coatings and periodically maintained cathodic protection systems, the expected life is 50 years or more.

For berths greater than 30 ft (9 m) water depth and in seismic areas, such as this project, the advantages of sheet pile bulkheads quickly disappear. Sheet pile bulkheads have performed poorly in severe seismic events, such as the 7.7 Mercalli Guam earthquake that occurred in 1993. Most of the wharves experienced some degree of structural damage, ground cracking and settlement, liquefaction, and lateral spreading. Underground utility lines and structures located within the affected areas were damaged, and significant settlement of trench backfill occurred. The worst damage occurred along portions of the Victor, Uniform, Sierra, and X-Ray Wharves, with Sierra Wharf experiencing lateral displacements of 4 to 6 ft (1.2 to 1.8 m). The primary cause was liquefaction of loose material placed behind the bulkhead during construction and the subsequent failure of the tie back system.

While the bulkheads and backfill can be designed for these seismic events, the need to use very large and heavy sheet pile sections negates the cost effectiveness they once enjoyed. They also tend to fail in a non-yielding manner that causes abrupt and not-easily-repaired failures. The deeper berths require more retained fill and hence larger soil retaining stresses. Furthermore, these heavy sections are only produced by one or two foreign mills and require long lead times for large quantities. To resist the lateral forces caused by a seismic event, the tie back system should be pile supported; however, that introduces more cost inefficiencies. Liquefaction of the backlands still remains a problem unless soil improvement techniques (surcharging, stone columns, and dynamic deep compaction being the most common) are incorporated.

2.3.4.3 Concrete Caissons

Reinforced concrete caissons are widely used for the construction of vertical breakwaters and gravity quay walls. Concrete caissons are particularly useful in areas of large tidal fluctuations. A caisson structure was used in the construction of Kilo Wharf in Apra Harbor. This type of construction is also employed where extreme waves are known to occur that could uplift and destroy a pile supported wharf. This is the primary reason that caissons were utilized in both the original construction and the planned extension (Military Construction P-502) of Kilo Wharf.

The caisson is constructed dry in a fabrication facility (typically a graving yard or dry dock), launched or lifted out, floated into place and sunk onto a dredged and prepared gravel foundation placed on the sea floor. The cells of the caisson are then filled with soil and Portland Cement Concrete paving is placed on top to provide the working surface. Because caissons are stand-alone units, they can be used in offshore installations by themselves (as is the case in a portion of the Kilo Wharf facility) or backfilled to provide a contiguous area with the backlands.

Similar to the sheet pile bulkhead, the caisson has a history of poor seismic performance, the primary example being Kobe Port in Kobe, Japan during the Hyogoken Nanbu 6.8 Mercalli event of 1995. In that case, the primary mode of failure was lateral movement (up to 25 ft [8 m]) and rotation of the top of the caissons (tipping) due to foundation failure. Both were due to liquefaction of the retaining and supporting materials during the earthquake.

This design option would require additional dredging/excavation to cut out and level the area behind the selected berth face. Alternatively, the caisson could be placed further offshore in deeper water, but that could require placing a gravel pad to raise the elevation of the foundation to an appropriate level. In addition to the cost for concrete, dry construction, launching, and towage to the site, the added costs of foundation preparation and dredging/excavation makes caissons the most expensive option of the three.

In addition, caisson fabrication in Guam is problematic. There is essentially only one facility capable of fabricating and launching the caissons in a timely manner: the floating dry dock (AFDB-8), that is currently the property of the Guam Shipyard, and may not be available for use in construction of the caissons. Foreign fabricators may be able to provide caissons in a cost effective manner, even though transportation costs may be high. There may be other options such as partial construction on land, launching into a nearby shallow waterway, and finishing construction in deeper water.

2.3.5 Dredging

2.3.5.1 Methodology

The NEPA approach for addressing aircraft carrier-related dredging methods is the same as described in Volume 2 for Sierra Wharf dredging (Volume 2, Chapter 2). There are two general types of dredging operations that could be implemented: mechanical dredging and hydraulic dredging. The operations vary by the method used to loosen the material from its in situ state and transport the material from the seafloor to the water surface. The type of dredging equipment that is used would affect the characteristics of the dredged material. Differences in dredged material characteristics resulting from dredging methods as well as logistical considerations relevant to the use of mechanical and hydraulic dredges are described in Appendix D in Volume 9 of this EIS/OEIS. The distinctions between the two dredging methods are described as follows:

<u>Mechanical Dredges</u>

- Excavates dredge sediments using an open or enclosed bucket that may vary in size from 1.5 cubic yards (cy) to 25 cy (1 to 20 m^3) ; typically barge mounted.
- Placement of dredged material into open scows that hold the material for transport to an offloading site. The offloading site can be upland or open water with proper permits.
- Operates best in hard-packed consolidated sediments and is not well suited for hard rock environments; loose or fine materials tend to be released into the water column during withdrawal from the dredge floor to the surface and back.
- Water content of the dredged material is typically in the range of 10%.

Hydraulic Dredges

- Excavates dredged sediment in place using a system of pipes and centrifugal pumps; typically a self-propelled unit.
- Placement of dredged material into upland placement site where dewatering occurs with return flow discharge into receiving water body; loose or fine material is not released into the water column during transfer of dredged material.
- Able to operate in a wide range of sediment types including some hard surface environments when a cutterhead can be used to grind or claw away hardened materials.
- Water content of the slurry containing the dredged material is approximately eighty percent requiring more management of the upland placement area than mechanical dredges. Freeboard of slurry from the top of the bermed storage area must be maintained and weir structures are typically needed to control effluent to meet water quality standards.

Mechanical or hydraulic dredging or a combination of both could be used for the project. Volume 9, Appendix D describes the general characteristics of the methods. Historically, mechanical dredging has been used in Apra Harbor, and would likely be the preferred method. Mechanical dredging is assessed as the environmentally conservative method (maximum adverse impact) of dredging in the EIS/OEIS because it has the greater combined potential for environmental impacts from direct and indirect impacts to coral reefs due to sediment redistribution. Specific potential impacts to water quality from mechanical dredging are addressed in Chapter 4 of this Volume. Specific potential impacts to marine biological resources are addressed in Chapter 11 of this Volume.

The standard best management practices associated with in-water work (including dredging), such as silt curtains, would be implemented (see Volume 7).

Dredged Material Disposal

This EIS/OEIS assumes four scenarios for the placement of dredged material: 100% disposal in a proposed ocean dredged material disposal site (ODMDS), 100% disposal upland, 100% beneficial reuse, and 20-25% beneficial reuse/75-80% ocean disposal. These four scenarios are explained further below. The 100% ODMDS and 100% upland disposal options are analyzed as the environmentally most adverse scenarios, because placing all dredged material in either location would limit the capacity of either the ODMDS or upland site(s) and does not account for some of the sediment being used for a beneficial purpose. Further discussion of each potential disposal option, including the sediment testing and sampling that has been conducted, is provided below.

Sediment Sampling/Testing

Sediment samples near the proposed dredging areas are being analyzed according to testing criteria (40 Code of Federal Regulations [CFR] Parts 225 and 227). If the sediment meets the criteria, it can be beneficially reused, placed on land, or disposed of in an ODMDS. If the material does not meet the criteria for ocean disposal, it would not be placed in the ODMDS but potentially can still be beneficially reused, placed on land in an upland placement site or a confined disposal facility for treatment or remediation. Preliminary sediment characterization data (NAVFAC Pacific 2006) suggest most, if not all, of the material would meet the testing criteria and be suitable for disposal/dewatering on land or ODMDS disposal (NAVFAC Pacific 2006).

Previous testing for Alpha/Bravo wharf construction and maintenance dredging of Inner Apra Harbor and the approach to the inner harbor has indicated minimal contamination in the nearshore substrate.

Sediment quality investigations in Inner and Outer Apra Harbor were conducted at three locations in Apra Harbor in 2006. The sites were being considered as potential locations for berthing an aircraft carrier. The three sites were: 1) former Charlie Wharf located at Polaris Point east of the Inner Apra Harbor Channel in Outer Apra Harbor; 2) northern coastline of the Former SRF area west of the Inner Apra Harbor Channel in Outer Apra Harbor; and 3) Sierra Wharf on the western edge of Inner Apra Harbor (NAVFAC Pacific 2006). The term Charlie Wharf is a term used in the NAVFAC Pacific 2006 report to describe the northern shoreline area of Polaris Point adjacent to Bravo Wharf even though there is no wharf presently at that location. The reconnaissance level effort was performed consistent with guidance outlined in the Ocean Testing Manual (EPA and USACE 1991). The purpose of the study was to delineate the distribution and magnitude of chemicals of concern within the materials to be dredged from these potential wharf sites.

Sediment core samples were selected from multiple locations within the dredging footprints for the three dredge areas (Figure 2.3-6). The number of samples and the compositing of samples were consistent with common practice for USACE dredging permit applications for Hawaii and Guam dredging projects. Within nine geographic areas, the core samples were composited and analyzed. Composite 1 (six sample locations) and Composite 2 (three sample locations) were representative of the proposed dredging for the turning basin and aircraft carrier berthing at the Former SRF location. Composite 1 and Composite 3 (five sample locations) were representative of the area to be dredged for the proposed turning basin and berthing at Polaris Point (see Figure 2.3-6).

The results of the physical testing indicated that, with the exception of the Composite 3 area adjacent to Charlie Wharf, the sediments were coarse-grained and comprised predominantly of gravelly sand. In the Composite 3 area and all of the Inner Apra Harbor areas, the sediment samples were predominantly finer-grained, silty clay material.

Chemical analyses were conducted according to USEPA and American Society for Testing and Materials standards. The results were compared to Effects Range-Low (ER-L) and Effects Range-Median (ER-M) values, and regulatory levels or total threshold limit concentration values (TTLC). The ER-L value represents the concentration below which adverse effects rarely occur and the ER-M value represents the concentration above which adverse effects frequently occur. Study areas in which many chemicals exceed the ER-M values and exceed them by a large margin would be considered more contaminated than those in which none of the sediment quality guidelines were exceeded. With respect to chemical analyses and as noted in detail in Chapter 4, Volume 2, in general, sediment contaminant concentrations were low throughout all the areas sampled. This included results for total organic carbon, heavy metals, ammonia, sulfides, total petroleum aromatic hydrocarbons, PCBs, chlorinated pesticides, organotins, and phthalates. Of all the composite sample chemical test results, only one result in Composite 3 (Polaris Point area) exceeded the ER-L concentration and that was for nickel (NAVFAC Pacific 2006). The ER-L concentration is 20.9 and the test result was slightly higher than the ER-L with a value of 21.50. The results from this study would suggest that the materials to be dredged would not require special handling and would be suitable for upland placement for beneficial reuse or ocean disposal, although the ocean disposal permitting process would require separate analysis and toxicity testing.

There is a low probability of encountering unexploded ordnance in the sediment as the area has been dredged recently. There are no known unexploded ordnance sites within the dredge areas. There have been no Navy dredging projects on Guam that have required designation of an upland site for the treatment or remediation of sediment. None is anticipated for this project.

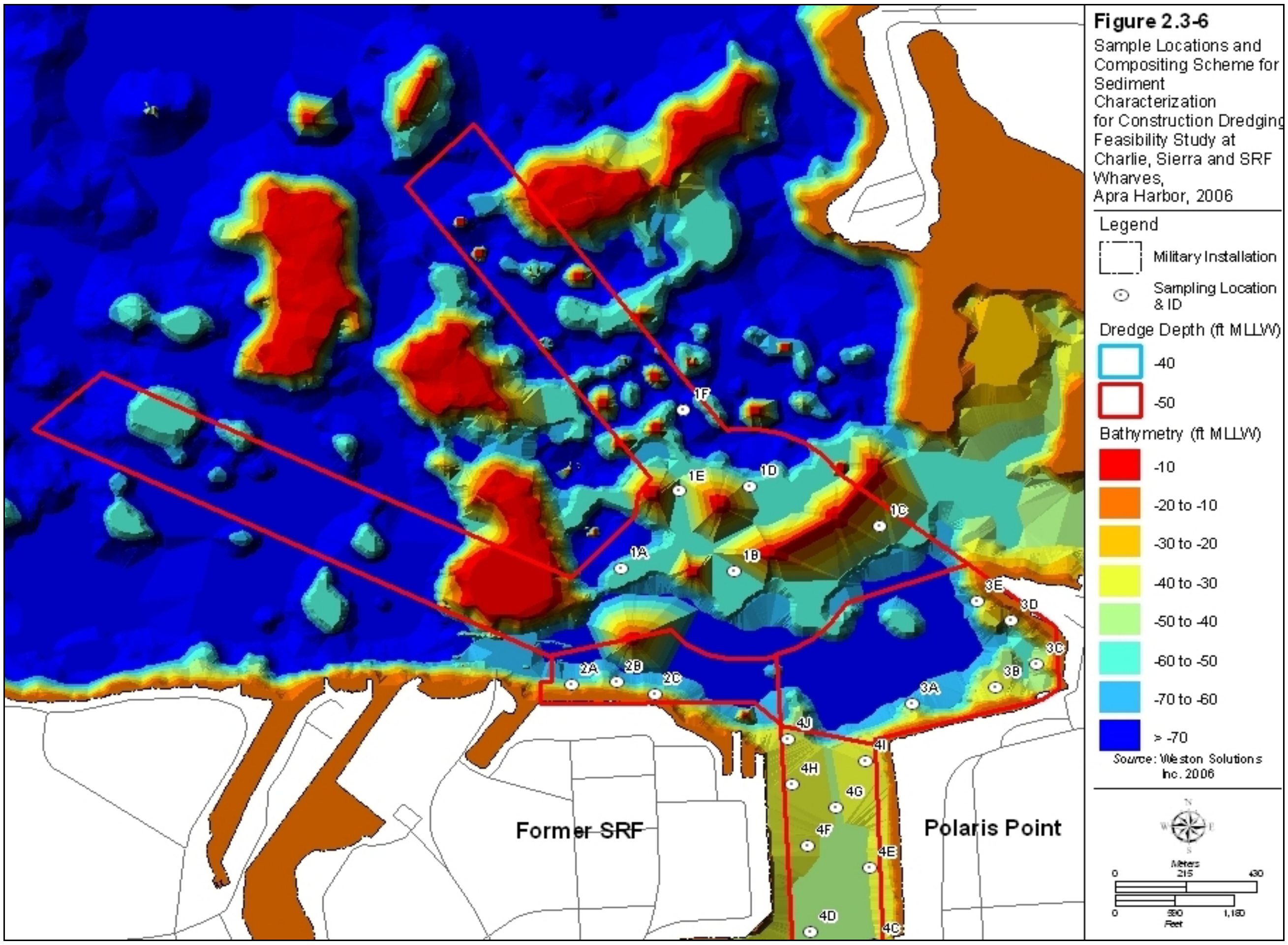


Figure 2.3-6. Sediment Sample Locations

Upland Disposal

The placement of dredged material in upland sites is often referred to as upland disposal even though the primary purpose is to first allow the dredged material to dry out (or "dewater") so it can more easily and cost-effectively be handled for relocation elsewhere once a beneficial reuse has been identified. Existing upland disposal sites are typically managed so that new wet dredged material is kept separate, if possible, from the dry material so that if there is a need for the dry material it easily can be removed from the site. Although sediment can be dewatered in a separate site, for the purposes of the proposed action in this EIS/OEIS, sediment would be "dewatered" and stored within the same areas.

There are existing and feasible new proposed sites for upland placement on Naval Base Guam. The feasible sites are Fields 3, 4, 5, former Public Works Center (PWC) and Polaris Point as discussed in Volume 2. As noted in Volume 2 and in detail in Volume 9 Appendix D, there is sufficient capacity, with berm modification, in the Polaris Point, PWC, and Field 5 sites individually to contain 100% of the total volume of the dredged material from either alternative. Some of the upland placement sites are described under previous NEPA documents (Fields 3 and 5 and Polaris Point) for historical dredging projects. The environmental impacts of using the disposal sites for aircraft carrier wharf dredged material are the same as those described in Volume 2 for the Sierra Wharf dredging, based on preliminary sediment characterization.

Beneficial Reuse

Between 1 and 1.1 million cubic yards (cy) (764,555 million cubic meters [m^3]) of dredged material would be excavated from the Inner and Outer Apra Harbor for the proposed Navy and Marine Corps actions. The dredged material is expected to consist of a mixture of sediments including sand from the outer harbor and silts/clays from the inner harbor. Additionally, there would be coral fragments and other submerged rubble that would be included in the volume of dredged material.

Beneficial use of portions of this total volume would be possible and several local projects have been identified. These local projects include:

- Support shoreline stabilization below Aircraft Carrier Wharf: As part of the construction process, some fill would be used with the riprap stone that would be placed along the shoreline and under the wharf to support the piles. Approximately 40,000 cy (30,582 m^3) of quarry stone in addition to an estimated 20,000 cy (15,291 m^3) of riprap stone is envisioned for this stabilization purpose. It is possible that some of the rubble or some other suitable material from the dredged material could be used and mixed in below the quarry stone layer. Therefore, it is estimated that approximately 50% of the quarry stone amount or 20,000 cy (15,291 m^3) of the dredged material could be used.
- Fill of berms and backstops at proposed military firing ranges on Guam: There are a number of berms and backstops that would be constructed as part of the development of new military firing ranges on Guam. The berms range in length from 35 to 255 ft (11 to 78 m); 7 to 56 ft (2 to 17 m) in width; and 3 to 7 ft (0.9 to 2 m) in height. Fill would be used to create these earthen mound structures. The volume within these berms and backstops has been calculated and equals an estimated 160,000 cy (122,328 m^3).
- Port Authority of Guam (PAG) expansion program: The PAG has prepared a Master Plan that includes a proposed eighteen acre area for expansion of fast land to support new commercial port cargo handling in Apra Harbor. The potential in-water expansion project is an ambitious endeavor that may be confronted with cost, feasibility and ecological concerns and also requires full environmental documentation by the USACE and subsequent permit approval before implementation. Up to 1.5 million cy (1.2 million m^3) of artificial fill would be needed to create this new land if this PAG expansion program comes to fruition. The Navy has a memorandum of agreement with PAG to provide fill from proposed dredging projects should the material be deemed suitable and the timing and logistics of both projects work out.

Given the potential availability of these upland beneficial use projects on Guam, the following four scenarios are possible for the disposal or placement of the proposed dredging projects in the Inner and Outer Apra Harbor:

1. 100 % beneficial use with all dredged material being used as artificial fill for the PAG expansion program (either direct waterfront placement or following placement at PAG upland placement site)
2. 20-25% beneficial use of dredged material in berm construction and under wharf for shore and pile stabilization (assumes no PAG need and/or logistics/approval problems for use of fill) and 75 to 80 % ODMDS placement;
3. 100% upland placement on existing Navy confined disposal facilities on base on Apra Harbor; and
4. 100% placement in the Guam ODMDS.

The percentage of beneficial re-use could exceed the 20-25% scenario depending on the individual potential projects noted above or a combination of them or other re-use options such as landfill cover or road base material use.

ODMDS

The U.S. Environmental Protection Agency (USEPA) is pursuing the designation of an ODMDS approximately 11 to 14 nm (20 to 26 km) from the west coast of Apra Harbor. The designation is anticipated in 2010 and an ODMDS EIS is being prepared concurrent with this EIS/OEIS. Ocean disposal is regulated under Title 1 of the Marine Protection, Research, and Sanctuaries Act (33 USC 1401 et seq.) Formal designation of an ODMDS does not constitute approval of dredged material for ocean disposal.

Results from additional analysis and testing would be required to develop a dredged material management plan and the USACE Section 404/10/103 permit application. Ocean disposal is only allowed when USEPA and USACE determine that the project dredged material: 1) is environmentally suitable according to testing criteria, as determined from the results of physical, chemical, and bioassay/ bioaccumulation testing that is briefly described in Section 2.7 (USEPA and USACE 1991); 2) does not have a viable beneficial reuse; and 3) there are no practical land placement options available. Should dredged material be deemed unsuitable for ocean disposal, it would have to be disposed of in an upland placement site on land.

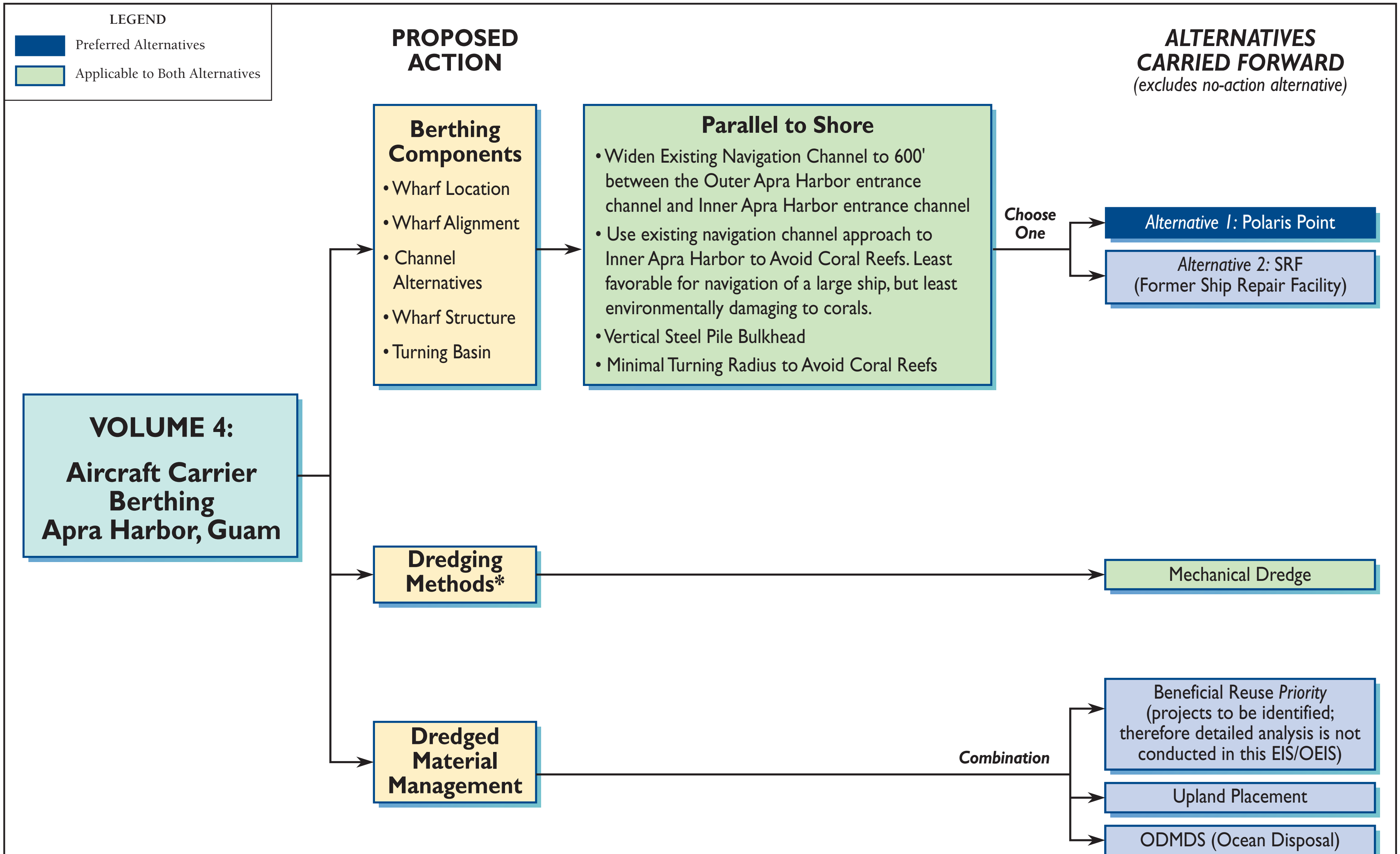
2.4 Alternatives Carried Forward for Analysis

The lead agency's primary decision relative to the visiting aircraft carrier is whether to construct a new deep-draft wharf along the northern coastline of Polaris Point or the Former SRF, or to take no action. The proposed operation and required facilities would be the same at both sites; however, there would be site-specific differences in construction required to meet the operational requirements. The two wharf location alternatives have the same navigation channel alignment that follows the existing ship navigation route between the Outer Apra Harbor entrance channel and the Inner Apra Harbor entrance channel. The turning basins are slightly different but both turning basin radii are the minimum allowable within Navy navigational and operational constraints.

The alternatives in this EIS/OEIS were evaluated to ensure they met the purpose and need as outlined in Chapter 1. Subsequent sections (Sections 2.5 and 2.6) describe in detail the two alternative wharf locations carried forward for analysis: Alternative 1, Polaris Point (preferred alternative), and Alternative 2, Former SRF. Figure 2.4-1 provides an overview of the alternatives that are considered for analysis in this EIS/OEIS.

2.4.1 Least Environmentally Damaging Practicable Alternative (LEDPA)

Chapter 4 of this Volume contains an analysis of the least environmentally damaging practicable alternative (LEDPA), which is required under the Section 404(b)(1) guidelines of the Clean Water Act (CWA). Specifically, Section 404(b)(1) of the CWA stipulates that no discharge of dredged or fill material into waters of the United States, which include wetlands, shall be permitted if there is a practicable alternative (LEDPA) which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant environmental consequences. Furthermore, an alternative is considered practicable if it is available and capable of being implemented after taking into consideration cost, existing technology, and logistics in light of overall project purposes. The Section 404 (b)(1) guidelines are applicable to the proposed aircraft carrier berthing activities analyzed in this Volume and are discussed in detail in Chapter 4.



*Note: Analysis assumed dredging by mechanical means as an environmental maximum potential adverse affect method and is the method historically used at Apra Harbor. Hydraulic dredge may be used in final design and permitting.

Figure 2.4-1
Summary of Proposed Action and Alternatives Carried Forward for the Navy Aircraft Carrier Berthing, Guam

2.5 ALTERNATIVE 1: POLARIS POINT -PREFERRED ALTERNATIVE

2.5.1 Operation

Figure 2.5-1 shows the Alternative 1 Polaris Point (referred to as Alternative 1) project area, including a 3-dimensional rendering. As described in the alternatives considered and dismissed section, the navigation channel would be widened to 600 ft (183 m) and the alignment would follow the existing navigation channel fairway with a sharp bend between Jade and Western Shoals. The most likely route of the aircraft carrier through the harbor and to the wharf is depicted by ship icons in Figure 2.5-1. The carrier would be pivoted within the minimum radius turning basin to be aligned starboard side to the wharf and the bow would be facing east. On departure, the aircraft carrier would follow the same route with assistance by tugboats. When a carrier is not present, other ships would be able to use the wharf at the discretion of Port Operations. These ships would be significantly shorter and easier to maneuver into the wharf than an aircraft carrier.

Access to the site on land is from the traffic signaled intersection at Marine Drive and existing Polaris Point Road through the Polaris Point manned security gate and manned security gates at the aircraft carrier compound. Because of the distance from the wharf to Naval Base Guam, there likely would be limited increased pedestrian traffic between the wharf and Naval Base Guam.

2.5.1.1 Radiological Material Operation

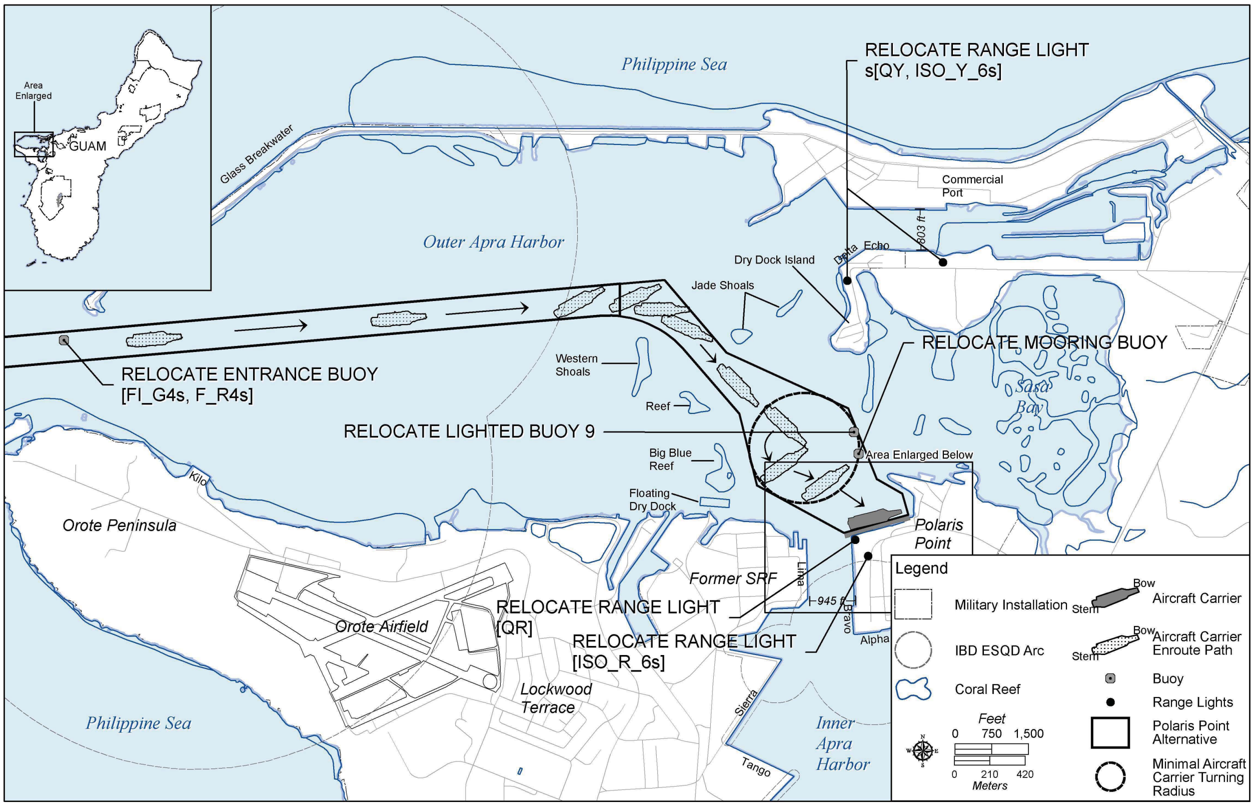
Nuclear-powered aircraft carriers already visit Guam. No changes to current in-port operations would be expected because of the anticipated longer visit times (21 days compared to 7 days). Minor regularly scheduled maintenance, or small emergent repairs, may occur while in port just as might happen today. If required, a routine transfer of radiological waste packaged per Department of Transportation requirements would be conducted. Existing radiological response capability stationed at the Polaris Point Alpha and Bravo wharf area supporting the homeported submarine squadron would to be available to support the aircraft carrier if needed, as occurs under existing conditions.

2.5.2 Facilities

2.5.2.1 Shoreside Structures

Staging Area and Access

Alternative 1 provides for approximately 5.8 ac (2.3 ha) of staging area adjacent to the back of the wharf (Figure 2.5-2 and Figure 2.5-3.) The staging area would be sloped landward at 1%, the same as the wharf. The entire area would be paved with asphalt and concrete over a crushed aggregate base. All underground utilities and storm drains as well as building and light standard foundations would be installed prior to paving.



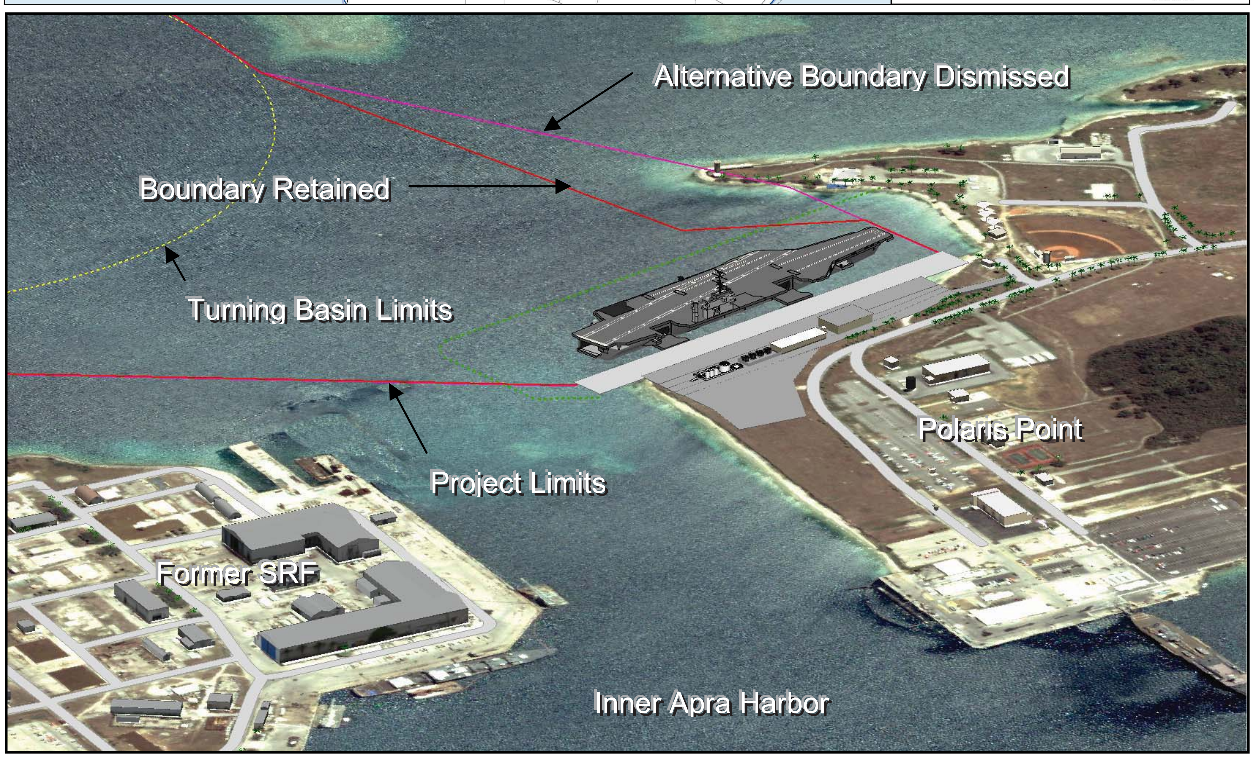


Figure 2.5-1
Alternative 1 – Polaris Point

Source: NAVFAC Pacific 2008

The proposed staging area for the aircraft carrier services is configured and sized to provide unimpeded access to the wharf, with a reasonable amount of area for operation, staging, and support. In addition, adequate areas to accommodate the various buildings listed in the previous section and associated parking would be provided. Demolition of nearby buildings and roadways would be kept to a minimum.

A new 10,000 ft^2 (929 m^2) Port Operations Support Building with restrooms would be used for storage of material and equipment that support the aircraft carrier visits, including floating security barriers and replacement parts shipped to Guam pending aircraft carrier arrival. The building would be uninhabited with no planned office space. The building would be constructed of concrete and designed to meet typhoon winds, seismic forces, anti-terrorism/force protection (AT/FP) requirements, sustainability objectives and other applicable codes. It would be located at the western end of the staging area and west of the proposed utility buildings.

The site plan provides access from Polaris Point Road with a short one-way access lane cut through the apex of the existing softball field lot. This would provide queuing for about 12 vehicles without obstructing Polaris Point Road or the right hand turn-off to the softball diamond. Vehicles denied entry would have room to back up onto the turn-off road and return back down Polaris Point Road. The driveway entrance/exit is quite a bit longer than that for the Former SRF site but the slope is not as steep (NAVFAC Pacific 2008).

Security/Biosecurity

Security

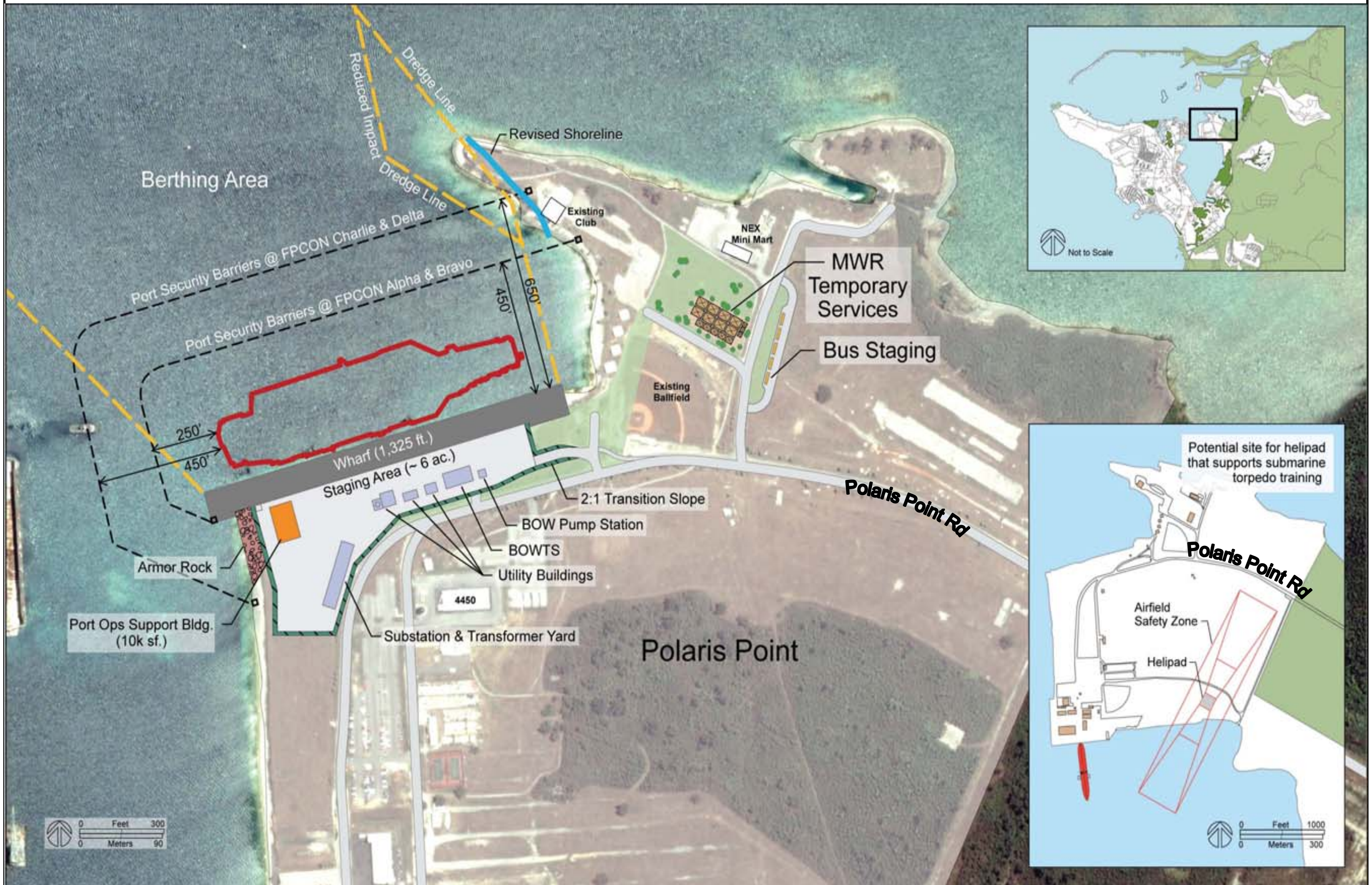
Landside and waterside security requirements were established from UFC 4-025-01 (*Waterfront Security Design*). The perimeters of staging areas are designed to protect against vehicle intrusion with hardened security fencing (security fencing supported on concrete vehicle barriers). In areas inaccessible to vehicles, such as rock revetments and beach shorelines, only security fencing would be used to prevent pedestrian intrusion. The wharf access control point, via the staging area or directly from an approach ramp, would be at a guard booth controlling active vehicle barriers (hydraulic bollards and traffic spikes) for the inspection of vehicles.

Watch towers are required for the berth. UFC specifications require that they be at least 30 to 50 ft (9 to 15 m) above the wharf, positioned to monitor the waterfront, spaced at approximately 1,000 ft (305 m) intervals, and that they be hardened and secured by fencing. The towers would be sized to support two personnel with Heating, Ventilation, and Air Conditioning (HVAC), water, sewage, telephone, fire alarm, security power circuits, etc., but designed to be operated by a single person. Due to the orientation of the wharf and the dredging required at the end of the point, the existing guard tower would have to be demolished. A replacement tower would be constructed at the southern side of the east end of the wharf.

Floating port security barriers are required to surround an aircraft carrier while it is at berth. The recommended minimum barrier standoff requirement for force protection condition Alpha and Bravo is 250 ft (76 m) from the aircraft carrier hull. In the event that force protection conditions Charlie and Delta are declared, the port security barriers would have to be relocated 200 ft (61 m) beyond the barriers for force protection condition Alpha and Bravo. The proposed locations are shown on Figure 2.5-2.

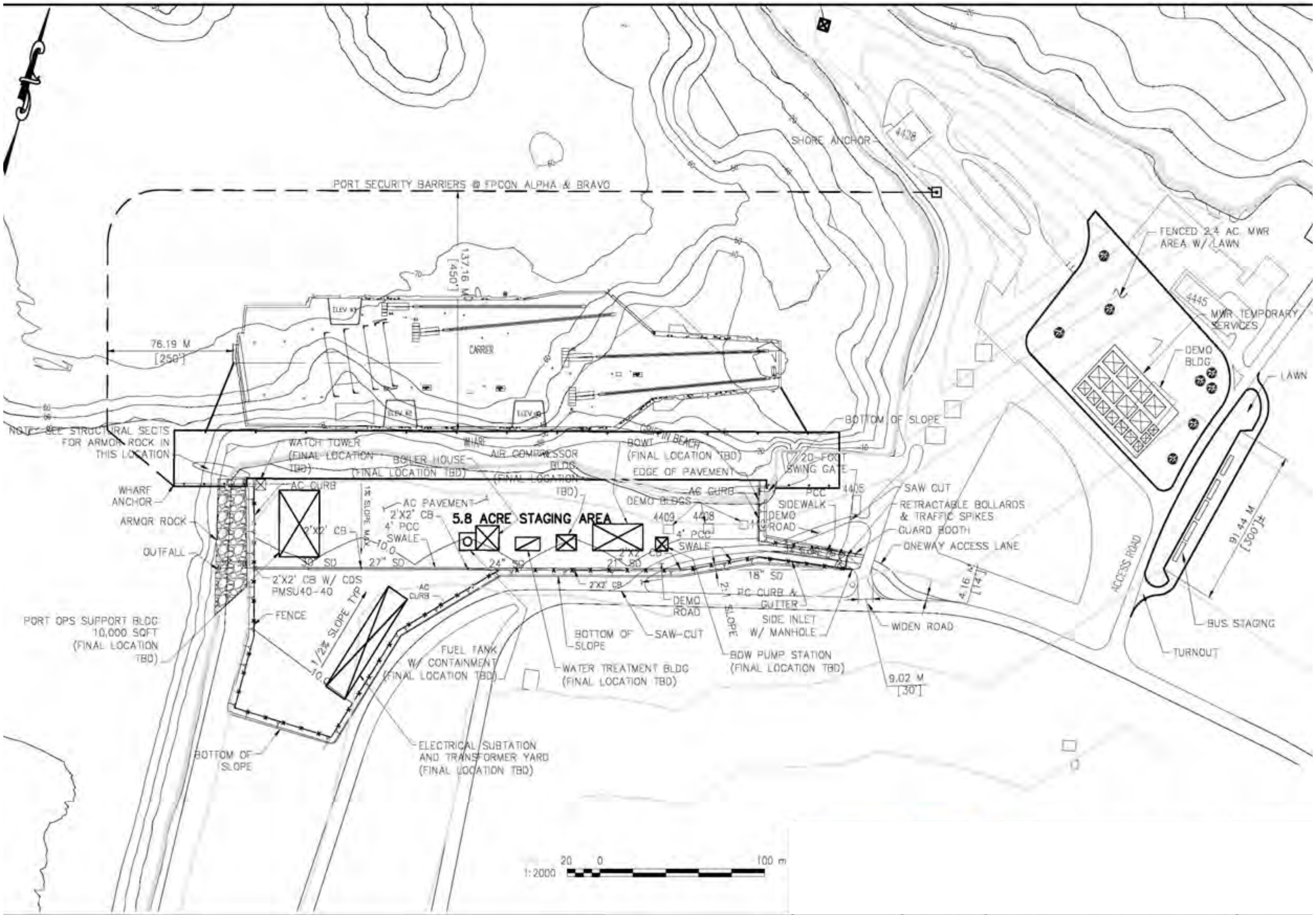
Shoreside security would be enhanced by a combined single entrance and exit ramp to the surrounding grade. Access to the facility would be controlled by a guard building at the entrance and protected by hydraulic bollards and traffic spikes. Traffic queuing would be afforded to various degrees in each alternative layout.

Figure 2.5-2 Polaris Point Alternative Site Plan



Source: NAVFAC Pacific 2008

Figure 2.5-3 Polaris Point Improvements



Source: NAVFAC Pacific 2008

Each layout is designed so that rejected vehicles can turn around without being boxed in from behind. This eliminates the possibility that a vehicle would have to drive past the check point and make a U-turn and leave. For additional protection, the entrance ramps also would be situated a reasonable distance from the asset. An enclave gate and concrete sidewalk along the entrance side of the ramp also would be provided for pedestrians. Pedestrian access would be controlled by the same guard booth as the vehicles. Appropriate electronic surveillance would be installed.

Biosecurity

Brown treesnake (BTS) control plans and other invasive species controls would include a quarantine and inspection area and security fencing designed for both humans/vehicles inspection and BTS control. The DoD has a joint region BTS Control and Interdiction Plan which includes measures such as 100% cargo inspections, 100% vehicle and aircraft inspections, fenceline trapping, and nighttime searches. A comprehensive Biosecurity Plan is being developed in cooperation with the U.S. Fish and Wildlife Service (USFWS), U.S. Department of Agriculture (USDA), U.S. Geological Survey (USGS), National Invasive Species Council (NISC), the state of Hawaii, the Commonwealth of the Northern Mariana Islands (CNMI), and GovGuam. Aircraft that stage at Andersen AFB would be subject to existing joint region BTS protocols. Additional protocols as identified in the joint region Biosecurity Plan would be adopted at that time. Volume 7 contains a more detailed description of the proposed Biosecurity Plan.

<u>MWR</u>

The Navy MWR area for supporting aircraft carrier activities would be situated on a 2.4 ac (0.97 ha) lot north of the existing baseball field on Polaris Point (see Figure 2.5-2 and Figure 2.5-3). The MWR area would be located about 500 ft (152 m) north of the access control point for the staging area. There is a 7,200 ft^2 (669 m^2) building pad that would have to be razed before that area could be graded and landscaped for lawn and trees. The lawn may be supported by a permanent irrigation system. A 3 in (7.62 cm) thick asphalt lot about 0.5 ac (0.2 ha) in size would be constructed for locating temporary facilities such as food and beverage booths, seating areas, parking and lighting.

The MWR area would require utility connections. The area would be enclosed by a 1,300 ft (396 m) long chain-link fence and would have multiple locking swing gate entry points. One of the gates would have a permanent turnstile and guard shack. A loop road would be constructed off of the east side of the Polaris Point access road. The loop road would have a 10 ft (3 m) wide by 300 ft (91 m) long turnout on the west side to park five buses. Bicycles would be made available at the MWR area.

<u>Aids to Navigation</u>

To accommodate the widened channel, turning basin, and approaches to both wharf location alternatives, the existing aids to navigation would require modification. The existing Inner Apra Harbor Channel is marked at the entrance in Outer Apra Harbor with two lighted buoys designated as: “FI G 4s” and “FI R 4s.” The centerline of this channel is defined for navigation by the entrance range lights designated “QY” and “Iso Y 6s.” Because the proposed realignment and widening of this channel is not identical with the current centerline, relocation of entrance lighted buoy “FI R 4s” and both range lights “QY” and “Iso Y 6s” would be required.

The existing Approach Channel to Inner Apra Harbor would be widened and slightly realigned. The alignment of this channel is currently designated by range lights “Q R” and “Iso R 6s.” Additionally, the channel limits are marked with lighted buoys to warn pilots of the shoals on either side of the navigation path. It is recommended that both range lights “Q R” and “Iso R 6s” be relocated to redefine the channel centerline. For Alternative 1, the range lights at Polaris Point would have to be relocated and raised so that the lights are high enough to be seen by other ships when the carrier passes in front of the lights. The proposed enlargement of the turning basin would also require relocation or removal of two other buoys. One is a mooring buoy located at the eastern edge of the proposed basin and the other is lighted buoy "9" just north of the mooring buoy. Figure 2.5-1 illustrates the buoys and range lights that would have to be relocated or removed to avoid obstructing the channel.

2.5.2.2 Utilities

Although the utility requirements for the CVN 68 (Nimitz Class) and CVN 78 (Ford Class) are similar, there are some differences, as shown in Table 2.5-1. The differences are highlighted in bold typeface. The requirements were compiled from Navy technical guidance and specifications (NAVFAC Pacific 2008). These requirements are significantly greater than for other Navy vessels. The *CVN-Capable Berthing Study* (NAVFAC Pacific 2008) contains detailed information on utility requirements. Table 2.5-2 indicates which utilities require new facilities or improvements to existing facilities based upon alternative locations. Volume 6 includes the waterfront demand on utilities and addresses alternatives to large scale utility demands as a result of the proposed nuclear aircraft carrier berthing, relocation of the Marine Corps, and Army Air and Missile Defense Task Force to Guam. The Volume 4 discussion of utilities is specific to utility improvements to support the aircraft carrier requirements.

<u>Steam, Compressed Air, and Pure Water</u>

Steam, compressed air, and pure water utilities do not exist at either alternative site.

Saturated steam (150 pounds per square inch gauge [psig]) is used by CVN 68 vessels to supply shipboard laundry and galley facilities, in addition to any supplementary heating requirements. The steam demand is what is required by the berthed vessel crew complement with an embarked air wing. Steam is not required for CVN 78 vessels. The constant load for the CVN 68 is 7,500 pounds/hour. System redundancy and capacity is described in UFC 3-430-08N. Two marine oil-fired boilers would be installed in a new boiler house with condensate collection systems. Two distribution pipes would be installed underground between the boiler house and the wharf.

A compressed air system is required for CVN 68 class vessels at all active berths, but CVN 78 does not have a compressed air requirement. Under emergency conditions, the vessel's compressed air system would be used to fill any additional compressed air demand. Typically, the vessel requirement for 125 psig compressed air should be at a minimum commercial quality. However, it is presumed that the air may also be used for emergency response equipment and thus shall meet the requirements of Class D breathing air as described by American National Standards Institute G-7.1-1989. Both the steam and compressed air requirements and conditions are defined by Military Handbook (MIL-HDBK) 1025/2, and UFC Manual 2150-02. A new 2,400 standard cubic foot per minute system would be built with underground piping along the wharf.

Pure water is required to support the nuclear powered capabilities of the aircraft carrier. The requirement is 20,000 gallons per day (gpd) (75,708 liters per day [lpd]). Existing potable water infrastructure would be used and water would be treated to Grade A quality. A structure would house the equipment, and underground pipes would extend to the wharf. The possibility of using temporary portable equipment was evaluated and determined not feasible due to procurement costs, maintenance, and storage when not in use; and labor for set-up, tearing down, and certification.

Table 2.5-1. Aircraft Carrier Utility Requirements

System	*Criteria*	*Requirement*		*Source*
		CVN 68 (Nimitz Class)	*CVN 78 (Ford Class)*	
Bilge Oily Waste	Peak Quantity	80,000 gpd	**82,000 gpd**	UFC 4-150-02;
	Average Quantity	35,000 gpd	**38,000 gpd**	
	Design Rate	90 gpm	90 - **180 gpm**	
Wastewater	Average Daily Flow	550,000 gpd	550,000 gpd	UFC 3-240-2N
Potable Water	Average Demand	185,000 gpd	**235,000 gpd**	UFC 4-150-02; UFC 2150-02
	Design Rate	1,000 gpm	1,000 gpm	
	Minimum Pressure	40 psi	40 psi	
Steam	Constant	7,500 lb/h	**Not required**	UFC 4-150-02; UFC 3-430-08N; UFC-3-430-09N
	Intermittent	7,200 lb/h	**Not required**	
Compressed Air	Design Rate	2,400 scfm	**Not required**	UFC 3-150-02; UFC 4-213-10; UFC-3-430-09N
Pure Water	Peak Rate	150 gpm	**100 gpm**	Draft CVN 78 facilities planning criteria
	Design Rate	20,000 gpd	20,000 gpd	
Shore Power	Peak Demand	21 MW 4,160 V	**30 MW @ 13,800V**	UFC 4-150-02; UFC 2150-02
Information Systems	Capacity	200 pair copper; 48-strand fiber optic cable; provision for CATV connection	Assume same as CVN 68	UFC 4-150-02; UFC 2150-02; and NCTS discussions

Legend: **BOLD** text indicates that requirements differ for CVN 78 compared to CVN 68
CATV = cable television, gpd = gallons per day, gpm = gallons per minute, lb/h = pounds per hour, MW = megawatts, psi = pounds per square inch, scfm = cubic feet per minute at standard conditions, V = volts.
Source: NAVFAC Pacific 2008.

Table 2.5-2. Aircraft Carrier Utility Type of Construction

System	*Alternative 1 Polaris Point*	*Alternative 2 Former SRF*
Bilge Oily Wastewater	New	New
Wastewater	Improve existing and supplement	Improve existing and supplement
Potable Water	Improvement (extend line)	Improvement (extend line)
Steam	New	New
Compressed Air	New	New
Pure Water	New	New
Shore Power	New and improvements	New and improvements
Information Systems	Improvement (extend line)	New extend from Building 3169

Bilge and Oily Wastewater Treatment System (BOWTS)

A BOWTS separates oil, grease, and oily waste found in bilge and oily water. A BOWTS has the capability to lower the contaminant levels to less than the permissible limits for discharge to publicly owned treatment works. The new BOWTS would be sized to accommodate the ultimate requirements of the CVN 78: i.e., a pumping rate of 90 gallons per minute (gpm) (341 liters per minute [lpm]) with an average flow rate of 38,000 gpd (143,846 lpd) and a peak flow rate of 82,000 gpd, (310,404 lpd).

The existing BOWTS at Apra Harbor Naval Complex are inadequate to handle the requirements of either a CVN 68 or CVN 78 for a 21 day duration visit. Therefore, a permanent BOWTS is proposed near the wharf and would include a combined gravity and force main collection system as well as a bilge oily wastewater (BOW) pump station. Separated water would be sent to the DoD water treatment facility at Apra Harbor. Reclaimed oil would be handled in accordance with existing base oil management procedures and used for power generation or recycled/re-refined for other purposes. BOW operations are carried out according to a Naval Base Guam Facilities Response Plan prepared under the Oil Pollution Act of 1990 (OPA 90) regulations and guidelines.

Wastewater

The existing wastewater treatment plant and collection system at Apra Harbor Naval Complex is inadequate to handle the volume of wastewater of either a CVN 68 or CVN 78 for a duration of 21 days. Depending on the selected berthing location, upgrades would be required for various portions of the landside wastewater collection system.

Proposed improvements to the Apra Harbor Wastewater Treatment Plant (AHWWTP) are being executed under other military construction projects (MCON P-262 and P-534). This particular plant currently operates at a secondary wastewater treatment plant level. The AHWWTP is being rehabilitated and upgraded to restore its designed capacity of 4.36 million gallons per day (mgd) (16.5 million liters per day [mld]). The Navy is upgrading the plant disinfection system to reduce the discharged coliform level, implementing/monitoring pre-treatment programs, and removing wastewater treatment plant (WWTP) sludge from the sewer to reduce metals to the plant. The composition of the wastewater from the aircraft carrier is primarily domestic waste but in a more concentrated form. The projected aircraft carrier wastewater inflows would increase wastewater flows to AHWWTP by approximately 550,000 gpd (2.1 mld). Currently AHWWTP has an average flow of 2.9 mgd (11 mld). Even with the additional proposed flow, the wastewater plant would be operating within its design parameters and permitted capacity. However, in addition to completion of the programmed projects, other improvements to the wastewater system would be required to support the aircraft carrier berthing.

Upgrades to the existing Sewage Pump Station (SPS) Number 9 at Polaris Point, associated force main, and trunkline “B” would be necessary to accommodate the additional flows from an aircraft carrier. Specific improvements would include the construction of a new submersible type SPS, a new dry pit/wet well-type pump station to replace the aging SPS 9, and 14,800 linear ft (4,511 m) of associated force mains. In addition to the pressurized systems, approximately 4,940 linear ft (1,506 m) of new gravity sewer lines would be required, including 4,420 linear ft (1,347 m) of 8, 12, 15, and 21 in (0.2, 0.3, 0.38, 0.53 m, respectively) lines. These upgrades would follow existing rights of way and utility lines that currently parallel Route 29 and Marine Corps Drive. Standard construction practices would be utilized to ensure that existing lines are not disrupted.

A standard ship to shore sewage hose capable of handling pressurized sewage would connect the vessel’s discharge fitting to the shore receiving station also known as a riser. The riser consists of a hose connector, plug valve, and a check valve. The manifold piping system transfers wastewater to the shore piping system and to the lift station. This control network ensures that the wastewater exits the ship and arrives into the lift station avoiding the possibility of uncontrolled release of the wastewater.

<u>Potable Water</u>

The potable water supply would be connected to the southern Navy water system, which receives its surface water supply from Fena Reservoir. Potable water demand for the aircraft carrier would have no impact on the Northern Guam Lens Aquifer. According to and following the applicable UFC documents and guidance provided in the review draft Navy Facility Planning Criteria for aircraft carriers, the daily average potable water requirements, with air wing or troops aboard, for a CVN 68 is 185,000 gpd (700,301 lpd) and for a CVN 78 is 235,000 gpd (889,572 lpd). Therefore, the existing potable water system requirements are based on the necessity to supply a minimum flow rate at the berthing location of 1,000 gpm (3,785 lpm) at 40 psi and satisfy an average daily demand of 235,000 gpd (889,572 lpd). During periods of low rainfall, the flow rate requirement may have a localized impact on the existing water distribution system, including water provided to GWA to supply water to southern Guam. In accordance with existing DoD directives and existing agreements with GWA, every effort would be made during periods of low rainfall and drought to ensure appropriate water conservation measures are implemented for on base demand at Naval Base Guam, including transient carrier demand.

Potable water is supplied to Polaris Point from the Tupo Tank system. In addition to Polaris Point, the Tupo Tank supplies water to areas outside of the Apra Harbor Naval Complex and north to Barrigada (Navy), including GovGuam and Navy areas between those two locations. Based on the water demands of the service area and the maximum fire flow requirements, the storage capacity of the tank was evaluated based on criteria provided in UFC 3-230-19N (*Water Supply Systems*). The storage capacity required for all users served by the Tupo Tank, including the proposed water demand of a CVN 78, was calculated to be 4.2 million gallons (mg) (15.9 million liters [ml]). The Tupo Tank has a capacity of 5.0 mg (18.9 ml). Therefore, no improvements are required at the Tupo Tank for the berthing of either a CVN 68 or CVN 78 at Polaris Point.

MCON Project P-431 (Alpha/Bravo Wharf Improvements) improved the water distribution lines within Polaris Point. Approximately 5,000 linear ft (1,524 m) of 8 and 12 in (0.2 m and 0.3 m) water lines supplying water to Polaris Point were replaced with a 16 in (0.4 m) main. The 6 in (0.15 m) water lines along the wharf were replaced with 8 in (0.2 m) lines. A new fire pump house was constructed under this project. These improvements were incorporated in the water system model used to evaluate the capacity of the existing potable water system. The results of the model indicate that more than 1,000 gpm (3,785 lpm) can be provided at pressures exceeding 40 psi to the berthing site at Polaris Point. Therefore, no major water system improvements would be required for this option. Water system improvements would be limited to the construction of a new 8 in (0.2 m) service lateral to the berthing site and the associated pier side water outlets.

The potable water system would be used for any fire fighting requirements at the berth.

Electrical Power Distribution and Communications System

The electrical infrastructure at Polaris Point is capable of supporting planned projects such as Military Construction Project (MCON) P-465, Consolidated Submarine Learning Center Training & Commander Submarine Squadron 15 Headquarters Facility, and P-528, Construct Torpedo Exercise Support Building.

The electrical infrastructure at Polaris Point is incapable of accommodating the aircraft carrier Polaris Point berth without major improvements and additions as follows:

- A new 34.5 kilovolts (kV) circuit breaker and underground feeder circuit in the Guam Power Authority (GPA) Piti 34.5 kV Switching Station (by GPA)
- A new aircraft carrier berth substation
- Operational and security lighting using high-mast steel poles with metal-halide luminaries

Stormwater

Alternative 1 provides for approximately 5.8 ac (2.3 ha) of staging area adjacent to the back of the wharf. The maximum surface area of the pier would be approximately 2.7 ac (1.1 ha). Additionally, the MWR area would be situated on a 2.4 ac (0.97 ha) lot adjacent to the pier. Surface flow would be directed toward the west and south perimeters of the staging area and would be intercepted by a concrete swale. The layout of the staging area intercepts surface flow from the southeast. Therefore, a catch basin is planned to intercept this flow (however, more refined topographical and planimetric information may demonstrate that this catch basin may be eliminated and the total design flow reduced accordingly). The storm drain path would be along the same alignment as the swale, southward and then westward. A cyclonic separator would be located in the southwest corner of the staging area and the outfall located on the east end of the channel between the Apra Inner and Outer Harbors. Armor rock would be installed from the back of the wharf to about 250 ft (76 m) southward along the channel. However, additional rock cover is planned on the east side of the staging area at the west end of Griffin Beach, to protect the concrete cut-off wall return from undercutting action by waves. Chapter 4 of this Volume contains more information on potential impacts from stormwater.

Solid and Hazardous Waste

Typically, solid waste storage bins would be provided in the aircraft carrier compound and near the MWR activity area, as needed. Solid waste would be handled and managed in accordance with Navy standard operating procedures and would be disposed of at the Navy landfill as long as it meets all criteria for disposal in the landfill.

A ship-board hazardous regulated waste receptacle is typically designated at the wharf. The hazardous waste would be managed in accordance with Navy standard operating procedures and the Navy Resource Conservation and Recovery Act (RCRA) permit would be modified to consider the additional volumes of waste. Additionally, the increase in hazardous materials would be handled and disposed of per applicable best management practices as described in Volume 7. Volume 4, Chapter 17 contains a description of the types and quantities of hazardous waste that would be generated from the proposed action.

2.5.3 Construction

2.5.3.1 Polaris Point-Specific

The wharf plan for Alternative 1 (Polaris Point) is shown on Figure 2.5-4. Site preparation would require the grubbing and removal of all ground cover for construction of the staging area. The site area is estimated at 250,000 ft^2 (23,226 m^2). Site preparation would include demolition and replacement in-kind of three minor buildings (4407, 4408, 4409) (totaling approximately 940 ft^2 [87 m^2]). Surveys of these buildings have been conducted for asbestos-containing material, lead-based paint, and PCB-containing electrical equipment. Demolition and recovery of these types of materials, if present, would be conducted in accordance with Navy procedures and applicable laws.

There would be required some minor roadway and remnant pavement removal and possibly re-alignment of utility lines along this portion of roadway. The soil would be scarified and re-compacted before the fill material is placed to prevent differential settlement. No tree removal would be required. Landscaping, including trees and grass, is proposed in the MWR area. Subgrade work would be required for installation of utility ducts and storm water facilities. Fill would be required behind the riprap slope underneath the wharf. Vertical sheet pile would be driven into the slope (Figure 2.5-5).

There would be required some minor roadway and remnant pavement removal and possibly re-alignment of utility lines along this portion of roadway. The soil would be scarified and re-compacted before the fill material is placed to prevent differential settlement. No tree removal would be required. Landscaping, including trees and grass, is proposed in the MWR area. Subgrade work would be required for installation of utility ducts and storm water facilities. Fill would be required behind the riprap slope underneath the wharf. Vertical sheet pile would be driven into the slope (Figure 2.5-5).

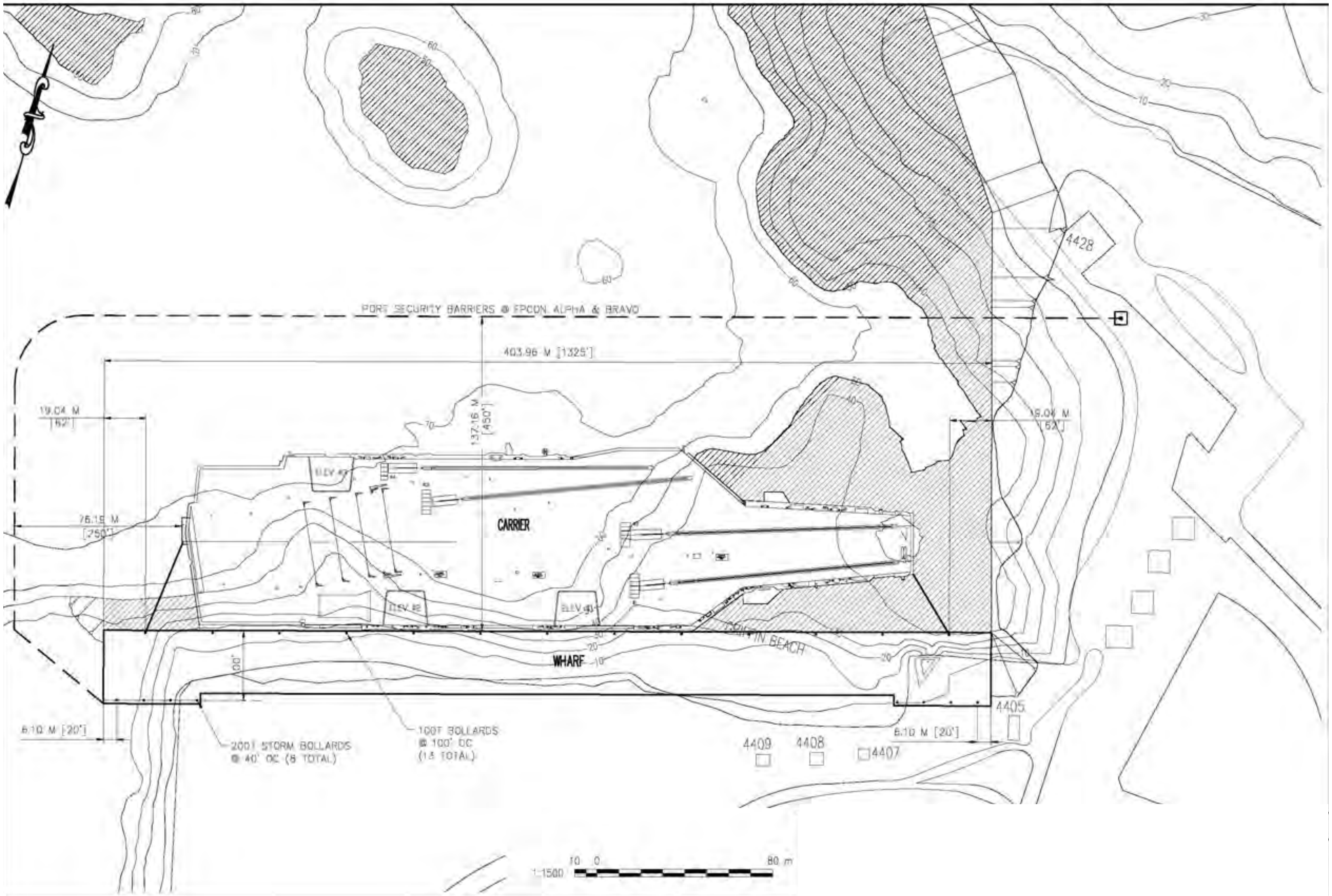
The project dredging would be limited to an area near the channel bend, portions of the turning basin and areas under the wharf structure. Figure 2.5-6 shows the outer limits of dredging and specific areas that would require dredging because they are currently less than -49.5 ft [-15 m] MLLW. The minimum turning basin radius is shown on Figure 2.5-1. Approximately 608,000 cy [465,850 m^3] of dredged material including 2 ft (0.6 m) for overdredge would be generated.

2.5.3.2 Construction Common to Both Action Alternatives

<u>Dredging</u>

Standard dredge design has been modified through continuing engineering studies to find the least environmentally damaging alternative for Polaris Point (see *CVN-Capable Berthing Study* [NAVFAC Pacific 2008]). Figure 2.5.6 illustrates the smallest dredge footprint for this alternative. The dredge methods and dredged material disposal options would be the same as those described to support the Marine Corps Sierra Wharf dredging in Volume 2, Section 2.5. Dredging operations have been modeled as a 24 hours per day operation for a duration of 6 to 9 months, but depending upon dredging efficiency, could last from 8 to 18 months. Continuing consultation between the Navy and regulatory agencies would determine the actual operational parameters and duration. The total dredge volume would be approximately 608,000 cy (465,850 m^3), including a 2 ft (0.6 m) overdredge. The total dredge area would be approximately 53 acres (ac) (21.5 hectares [ha]). Approximately 30% of the dredged material would be generated at the shoreline area of Polaris Point to provide an appropriate slope for the wharf structure. The anticipated dredging production rate is 75 cy/hour (57 m^3/hour) based on recent mechanical dredging of similar substrate (Volume 9, Appendix E). At this rate, total production would be approximately 1,800 cy (1,376 m^3) per day.

Figure 2.5-4 Polaris Point Wharf-Plan View



Source: NAVFAC Pacific 2008

The thickness of the substrate to be dredged (from existing water depths to proposed water depths) is only 1.6 to 3.3 ft (0.5 to 1 m) throughout most of the project area. Dredging would therefore pass rapidly from site to site; a 75.5 by 75.5 ft (23 m by 23 m) grid area would require only a half day of dredging. The wharf area would require a longer dredging duration because there would be a greater volume of dredged material. Assuming two 4,000 cy (3,058 m^3) scows, there would be one to two barge trips per day to the ODMDS or an Inner Apra Harbor wharf for loading trucks and hauling to an upland placement site.

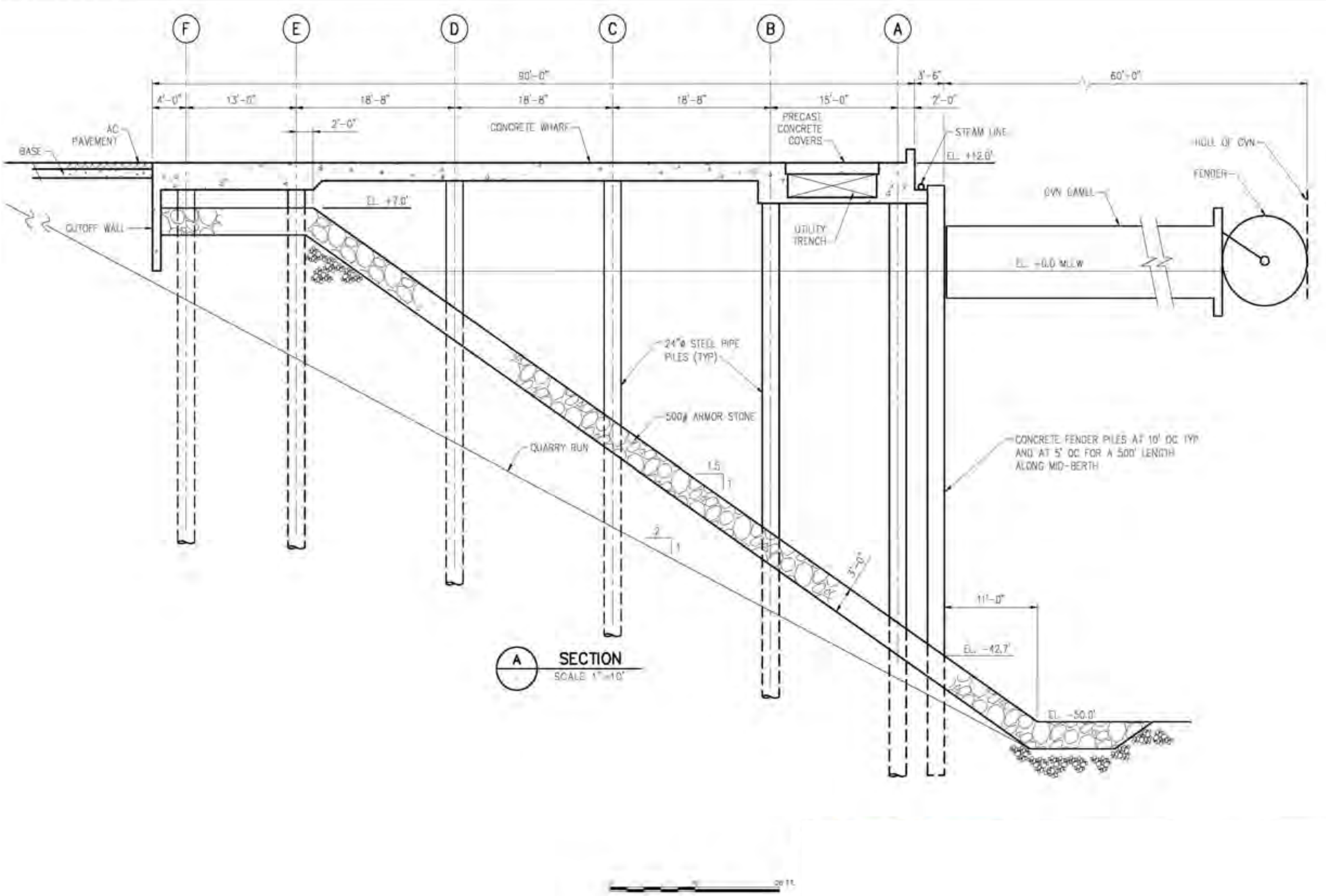
The required Best Management Practices (BMPs) that are not project-specific are described in Volume 7. BMPs to avoid or minimize indirect impacts to nearby reefs would likely include installation and maintenance of silt curtains to contain the re-suspended material within the dredge area. The substrate may require chiseling to roughen the surface prior to dredging to allow the clamshell to grab hold of the material. No blasting would be required.

2.5.3.3 Equipment and Materials

The project would utilize specialized heavy equipment including a dredger and a large floating crane barge with pile driving equipment (if piles are specified in final design). Smaller equipment would include smaller cranes, concrete pumps, small barges, tugboats, and excavation equipment that is available locally. Smaller dredgers have been used historically in Apra Harbor, but the magnitude of this project would likely require imported equipment.

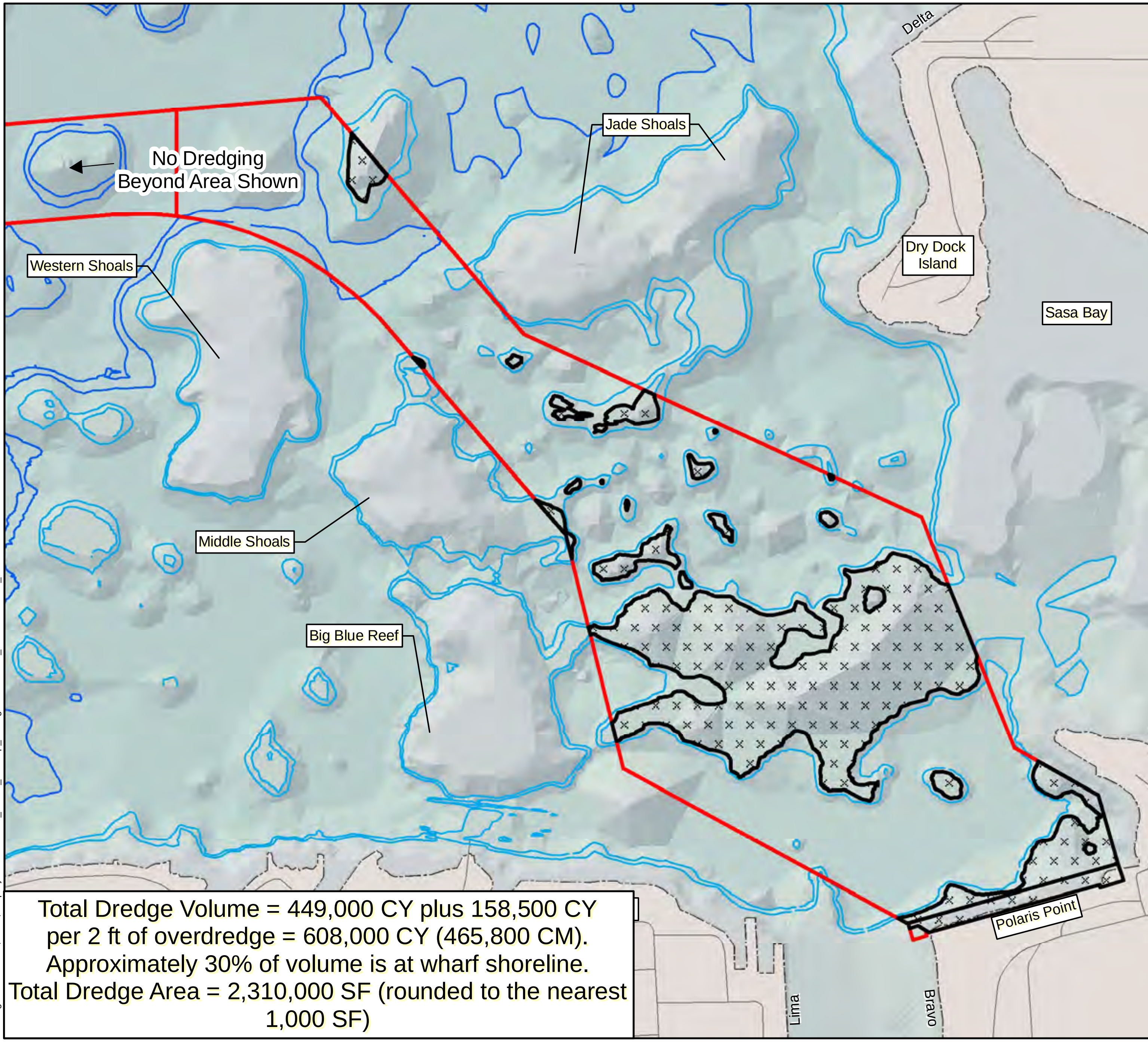
This project would utilize imported materials, including steel pipe piles and steel shapes, concrete forms, miscellaneous metals, fenders, bollards, steel reinforcing and cement for concrete, asphalt, and mechanical equipment and piping for steam, compressed air, and pure water. Some assembly of these items on Guam would be required. Local aggregates for concrete, road base, asphalt paving, and possibly armor rock may be used. All imported materials would come through either the local commercial port or be specially shipped by barge.

Figure 2.5-5
Wharf Profile View-Steel Piles



Source: NAVFAC Pacific 2008

Figure 2.5-6
Polaris Point Dredge Areas



Legend

- Military Installation
- Dredge Area
- Project Area

Bathymetry

- -60 to -49.5 (ft MLLW)
- -120 to -100 (ft MLLW)

N
W E
S

Meters
0 135 270

0 370 740
Feet

Total Dredge Volume = 449,000 CY plus 158,500 CY per 2 ft of overdredge = 608,000 CY (465,800 CM). Approximately 30% of volume is at wharf shoreline. Total Dredge Area = 2,310,000 SF (rounded to the nearest 1,000 SF)

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2.6 ALTERNATIVE 2: FORMER SRF

2.6.1 Operation

The Alternative 2 Former SRF (referred to as Alternative 2) project area and a 3-dimensional rendering are shown in Figure 2.6-1. The site plan is shown as Figure 2.6-2. As described in the alternatives considered and dismissed section, the channel would be 600 ft (183 m) in width and the alignment would follow the existing navigation channel fairway with a sharp bend between Jade and Western Shoals. The proposed route of the aircraft carrier through the harbor and to the wharf is depicted by ship icons in Figure 2.6-1. The carrier would be pivoted within the minimum radius turning basin to be aligned starboard side to the wharf and the bow would be facing east. Unlike at Alternative 1 (Polaris Point), the full 600 ft (183 m) approach distance in front of the wharf would be available. On departure, the aircraft carrier would follow the same route with assistance by tugboats. Operation would be as described for Alternative 1, except for the specifics identified in this section.

Access to the site is from existing primary (Marine Drive and Sumay Drive) and secondary roads (4th Street and Main Street) through Naval Base Guam and into the Guam Economic Development and Commerce Authority (GEDCA) lease area. The lease to GEDCA expires in 2012 and is currently being renewed by the Navy. No decision has been made at the present time in connection with the future reuse of the Former SRF lands to include a new lease for commercial ship repair facility purposes beyond the current 2012 lease expiration date. The proposed project construction would occur after the existing lease term expires. The lease area could be reduced and the proposed project area could be excluded from any new lease.

There would be some disruption of shipyard activities during wharf construction and aircraft carrier visits. Disruption from construction would be temporary and would be mitigated through scheduling of construction and ship repair visits. Disruption of shipyard activities during aircraft carrier visits would be minimized through scheduling with the shipyard and potentially mitigated through compensation for delays or lost work. When an aircraft carrier is in port, the dry dock (AFDB-8, Big Blue) could not be used for docking or undocking. Further, force protection requirements, including deployment of the floating port security barriers, would conflict with continued use of the dry dock at its present location. The effects of these limitations would be a restriction on commercial business opportunities at the commercial ship repair facility. Figure 2.6-1 and Figure 2.6-2 show the location of the dry dock.

2.6.1.1 Radiological Material Operation

Nuclear-powered aircraft carriers already visit Guam. No changes to current in-port operation are expected because of the anticipated longer visit times (21 days compared to 7 days). Minor regularly scheduled maintenance, or small emergent repairs, may occur while in port just as might happen today. If required, a routine transfer of radiological waste packaged per Department of Transportation requirements would be conducted. Existing radiological response capability stationed at the Polaris Point Alpha and Bravo wharf area to support the homeported submarine squadron would continue to be available to support the aircraft carrier if needed, as occurs under existing conditions.

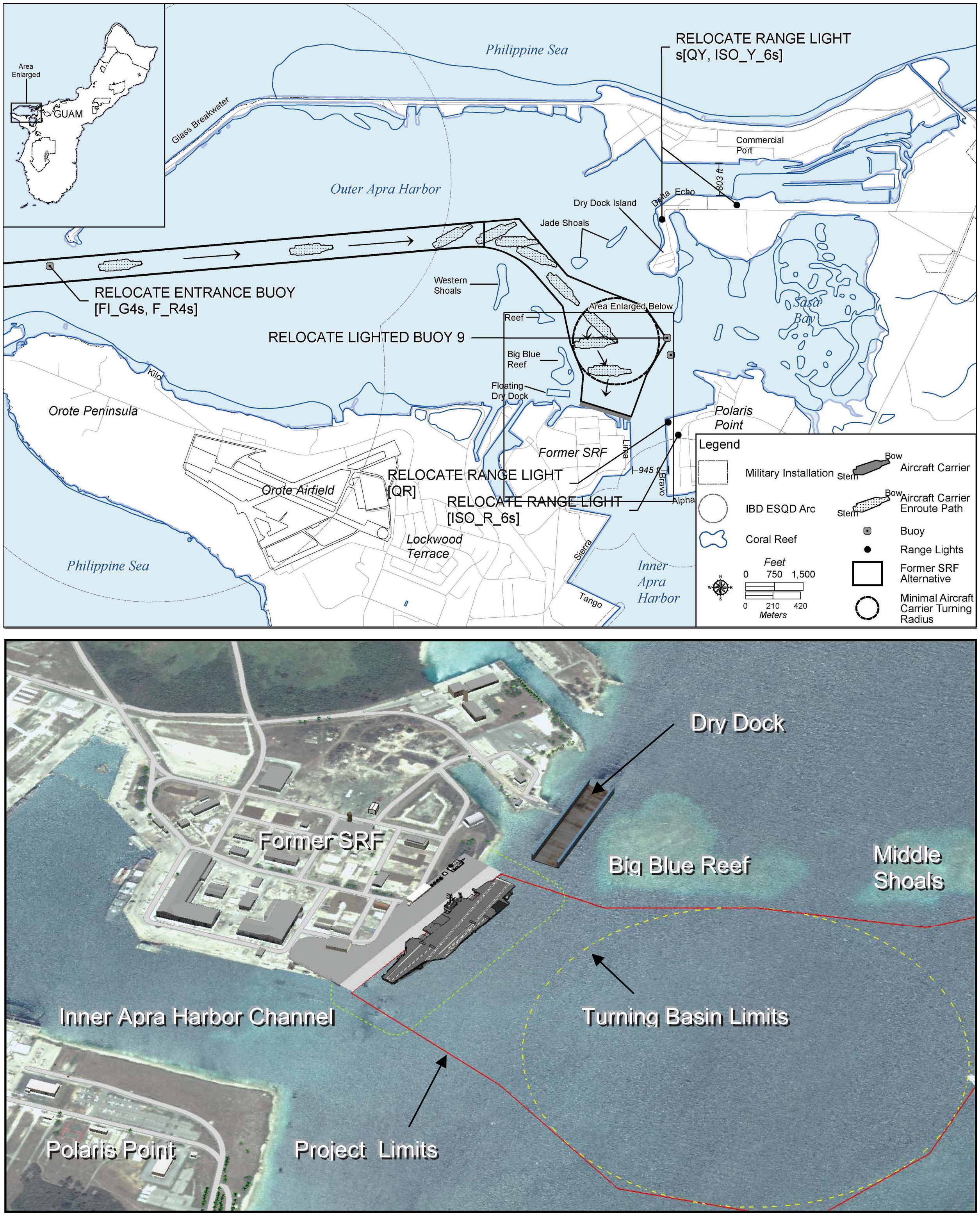


Figure 2.6-1
Alternative 2 – Former SRF

Source: NAVFAC Pacific 2008

Figure 2.6-2
Former SRF
Alternative Site
Plan

Source: NAVFAC Pacific 2008

2.6.2 Shoreside Structures

2.6.2.1 Design Standards

Design standards would be the same as described for Alternative 1 (Section 2.5).

2.6.2.2 Staging Area and Access

The Alternative 2 location would provide an approximate 6 ac (2.3 ha) staging area adjacent to the back of the wharf (see Figure 2.6-2). The staging area would be sloped landward at 1%, the same as the wharf deck. The entire area would be paved with asphalt concrete over a crushed aggregate base. All underground utilities and storm drains, building, and light standard foundations would be installed prior to paving. The Port Operations Support Building would be at the eastern end of the wharf near Lima Wharf.

<u>Security/Biosecurity</u>

Security

Security measures would be similar to that of Alternative 1, Polaris Point, in that the location is within an active military base with the full complement of protective measures. Site specific requirements would be similar to Polaris Point. Watch towers would be located just behind and at either end of the wharf.

Biosecurity

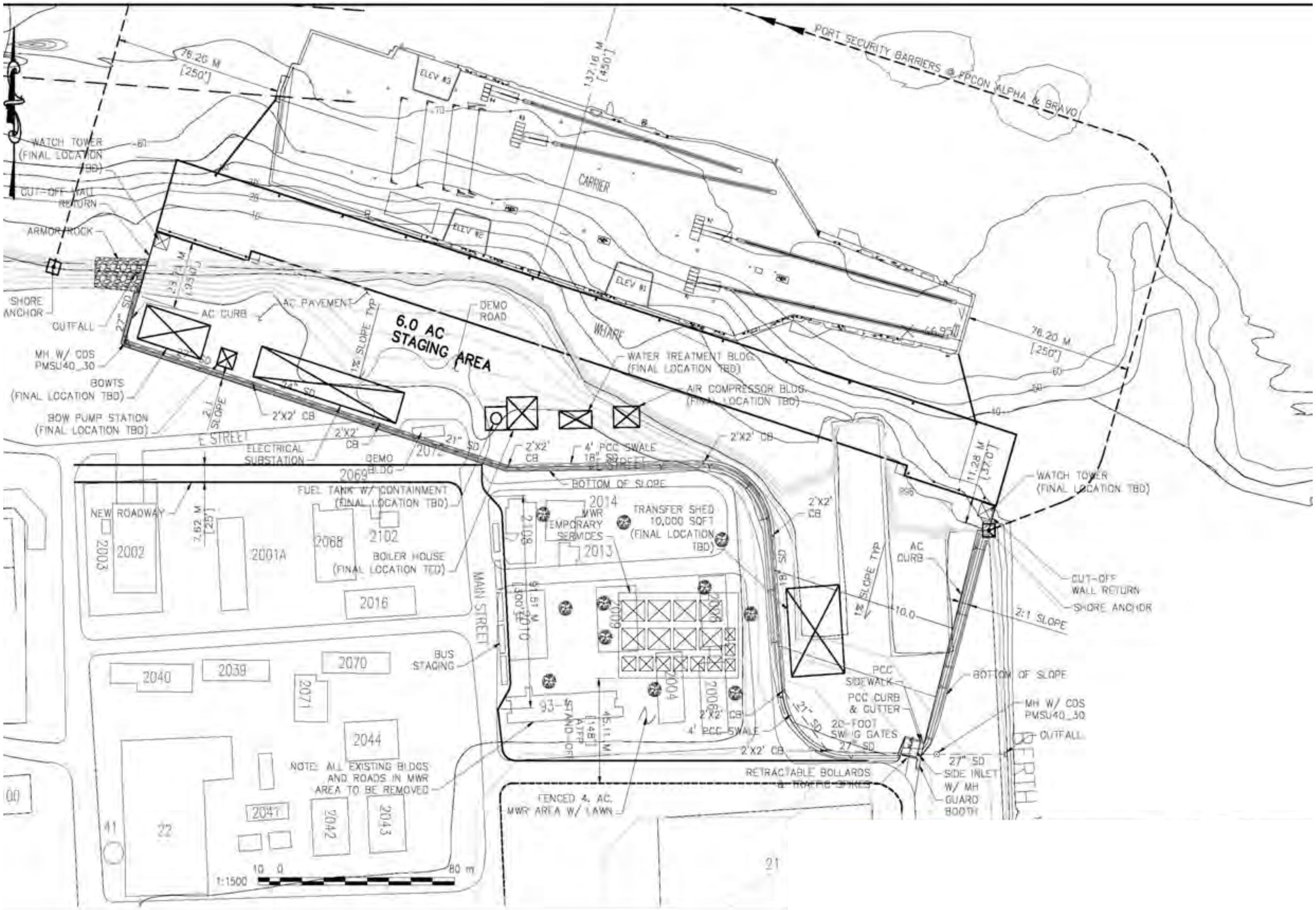
BTS control plans and other invasive species controls would include a quarantine and inspection area and security fencing designed for both inspection of humans/vehicles and BTS control. The DoD has a joint region BTS Control and Interdiction Plan which includes measures such as 100% cargo inspections, 100% vehicle and aircraft inspections, fenceline trapping, and nighttime searches. A comprehensive Biosecurity Plan is being developed in cooperation with the USFWS, USDA, USGS, National Invasive Species Council (NISC), the state of Hawaii, the Commonwealth of the Northern Mariana Islands (CNMI), and GovGuam. Aircraft that stage at Andersen AFB would be subject to existing joint region BTS protocols. Additional protocols as identified in the joint region Biosecurity Plan would be adopted at that time. Chapter 2, Volume 7 contains a more detailed description of the proposed Biosecurity Plan.

Biosecurity requirements would be the same as those described at Polaris Point, but because the area is a previously developed industrial area and does not contain forest or secondary growth, the habitat is less favorable for snakes or other invasive species.

<u>MWR</u>

The Navy MWR area for supporting aircraft carrier activities would be situated on a 4 ac (1.6 ha) lot to the west of the access control point for the staging area (Figure 2.6-2 and Figure 2.6-3). There are nine existing structures totaling about 36,500 ft^2 (3,391 m^2) that would have to be razed and about 43,900 ft^2 (4,078 m^2) of roadway servicing the buildings removed. Relocation of existing shipyard capabilities at these locations would be required. Subsequently, the area would be graded and landscaped for lawn and trees. The lawn may be supported by a permanent irrigation system. A 3 in (7.62 cm) thick asphalt lot about 0.5 ac (0.2 ha) in size would be constructed for locating temporary facilities such as food and beverage booths, seating areas, parking and lighting.

Figure 2.6-3 Former SRF Improvements



Source: NAVFAC Pacific 2008

The MWR area would require utility connections. The area would be enclosed by a 900-ft long (274-m long) chain link fence, and would have multiple locking swing gate entry points. One of the gates would have a permanent turnstile and guard shack. Additional parking for five buses would be provided in a 10-ft wide by 300-ft long (3-m wide by 91-m long) turnout on the east side of Main Street. Bicycles would be made available at the MWR area.

Aids to Navigation

Aids to navigation modifications would be as described for Alternative 1, with the exception that range lights at Polaris Point, while requiring relocation, would not have to be raised, and the mooring buoy would not have to be relocated (see Figure 2.6-3).

2.6.2.3 Utilities

Refer to the engineering drawings included in the *CVN-Capable Berthing Study* (NAVFAC Pacific 2008) for details on existing conditions. Table 2.5-1 and Table 2.5-2 summarize the utility requirements.

Steam, Compressed Air and Pure Water

Although there is a possibility of re-using the existing steam plant at the Former SRF, the cost for a new system and the upgrades are comparable. Therefore, a new system as proposed for Polaris Point is proposed for Alternative 2.

There would be no differences in terms of the pure water systems between this alternative and Alternative 1, with the exception of pipe lengths from the wharf structure and water source to the pure water production plants, compressed air production plants, and steam production plant.

BOWTS

The new BOWTS would be sized to accommodate the ultimate requirements of the CVN 78, i.e., a pumping rate of 90 gpm (341 lpm) with an average flow rate of 38,000 gpd (143,846 lpd) and a peak flow rate of 82,000 gpd (310,404 lpd).

The existing BOWTS at Apra Harbor Naval Complex is inadequate to handle the aircraft carrier BOWTS requirements of either a CVN 68 or CVN 78 for a 21 day duration visit. There is no BOWTS at the Former SRF. Mobile BOWTS units are available at the Former SFR; however, these units are typically small and would not be able to process the amount of BOW generated by a carrier. Therefore, a new BOW collection and treatment system would be constructed near the location of the proposed berth. The BOWTS would consist of a combined gravity and force main collection system, a BOW pump station, and a treatment system.

Wastewater

For the proposed berthing at the Alternative 2 location, a separate and dedicated wastewater collection system sized to handle only the aircraft carrier loadings would be required because this alternative provides for the wharf to be located adjacent to a commercial industrial area and segregation of wastewater would be necessary. This dedicated system would be designed and constructed solely within military property and would include the construction of three new submersible type sewage pump stations and 6,700 linear ft (2,042 m) of associated force mains. In addition to the pressurized systems, approximately 4,420 linear ft (1,347 m) of new gravity sewers are required; of that, 2,720 linear ft (829 m) of 15 in, 18 in, and 24 in (0.38 m, 0.46 m, 0.61 m, respectively) relief sewer lines are proposed along Marine Corps Drive to increase the capacity of the existing sewer trunkline "A" for the aircraft carrier berthing. As with Alternative 1, the sewage line would terminate at the military AHWWTP, and improvements as described for Alternative 1 would be required. Regarding the makeup of the wastewater generated from the aircraft carrier for Alternative 2, the composition of the wastewater is primarily domestic but in a more concentrated form than residential wastewater. The transfer of the wastewater from the aircraft carrier to the landside lift station would occur as described for Alternative 1 in Section 2.5. These upgrades would follow existing rights of way and utility lines that currently parallel Marine Corps Drive. Standard construction practices would be utilized to ensure that existing lines are not disrupted.

Potable Water

The potable water supply would be connected to the southern Navy water system, which receives its surface water supply from Fena Reservoir. Potable water demand for the aircraft carrier would have no impact on the northern Guam Lens Aquifer.

Potable water is supplied to the Alternative 2 site from the Apra Heights Tank system. In addition to the Alternative 2 site, the Apra Heights Tank supplies water to most of the Apra Harbor Naval Complex. Based on the water demands of the service area and the maximum fire flow requirements, the storage capacity of the tank was evaluated based on criteria provided in UFC 3-230-19N (*Water Supply Systems*). The storage capacity required for all users served by the Apra Heights Tank, including the proposed water demand of a CVN 78, was calculated to be 2.6 mg (9.8 ml). The Apra Heights Tank has a capacity of 5.0 mg (18.9 ml). Therefore, no improvements are required for the Apra Heights Tank for the berthing of either a CVN 68 or CVN 78 at the Alternative 2 site.

Approximately 1,200 linear ft (366 m) of 10 in (0.25 m) water line along the entrance road to the Alternative 2 site would be replaced with a 12 in (0.30 m) water line under project P-494 (an Environmental Assessment [EA] and Finding of no Significant Impact [FONSI] have been completed). In addition to this project, approximately 2,200 linear ft (671 m) of 16 in (0.41 m) water line along Sumay Drive is currently being replaced with an 18 in (0.46 m) main. These improvements were incorporated in the water system model used to evaluate the capacity of the existing potable water system. The results of the model indicate that more than 1,000 gpm (3,785 lpm) can be provided at pressures exceeding 40 psi to the berthing site at the Alternative 2 site. Therefore, no major water system improvements would be required for this option. Water system improvements would be limited to the construction of a new 8 in (0.20 m) service lateral to the berthing site and the associated pier side water outlets.

The potable water system improvements required to support the aircraft carrier would be located along and adjacent to the proposed berthing location. The pier side water lines and outlets would be constructed concurrently with the wharf site work. Construction scheduling of the supply lateral to the wharf would be coordinated with other adjacent site improvements. The potable water system would be used for and has sufficient capacity for fire fighting.

Electrical Power Distribution and Communications System

A programmed construction project (P-494) would construct a new SRF Substation to support planned waterfront upgrades for Sierra, Romeo, and Uniform Wharves and existing SRF loads. The SRF Substation would be fed from the new Orote Substation with two 34.5 kV circuits, each with conductors capable of roughly 25 mega volt amperes (MVA), but with duct capacity that would enable doubling the capacity of each circuit.

The scope of P-494 does not include providing the capacity to accommodate the aircraft carrier without additional circuits and 34.5 kV switchgear additions. Proposed improvements under Alternative 2 include:

- Provide a new circuit breaker in the GPA Piti 34.5 kV Switching Station (by GPA)
- Upgrade existing GPA 34.5 kV Overhead Feeder Circuit X20 between Piti 34.5 kV Switching Station and Orote
- Provide a new underground, concrete encased, 34.5 kV feeder circuit from the GPA Piti 34.5 kV Switching Station to Orote Substation
- Provide additions to the Orote Substation 34.5 kV switchgear
- Provide a new aircraft carrier berth substation
- Provide one underground, concrete-encased, 34.5 kV express feeder circuit from the SRF Substation to the aircraft carrier SRF berth substation
- Provide wharf operational and security lighting using high-mast steel poles with metal-halide luminaries

Stormwater

Initial designs indicate that a concrete swale to collect surface flow would run east to west along the perimeter of the pad on the east side and would subdivide the pad on the west side. Flows captured in catch basins would be conveyed through two separate concrete storm drain pipe systems. Following the last catch basin and before discharge, the stormwater would be treated in each system by inline cyclonic separators to remove oil, grease, and trash. The separators would collect and retain the undesirable material for the first 0.5 in (12.7 mm) of rainfall that occurs. Greater flows would bypass the separator. Discharge from the separators would be to an outfall to Outer Apra Harbor and at the channel connecting the Outer and Inner Harbors. Volume 4, Chapter 4 contains more information on potential impacts from stormwater.

Solid and Hazardous Waste

As described for Polaris Point, solid waste storage bins are typically provided in the aircraft carrier compound and near the MWR activity area, as needed. Solid waste would be handled and managed in accordance with Navy standard operating procedures and would be disposed of at the Navy landfill as long as it meets all criteria for disposal in the landfill.

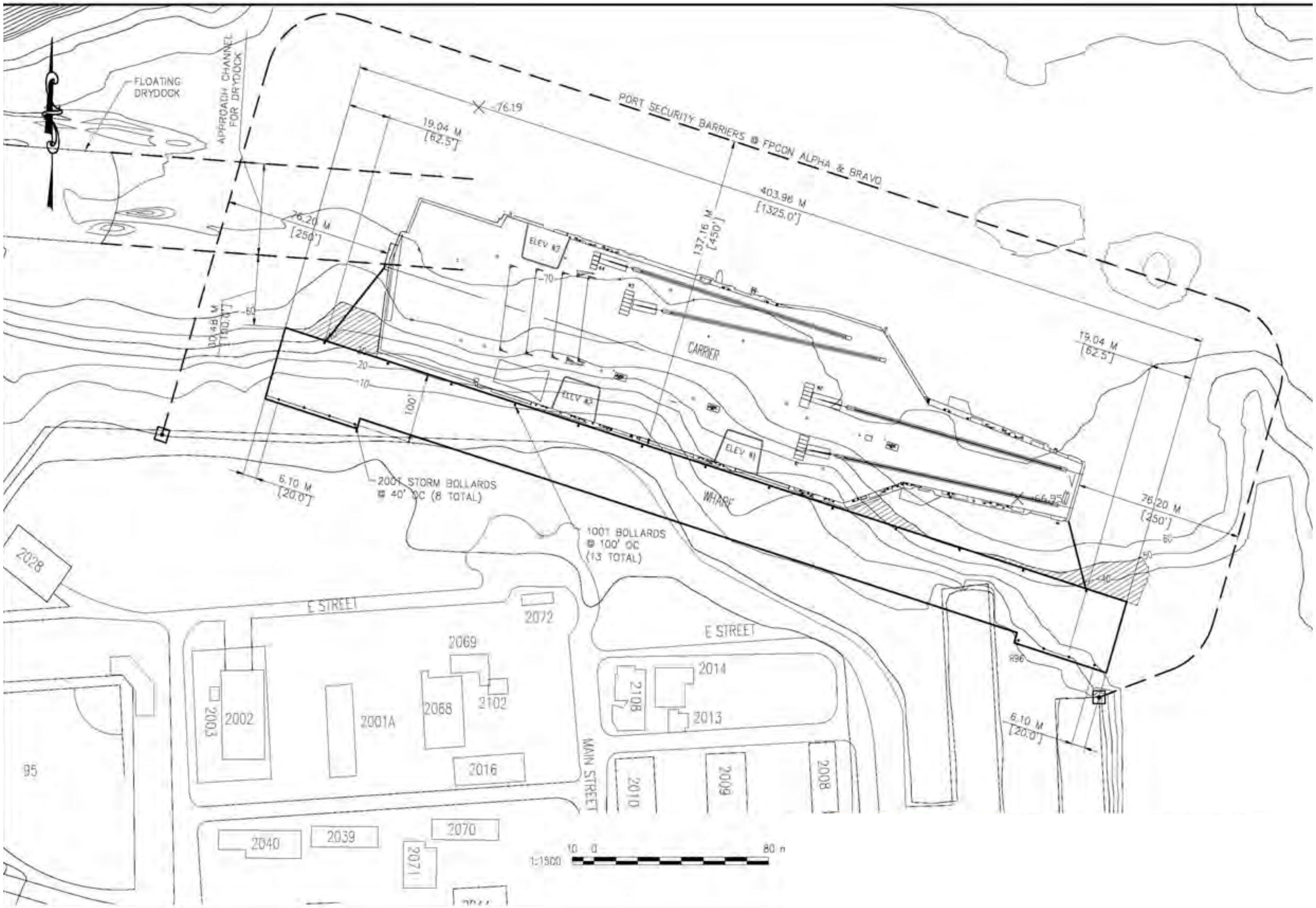
A ship-board hazardous regulated waste holding area is typically designated at the wharf. The hazardous waste would be managed in accordance with Navy standard operating procedures and the Navy RCRA permit would be modified to accommodate the increased volumes of waste. Volume 4, Chapter 17 contains a description of the types and quantities of hazardous waste that would be generated from the proposed action.

2.6.3 Construction

2.6.3.1 Alternative 2 - Specific

Site preparation would require the grubbing and removal of all ground cover for construction of the staging area. This would include the demolition and removal of a minor building (approximately 700 ft^2 [213 m^2]) and the removal of about 3,400 ft^2 (1,036 m^2) of the end of the inner finger pier. Surveys of these buildings have been conducted for asbestos-containing material, lead-based paint, and PCB-containing electrical equipment. Demolition and recovery of these types of materials, if present, would be conducted in accordance with Navy procedures and applicable laws.

Figure 2.6-4 Former SRF Wharf-Plan View



Source: NAVFAC Pacific 2008

There would be some minor roadway removal around the demolished building and re-alignment of some utility lines along E Street near the demolished building location. The pavement over the finger piers would be pulverized and left in place. The soil in the other areas would be scarified and re-compacted to prevent differential settlement before the fill material is placed. The water areas between the slips would be filled and the entire site would be raised to the required grade using reclaimed dredged materials. Soil improvement methods may need to be utilized to consolidate the various soil fills to prevent liquefaction.

The project dredging would be limited to an area near the channel bend, portions of the turning basin and areas under the wharf structure. Figure 2.6-5 shows the specific areas that would require dredging (areas less than -49.5 ft [-15 m] MLLW) within the project area, that represent the outer limits of the proposed dredging activity. The minimum turning basin radius to allow the aircraft carrier to be safely maneuvered within Navy operational and navigational constraints is shown on the figure in blue. The total dredge volume would be 479,000 cy (366,200 m^3) including 2 ft (0.6 m) overdredge and approximately 30% of that would be generated at the shoreline area of Alternative 2 to provide an appropriate slope for the wharf structure. The anticipated dredging production rate is as described for Alternative 1: 75 cy/hour (57 m^3/hour) based on recent mechanical dredging of similar substrate. The total dredge area would be approximately 44.3 ac (17.9 ha). At this rate total production per day would be approximately 1,800 cy (1,376 m^3). Throughout most of the project area the depth to be dredged is less than 1 ft (0.3 m) and the dredging would proceed quickly at an estimated rate of 22,777 ft^2 (2,116 m^2) per day in the turning basin and the channel. The wharf area would require a longer dredging duration because there would be greater depths of dredging (excavation) required, creating a higher volume of dredged material.

2.6.3.2 Construction Common to Both Action Alternatives

The dredging equipment and materials required for Alternative 2 would be the same as those described for Alternative 1 (refer to Section 2.5.3.2).

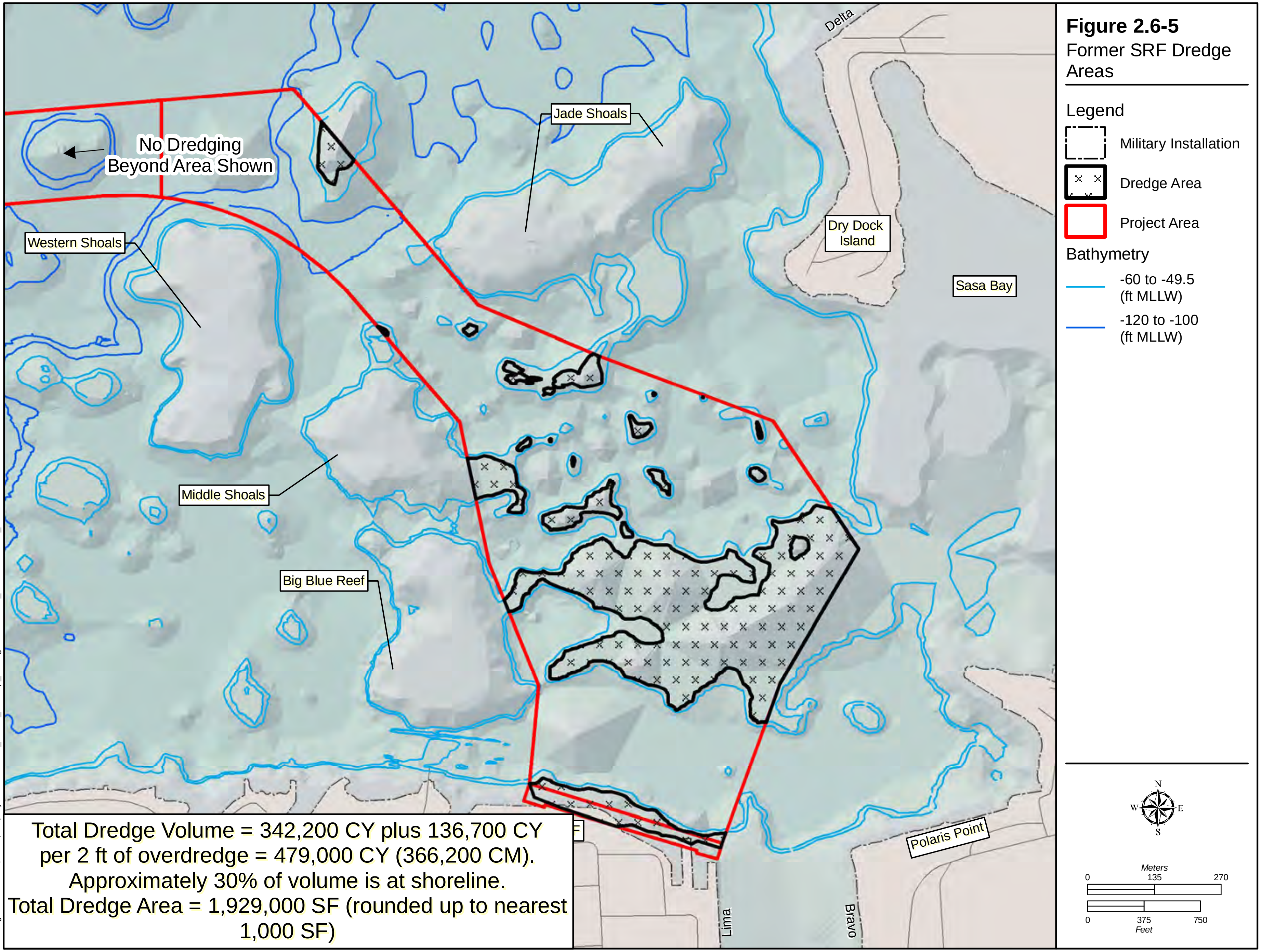


Figure 2.6-5
Former SRF Dredge Areas

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2.7 NO-ACTION ALTERNATIVE

Under the no-action alternative there would be no wharf, deep water channel access or associated facility construction to support the aircraft carrier extended visits in Apra Harbor. No dredging would be required.

Under the no-action alternative the transient aircraft carrier visits could not be accommodated and the projected level of port visits for ammunition ships would be reduced due to increased ammunitions ship operations.

The no-action alternative would not meet the purpose for and need of the proposed action. It would not support the QDR goal of an increased aircraft carrier presence in the Western Pacific.

Chapter 2:

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CHAPTER 3.
GEOLOGICAL AND SOIL RESOURCES

3.1 INTRODUCTION

This chapter describes the potential environmental consequences to geological and soil resources associated with implementation of the alternatives within the region of influence (ROI), i.e., areas that could be affected by construction or operation of facilities associated with transient berthing of an aircraft carrier. For a description of the affected environment for all resources, refer to the respective chapters of Volume 2 (Marine Corps Relocation – Guam). The locations described in that Volume include the ROI for the aircraft carrier berthing component of the proposed action and the chapters are presented in the same order as in this Volume.

3.2 ENVIRONMENTAL CONSEQUENCES

3.2.1 Approach to Analysis

3.2.1.1 Methodology

The methodology for identifying, evaluating, and mitigating impacts to geology and soil resources was established through review of reports of relevant geologic and soils studies, federal laws and regulations, local building codes and grading ordinances, and Navy guidance documents. The impact analyses in this chapter are presented by alternative and geographic area as described in the affected environment sections in Volume 2. Geology and soils conditions may also constrain the placement of a facility or location of a land use; where such constraints occur, they are discussed below.

Analysis of topography, soil, and vegetation was completed during site characterization using LIDAR Contour Data, geotechnical reports, and site visits to ensure minimal impacts to geologic and soil resources.

Activities associated with construction and operation of facilities for the transient aircraft carrier berthing, their potential effects on geologic and soils resources, and potential constraints to facilities siting resulting from geologic or soils conditions are as follows:

<u>Construction</u>

- Cut and fill activities leading to soil erosion
- Removal of vegetation, landscaping and/or existing facilities leading to soil erosion
- Use of heavy equipment resulting in soil compaction
- Creation of impervious surfaces resulting in increased runoff and soil erosion

<u>Operation</u>

- Vehicle movements on unpaved surfaces resulting in increased soil erosion and compaction
- Potential damage from soil liquefaction, landslides, or tsunamis, which constrain facilities siting

The potential effects of these activities or constraints and their significance within the ROI under the alternatives are described below. The analysis of potential impacts to geology and soils identifies direct and indirect impacts. Direct impacts are those that may occur during the construction phase of the project and result in physical soil disturbance. Such disturbance may cause increased erosion, compaction, and loss of productive soil. Potential direct impacts of construction include stormwater discharges that contain elevated sediment concentrations that may increase pollutant loading into surface waters.

Indirect impacts are those that result from the completed project, such as the leaching of contaminants into soils. For non-training activities, indirect impacts include stormwater discharges that contain elevated sediment concentrations that may increase pollutant loading into surface waters. Potential soil contamination issues are addressed in Chapter 17, Hazardous Materials and Waste.

Indirect groundwater impacts associated with construction and operational activities include contamination of groundwater resources through percolation of surface runoff. Direct spills and leaks as well as stormwater runoff can contribute to groundwater contamination. Increased soil erosion also may indirectly impact water quality and aquatic ecosystems. Potential impacts to these resources are described in Chapter 4, Water Resources; Chapter 10, Terrestrial Biological Resources; and Chapter 11, Marine Biological Resources.

Applicable Regulatory Standards

The U.S. Environmental Protection Agency (USEPA) Region 9 grants the Guam Environmental Protection Agency (GEPA) the authority to enforce portions of federal statutes via a Memorandum of Agreement. Under this agreement, the Safe Drinking Water Program, Water Resources Management Program, and the Water Pollution Control Program (WPCP) are administered by GEPA. The GEPA WPCP is responsible for protecting Guam's resources from point and non-point source pollution, including administration of the National Pollutant Discharge Elimination System (NPDES) program. NPDES permits are required for large and small construction activities. Requirements include a Notice of Intent, a Notice of Termination and a construction site Storm Water Pollution Prevention Plan (SWPPP). Permits are required for projects that disturb greater than 1 acre (ac) (0.4 hectares [ha]) of soil, including lay-down, ingress and egress areas. Phase I regulates construction activities disturbing 5 ac (2 ha) or more of total land area and Phase II regulates small construction activities disturbing between 1 and 5 ac (0.4 and 2 ha) of total land area.

An Environmental Protection Plan (EPP) is required for all projects at the discretion of the GEPA Administrator. EPPs are specifically identified in 22 Guam Annotated Regulations, Division II, Chapter 10, Section 10103.C.5(d). EPPs shall include nonpoint source control measures including erosion and sedimentation control; vegetation, wildlife and coral/marine resource protection measures; fugitive dust control; solid and hazardous waste management and disposal procedures; nutrient management plan; integrated pest management strategy/plan; confined animal facilities management plan; irrigation water management plan; personnel safety procedures; work site maintenance and typhoon contingency plans; as necessary, depending on the work, project, activity and facility function.

Minimization of seismic, liquefaction, and ground shaking impacts and hazards are addressed in Unified Facility Code (UFC) 3-310-04 Seismic Design for Buildings (USACE 2007).

3.2.1.2 Determination of Significance

For geology and soils, the significance of impacts is determined by subjective criteria, as well as by regulatory standards. A significant impact may result from any of the following:

- Increased rate of erosion and soil loss from physical disturbance including removal of vegetation
- Reduced amounts of productive soils

- Alteration of surrounding landscape and effect on important geologic features (including soil or rock removal and filling of sinkholes)
- Diminished slope stability
- Increased vulnerability to a geologic hazard (e.g., seismic activity, tsunami, liquefaction), and the probability that such an event could result in injury

3.2.1.3 Issues Identified during Public Scoping Process

The following analysis focuses on potential effects to geology and soils that would arise from the proposed action. As part of the analysis, concerns relating to geology and soils that were identified during scoping meetings by the public, including regulatory stakeholders, were addressed. These included:

- Implementing erosion control measures for construction and post-construction phases
- Ensuring that proper permitting and local government clearances are sought where applicable

3.2.2 Alternative 1 Polaris Point (Preferred Alternative)

3.2.2.1 Onshore

Onshore activities associated with Alternative 1, Polaris Point (referred to as Alternative 1) include construction of a wharf and staging area with ground disturbance of approximately 5.8 ac (2.3 ha), a Morale, Welfare, and Recreation (MWR) area of 2.4 ac (1.0 ha), security structures including a 50 ft (15.2 m) watch tower and fencing, and various buildings including a Port Operations Support Building, substation, water treatment facility, and a pump station. As part of the project, four existing structures (Buildings 4407, 4408, 4409, and an existing guard tower) would be demolished. A 300 ft (94 m) roadway would be demolished and replaced with a new access road to connect Polaris Point Drive to the staging area. Underground utilities would be constructed in existing utility corridors except in the vicinity of the wharf where extensions from nearby utility systems would be constructed.

There would be the potential for an increased rate of erosion, compaction, and soil loss from the physical disturbance of construction activities. Soil erosion is primarily a concern for discharge into surface or nearshore waters. The erosion potential of soil types found in the proposed action is found in Table 3.2-1.

Table 3.2-1. Erosion Potential at Apra Harbor

Soil Type	*Location*	*Erosion Potential*
Ritidian Rock Outcrop at 3-15% slope	Orote	slight
Urban Land Coastal Fill at 0% slope	Orote	slight

Source: Young 1988.

The construction Standard Operating Procedures (SOPs) would include requirements for stormwater compliance with stormwater best management practices (BMPs), including a Stormwater Pollution Prevention Plan (SWPPP) to ensure that all aspects of project construction would be performed in a manner to minimize impacts during construction activity. A description of the standard BMPs and resource protection measures required by regulatory mandates can be found in Volume 7. Implementation of these measures such as silt fences and hay bales would prevent erosion and limit sediment runoff in stormwater; thus, there would be minimal impacts from soil erosion and stormwater runoff. A more detailed explanation of regulatory permitting requirements is available in Volume 8.

Soil types potentially lost are not agriculturally productive. Topography or landscape features would not be changed substantially by the proposed action.

Apra Harbor is located in a potentially active seismic zone. Hazards associated with earthquakes, fault rupture, and slope instability would be minimized by adherence to UFC 3-310-04 Seismic Design for Buildings (USACE 2007). The developments proposed as Alternative 1 would be located on a relatively flat area that would not be subject to slope instability. The underlying fill at Apra Harbor is vulnerable to liquefaction. Alternative 1 would result in less than significant impacts associated with geologic hazards.

<u>Construction</u>

Apra Harbor

Alternative 1 would disturb soil during construction at Apra Harbor. There is a risk of an increased rate of erosion, compaction, and soil loss from the physical disturbance caused by construction activity. Erosion potential for soils found at Apra Harbor is shown in Table 3.2-1.

To reduce the potential for significant impacts during construction of Alternative 1, the following soil conservation and management procedures would be followed:

- Soil piles and exposed slopes would be covered during times of inclement weather.
- Revegetation would occur as soon as possible after any ground disturbance or grading.
- Construction and grading would be minimized during times of inclement weather.

The construction SOP would include requirements for stormwater compliance, with BMPs to ensure that all aspects of project construction would be performed in a manner to minimize soil loss impacts during construction activity. A description of the standard BMPs and resource protection measures required by regulatory mandates can be found in Volume 7. Implementation of measures such as silt fences and hay bales would prevent erosion; thus, there would be minimal impacts from soil erosion. A more detailed explanation of regulatory permitting requirements is available in Volume 8.

As stated in Volume 2, there are no sinkholes in the project vicinity. Therefore, Alternative 1 would result in less than significant impacts to a unique geologic resource.

Apra Harbor is located in a potentially active seismic zone. Hazards associated with earthquakes, fault rupture, and liquefaction would be minimized by adherence to UFC 3-310-04 Seismic Design for Buildings (USACE 2007). The developments proposed as Alternative 1 would be located on a relatively flat area that would not be subject to slope instability. The high risk of liquefaction at Apra Harbor requires a geotechnical survey prior to construction. Wherever possible, liquefiable soils would be replaced with properly compacted fill soils as recommended in the site-specific geotechnical report. UFC 3-310-04 Seismic Design for Buildings (USACE 2007) would be followed to minimize structural hazards associated with ground shaking.

Alternative 1 would result in less than significant impacts associated with geologic hazards.

Naval Base Guam

The feasible upland placement sites for dredged materials and resulting potential geological impacts are described for the Inner Apra Harbor dredging in Volume 2, Chapter 3 of this EIS/OEIS. The upland placement sites are considered temporary (3 to 4 years). The sites are all vacant lands and would be developed with bermed perimeters approximately 16 to 30 ft (5 to 9 m) in height. When the material is dry it can be reused by the receiver, resulting in a beneficial impact to geological and soil resources, or stockpiled.

Soil types disturbed would not be agriculturally productive. Construction SOPs and a SWPPP (required by the NPDES permit) would be followed to minimize soil erosion. Therefore, Alternative 1 would result in less than significant impacts to unique geologic resources and would not result in significant soil erosion, compaction, or loss of agriculturally productive soil.

The construction SOPs would include requirements for stormwater compliance and BMPs to ensure that all aspects of project construction would be performed in a manner to minimize impacts during construction activity. A description of the standard BMPs and resource protection measures required by regulatory mandates can be found in Volume 7. Implementation of these measures would prevent erosion; thus, there would be minimal impacts from soil erosion. A more detailed explanation of regulatory permitting requirements may also be available in Volume 8.

There are no known sinkholes in the vicinity of any of the proposed projects. Therefore, Alternative 1 would result in less than significant impacts to a unique geologic resource.

Naval Base Guam is located in a potentially active seismic zone. Hazards associated with earthquakes, fault rupture, and liquefaction would be minimized by adherence to UFC 3-310-04 Seismic Design for Buildings (USACE 2007). The developments proposed as Alternative 1 would be located on a relatively flat area that would not be subject to slope instability. The underlying fill at Naval Base Guam is vulnerable to liquefaction. The high risk of liquefaction at Naval Base Guam requires a geotechnical survey prior to construction. Wherever possible, liquefiable soils would be replaced with properly compacted fill soils as recommended in the site-specific geotechnical report. UFC 3-310-04 Seismic Design for Buildings (USACE 2007) would be followed to minimize structural hazards associated with ground shaking. Alternative 1 would result in less than significant impacts associated with geologic hazards.

<u>Operation</u>

Apra Harbor

Operations under Alternative 1 would result in less than significant impacts to unique geologic resources and would not result in significant soil erosion or compaction or loss of agriculturally productive soil.

In addition to SOPs to account for the high potential for liquefaction, appropriate construction planning measures as discussed below would be implemented. Although Apra Harbor is located in a potentially active seismic zone, the hazards associated with earthquakes, fault rupture, and liquefaction would be minimized during construction. The developments proposed as Alternative 1 would be located on a relatively flat area that would not be subject to slope instability. Alternative 1 would result in less than significant impacts associated with geologic hazards.

Naval Base Guam

Operations under Alternative 1 would result in less than significant impacts to unique geologic resources and would not result in significant soil erosion, compaction, or loss of agriculturally productive soil.

Although Naval Base Guam is located in a potentially active seismic zone, the hazards associated with earthquakes, fault rupture, and liquefaction would be minimized during construction. The Alternative 1 proposed developments would be located on a relatively flat area that would not be subject to slope instability. Alternative 1 would result in less than significant impacts associated with geologic hazards.

3.2.2.2 Offshore

<u>Construction</u>

Offshore construction activities associated with Alternative 1 include dredging of the berthing area, the turning basin, and the channel bend; construction of a wharf at Polaris Point; and the operations associated with berthing of the aircraft carrier. Approximately 30% of the dredged volume would be removed from the shoreline area, as excavation would be required to achieve the appropriate slope for wharf construction. Direct impacts to benthic habitats and their organisms would result from the proposed dredging activities. The underwater topography would change somewhat in that dredging of coral within the turning basin area would remove underwater structural relief. Areas that are dredged would change from coral cover to sand, with the exception of the area near the shoreline of Polaris Point, which is mostly silty clay. Chapter 11, Marine Biological Resources, describes impacts from these disturbances to marine flora and fauna in greater detail.

The conditions of the applicable U.S. Army Corps of Engineers (USACE) dredging permits would include measures to minimize effects of dredging, including the use of silt curtains. Dredging activities are a concern for water resources and are addressed under Chapter 4, Water Resources, in this Volume.

Operation

The proposed USEPA Ocean Dredged Material Disposal Site (ODMDS) was evaluated for geological impacts as described in the project–specific ODMDS EIS (USEPA 2009). The designation of the ODMDS is anticipated in January 2010. Briefly summarized, the impact assessment analysis concluded that the geological impacts would be significant if the disposal of dredged material would: 1) alter the regional and site-specific bathymetry, 2) interfere with or change sediment transport processes, or 3) alter the existing characteristics of the seafloor (e.g., change the substrate from predominantly silty sand to gravel). The analysis was based on sediment analysis and sediment transport modeling; the conclusion was that impacts to regional geology would be minor.

Offshore construction and operation activities would have minimal impacts to geologic and soil resources.

3.2.2.3 Summary of Alternative 1 Impacts

Table 3.2-2 summarizes construction and operation impacts from Alternative 1.

Table 3.2-2. Summary of Alternative 1 Impacts

Area	*Project Activities*	*Project Specific Impacts*
Onshore	Construction	• Alternative 1 would result in minimal impacts to topography by changing the landscape at Apra Harbor. • Soil disturbances and loss of vegetation could cause increased rates of erosion and soil loss from physical disturbance in all proposed construction areas under Alternative 1. Minimal impacts would occur with the use of BMPs. • Soil types impacted would not be agriculturally productive; thus, minimal impacts to soil resources would occur. • Adherence to UFC 3-310-04 Seismic Design for Buildings would reduce risk of damage to structures from seismic hazards.
	Operation	Adherence to UFC 3-310-04 Seismic Design for Buildings during construction would reduce risk of damage to structures from seismic hazards that could potentially impact operation. Minimal impacts would occur due to geologic hazards.
Offshore	Construction	Alternative 1 would result in minimal impacts to geological resources.
	Operation	Alternative 1 would result in minimal impacts to geological resources.

3.2.2.4 Alternative 1 Potential Mitigation Measures

No potential mitigation measures are required or recommended under Alternative 1.

3.2.3 Alternative 2 Former Ship Repair Facility (SRF)

3.2.3.1 Onshore

Construction

Under Alternative 2, the Former SRF would be the project area. Although sited in a different location, the geology of and soil types found at the Former SRF are similar to those described under Alternative 1; thus, impacts would not differ from those of Alternative 1.

Operation

Under Alternative 2, the Former SRF would be the project area. Although sited in a different location, the geology of and soil types found at the Former SRF are similar to those described under Alternative 1; thus, impacts would not differ from those of Alternative 1.

3.2.3.2 Offshore

Construction

Impacts would not differ from those of Alternative 1.

Operation

Impacts would not differ from those of Alternative 1.

3.2.3.3 Summary of Alternative 2 Impacts

Table 3.2-3 summarizes construction and operation impacts from Alternative 2.

Table 3.2-3. Summary of Alternative 2 Impacts

Area	*Project Activities*	*Project Specific Impacts*
Onshore	Construction	• Alternative 2 would result in minimal impacts to topography by changing the landscape at Apra Harbor. • Soil disturbances and loss of vegetation could cause increased rates of erosion and soil loss from physical disturbance at all proposed construction areas under Alternative 2. Minimal impacts would occur with the use of BMPs. • Soil types impacted would not be agriculturally productive; thus, minimal impacts to soil resources would occur. • Adherence to UFC 3-310-04 Seismic Design for Buildings would reduce risk of damage to structures from seismic hazards.
	Operation	Adherence to UFC 3-310-04 Seismic Design for Buildings during construction would reduce risk of damage to structures from seismic hazards that could potentially impact operation. Minimal impacts would occur due to geologic hazards.
Offshore	Construction	Alternative 2 would result in minimal impacts to geological resources.
	Operation	Alternative 2 would result in minimal impacts to geological resources.

3.2.3.4 Alternative 2 Potential Mitigation Measures

Potential mitigation measures would not differ from those of Alternative 1.

3.2.4 No-Action Alternative

Under the no-action alternative, no construction, dredging, or operation associated with the aircraft carrier berthing would occur. Existing operations at Polaris Point, as a military training and recreational facility, and at the Former SRF, as a commercial ship repair facility, would continue. Therefore, the no-action alternative would have impacts to geology or soils.

3.2.5 Summary of Impacts

Table 3.2-4 summarizes the potential impacts of each action alternative and the no-action alternative. A text summary is provided below.

Soil types disturbed would not be agriculturally productive. Construction SOPs and a SWPPP (required by the NPDES permit) would be followed to prevent soil erosion. Therefore, the proposed action would result in less than significant soil erosion, compaction, or loss of agriculturally productive soil. The construction SOPs would include requirements for stormwater compliance and BMPs to ensure that all aspects of project construction would be performed in a manner to minimize impacts during construction activity. A description of standard BMPs and resource protection measures required by regulatory mandates can be found in Volume 7. Implementations of measures such as silt fences and hay bales would prevent erosion, thus there would be minimal impacts from soil erosion. A more detailed explanation of regulatory permitting requirements is available in Volume 8.

There are no known sinkholes in the vicinity of any of the proposed projects; therefore, no sinkholes would be affected.

Apra Harbor and Naval Base Guam are located in a potentially active seismic zone. Hazards associated with earthquakes, fault rupture, and liquefaction would be minimized by adherence to UFC 3-310-04 Seismic Design for Buildings (USACE 2007). The proposed developments would be located on a relatively flat area that would not be subject to slope instability. Neither Alternative 1 nor Alternative 2 would result in significant impacts associated with geologic hazards.

3.2.6 Summary of Potential Mitigation Measures

As previously described, there would be no significant impacts to geological and soil resources from the proposed action; therefore, no mitigations have been identified or would be required.

Table 3.2-4. Summary of Impacts

Alternative 1	*Alternative 2*	*No-Action Alternative*
Topography		
LSI • Alternative 1 would result in minimal impacts to topography by changing the landscape at Apra Harbor.	LSI • Alternative 2 would result in minimal impacts to topography by changing the landscape at Apra Harbor.	NI • No impacts to geological and soil resources.
Geology		
NI • No impacts to geological resources.	NI • No impacts to geological resources.	NI • No impacts to geological and soil resources.
Soil		
LSI • Soil disturbances and loss of vegetation could cause increased rates of erosion and soil loss from physical disturbance at all proposed construction areas under Alternative 1. Minimal impacts would occur with the use of BMPs. • Soil types impacted would not be agriculturally productive; thus, minimal impacts to soil resources would occur. BI Dredged material can be beneficially re-used by receiver.	LSI • Soil disturbances and loss of vegetation could cause increased rates of erosion and soil loss from physical disturbance at all proposed construction areas under Alternative 2. Minimal impacts would occur with the use of BMPs. • Soil types impacted would not be agriculturally productive; thus, minimal impacts to soil resources would occur. BI Dredged material can be beneficially re-used by receiver.	NI • No impacts to geological and soil resources.
Geological Hazards		
LSI • Adherence to UFC 3-310-04 Seismic Design for Buildings would reduce risk of damage to structures from seismic, liquefaction and ground shaking hazards.	LSI • Adherence to UFC 3-310-04 Seismic Design for Buildings would reduce risk of damage to structures from seismic liquefaction, and ground shaking hazards.	NI • No impacts to geological and soil resources.

Legend: SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact, BI = Beneficial impact

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CHAPTER 4.
WATER RESOURCES

4.1 INTRODUCTION

Water resources as defined in this Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) are sources of water available for use by humans, flora, or fauna, including surface and groundwater, nearshore waters, and wetlands. Surface water resources, including but not limited to lakes, streams, and rivers, are important for economic, ecological, recreational, and human health reasons. Groundwater may be used for potable water, agricultural irrigation, and industrial applications. Groundwater is classified as any source of water beneath the ground surface, and is the primary source of potable water used for human consumption. Consistent with the definition contained in 22 Guam Administrative Rule 5105, nearshore waters are defined as all coastal waters lying within a defined reef area, all coastal waters of a depth of less than ten fathoms (60 feet [ft], 18.3 meters [m]), and all coastal waters greater than 10 fathoms up to 1,000 ft (305 m) offshore where there is no defined reef area. Nearshore waters can be directly affected by human activity, and are important for human recreation and subsistence. Wetlands are habitats that are subject to permanent or periodic inundation or prolonged soil saturation, and include marshes, swamps, and similar areas. Areas described and mapped as wetland communities may also contain small streams or shallow ponds, or pond or lake edges.

This chapter contains the discussion of the potential environmental consequences associated with implementation of the alternatives within the region of influence (ROI) for water resources. For a description of the affected environment, refer to the respective chapter of Volume 2 (Marine Corps Relocation – Guam). The locations described in that Volume include the ROI for the aircraft carrier berthing component of the proposed action (Apra Harbor), and the chapters are presented in the same order as the resource areas contained in this Volume.

4.2 ENVIRONMENTAL CONSEQUENCES

4.2.1 Approach to Analysis

4.2.1.1 Methodology

This section contains a discussion of potential environmental consequences associated with implementation of the alternatives within the ROI for water resources. The environmental consequences of each action alternative and the no-action alternative are presented in this section. The methodology for identifying, evaluating, and mitigating impacts to water resources has been established based on federal and local laws and regulations as described in Volume 2, Chapter 4, Section 4.1.

The environmental consequences evaluation for water resources includes a qualitative and quantitative analysis of surface water, groundwater, nearshore waters, and wetlands to the extent possible given available project data. Environmental impact assessments were made and compared to baseline conditions, issues of public concern, and significance criteria to determine the magnitude of potential impacts to water resources.

The proposed action analysis is separated into two main activities: construction and operation. Each of these activities has potential effects with associated impacts. The analysis of potential impacts considers both direct and indirect impacts. Direct impacts are those that may occur during the construction phase of the project and cease when the project is complete or those that may occur as a result of project operation following completion of construction. Indirect impacts are those that may occur as a result of the completed project or those that may occur during operation but not as a direct result of the construction or operational action.

Sustainability Requirements and Goals

Implementation of the proposed action would be consistent with Navy policy in compliance with laws and executive orders whereby Department of Defense (DoD) entities are required to reduce demand for indoor water by as much as 20% and outdoor water use by 50% in the coming years. Concurrent with these mandates is the Navy/Marine Corps policy to pursue and facilitate Leadership in Energy and Environmental Design (LEED) Silver certification for their facilities. LEED is a voluntary point system tool that measures the degree of sustainability features incorporated into a development.

Water resource sustainability is addressed in two categories: minimize water demand and maximize the quantity and quality of groundwater recharge. Elements identified to achieve minimum water use are:

- Water Conservation - identify and specify appropriate minimum water demand fixtures and devices
- Irrigation - minimize use of irrigation systems and water
- Grey Water Use - evaluate options for use of grey water for irrigation
- Rainwater Harvesting - investigate harvesting, storage and distribution systems

Provisions of the existing Unified Facility Code (UFC) Low Impact Development (LID) Manual would be followed. This manual includes specific Integrated Management Practices to be considered and included in the drainage design of the proposed action sites. In addition, National Pollutant Discharge Elimination System (NPDES) permitting requirements, LEED goals, and recent laws mandate certain drainage quantity and quality performance standards. Thus, the proposed action includes incorporating post-construction drainage quality, quantity, and velocity dissipation measures to approximate (or improve upon) pre-construction conditions at the property line. Following is a brief discussion of the approach to impact analysis for water resources, including surface water/stormwater, groundwater, nearshore water, and wetlands, for construction and operation. Subsequent sections of the chapter provide a detailed description of the potential impacts to these resources.

Construction

Surface Water/Stormwater

Surface water issues include:

- Water quality
- Flooding
- Flow path alterations

Surface water quality impacts were evaluated by examining the potential increase of contamination including chemicals, heavy metals, nutrients, and/or sediments in the surface water as a result of the proposed action. The analysis was performed by comparing existing water quality data with possible increases in water quality contaminants in the surface water. Potential impacts to surface water quantity and velocity were analyzed by examining changes in drainage volumes and patterns associated with the proposed action.

For construction activities, some of the key effects include stormwater discharges that may contain elevated sediment concentrations, spills, and leaks of chemicals such as lubricants, fuels, or other construction materials that may increase pollutant loading in the surface water. In addition, direct construction or alteration of stream channels or reservoirs may cause increased contamination by sedimentation or chemical constituents.

Groundwater

Groundwater impact concerns include water quality and water quantity. Groundwater quality was assessed by examining the potential risk of a hazardous or regulated waste release, as well as approximating the amount of additional stormwater and associated non-point source pollution that enters the groundwater. Water availability is addressed in Volume 6, Chapter 3, Section 3.1, Potable Water.

Potential groundwater impacts associated with construction activities include direct spills and leaks having direct impacts to stormwater runoff that can contribute to groundwater contamination, as well as direct contamination of groundwater resources through percolation.

Nearshore Water

The nearshore water impact analysis focused on water quality. Recreational nearshore issues are addressed in Chapter 9, Recreational Resources. The potential increases of contamination including chemicals, heavy metals, nutrients, and/or sediments in nearshore waters as a result of the proposed action were assessed by comparing existing water quality data with the projected changes in water quality.

Potential impacts associated with construction activities include construction spills and leaks that may discharge to nearshore waters and an increase in stormwater discharge that may increase non-point source pollution.

Wetlands

Impacts to wetlands were evaluated to determine if there would be any impacts from:

- Pollutants
- Loss of area
- Loss of functionality

The potential for pollutants to impact a wetland was evaluated by examining the risk of hazardous materials leaking or spilling and their proximity to the wetlands. The loss of wetland area was assessed by the total amount of delineated wetland area that would be directly removed either in loss of area or function as a result of the proposed action. Wetland functionality refers to the ability of the wetland to trap sediments and nutrients, receive and retain water, maintain wildlife habitat (both flora and fauna), and provide recreational uses. The impacts to wildlife habitat associated with wetlands are addressed in Chapter 10, Terrestrial Biological Resources.

For construction activities, the effects associated with activities in close proximity to any designated wetland or activities in the wetlands themselves are considered. Runoff from nearby construction sites may contain increased chemicals, heavy metals, nutrients, and/or sediment that could adversely affect those wetlands. Wetland impacts could result from changes in land uses and/or spills or leaks from construction operation and equipment. Loss of functionality can also occur if construction operations occur directly within the designated wetlands. Loss of wetland area would occur if the proposed action involves the direct removal of wetlands.

Operation

Surface Water/Stormwater

For non-training operation activities, potential causes of impacts to surface waters include stormwater discharges which may increase the volume of sediment loading to the surface water as well as increased contaminants from sources such as vehicle maintenance, household discharges, privately-owned vehicles, and animal waste. Contamination of surface water from leaks or spills of hazardous, or otherwise regulated materials, is also a potential impact. Increased water usage may reduce the water availability in the reservoirs and/or reduce instream flows. Increased impervious areas may increase the runoff and increase the potential for flooding. Development in the floodplain may result in potential damage from flooding. The storage of hazardous materials and fuels pose a continued risk of contamination of surface water from leaks or spills.

Groundwater

Effects to groundwater from non-training operation activities may result from increases in impervious surfaces, waste generating activities, and storage of potential contaminants. The direct impacts may include an increase in polluted stormwater runoff and contamination from leaks or spills of hazardous or regulated materials. In addition, the increased water usage may increase the depletion of groundwater resources (see Volume 6, Chapter 3). The indirect impacts may include decreases in groundwater recharge from increased impervious areas and saltwater intrusion from increased aquifer pumping.

Effects to groundwater from operational activities may result from increases of impervious areas, waste-generating activities, and storage of potential contaminants. The direct impacts may include an increase in polluted stormwater runoff and contamination from leaks or spills of hazardous or regulated materials. These activities can pose both short-term and long-term effects.

Nearshore Water

Nearshore waters may be impacted by non-point source runoff containing chemical pollutants, nutrients, and/or sediments from upland support sites. In addition, ship operations, most notably docking activity, can stir up sediments, resulting in temporary suspended sediment plumes and associated localized increases in turbidity in nearshore waters.

Wetlands

Wetlands were assessed for the potential to be impacted by potential spills and leaks of hazardous materials that may be stored in close proximity. Indirect impacts to existing wetlands could occur by altering (i.e., diverting or restricting) the surface water flowing into the wetlands. Indirect impacts to wetlands could also occur as a result of altered sedimentation of watercourses or drainage conveyances connected to wetland areas.

4.2.1.2 Determination of Significance

The following factors were considered in evaluating potential impacts to groundwater and surface waters:

- Long-term increased inundation, sedimentation, and/or damage to water resources in the ROI caused by project activities, including impervious surfacing that increases and/or diverts rainfall runoff and/or affects its collection and conveyance and implementation of potential mitigation measures
- Depletion, recharge, or contamination of a usable groundwater aquifer for municipal, private, or agricultural purposes

- Increases in soil settlement or ground swelling that damages structures, utilities, or other facilities caused by inundation and/or changes in groundwater levels
- Creating noncompliance with any applicable law or regulation
- Increasing risk of environmental hazards to human health
- Decreasing existing and/or future beneficial use
- Reducing the amount of water or wetlands available for human use or ecological services
- Reducing availability or accessibility of water resources

If an activity was determined to have a potential impact, the impact was then evaluated to determine its significance. For significant impacts, a determination was made as to whether the impact can be mitigated to less than significance.

4.2.1.3 Issues Identified during Public Scoping Process

The following analysis focuses on the effects to water resources: surface water, groundwater, nearshore water, and wetlands that could be impacted by the proposed action. As part of the analysis, concerns relating to water resources that were identified by the public, including regulatory stakeholders, during the scoping meetings were addressed. These include:

- Describe water quality with respect to public health requirements, drinking water regulations, and applicable water quality standards
- Estimate quality and quantity of stormwater runoff to be generated by increased impervious surfaces, methods of contaminant removal, methods of runoff redirection to recharge the aquifer, and effects to groundwater under the direct influence of surface water
- Accidental or intentional contamination of groundwater
- Capacity of water resources to meet agricultural needs
- Stormwater management controls to prevent pollution during construction and subsequent operation
- Construction and bulldozing of the jungles that could potentially cause runoff, pollute the beaches, and destroy marine life
- Effects of training and dredging on sedimentation stress for the coral reefs and other marine life
- Identify ways to monitor and mitigate indirect impacts from sediments on coral reefs

4.2.2 Alternative 1 Polaris Point (Preferred Alternative)

4.2.2.1 Onshore

This discussion of potential impacts to onshore water resources focuses on potential impacts to surface water resources, groundwater resources, and wetland areas for Alternative 1, Polaris Point (referred to as Alternative 1). For a discussion of potential impacts to nearshore waters, see the Offshore section below.

<u>Construction</u>

Surface Water/Stormwater

Proposed construction activities under Alternative 1 would be located more than 1,500 ft (457 m) from any of the streams around Apra Harbor. Due to the distance from these streams, the proposed action is not anticipated to have any direct impacts to these streams. However, there is a potential to increase the amount of sediment in the runoff that could eventually flow into area streams, resulting in an indirect impact. The sediment can transport other constituents such as nutrients, heavy metals, organic and inorganic compounds, and detrimental microorganisms. In addition, there is an increased potential for leaks and spills of petroleum, oil, and lubricants (POLs) or other contaminants from equipment. To minimize these potential impacts, site-specific construction Best Management Practices (BMPs) (Volume 7) would be implemented to reduce the potential for erosion, runoff, sedimentation, and associated water quality impacts. BMPs such as silt fences and hay bales would retain silt laden stormwater before it reaches a sensitive surface water resource. In addition, roadway-specific BMPs would be included in the planning, design, and construction of all roadways. The facilities associated with the Polaris Point wharf would be constructed within the 100-year flood zone. Thus, all facilities within this area would be designed and constructed to elevate the structure out of the flood zone and reduce potential impacts from flooding.

Under Alternative 1, dredged material would potentially be placed in an upland placement facility. Five potential upland placement facilities have been identified at Naval Base Guam, none of which would be located on a surface water feature (refer to Figure 4.2-1 in Volume 2, Chapter 4). Upland placement facilities would consist of a fully bermed disposal area, thereby isolating the dredged material from the surrounding environment. Following placement of dredged material, the sediments would be allowed to consolidate, settle, and dewater. Water would evaporate or percolate into the ground. The exterior slope of the upland placement facility berms would be seeded with grass to minimize erosion.

Water generated from mechanically dredged material (i.e., effluent) placed in an upland placement facility would not discharge into sensitive surface waters because infiltration rates of the foundation soils at the upland placement sites are greater than any potential effluent discharge (NAVFAC Pacific 2005). In addition, runoff generated from rainfall would not be expected to exit the upland placement site due to high infiltration rates. Because dredged material placed in an upland placement facility would be finer and therefore, have lower infiltration rates than foundation soils, trenches would be constructed to allow water to reach foundation soils and facilitate rapid infiltration of runoff. Based on recent Inner Apra Harbor maintenance dredged material placement experience that used the same dredging and dredged material handling methods, little water would accumulate in the upland placement sites. Therefore, construction activities associated with Alternative 1 would result in less than significant impacts to surface water.

Groundwater

Under Alternative 1, proposed construction and dredged material upland placement activities would be in compliance with the water protection measures identified in the surface water section above, which would therefore also protect local groundwater quality. The dredged material upland placement sites would be located over aquifers. However, those aquifers are not used for supplying drinking water; thus, any effluent that might percolate into the aquifer would not affect regional groundwater drinking quality or quantities. Based upon sediment sampling that has been conducted and historical sampling of dredged sediment associated with Outer and Inner Apra Harbor Navy dredge projects, it is anticipated that the dredged material would be within environmental risk low thresholds for National Oceanic and Atmospheric Administration (NOAA) sediment quality guidelines and contains no or low concentrations of contaminants of concern. The upland placement sites would be enclosed by earthen berms of 16 to 30 ft (5-9 m) in height. As the dredge dewatering effluent has the potential to impact the quality of the local, non-potable groundwater beneath the upland placement sites, a leachate pathway analysis was conducted for dredged material placement at the Field 5 upland placement site as part of the Environmental Assessment (EA) for Alpha and Bravo Wharves. No contaminants of concern were discovered in the leachate that would exceed the Guam Environmental Protection Agency (GEPA) Water Quality Standards for groundwater, and no engineering controls at the upland placement site were required (NAVFAC

Pacific 2005). Because the dredged material to be generated in this action would be similar to that evaluated for the Alpha and Bravo Wharf EA, the impacts to groundwater are expected to be similar. Therefore, construction activities associated with Alternative 1 would result in less than significant impacts to groundwater.

Wetlands

The dredging activities proposed under Alternative 1 would occur in Outer Apra Harbor, away from the wetlands located in Inner Apra Harbor and Sasa Bay. The nearest wetland to the proposed dredging activity would be Wetland Area T, located approximately 2,500 ft (762 m) east of the nearest extent of proposed dredging (Figure 4.2-1). Other wetland areas (W, V2, U, S, X, and SV-O) would be located even further away from the proposed dredging areas. To the west, Wetland Areas A and B are located over 3,000 ft (914 m) from the nearest extent of proposed dredging (Figure 4.2-1). Due to the distance and implementation of BMPs such as the use of silt curtains and operational controls, there would be no impacts to wetlands.

<u>Operation</u>

Surface Water/Stormwater

The operational phase of Alternative 1 would increase the area of impervious surface which would result in an associated relatively minor increase in stormwater discharge intensities and volume. This increase would be accommodated by stormwater infrastructure, and stormwater flow paths would continue to mimic area topography. Furthermore, stormwater would be pre-treated to remove contaminants prior to discharge into the harbor, as detailed in a design-phase plan that would cover the entire project area. It is the intent that all designs would result in 100% capture and treatment, if required, of stormwater runoff.

Alternative 1 would be conducted in accordance with all applicable federal, Government of Guam (GovGuam), and military orders, laws, and regulations, including the preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP), Stormwater Management Plan (SWMP), and Spill Prevention, Control and Countermeasure (SPCC) Plan that would control runoff and minimize potential leaks and spills. In addition, Alternative 1 would include the implementation of BMPs and LID measures. All nonpoint and point source discharges would be monitored pursuant to Clean Water Act (CWA) permits. Implementation of these protective measures would minimize potential impacts of runoff, spills, and leaks, and would minimize potential impacts to surface water resources by retaining and treating stormwater prior to discharge to surface waters and by responding to oil and hazardous waste spills and preventing their discharge to surface waters. Therefore, operations associated with Alternative 1 would result in less than significant impacts to surface water.

Groundwater

The project area is located over 4 miles (mi) (7 kilometers [km]) west of the Northern Guam Lens Aquifer (NGLA). Spills and leaks from POLs or hazardous materials would have the potential to impact non-production groundwater in the project area. The BMPs and follow-on measures and plans identified under the surface water discussion would also serve to protect groundwater quality in the area. Therefore, operations associated with Alternative 1 would result in less than significant impacts to groundwater.

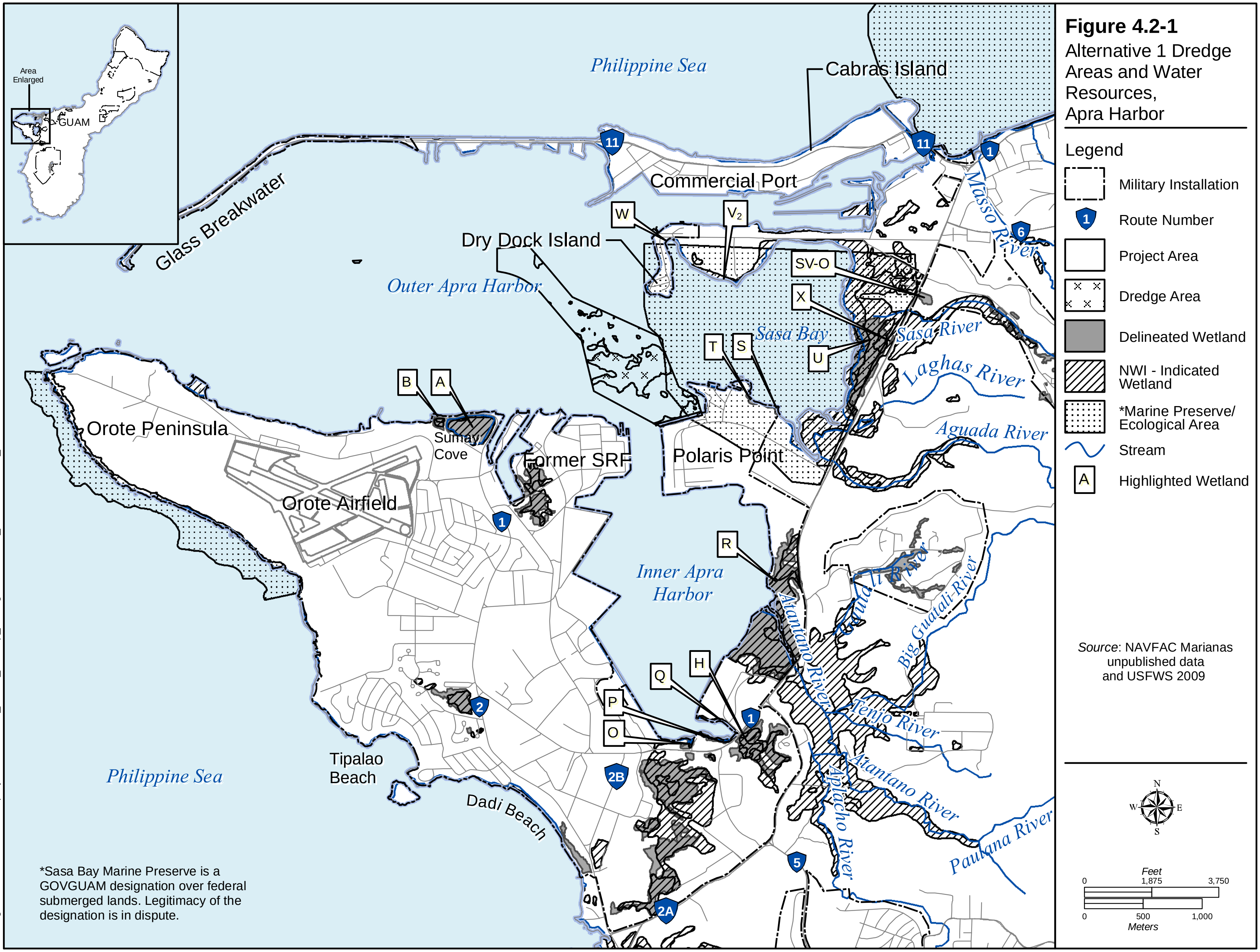

Figure 4.2-1
Alternative 1 Dredge Areas and Water Resources, Apra Harbor

Printing Date: Oct 5, 2009, M:\projects\GIS\8806_Guam_Buildup_EIS\figures\Current_Deliverable\Vol_4\4.2-1.mxd

Wetlands

No wetland areas would be directly or indirectly affected by operational activities associated with Alternative 1 as no delineated wetland areas are located near the proposed operational areas. Proposed BMPs, LID measures, and wastewater treatment plant (WWTP) improvements would collectively reduce the potential for pollutants to impact wetland areas. Therefore, operations associated with Alternative 1 would not impact wetlands.

4.2.2.2 Offshore

Construction

Nearshore Waters

As a consequence of construction, approximately 3.6 acres (1.5 hectares) of intertidal area and open water would be filled. The area of fill would consist of a riprapped slope from the Mean High Water line at the shoreline to the outer edge of the wharf. Wharf pilings would be installed first and then the riprap protection slope under the full width and length of the wharf deck would be added. The aggregate impacts to water resources under the preferred alternative are summarized in Table 4.2-1.

Table 4.2-1. Summary of Aggregate Effects to Jurisdictional Waters of the U.S. and Wetlands

Component Action	*Jurisdictional*		*Type and Area (ac/ha) of Impact*				*Impacted Feature*
	Waters	*Wetlands*	*Direct*	*Indirect*	*Temp.*	*Perm.*	
Dredging	●			ND	●		Outer Apra Harbor
Pilings and riprap	●		3.6ac/ 1.5 ha			●	Outer Apra Harbor

During construction operation under Alternative 1, contaminated runoff or spills and leaks could potentially be transported to, or directly released to nearshore waters. However, implementation of the Naval Base Guam SPCC Plan would reduce the potential for spills and leaks of POLs and hazardous materials. Additionally, as noted above, BMPs such as silt curtains and LID measures, would be implemented, which would also serve to reduce potential impacts to nearshore waters from construction activities.

Under Alternative 1, wharf construction activities would result in localized temporary impacts to nearshore water quality from resuspended sediment; however, these localized temporary impacts would be minimized by implementing BMPs such as silt curtains and operational measures. BMPs and operational measures would contain turbidity within the immediate area. All applicable local, state and federal certifications and permits would be obtained prior to construction, including: Department of Army permit under Section 10 of the Rivers and Harbors Act, Section 404 of the CWA and GEPA, and Section 401 Water Quality Certification (WQC). Conditions and measures imposed by those certifications and permits would be followed to ensure protection of nearshore waters. Upon completion of construction, water quality would be expected to return to pre-construction conditions.

Under Alternative 1, the total dredged material volume anticipated for Polaris Point would be approximately 608,000 cubic yards (cy) (465,850 cubic meters [m^3]), including the overdredge. As discussed previously in Chapter 2 of this Volume, there are four possible disposal scenarios for dredged material: 100% disposal in the ODMDS, 100% disposal upland, 100% beneficial reuse and 20-25% beneficial reuse/75-80% ocean disposal. Several beneficial use projects have been identified as described in Chapter 2. However, for the purposes of impact analysis, the EIS/OEIS conservatively assumes that all dredged sediments would be placed at one or more of five potential upland sites at Naval Base Guam (refer to Figure 4.2-1 in Volume 2, Chapter 4) for dewatering and reuse, or placed in a U.S. Environmental Protection Agency (USEPA) approved Ocean Dredged Material Disposal Site (ODMDS) for Guam. The more likely outcome would be a combination of the three approaches (i.e., ocean disposal, upland placement, and beneficial reuse).

The following sections present an analysis of the potential impacts to nearshore waters from the proposed dredging activity.

Physical Impacts to Nearshore Waters from Dredging

During dredging activities, nearshore water quality would be temporarily impacted by turbidity and sediment generated during the dredging process that is scheduled to last between 8 and 18 months, depending upon the dredging schedule chosen. Dredged materials would be transported to existing upland disposal sites for upland placement or disposed of at an offshore site, if available.

Mechanical dredging was used for analysis because it represents the maximum potential adverse environmental effect to water quality. The primary physical impact from mechanical dredging involves a disturbance to the marine environment that generally leads to re-suspension of sediments and increased turbidity that could adversely affect marine corals and filter-feeding invertebrates. Selection and operation of the type of dredge equipment, as well as the type of sediment being dredged, affect the degree of adverse impacts during dredging. Sediment loss to the water column reduces the efficiency of the dredging process, increases the size of the residual sediment plume, and compounds the impacts to the marine environment. The source of the suspended sediment plume is the sediment loss that occurs throughout the dredging process. The mechanical disturbance applied to the sediment, the ambient currents, and the composition of the sediment determines the magnitude of this loss (SAIC 2001).

The nature, degree, and extent of sediment re-suspension that occurs during dredging are controlled by many factors including: the particle size distribution, solids concentration, and composition of the dredged material; the dredge type and size; operational procedures used; and finally the characteristics of the receiving water in the vicinity of the operation, including seawater density, turbidity, and hydrodynamic forces (i.e., waves, currents, etc.) causing vertical and horizontal mixing. The relative importance of the different factors varies significantly from site to site (SAIC 2001).

Even under ideal conditions, substantial losses of loose and fine sediments will usually occur. Sediment loss during a typical mechanical dredging operation occurs throughout the water column from the following specific sources: impact of the bucket on the seabed; material disturbance during bucket closing and removal from the bed; material spillage from the bucket during hoisting; material washed from the outer surfaces of the bucket during hoisting; leakage and dripping during bucket swinging; aerosol formation during bucket re-entry; and residual material washed during bucket lowering (SAIC 2001).

Given the coarse nature of Outer Apra Harbor sediments, it is likely that the majority of the suspended sediment would settle out rapidly, resulting in a much shorter turbidity plume than otherwise would be the case. Maximum concentrations of suspended solids in the surface plume should be less than 0.5 parts per thousand (ppt) in the immediate vicinity of the operation and decrease rapidly with distance from the operation due to settling and dilution of the material. Average water-column concentrations should generally be less than 0.1 ppt. The near-bottom plume would probably have higher solids concentrations, indicating that re-suspension of bottom material near the bucket impact point is probably the primary source of turbidity in the lower water column. In typical dredging projects, the visible near-surface plume normally dissipates rapidly within an hour or two after the operation ceases (SAIC 2001). Given the course nature of the samples, the time period for dissipation is anticipated to be similar. It is assumed that because of the proximity of coral reefs to the project area, no barge overflow would be a condition of the WQC. This likely permit certificate condition would help reduce the potential for impacts to nearshore waters by preventing the release of silt laden water during barge loading and transport.

A primary influence on the plume is the composition of the sediment. If the sediment is sand, for instance, material released to the water column quickly settles out. Fine grained, silty sediment produces higher turbidity and would remain suspended in the water column while being subject to advection and diffusion, resulting in a larger plume footprint. It has been demonstrated that elevated suspended solids concentrations are generally confined to the immediate vicinity of the dredge or discharge point and dissipate rapidly at the completion of the operation (SAIC 2001).

Sediment grain size analyses indicate that sediments in the area of the navigation channel and proposed turning basin consist primarily of sand and rubble with silty sediments being found along the proposed berthing areas (NAVFAC Pacific 2006). The coarse grain size of the material to be dredged indicates that the majority of the resuspended sediment would settle out of the water column rapidly.

Historically, silt curtains and other mitigation measures have been implemented during dredging operations in Outer Apra Harbor in order to protect corals and filter-feeding invertebrates; similar potential mitigation measures would be used under Alternative 1. Silt curtains are physical barriers to sediment transport that extend from the water surface to a specified water depth. Silt curtains are designed to contain or deflect suspended sediments or turbidity in the water column and, when properly deployed and maintained, can effectively control the flow of turbid water. Sediment containment within a limited area is intended to provide residence time to allow soil particles to settle out of suspension and reduce flow to other areas where negative impacts could occur. Silt curtains may also be used to protect specific areas (e.g., sensitive habitats, water intakes, or recreational areas) from suspended sediment and particle-associated contamination. The use of silt curtains near sensitive resources in addition to around the dredging area might further reduce the potential impacts from sediments that may be released (see also Chapter 11 of this Volume for a discussion on sediment plume modeling).

The area proposed for dredging is designated as M-2 or area of “Good” water quality. Under Alternative 1, turbidity control measures such as silt curtains and operational measures would be implemented to prevent suspended sediments from exceeding Guam Environmental Protection Agency (GEPA) water quality standards, and frequent monitoring during construction to ensure the effectiveness of suspended sediment containment would be performed. Should exceedances of water quality standards occur, construction activities would be interrupted until the total suspended solids (TSS) levels returned to acceptable levels. The sedimentation controls would reduce impacts to aquatic communities and water quality outside of the project area.

Chemical Impacts to Nearshore Waters from Dredging

Resuspended sediment plumes may result in a decrease in dissolved oxygen (DO) in the water column by increasing the biological oxygen demand, affecting marine organisms both on the seabed and in the water column. In addition, because contaminants have a tendency to adhere to sediment particles, a portion of the chemical burdens in the sediment would be released into the water column.

DO reduction due to dredging is a function of the amount of resuspended sediment in the water column, the oxygen demand of the sediment, and the duration of resuspension (LaSalle et al. 1991). Studies have indicated wide variations in DO levels associated with dredging, from minimal or no measurable reduction, to large reductions in DO levels (USACE 1998). The release of organic rich sediments during dredging or dredged material disposal can result in the localized removal of oxygen from the surrounding water. The resuspension of this material creates turbid conditions and decreases photosynthesis. The combination of decreased photosynthesis and the release of organic material with high biological oxygen demand can result in short-term oxygen depletion to aquatic resources (Nightingale and Simenstad 2001b in NOAA 2008). Under Alternative 1, it is not anticipated that there would be releases of organic (silty) sediment except close to shore, where there is a higher percentage of organic sediment. According to Herbich (2000), elevated suspended solids concentrations, and subsequent impacts on DO levels, are generally confined to the immediate vicinity of the dredge or discharge point and dissipate rapidly at the completion of the operation.

Contaminants are sequestered in the total organic carbon (TOC) fraction of sediments (USEPA 2003a in NOAA 2008; USEPA 2003b in NOAA 2008; USEPA 2003c in NOAA 2008). Dredging and disposal causes resuspension of the sediments into the water column and the contaminants that may be associated with the sediment particles. The disturbance of bottom sediments during dredging can release metals (e.g., lead, zinc, mercury, cadmium, copper), hydrocarbons (e.g., polyaromatic hydrocarbons), hydrophobic organics (e.g., dioxins), pesticides, pathogens, and nutrients into the water column and allow these substances to become biologically available either in the water column or through trophic transfer (Wilbur and Pentony 1999 in NOAA 2008; USEPA 2000 in NOAA 2008; Nightingale and Simenstad 2001b in NOAA 2008).

Sediment grain size analyses indicate that sediments in the area of the navigation channel and proposed turning basin consist primarily of coarse grained materials with low amounts of TOC (≤ 0.17% dry weight) (NAVFAC Pacific 2006). The coarse grain size of the material to be dredged coupled with the low TOC and contaminant concentrations indicate that dredging would only result in short term and localized impacts to water quality. These impacts would be further reduced by deployment of silt curtains and operational control measures which historically have been implemented during dredging operations in Apra Harbor.

Sediment quality investigations in Outer Apra Harbor were conducted in 2006. Sediment core samples were taken to the proposed dredged depth needed to accommodate visiting aircraft carriers. The proposed dredge footprint was geographically covered by the sediment sampling regime. A total of fourteen discrete sampling sites were included. The areas included the proposed turning basin in the Outer Harbor and the berthing areas of Alternative 1 (Polaris Point) and Alternative 2 (Former SRF) (NAVFAC Pacific 2006). The outer entrance channel was not sampled as the sediment in that area is sand and predominately clean. The 2006 reconnaissance level effort was performed consistent with guidance outlined in the Ocean Testing Manual (USEPA and USACE 1991). The purpose of the investigation was to delineate the distribution and magnitude of chemicals of potential concern within the material to be dredged from these two potential wharf sites and common turning basin area. The 14 sediment sampling sites were evenly distributed around the two alternative wharf locations and within the proposed turning basin area. Sediment sampling cores were not taken in coral areas to avoid impacts to this sensitive habitat. Refer to Figure 2.3-6 in Chapter 2 of this Volume for sediment sample locations.

Water depths in the area of Alternative 1 (Polaris Point) range from -20 to -80 ft (-6 to -24 m) mean lower low water (MLLW). The Alternative 2 (Former SRF) site has water depths that range from -20 to -73 ft (-6 to -22.3 m) MLLW, with the exception of a shallow reef that lies immediately north of the site. Within the logical geographic areas associated with each wharf alternative location and the turning basin, the core samples were composited and the composited samples were analyzed. Composites 1 (six sample locations) and 3 (five sample locations) are representative of the areas to be dredged for the aircraft carrier turning basin and berthing at Alternative 1 (Polaris Point). Composites 1 (six sample locations) and 2 (three sample locations) were representative of the areas to be dredged for the aircraft carrier turning basin and berthing at Alternative 2 (Former SRF). The results of the sediment quality analysis indicate that, with the exception of Area 3 adjacent to the proposed Alternative 1 (Polaris Point) site, sediments in Outer Apra Harbor (Areas 1 and 2) were coarser-grained and comprised predominantly of a gravelly sand. In Area 3 (immediately offshore Polaris Point), material was predominantly composed of a finer-grained, silty clay material.

Chemical analyses were conducted according to USEPA and American Society for Testing and Materials standards. The results were compared to Effects Range-Low (ER-L) and Effects Range-Median (ER-M) values, and regulatory levels or total threshold limit concentration values (TTLC). The results are summarized in Table 4-2.2. The ER-L value represents the concentration below which adverse effects rarely occur and the ER-M value represents the concentration above which adverse effects frequently occur. Samples or study areas in which many chemicals exceed the ER-M values and exceed them by a large degree may be considered more contaminated than those in which none of the sediment quality guidelines were exceeded. Samples in which ER-L concentrations are exceeded, but no ER-M values are exceeded, may be given intermediate ranks. The effects range values are helpful in assessing potential significance of elevated test results related to biological impacts. The ER-L and M values were developed from a large data set of benthic organism effects. ER-L represents the lower 10^{th} percentile of observed effects concentration and ER-M represents the 50^{th} percentile of the observed effects concentrations. These values are useful in identifying sediment contaminants but actual biological testing would be conducted as part of the testing required for ODMDS disposal. General chemistry parameters (i.e., TOC, ammonia, sulfides, oil and grease and total recoverable petroleum hydrocarbons) do not have ER or TTLC values.

In general, sediment contamination was low throughout all the areas sampled. Special handling of dredged material would not be required and it is likely that the dredged material would meet the testing requirements for ocean disposal. None of the composite samples exceeded any of the ER-M values. Composites 1 and 2 did not exceed any of the ER-L values. There were minor exceedences of the ER-L value for one metal (nickel) for Composite 3. Nickel occurs naturally in the environment and this exceedance is not expected to classify the dredged material as unsuitable for ocean disposal.

Other analytes detected at levels lower than the ER-L included polyaromatic hydrocarbons and arochlor-1260 (polychlorinated biphenyl [PCB]) in Composite 2. All other analytes, e.g., PCBs (aroclor and individual congeners), chlorinated pesticides, organotins, phenols, phthalates were either not detected or reported at less than the laboratory detection limits. Composite 3 had the lowest ammonia level. Composite 2 had the lowest total sulfides levels and Composite 7 had the highest (NAVFAC Pacific 2006).

The results from this study, when compared to other recently conducted dredged material evaluations in Apra Harbor, provide sufficient information to suggest the sediments would be deemed suitable for ocean disposal or upland placement, assuming a preferred beneficial use option was not available and that no special handling of dredged material would be required.

Physical Impacts from Ocean Disposal

A detailed discussion of water quality impacts at the proposed Guam ODMDS is presented in the EIS/OEIS for the ODMDS designation (USEPA 2009).

Table 4.2-2. Sediment Sampling Summary Table

Analyte	*ER-L/ER-M*	*Composite*		
		Outer Apra Harbor		
		1	*2*	*3*
TOC (%)		0.13	0.17	0.5
Arsenic	8.2/70	3.76	3.76	7.55
Cadmium	1.2/9.6	0.27	0.15	0.10
Chromium	81.0/370	11.50	13.30	53.90
Copper	34.0/270	4.85	23.60	17.90
Lead	46.7/218	4.08	18.60	8.71
Mercury	0.15/0.71	0.04	0.12	0.05
Nickel	20.9/51.6	4.91	5.41	**21.50**
Silver	1.0/3.7	<0.025	<0.025	<0.025
Zinc	150/410	6.96	24.80	26.80
Total PAH	4022/44792	34.00	1115.10	129.30
Arochlor 1260	-	<10	22.2	<10

In general, there are a number of physical water quality effects resulting from the ocean disposal of dredged material. These effects include elevated suspended material concentration during dredge disposal, resuspension of sediments by currents, and a change in dredged sediment characteristics (size distribution or sorting coefficient) versus adjacent unaffected areas. The extent of suspended materials concentrations increase during and after dredge disposal at open water disposal sites has been studied by transmissometer. NOAA (1974, 1975b, c in Navy 2004) showed that the suspended material concentration returned to ambient levels in both surface and near-bottom waters in under one hour.

As part of the Ocean Current Study conducted by Weston (NAVFAC Pacific 2007), the distribution of sediment during disposal activities was modeled using SSFATE. The modeling of a single disposal event predicted coarse grained material to settle to the seafloor within 32 hours of the disposal event, with gravel material settling directly beneath the disposal site and sand material being deposited within 4.1 nautical miles (nm) (7.6 km), nearly radially, of the disposal site.

As modeled in the ODMDS EIS, the footprint of material deposited on the seafloor would be elongated toward the northeast having a width of 6.5 nautical miles (12.0 kilometers [km]) and a length of 8.1 nm (15.0 km). This would be most evident in the dispersion of fine-grained material that would tend to stay in suspension the longest. At the proposed ODMDS, the footprint of deposits thicker than 0.04 inch (in) (1 millimeter [mm]) would be contained within a bathymetric depression, in depths of approximately 8,530 ft (2,600 m) at the disposal site and shoaling at the northwestern, northeastern and southeastern edges of the footprint to about 7,220 ft (2,200 m).

The possibility of resuspension of dumped sediments has been studied at open water disposal sites (SAIC 1980, 1989) as part of the disposal area monitoring system (DAMOS) monitoring. Generally, these studies have found that ocean disposal mounds sited within depositional areas at proper depth were quite stable even during storm events. As a result, there would be no significant impacts to nearshore waters from the disposal of dredged material at an ODMDS.

Chemical Impacts of Ocean Disposal of Sediment

As part of the DAMOS monitoring studies of disposal sites in Long Island Sound (CT/NY), chemical measurements suggested that only minor and transient alterations in the water column occurred during hopper discharges. As expected the redox potential (Eh), pH, turbidity, DO, suspended or volatile solids all showed some seasonal variation in concentration but no consistent patterns relative to disposal site proximity were noted (NOAA 1974 in Navy 2004; 1975a,b,c,d,e in Navy 2004; 1976a,b in Navy 2004). The DO concentration in near-bottom waters only decreased 30%, returning to pre-disposal levels in less than 40 minutes (NOAA 1975b in Navy 2004). The pH was reduced very slightly after a hopper discharge but returned to pre-placement values in less than 30 minutes. Surface turbidity in the barge wake quickly disappeared. Suspended and volatile solids concentrations increased dramatically in near-bottom waters following a hopper dump but returned to background values in less than 33 minutes (NOAA 1975c in Navy 2004). Occasionally there were transient and slight increases in TOC within 1 mi (1.6 km) of the disposal buoy (NOAA 1975b in Navy 2004). Water column currents aid in the dissipation of any chemical effect. Given relatively high currents in the water column over the proposed ODMDS, any chemical effects of hopper discharge are expected to dissipate rapidly with the ambient conditions returning shortly after disposal.

Dredged material disposal is expected to produce temporary and localized impacts at the proposed ODMDS, including increased turbidity and decreased light transmittance due to the suspension of sediments (finer-grained silts and clays). The degree of suspension of sediments from dredged material disposal depends on four main variables including size, density and quality of the dredged material; method of disposal; hydrodynamic regime of disposal area; and ambient water quality and characteristics of the disposal site. During suspension and settling, changes in physical and chemical conditions may lead to the desorption of particulate-bound contaminants into the water column. Potential toxicity and bioaccumulation may result from biologically available, desorbed heavy metals and anthropogenic organics. Dissolved contaminants may in turn be sequestered from the water column by mechanisms such as the re-adsorption (onto sediment particles which eventually settle out of the water column), precipitation processes, redox transformations, uptake by aquatic life, degradation, and volatilization. The release of organic-rich sediments during disposal into environments adapted to low nutrient conditions can also result in eutrophication effects such as the localized confiscation of oxygen in the surrounding water column.

Numerical modeling may be conducted using chemical concentrations in proposed dredged materials to determine the diluted concentrations of potential contaminants in the water column. These modeled results would be compared to water quality criteria to determine suitability for ocean disposal. Only dredged material deemed suitable under these protocols would be permitted for disposal at an ODMDS. Screening of the dredged material would ensure that no significant effects to water quality would result from the ocean disposal of the dredged material at the ODMDS.

Overall, potential impacts on water quality from suitable dredged material permitted for ocean disposal at the ODMDS site are expected to be transient and localized (i.e., contained within the overall boundary of the disposal site) within four hours of the initial disposal activity (USEPA 2009). Significant dilution is expected to mitigate any potential impacts caused by sediments remaining in suspension beyond the boundary of the disposal site for longer than four hours.

As noted above, preliminary chemical testing results revealed low concentrations of contaminants, indicating the material is likely suitable for ocean disposal. Pursuant to Section 103 Marine Protection, Research, and Sanctuaries Act (MPRSA), all material would be tested for the presence of contaminants as well as the potential for toxicity and bioaccumulation prior to dredging using national testing guidance (USEPA and USACE 1991). Testing would be accomplished within three years of the start of the proposed construction dredging.

Impacts of Upland Site Placement to Nearshore Waters

The dredged material would be placed in scows, then into sealed end dump trucks for transfer to the upland placement sites. During most rainfall events, stormwater runoff from within the upland placement facilities is not expected except in the rare case such as a typhoon.

The dredged material would be dewatered in accordance with USACE and Guam permitting requirements. Therefore, with the implementation of potential mitigation measures as identified in Section 4.1.2.4, construction activities associated with Alternative 1 would result in less than significant impacts to nearshore waters.

Operation

Nearshore Waters

Currently, sediment plumes occur as a result of propeller wash from tugboats and aircraft carriers while docking and getting underway. Under the proposed action, transient aircraft carriers would dock in Apra Harbor for a cumulative total of up to 63 visit days per year, with an anticipated length of 21 days or less per visit. Similar to dredging operations, the extent of the turbidity plume generated from propellers would be a function of bottom current velocities and sediment grain size as well as propeller jet flow velocities. Ambient water conditions would return shortly after ship movement ceases in the harbor. The proposed dredging would increase the distance between propellers and the sea floor, which is expected to reduce but not eliminate sediment resuspension by ship propellers. This reduction would have a beneficial impact on water quality as there would be fewer incidents of sediment resuspension from propeller wash with less sediment being resuspended. Should sediment resuspension occur, any potential impact to the nearby high quality coral resources of Big Blue Reef would be lessened because of the distance between that reef and Alternative 1.

Leachate from hull coatings commonly discharges into surrounding seawater from vessels, including Navy aircraft carriers. Vessel hulls that are continuously exposed to seawater are typically coated with a base anti-corrosive coating covered by an anti-fouling coating. This coating system prevents corrosion of the underwater hull structure and through leaching action releases antifouling compounds. These compounds inhibit the adhesion of marine organisms to the hull surface. The coatings on most Navy vessels are copper based ablative paints. Tributyl tin-based paints have been phased out by the Navy (Booz Allen 1999). The increase in proposed aircraft carrier visits to Apra Harbor would not be expected to increase substantially the amount of hull coating leachate. Aircraft carriers and other Navy vessels routinely visit Apra Harbor. Results of sediment sampling in Outer Apra Harbor indicate that levels of copper range from 4.85 to 23.60 parts per million, below the NOAA sediment quality environmental risk levels of 34 parts per million for copper in marine sediment (NAVFAC Pacific 2006). Adding 47 visit days per year is not anticipated to increase the amount of hull coating leachate sufficiently to present an increase in environmental risk in coastal waters and/or marine sediments.

With implementation of the proposed upgrades, the existing wastewater collection system at Apra Harbor Naval Complex would be sufficient to handle the wastewater requirements of either a CVN 68 (Nimitz Class) or CVN 78 (Ford Class) aircraft carrier for a duration of 21 days. Proposed improvements to the wastewater system at Naval Base Guam, which have been previously discussed, would result in a minor beneficial impact to the treatment of wastewater and thus nearshore receiving waters.

Therefore, operations associated with Alternative 1 would result in less than significant impacts to nearshore waters.

4.2.2.3 Summary of Alternative 1 Impacts

Table 4.2-3 summarizes the potential construction and operational impacts associated with implementation of Alternative 1.

Table 4.2-3. Summary of Alternative 1 Impacts

Area	*Project Activities*	*Project Specific Impacts*
Onshore	Construction	SW: temporary increase in stormwater runoff, erosion, and sedimentation; potential for water to accumulate in the upland placement sites GW: increased potential for local groundwater contamination WL: no impacts due to distance from proposed action site
	Operation	SW: increase in stormwater volume and intensity GW: increased potential for local groundwater contamination WL: no impacts due to distance from proposed action site
Offshore	Construction	NW: minor increase in runoff volume and pollutant loading potential; minor increase in wharf-construction related suspended sediment and floating debris; localized and temporary increases in turbidity and total suspended solids from dredging; sediment plumes; short-term reduction in DO concentrations; re-suspension of sequestered contaminants; decreased light transmittance; minor and transient chemistry alterations in the water column
	Operation	NW: minor increase in runoff volume and pollutant loading potential; minor, temporary turbidity plumes; beneficial reduction in wastewater-related pollutants

Legend: SW = surface water/stormwater, GW = groundwater, NW = nearshore waters, WL = wetlands, ac = acre, ha = hectare, DO = dissolved oxygen

With the implementation of project-specific potential mitigation measures for the dredging of Apra Harbor, there would be no reduction in the amount of wetlands on Guam, and there would be less than significant reductions in the availability or accessibility of water resources. No impacts to usable groundwater would occur as no groundwater aquifers used for production are located in the project area. Increases in stormwater would be managed by stormwater infrastructure. Through the development and implementation of site-specific BMPs (Volume 2, Chapter 4, Table 4.2.1) and LID measures, and facility-specific plans and procedures, there would be no increased risk from environmental hazards to human health. Furthermore, all actions associated with Alternative 1 would be implemented in accordance with all applicable federal, GovGuam, and Navy environmental guidance (hazardous materials and oil spill management), laws, and regulations (Table 3.1-1, Volume 8). Therefore, Alternative 1 would result in less than significant impacts to water resources.

4.2.2.4 Alternative 1 Potential Mitigation Measures

Dredging of Apra Harbor and subsequent handling of the dredged materials and fill of jurisdictional waters of the U.S. would require Section 404(b) and Section 10 of the Rivers and Harbors Act permits from the USACE and WQC from the GEPA. These permits would stipulate procedures and mitigation requirements in addition to BMPs.

Examples of potential mitigation measures (from USACE 2001 and Palermo et al. 2008) include:

- Installation of physical barriers such as silt curtains or pneumatic (bubble curtains).
- Dredging within seasonal windows to avoid impacts to larval coral and other sensitive aquatic species during peak spawning periods.
- Avoidance of dredging during rough sea conditions to minimize turbidity curtain failures.
- Prohibition of barge overflow during dredging operations.

- Limitations on dredging rates.
- Monitoring water quality.

During the dredging process, potential mitigation measures including silt containment measures and frequent monitoring of effectiveness of suspended sediment containment could be implemented to prevent sediments from migrating beyond the action area. The sedimentation controls and potential mitigation measures would prevent significant impacts to nearshore waters. In addition, dredge upland placement areas would be constructed and operated in accordance with all permit requirements.

A detailed description of resource protection measures, including BMPs, potentially required by regulatory mandates is in Volume 7 and a more detailed explanation of potential regulatory permitting requirements is available in Volume 8 (refer to Table 3.1-1).

4.2.3 Alternative 2 Former Ship Repair Facility (SRF)

4.2.3.1 Onshore

Construction

Surface Water/Stormwater

Proposed activities under Alternative 2, Former SRF (referred to as Alternative 2), are the same as those described under Alternative 1, except that the Former SRF would be the project area. Thus, potential construction impacts to surface water resulting from implementation of Alternative 2 are similar to the potential impacts discussed under Alternative 1. Please refer to Section 4.2.2.1.

Potential dredging impacts to surface water resulting from implementation of Alternative 2 would be slightly less than the potential impacts discussed under Alternative 1 as the volume of dredged material would be less under Alternative 2. Please refer to Section 4.2.2.1. Therefore, construction activities associated with Alternative 2 would result in less than significant impacts to surface water.

Groundwater

Proposed activities under Alternative 2 are the same as those described under Alternative 1, except that the Former SRF would be the project area. Thus, potential construction impacts to groundwater resulting from implementation of Alternative 2 are similar to the potential impacts discussed under Alternative 1. Please refer to Section 4.2.2.1. Therefore, construction activities associated with Alternative 2 would result in less than significant impacts to groundwater.

Wetlands

Proposed activities under Alternative 2 are the same as those described under Alternative 1, except that the Former SRF would be the project area. Under Alternative 2, construction and dredging activities would occur at about the same distance from the identified wetland areas to the east of the dredging area associated with Alternative 1 (at least 2,000 ft [610 m]) (Figure 4.2-2). With the dredging in front of the SRF, Wetland Areas A and B would be approximately 2,600 ft (823 m) west of the nearest extent of dredging operations, slightly closer than under Alternative 1 (Figure 4.2-2).

While dredge operations would be slightly closer, the dredge volume under Alternative 2 would be less than under Alternative 1, resulting in a slightly smaller potential suspended sediment volume in the water column. Thus, potential construction impacts to nearshore waters resulting from implementation of Alternative 2 would be slightly less than the potential impacts discussed under Alternative 1.

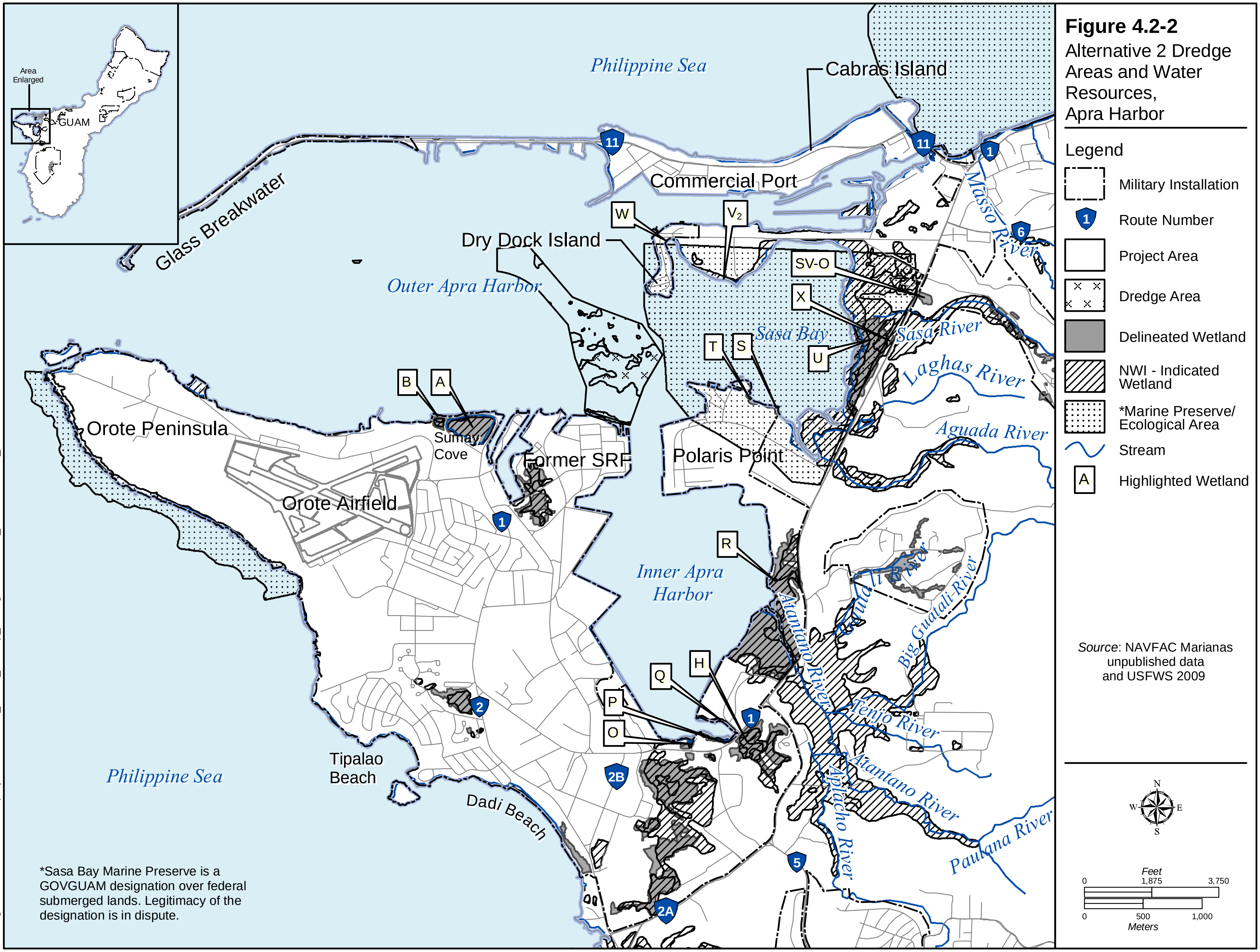

Figure 4.2-2
Alternative 2 Dredge Areas and Water Resources, Apra Harbor

Printing Date: Oct 5, 2009, M:\projects\GIS\8806_Guam_Buildup_EIS\figures\Current_Deliverable\Vol_4\4.2-2.mxd

Silt curtains and other mitigation measures would be used, consistent with past dredging operations in Apra Harbor, in order to protect sensitive areas including wetlands. BMPs and associated potential mitigation measures, distance to the wetlands, and the prevailing currents (i.e., the prevailing surface water motion in Apra Harbor is generally westward, away from the majority of wetland areas in Apra Harbor and Sasa Bay) would minimize impacts. Therefore, construction activities associated with Alternative 2 would not affect wetlands.

Operation

Surface Water/Stormwater

Potential operational impacts to surface water resulting from implementation of Alternative 2 would be the same as the potential impacts discussed under Alternative 1. Please refer to Section 4.2.2.1. Therefore, operations associated with Alternative 2 would result in less than significant impacts to groundwater.

Groundwater

Potential operational impacts to groundwater resulting from implementation of Alternative 2 would be the same as the potential impacts discussed under Alternative 1. Please refer to Section 4.2.2.1. Therefore, operations associated with Alternative 2 would result in less than significant impacts to groundwater.

Wetlands

Potential operational impacts to wetlands resulting from implementation of Alternative 2 are similar to the potential impacts discussed under Alternative 1. Please refer to Section 4.2.2.1. Therefore, operations associated with Alternative 2 would not affect wetlands.

4.2.3.2 Offshore

Construction

Nearshore Waters

Potential impacts of construction to nearshore waters resulting from implementation of Alternative 2 would be similar to those discussed under Alternative 1; however, due to the proximity of Alternative 2 to Big Blue Reef, effects would be greater to this high quality coral reef habitat and its associated Endangered Species Act (ESA)-listed species (see Chapter 11 of this Volume for additional details).

Under Alternative 2, the total dredged volume anticipated for the SRF would be approximately 479,000 cy (366,000 m^3), including the overdredge. As is also the case under Alternative 1, under Alternative 2, the dredged sediments would be placed upland at Naval Base Guam (refer to Figure 4.2-1 in Volume 2, Chapter 4) for dewatering and reuse, disposed of in a USEPA-approved ODMDS for Guam, or disposed of via a combination of these approaches (i.e., ocean disposal, upland placement, and beneficial reuse).

Three sediment samples collected along the SRF wharf during the 2006 characterization effort indicated that sediments in that area were predominantly coarse grained consisting mostly of sand and gravel (85%) and had low TOC (0.17%). Although sediments in that area contained the highest concentrations of total polyaromatic hydrocarbons, lead, and mercury when compared to the other composite samples, none of the analytes exceeded their respective ER-L values. The coarse grain size of the material to be dredged coupled with the low TOC and contaminant concentrations indicate that dredging and disposal would not have significant impacts on water quality and impacts would be similar to those described under Alternative 1. Thus, potential dredging impacts to nearshore waters resulting from implementation of Alternative 2 are similar to the potential impacts discussed under Alternative 1. Please refer to Section 4.2.2.2. Therefore, with the implementation of potential mitigation measures as identified in Section

4.2.3.4, construction activities associated with Alternative 2 would result in less than significant impacts to nearshore waters.

Operation

Nearshore Waters

Potential operational impacts to nearshore waters resulting from implementation of Alternative 2 would be similar to those discussed under Alternative 1; however, due to the proximity of Alternative 2 to Big Blue Reef, effects of resuspended sediments would result in greater long-term impacts (see Chapter 11 of this Volume for additional details).

4.2.3.3 Summary of Alternative 2 Impacts

Table 4.2-4 summarizes the potential construction and operational impacts associated with implementation of Alternative 2.

Table 4.2-4. Summary of Alternative 2 Impacts

Area	*Project Activities*	*Project Specific Impacts*
Onshore	Construction	SW: temporary increase in stormwater runoff, erosion, and sedimentation; potential for water to accumulate in the upland placement sites GW: increased potential for local groundwater contamination WL: no impacts due to distance from wetlands
	Operation	SW: increase in stormwater volume and intensity GW: increased potential for local groundwater contamination WL: no impacts due to distance from wetlands
Offshore	Construction	NW: minor increase in runoff volume and pollutant loading potential; minor increase in wharf construction-related suspended sediment and floating debris; localized and temporary increases in turbidity and total suspended solids from dredging; sediment plumes; short-term reduction in DO concentrations; re-suspension of sequestered contaminants; decreased light transmittance; minor and transient chemistry alterations in the water column
	Operation	NW: minor increase in runoff volume and pollutant loading potential; minor, temporary turbidity plumes; beneficial reduction in wastewater-related pollutants

Legend: SW = surface water/stormwater, GW = groundwater, NW = nearshore waters, WL = wetlands, ac = acre, ha = hectare, DO = dissolved oxygen

With the implementation of dredge-specific potential mitigation measures (see Section 4.2.3.4) for the dredging of Apra Harbor, there would be no reduction in the amount of wetlands on Guam, and there would be less than significant reductions in the availability or accessibility of water resources. No impacts to usable groundwater would occur as no groundwater aquifers used for production are located in the project area. Increases in stormwater would be managed by stormwater infrastructure. Through the development and implementation of site-specific BMPs (Volume 2, Chapter 4, Table 4.2.1) and LID measures, and facility-specific plans and procedures, there would no increased risk from environmental hazards to human health. Furthermore, all actions associated with Alternative 2 would be implemented in accordance with all applicable federal, GovGuam, and Navy environmental guidance (hazardous materials and oil spill management), laws, and regulations. Therefore, Alternative 2 would result in less than significant impacts to water resources.

4.2.3.4 Alternative 2 Potential Mitigation Measures

Under Alternative 2, the same potential mitigation measures as described under Alternative 1 would be implemented.

4.2.4 No-Action Alternative

4.2.4.1 Surface Water/Stormwater

Under the no-action alternative, no construction, dredging, or operations associated with the aircraft carrier berthing would occur. Existing operations at Polaris Point, as a military training and recreational facility, and the Former SRF, as a commercial ship repair facility, would continue; therefore, existing surface water conditions would remain.

There are limited surface water resources flowing into or adjacent to Apra Harbor. Threats to surface water adjacent to Apra Harbor would continue to be monitored by federal and Guam agencies, and appropriate regulatory action would continue to occur in order to maximize surface water quality and availability. In time, surface water quality is expected to slowly improve as point and non-point sources of pollution are identified and pollution loading to surface waters is reduced. Not berthing the carrier in Apra Harbor would not change the on-going water quality concerns or protection actions for surface waters; these conditions and actions would continue to persist. Therefore, implementation of the no-action alternative would result in no impacts to surface water.

4.2.4.2 Groundwater

Under the no-action alternative, no construction, dredging, or operations associated with the aircraft carrier berthing would occur. Existing operations at Polaris Point, as a military training and recreational facility, and the Former SRF, as a commercial ship repair facility, would continue; therefore, existing groundwater conditions would remain.

There are no local usable groundwater resources in or adjacent to Apra Harbor. However, regional threats to groundwater availability and quality would continue to be monitored by federal and Guam agencies to minimize potential impacts, and appropriate regulatory action would continue to occur in order to protect groundwater resources. Monitoring for saltwater intrusion and coordination amongst water users, as well as potential designations for groundwater resources is expected to ensure there is a dependable, safe supply of groundwater for Guam users. Not berthing the carrier in Apra Harbor would not change the on-going groundwater availability and quality concerns or the protection actions for Guam nearshore waters; these conditions and actions would continue. Therefore, implementation of the no-action alternative would result in no impacts to groundwater.

4.2.4.3 Nearshore Waters

Under the no-action alternative, no construction, dredging, or operations associated with the aircraft carrier berthing would occur. Existing operations at Polaris Point, as a military training and recreational facility, and the Former SRF, as a commercial ship repair facility, would continue; therefore, existing nearshore conditions would remain.

The identified nearshore water quality concerns for the marine waters of Apra Harbor (copper, aluminum, nickel, *enterococci* bacteria, total residual chlorine, biochemical oxygen demand and total suspended solids) would persist. These threats to nearshore water quality would continue to be monitored by federal and Guam agencies to minimize potential impacts, and appropriate regulatory action would continue to occur to protect nearshore waters. In time, nearshore water quality is expected to slowly improve as point and non-point sources of pollution (e.g., the former Orote Landfill) are identified and pollution loading to nearshore waters is reduced. Not berthing the carrier in Apra Harbor would not change the on-going nearshore water quality concerns or the protection actions for Guam nearshore waters; these conditions and actions would persist. Therefore, implementation of the no-action alternative would result in no impacts to nearshore waters.

4.2.4.4 Wetlands

Under the no-action alternative, no construction, dredging, or operations associated with the aircraft carrier berthing would occur. Existing operations at Polaris Point, as a military training and recreational facility, and the Former SRF, as a commercial ship repair facility, would continue; therefore, existing wetland conditions would remain.

The identified primary threats to wetlands in and adjacent to Apra Harbor (human disturbance, invasive plants species, sedimentation, and erosion) would persist. These threats to wetland area and function are of concern and are therefore monitored by federal and Guam agencies to protect wetland areas. The absence of berthing the carrier in Apra Harbor would not change the on-going threats or protection actions for wetlands on Guam; these conditions and actions would continue. Therefore, implementation of the no-action alternative would result in no impacts to wetlands.

4.2.5 Summary of Impacts

Table 4.2-5 summarizes the potential impacts of each action alternative and the no-action alternative. A text summary is provided below.

Implementation of either Alternative 1 or Alternative 2 would have the potential to impact the quality and quantity of stormwater runoff during both the construction and operational phases of the project. Construction activities would have the potential to cause erosion and sedimentation which could degrade surface water quality. In addition, the action alternatives would increase the potential for leaks and spills from contaminants. These potential impacts would be reduced through the combination of site-specific BMPs (Volume 2, Chapter 4, Table 4.2.1), LID measures, and monitoring programs. In addition, roadway-specific BMPs would be included in the planning, design, and construction of all roadways. Increases in stormwater would be managed by stormwater infrastructure. Proposed construction activities within the 100-year flood zone would incorporate flood protection measures.

Under Alternatives 1 and 2, the dredged material upland placement sites would be located several miles/kilometers from the NGLA; any effluent that percolates into the underlying soils would not affect groundwater drinking quality or quantities. Nearshore water quality would be temporarily degraded by turbidity and suspended sediments. However, with implementation of BMPs and potential mitigation measures, there would be less than significant impacts to nearshore waters from dredging or ocean disposal. With implementation of impact minimization measures that would reduce suspended sediments and associated turbidity levels, impacts would be less than significant to wetland areas during dredging activities.

Alternatives 1 and 2 would be implemented in compliance with all federal, local, and Navy environmental guidance (hazardous materials and oil spill management), laws, and regulations (Table 3.1-1, Volume 8), and would include the implementation of BMPs, LID measures, and monitoring. Implementation of Alternative 1 would result in less than significant impacts to water resources. Similarly, implementation of Alternative 2 would also result in less than significant impacts to water resources. Existing conditions would remain the same under the no-action alternative; therefore, there would be no impacts to water resources under the no-action alternative.

Table 4.2-5. Summary of Impacts

Alternative 1	*Alternative 2*	*No-Action Alternative*
Construction Impacts		
SW: LSI • temporary increase in stormwater runoff and sedimentation; temporary discharge of ponded rainwater GW: LSI • increased potential for local groundwater contamination NW: SI-M • minor increase in runoff volume and pollutant loading potential; minor increase in wharf-construction related suspended sediment and floating debris; localized and temporary increases in turbidity and total suspended solids from dredging; sediment plumes; short-term reduction in DO concentrations; re-suspension of sequestered contaminants; decreased light transmittance; minor and transient chemistry alterations in the water column WL: NI • no impact due to distance from wetlands	SW: LSI • temporary increase in stormwater runoff and sedimentation; temporary discharge of ponded rainwater GW: LSI • increased potential for local groundwater contamination NW: SI-M • minor increase in runoff volume and pollutant loading potential; minor increase in wharf-construction related suspended sediment and floating debris; localized and temporary increases in turbidity and total suspended solids from dredging; sediment plumes; short-term reduction in DO concentrations; re-suspension of sequestered contaminants; decreased light transmittance; minor and transient chemistry alterations in the water column WL: NI • no impact due to distance from wetlands	Water Resources: NI
Operation Impacts		
SW: LSI • increase in stormwater volume and intensity GW: LSI • increased potential for local groundwater contamination NW: LSI • minor increase in runoff volume and pollutant loading potential; minor, temporary turbidity plumes; beneficial reduction in wastewater-related pollutants WL: NI • no impact due to distance from wetlands	SW: LSI • increase in stormwater volume and intensity GW: LSI • increased potential for local groundwater contamination NW: LSI • minor increase in runoff volume and pollutant loading potential; minor, temporary turbidity plumes; beneficial reduction in wastewater-related pollutants WL: NI • no impact due to distance from wetlands	Water Resources: NI

Legend: SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact, BI = Beneficial impact, SW = surface water/stormwater, GW = groundwater, NW = nearshore waters, WL = wetlands, DO = dissolved oxygen

4.2.6 Summary of Potential Mitigation Measures

Table 4.2-6 summarizes the potential mitigation measures.

Table 4.2-6. Summary of Potential Mitigation Measures

Alternative 1	*Alternative 2*
Construction	
Dredging: • Physical Barriers: silt curtains or pneumatic (bubble) curtains. • Dredge within seasonal windows to minimize impacts to larval coral and other sensitive aquatic species • No barge overflow during dredging operations • Dredging rate limitations • Water quality monitoring	• Same as Alternative 1
Operation	
• None identified	• None identified

4.3 Least Environmentally Damaging Practicable Alternative (LEDPA)

This section focuses on compliance with the Section 404(b)(1) guidelines of the CWA. In addition to being the preferred alternative, Alternative 1, Polaris Point, is considered the *least environmentally damaging practicable alternative* (LEDPA). Specifically, Section 404(b)(1) of the CWA stipulates that no discharge of dredged or fill material into waters of the United States, which include wetlands, shall be permitted if there is a practicable alternative which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant environmental consequences. Furthermore, an alternative is considered practicable if it is available and could be implemented after taking into consideration cost, existing technology, and logistics in light of overall project purposes. Section 404 permitting is applicable to the proposed new berthing of the aircraft carrier at Guam for the proposed work within Apra Harbor. Permitting decisions are based on guidelines ("404(b)(1) Guidelines") developed jointly with the USEPA that are now part of the Code of Federal Regulations (40 CFR 230). A Section 404 Permit would be applied for and obtained prior to construction. This analysis is to show that the screening and selection process used in the development of this EIS/OEIS has identified the LEDPA consistent with the Section 404(b)(1) guidelines.

The Section 404(b)(1) analysis below follows the legal guidelines with regard to content and format; thus, the various subparts and section headings can readily be cross referenced with the regulations. The list of subparts that are discussed include:

- Subpart A: General
- Subpart B: Compliance with the 404(b) Guidelines
- Subpart C: Potential Impacts on Physical and Chemical Characteristics of the Aquatic Ecosystem
- Subpart D: Potential Impacts on Biological Characteristics of the Aquatic Ecosystem
- Subpart E: Potential Impacts on Special Aquatic Sites
- Subpart F: Potential Effects on Human Use Characteristics
- Subpart G: Evaluation and Testing
- Subpart H: Actions Taken to Minimize Adverse Effects

This section ends with a brief comparative summary of the two alternatives carried forward for analysis in this EIS/OEIS and highlights the reasons why Alternative 1, Polaris Point, is considered the LEDPA.

Table 4.3-1 at the end of this discussion identifies the corresponding sections within the Section 404(b)(1) guidelines analysis that follows. Some of the items listed in the table that were used to compare the alternatives are not required under Section 404(b)(1); thus, a corresponding reference is not provided.

SECTION 404(B)(1) GUIDELINES ANALYSIS

Subpart A. GENERAL:

Location. Outer Apra Harbor, Guam (See Figure 2.3-1, Volume 4).

Project Purpose.

The proposed project is the construction and operation of a new deep-draft wharf with outer harbor and shoreside infrastructure improvements, creating the capability to support a transient nuclear powered aircraft carrier in Apra Harbor, Guam.

General Description.

Two wharf locations, Polaris Point, Alternative 1 (preferred), and the Former SRF, Alternative 2, are carried forward for analysis (see the following section for more information on alternatives considered and dismissed).

Under the proposed action with a transient-capable port, the new aircraft carrier berth would support a cumulative total of up to 63 visit days per year, with an anticipated length of 21 days or less per visit. This capability is required to support increased aircraft carrier operational requirements in the Western Pacific. The longer transient visits would interfere with existing munitions operations and therefore require a new deep-draft wharf that can accommodate the transient aircraft carrier. Additionally, due to the length of a transient visit, shoreside infrastructure for utilities (i.e., power, wastewater management, potable water supply) must be improved to minimize or eliminate reliance on shipboard systems while in port.

The primary project components include wharf construction and dredging. Although final designs are not available, impact analysis for wharf construction is based on steel pile construction. Dredging is required within the area near the channel bend, portions of the turning basin, and areas alongside the proposed wharf structure to accommodate the aircraft carrier at either wharf location. Dredging is required to deepen these areas to the required -49.5 ft (-15 m) plus 2 ft (0.6 m) of overdredge. Approximately 608,000 cy (465,850 m^3) of dredged material would be removed for Alternative 1 and approximately 479,000 cy (366,200 m^3) would be removed for Alternative 2. The dredge footprint area for Alternative 1 is 53 ac (21.5 ha) and 44 ac (17.9 ha) for Alternative 2.

The dredging method historically used in Guam is mechanical dredging with a barge-mounted crane with attached clamshell buckets to retrieve the sediment and deposit it on a scow (barge). Mechanical dredging using a traditional clamshell bucket is assumed for this EIS/OEIS analysis because it represents the maximum adverse environmental impact in terms of short-term water quality impacts. It is likely that this method would be used for the proposed dredging; however, the decision would not be made until final design.

Alternatives Considered, Dismissed, and Carried Forward. As previously discussed in this EIS/OEIS, the analysis and selection of reasonable alternatives and options for: 1) wharf location, 2) wharf alignment, 3) navigation channel, and 4) turning basin options for transient carrier visits were based on consideration of the following criteria:

- Practicability (with sub-criteria)
  - Meets security/force protection requirements
  - Meets operational/navigational characteristics
  - Meets cost, technology, and logistics requirements
- Avoids and/or minimizes environmental impacts to the extent practicable

Section 2.3 of Volume 4, along with Table 2.3-1, provides an overview of the reasons why numerous options including 10 individual wharf locations, 4 wharf alignments, 2 navigation channel alignments, 1 turning basin option, and 2 structural wharf design options were dismissed from further study in this EIS/OEIS. A short summary is provided below.

Wharf Location. Ten individual wharf locations were considered (see Section 2.3 of this Volume). Following is the list of locations considered and dismissed and the criteria why they were dismissed. Section 2.3 contains a detailed discussion of this elimination process.

Guam Commercial Port – security/force protection and operational/navigational

Glass Breakwater – security/force protection, environmental, and cost/technology/logistics

Dry Dock Island - security/force protection, environmental, and cost/technology/logistics

Bravo Wharf/pier – operational/navigational

Lima Wharf – operational/navigational

Delta and Echo Wharves – operational/navigational

Sierra Wharf (and all Inner Apra Harbor Wharves) – security/force protection and operational/navigational

Kilo Wharf – operational/navigational

Polaris Point (preferred) and the Former SRF are the only two sites that meet the screening criteria and are therefore carried forward for analysis in this EIS/OEIS.

Wharf Alignment. Section 2.3 of this Volume describes in detail the various wharf alignments that were considered and dismissed. Two wharf alignments were assessed for Polaris Point: parallel to shore (east-west) and a diagonal alignment from Polaris Point across the bay (southwest to northeast). For the parallel to shore (east-west) alignment, two options for aircraft carrier approach were considered, one with a full clearance area and one with a reduced clearance area. The diagonal alignment was dismissed because of the potential direct impacts to coral, it would be most exposed to storm waves, and it would require additional cost to implement. The full clearance, parallel to shore alignment was also dismissed because a land outcrop north of Polaris Point would have to be removed, which would also result in greater direct coral impacts than the reduced clearance option under consideration. A reduced clearance was approved by port operations, harbor pilots and Commander, U.S. Pacific Fleet to ensure that the reduction was acceptable from a navigation and operations perspective. Therefore, the parallel to shore (east-west), reduced clearance is carried forward for analysis in the EIS/OEIS.

Three wharf alignments were considered for the Former SRF, all of which were parallel to shore. Two options were dismissed, one of which would permanently block access to the dry dock, even when the aircraft carrier is not present and the second of which would require significant amounts of excavation of existing land area. The wharf alignment alternative retained for further consideration in this EIS/OEIS at the Former SRF follows the current shoreline as it extends from the end of the finger pier at Lima Wharf in a north-northwesterly direction toward the current location of the floating dry dock.

Navigation Channel. Three navigation channel options were considered, including a channel with a sharp bend (54 degrees), a straight channel, and slight bend option. As discussed in Section 2.3 of Volume 4, the straight channel and slight bend option were dismissed because of their direct impacts to high quality coral. The sharp bend option, which has been retained for analysis in this EIS/OEIS, is the least favorable for navigation but the least environmentally damaging because it minimizes direct impacts to coral in the vicinity of Jade and Western Shoals and requires less dredging than the other two options.

Turning B asin. The minimum radius turning basin option was retained for analysis in this EIS/OEIS because it met the minimum radius needed to safely maneuver the aircraft carrier while minimizing dredging and impacts to corals. See Section 2.3 of this Volume for additional details.

Wharf Design. Structural design options include vertical steel pile supported wharf on armored slope embankment, tied-back steel sheet pile bulkhead (including solid fill), and concrete caissons. All design options would disturb the same area, but there are structural and environmental impact advantages (alters but retains open water and intertidal habitat under the wharf) to a steel pile supported wharf, as described in Section 2.3. Also, due to the need to have a level foundation for the full width of the caisson alternative, additional dredging would be needed for the caisson design alternative increasing its potential environmental impacts as well as cost. Final design is not available for inclusion in this EIS/OEIS. The impact analysis is based on steel pile construction.

Subpart B. COMPLIANCE WITH THE 404(b) GUIDELINES

230.10. Restrictions on Discharge

Description of the Proposed Discharge Site(s). Discharge sites regulated by Section 404(b)(1) associated with the proposed action would be located at the site of construction for the new wharf. As discussed in Section 2.3, this EIS/OEIS assumes that steel pile construction would be used; however, final design is not yet available. A typical steel pile wharf design is shown on Figure 2.5-5 of this Volume. Fill would be in the form of a sloped marine revetment that would be placed under the wharf and along the shoreline to support the vertical steel piles and stabilize the shoreline. In comparison to other wharf construction methods, steel pile construction would require less fill than sheet pile bulkhead wharves and less dredging than caisson-based wharves.

Because the proposed dredging is also an integral part of this project, a discussion of dredged material disposal is included here. The EIS/OEIS assumes four disposal scenarios: 100% ODMDS disposal, 100% upland placement, 100% beneficial reuse, and 20-25% beneficial reuse/75-80% ocean disposal.

Under the 100% upland placement scenario, five upland placement sites on Navy land have been identified for potential use in support of the proposed dredging action. These sites are referred to as Field 3, Field 4, Field 5, PWC Compound and Polaris Point and are described in detail in Appendix D of Volume 9. Fields 3 and 5 and Polaris Point have been proposed for other dredging projects and have been addressed in a NEPA document. Field 4 and PWC Compound sites are addressed in this EIS/OEIS in

Volume 2 and Volume 9, Appendix D. Polaris Point, Field 5, and PWC Compound sites, each individually have sufficient capacity to accommodate all of the anticipated dredged material from either alternative action. Used in combination with the ODMDS and beneficial reuse, only a portion of the candidate sites would be required to accommodate the dredged material. Upland dewatering, which occurs through evaporation and infiltration of the dredged material, is planned to contain all of the mechanically-removed dredged material and does not involve an effluent discharge of slurry water from the upland placement sites.

As noted in Section 2.3, USEPA is pursuing the designation of an ODMDS approximately 11 to 14 nm (20 to 26 km) from the west coast of Apra Harbor. The designation is anticipated in 2010 and the ODMDS EIS/OEIS is being prepared concurrent with this EIS/OEIS. Volume 9, Appendix D provides the details regarding the dimensions, dike heights, and volume capacities of the five upland placement sites noted above. The upland placement sites are enclosed by earthen berms of 16 to 30 ft (5-9 m) in height. The dredged material would always be at or below the berm height. The berms would have an exterior horizontal to vertical slope of 2:1. No soil or fill would be brought to the site for construction. Vegetation would be cleared and soil compacted. Non-hazardous dredged material water would be allowed to evaporate or percolate through the ground. However, during extended periods of intense rain such as would occur with a typhoon, infiltration rates may be exceeded and, although unlikely, temporary discharge of stormwater may occur. All of the sites considered for dewatering are uplands and no wetland impacts would occur from their use.

<u>Types of discharge sites.</u> Open water and upland disposal.

> i) <u>Type(s) of Habitat</u>. The proposed wharf construction in-water area is designated as M-2 or an area of "Good" water quality. The existing upland sites contain previously disturbed upland vegetation and for Field 5 previously dredged materials; the proposed ODMDS open-water sites are deep water bottom and are being addressed in a separate EIS (NAVFAC 2009).
>
> ii) <u>Timing and duration of discharge</u>. Wharf construction would take approximately three and one half years to complete, which includes the time needed for dredging. The dredging project is expected to take approximately eight to eighteen months to complete.

<u>Description of discharge.</u> Pile driving equipment would be used for wharf construction. Impacts to marine resources from pile driving are discussed in Chapter 11 of this Volume. Placement of the quarry stone and riprap stone for the marine revetment for shoreline protection would involve the use of clamshell loaders or similar bucket loaders to place the rock along the slope of the shoreline beneath where the wharf would be constructed for either alternative. The overall area of the concrete deck for both alternatives is 90 ft (27 m) wide by up to approximately 1,325 ft (404 m) long except where the storm bollards are installed where the width would be approximately 115 ft (35 m). The marine revetment would be placed under this deck on the existing surface at a slope of 1 vertical to 1.5 horizontal to a depth of 3 ft (1 m). Approximately 42,000 cy (32,111 m^3) of quarry stone would be placed as fill and 19,815 cy (15,150 m^3) of riprap stone placed as fill. The affected surface area would be approximately 3.6 ac (1.5 ha) that would represent a loss of open water/intertidal habitat. For Alternative 2 (Former SRF), an additional amount of fill would be needed for the water areas between the slips of the finger piers that would be incorporated into that structure. Alternative 1 (Polaris Point) does not have this additional fill requirement. As part of the construction of the pile supported structure, there would be temporary resuspension and redistribution of sediments in the construction area. For purposes of the EIS/OEIS, it has been assumed that the material would be removed using a mechanical (bucket) dredge with placement of the dredged material into scows

for disposal.

230.11. Factual Determinations

A. Physical Substrate Determination. Dredging is required within the area near the channel bend, portions of the turning basin, and areas alongside the proposed wharf structure to accommodate the aircraft carrier at either wharf location. Dredging is required to deepen these areas to the required -49.5 ft (-15 m) plus 2 ft (0.6 m) of overdredge. Approximately 608,000 cy (465,850 m^3) of dredged material would be removed for Alternative 1 and approximately 479,000 cy (366,200 m^3) would be removed for Alternative 2. The dredge footprint area for Alternative 1 is 53 ac (21.5 ha) and 44 ac (17.9 ha) for Alternative 2.

The proposed dredging activities under either alternative would significantly impact coral and coral reefs. For a discussion of corals, see Section 230.44 coral reefs below. The impacts to non-coral substrate would be localized and not significant. Potential impacts to non-coral benthic organisms include direct impacts to those organisms residing in the immediate dredge areas. Organisms residing in the area adjacent to and outside the dredged impact area could experience indirect impacts due to increased sedimentation from dredging activities. Sessile (permanently attached or immobile) organisms such as marine floral communities (macroalgae) have been found to be the predominant benthic community at 40% (almost twice the overall coral cover [22%]) within the area to be dredged. Under Alternatives 1 and 2, dredging activities would have direct and permanent impacts to non-coral benthic organisms, particularly to sessile organisms. Impacts to non-coral benthic organisms (not including corals) would be less than significant as a result of implementing the offshore dredging component of Alternatives 1 and 2. Although some mortality would occur to marine flora and sessile invertebrates, new recruits would replenish these populations post-construction (see Chapter 11 of this Volume for further details).

Actions have been taken to minimize adverse impacts to coral by the selection of alternatives that reduce the direct potential impacts to coral utilizing the sharp bend alternative for access to the proposed turning basin for each alternative. The potential impacts to corals have been further reduced by minimizing the turning basin radii for each alternative under consideration. The potential impacts to coral of Alternative 1 (Polaris Point) were minimized by dismissal of the full clearance, parallel to shore alignment because under that alignment a land outcrop north of Polaris Point would have to be removed, which would also result in greater direct coral impacts.

Considering that both of the alternative areas have been previously dredged and that dynamic physical conditions dominate the areas, pre-construction conditions would return relatively quickly except where changed by the presence of pilings and riprap beneath the wharf. Those structures associated with wharf construction are likely to provide additional benthic settlement areas for sessile organisms as well as refuge for Apra Harbor fish species.

A suite of potential mitigation options are being proposed to offset the loss of corals (see Section 230.44).

B. Water Circulation, Fluctuation and Salinity Determination. No significant change to water circulation, fluctuation, or salinity is expected to occur.

C. Suspended Particulate/Turbidity Determinations. During dredging and construction of the proposed wharf for either alternative, nearshore water quality would be temporarily impacted by turbidity and suspended sediment generated during the dredging process and construction activities as described in Section 4.2 of this Volume. Given the coarse nature of the majority of Outer Apra Harbor sediments, it is likely that the suspended sediment would settle out rapidly, resulting in a much shorter turbidity plume than fine grained sediments in Inner Apra Harbor. Turbidity control measures such as the installation of silt curtains would be implemented to prevent suspended sediments from exceeding water quality standards outside the work area, and frequent monitoring during construction to ensure the effectiveness of suspended sediment containment would be performed.

D. Contaminant Determinations. Sediment quality investigations in Outer Apra Harbor were conducted at three locations at Apra Harbor in 2006. The sites were being considered as potential locations for berthing an aircraft carrier, including the vicinity of Alternatives 1 and 2. Sediment contamination was low throughout all the areas sampled. Special handling of dredged material would not be required and it is likely that the dredged material would meet the testing requirements for ocean disposal.

E. Aquatic Ecosystem and Organism Determination. As described in Volume 4, Section 11.2, the proposed dredging activities under either alternative would significantly impact coral and coral reefs and potential mitigation as proposed in Section 230.44 would be required. The proposed construction of the aircraft carrier wharf would change the bottom habitat for either alternative location. Under Alternatives 1 and 2, dredging activities would have direct and permanent impacts to non-coral benthic organisms particularly to sessile (non-mobile) organisms. Although some mortality would occur to marine flora and sessile invertebrates, other such organisms are anticipated to quickly colonize the area once project activities cease, as described further in Chapter 11 of this Volume. Impacts to non-coral benthic organisms (not including corals) would be less than significant as a result of implementing the offshore dredging component of Alternatives 1 and 2.

Those mobile organisms in the region of influence that are not directly subjected to removal or fill activities could sustain impacts as a result of transport, suspension and deposition of dredging-generated sediments. Removal of soft bottom substrate overlying hard substrate would provide additional potential habitat for coral and non-coral benthic organisms.

Regarding threatened or endangered species, green and hawksbill turtles are known to utilize Apra Harbor, but there are few records documenting use of beaches for nesting in this area. Impacts to these species would be less than significant, as explained in Chapters 10 and 11 of this Volume. Formal consultation with the NOAA in the context of Section 7 consultation includes these species. Two additional special-status species known to occur in the region include the bumphead parrotfish (a NMFS species of concern) and the spinner dolphin (protected under the Marine Mammal Protection Act [MMPA]). The bumphead parrotfish is reported nearby within Piti Bomb Holes Reserve (NOAA 2005); however, it has not been observed in Apra Harbor. Spinner dolphins are rarely reported in Outer Apra Harbor. There would be no significant impacts to or no adverse effects on special-status species (i.e., the action would not “jeopardize” or result in a “take” of an ESA-listed species or a species listed under the MMPA).

F. Proposed Disposal Site Determinations. Under the 100% upland placement scenario, five upland placement sites on Navy land have been identified for potential use in support of the proposed dredging action. These sites are referred to as Field 3, Field 4, Field 5, PWC Compound and Polaris Point and are described in detail in Appendix D of Volume 9. Three of the alternative upland placement sites, Polaris Point, Field 5, and the PWC Compound sites, each individually have sufficient capacity to accommodate all of the anticipated dredged material from either alternative action. There would be no discharge of effluent associated with the upland placement at any of these five possible upland sites and therefore no mixing zones are necessary for this disposal option.

G. Determination of Cumulative Effects on the Aquatic Ecosystem. The proposed action is not expected to have significant cumulative adverse impacts. Dredging and disposal of dredged material has and would continue to cause temporary increases in turbidity in dredged areas. Ongoing and future dredging projects in Apra Harbor would have additive impacts with the dredging proposed under either alternative. The majority of these impacts would be temporary in nature and/or would be minimized through the implementation of BMPs.

Potential cumulative anthropogenic impacts on non-coral benthic organisms include potential releases of chemicals attached to suspended sediment into the ocean; introduction of debris into the water column and onto the seafloor; and mortality and injury of marine organisms near the areas of impact. Implementation of the proposed action, when considered cumulatively with the past, present and future projects, would have no significant long-term effects or changes to species abundance or diversity; or result in significant loss or degradation of sensitive habitats. None of the potential impacts would affect the sustainability of resources, the regional ecosystem, or the human community. Therefore, cumulative impacts to non-coral benthic organisms on Guam would be less than significant.

Potential cumulative impacts to fish and essential fish habitat (EFH), when considered cumulatively with the past, present and future projects would include potential release of chemicals into the nearshore environment; introduction of debris into the water column; mortality and injury of marine organisms (including coral and coral reef ecosystems) near the dredging impact areas; and physical and noise impacts from increased vessel activity. Direct and indirect impacts have been documented to marine biological resources, including EFH and ESA-listed species from past projects.

The cumulative impacts to nearshore waters from the various aspects of the proposed action include temporary increases in suspended sediments and turbidity in Apra Harbor and at the existing ODMDS from dredging and disposal activities; potential changes in hydrodynamics from deepening the harbor; increases in stormwater runoff from upland development; and increased sedimentation from construction-related ground disturbance. The majority of these impacts would be temporary in nature and/or would be minimized through the implementation of BMPs, LID measures, permit requirements, sustainability measures, and compliance with federal and local regulations. Cumulative impacts on coral and coral reef management unit species (MUS) present in the EFH of Apra Harbor would be significant. This significant impact would be compensated following the implementation of appropriate mitigation.

H. Determination of Secondary Effects on the Aquatic Ecosystem. The proposed action is not expected to have significant secondary effect on the aquatic ecosystem. Implementation of BMPs, monitoring during construction activities, permit compliance, and potential mitigation of unavoidable impacts would reduce the secondary impacts of the proposed action to a less than significant impact.

230.12. Findings of compliance or non-compliance with the restrictions on discharge.

A. No significant adaptation of the guidelines were made relative to this evaluation.

B. There is no practicable alternative to the proposed action that does not involve the discharge of fill material into waters of the United States.

C. The discharges of fill materials would not cause or contribute to violations of any federal or Guam EPA water quality standard with the implementation of BMPs to control turbidity and giving consideration to the low concentrations of contaminants found in sediment samples for the project area in previous site characterizations.

D. The placement of fill materials would not result in significant adverse impacts to human health and welfare, including municipal and private water supplies, recreational and commercial fisheries, or special aquatic sites. Significant impacts to coral reefs would occur but this impact would be compensated by appropriate mitigation.

E. The upland placement scenario would not result in the discharge of effluent or suspended sediments from the upland site(s) which would require a specified mixing zone or restriction on their discharge.

The proposed action is therefore found to be in compliance with the 404(b)(1) Guidelines.

Subpart C. POTENTIAL IMPACTS ON PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE AQUATIC ECOSYSTEM

230.20. Physical Substrate. As described in Volume 4, Section 11.2, the proposed dredging activities under either alternative would significantly impact coral and coral reefs. For a discussion on corals, see Section 230.44 coral reefs below. The impacts to non-coral substrate would be localized and not significant. Potential impacts to non-coral benthic organisms include direct impacts to those organisms residing in the immediate dredge areas. Organisms residing in the area adjacent to and outside the dredged impact area could experience indirect impacts due to increased sedimentation from dredging activities. Sessile (permanently attached or immobile) organisms such as marine floral communities (macroalgae) have been found to be the predominant benthic community at 40% (almost twice the overall coral cover [22%]) within the area to be dredged. Under Alternatives 1 and 2, dredging activities would have direct and permanent impacts to non-coral benthic organisms particularly to sessile organisms. Although some mortality would occur to marine flora and sessile invertebrates, other such organisms are anticipated to quickly reestablish once project activities cease, as described further in Chapter 11 of this Volume (NOAA Benthic Habitat Mapping 2007; DOER 2005; Atlantic States Marine Fisheries Commission 2002; and U.S. Army Corps of Engineers Coastal Engineering Research Center 1982). Furthermore, removal of soft bottom substrate overlying hard substrate would provide additional potential habitat for coral and non-coral benthic organisms. Therefore, impacts to non-coral benthic organisms (not including corals) would be less than significant as a result of implementing the offshore dredging component of Alternatives 1 and 2.

230.21. Suspended Particulate/Turbidity. During dredging and construction of the proposed wharf for either alternative, nearshore water quality would be temporarily impacted by turbidity and suspended sediment generated during the dredging process and construction activities as described in Section 4.2 of this Volume. Given the coarse nature of the majority of Outer Apra Harbor sediments, it is likely that the suspended sediment would settle out rapidly, resulting in a much shorter turbidity plume than fine grained sediments in Inner Apra Harbor (see Chapter 4 of this Volume). Maximum concentrations of suspended solids in the surface plume should be less than 0.5 parts per thousand (ppt) in the immediate vicinity of the operation and decrease rapidly with distance from the operation due to settling and dilution of the material. Turbidity control measures such as the installation of silt curtains would be implemented to prevent suspended sediments from exceeding water quality standards, and frequent monitoring during construction to ensure the effectiveness of suspended sediment containment would be performed. The Navy would monitor for any exceedances of water quality standards. If any exceedances occur, construction activities would be interrupted until the TSS levels returned to acceptable levels. The sedimentation controls would prevent significant impacts to aquatic communities and water quality outside of the project area. According to the TSS modeling results noted in Section 230.60, the turbidity plumes rapidly dissipated following dredging resulting in less than significant impacts.

230.22. Water. Ambient conditions in the project area are designated as M-2 or an area of "Good" water quality as described in Volume 2, Section 2.6, Least Environmentally Damaging Practicable Alternative for Waterfront Functions, and Section 4.2 of this Volume, which addresses water quality impacts from the proposed dredging and construction activities under both alternatives. There would be temporary minor increases in the resuspension of sequestered contaminants (attached to sediments), decreased light transmittance, and minor transient chemistry alterations in the water column during dredging and wharf construction.

230.23. Current Patterns and Circulation. Circulation patterns within the area are controlled by astronomical tides, winds, and to a lesser degree, freshwater discharge from upland water resources. The proposed dredging project and wharf construction would have no effect on circulation patterns, current velocities, or water stratification in Outer Apra Harbor.

230.24. Normal Water Fluctuation. No change in water fluctuation consisting of daily, seasonal, annual tidal and flood fluctuations in water level would occur as a result of the proposed dredging and wharf construction.

230.25. Salinity Gradients. Salinity gradients in Outer Apra Harbor are not expected to change from either alternative.

Subpart D. POTENTIAL IMPACTS ON BIOLOGICAL CHARACTERISTICS OF THE AQUATIC ECOSYSTEM

230.30 Threatened and endangered species. Special Status Species in the project area include sea turtles. Green and hawksbill turtles are known to utilize Apra Harbor, but there are only historic records documenting use of beaches for nesting near the project area. Noise impacts from in-water construction activities would be the main focus for sea turtles. As identified in Volume 2, Chapter 11, the available data on sea turtle hearing suggests a hearing in the moderately low frequency range, and a relatively low sensitivity within the range they are capable of hearing (Bartol et al. 1999; Ketten and Bartol 2006). Green turtles are most sensitive to sounds between 200 and 700 Hz, with peak sensitivity at 300 to 400 Hz (Ridgway et al. 1969). Sensitivity even within the optimal hearing range is apparently low—threshold detection levels in water are relatively high at 160 to 200 dB with a reference pressure of one dB re 1 μPa-m (Lenhardt 1994).

The ability of sea turtles to detect noise and slow moving vessels via auditory and /or visual cues would be expected based on knowledge of their sensory biology (Navy 2009a). Noise from dredging activities (87.3 dB at 50 ft [15 m]) and pile driving (average 165 dB at 30 ft [9 m] would occur. Sound levels would decline to ambient levels (120 dB) within approximately 150 ft (45.8 m) from in-water construction activities (NMFS 2008c). It is anticipated that NMFS-trained monitors would perform visual surveys prior to and during in-water construction work as part of the USACE permit conditions. If sea turtles are detected (within a designated auditory protective distance), in-water construction activities would be postponed until the animals voluntarily leave the area.

Sea turtles are highly mobile and capable of leaving or avoiding an area during proposed dredging and in-water wharf construction (i.e. pile driving) activities. Sea turtles are expected to avoid areas of noise and disturbances. Dredging and pile driving activities would probably deter green sea turtles from closely approaching the work area, and as a result, the likelihood that a green sea turtle would get close enough to experience and effects is remote, especially with the silt curtain barriers and mitigation measures in place.

The Navy recognizes that there are many on-going and recent past studies on the subject of potential exposures to sea turtles and other marine species from pile driving actions. Further research and validation of these studies are necessary prior to being able to determine the applicability of the methodologies and results to the proposed action within this DEIS/OEIS. The Navy would continue to research these studies and where appropriate, incorporate and apply methodologies, analysis, and results to the on-going impact analysis to sea turtles from the proposed action. Applicability of these studies would also be coordinated through consultations with the National Marine Fisheries Service. The Final EIS/OEIS will contain revised sea turtle impact analysis as developed through the process described above.

To further protect sea turtles, the contractor performing work in Apra Harbor would be directed to stop work when there is a positive visual sighting of a turtle anywhere near the project. The contractor can resume work fifteen minutes after the turtle submerges and is no longer seen. This instruction is the same for turtles within or outside of the silt curtains.

Additionally, the Navy would comply with USACE permit conditions, which include resource agency recommended BMPs for sea turtle avoidance and minimization measures and protocols during in-water construction activities (dredging and pile driving) and vessel operations. These measures (including look outs, stop work policies when turtles approach the area, and “ramping up” on pile driving activities, and others) are described in detail in the Mitigation Measures section, Volume 7, and are expected to considerably lessen any potential impacts to sea turtles in the area. Impacts would be less than significant, as explained in Chapter 10 and 11 of this Volume. Formal consultation with NOAA in the context of Section 7 consultation includes these species. Informal consultations between the Navy and these agencies have been ongoing since June 2007 concerning the activities associated with the proposed action.

Potential indirect impacts from construction and operation include noise and activity, which would be less than significant for the reasons discussed in Chapter 10, Terrestrial Biological Resources and Chapter 11, Marine Biological Resources. Direct impacts from incidental boat strikes would be very uncommon and less than significant. Spills, should they occur, could significantly impact the sea turtle nesting area at Sumay Cove and possibly others. However, with implementation of BMPs, SPCC Plans, and with adequate spill equipment and response capabilities, impacts would be less than significant. BMPs and Mitigations are listed in Volume 7.

Three additional special-status species known to occur in the region include the Napoleon wrasse and bumphead parrotfish (NMFS species of concern), and spinner dolphin (protected under the MMPA). The bumphead parrotfish is reported nearby within Piti Bomb Holes Reserve, approximately 4 mi (6.4 km) from the Outer Apra Harbor Entrance Channel (NOAA 2005a), but has not been observed in Apra Harbor. Spinner dolphins are rarely reported in Outer Apra Harbor. When they are sighted, it is only near the outer entrance channel several times a year for short durations. The location of these sightings range from 7,500 - 11,250 ft (2,300 – 3400 m) away from the proposed area of dredging depending upon the stage of dredging. Therefore, a no effects determination for spinner dolphins and bumphead parrotfish are applicable. Effects on the Napoleon wrasse are expected to be short-term and localized, and therefore there would be no adverse affects to this species.

In summary, it is anticipated that through consultation with NOAA, including implementation of BMPs and potential mitigation measures for dredging and pile driving activities, that the proposed action may affect, but are not likely to adversely affect the ESA-listed green sea turtles in Apra Harbor. The short-term dredging, pile driving activities and episodic vessel movement impacts associated with Alternative 1 actions may affect, but are not likely to adversely affect ESA-listed sea turtles. Alternative 1 would not “jeopardize” or “take” ESA-listed sea turtles as defined under Section 7 and 9 of ESA. Therefore, Alternatives 1 and 2 would result in less than significant impacts on special-status species.

230.31 <u>Fish, crustaceans, mollusks, and other aquatic organisms in the food web.</u> As described in Volume 4, Section 11.2, those mobile organisms in the region of influence that are not directly subjected to removal or fill activities could sustain impacts as a result of transport, suspension, and deposition of dredging-generated sediments. Mobile invertebrates would likely vacate the area due to the increased disturbance. Under Alternatives 1 and 2, dredging and construction activities would have direct and permanent impacts to non-coral benthic organisms, particularly to sessile organisms. Although some mortality would occur to common marine flora and sessile invertebrates, other such organisms are anticipated to quickly recolonize the area once project activities cease. There would be no loss of unique species (Dollar, 2009). Therefore, impacts to non-coral benthic organisms would be less than significant as a result of implementing either Alternative 1 or 2.

<u>Essential Fish Habitat</u>

As discussed in Volume 2, Chapter 11, all of Apra Harbor is considered EFH and Jade Shoals is a Habitat Area of Particular Concern. Four sensitive MUS associated with EFH include Napoleon or humphead wrasse (NMFS species of concern and EFH-Currently Harvested Coral Reef Taxa [CHCRT]); bigeye scad (EFH-CHCRT); scalloped hammerhead shark (EFH-Potentially Harvested Coral Reef Taxa [PHCRT]); and sessile MUS (EFH-PHCRT), including stony corals, soft corals, sponges, algae, etc. The proposed construction of the aircraft carrier wharf would change the bottom habitat of either alternative location. Considering that both of the alternative areas have been previously dredged and the dynamic physical conditions that dominate the area, pre-construction conditions would return relatively quickly, except in the area changed by the presence of pilings and riprap beneath the wharf. Those structures associated with wharf construction likely would provide additional benthic settlement areas for sessile organisms as well as refuge for Apra Harbor fish species.

Dredging impacts to EFH would be greatest for all life stages of coral and sessile reef species, and some crustacean MUS. Site-attached reef fish and pelagic egg/larval stages of bottomfish and pelagic MUS may also be affected. Coral reef habitat would be permanently lost and would be compensated for through potential mitigation. Dredging activities would cause turbidity plumes and underwater noise that would temporarily disturb Fishery Management Plan species. Indirect impacts to EFH would include effects from the temporary degradation of water quality as a result of suspended solids, reduction of light penetration and interference with filter-feeding benthic organisms. The increase in turbidity would be short-term and localized.

BMPs and potential mitigation such as the use of silt curtains as identified in Volume 7 would minimize impacts to this EFH resource through a reduction in sedimentation associated with dredging activities.

230.32 <u>Other wildlife (migratory birds for this analysis).</u> The indigenous grey-tailed tattler and Pacific reef heron utilize food resources within Apra Harbor shoreline areas. A small amount of shoreline habitat that is not currently developed would be removed at the proposed aircraft carrier project area. The amount removed would be very small in relation to the total amount available. Similar areas of habitat are common in the area and any individuals affected would move to these other areas so that there would be less than significant impacts to populations of these shorebirds from removal of habitat.

Potential indirect impacts include noise and activity, pollutants, and dredging sedimentation. Only common migratory bird species widespread on Guam are known within the Polaris Point and Former SRF terrestrial area. Noise and activity from construction could force them to move temporarily but there are other areas of suitable habitat nearby. Existing commercial and Navy activity in Apra Harbor generates substantial background noise and lighting; however, migratory birds still frequent the area. Any noise associated with the temporary construction and dredging would not contribute substantially to the overall background noise and light levels nor significantly impact migratory birds.

Fueling of project-related construction or operation vehicles, watercraft, and equipment could result in accidental releases of petroleum products that would migrate within Apra Harbor. The Sasa Bay mangrove area is over 4,000 ft (1,220 m) from the aircraft carrier dredging location. Required BMPs during construction would make it unlikely for a major spill to occur. There would be a containment boom around the dredging operation to guard against fuel spills. Additionally, Navy oil response units would be present nearby. Pursuant to Navy response plans, small spills would be quickly contained and unlikely to reach environmentally sensitive areas. Potential impacts would be less than significant.

Proposed dredging and construction of the proposed wharf for either alternative location would result in suspension of sediments that could be mitigated. However, resuspended plume modeling results show that sediments would largely be contained within silt curtains employed for the dredging; any sediment plume would not migrate into Sasa Bay or only a very short distance into the bay under all scenarios modeled (Ericksen 2009). Use of silt curtains is part of standard procedures to minimize suspended sediment migration. The two alternatives are located within the confines of Outer Apra Harbor, well away from high wind and wave action, thus increasing the effectiveness of the silt curtains. Impacts would be less than significant.

Subpart E. POTENTIAL IMPACTS ON SPECIAL AQUATIC SITES

230.40 Sanctuaries and refuges. Dredging and construction activities would not significantly affect any of the fish and wildlife resources that are designated for preservation or refuges on Guam.

230.41 Wetlands. The onshore impacts to wetlands are discussed in Volume 4, Section 4.2 for both Alternatives 1 and 2. There would be no direct filling or dredging of wetlands with either alternative. Indirect impacts to coastal wetlands as a result of the release of sediment into the water column is unlikely to reach any wetlands. As noted in Section 4.2, for Alternative 1, the nearest wetland to the proposed dredging activity would be Wetland Area T, located approximately 2,500 ft (762 m) east of the nearest extent of proposed dredging (Figure 4.1-1). Other wetland areas (W, V2, U, S, X, and SV-O would be located even further away from the proposed dredging areas. To the west, Wetland Areas A and B would be located over 3,000 ft (914 m) from the nearest extent of proposed dredging (Figure 4.1-1). For Alternative 2, Section 4.2 notes that the closest wetland area is the same distance from the identified wetland areas to the east of the dredging area associated with Alternative 1 (at least 2,000 ft [610 m]) (Figure 4.1-2). With the dredging in front of the SRF, Wetland Areas A and B would be approximately 2,600 ft (823 m) west of the nearest extent of dredging operations. Potential impacts would be unlikely due to the implementation of dredging BMPs, distance to the wetlands, and the prevailing currents (i.e., the prevailing surface water motion in Apra Harbor is generally westward, away from the majority of wetland areas in Apra Harbor and Sasa Bay). Therefore, construction activities associated with Alternative 1 or 2 would not impact wetlands.

230. 42 Mudflats. No effect.

230.43 Vegetated shallows. No effect.

230.44 Coral reefs. The interaction of sediment removal and resuspended sediment with benthic communities, particularly corals, is of considerable importance in estimating the effects of the proposed dredging and wharf construction activities. Section 11.1, Volume 4, addresses non-coral benthic organisms. Section 11.2 addresses the impacts of Alternatives 1 and 2 to corals. Under Alternatives 1 and 2, dredging activities would have significant direct, permanent impacts to coral and coral reefs. Coral and coral reef habitat is an important component of the EFH within Apra Harbor, providing habitat necessary to fish for spawning, breeding, feeding, or growth to maturity. In addition to the significance determination described in Section 11.2, the following Habitat Equivalency Analysis (HEA)-related approach was utilized in assessing potential impacts (Navy 2009a). Under the 2008 USACE compensatory mitigation rule, permit applicants are required to mitigate to no net loss of ecological services and function. HEA is a modeling tool that has been used in a variety of legal and technical contexts to quantify impacts to natural resources and the services/functions they provide, and quantify the amount of restoration/mitigation required to offset documented losses. A HEA model was conducted for both aircraft carrier alternatives and a report entitled *Habitat Equivalency Analysis (HEA) Mitigation of Coral Habitat Losses* was prepared. It is included in Volume 9, Appendix E, Section F of this EIS/OEIS.

The HEA addresses direct and indirect impacts to coral habitat arising from dredging to support aircraft carrier berthing and maneuvering in Outer Apra Harbor. The basic HEA steps include:

1. Loss calculation: Document and estimate the duration and extent of injury from the time of injury until the resource recovers to baseline, or possibly to a maximum level below baseline.
1. Restoration calculation: a) Document and estimate the services provided by the compensatory project over the full life of the habitat, and b) Calculate the size of the replacement project for which the total increase in services provided by the replacement project equals the total interim loss of services due to the injury.

The HEA analysis focuses on the coral habitat expected to be either permanently lost due to dredging or temporarily affected by sedimentation. Much of the habitat within the dredge footprint is previously dredged and unconsolidated soft sediment with no coral cover (Smith 2007; Dollar et al. 2009). Due to the short-term and localized impacts associated with dredging on soft bottoms and the anticipated quick recolonization of the benthic community, those habitats were not included in the HEA model.

The total area of removal by dredging (two dimensional view) of habitat with some coral coverage is approximately 25 ac (10.2 ha) for the Polaris Point alternative, and approximately 24 ac (9.6 ha) for the Former SRF Alternative. These acreages represent approximately 5% of the coral habitat of Apra Harbor. When a 200 m buffer is applied, each alternative has approximately the same impact of approximately 71 ac (29 ha). The total area (three dimensional view) of habitat with some coral coverage is approximately 33 ac (13 ha) for the Alternative 1 Polaris Point, and approximately 32 ac (13 ha) for the Alternative 2 Former SRF.

In addition, an estimate was made of the discounted service acre-years expected to be lost due to aircraft carrier dredging-related activities. The “acre-year” metric allows the analysis to consider not only the number of acres lost, but also injury severity and recovery over time. A loss of one acre-year equates to a complete loss of ecological function provided by the identified habitat for one year. Such a loss could be arrived at in numerous ways (e.g., 50% degradation of two acres of habitat for one year, 10% degradation of five acres of habitat for two years, 5% degradation of one acre of habitat for 20 years, etc.).

The simplified examples above do not take into account the effects of discounting, which is applied in the HEA methodology to convert losses occurring in different years into a single, common year. A 3% annual discount rate is applied to the calculations, which is the most common discount rate used in HEA applications and one that research indicates reasonably reflects society’s general preference for current use and enjoyment of resources, compared to future resource use and enjoyment (NOAA 1999, Freeman 1993). The sum of these discounted losses across years represents the present value acre-years of ecological services lost.

Alternative 1 would require the dredging of approximately 608,000 cy (465,850 m^3) of dredged material to obtain the desired -49.5 ft (15 m) MLLW plus 2 ft (0.6 m) water depth to accommodate the aircraft carrier. The total dredge footprint for Alternative 1, with coral, is estimated at 53 ac (21.5 ha). Alternative 2 would require the dredging of approximately 479,000 cy (366,200 m^3) of dredged material. The total dredge area for Alternative 2, with coral, is estimated at 44 ac (17.9 ha). Table 11.2-10 summarizes the direct and indirect impacts of dredging to corals based on coral coverage category with the implementation of Alternatives 1 and 2. Areas with the greatest coral abundance (>70 to < 90%) would comprise the smallest portion (10%) of the total coral coverage category that would be lost due to proposed dredging. Areas with the least amount of coral coverage (0 – ≤10%) would comprise the largest portion (approximately 36%) of the total coral coverage category that would be lost due to proposed dredging. About two thirds (62%) of the area proposed for dredging contains corals with a coverage of less than 30%. Approximately 3% of the total area proposed for dredging contains corals in the 70-90%, coverage category and 10% for the 50-90% range of coverage.

In general, approximately 35% of the proposed dredge area contains some coral coverage and virtually all of the area consists of reefs that were dredged 60 years ago during the creation of Inner Apra Harbor, Polaris Point, and Dry Dock Island. Therefore, there would be unavoidable permanent significant impacts to coral reefs from a dredging of approximately 25 acres (10.2 ha) of live coral (all classes [>0% to ≤90%]).

Tables 11.2-7 and 11.2-8 in Chapter 11 of Volume 4 summarize the data used in the HEA calculations to estimate aircraft carrier-related coral habitat impacts and the resulting loss estimates. As shown in these tables, Alternative 1(Polaris Point) (Table 11.2-1) is expected to result in a loss of approximately 1,048 discounted service acre-years (DSAYs) of coral habitat (across all coral habitat categories), approximately 996 DSAYs due to direct impacts and 52 DSAYs due to indirect impacts. Alternative 2 (Former SRF) is expected to result in a loss of approximately 1,023 DSAYs (969 DSAYs due to direct impacts and 54 DSAYs due to indirect impacts).

The HEA was used to develop an estimate of the DSAYs gained per acre of artificial reef, discounted in the same manner as HEA loss calculations. Given a total expected loss of 1,048 DSAYS, a total of approximately 123 ac (49.8 ha) of artificial reef would be required to compensate for coral habitat impacts expected due to the Polaris Point Alternative. Results indicate that each acre of artificial reef would provide approximately 22.1 DSAYs. Approximately 121 ac (49.0 ha) of artificial reef would be required for potential mitigation of impacts due to Alternative 2.

The Navy proposes a suite of options for potential compensatory mitigation consideration. The final determination may not be made until after the Record of Decision on this EIS/OEIS and during the USACE permit process. Both artificial reefs and watershed management projects would be considered as potential compensatory mitigation, and it is possible that a combination of those potential mitigation efforts listed below would be appropriate. However, the Navy has not advanced a proposal at this time and potential mitigation measures would be subject to the permitting action/mitigation rule.

There are differences of opinion regarding the validity of artificial reefs and watershed management mitigation plans, as neither have been proved scientifically valid. Section A of the *HEA and Supporting Studies* report (Volume 9, Appendix E, Section A) summarizes key points of discussion that were raised during review of the draft HEA, including relative merits (pros and counterpoints/cons) of artificial reefs and watershed management projects (HEA Section A, 3.3.4, Tables 2 and 3, respectively). Compensatory mitigation for unavoidable coral community impacts includes the below options (Note, the text below is a summary only. See Chapter 11 of this Volume for additional details).

Option 1: Artificial Reefs within Apra Harbor or Other Locations

This option would be a direct application of a HEA derived artificial reef project in Apra Harbor. The Navy would install an artificial reef in approximately 80+ ft (24.4 + m) of water (to ensure its survival even in a super-typhoon) using one or more agreed upon artificial reef concepts. Reef alternatives may include “Z blocks” (used in Hawaii), Biorock, and Reefballs. Suggestions of other artificial reef options are welcome. Placement would be on the harbor floor and would not affect hard substrate. The potential mitigation site would be located within the Explosive Safety Quantity-Distance arc of Kilo Wharf (to prevent the reef from being used as a Fish Aggregation Device).

Success criteria would be based on a replacement of benthic structure and on percent coral cover, as a proxy to ecosystem function. Long-term monitoring would be implemented to measure success. Potential Guam Integrated Natural Resources Management Plan projects associated with the artificial reef could include assessment of functions these structures provide. Artificial reefs, though quantitatively easier to scale for a ratio between replacement and function lost than watersheds, have been criticized as being primarily fish aggregating devices that do not increase coral community productivity. In other words, the replacement of structure does not necessarily equate to a restoration of coral community function.

Option 2: Watershed Restoration and Management

The approach to watershed restoration/conservation is to address reef degradation from discharge of eroded sediments from upland sources. Restoring vegetation to barren areas to reduce soil runoff and subsequent discharge into coastal waters is a major step in watershed restoration and improvement of coastal waters. Most potential watershed restoration projects would involve planting native seedlings in grasslands and badland areas as well as in fertile valley areas of watersheds. Other important elements of a successful watershed restoration project include but are not limited to animal control, monitoring and continuous watershed management.

EPA looks at the watershed restoration process as consisting the following major steps: (1) build partnerships, (2) characterize the watershed to identify problems, (3) set goals and identify solutions, (4) design an implementation program, (5) implement the watershed plan, (6) measure progress and make adjustments (EPA 2008).

The following projects could be used separately or in combination to develop a conceptual mitigation plan for watershed restoration:

Aforestation

Coastal marine waters and associated rivers and watersheds on Guam have been recommended by resource agencies for potential compensatory mitigation for coral reef impacts. The approach to restoration/conservation of sites rather than a detailed assessment is described to address on-going problems of reef degradation from discharge of eroded sediments from upland sources.

The Navy has held several conversations with Federal and Guam resource agencies on coral impact assessment and compensatory mitigation methods associated with the Guam Military Relocation EIS/OEIS. Resource agencies have recommended coastal marine waters and associated rivers and watersheds as restoration candidates for potential compensatory mitigation for coral reef impacts. USFWS has recently provided the following potential sites for a watershed aforestation coral reef restoration option (USFWS 2009). The information below is also supplemented by information from GEPA (2008).

- Achugao Subwatershed – Coastal waters and beach south of Achugao Point located in the southwestern portion of Guam. This beach is the discharge point for Agaga River associated with the Cetti Watershed.
- Fouha Subwatershed – Coastal waters at the head of Fouha Bay, located south of Cetti Bay, in the southwestern portion of Guam. Fouha Bay is the discharge point for the La Sa Fua River associated with Umatac Watershed in the southwestern portion of Guam.
- Geus Watershed – Coastal waters and marine bay (5 mi^2 [13 km^2]) associated with Cocos Lagoon located at the southern tip of Guam. The Geus River, associated with the Geus Watershed, discharges into the Cocos Lagoon.
- Ajayan Subwatershed – Coastal waters and intermittent beach at Ajayan Bay located east of Cocos Lagoon. The *Ajayan River*, associated with the Manell Watershed, discharges into Ajayan Bay.

The recommended watersheds have not been fully evaluated to determine their suitability, but are being considered by the Navy as options for potential mitigation. These watersheds are associated with reefs that are degraded by sedimentation, but were healthy a few decades ago (USFWS 2009).

Additional restoration/enhancement projects as recommended in Guam Bureau of Statistics and Plans (BSP) (2009) include the following Project Locations: Apra, Tumon, Tamuning, Piti, Asan, Fonte, Southern, Agat, Togcha, Ylig, Pago, and Ugum. Project objectives would be to improve water quality and forest habitat restoration in these watersheds as they flow into waters that host marine preserves and other valuable marine resource areas. Most of the potential restoration projects would involve the planting of native seedlings in grasslands and badland areas as well as in fertile valley areas of watersheds. Other important elements of a successful watershed restoration project include but are not limited to animal control, monitoring and continuous watershed management.

Guam BSP (2009) provided figures delineating the boundary of the watershed area in which the listed projects would occur (see Figures 11.2-5 through 11.2-8 in Chapter 11). The watershed area on the figures is approximately 4,694,980 ac (1,900,000 ha) along the southwestern coast of Guam, extending from south of Naval Base Guam to the southern point of Guam and Cocos Island. The watershed area was selected because there is evidence that coral communities have previously existed in the receiving coastal waters. Under improved water quality conditions, these coral communities could be restored.

The potential for watershed restoration on privately owned lands would be limited as these types of projects require full control of the land and its uses to be successful. A Cetti Bay watershed restoration project was attempted as compensatory mitigation for coral loss at Kilo Wharf. Because land use was not totally controlled and management agreements could not be concluded, the project has not been successful. It may be possible, however, to have a combination of reforestation/aforestation on some smaller scale when done in conjunction with watershed restoration project on Navy-owned lands, artificial reef installation within Apra Harbor or other areas, and/or riparian enhancement that would benefit fish, corals, and other marine organisms.

Ordnance Annex Aforestation

This option would be all on Navy-owned land. The watershed associated with the Ordnance Annex currently suffers from soil erosion issues. This erosion manifests itself in sediment transfer to various streams that feed into Talofolo Bay. The Ordnance Annex Watershed of savanna grassland vegetation would be restored and protected within the northeastern portion to address an on-going problem of reef degradation in Talofofo Bay from the transport of eroded sediments.

Apra Harbor and/or Philippine Sea Riparian Enhancement

This option would include mangrove and/or wetlands enhancement in the Apra Harbor area. This may be based on BSPs developed system of reference wetlands as a baseline for future classification and to establish a basis for ecological function when formulating the scope and extent of compensatory mitigation.

Stream Bank Stabilization Component

This option would involve stabilization of stream banks within watersheds that would involve the placement of vegetative and/or mechanical riprap revetment on banks of rivers and streams to minimize erosion and sediment laden run-off from entering sensitive riverine systems. The design would include major factors including: a) capability of conveying peak runoff flows produced by major storms and b) maintenance crew accessibility to structural BMP for vegetation maintenance (i.e., through cutting vs. spraying) and riprap/revetment repair.

Option 3: Coastal Water Resource Management

Shallow Water Reef Enhancement

This option would include the transplanting of a significant quantity of coral that would be removed by the proposed dredging project. The objective of shallow water reef enhancement is to minimize coral colony mortality by transplanting coral to several new sites on Navy submerged lands in outer Apra Harbor. Transplantation site selection criteria would include physical, chemical, and biological factors. Studies have shown that larger intact colonies survive transplanting much better than small or fragmented colonies. Larger colonies also have far greater reproductive potential than small ones. Therefore, these types of projects often focus on transplanting large specimens. A detailed transplantation would be prepared which would include methods for moving large colonies, techniques for stabilizing the colonies at the transplant site, and monitoring protocols.

A direct and predictable relationship between a specific watershed project(s) and replacement of coral function is difficult to determine. Therefore, it would be difficult to predict how many watershed projects and of what type that would be required to restore the productivity lost due to dredging. On the other hand, the effectiveness of artificial reefs would be more readily quantified as to its success in replacing lost coral function and value. All potential mitigation options are under consideration.

Coastal Water Resource Management – Upgrade Wastewater Management Systems

This option would involve upgrading Guam treatment plants and ocean outfalls to have secondary treated effluent to improve coastal water quality that would in turn enhance coral health in the coastal zone of Guam. This option is an alternative for the Northern District Wastewater Treatment Plant under consideration within this EIS/OEIS.

Option 4: In-Lieu Fee or Mitigation Banking Program

Within the HEA Administrative Working Group, DoD, and the Military Civilian Task Force on Guam, there is support for the use of In-Lieu Fee or mitigation banking programs to manage, implement and monitor the success of natural resource compensatory mitigation projects on Guam. Revised regulations by the USACE and EPA in March 2008 governing compensatory mitigation for authorized impacts to waters of the U.S. under Section 404 of the CWA. In-lieu fee mitigation and mitigation banks would included in this 2008 compensatory mitigation rule as endorsed Federal programs. These programs have not yet been established on Guam.

Under mitigation banks, units of restored, created, enhanced, or preserved resources are expressed as "credits" which may subsequently be withdrawn to offset "debits" incurred at a project development site. Ideally, mitigation banks are constructed and functioning in advance of development impacts, and are seen as a way of reducing uncertainty in the CWA Section 404 permit program by having established compensatory mitigation credit available to an applicant.

In-Lieu-Fee mitigation occurs in circumstances where a permittee provides funds to an in-lieu-fee sponsor instead of either completing project-specific mitigation or purchasing credits from an approved mitigation bank. The program sponsor periodically funds a consolidated mitigation project from the proceeds of the accumulated in-lieu-fees. A memorandum of understanding would be executed among DoD, regulators and stakeholders that establishes an In-Lieu-Fee Mitigation Sponsor (typically a non-government organization) and a Review Team to determine how the bank would work.

The In-Lieu-Fee amount is based upon the compensation costs that would be necessary to restore, enhance, create or preserve coral ecosystems or other habitats with similar functions or values to the one affected. The fee is banked in an investment account until a project is approved for implementation. The in-lieu fee mitigation bank would be managed by the In-Lieu-Fee Mitigation Sponsor (Sponsor) that uses the accumulated funds to implement projects that restore, enhance, or preserve ecosystems with similar functions and values that are located within the same biophysical region as the permitted disturbance. Key stakeholders, including regulatory agencies, DoD and the Sponsor, form an advisory committee that determines the projects that would be implemented. The Sponsor is responsible for implementing the project according to an approved work plan.

Development of Compensatory Mitigation Plan

A USACE permit would be required for the construction of the aircraft carrier wharf for alteration of navigable waters and discharge of fill materials into the water. This permit is the vehicle through which compensatory mitigation would be implemented. The project would be designed to avoid coral reef impacts and to minimize any unavoidable impacts. Unavoidable impacts would be mitigated through implementation and/or funding of mitigating measures to compensate for the resulting loss of ecological functions and/or services. Selection, scaling, and implementation of appropriate compensatory mitigation actions are being carried out in consultation with USACE, NOAA, USFWS, USEPA and GOVGUAM Resource Agencies. The HEA presented is a tool designed to equate impact habitat services to mitigation habitat services. The financial aspect does not come into consideration until after the mitigation project has been selected (e.g. execution costs of the mitigation project). As more information is gathered on the likely impacts and costs of the compensatory mitigation projects under consideration, a more detailed mitigation plan would be developed to comply with requirements of the USACE-EPA 2008 Compensatory Mitigation Rule.

230.45 Riffle and pool complexes. Not applicable.

Subpart F. POTENTIAL EFFECTS ON HUMAN USE CHARACTERISTICS

230.50 Municipal and private water supplies. No effect.

230.51 Recreational and commercial fisheries. No effect on commercial fisheries. There may be temporary effects on recreational fisheries as a result of construction and operation. The impact would not be significant on recreational fisheries but would temporarily displace recreational fishing to other areas.

230.52 Water-related recreation. The effects on water related recreation by both alternatives would be the same as described in Volume 4, Section 9.2. for Alternatives 1 and 2. This impact would not be significant and would involve the temporary displacement of recreational divers from the Western Shoals dive sites but these divers could relocate and utilize other dive sites for recreational purposes and return once the dredging and wharf construction were completed. Other users that could be affected include recreational users such as jet skiers, tour operators, and commercial tour submarines. Impacts would be temporary and less than significant.

230.53 **Aesthetics**. The aesthetic environment would be altered by the construction of the site and presence of the aircraft carrier when it visits. Additionally, there would be temporary impacts to the visual environment as a result of the physical presence of heavy equipment during construction causing a temporary degradation of the aesthetic environment.

230.54 **Parks, national and historical monuments, national seashores, wilderness areas, research sites, and similar preserves**. No effect. See Chapter 9, Volume 4.

Subpart G. EVALUATION AND TESTING

230.60 **General evaluation of dredged or fill material.** Section 4.2., Volume 4, discussed the dispersion modeling of TSS for sediments from dredging activities in Apra Harbor in March 2009 as part of the *CVN-Capable Berthing Study* which is described in more detail in Appendix D in Volume 9. The results of the modeling were that surface turbidity plumes exceeding background levels of 3 mg/L were generally predicted to occur only directly at the dredge site. According to the modeling results, the plumes rapidly dissipated following dredging resulting in less than significant impacts. See also 230.61 below.

230.61 **Chemical, biological and physical evaluation and testing.**

Section 4.1, Volume 2 and Volume 4, discuss historical testing of sediments including their chemical, biological, and physical evaluations. Sediment quality investigations in Outer Apra Harbor were conducted at three locations at Apra Harbor in 2006. The sites were being considered as potential locations for berthing an aircraft carrier, including the vicinity of Alternatives 1 and 2. The three sites were: 1) former Charlie Wharf located at Polaris Point 2) the Former SRF site, and 3) the turning basin common to each in Outer Apra Harbor. Fourteen discrete samples of sediment to the proposed dredge depth were taken. The area samples were combined into three composites. Composite 1 (six sample locations) was of the turning basin; Composite 2 (three sample locations) was of the area in front of the Former SRF site; and Composite 3 (five sample locations) was representative of the area to be dredged for Polaris Point. Sediment contamination was low throughout all the areas sampled. Special handling of dredged material would not be required and it is likely that the dredged material would meet the testing requirements for ocean disposal.

As noted above, preliminary chemical testing results indicate the low concentrations of contaminants, indicating the material is likely suitable for ocean disposal. Pursuant to Section 103 MPRSA, all material would be tested for the presence of contaminants as well as the potential for toxicity and bioaccumulation prior to dredging using national testing guidance (USEPA and USACE 1991). Testing would be accomplished within three years of the start of the proposed construction dredging.

Subpart H. ACTIONS TAKEN TO MINIMIZE ADVERSE EFFECTS

230.70 **Actions concerning the location of the discharge.** The effects of the discharge of the dredged material would be minimized by locating and confining the upland placement sites with no return effluent discharge. Impacts would be further reduced by utilizing previously used upland placement sites so that the substrate would be composed of similar material to that of the dredged material. With the high probability that a mechanical dredge would be used, the upland placement sites would not have large areas of standing bodies of water that could potentially drain into adjoining areas. Silt curtains and other BMPs and mitigation measures, as described in Volume 7, would be used to control silt plumes at the construction and dredging sites.

230.71 **Actions concerning the material to be dredged.** Information provided in Section 230.21 noted that the materials to be dredged from Outer Apra Harbor are predominantly coarse materials and sand. Sediments of this type are less likely to contain high concentrations of contaminants versus sediments composed of fine materials such as silts. As noted in Section 4.1 of Volume 2, no special treatment of these dredged materials is expected.

230.72 **Actions concerning the material after discharge.** Selection of diked upland placement sites would minimize the potential impacts of the material after discharge. The materials would be isolated from the surrounding areas by the dikes which would be maintained using grassed slopes to prevent erosion as noted in Appendix D of Volume 9. As the dredged materials have not been found with limited testing to be contaminated and the historical test results as noted in Section 4.1, Volume 2 provided similar results regarding a lack of high concentrations of contaminants, no special measures such as liners or special treatment of the materials after discharge would have to be utilized.

230.73 **Actions concerning the method of dispersion.** The environmental effects of the material to be dredged would be minimized as the proposed dredging would include the use of silt curtains and other protective measures to minimize the distribution of suspended sediment in the water column during dredging. The dredged materials would be placed in scows and not be allowed to overflow into the water minimizing potential turbidity impacts. There would be no return effluent from the upland placement site into Apra Harbor.

230.74 **Actions related to technology.** Section 4.2 of Volume 4 presents possible equipment and machinery that can be used to minimize the impacts during dredging and disposal/dewatering activities. Section 4.2 of Volume 2 and Appendix D of Volume 9 present operational controls of the dredging equipment that can be employed to minimize impacts to the environment. Silt curtains and similar devices can also be placed around areas of specific concern such as coral to provide them with additional measures of protection.

230.75 **Actions affecting plant and animal populations**. As noted in Section 2.3 in Volume 4, the channel option carried forward was the option that reduced dredging impact to corals to the greatest extent possible versus the other two channel options considered and dismissed. Selection of existing upland sites would further reduce potential impacts to plant and animal populations. As noted in Section 11.2, Volume 4, mitigation measures including restrictions on dredging during stony coral spawning periods which occur in Apra Harbor during the full moon phases in June, July, and August would be considered.

230.76 **Actions affecting human use.** As described in Chapter 9 of this volume, there would be some impacts to recreational users from both alternatives. To assist the public in planning its offshore recreational activities near the project area, public notice of dredging activities would be provided. Dredging would proceed as rapidly as practicable to minimize the impact.

Although the impacts to the existing on-base recreational resources would be short-term, recreational resource users—existing and new—would experience crowding and increased competition for the available recreational resources. To mitigate the potentially significant impacts to the existing recreational resources at Polaris Point, the Navy would consider providing additional shuttle bus services and taxis to be made available on-base to offer transportation services for the Sailors to the most popular sites on the island including Tumon/Tamuning villages, which offer recreational, shopping, and entertainment resources. Comparable and alternate marine activities, such as diving (snorkeling, SCUBA, free diving), boating, kayaking, marine tours (dolphin watching, cruise, catamaran rides), and beachcombing are some of the recreational resources popular in these regions.

230.77 Other actions. As noted above, there is no proposed return flow effluent from the upland placement site as part of the dredging cycle.

The total area of removal by dredging (two dimensional view) of habitat with some coral coverage is approximately 25 ac (10.2 ha) for the Polaris Point alternative, and approximately 24 ac (9.6 ha) for the Former SRF Alternative. Cumulative impacts on coral and coral reef MUS present in the EFH of Apra Harbor would be significant. This significant impact would be compensated following the implementation of appropriate mitigation. The total area (three dimensional view) of habitat with some coral coverage is approximately 33 ac (13 ha) for the Alternative 1 Polaris Point, and approximately 32 ac (13 ha) for the Alternative 2 Former SRF.

ALTERNATIVES COMPARISON SUMMARY

There are several reasons why Alternative 1 (Polaris Point) is considered the LEDPA. After a detailed analysis, the Navy has determined that Alternative 1 has advantages for environmental reasons, operational reasons, and is the more practicable alternative. These reasons are highlighted below and identified in Table 2.8-1.

Alternative 1 (Preferred, LEDPA) (Polaris Point)

Environmental differences.

Dredging and F ill. Alternative 1 requires a greater volume of dredged material than Alternative 2 to accommodate the aircraft carrier. Alternative 1 would require a dredge volume of 608,000 cy (465,850 m^3) while Alternative 2 would require a dredge volume of 479,000 cy (366,200 m^3). However, even though the total dredged material volume is higher, the difference is due to coastal excavation compared to open water dredging, where coral habitat is located. There is some coral located at the shoreline at Polaris Point, but the large majority of material is fill material and not coral. Because of the wharf alignment needed to accommodate the aircraft carrier, Alternative 1 would require less fill than Alternative 2. Both alternatives would result in approximately 3.6 ac (1.5 ha) of fill below the wharf structure, with an additional amount of fill required at Alternative 2 for the water areas between the slips of the finger piers that would be incorporated into that structure. Alternative 1 (Polaris Point) does not have this additional fill requirement.

Sensitive R esources. As shown in Table 2.8-1, the impacts to coral under both alternatives are comparable. The advantage of Alternative 1 (Polaris Point) is that although there would be greater short-term impacts to coral from dredging, over the long term there would be less impacts to sensitive resources from operations, especially to areas containing high quality coral such as Big Blue Reef, because Alternative 1 is located further away from Big Blue Reef than Alternative 2. The turning basin for Alternative 1 is further from Big Blue Reef and this distance may decrease the risk of construction and operation sediment resuspension impact on this valued coral community and threatened and endangered species. Alternative 1 would be expected to affect, but would not adversely affect, ESA-listed sea turtles. Alternative 1 may adversely affect EFH. Further discussion of impacts to water quality and marine resources may be found in Chapter 4, Water Resources and Chapter 11, Marine Biological Resources of this Volume.

Operational differences. Radionuclear response times can be met at either alternative, but the proximity to the existing radionuclear response facilities and personnel at Polaris Point reduces the challenge of meeting response times at Former SRF. It is more efficient to consolidate the radionuclear facilities at one location. From a land use planning perspective, it is preferred to co-locate nuclear powered vessels and the nuclear powered submarines are berthed at adjacent wharves on Polaris Point. The Polaris Point alternative would not impact dry dock operations and would not require a reduction in the Guam Shipyard lease area. Alternative 1 security is not constrained by proximity to a civilian population. Further discussion may be found in Chapter 2, Section 2.5 of this Volume.

Quality of Life/Aesthetic differences. The Polaris Point site borders recreational areas and is less industrial than the Former SRF. There is more space for recreational activities near the wharf for military personnel while the carrier is at the transient port. Further discussion may be found in Chapter 9, Recreational Resources and Chapter 13, Visual Resources in this Volume.

Traffic differences. An advantage of Alternative 1 is that access to Polaris Point does not require transit through the Main Gate to Naval Base Guam. Short-term aircraft carrier visit traffic is characterized as predominantly to off-base destinations. This Alternative would minimize the traffic impacts on Main Base, specifically the Main Gate, representing a benefit to permanent personnel at the base. There would be some increase in traffic on base but most of the traffic would be outside the Main Base. Commercial vendor supply trucks also could make deliveries to Polaris Point without Main Base access. Traffic impacts are assessed in Volume 6.

Utility Improvement cost differences. Alternative 1 would have higher costs for wastewater upgrades, but costs would be offset by the added benefit of improved reliability for other Polaris Point facilities. The power and communications costs for Alternative 1would be lower than for Alternative 2.

<u>Alternative 2 (Former SRF)</u>

Environmental differences. Proximity to Big Blue Reef represents an increased risk of indirect impacts to valued coral communities and threatened and endangered species due to sediment resuspension during construction and operation. Alternative 2 would be expected to affect, but would not adversely affect, ESA-listed sea turtles. Alternative 2 actions may adversely affect EFH. Alternative 2 has the potential to result in greater long term impacts to high quality coral located at Big Blue Reef, due to the closer proximity to this area. Further discussion of impacts to water quality and marine resources may be found in Chapter 4, Water Resources and Chapter 11, Marine Biological Resources of this Volume.

Operational differences. Radionuclear response times can be met at either alternative, but the overland distance from the existing radionuclear response facilities and team located at Polaris Point creates a challenge for meeting emergency response times. Although the Navy would compensate for work days lost, Alternative 2 would impact Guam's dry dock operations. The Guam Shipyard lease area would have to be renegotiated to reduce the footprint and provide room for the aircraft carrier. The lease is scheduled for renegotiation, but the aircraft carrier wharf would impact the lease area. Security and force protection requirements can be met at the Former SRF; however, the proximity of the civilian Guam Shipyard personnel adds an additional security consideration requiring greater perimeter setbacks. Further discussion may be found in Chapter 2, Section 2.5.

Quality of Life/Aesthetic differences. The area is industrial. It is less aesthetically pleasing and does not offer grassed open space for recreation. Recreational and retail opportunities are within walking distance, but there are no facilities near the wharf for the military personnel on the carrier while at the transient port. Further discussion may be found in Chapter 9, Recreational Resources, and Chapter 13, Visual Resources, in this Volume.

Traffic differences. All of the vehicular traffic associated with the aircraft carrier, including commercial supply trucks, would impact Navy Main Base and the Main Gate traffic. Traffic impacts are discussed in greater detail in Volume 6.

Utility Improvement cost differences. Lower costs for wastewater upgrades, but the additional pump stations would result in higher life cycle costs. The power and communications costs are higher than for Alternative 1.

Table 4.3-1. Comparison of Polaris Point and Former SRF Alternatives

LEDPA Analysis Reference	*Characteristic*	*Polaris Point (NEPA Preferred and LEDPA)*	*Former SRF*
Subpart A	Navigation channel: Generally follows existing channel to minimize dredging	Same	Same
Subpart A	Wharf design – steel pile	Same	Same
Subpart A	Dredge method - mechanical	Same	Same
Subpart B (230.10)	Dredged Material Disposal: Beneficial Reuse/ODMDS/Upland Combination	Same	Same
Subpart A	Turning Basin Radius	Same	Same
Subpart A	Turning Basin Location	**Further away from Big Blue Reef (high quality coral and coral reef habitat)**	Closer to Big Blue Reef
Subpart E (230.44)	Coral Reef Impacts (2 Dimensional) Coral Impact (Direct) Coral Impact (Indirect - 200 m buffer around dredged area) Coral Reef Impacts (total) Coral Reef Impacts (3 Dimensional)	 25 ac (10.2 ha) 46 ac (18.7 ha) 71 ac (29 ha) 33 ac (13 ha)	 24 ac (9.6 ha) 47 ac (19.1 ha) 71 ac (29 ha) 32 ac (13 ha)
Subpart E (230.44)	Coral Reef Removal	**Less high quality coral removed by percentage (see Table 11.1-3 in Chapter 11 of this Volume)**	More high quality coral removed by percentage (see Table 11.1-3 in Chapter 11 of this Volume)
	Proximity to Big Blue Reef (nearest named reef)	**Greater distance to Big Blue Reef-less likely to impact the reef and threatened and endangered species from dredging and regular operations**	Adjacent to Big Blue Reef
Subpart D (230.30)	Threatened and Endangered Species May affect, but not likely to adversely affect, ESA-listed sea turtles.	**Fewer impacts to threatened and endangered species due to increased distance from foraging and resting areas**	Greater potential impacts to threatened and endangered species
Subpart D (230.31)	EFH (May adversely affect EFH)	Same	Same
Subpart C	Water Quality	Same	Same

LEDPA Analysis Reference	*Characteristic*	*Polaris Point (NEPA Preferred and LEDPA)*	*Former SRF*
(230.21, 230.22, 230.23, 230.24, 230.25)	Increased turbidity during dredging; would be minimized by silt curtains and other potential mitigation measures.		
Subpart E (230.41)	Wetlands: No dredge/fill of wetlands.	Same	Same
Subpart A	Dredge Volume (including 2 ft overdredge)	608,000 cy (465,850 m^3) (difference due to coastal excavation not open water dredging)	479,000 cy (366,200 m^3)
Subpart A	Dredge Footprint Area Fill	53 ac (21.5 ha) 3.6 ac (1.5 ha)	44 acres (17.9 ha) 3.6 ac (1.5 ha) plus additional for finger piers
NA	Radiological Material Operation	**Co-location of nuclear assets**	3.2 miles from other existing nuclear assets
	Force Protection	**Co-location of nuclear assets**	Duplication of force protection to support nuclear assets
NA	Utilities	Slightly higher costs for wastewater upgrades associated with pipeline lengths. Costs are offset by the added benefit of improved reliability for other Polaris Point facilities. Electrical and communications costs are lower.	Lower costs for wastewater upgrades, but the additional pump stations would result in higher life cycle costs. Power and communications costs are higher.
NA	Quality of Life/Aesthetics	Borders open space and recreational areas	Industrial area with abandoned buildings
NA	Impact by Vessel Operation (i.e. resuspension of sediments associated with berthing movements)	**Greater distance to sensitive habitat**	Closer to sensitive habitat
NA	Impact on Guam Shipyard Operation	**No impact to Guam Shipyard operation**	Impact to Guam Shipyard because of suspension of dry-dock operation.

Based on the above discussion, Alternative 1 is considered the NEPA preferred alternative and the LEDPA. Impacts to the aquatic ecosystem would be avoided or minimized to the greatest extent possible. Implementation of Alternative 1 would have less high quality coral removed by a percentage comparison (42% for Alternative 1 and 46% for Alternative 2); its construction and operational phases are further away from Big Blue reef having both short-term and long-term environmental protection advantages when compared to Alternative 2; fewer impacts to threatened and endangered species due to increased distance to resting and foraging areas; co-location of nuclear assets by the use of Alternative 1; and no impact to the Guam Shipyard operation. BMPs and compensatory mitigation would be provided as described in Volume 7 and at the end of each chapter in Volume 4. Once final impacts through complete design are identified, a final mitigation plan would be prepared.

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CHAPTER 5.
AIR QUALITY

5.1 INTRODUCTION

This chapter contains the discussion of the potential environmental consequences associated with implementation of the alternatives for aircraft carrier berthing within the region of influence (ROI) – Apra Harbor – for air quality. A description of the air quality resources in the Apra Harbor ROI is provided in Section 5.1 of Volume 2 (Marine Corps Relocation – Guam).

5.2 ENVIRONMENTAL CONSEQUENCES

5.2.1 Approach to Analysis

5.2.1.1 Methodology

This section describes the analysis approach used to address potential impacts from the proposed increase in aircraft carrier berthing and construction of a wharf and associated shoreside facilities at Apra Harbor. Since some of the effects from this action would contribute to the aggregate effects in this ROI, the analysis results presented in this section are also considered in the aggregate impact analysis on Guam discussed in Volume 7 that combines the impacts from all applicable actions.

As described in Chapter 2, two alternative locations are being considered for a new wharf to provide aircraft carrier berthing capabilities for extended port calls, one at Polaris Point (Alternative 1) and the other at the Former SRF (Alternative 2). The alternatives are largely equivalent based on the requirements for supporting an aircraft carrier, and the location of both alternatives would be at the entrance to Apra Harbor with similar wharf alignment. The differences between the two alternatives are mainly limited to the specific location of elements relative to the wharf. The major components of the proposed project include shoreside structures, utilities, a new wharf, and dredging. Due to the general similarity of the alternatives and the associated construction and operation activities, they are not estimated separately in this analysis. The assumptions made in developing the list of major construction items, the equipment necessary to complete construction, and construction productivity are presented in Volume 9, Appendix I, Section 3.4 Construction Activity Emissions.

<u>Construction</u>

Construction activities including the operation of construction equipment, trucks, and workers' commuting vehicles may have short-term air quality impacts. Although the emissions from construction workers' commuting vehicles are considered part of the overall construction emissions, it is anticipated that the majority of construction workers would be living in limited areas with appropriate consolidated transportation support. As such, the emission component from commuting vehicles is relatively small (see Chapter 7 in Volume 6 for details).

In estimating construction-related criteria pollutants and carbon dioxide (CO_2) emissions, the usage of equipment, the likely duration of each activity, and manpower estimates for the construction were based on the information provided in Chapter 2 for the future project-associated construction activities under each alternative.

Estimates of construction crew and equipment requirements and productivity were based on the data contained in 2003 *RSMeans Facilities Construction Cost Data* (RSMeans 2003) and 2006 *RSMeans*

Heavy Construction Cost Data (RSMeans 2006). It is assumed for emissions estimate purposes that most construction activities would occur between 2011 through 2014 and then dredging would occur from 2014 to 2015.

Estimates of construction equipment operational emissions were based on estimated hours of equipment use and the emission factors for each type of equipment, as provided by the United States (U.S.) Environmental Protection Agency's (USEPA) NONROAD emission factor model and the national default model inputs for NONROAD engines, equipment, and vehicles of interest provided with the model (USEPA 2008). The average equipment horsepower values and equipment power load factors are also provided in association with the NONROAD emission factor model. Since the operational activity data presented in RSMeans' cost data books are generated based on the overall length of time equipment is present on site, an equipment actual running time factor (i.e., actual usage factor) was further employed to determine actual equipment usage hours for the purpose of estimating equipment emissions. The usage factor for each equipment type was obtained from Federal Highway Administration's (FHWA) Roadway Construction Noise Model User's Guide (FHWA 2006). Emission factors related to construction-associated delivery trucks were estimated using USEPA Mobile 6 emission factor model (USEPA 2003), because it provides a specific emission factor database for various truck classifications. The workers' commuting vehicle emissions were also estimated using the Mobile 6 model and assumed workers would travel approximately an average of 10 miles (mi) (16.1 kilometers [km]) per day to the site using shuttle buses or vans. Given Guam's exempt status from using low sulfur fuel, the highest sulfur content (0.5 %) diesel fuel input available in both NONROAD and Mobile 6 models was conservatively used to predict SO_2 and PM emissions for diesel-powered equipment and vehicles.

The detailed methodology used to calculate these emissions is presented in Volume 9, Appendix I, Section 3.4 Construction Activity Emission.

<u>Operation</u>

Operational activities are common to both of the alternatives. The operational elements that have potential to have air quality impact during aircraft carrier berthing include:

- Aircraft carrier on-board diesel generator operations
- Aircraft carrier routine maintenance
- Transient aircraft
- Escort vessels
- Tugboats that assist in navigating the aircraft carrier through the harbor
- On-road vehicles transporting the aircraft carrier crew
- On-road trucks for transporting materials to and from aircraft carriers.

In 1999, the Navy published a Final Environmental Impact Statement (FEIS) for *Developing Home Port Facilities for Three Nimitz Class Aircraft Carriers in Support of the U.S. Pacific Fleet* (U.S. Navy 1999). In the FEIS, an emissions inventory for one aircraft carrier homeporting for half a year was developed. This inventory was used to prorate the aircraft carrier emissions based on an increase in aircraft carrier berthing days at Apra Harbor of 47 days.

The emissions from aircraft taking off from the aircraft carrier, parking at Andersen Air Force Base (AFB), and ultimately flying back were estimated using the methods, emission factors, and numbers of new sorties obtained from the following references:

- The Procedures of Emission Inventory Preparation, Volume IV: Mobile Sources (USEPA 1992)
- Aircraft engine emission factors developed by the Navy's Aircraft Environmental Support Office (AESO 1999-2001)
- The Aircraft Noise Study for Guam Joint Military Master Plan at Andersen AFB (Wyle 2008).

Accompanying vessel and tugboat emissions during each air carrier escort were not considered in the analysis because the number of aircraft carrier visits on an annual basis would not increase although the number of berthing days would increase. The operations of vessels and tugboats are expected to increase during the training when the aircraft carrier stays longer at the Apra Harbor and such training-related increased activities from vessels and tugboats are considered in Volume 2.

As described in Chapter 2, the radioactive material operation on Guam would be limited to minor emergency unscheduled repairs and emergency response, and no radioactive waste would be brought ashore. Scheduled maintenance and repair of the Naval Nuclear Propulsion Program (NNPP) would be conducted at the ship's homeport; therefore, there would be no radioactive air emissions from the proposed action.

The aircraft carrier berthing-related vehicle operation would be increased due to an increase in berthing days. However, since air emissions resulting from an increase in on-road vehicular trips are considered in the traffic-related air quality impact analysis contained in Volume 6, vehicular emissions are not discussed in this Volume.

5.2.1.2 Determination of Significance

Under the Clean Air Act (CAA), ships, motor vehicles, and construction equipment are exempt from air permitting requirements. Since the emissions from these sources associated with the proposed project would occur in areas that are in attainment of the National Ambient Air Quality Standards (NAAQS) for all criteria pollutants except sulfur dioxide (SO_2), the General Conformity Rule (GCR) is not applicable. Nonetheless, the National Environmental Policy Act (NEPA) and its implementing regulations require analysis of the significance of air quality impacts from these sources as well as non-major stationary sources. However, neither NEPA nor its implementing regulations have established criteria for determining the significance of air quality impacts from such sources in CAA attainment areas.

In the GCR applicable to nonattainment areas, USEPA uses the "major stationary source" definition under the New Source Review program as the *de minimis* levels to separate presumably exempt actions from those requiring a positive conformity determination. Since the proposed action and alternatives would occur mostly in areas that have always been in attainment, this Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) selected the "major stationary source" definition (250 tons per year [TPY] or more of any air pollutant subject to regulations under the CAA) from the Prevention of Significant Deterioration (PSD) program. The PSD source threshold is used as the threshold for locations that are in attainment for determining the potential significance of air quality impacts from these sources. CO_2 is not a criteria pollutant and the 250 TPY significance threshold is not applicable to it. The potential effects of CO_2 and other greenhouse gas emissions are by nature global and are based on cumulative impacts. Individual sources are not large enough to have an appreciable effect on climate change. Hence, the impact of proposed CO_2 and other greenhouse gas emissions is discussed in the context of cumulative impacts in Volume 7.

As noted above, neither the PSD permitting program nor the GCR are applicable to these mobile sources and non-major stationary sources in attainment areas. Therefore, the analysis of construction and operational incremental emissions from these sources in attainment areas and the significance criteria selected (250 TPY) are solely for the purpose of informing the public and decision makers about the relative air quality impacts from the proposed action and other alternatives under NEPA requirements.

Parts of Apra Harbor, including the area proposed for the aircraft carrier berthing, are within a SO_2 nonattainment area due to emissions associated with the operation of the Piti Power Plant (see Figure 5.1-1 of Volume 2). Under the GCR, emissions associated with all operational and construction activities from a proposed federal action, both direct and indirect, must be quantified and compared to annual *de mi nimis* (threshold) levels for pollutants that occur within the applicable nonattainment area. Direct emissions are emissions of a criteria pollutant or its precursors that are caused or initiated by a federal action and occur at the same time and place as the action. Indirect emissions are emissions occurring later in time and/or further removed in distance from the action itself. Indirect emissions must be included in the determination, if both of the following apply:

- The federal agency proposing the action can practicably control the emissions and has continuing program responsibility to maintain control.
- The emissions caused by the federal action are reasonably foreseeable.

Both of these situations apply and therefore indirect emissions were included in the determination. The SO_2 emissions estimated for the activities associated with the proposed aircraft carrier berthing from both stationary and mobile sources are compared with the 100 TPY *de minimis* level to determine the impact significance of the increase in SO_2 emissions. The overall air quality impacts, including the general conformity applicability requirements, are discussed for Alternative 1 in Volume 7, which addresses the combined effects from all project components under the proposed action and presents an overall aggregate effect.

5.2.1.3 Issues Identified during Public Scoping Process

The following analyses focus on addressing potential air quality impacts onshore and offshore from implementation of the proposed action. As part of the analysis, concerns relating to air quality effects that were raised by the public, including regulatory stakeholders, during scoping meetings were addressed, if sufficient project data and available impact criteria were available. These include:

- Increases in vehicle and vessel emissions and disclosure of available information of health risks associated with vehicle emissions and mobile source air toxics.
- Increases in construction-related emissions and impacts including emissions estimates of criteria pollutants and diesel particulate matter (PM) from construction of alternatives.
- Compliance with the GCR in siting project facilities.

5.2.2 Alternative 1 Polaris Point (Preferred Alternative)

5.2.2.1 Onshore

Construction

Under Alternative 1 Polaris Point (referred to as Alternative 1), the Navy proposes to construct a new deep-draft wharf along the northern coastline of Polaris Point, which is the preferred location for a new aircraft carrier wharf. The design and construction of a new wharf at Polaris Point supports the Navy's need to berth transient aircraft carriers for extended port calls and durations increasing from 16 to 63 days annually; an increase of 47 days. The proposed Polaris Point wharf would be aligned parallel to the coast with reduced clearance on the eastern edge.

Estimates on construction activities were calculated to identify equipment, material, and manpower requirements for the construction associated with the proposed aircraft carrier berthing project at Polaris Point. Assumptions were made to develop a list of major construction items, necessary equipment, and productivity levels necessary for the completed construction of Polaris Point including, but not limited to: shoreside structure prototypes, a bermed fuel tank, an electric substation, stormwater management, the Morale, Welfare and Recreation (MWR) area, a sewer pump station, a Bilge and Oily Wastewater Treatment System (BOWTS) pump station, a BOWTS pump station prototype, and the wharf and related dredging activities.

The emissions produced from potential construction, vehicle and paving activities that would occur from 2011 to 2014 form the basis from which the total air pollutant emissions in TPY were calculated. The calculated total emissions are summarized in Table 5.2-1 and detailed in Volume 9, Appendix I, Section 3.4.3 Construction Emissions: Marine Corps Relocation – Aircraft Carrier Berthing. Estimates of the emissions associated with dredging activities and dredged material disposal were conducted for both 100% disposal in the Ocean Dredged Material Disposal Site (ODMDS) and 100% disposal at the upland site(s) (Table 5.2-1). Logistics and air quality impacts for beneficial reuse of dredged material were covered as part of estimates of movements of aggregates for construction projects, which is discussed in Volume 6.

<u>Operation</u>

The operational emissions from the extended aircraft carrier berthing were predicted based on Navy-provided aircraft carrier emission inventory data for half-year berthing (U.S. Navy 1999). The increase in emissions from the additional 47 days per year aircraft carrier berthing schedule was prorated using the emissions inventory established by the Navy (U.S. Navy 1999).

Given the lack of sortie data for aircraft flight operation originated from the aircraft carrier during the additional 47-day berthing schedule, the air emissions that would result from aircraft operations initiated from the aircraft carrier were estimated using the operational forecasts described in the Aircraft Noise Study for Guam Joint Military Master Plan at Andersen AFB (Wyle 2008). The net increase in the sortie level for each applicable aircraft type in additional 47-day berthing, input parameters, and the methodologies used to calculate them are described in Volume 9, Appendix I, Section 3.3.2 Aircraft Operational Emissions from Aircraft Carrier Berthing. The estimated emissions of the aircraft operations at the aircraft carrier berthing site are shown in Table 5.2-1.

In Volume 7, predicted construction emissions (2011 through 2015) and operational emissions (2015 and after) are combined with the emissions from other components of the proposed action to determine the overall potential air emissions impact significance using the impact thresholds described in Section 5.2.1.2.

The construction and operation emissions shown in Table 5.2-1 are all below the significance criteria of 250 TPY for air pollutants subject to regulations under the CAA, as described in Section 5.2.1.2. The SO_2 emissions were also all below the 100 TPY *de minimis* level, indicating that there would be no significant impact from SO_2 emissions.

Table 5.2-1. Total Increased Annual Emissions - Alternatives 1 and 2

Activity	*Pollutant (TPY)*						
	SO_2	*CO*	*PM_{10}*	*$PM_{2.5}$*	*NO_x*	*VOC*	*CO_2*
Construction (2011 – 2014)	0.4	1.4	0.1	0.1	0.7	0.2	118.9
Dredging and Disposal, ODMDS Option (2014 – 2015)	0.7	5.2	0.8	0.4	2.6	5.3	491.5
Dredging and Disposal, Upland Site Option (2014 – 2015)	0.8	3.2	0.5	0.3	2.6	2.8	389.3
Operation (2015 and after)							
Aircraft Carrier	0.1	0.2	0.1	N/A	1.1	1.3	N/A
Transient Aircraft	0.4	91.1	4.6	8.4	26.2	0.4	N/A
Total Operation	0.5	91.3	4.7	8.4	27.3	1.7	N/A

Legend: VOC = volatile organic compound

5.2.2.2 Offshore

As discussed previously, offshore aircraft carrier, accompanying vessels, and tugboat emissions would not change from current levels, as these operations are associated with number of aircraft carrier visits, rather than the number of berthing days. Therefore, existing air quality conditions offshore would remain unchanged under Alternative 1. Offshore aircraft carrier presence, including accompanying vessels and air operation, is associated with continued operations in international waters. Limited near shore activity within territorial waters of the United States would be associated with the limited port calls to Guam and would not result in a significant increase in emissions over present activities.

Construction

Existing air quality conditions offshore would remain unchanged under Alternative 1.

Operation

Existing air quality conditions offshore would remain unchanged under Alternative 1.

5.2.2.3 Summary of Alternative 1 Impacts

As summarized in Table 5.2-2, air emissions associated with both construction and operational components of Alternative 1 would be well below the significance criteria of 250 TPY for air pollutants subject to regulations under the CAA. The predicted SO_2 emissions would be below the 100 TPY *de minimis* level within the nonattainment area. Therefore, all project-specific air quality impacts are considered less than significant for all areas for this action. The overall air quality impacts, including the general conformity applicability requirements, are discussed in Volume 7, which addresses the combined effects from all project components under the proposed action and presents an overall aggregate effects determination.

5.2.2.4 Alternative 1 Potential Mitigation Measures

No mitigation measures would be required for this action, as emissions are below criteria levels. However, the use of low sulfur fuels for construction vehicles could be used to minimize emissions. Potential mitigation measures for combined effects of all components considered in this EIS/OEIS are discussed in Volume 7.

Table 5.2-2. Summary of Alternative 1 Impacts

Area	*Project Activities*	*Project Air Quality Impacts*
Onshore	Construction	Less than significant adverse impacts to air quality. Construction emissions from all components would be well below significance criteria.
	Operation	Less than significant adverse impacts to air quality. Operational emissions from all components would be well below significance criteria.
Offshore	Construction	No impacts to air quality.
	Operation	No impacts to air quality.

5.2.3 Alternative 2 Former Ship Repair Facility (SRF)

5.2.3.1 Onshore

Construction

The construction of a new deep-draft wharf at Alternative 2 Former SRF (referred to as Alternative 2) would angle the structure through the finger piers at the site. As described in Section 2.3, Alternatives 1 and 2 share many of the same components. The construction, inclusive of dredging, and operation elements would be similar for Alternatives 1 and 2. Therefore, construction air emissions associated with Alternative 2 are the same as under Alternative 1, as presented in Section 5.2.

Operation

The operational emissions from the extended aircraft carrier berthing for Alternative 2 are considered to be the same as under Alternative 1. These emissions are summarized in Table 5.2-1.

5.2.3.2 Offshore

Air quality conditions under Alternative 2 would be the same as those described under Alternative 1. Therefore, potential air quality impacts would not result in a significant increase in emissions over present activities under Alternative 2.

Construction

Air quality conditions under Alternative 2 would be the same as those described under Alternative 1.

Operation

Air quality conditions under Alternative 2 would be the same as those described under Alternative 1.

5.2.3.3 Summary of Alternative 2 Impacts

As summarized in Table 5.2-3, air emissions associated with both construction and operational components of Alternative 2 would be well below the significance criteria of 250 TPY for air pollutants subject to regulations under the CAA. The predicted SO_2 emissions would be below the 100 TPY *de minimis* level within the nonattainment area. Therefore, all project-specific air quality impacts are considered less than significant for all areas for this action.

Table 5.2-3. Summary of Alternative 2 Impacts

Area	*Project Activities*	*Project Air Quality Impacts*
Onshore	Construction	Less than significant adverse impacts to air quality. Construction emissions from all components would be well below significance criteria.
	Operation	Less than significant adverse impacts to air quality. Operational emissions from all components would be well below significance criteria.
Offshore	Construction	No impacts to air quality.
	Operation	No impacts to air quality.

5.2.3.4 Alternative 2 Potential Mitigation Measures

The predicted construction emissions (2011 to 2014) and operational emissions (2015 and after) for criteria pollutants within each ROI are all below the 250 TPY threshold or 100 TPY SO_2 threshold applicable for SO_2 nonattainment areas. Therefore, potential air quality impacts under Alternative 2 are considered less than significant and emissions mitigation measures are not warranted. As identified for Alternative 1, low sulfur fuels for construction vehicles could be used to minimize emissions.

5.2.4 No-Action Alternative

Existing air quality conditions would remain unchanged under the no-action alternative. Under the no-action alternative there would be no wharf or associated facility construction to support the aircraft carrier extended visits in Apra Harbor and no dredging would be required.

5.2.5 Summary of Impacts

Table 5.2-4 provides a summary of the potential impacts of the two action alternatives and the no-action alternative. None of the alternatives associated with construction and operational activities would result in significant adverse air quality impacts when compared to the significance criteria of 250 TPY for air pollutants subject to regulations under the CAA. SO_2 emissions were also well below the 100 TPY *de minimis* level used as the threshold for emissions within a nonattainment area. Air quality impacts associated with vehicle trips generated from all proposed activities, including the action described in this Volume, are covered in Volume 6. It should be noted that emissions thresholds must be applied to all relevant emissions from the entire proposed action to determine potential impact significance. Overall, air quality impacts for Alternative 1 are addressed in Volume 7 through a detailed comparison of such thresholds. Volume 7 also addresses the aggregate effects of all project components under the proposed action.

Table 5.2-4. Summary of Impacts

Alternative 1	*Alternative 2*	*No-Action Alternative*
Potentially Impacted Resource: Onshore		
• LSI	• LSI	• NI
Potentially Impacted Resource: Offshore		
• LSI	• LSI	• NI

Legend: SI = Significant impact, SI-M = Significant impact mitigable to less than significant,
LSI = Less than significant impact, NI = No impact, BI = Beneficial impact

5.2.6 Summary of Potential Mitigation Measures

As the predicted air emissions would result in less than significant impacts for all alternatives for both construction and operation components of the proposed action, no mitigation measures are warranted.

CHAPTER 6. NOISE

6.1 INTRODUCTION

This chapter contains a discussion of the potential environmental consequences of noise associated with implementation of the alternatives within the region of influence (ROI). For a description of the affected environment, refer to the respective chapter of Volume 2 (Marine Corps Relocation – Guam). The locations described in that volume include the ROI for the aircraft carrier berthing component of the proposed action (Apra Harbor), and the chapters are presented in the same order as the resource areas contained in this Volume.

6.2 ENVIRONMENTAL CONSEQUENCES

6.2.1 Approach to Analysis

Potential sound-generating events associated with the proposed action were identified and the potential sound levels from these activities were estimated on the basis of published military sound sources of information. These estimated sound levels were reviewed to determine: if they would represent a significant increase in the current ambient sound level, would have an adverse impact on a substantial population of sensitive receptors, or would be inconsistent with any relevant and applicable standards. This chapter focuses on potential impacts to human receptors (see Chapter 10, Terrestrial Biological Resources and Chapter 11, Marine Biological Resources in this Volume for potential noise impacts to wildlife).

6.2.1.1 Methodology

Construction

Construction noise is generated by the use of heavy equipment on job sites. Table 6.2-1 provides a list of representative examples of construction equipment and their associated noise levels. Impact devices typically generate more noise than non-impact devices. Acoustical Usage Factor refers to the percentage of time the equipment is running at full power on the job site. The Federal Highway Administration (FHWA) published a Roadway Construction Noise Model to predict noise levels adjusted from empirical data for construction operation to the actual distance of a receptor.

The decibel (dB) level of a sound decreases (or attenuates) exponentially as the distance from the source increases. For a single point source like a construction bulldozer, the sound level decreases by approximately 6 dBs for each doubling of distance from the source. Sound that originates from a linear, or 'line' source, such as a passing aircraft, attenuates by about 3 dBs for each doubling of distance where no other features such as vegetation, topography, or walls absorb or deflect the sound. Depending upon their nature, such features can range from having minimal to substantial noise level reduction capabilities.

Table 6.2-1. Examples of Construction Noise Equipment

Equipment Description	*Impact Device[1]*	*Acoustical Usage Factor[2] (%)*	*Actual Measured Lmax @ 50 feet[3] (dBA, slow) (Samples Averaged)*	*Number of Actual Data Samples[4] (Count)*
All Other Equipment > 5 HP	No	50	N/A	0
Backhoe	No	40	78	372
Clam Shovel (dropping)	Yes	20	87	4
Compactor (ground)	No	20	83	57
Compressor (air)	No	40	78	18
Concrete Mixer Truck	No	40	79	40
Concrete Saw	No	20	90	55
Crane	No	16	81	405
Dozer	No	40	82	55
Dump Truck	No	40	76	31
Excavator	No	40	81	170
Front End Loader	No	40	79	96
Generator	No	50	81	19
Grader	No	40	N/A	0
Impact Pile Driver	Yes	20	101	11
Jackhammer	Yes	20	89	133
Pavement Scarifier	No	20	90	2
Paver	No	50	77	9
Roller	No	20	80	16
Scraper	No	40	84	12
Tractor	No	40	N/A	0
Vibratory Pile Driver	No	20	101	44

Notes:
[1]Indication whether or not the equipment is an impact device
[2]The acoustical usage factor to assume for modeling purposes
[3]The measured "Actual" emission level at 50 feet (15 meters) for each piece of equipment based on hundreds of emission measurements performed on Central Artery/Tunnel, Boston MA work sites
[4]The number of samples that were averaged together to compute the "Actual" emission level
Source: USDOT 2006

Operation

Operational noise associated with a visiting aircraft carrier would be primarily due to increased traffic on the roadways. FHWA has prepared a traffic study and potential road traffic noise is described in Section 6.2 of Volume 2.

6.2.1.2 Determination of Significance

Noise impacts result from perceptible changes in the overall noise environment that increase annoyance or affect human health. Annoyance is a subjective impression of noise and is subject to various physical and emotional variables. Annoyance levels generally increase when the cumulative noise energy also increases. Human health effects such as hearing loss and noise-related awakenings can result from noise.

For this EIS, noise is evaluated for both construction and operational activities. It is not anticipated that maintenance activities would noticeably contribute to the noise environment due to their intermittent nature and short duration. The threshold level of significant impacts for noise is:

- The increase of any incompatible noise contours where there are sensitive noise receptors (residences, hospitals, libraries, and etc.) due to operation. This threshold is intended to identify areas where there would be "high annoyance" effects associated with operational noise as well as identifying potential health effects and complaints.

- Construction noise resulting in an hourly equivalent sound level of 75 A-weighted decibels (dBA) (based on United States Environmental Protection Agency data for construction noise) at a sensitive receptor (such noise exposure would be equivalent to noise Zone III) or consistent exposure to noise levels at 85 dBA, over an 8-hour period, which is the National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit (NIOSH 1998).
- The significance criteria expressed in this section apply to human receptors, but noise could also affect biological resources, land use, and cultural resources. Please refer to specific applicable resource sections for details about potential noise impacts to biological and other resources.

6.2.1.3 Issues Identified during Public Scoping Process

Comments received during the scoping process from the public, including regulatory stakeholders, do not specifically mention concerns about increased noise pollution due to the proposed action for the aircraft carrier berthing. Consequently, no related public scoping issues were identified.

6.2.2 Alternative 1 Polaris Point (Preferred Alternative)

Alternative 1, Polaris Point (referred to as Alternative 1), consists of the construction of a wharf and supporting infrastructure in Outer Apra Harbor that would result in increases in berthing visits from Nimitz and/or Ford Class nuclear powered aircraft carriers. Siting for these facilities would be along the northern shore of Apra Harbor at the Polaris Point site. Construction and construction-related noise may be divided into the two major construction phases: namely onshore facilities construction and offshore construction. Once construction is completed, noise impacts from daily operation of these facilities would begin. Potential noise impacts and their possible environmental consequences are described below.

6.2.2.1 Onshore

Onshore noise generating activities from Alternative 1 are divided into construction and operation phases. Construction is simply the activities that would generate noise during the building of facilities; operation would be the noise load generated from the day-to-day use of these newly constructed facilities.

<u>Construction</u>

Noise impacts during the construction phase of this alternative would include noise generated by the use of heavy equipment for:

- Grubbing, clearing, and grading of a construction staging area
- Demolition and replacement in-kind of three minor buildings totaling approximately 700 square feet (ft^2) (25 square meters [m^2])
- Minor roadway and pavement removal
- Realignment of utility lines along a portion of the adjacent roadway
- Filling of the marine revetment area—possibly with suitable dredged material
- Transportation of dredged material
- Pile driving for wharf construction

During facilities construction, use of heavy equipment generally occurs during daytime hours and would occur in industrial areas that have generally higher ambient noise levels. Heavy equipment would generate the highest noise levels throughout the construction phase, and would diminish the farther sensitive noise receptors are from the construction site. Use of heavy equipment would depend on the construction schedule, and would not be permanent. Temporary increases in truck traffic used to transport dredged material, as well as to bring materials on- and off-site would also produce greater noise disturbance within and near the construction corridors. Volume 6 contains a discussion of impacts from roadway noise. The method for disposing of dredged materials would be transporting to a beneficial reuse site, an upland placement site, or an Ocean Dredged Material Disposal Site. The latter would remain offshore as is discussed in the following section.

Transportation to a beneficial reuse site or an upland placement site would require truck transportation to the ultimate location. This would produce temporary, localized noise for brief periods, but it would not create any permanent, adverse noise impacts to human health or the local environment. Therefore, noise impacts would be less than significant.

Construction of the pile-supported dock would involve the use of an impact pile hammer to drive steel piles into the sediment, as well as a vibratory hammer for driving sheet piles for wharf construction. Associated noise and vibration impacts would be minor and temporary, for the duration of the wharf construction. Generally, both impact and vibratory pile driving operations produce airborne noise levels of 101 dBA 50 ft (15 m) from the source; however, as the distance from the pile driving operation increases, the level of disturbance from the noise decreases. By 400 feet (122 m) away the noise level would drop to approximately 83 dBA. Only construction workers with appropriate hearing protection would be allowed within the area where noise reaches this level. Maximum airborne construction noise from pile driving would be 61 dBA at the nearest residence located 1 mile (mi) (1605 meters [m]) away on the east side of Route 1. For pile driving operations, equipment with noise attenuating features could potentially be used to minimize disturbances to the surrounding environment. Consequently, noise impacts would be less than significant. Construction workers would be required to utilize hearing protection.

<u>Operation</u>

Sources of noise pollution during daily onshore operations are common to both alternatives. These sources would include:

- An increase in the number of people arriving or waiting to depart the wharf area by bus or car
- Personnel congregating around the wharf's temporary Morale, Welfare and Recreation facilities
- Increased shoreside security patrols
- Periodic truck traffic to the wharf to re-supply the ship
- Cargo movement likely requiring mobile cranes and/or forklifts

Noise impacts associated with day-to-day operations from Alternative 1 would likely produce no adverse impacts to the surrounding environment. Periodic and temporary impacts would be associated with truck traffic and cargo movement, resulting in impacts that would be similar to those experienced during the construction phase. There would be an increase in general traffic during times when the wharf and facilities were in use; however, it is unlikely that this would create an unacceptable noise environment. In summary, potential operational noise impacts would be less than significant.

6.2.2.2 Offshore

<u>Construction</u>

Mechanical or hydraulic dredging would be necessary for either alternative. Noise pollution due to dredging activities would be caused by the dredging equipment, watercraft (tugboats and barges), and human activity. No blasting would be required. Noise levels would be comparable to those that currently occur during periodic maintenance dredging of the turning basin and entrance channel. Operations for the proposed dredging could take place up to 24 hours a day, 7 days a week, for approximately 8 to 18 months. Noise levels from dredging would be 87.3 dBA at 50 feet (ft) (15 m) dropping to 61.2 dBA at 1000 ft (305 m) and to 55.2 dBA at 2000 ft (610 m) from the source. Chapter 11 of this Volume contains a discussion of in-water noise impacts.

Wharf construction would occur under the proposed action. Along with the construction of a new wharf, all necessary utility infrastructure would be added to the sites. This construction has the potential to temporarily create adverse noise impacts to the offshore environment.

During pier construction, pile driving operations would create both waterborne and airborne noise. This method of construction would produce the most adverse noise impact to the project area. Waterborne noise created by vibratory pile driving at an average of approximately 160 dB re 1 µPa (Betke et al. 2004) and a peak of 192 dB re 1 µPa at 30 ft (9 m) could increase underwater noise levels to an average of 165 dB re 1 µPa and a peak of 192 dB re 1 µPa. Noise impacts to humans would be less than significant. Impacts to biological resources are discussed in the biological resources chapter of this Volume.

<u>Operation</u>

Sources of noise pollution during offshore operations would occur with both alternatives. These sources would include:

- Port calls by aircraft carriers estimated to be up to 21 days or combination thereof, for a total of approximately 63 days in port per year.
- Associated harbor craft, tugboats, security, and maintenance boats associated with navigation and support of an aircraft carrier within the harbor.
- Up to 59 aircraft flying from the aircraft carrier to beddown at Andersen AFB on a space-available basis. [*Note: Aircraft from visiting aircraft carriers would be flown off of the carrier while outside of port. Volume 2 discusses noise associated with current and proposed aircraft activities. This includes increased operations associated with aircraft from visiting aircraft carriers. The combined noise analyses of these aircraft and all other project-related aircraft are discussed in Volume 2.]

6.2.2.3 Summary of Alternative 1 Impacts

Alternative 1 noise impacts would be caused by construction and operations occurring both onshore and offshore. All of the activities would produce less than significant impacts (Table 6.2-2).

6.2.2.4 Alternative 1 Potential Mitigation Measures

Noise impacts due to the aircraft carrier berthing would be less than significant. Although pile driving activities would generate high noise levels at the source, the noise level at the nearest receptor is well within acceptable limits. Therefore, no noise mitigation measures have been determined to be necessary for Alternative 1 for the proposed aircraft carrier berthing at Apra Harbor.

Table 6.2-2 Summary of Alternative 1 Impacts

Area	*Project Activities*	*Project Specific Impacts*
Onshore	Construction	LSI – Onshore construction noise would be typical of standard construction activities, but would include pile-driving for the wharf project. All of the activities would occur sufficiently far away from sensitive receptors to be considered less than significant.
	Operation	LSI – Noise emanating from onshore operations would be due to increased traffic. The lack of sensitive receptors in the Apra Harbor area makes the impacts less than significant.
Offshore	Construction	LSI – Underwater noise from pile-driving would be the dominate source of offshore noise impacts. Human receptors would not be impacted by these potential noises above acceptable levels. See the biological resource chapter for impacts to biological resources.
	Operation	LSI – Noise from offshore operations would be from tugboats and other smaller vessels operating in the harbor. The operations would be concentrated during the periods when the aircraft carrier is in port, would be short-term, and are considered less than significant.

6.2.3 Alternative 2 Former Ship Repair Facility (SRF)

6.2.3.1 Onshore

<u>Construction</u>

Noise impacts during the construction phase of Alternative 2, Former SRF (referred to as Alternative 2), would be identical to those of Alternative 1 except the nearest residence is located in on-base housing approximately 4,300 ft (1,300 m) away. Noise levels at that location would be 62 dBA and would be well below acceptable limits. The nearest school is the Commander William C. McCool Elementary/Middle School approximately 3,900 feet (1,200m) away on Naval Base Guam. Noise levels at the school would be approximately 65 dBA which is also within acceptable levels. Therefore, the construction noise impacts associated with Alternative 2 would be less than significant.

<u>Operation</u>

Sources of noise pollution during daily onshore operations are common to both alternatives and are discussed as part of Alternative 1.

6.2.3.2 Offshore

<u>Construction</u>

Construction sources of noise pollution due to offshore construction are common to both alternatives and are described as part of Alternative 1.

<u>Operation</u>

Sources of noise pollution due to offshore operations are common to both alternatives and are described as part of Alternative 1.

6.2.3.3 Summary of Alternative 2 Impacts

Noise impacts associated with Alternative 2 would be the same as for Alternative 1 (Table 6.2-3).

Table 6.2-3. Summary of Alternative 2 Impacts

Area	*Project Activities*	*Project Specific Impacts*
Onshore	Construction	LSI – Same as Alternative 1
	Operation	LSI – Same as Alternative 1
Offshore	Construction	LSI – Same as Alternative 1
	Operation	LSI – Same as Alternative 1

6.2.3.4 Alternative 2 Potential Mitigation Measures

Noise impacts for Alternative 2 would be the same as for Alternative 1 and less than significant. Therefore, no noise mitigation measures have been determined to be necessary for Alternative 2.

6.2.4 No-Action Alternative

Under the no-action alternative, there would be no wharf construction to support the aircraft carrier extended visits to Apra Harbor. As a result, there would be no construction-related noise impacts and noise impacts due to operations would not increase. However, under this alternative, the objective, needs, and treaty commitments of DoD would not be met.

6.2.5 Summary of Impacts

Table 6.2-4 summarizes the potential impacts of each action alternative and the no-action alternative. A text summary is provided below.

Table 6.2-4. Summary of Impacts

Alternative 1	*Alternative 2*	*No-Action Alternative*
LSI • Onshore construction noise impacts would be due to heavy equipment operation including pile-driving and away from sensitive receptors • Offshore construction noise impacts would be due to dredging and pile driving (see biological section for impacts to biological resources) • Operational noise impacts would only occur while the ship is in port	LSI • Same as Alternative 1	NI

Legend: SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact, BI = Beneficial impact

Noise sources related to the proposed aircraft carrier berthing at Apra Harbor would include construction noise, both onshore and offshore, and noise associated with normal operation. Onshore construction noise would occur due to heavy construction equipment operation and truck traffic during construction. Dredging and pile driving would be major sources of the offshore noise, last for 8 to 18 months, and possibly be conducted for up to 24 hours per day. Other construction noise would mainly occur during daylight hours. As construction noise ceases once construction ends, potential impacts would be short-term and localized.

Operational noise would primarily be due to increased traffic while the ship is in port. As the frequency of aircraft carrier berthing would be for a cumulative total of up to 63 days per year with approximately 21 days per visit, the noise impacts would be limited to those periods when the ship is in port.

6.2.6 Summary of Potential Mitigation Measures

Because impacts from noise would be less than significant, there would be no required mitigation measures.

CHAPTER 7. AIRSPACE

7.1 INTRODUCTION

This chapter discusses the potential environmental consequences associated with implementation of the alternatives within the region of influence for airspace. For a description of the affected environment, refer to the respective chapter of Volume 2 (Marine Corps Relocation – Guam). The locations described in that Volume include the region of influence for the aircraft carrier berthing component of the proposed action (Apra Harbor), and the chapters are presented in the same order as the resource areas contained in this Volume.

7.2 ENVIRONMENTAL CONSEQUENCES

There would be no airspace environmental consequences associated with the proposed aircraft carrier berthing. The temporary flight activity within Guam airspace associated with a transient aircraft carrier would generate small increases in airfield operations at Andersen Air Force Base and use of existing airspace associated with the Mariana Islands Range Complex while the carrier air wing is in port. Increases in Andersen Air Force Base airfield operations would not alter existing flight patterns or airspace requirements. Flight activity would be based on a space-available basis, as is the current practice. Therefore, there would be no impacts to airspace resources.

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CHAPTER 8.
LAND AND SUBMERGED LANDS USE

8.1 INTRODUCTION

This chapter describes land and submerged lands ownership and use in and around Naval Base Guam, which is the site for the proposed new aircraft carrier wharf. The two wharf alternatives are located in proximity to each other at the entrance to Inner Apra Harbor, but the land uses and utility infrastructure are different at the sites. One alternative requires an adjustment to an existing private lease and the other would have no potential impact on land ownership. Submerged lands are areas in coastal waters extending from the Guam coastline into the ocean 3 nautical miles (nm) (5.6 kilometers [km]). As points of reference, primary land use constraints are mentioned (e.g., Explosive Safety Quantity Distance [ESQD] arcs), but details are provided in other resource chapters of this Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS).

A description of the affected environment for Naval Base Guam is presented in Volume 2. For example, the land use issues associated with upland placement of dredged material are addressed in Volume 2. The impacts to land and submerged lands use are identified in this chapter by alternatives and components, and the chapter concludes with identification and discussion of potential mitigation measures that apply to significant impacts.

The region of influence for the Volume 4 land use discussion is land and submerged lands in and around Naval Base Guam within 3 nm (5.6 km) offshore, which is the limit of state or territorial jurisdiction.

8.2 ENVIRONMENTAL CONSEQUENCES

8.2.1 Approach to Analysis

The affected environment section for Land and Submerged Lands Use is organized under two categories: 1) land/submerged lands ownership and management; and 2) land/submerged lands use. There are different criteria for assessing potential impacts under the two categories. Short-term impacts would be related to facility construction activities that would be located within the project footprint or on previously disturbed lands. No construction staging area has been designated away from the project site. These construction activities would have minimal and localized impacts on land use. All impacts related to land ownership and use are assumed to occur during the long-term operational phase of the proposed action as the changed conditions would alter the development and use of the current site and its vicinity.

The potential indirect impacts that would be due to changes in land ownership and use are addressed under other specific resource categories such as traffic, noise, natural resources and recreation. Incompatibility with adjacent land uses to the extent that public health and safety is impacted is addressed under public health and safety and noise resource sections. Federal actions on federal lands are not subject to local zoning or land management regulations; however, consistency with surrounding non-federal land uses is an important consideration in land use planning. A Coastal Zone Management Act consistency determination assessment is being prepared for all Guam proposed actions and the correspondence will be included in the Final EIS/OEIS appendices.

8.2.1.1 Land Ownership/Management

The impact assessment for land/submerged lands ownership and management was not based on regulatory authority or permit requirements. There is flexibility in the methodology and assumptions were made. The basic premise was that a release of federal lands/submerged lands to GovGuam or individuals would have beneficial impacts on the new landowners. Conversely, the taking of land by the federal government may be considered an adverse impact on the entities that are losing ownership or control of their property. Taking property in this discussion refers to a situation where the property owner is legally required to sell property to the federal government. There may be some owners who are motivated to sell or lease land to the federal government and would perceive the federal acquisition or lease of their property as a beneficial impact. Other owners who do not want to sell their property (or relocate) would be likely to consider the forced sale or relocation as an adverse impact even though they are properly compensated. This situation was considered a significant adverse impact on the individual landowner. Until the land negotiations are complete, the impact analysis assumes a significant impact on the individual landowner. There are exceptions to this significant impact for minor rights-of-way and easements for utilities. Mitigation for the taking of property that is not acceptable to the land owner may be a long-term lease agreement instead of purchase where the property returns to the owner on termination of the lease.

The change in land ownership may result in a change in public access policies that may result in an adverse land ownership impact.

The aircraft carrier berthing alternatives are located within the Naval Base Guam on Navy submerged lands; therefore, land and submerged lands ownership is not a factor in the impact analysis.

8.2.1.2 Land Use

There are three criteria that are applied for assessing impacts on land/submerged lands use:

- Consistency with Farmland Protection Policy Act (FPPA) of 1981 (not applicable to submerged lands)
- Consistency with current or documented planned land/submerged lands use
- Restrictions on access due to changes in land use on federally controlled- property

<u>Land Use Criterion 1: FPPA</u>

The FPPA is intended to minimize the impact of federal programs on the unnecessary and irreversible conversion of land to non-agricultural uses. Actions inconsistent with this Act are considered to have an adverse impact and determination of significance is a qualitative assessment of the value of the farmland affected. The Department of Defense (DoD) lands on Guam are not currently used or planned for farming; therefore, according to this criterion there would be no impact associated with changes in land use. The non-DoD lands proposed for acquisition could potentially be used for farming and the potential impacts are assessed herein.

<u>Land Use Criterion 2: Consistency with Current or Documented Planned Land/Submerged Lands Use</u>

Land use plans are intended to guide future development. The DoD and non-DoD land use plans and constraint figures were presented in Volume 2, Chapter 8. Potential adverse land use impacts would result from a proposed land use that is inconsistent with the existing land use, planned land use, or if vacant land and open space would be developed. Potential adverse impacts would also result if there are incompatible changes in use within submerged lands.

The test for adverse impact significance is less rigorous for existing DoD land and submerged lands, where the limited land availability may force less than ideal land use changes. Federal actions on federal lands/submerged lands are subject to base command approval, but are not required to conform with state/territory land use plans or policies. The proposed waterfront improvements are water dependent activities that would be consistent with the Guam Coastal Zone Management Act policies. The proposed action alternatives of this EIS/OEIS have been developed in consultation with base command planners and approved by base commands. As a result, there would be no anticipated significant adverse impact to land use within DoD parcel boundaries. Land use changes on existing DoD land could be the basis for significant adverse impacts to other resource categories (such as aesthetics, noise, traffic, recreation, cultural, and natural resources) within and beyond DoD land boundaries. Impacts to these resources and others are addressed elsewhere in this EIS/OEIS.

Proposed land uses on newly acquired lands would have an adverse impact if they are not consistent with the existing or proposed land use at that site. Similarly, a change in use within non-DoD submerged lands could have an adverse impact. The test for significance is the degree of incompatibility and is qualitative. For example, proposed military housing would be consistent with existing or planned civilian residential communities and there would be no adverse impact to land use. A proposed industrial facility in an area that is designated for public park would be a significant adverse impact, while the same facility in an area proposed for heavy commercial would have no significant adverse impact.

While the proposed land use under the action alternatives may be consistent with the existing land use, there is potential for adverse impacts due to changes in land use intensity. For example, a training range that is used once per month may have an adverse impact if it were to be used daily. Potential adverse impacts associated with changes in land use intensity such as increases in marine traffic (Chapter 14), noise (Chapter 6), and unexploded ordnance (Chapter 18) are addressed under other resource area discussions of this EIS/OEIS. No significance criterion is established for land use intensity impacts.

Land Use Criterion 3: Access Restrictions

Additional restrictions on public access would be a potential adverse impact. For example, an increase in the setback distance from Navy ships for security purposes may restrict access to a SCUBA diving site. The test for significance is subjective and based on geographic area affected, the schedule or timing of the access restrictions (permanent or occasional), and the population affected.

Physical access restrictions can result if land acquisition by the federal government results in a pocket or island of non-federal land. This would be an adverse impact on the landowner(s) of the pocket of land. The significance of the impact is based on the extent to which the non-federal land is bordered by military land. Significant adverse impacts result when the property is surrounded by military property (even when access to property is provided). Similarly, pockets of civilian land use within a DoD installation would be a potential adverse impact on military land use.

The pockets of land use and public access restrictions have potential indirect impacts on other resources that are discussed elsewhere in this EIS/OEIS.

8.2.1.3 Issues Identified During Public Scoping Process

Many of the scoping issues regarding land use overlap with other resource areas such as noise and recreation and are discussed under those sections. The following are public, including regulatory stakeholders, concerns:

- No increase in federal land ownership (although there were some land owners interested to sell).
- No re-acquisition of lands that have been or are in the process of being released by the federal government.
- Current public rights-of-way should be retained.
- No further restrictions on recreational use of submerged lands. Current restrictions have interfered with boat races and competitions in Outer Apra Harbor.

8.2.2 Alternative 1 Polaris Point (Preferred Alternative)

8.2.2.1 Onshore

The proposed aircraft carrier wharf location at Alternative 1 Polaris Point (referred to as Alternative 1) and the proposed upland placement sites are proposed entirely on federal land within Naval Base Guam. No land acquisition is proposed. No farmlands exist on the base; therefore, there would be no impact under the FPPA. The project site does not border non-federal lands and would have no adverse impact on neighboring civilian communities.

Construction

There is adequate previously disturbed land at the proposed wharf areas for construction staging at the project site. The underground utilities would be within existing utility corridors, except for the local Polaris Point connections to the wharf structure.

As described in Volume 2, dredged material may be reused, placed in upland placement facilities and/or disposed of in an ocean dredged material disposal site (ODMDS). The EIS/OEIS assumes four scenarios: 100% ODMDS disposal, 100% upland placement, 100% beneficial reuse, and 20-25% beneficial reuse/75-80% ODMDS disposal. No land use impacts are anticipated from use of the ODMDS site and its selection would avoid any use or impact on land use.

The potential land use impacts of the upland placement site options are as described in Volume 2, Chapter 8, Land Use. The only difference is the aircraft carrier volume of dredged material is greater than that proposed in Volume 2 for Sierra Wharf dredging. Of the five upland placement sites, only Fields 3 and 4 do not have the capacity for 100% of the aircraft carrier dredged material. No adverse impact to land use near the site would result from the use of any of the candidate upland disposal sites. There is a potentially adverse land use impact associated with the existing upland placement sites if there are other more productive uses of the land than stockpiling dry dredged material. Reuse of dredged material, described further in Volume 2, would provide other beneficial land use opportunities if the upland placement site is no longer needed, thus, creating a beneficial impact to land use.

Operation

The proposed new aircraft carrier wharf would be compatible with adjacent submarine compound operational facilities. The proposed wharf and associated facilities would be within and consistent with the Operation land use area of the land use plan (refer to Volume 2, Figure 8.1-12) and consistent with the nearby submarine compound land use. There would be negligible impacts on existing Polaris Point radiological response and emergency repair operations at the submarine compound. There would be sufficient capacity and staff to support the aircraft carrier (COMPACFLT 2009).

The development of a new wharf is consistent with historical use of the proposed project area for ship berthing. These facilities and the wharf would develop an area that is currently vacant and provides open space. The adjacent Fleet/Community Support land use designation is consistent with the planned Morale, Welfare, and Recreation (MWR) facilities. The impact on land use is minor and would be less than significant.

The proposed MWR area lies within and is consistent with the designated Fleet/Community Support land use area on base land use maps. MWR facilities are often provided close to the waterfront to support transient personnel. There may be interruptions to current MWR activities at Griffin Beach or nearby ballfields when the aircraft carrier is in port, but this would not be an adverse impact as there are alternative recreational areas on base. The proposed MWR area would be open space when the aircraft carrier is not in port and available for suitable MWR facilities and uses. When the aircraft carrier is in port, there would be temporary MWR facilities. These MWR activities would be consistent with the adjacent MWR uses that include ballfields and Griffin Beach. No adverse impacts were identified on existing land uses or future land use plans.

No changes to existing public access policy are proposed. Land access to Polaris Point would continue to be limited to authorized personnel. There would be additional security restrictions at the aircraft carrier wharf area when the aircraft carrier is in port, including a fenced perimeter and manned gate. These restrictions would be comparable to those used at the existing submarine compound.

Minor structures (e.g., guard tower) at the project site would be removed or relocated. The proposed shoreside facilities operations are typical of other Navy waterfront development (i.e., wharf, utilities, storage facility, access roads, and paving). Volume 2, Section 2.4 summarizes the utility requirements. New construction and significant upgrades are proposed to meet the utility requirements. The buildings proposed at the wharf would include: Bilge and Oily Wastewater Treatment System (BOWTS), Bilge and Oily Wastewater (BOW) pump station, boiler house with fuel storage, air compressor building, water treatment building, Port Operations Support Building, watch towers, and electrical substation. Improvements to Piti Power Plant, with no change to footprint, and the proposed underground lines along existing utility corridors would have no impact on land use. Upgrades to the existing sewage pump station nine on Polaris Point and the proposed underground gravity sewer lines to the wharf that are necessary would have no impact on land use. Water and communication upgrades would require extensions to the underground lines from the Alpha/Bravo Wharves' area to the aircraft carrier wharf and, again, no impact to land use is anticipated. Minor roads would be added and modified in the aircraft carrier project area, with no adverse impact on land use.

8.2.2.2 Offshore

The navigational channel, turning basin, and wharf structure are all proposed within federal submerged lands. No change in submerged lands ownership is proposed. Multiple uses of Apra Harbor would continue, and existing restrictions including existing setback distances from Navy assets would remain, with no changes to public access policies.

<u>Construction</u>

Dredging and wharf construction is typical of an active harbor and would be consistent with the industrial activities of Apra Harbor. Maintenance dredging occurs periodically, as does construction dredging. The equipment and barges may temporarily block access to Inner Apra Harbor Channel resulting in minor impacts to access.

One or more of the candidate upland placement sites would be required to accommodate the dredged material. Potential land use impacts are described in Volume 2. Land use impacts would be limited to the DoD community and would be less than significant. There would be no direct submerged lands use impacts during use of the ODMDS. There would be temporary impacts to navigation in the shipping lane due to scows carrying dredged material. These impacts would be managed through communication between the dredging contractor and other vessel operators. There would be ample room in the outer harbor for smaller vessels to go around dredging equipment and where larger commercial vessels are involved, coordination between the dredging equipment and vessel operators would minimize any scheduling delays for either operation.

<u>Operation</u>

All in-water operational activities associated with berthing an aircraft carrier at a new Polaris Point wharf would be the same as those occurring at a typical Navy harbor. The widening of the ship navigation channel would not have an adverse impact on the use of the channel by other ship or boat operators. Channel markers would be relocated as needed. The navigation route in the vicinity of the new wharf would be dredged deeper, which would have no impact on submerged lands use. Use of the project area turning basin and submerged lands fronting the wharf would be restricted and subject to Navy Port Operations approval, as is current practice. Commercial ship traffic does not use the turning basin area and would not be impacted by security barriers at the wharf.

During typical aircraft carrier visits, there would be a disruption to normal ship traffic patterns because of force protection restrictions during aircraft carrier arrival and departure. Normal arrivals and departures would result in disruption of harbor traffic for periods not to exceed four hours (average two). Under the proposed action, there would be a cumulative total of up to 63 in-port days per year, with actual arrivals and departures being determined by operational requirements. Ship schedules have fluctuated over the past 10 years as noted in Section 1.1 of this EIS/OEIS. For further discussion of navigation impacts refer to Chapter 14, Transportation.

Once the aircraft carrier is docked, there would be no impact on commercial or recreational ship traffic in the northern part of Outer Apra Harbor. No additional submerged lands use restrictions are anticipated while the aircraft carrier is in port. In-water security barriers surrounding the aircraft carrier in port would have to be moved to allow military vessels to enter and exit Inner Apra Harbor. This is considered a minor impact on harbor operations as it only affects military operations.

8.2.2.3 Summary of Alternative 1 Polaris Point Impacts

Table 8.2-1 summarizes the potential impacts of Alternative 1 Polaris Point (Alternative 1).

Table 8.2-1. Summary of Alternative 1 Impacts

Area	*Project Activities*	*Project Specific Impacts*
Onshore	Construction	Activity and staging on DoD-owned compatible lands Disturbance of previously disturbed lands Loss of other potential uses for land designated as upland dredged material placement sites
	Operation	Temporary interruptions to current MWR activities Compatible with surrounding land uses Efficient use of non-DoD land
Offshore	Construction	Dredging activities would be consistent with existing land use Intermittent (1 to 2 ships per day) impact to harbor traffic Interruptions in access to Inner Apra Harbor Channel
	Operation	Temporary impacts to submerged lands use Temporary impact on harbor operations when security barriers are moved Restricted access to Outer Apra Harbor during the infrequent transient aircraft carrier movements

8.2.2.4 Alternative 1 Potential Mitigation Measures

No significant impacts to land/submerged lands ownership, management, or use were identified under Alternative 1; therefore, no mitigation is necessary or proposed.

8.2.3 Alternative 2 Former Ship Repair Facility (SRF)

8.2.3.1 Onshore

The proposed site is within the current private shipyard leasehold area at Former SRF (referred to as Alternative 2). The current lease term expires in 2012. Future use of the SRF lands beyond 2012 is currently being reviewed by the Navy. Although no decision has been made at the present time in connection with the future reuse of the Former SRF lands to include a new lease for commercial ship repair facility purposes beyond the current 2012 lease term expiration date. The proposed project construction would occur after the existing lease term expires. Consequently, there would be no effect on the current lease. The Former SRF lease area could be reduced and the proposed project area could be excluded from any new lease. The new aircraft carrier wharf would require reduction of the existing Guam Shipyard leased area but because of the timing of the expiration of the lease, would be considered a less than significant adverse impact on the lessee. This is a conservative assessment and assumes the lessee would prefer not to reduce the lease area during the present lease. The construction of the shoreside infrastructure would not commence until a new land use plan is implemented. Any impact would not be significant because any reduction in the current leasehold footprint would be done on a negotiated basis with the lessee; and if ship repair operations were to continue, they would be done with a more consolidated operation through a more efficient configuration of the physical plant with no reduction in capacity or service capability. No additional land acquisition is proposed. No farmlands would be affected; therefore, there is no impact under FPPA. There would be no change to existing public access policy. Land access to the Former SRF would continue to be limited to authorized personnel only. Any new leased area would continue to be surrounded by DoD land, with no change in access policy.

<u>Construction</u>

Potential land use impacts during construction would be similar to those described for Alternative 1. However, Alternative 2 Former SRF (Alternative 2) may result in a new real estate arrangement where construction activities may be adjacent to a private commercial leasehold interest.

<u>Operation</u>

Development of a Navy general purpose wharf at the Former SRF is consistent with the Navy's existing land use plan that designates the project area as Operations and Industrial Support (refer to Volume 2, Figure 8.1-12). The new wharf would remove the finger piers, which are not used anyway. The area is underutilized and no relocation of occupied facilities would be required. One abandoned building would be demolished. The proposed shoreside facility (i.e., wharf, utilities, storage facility, and paving) would be operated in a manner typical of other Navy waterfront facilities. MWR facilities are often provided close to the waterfront, within operational areas, to support transient personnel. The proposed MWR area would be open space when the aircraft carrier is not in port. When the aircraft carrier is in port, there would be temporary MWR facilities. No adverse impacts were identified on existing land uses or future land use plans.

Volume 2, Section 2.4 summarizes the utility requirements for a new aircraft carrier wharf. New construction and significant upgrades are proposed to meet the utility requirements. The buildings proposed at the wharf would include: BOWTS, BOW pump station, boiler house with fuel storage, air compressor building, water treatment building, Port Operations Support Building, watch towers, and electrical substation. Improvements to Piti Power Plant and Orote Substation would not change the footprint of the facilities. The underground lines would be within existing utility corridors. The three new submersible pump stations and underground pipelines would be on the existing utility corridor, except in the Former SRF area. Water and communication upgrades would require extensions of the underground lines from the existing Former SRF waterline and Building 3169 (near Victor Wharf) communications hub to the aircraft carrier wharf. No impact to land use is anticipated due to utility improvements.

Potential land use impacts for operations would be similar to those described for Alternative 1. However, Alternative 2 may result in a new real estate arrangement where aircraft carrier wharf operations may be adjacent to a private commercial leasehold interest. Any new lease area would continue to be surrounded by DoD land/submerged lands, continuing a pocket of non-DoD land.

Antiterrorism/force protection is a standard consideration for siting military facilities. Even with a commercial leasehold adjacent to the military property there is sufficient land area at the Former SRF site to accommodate the stand-off distances. Minor roads would be added and modified in the aircraft carrier project area, with no adverse impact on land use.

8.2.3.2 Offshore

Construction

The potential in-water impacts would be as described for Alternative 1, with one additional potential impact. The current design allows for adequate space to access the private shipyard floating dry-dock facility when the wharf is not in use. However, force protection standoff distances restrict ingress and egress to the floating dry dock when the wharf is in use. This limitation would restrict the scheduling of docking and undocking ships at the commercial shipyard. Though the impact would be short in duration, any impact to the private shipyard would be mitigated through scheduling of ship repairs. Therefore, Alternative 2 would result in less than significant impacts to land use.

Operation

The potential in-water impacts would be as described for Alternative 1, with one additional potential impact. The current design allows for adequate space to access the private shipyard floating dry-dock facility when the wharf is not in use. However, force protection standoff distances restrict ingress and egress to the floating dry dock when the wharf is in use. This limitation would restrict the scheduling of docking and undocking of ships at the commercial shipyard during periods when CSG support vessels may require docking capability. Though the impact would be short in duration, this could have a significant commercial impact to the private shipyard and would have to be mitigated through compensation for delays or lost work. Therefore, Alternative 2 may result in a significant impact to land use that would be mitigated to less than significant through compensation for lost work.

8.2.3.3 Summary of Alternative 2 Impacts

Table 8.2-2 summarizes the potential impacts of Alternative 2.

Table 8.2-2. Summary of Alternative 2 Impacts

Area	*Project Activities*	*Project Specific Impacts*
Onshore	Construction	Activity and staging on DoD-owned compatible lands Disturbance of previously disturbed lands Loss of other potential uses for land designated as dredged material placement sites
	Operation	Temporary interruptions to current MWR activities Compatibility with surrounding land uses Efficient use of non-DoD land Reduction in the Guam Shipyard Lease area would be an impact if lease renegotiated prior to its current 2012 end
Offshore	Construction	Dredging activities would be consistent with existing land use Intermittent (1-2 ships per day) impact to harbor traffic movement Interruptions in access to Inner Apra Harbor Channel
	Operation	Temporary impacts to submerged lands use Temporary impact on harbor operations when security barriers are moved Temporary restricted access to Outer Apra Harbor during the infrequent transient aircraft carrier movements Potential delays in private dry dock operations

8.2.3.4 Alternative 2 Potential Mitigation Measures

No significant impacts to land/submerged lands ownership, management, or use were identified under Alternative 2 that would not be mitigated to less than significant. One potential mitigation measure to reduce impacts to operations that could be employed is to negotiate long-term leases instead of purchase of non-federally-controlled land.

8.2.4 No-Action Alternative

No change to land ownership would occur at Apra Harbor. Under the no-action alternative, the lease area at the Former SRF would likely continue in its current or similar industrial use, resulting in the same less than significant impact identified under Alternative 2. The Former SRF area would continue to be underutilized and the existence of deteriorating buildings would continue. The Polaris Point site would not be fully utilized, but could potentially be used for submarine compound or MWR facility expansion. The area proposed for MWR could be developed as permanent MWR facilities. There would be no impact to submerged lands use. Except for the potential for negotiated modifications to the lease, no adverse land use impacts are anticipated under the no-action alternative.

8.2.5 Summary of Impacts

Table 8.2-3 summarizes the potential impacts of each action alternative and the no-action alternative. A text summary is provided below.

Table 8.2-3. Summary of Impacts

Alternative 1	*Alternative 2*	*No-Action Alternative*
Land Ownership/Management		
• Land: NI • Submerged Lands: NI	• Land: LSI • Submerged Lands: NI	• Land: LSI • Submerged Lands: NI
Land Use		
• FPPA: NI	• FPPA: NI	• FPPA: NI
Consistency with Existing or Proposed Land Use		
• DoD Land: NI • DoD submerged lands: NI • Non-DoD land: NI • Non-DoD submerged lands: NI • Access/pocket of non-DoD land: NI	• DoD Land: LSI • DoD submerged lands: SI-M • Non-DoD land: NI • Non-DoD submerged lands: NI • Access/pocket of non-DoD land: LSI	• DoD Land: LSI • DoD submerged lands: NI • Non-DoD land: NI • Non-DoD submerged lands: NI • Access/pocket of non-DoD land: LSI

Legend: FPPA = Farmland Protection Policy Act, SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact, BI = Beneficial impact

From a land/submerged lands ownership and use perspective, there is little difference between the two action alternatives. However, Alternative 2 and the no-action alternative could both result in a change to the Guam Shipyard Lease area that maintains a pocket of non-DoD land surrounded by DoD land and represents a decrease in non-DoD land use, which is an adverse impact. This is a conservative assessment and assumes the lessee would prefer not to reduce the lease area, but does not evaluate the expiration of the lease prior to construction nor the increase in efficiency that may result from consolidation of shipyard activities within a new leased area. The impact would be a less than significant adverse impact because: 1) the Navy is entitled to change the terms of the lease at lease expiration; 2) the sublessee would be more efficient and continue ship repair operations with no reduction in capacity or service capability; and 3) existing access policies would be retained. A beneficial impact of the reduced footprint would be the increased land use efficiency in the area.

The proposed waterfront land and submerged lands use at either site is consistent with existing and planned waterfront uses. Upland placement of stockpiled dredged material would be an adverse impact because it would not represent the best use of the land; however, the upland placement sites being considered were selected to minimize impacts on land use.

8.2.6 Summary of Potential Mitigation Measures

Table 8.2-4 summarizes the potential mitigation measures.

Table 8.2-4. Summary of Potential Mitigation Measures

Alternative 1	*Alternative 2*
Construction	
• Not warranted	• Not warranted
Operation	
• Not warranted	• Negotiate long-term leases instead of purchase of non-federally-controlled land

CHAPTER 9.
RECREATIONAL RESOURCES

9.1 INTRODUCTION

This chapter contains the discussion of the potential environmental consequences associated with implementation of the alternatives to accommodate the proposed transient berthing of an aircraft carrier within the region of influence (ROI) for recreational resources. For a description of the affected environment, refer to the respective chapter of Volume 2 (Marine Corps Relocation – Guam). The locations described in that Volume include the ROI for the aircraft carrier berthing component of the proposed action (Apra Harbor), and the chapters are presented in the same order as the resource areas contained in this Volume.

9.2 ENVIRONMENTAL CONSEQUENCES

9.2.1 Approach to Analysis

9.2.1.1 Methodology

Information on recreational resources on Guam and public access was collected through stakeholder meetings in April 2007, geographic information system data compiled and reviewed for this Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS), literature review, personal communications, and the limited visitor data that are available at a few specific locations on the island. A comprehensive recreational carrying capacity analysis, assessing the number of individuals that could be supported in a given area within natural resource limits without degrading the natural social, cultural, or economic environment (Global Development Research Center 2008), was not conducted as part of this EIS/OEIS, but is suggested as a potential mitigation measure to better quantify potential impacts to recreational resources and their users. Existing baseline data for conducting recreational resource impact analyses are somewhat limited because the Government of Guam (GovGuam), Department of Parks and Recreation does not collect visitor data (e.g., user counts, visitor satisfaction, user conflicts, visitor demands, etc.) for its recreational facilities (Department of Parks and Recreation 2009). Consequently, the analysis in this chapter relied considerably on information obtained through site reconnaissance and communications with natural resource planners at Andersen Air Force Base (AFB) and park rangers at the National Park Service that manage the War in the Pacific National Historical Park.

9.2.1.2 Determination of Significance

For the purpose of the EIS/OEIS, the proposed action and alternatives would cause a significant impact to recreational resources if they:

- Would impede access to recreational resources
- Would substantially reduce recreational opportunities
- Would cause substantial conflicts between recreational users
- Would cause substantial physical deterioration of recreational resources

9.2.1.3 Issues Identified during Public Scoping Process

As part of the analysis, concerns regarding the potential impact of the project mentioned by the public, including regulatory stakeholders, during the public scoping meetings were addressed. These include:

civilian access to Department of Defense (DoD) facilities, recreation areas, Apra Harbor, and other locations, both in terms of the impact of construction activity and actual implementation of the proposed action.

9.2.2 Alternative 1 Polaris Point (Preferred Alternative)

9.2.2.1 Onshore

Construction

There are existing Morale, Welfare, and Recreation (MWR) facilities at Polaris Point with access restricted to installation personnel and guests only. Access to MWR facilities, which include softball/baseball fields, cabana, tennis courts, and indoor recreational facilities may be impeded during construction activities at Polaris Point. Comparable and alternate forms of recreational resources are available outside of the base in adjoining villages and popular tourist locations, albeit at the cost of inconveniencing the personnel associated with the proposed action (e.g., finding transportation to the recreational resources). Therefore, Alternative 1 Polaris Point (referred to as Alternative 1) would result in less than significant impacts to onshore recreational resources and users at Polaris Point during the construction phase of the project.

Operation

Under Alternative 1, there would be a cumulative total of up to 63 transient carrier visit days per year, with an anticipated length of 21 days or less per visit. One of the primary reasons for extended port visits is to provide the liberty for Sailors and airmen deployed for extended periods of time to the Western Pacific. As such, personnel involved with the proposed action are considered potential users of recreational resources on Guam during aircraft carrier visit days. No housing would be provided on-shore and the ship would continue to support the ship's personnel. Popular existing MWR facilities, such as gyms, bowling alleys, baseball fields, cabanas, and swimming pools would experience increased use. A beach that is used exclusively by installation personnel and guests is situated east of the proposed location of the proposed wharf and adjacent to the MWR facilities would also experience increased use. Although the impacts to these resources would be short-term, recreational resource users—existing and new—would experience crowding and increased competition for the available recreational resources.

To mitigate the potentially significant impacts to the existing recreational resources at Polaris Point, it is suggested that additional shuttle bus services and taxis be made available on-base to offer transportation services for the Sailors to other popular sites on the island including Tumon/Tamuning villages, which offer recreational, shopping, and entertainment resources. By providing comparable and/or alternate recreational resources available and accessible to Sailors and airmen, the impacts to the resources at Apra Harbor may be alleviated. Therefore, by applying the proposed mitigating measures, the potentially significant impacts to the recreational resources at Apra Harbor may be mitigated to a level of less than significance.

9.2.2.2 Offshore

Construction

The Outer Apra Harbor hosts sunken historical relics and vessels from World War I and II and as a result, many dive sites exist today. The existing southward channel bend is between Jade and Western Shoals and in the vicinity of one dive site.

The proposed action would widen the channel at the bend and require dredging. The area of dredging is small and dredging would likely be completed within one to two days, based on dredging production estimates. A conservative assumption of a week of dredging in the area to include silt curtain set up and interruptions in work due to Inner Apra Harbor transiting traffic, would result in an adverse impact on recreation. This impact would be less than significant because only the Western Shoals dive site would be impacted, and there are numerous recreational dive sites in Outer Apra Harbor and around Guam that could be used as alternatives. The short-term duration of the construction impact would not result in dive pressure on other Guam sites. No recreational sites were identified in the turning basin or proposed wharf area.

The east-west portion of the channel in Outer Apra Harbor would be shared by the aircraft carrier and other ship traffic. No dredging would be required along this portion of the channel. Dredging would result in an estimated one to two barges per day for an estimated 8 to 18 months. No impacts on recreational uses in Outer Apra Harbor are anticipated. No recreational sites are located within the shipping channel. Alternative 1 would result in less than significant impacts to onshore recreational resources during construction. As a public awareness measure and to assist the public in planning its recreational activities near the project area, public notice of dredging activities would be provided. Dredging would proceed as rapidly as practicable to minimize the impact.

Operation

During aircraft carrier visits, a security clearance zone serving as a buffer to the ships would be enforced throughout the length of stay as a measure of force protection. The buffer distance is subject to change according to the force protection levels, with the minimum distance being 450 feet (ft) (137 meters [m]). Neither of the proposed wharves is in an area of offshore recreational water activities. The security barriers would not impact recreational uses in Outer Apra Harbor (Table 9.2-1). Therefore, Alternative 1 would result in no impacts to offshore recreational resources during operation.

9.2.2.3 Summary of Alternative 1 Impacts

Table 9.2-1 summarizes Alternative 1 impacts.

Table 9.2-1. Summary of Alternative 1 Impacts

Area	*Project Activities*	*Project Specific Impacts*
Onshore	Construction	Access to recreational resources at Apra Harbor may be impeded during construction activities
	Operation	Reduction in recreational opportunities; potential displacement of users
Offshore	Construction	Western Shoals dive sites would be impacted during dredging; other dive sites available for use
	Operation	No impacts

9.2.2.4 Alternative 1 Potential Mitigation Measures

To alleviate impacts to the limited recreational resources at Apra Harbor during carrier visits, provide additional on-base shuttle bus and taxi services to ensure Sailors and airmen have the ability to access comparable and/or alternate recreational resources off-base.

9.2.3 Alternative 2 Former Ship Repair Facility (SRF)

9.2.3.1 Onshore

Construction

At present, there are no recreational resources occurring at the Former SRF site. Therefore, Alternative 2 Former SRF (referred to as Alternative 2) would result in no impacts to recreational resources.

Operation

The proposed action would produce similar results as Alternative 1. Although there are no existing MWR facilities on-site, shuttle services are available to transport ship personnel to sites on and off base. Alternative 2 is closer to Naval Base Guam recreational activities and there may be less reliance on shuttle services. Therefore, Alternative 2 would result in no impacts to recreational resources.

9.2.3.2 Offshore

Construction

The proposed action would produce identical results as Alternative 1. Therefore, Alternative 2 would result in less than significant impacts to recreational resources.

Operation

The proposed action would produce identical results as Alternative 1. Therefore, Alternative 2 would result in no impacts to recreational resources.

9.2.3.3 Summary of Alternative 2 Impacts

Table 9.2-2 summarizes Alternative 2 impacts.

Table 9.2-2. Summary of Alternative 2 Impacts

Area	*Project Activities*	*Project Specific Impacts*
Onshore	Construction	No impacts
	Operation	No impacts
Offshore	Construction	Western Shoals dive sites would be impacted during dredging; other dive sites available for use
	Operation	No impacts

9.2.3.4 Alternative 2 Potential Mitigation Measures

No mitigation measures are required for Alternative 2.

9.2.4 No-Action Alternative

Under the no-action alternative, no construction, dredging, or operations associated with the aircraft carrier berthing would occur. Existing operations at Polaris Point, as a military training and recreational facility, and the Former SRF, as a commercial SRF, would continue. When an aircraft carrier is berthed at Kilo Wharf, there are restrictions to recreational uses including dive sites in the vicinity of the wharf. Kilo Wharf would not be able to accommodate the planned tempo of visits, but the current port visit schedule would be accommodated and there would continue to be impacts on recreational uses. The no-action alternative would have impacts on recreation, but there are sufficient alternative recreational areas that the impact is minimized to less than significant levels.

9.2.5 Summary of Impacts

Table 9.2-3 summarizes the potential impacts.

Table 9.2-3. Summary of Impacts

Alternative 1	*Alternative 2*	*No-Action Alternative*
Onshore: Construction		
LSI • Access to recreational resources at Apra Harbor may be impeded during the construction period	NI • No impacts expected	NI • No impacts expected
Onshore: Operation		
SI-M • Increased users at the existing MWR facilities. Crowding at other recreational resources on non-DoD lands; competition for space/opportunity. Impacts may be alleviated with the application of potential mitigation measures.	NI	NI • No impacts expected
Offshore: Construction		
LSI • Western Shoals dive sites would be impacted during dredging. Other sites available for use.	LSI • Western Shoals dive sites would be impacted during dredging.	NI • No impacts expected
Offshore: Operation		
NI • No impacts expected	NI • No impacts expected	NI • No impacts expected

Legend: SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact, BI = Beneficial impact

9.2.6 Summary of Potential Mitigation Measures

Table 9.2-4 summarizes the potential mitigation measures.

Table 9.2-4. Summary of Potential Mitigation Measures

Area	*Alternative 1*	*Alternative 2*
Onshore	**Construction**	
	• To alleviate impacts to the limited recreational resources at Apra Harbor during carrier visits, provide additional on-base shuttle bus and taxi services to ensure Sailors and airmen have the ability to access comparable and/or alternate recreational resources off-base.	• None
	Operation	
	• To alleviate impacts to the limited recreational resources at Apra Harbor during carrier visits,	• None

Area	*Alternative 1*	*Alternative 2*
	provide additional on-base shuttle bus and taxi services to ensure Sailors and airmen have the ability to access comparable and/or alternate recreational resources off-base.	
Offshore	**Construction**	
	• None	• None
	Operation	
	• None	• None

During aircraft carrier visits, bus and tour transport of ship personnel would be limited to tourist spots with higher carrying capacities than smaller and remote areas. To alleviate potentially significant impacts to the existing recreational resources at Apra Harbor during carrier visits, it is suggested that additional on-base shuttle bus and taxi services be made available to ensure Sailors and airmen have the ability to access comparable and/or alternate recreational resources off-base. Other than the suggested use of alternative recreation sites in Outer Apra Harbor, no mitigation is proposed for the one week of restricted access due to construction at Western Shoals. For public awareness purposes, advance public notice of when that area would be dredged could be provided to assist the public in planning their recreational activities. Dredging would proceed as rapidly as practicable to minimize the impact.

CHAPTER 10. TERRESTRIAL BIOLOGICAL RESOURCES

10.1 INTRODUCTION

This chapter contains the discussion of the potential environmental consequences associated with implementation of the alternatives within the region of influence (ROI) for terrestrial biological resources. For a description of the affected environment, refer to the respective chapter of Volume 2 (Marine Corps Relocation – Guam). The locations described in that Volume include the ROI for the aircraft carrier berthing component of the proposed action (Apra Harbor), and the chapters are presented in the same order as the resource areas contained in this Volume. Potential impacts to marine species from proposed offshore activities are addressed in Chapter 11, Marine Biological Resources.

10.2 ENVIRONMENTAL CONSEQUENCES

10.2.1 Approach to Analysis

10.2.1.1 Methodology

Biological resource issues and concerns include the potential direct, indirect, and cumulative impacts of the proposed action and alternatives during the construction and operation phases. Impacts may be either temporary (reversible) or permanent (irreversible). Direct and indirect impacts are distinguished as follows.

Direct impacts are associated with proposed construction activities (e.g., ground-disturbing activities) and operations (e.g., noise and lighting). Potential types of direct impacts include, but are not limited to:

- Loss of habitat due to vegetation removal during construction.
- Temporary loss of habitat during construction from noise, lighting, and human activity.
- Potential loss of habitat due to disturbance of species in areas surrounding operations from noise, lighting, and human activity.
- Injury or mortality to wildlife or special-status species.

Indirect impacts are caused by or result from project-related activities, are usually later in time, and are reasonably foreseeable (e.g., increased likelihood of invasive species moving into the area after disturbance). Potential indirect impacts include, but are not limited to:

- All disturbances from human activity, noise, and lighting that would potentially impact unoccupied suitable habitat for special-status species.
- Introduction of new non-native species or increased dispersal of existing non-native species on Guam.
- Dispersal of existing non-native species from Guam to the Commonwealth of the Northern Mariana Islands (CNMI), Hawaii, or other destinations.
- Adverse effects from pollutants that are released from construction or military operations.

General principles used to evaluate impacts are:

- The extent, if any, that the action would permanently lessen ecological habitat qualities that Endangered Species Act (ESA)-listed species depend upon, and which partly determines the species' prospects for conservation and recovery.

- The extent, if any, that the action would diminish population sizes, distribution, or habitat of regionally important native plant or animal species.
- The extent, if any, that the action would be likely to jeopardize the continued existence of any ESA-listed species.
- The extent, if any, that the action would be inconsistent with the goals of U.S. Fish and Wildlife Service (USFWS) recovery plans, Navy and Air Force Integrated Natural Resources Management Plans (INRMPs), or the Guam Comprehensive Wildlife Conservation Strategy (CWCS).

10.2.1.2 Determination of Significance

Significance of impacts to vegetation, wildlife, and special-status species were determined using guidelines as described in the previous section. Special-status species are defined as ESA- and Guam-listed species and species that are designated candidates for ESA listing. Specific significance criteria are discussed below. If significant impacts are determined, then mitigation may be proposed to offset the impacts. For this Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS), a major consideration is biosecurity. This issue is discussed under *Best Management Practices* in this chapter (see Section 10.2.2.1).

<u>Vegetation</u>

Impacts would be determined significant if any primary limestone forest (mature forest dominated by native species) would be cleared, unless determined to be very minor in the context of the surrounding forest areas. Any loss of this forest vegetation community would be considered significant because of the large historical and continuing losses of this forest type on Guam. Loss of wetland or mangrove vegetation would also be considered potentially significant.

<u>Wildlife</u>

Impacts would be determined significant if native wildlife species are present and the proposed project would result in diminished population sizes or distributions of regionally important native animal species. These wildlife species include those designated as Species of Greatest Conservation Need in the Guam CWCS. Invasive species that have the potential for direct or indirect impacts were evaluated. Historical impacts from non-native species have been severe, particularly from the brown treesnake (BTS) (see discussion in Volume 2). Although the proposed action would not result in additional impacts from BTS on Guam, the concern is that the BTS would be inadvertently introduced to other islands throughout the Pacific. This concern is addressed comprehensively for all actions proposed in this EIS/OEIS with potential mitigation measures described in Section 10.2.2.3.

Migratory Birds

For migratory birds, the Migratory Bird Treaty Act prohibits the taking, killing, or possession of migratory birds, with an exemption for military readiness activities (as defined in federal regulations) provided they do not result in a significant adverse effect on a population of a migratory bird species. Congress defined military readiness activities as all training and operations of the Armed Forces that relate to combat and the adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use. Military readiness activities do not include: (A) routine operation of installation support functions such as administrative offices, military exchanges, water treatment facilities, schools, housing, storage facilities, and morale, welfare, and recreation activities; (B) the operation of industrial activities; and (C) the construction or demolition of facilities used for a purpose described in A or B (50 CFR Part 21).

The DoD must consult with the USFWS if it is determined that a military readiness activity would have a significant adverse effect on a population of a migratory bird species. An activity has a significant adverse effect if, over a reasonable period of time, it diminishes the capacity of a population of a migratory bird species to maintain genetic diversity, to reproduce, and to function effectively in its native ecosystem.

Migratory bird conservation relative to non-military readiness activities is addressed separately in a Memorandum of Understanding developed in accordance with EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*. The Memorandum of Understanding between the DoD and USFWS was signed in July 2006 and DoD responsibilities included, but are not limited to: (1) incorporating conservation measures addressed in regional or state bird conservation plans and INRMPs; (2) managing military lands and activities other than military readiness in a manner that supports migratory bird conservation; and (3) avoiding or minimizing impacts to migratory birds, including incidental take and the pollution or detrimental alteration of the environments used by migratory birds.

The following species that occur on Guam are considered non-migratory birds and are not covered under the Migratory Bird Treaty Act: black francolin, black drongo, Eurasian tree sparrow, island-collard dove (previously known as Philippine turtle dove), common pigeon, and king quail.

Special-Status Species

The presence of special-status species in the project areas was described in Volume 2. Background information is presented in the species profiles in Appendix G. Impacts would be determined significant if special-status species are present in the project area and any project action is likely to result in harassment or harm of an individual, population or species. Impacts to ESA-listed species would include vegetation clearing of designated undeveloped Overlay Refuge habitat, or recognized essential habitat or recovery zones, unless it is determined that the removal of habitat or other affect is minor when considering all the remaining habitat and quality of habitat available to that species and considering USFWS recovery plan goals. Significant impacts would also include disturbing ESA- and Guam-listed species due to noise, lighting, or human activity. If species are currently present in a proposed project area, noise, lighting, and general human activity are considered direct impacts for the purposes of this analysis, even though it is recognized that some of the impacts from the proposed action may be indirect, rather than direct. If unoccupied but recognized habitat is affected by noise, lighting, or human activity, impacts would be considered indirect and would be determined significant unless the area affected is considered minor when considering all the remaining habitat and quality of habitat available to that species.

For ESA-listed species, federal agencies are required to ensure that their actions do not jeopardize the continued existence of an endangered or threatened species or its critical habitat. Analyses of potential impacts were based on review of plans for the proposed action and the available current and historical distributional data for each species. In accordance with section 7 of the ESA, a Biological Assessment (BA) is being prepared by the Navy to analyze the potential impacts on ESA-listed and candidate species and critical habitat under the jurisdiction of the USFWS.

The BA and the subsequent Biological Opinion (BO) issued by the USFWS after their review of the BA will be the final determination of impacts to ESA-listed species that are being evaluated in this EIS/OEIS. Candidate species must also be evaluated in the BA, however if they are not formally listed by the time the BO is issued and the proposed action would not result in their listing, no determination for these species will be made in the BO. The BO will provide an Incidental Take Statement that will list the amount or extent of take anticipated. Based on that take it will specify Terms and Conditions that the action proponent must comply with to be exempt from the prohibitions of Section 9 of the ESA. These are non-discretionary requirements. The BO will also specify conservation recommendations that are discretionary proponent activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The USFWS effects determinations from the BO will be incorporated into the Final EIS/OEIS.

10.2.1.3 Issues Identified During Public Scoping Process

Terrestrial biological resource issues identified during the public scoping process, including by regulatory stakeholders, that are applicable to the proposed action include:

- Activities associated with the military expansion (i.e., construction, expansion, and renovation projects and military training activities) may result in habitat loss and physical disturbance of federally listed endangered species and other federal trust species.
- Potential for harm to fragile ecosystems on Guam and in the Marianas from the introduction of invasive species due to increased traffic among the islands from the movement of personnel and materials. Such species include the BTS, flatworms, various insects, and some plants. The EIS/OEIS should outline inspection and sanitary procedures to prevent this movement.
- Existing control and containment activities at air and sea ports for BTS are insufficient to deal with the risk associated with the increased cargo and personnel movement from Guam to other vulnerable destinations. The issue "of utmost concern" is BTS interdiction and an effective, enforceable, and fail-proof procedure for inspecting all military cargo, personnel, and equipment entering the CNMI. The Navy must assure funding to sustain a 100% inspection rate of all cargo, vehicles, munitions, and household goods. Guam regulation protocols 505 and 506 should be incorporated into a BTS control plan to be included as part of the EIS/OEIS.
- Discuss streams and wetlands, including acreage and habitat type for mitigation areas, size and location of mitigation zones, and contingency plans.
- Concern that development along the shoreline has the potential to require removal of coastal marine and terrestrial habitat.

10.2.2 Alternative 1 Polaris Point (Preferred Alternative)

10.2.2.1 Onshore and Offshore

<u>Construction</u>

Vegetation

Alternative 1 Polaris Point (referred to as Alternative 1) is in a location of developed land (Figure 10.2-1). There would be no significant impacts to vegetation.

Wildlife

Terrestrial project areas are developed areas of the base with minimal bird habitat, particularly for the shorebirds that are some of the most common bird species in the general area. The Pacific golden plover, whimbrel, ruddy turnstone, and brown noddies were documented in the Polaris Point shoreline areas in 2008 and 2009 (Eggleston 2009; Vogt 2009). Approximately 1,200 ft (366 m) of shoreline would be used for the aircraft carrier berth. The shoreline in this developed portion of the base can be described as semi-natural, consisting of mixed sand and gravel beach (NOAA 2005). This is a small amount of shoreline habitat in relation to the total amount available in the Apra Harbor area of several kilometers according to NOAA (2005) mapping.

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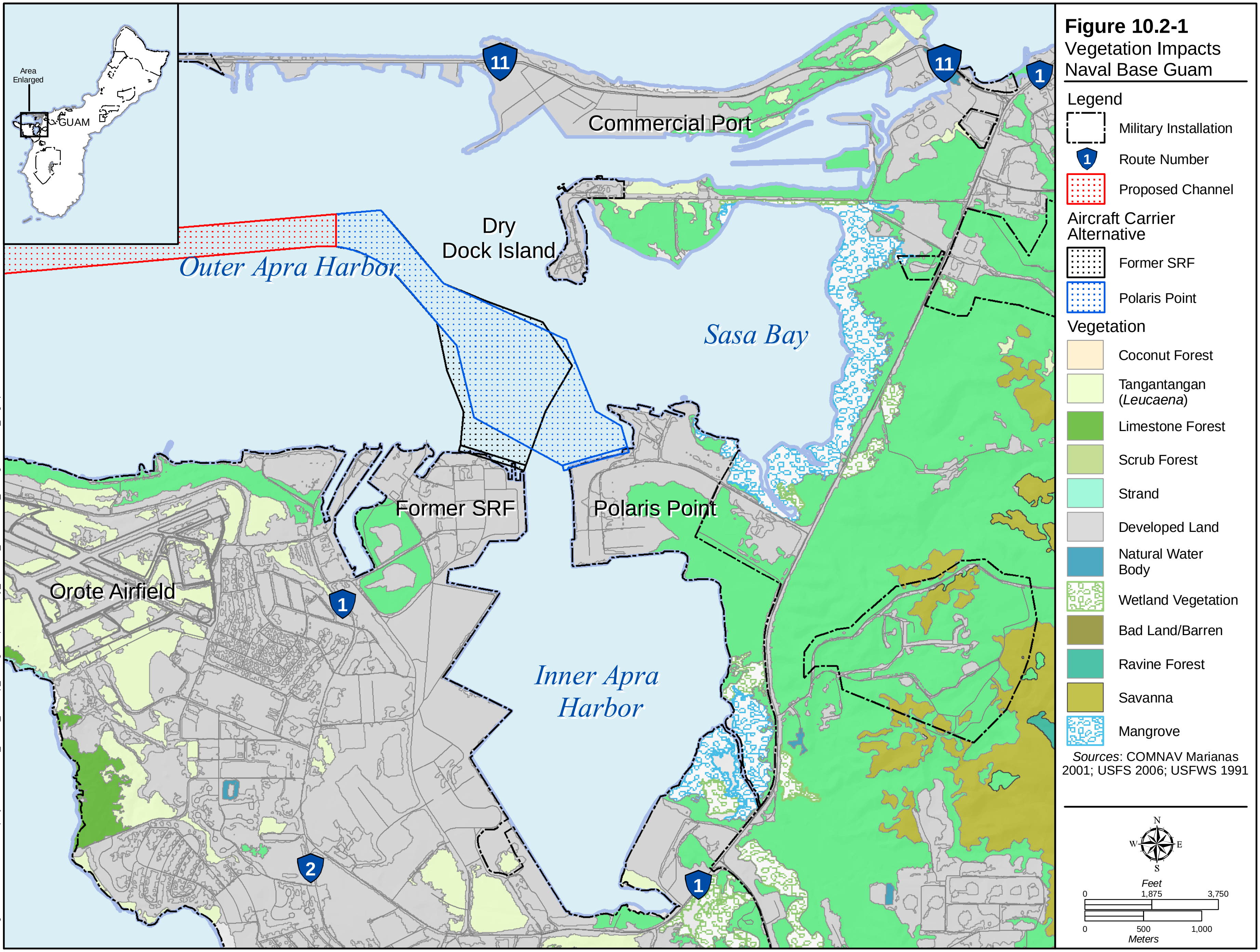

Figure 10.2-1
Vegetation Impacts
Naval Base Guam

Similar areas of habitat are common in the area and any individuals affected would move to these other areas. There would be no diminished population sizes or distributions of migratory birds or regionally important native animal species. Therefore, impacts to wildlife due to proposed removal of habitat from construction activities would be less than significant.

Potential direct impacts include noise and general construction activity, and indirect impacts include pollutants and dredging sedimentation. Noise and activity from construction would force shorebird species to move but there are other areas of suitable habitat nearby so that impacts would be less than significant. Noise and lighting from night-time dredging would impact migratory birds using or potentially using Sasa Bay and its extensive mangroves. The temporary dredging operation would adversely affect bird feeding, roosting, and nesting. In order to minimize impacts, BMPs would be implemented, including measures to limit nighttime lighting and noise from the dredging operations would be implemented (see Chapter 11, Marine Biological Resources in this Volume). Before the start of construction, all personnel involved would receive a briefing on special-status species potentially present and avoidance measures. In addition, during nighttime no vessels or any activity would be allowed within Sasa Bay, the limits of which are defined by the Government of Guam Sasa Bay preserve boundary. With implementation of these measures, impacts would be less than significant.

Fueling of project-related construction or operations vehicles, watercraft, and equipment could result in accidental releases of petroleum products that would migrate within Apra Harbor. The Sasa Bay mangrove area is over 4,000 ft (1,220 m) distant from the aircraft carrier dredging location (Figure 10.2-1). Required BMPs during construction would make it unlikely for a major spill to occur (see Chapter 4 on water resources and Chapter 11 on marine biological resources for further information). Fueling of project-related construction vehicles and equipment would take place away from the water when feasible. In addition, a spill prevention, control, and countermeasure plan would be in place. There would be time for small spills to be cleaned up before reaching the mangrove area. BMPs that are applicable during construction and operation would be detailed in required stormwater and spill contingency plans. These would prevent or control discharges and spills that may potentially occur during Navy activities within and adjacent to Apra Harbor. Absorbent materials and containment booms would be stored on-site to facilitate the clean-up of potential petroleum spills. Various booms, skimmers and sorbents are available to response agencies and the Navy has a waste oil barge (ITOPF 2000). Additional BMPs are listed in Volume 7. These procedures would result in less than significant impacts.

Proposed dredging, as well as shoreline activities, would result in suspension of sediments that could migrate to shorelines. However, modeling results show that sediments would largely be contained within silt curtains employed for the dredging, which are stipulated in a U.S. Army Corps of Engineers permit as required for construction and dredging; any sediment plume would not migrate into Sasa Bay or only a very short distance into the bay under all scenarios modeled (Ericksen 2009) and would not reach shoreline areas. Therefore, BMPs would include appropriate silt curtains and/or other silt containment measures would be used to enclose project areas where in-water activities would occur. In addition, there would be frequent monitoring of the effectiveness of the silt curtains. The sedimentation controls would minimize or eliminate the potential for impacts to the mangrove community and the associated species it supports and sea turtle nesting beaches. Therefore, there would be no impacts to wetlands from sedimentation.

Special-Status Species

Species present in the area are discussed below.

Mariana Common Moorhen. The ESA- and Guam-listed Mariana common moorhen is likely to use the wetland communities that are designated secondary moorhen habitat in the USFWS recovery plan. These areas are located northwest and southeast of the Sumay inlet (see Figure 10.2-2) (USFWS 1991) and at the Atantano wetlands east of the inner harbor. These wetland habitats (not mangroves) are not directly adjacent to the harbor and would be unlikely to be affected by suspended sediments or small petroleum spills that might result from the proposed action. Sasa wetlands behind the mangroves are also unlikely to be adversely impacted because the mangroves are 98 ft (30 m) to 574 ft (175 m) wide (Wiles and Ritter 1993). Furthermore, there are no records of moorhens in the freshwater emergent portions of Sasa wetland behind the mangroves (Wiles and Ritter 1993). Impacts would be less than significant. Potential direct impacts to the moorhen from construction include noise and activity. The moorhen may use the freshwater wetland area of the Sasa Bay wetlands well over a half-mile from where the dredging and construction would take place. Noise and activity from construction would be very unlikely to affect these areas. Potential impacts from project construction pollutants, if any, would be to the mangroves that are adjacent to the harbor waters and not the freshwater wetlands that are further inland. Impacts would be less than significant.*Sea Turtles*. Green and hawksbill sea turtles are known to utilize Apra Harbor (Figure 10.2-2) but there are few records documenting use of beaches. Hawksbill turtles occasionally approach the edges of the mangroves to feed on certain species of sponges (G. Davis, Pers. Comm. cited in Wiles and Ritter 1993) (see Figure 10.2-1). Green sea turtles have nested along the northern beaches of Orote Point and there is a 1997 record of hawksbill nesting in or around Sumay inlet (G. Davis Pers. Comm. cited in Grimm and Farley 2008). Polaris Point beaches are identified as potential nesting beaches (Grimm and Farley 2008), but there is no documentation that they have ever used Polaris Point beaches (Defley 2009). The potential for use of this beach is considered very low due to suboptimal beach morphology including the following features: minimal height above the water level, very narrow, and very rubble substrate from dredge spoil origins (Defley 2009). Direct impact to the potential nesting beaches from noise and artificial lighting is possible during dredging operations but pile driving noise at the berthing is unlikely to be a concern because the distance to the nearest known nesting beach at Sumay Cove is approximately 3,800 ft (1,158). Potential impacts on sea turtles from lighting during dredging operations would be minimized to less than significant through the use of special lights or lighting control and potential nesting beach monitoring. Although sea turtles are not known to be particularly sensitive to noise, beach monitoring would help to evaluate any potential effects from noise (Bartol et al. 1999; Ketten and Bartol 2006).

BMPs would be employed to protect sea turtles during dredging. Artificial or excessive lighting (especially short wavelengths such as ultraviolet, blue, green, and white) would be avoided during nesting and hatching seasons near Sumay Cove where possible, or shielded and/or filtered if they cannot be avoided and noise in the Sumay Cove area would be minimized. Additionally, during the period of nighttime dredging activities observers would monitor all potential nesting beaches and look for recent turtle tracks and signs of nesting activity. If a nest is observed, the area would be photographed and marked, and the date and location recorded; hatching from the nest would be monitored. During imminent hatching all activities that might affect the species would be halted. Any observed disturbance to the species that was noted during monitoring would be halted. Therefore, with implementation of BMPs, spill plans, and with adequate spill equipment and response capabilities, in addition to nest observation, impacts to terrestrial environments would be less than significant.

Formal consultation with USFWS and National Oceanic and Atmospheric administration (NOAA) in the context of Section 7 consultation will include the special-status species discussed above. Informal consultations have been ongoing since June 2007 concerning the proposed action.

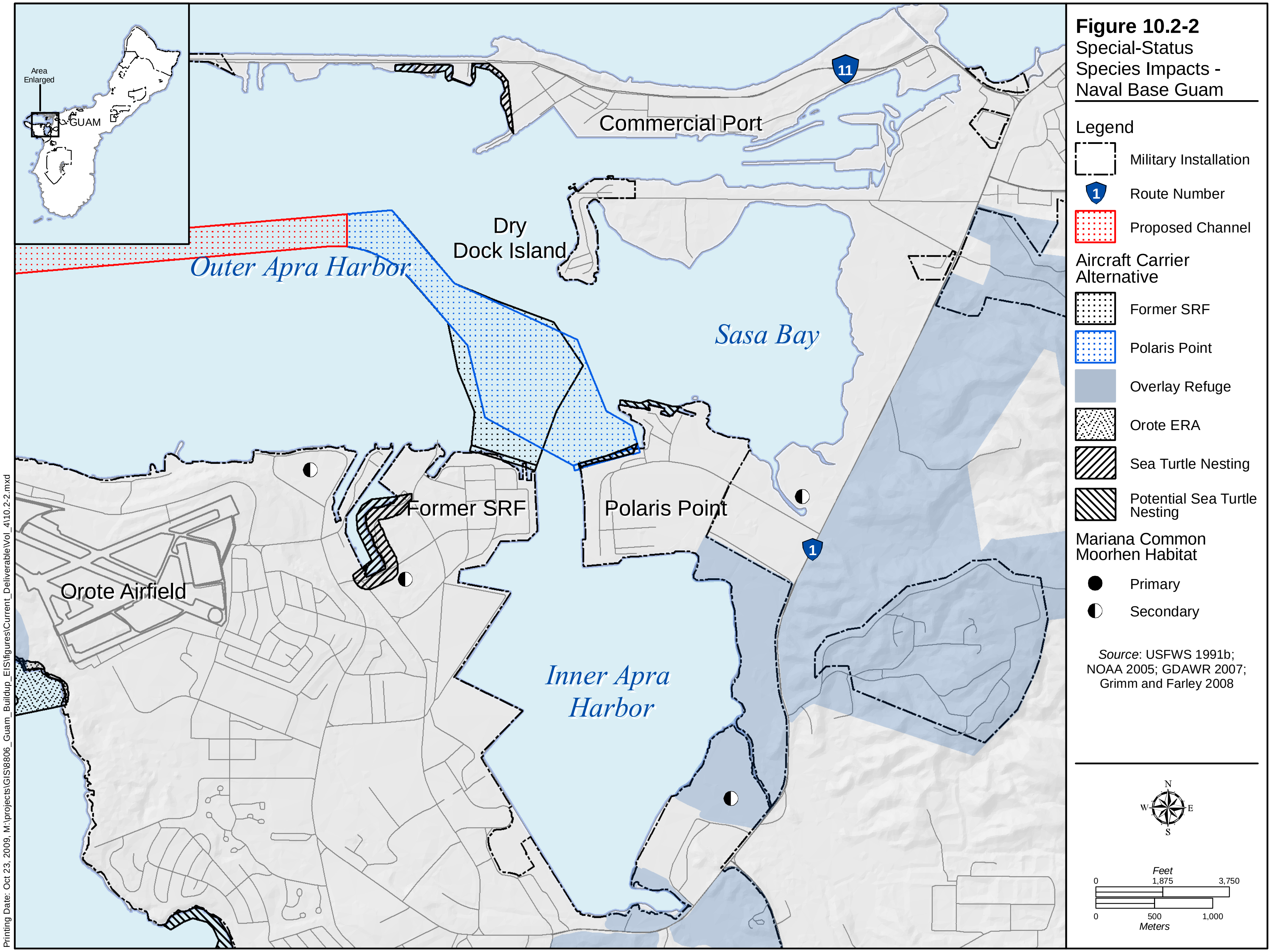

Figure 10.2-2
Special-Status Species Impacts - Naval Base Guam
Legend
Military Installation
Route Number
Proposed Channel
Aircraft Carrier Alternative
Former SRF
Polaris Point
Overlay Refuge
Orote ERA
Sea Turtle Nesting
Potential Sea Turtle Nesting
Mariana Common Moorhen Habitat
Primary
Secondary
Source: USFWS 1991b; NOAA 2005; GDAWR 2007; Grimm and Farley 2008
Feet
0
1,875
3,750
0
500
1,000
Meters
Area Enlarged
GUAM
Commercial Port
Dry Dock Island
Outer Apra Harbor
Sasa Bay
Former SRF
Polaris Point
Orote Airfield
Inner Apra Harbor
11
1
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Operation

Vegetation

There would be no direct or indirect impacts to vegetation. No native vegetation would remain in the area after construction.

Wildlife

Very few terrestrial species use the area proposed for the aircraft carrier berth because it is a developed area. Direct impacts to terrestrial wildlife at the aircraft carrier berthing area would be less than significant.

The aircraft carrier wharf area is over one-half mile from the Sasa Bay wetlands. Noise and activity from operations at the wharf would be very unlikely to affect these areas. Impacts would be less than significant. Ship operations out in the harbor would involve potential lighting and noise during nighttime operations. Lighting and noise from nighttime operations would temporarily impact migratory birds using or potentially using Sasa Bay and its extensive mangroves. As discussed below in Potential Mitigation Measures for Alternative 1 Impacts, during nighttime no vessels or any activity would be allowed within Sasa Bay, the limits of which are defined by the Government of Guam Sasa Bay preserve boundary in order to mitigate for impacts. With implementation of these measures, impacts would be less than significant.

Potential severe oil spills from proposed action under Alternative 1 are unlikely given the history of Navy operations in Apra Harbor. However, if a severe oil spill were to occur and reach the mangroves, substantial damage to that community would be likely. The Sasa Bay mangrove area is approximately 4,000 ft (1,220 m) from the proposed wharf area project locations. This wetland is a large natural wetland that fringes the bay in eastern Apra Harbor (see Figure 10.2-2). The mangroves and associated wetlands further inland are supported by flows of the Sasa, Laguas and Aguada Rivers. Various mangrove species occupy the edge of the bay and there is a small grove of nipa near the Laguas River (Moore et al. 1977). Other areas are occupied by dense, disturbed secondary forest that floods seasonally and in scattered areas are beds of reeds and an intertidal mudflat generally lacking in vegetation (Wiles and Ritter 1993). This wetland is important for aquatic organisms that are specific to mangroves, including molluscs, clams and oysters, fiddler crabs, land crabs and mangrove crabs. The mangroves are nursery grounds for various marine fishes (Wiles and Ritter 1993).

Mangrove responses to oil spills have been summarized by Hoff et al. (2002). Mangrove tree species themselves are highly susceptible to oil exposure and the lighter oils are more acutely toxic than heavier oils. Acute effects of oil (mortality) occur within 6 months of exposure and usually within a much shorter time frame (a few weeks). Common responses of mangrove tree species to oil include yellowing of leaves, defoliation, and tree death. Mangrove communities are complex but the available information suggests that the mangrove faunal community recovers faster than the mangrove trees themselves (Hoff et al. 2002).

The potential that oil spills at the berthing area would reach the mangroves is partly controlled by currents in Apra Harbor. Currents in the harbor are predominantly wind-driven, and occur as a two-layered system. Project area currents were found to be weak with surface currents at 4 to 8 centimeters per second (Eriksen 2009). Tidal effects within the harbor are small. The surface layer flows in the direction of the wind, and the deeper layer flows in the opposite direction. During typical trade wind conditions, surface flow is to the west out of the harbor, while deeper flow is to the east into the harbor. Surface flows to the west would move an oil spill away from the Sasa Bay mangroves. However, it is noted that during typhoons, when spills are more likely to occur, surface water movements may be towards the mangroves. Minimization measures for responding to spills are discussed below.

The capability to respond to any spill resulting from the proposed action is substantial. NOAA has developed a modeling tool for spills called the General NOAA Operational Modeling Environment and has developed specific information for Apra Harbor (NOAA 2009). Other minimization is discussed in the potential mitigation section.

The potential for sediment migration and petroleum spills reaching mangrove areas would be minimized through BMPs with avoidance and minimization measures. A spill prevention, control, and countermeasures plan would be in place. With the combined prevention, and response and cleanup capabilities, potential impacts to the mangrove areas and the migratory birds and other species it supports that would result from operations would be less than significant.

Special-Status Species

Species present in the area are discussed below.

- *Mariana C ommon M oorhen*. Noise and activity and incidental bird boat strikes during operations would have a less than significant effect on the moorhen because it is over one-half mile (0.8 km) to the nearest known habitat, wetlands to the west of Sumay inlet. Petroleum spills would be unlikely to impact moorhen habitat because the freshwater wetland habitat of the moorhens are behind shorelines or behind mangroves. Impacts to the moorhen would be less than significant.
- *Sea Turtles*. Sea turtles are known to use the marine environment in the area and these impacts are evaluated under the marine biological resources section, Chapter 11 of this Volume. As discussed under construction, the nearest known sea turtle nesting area is documented from Sumay Cove, approximately 3,800 ft (1,158 m) from the ship berthing area, so direct impacts to sea turtles from noise or lighting during construction or operations in the berthing area would be less than significant. Petroleum spills (see also the discussion under wildlife above) would significantly impact the potential sea turtle nesting area at Sumay Cove and possibly other potential sea turtle beaches. To protect sea turtles during dredging, artificial or excessive lighting (especially short wavelengths such as ultraviolet, blue, green, and white) would be avoided during nesting and hatching seasons near Sumay Cove where possible, or shielded and/or filtered if they cannot be avoided and noise in the Sumay Cove area would be minimized. Additionally, during the period of nighttime dredging activities observers would monitor all potential nesting beaches and look for recent turtle tracks and signs of nesting activity. If a nest is observed, the area would be photographed and marked, and the date and location recorded; hatching from the nest would be monitored. During imminent hatching all activities that might affect the species would be halted. Any observed disturbance to the species that was noted during monitoring would be halted. Therefore, with implementation of BMPs, spill plans, and with adequate spill equipment and response capabilities, in addition to nest observation, impacts to terrestrial environments would be less than significant.

Best Management Practices

To control and manage invasive species impacts, a Regional Micronesian Biosecurity Plan with Risk Analysis is currently being developed by the National Invasive Species Council in conjunction with USFWS, U.S. Department of Agriculture, Guam Division of Aquatic and Wildlife Resources, and other interested parties to facilitate a comprehensive approach to control invasive species export, import, and spread. This plan will address all aspects of the proposed military buildup. Further description is provided in the Volume 2, Chapter 10 discussion for Alternative 1. Specific protection measures included within this BMP that would apply to most actions proposed in this EIS/OEIS, including those associated with the aircraft carrier are:

- Compliance with the COMNAV Marianas Training Handbook, COMNAV Marianas Instruction 5090.10A and DoD Transportation Regulations (4500.9-R, Chapters 505 and 506) will be required for travel to and from training sites within the Mariana Islands Range Complex. The intent of these measures is to minimize the transport of potentially invasive plant and animal species (other than BTS which is addressed separately below) associated with transport of troops and personnel within and between Guam and the CNMI.
- The Navy would supplement and update the existing environmental education program for new arrivals. The updates may include (1) mandatory viewing of a new BTS educational video, (2) pocket guides with BTS information and personal inspection guidelines, and (3) assurance that BTS awareness extends from the chain of command to the individual marine and Sailor.
- The DoD, working in collaboration with the USFWS, and United States Department of Agriculture – Wildlife Services (USDA-WS) and Animal and Plant Health Inspection Service (APHIS) will decide how best to implement the Joint Region BTS Control Plan relevant to the proposed activities. The Navy strategy will involve three components: (1) avoidance, (2) minimization, and (3) offsetting measures. Specific aspects of these strategies are still in development and will be included in the USFWS Biological Opinion; however, the overall strategies are outlined in the following bullets.
- The Navy, in compliance with the DoD Defense Transportation Regulations, Chapter 505 protocols, is committed to implementing 100 percent inspection of all outgoing vessels and aircraft with dog detection teams. This could be supplemented by other pest control expertise (with appropriate USDA-WS BTS detection training and oversight) to meet 100 percent inspection goals for large-scale training activities. The Navy understands that inspection capacity limitations exist within the present USDA-WS interdiction capabilities. In the event of DoD-related, vehicles, and equipment leaving Guam without inspection, the Navy will notify the point of destination port or airport authorities.
- The Navy could support rapid response actions to BTS sightings within the CNMI and locations outside of the CNMI and Guam, specifically Hawaii, by working with USGS Biological Resources Discipline (BRD) in developing procedures and protocols that will support rapid action for a BTS sighting. The Navy could also establish temporary snake-free quarantine areas for cargo traveling from Guam to CNMI and locations outside of the CNMI and Guam. These BTS sterile areas would be subject to multiple night searches with appropriately trained interdiction (dog) teams. Temporary barriers are preferable to permanent exclosures because of the variable sizes needed for various training activities.
- The Navy would fund additional research to protect ESA-listed and recently delisted species from BTS. From the research and development list provided by the BTS Technical Working Group, the Navy proposes to fund the United States Geological Survey (USGS)-led project for integrating canine and human search teams, which will improve snake sightings in low density areas (e.g., to ensure a snake can be found if a sighting occurs on Tinian). Other promising research would also be funded such as chemical irritants to assist dog teams with

capture of detected snakes. If successful, this method enhancement would fully integrate three tools: human searching, dog-aided searches, and snake repellents/irritants.

- The movement and spread of invasive plant and animal species within Guam and to other locations from Guam is a potential indirect impact resulting from actions proposed. Invasive species might be imported to Guam through shipment of supplies and equipment. This could result in significant impacts to all special-status species however, to prevent potentially invasive species from being imported to or exported from Guam from all actions proposed, a comprehensive invasive species program, as discussed above, would be implemented as a BMP. With implementation of this minimization measure, impacts from invasive species would be less than significant.

As mentioned previously, in addition to the BMPs discussed above, additional BMPs are listed and discussed in Volume 7.

Table 10.2-1 summarizes Alternative 1 impacts.

Table 10.2-1 Summary of Alternative 1 Impacts

Area	*Project Activities*	*Project Specific Impacts*
Apra Harbor Polaris Point	Construction	Construction on land would occur in an area already developed with minimal or no native vegetation; wildlife use of this terrestrial area is also minimal or if used it is by species widespread on Guam; the nearest area with abundant wildlife is the Government of Guam Sasa Bay preserve over 4,000 ft (1,220 m) distant; noise and activity from night-time dredging of Apra Harbor would result in significant disturbance to migratory birds in terrestrial areas of Sasa Bay but would be mitigated to less than significant; potential impacts from excessive lighting during dredging on the sea turtle nesting area at Sumay Cove would be minimized to less than significant.
	Operation	There would be potential significant direct impacts to wildlife at Sasa Bay from noise and light, mitigated to less than significant; there would be potential significant impacts to sea turtles at Sumay Cove and other beaches from potential petroleum spills, minimized to less than significant.

10.2.2.2 Alternative 1 Potential Mitigation Measures

The following potential mitigation measure would be required for Alternative 1.

- During nighttime no vessels or any activity would be allowed within Sasa Bay, the limits of which are defined by the Government of Guam Sasa Bay preserve boundary in order to mitigate for impacts.
- Conduct sea turtle natural history studies to better understand the species and benefit long-term military mission planning.
- The 5-Step Hazard Analysis and Critical Control Point planning method (an international standard, ASTM E2590-08) for reducing or eliminating the spread of unwanted species would be used for high-risk activities (to be identified in the Biosecurity Plan) and would be required for all construction project sites.

10.2.3 Alternative 2 Former Ship Repair Facility (SRF)

10.2.3.1 Onshore and Offshore

All proposed activities under Alternative 2 Former SRF (referred to as Alternative 2) are the same as those proposed under Alternative 1 except that aircraft carrier berthing would occur at the Former SRF and not Polaris Point (see Table 10.2-1). All proposed wharf and building construction actions under this alternative would be conducted in areas that are already developed and are currently used for existing Navy operations.

<u>Construction</u>

Vegetation

Impacts would be the same as for Alternative 1.

Wildlife

Impacts would be the same as for Alternative 1.

Special-Status Species

Mariana Common Moorhen. Impacts to the Mariana common moorhen would be the same as for Alternative 1.

Sea Turtles. The potential sea turtle nesting area Sumay Cove is approximately 1,800 ft (549 m) from the proposed aircraft carrier berthing site. Although a recorded nesting has only occurred once (in 1997) and no activity has been recorded since that time, it is possible it could be used again. Artificial light sources at night during construction that shine on a nesting beach could result in a number of impacts including: deterring adult females from exiting the water to lay eggs on the beach, causing abandonment of nesting attempts, disorienting adult females after nesting, or disorienting hatchlings. BMPs would be used to eliminate or reduce the impacts of artificial night lighting such as through the use of special or hooded lights. Observers would monitor potential sea turtle nesting at any beaches in the vicinity that are determined to be viable potential nesting beaches and activity and nests would be recorded and monitored through hatching.

Construction at the berthing area would generate noise. The Navy recognizes that there are many on-going and recent past studies on the subject of potential exposures to sea turtles from pile driving actions. Further research and validation of these studies are necessary prior to being able to determine the applicability of the methodologies and results to the proposed action within this EIS/OEIS. The Navy will continue to research these studies and where appropriate, incorporate and apply methodologies, analysis, and results to the on-going impact analysis to sea turtles from the proposed action. Applicability of these studies will also be coordinated through consultations with the National Marine Fisheries Service. The Final EIS/OEIS will contain revised sea turtle impact analysis as developed through the process described above. The monitoring that would be in place for potential sea turtle nesting areas would help to determine if there were any effects and, if necessary, noise reduction methods would be employed. With these BMPs, impacts to sea turtles would be less than significant.

The same BMPs for Alternative 1 for construction at the berthing area would be employed to protect sea turtles during dredging.

<u>Operation</u>

Vegetation

Impacts would be the same as for Alternative 1.

Wildlife

Impacts would be the same as for Alternative 1.

Special-Status Species

Impacts to special-status species would be similar to those described for Alternative 1. An additional potential impact would be as described below.

Sea Turtles. Artificial lighting during operations would potentially affect Sumay Cove in a similar manner to that described for construction above. Measures for minimization would be employed to eliminate or reduce the impacts of artificial night lighting such as through the use of hooded lights. Observers would monitor potential sea turtle nesting at any beaches in the vicinity that are determined to be viable and activity and nests would be recorded and monitored through hatching. Any disturbances noted would be halted or corrected. . Lighting would be controlled during operations, using the same methods as during construction. With these measures, impacts to sea turtles would be less than significant.

Table 10.2-2. Summary of Alternative 2 Impacts

Area	*Project Activities*	*Project Specific Impacts*
Apra Harbor Former SRF	Construction	Construction on land would occur in an area already developed with minimal or no native vegetation; wildlife use of this terrestrial area is also minimal or if used it is by species widespread on Guam; the nearest area with abundant wildlife is the Government of Guam Sasa Bay preserve over 4,000 ft (1,220 m) distant; noise and activity from night-time dredging of Apra harbor would result in significant disturbance to migratory birds in terrestrial areas of Sasa Bay but would be minimized to less than significant; there would be potential significant direct impacts to sea turtles from artificial lighting and noise, minimized to less than significant.
	Operation	There would be potential significant direct impacts to wildlife at Sasa Bay from noise and light, minimized to less than significant; there would be potential significant direct impacts to sea turtles from artificial lighting and noise, minimized to less than significant.

10.2.3.2 Alternative 2 Potential Mitigation Measures

Mitigation measures would be the same as those previously described for Alternative 1.

10.2.4 No-Action Alternative

Existing terrestrial biological resources would remain unchanged under the no-action alternative.

10.2.5 Summary of Impacts

Table 10.2-3 summarizes the potential impacts of each action alternative and the no-action alternative.

Table 10.2-3. Summary of Impacts

Alternative 1	*Alternative 2*	*No-Action Alternative*
Vegetation		
NI	NI	NI
Wildlife		
SI-M • Significant direct impact to Sasa Bay wildlife from noise and activity during nighttime dredging and during nighttime operations, minimized to less than significant	SI-M • Significant direct impact to Sasa Bay wildlife from noise and activity during nighttime dredging and during nighttime operations, minimized to less than significant	NI • No impacts to terrestrial biological resources
Special-Status Species		
SI-M • Significant potential direct impacts to wildlife at Sasa Bay, minimized to less than significant • Significant potential direct impact to sea turtles at Sumay Cove beach from night lights and noise during construction, minimized to less than significant	SI-M • Significant potential direct impacts to wildlife at Sasa Bay, minimized to less than significant • Significant potential direct impact to sea turtles at Sumay Cove beaches from night lights and noise during construction and operation, minimized to less than significant	NI • No impacts to terrestrial biological resources

Legend: SI-M = Significant impact mitigable to less than significant, NI = No impact

10.2.6 Summary of Potential Mitigation Measures

Table 10.2-4 summarizes the potential mitigation measures to compensate for the impacts.

Table 10.2-4. Summary of Potential Mitigation Measures

Alternatives 1 and 2	*No-Action Alternative*
• None	• None
• No ships would be allowed to enter Sasa Bay at night • Conduct sea turtle natural history studies to better understand the species and benefit long-term military mission planning • Use Hazard Analysis and Critical Control Point planning for high-risk activities and construction projects	• None

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CHAPTER 11.
MARINE BIOLOGICAL RESOURCES

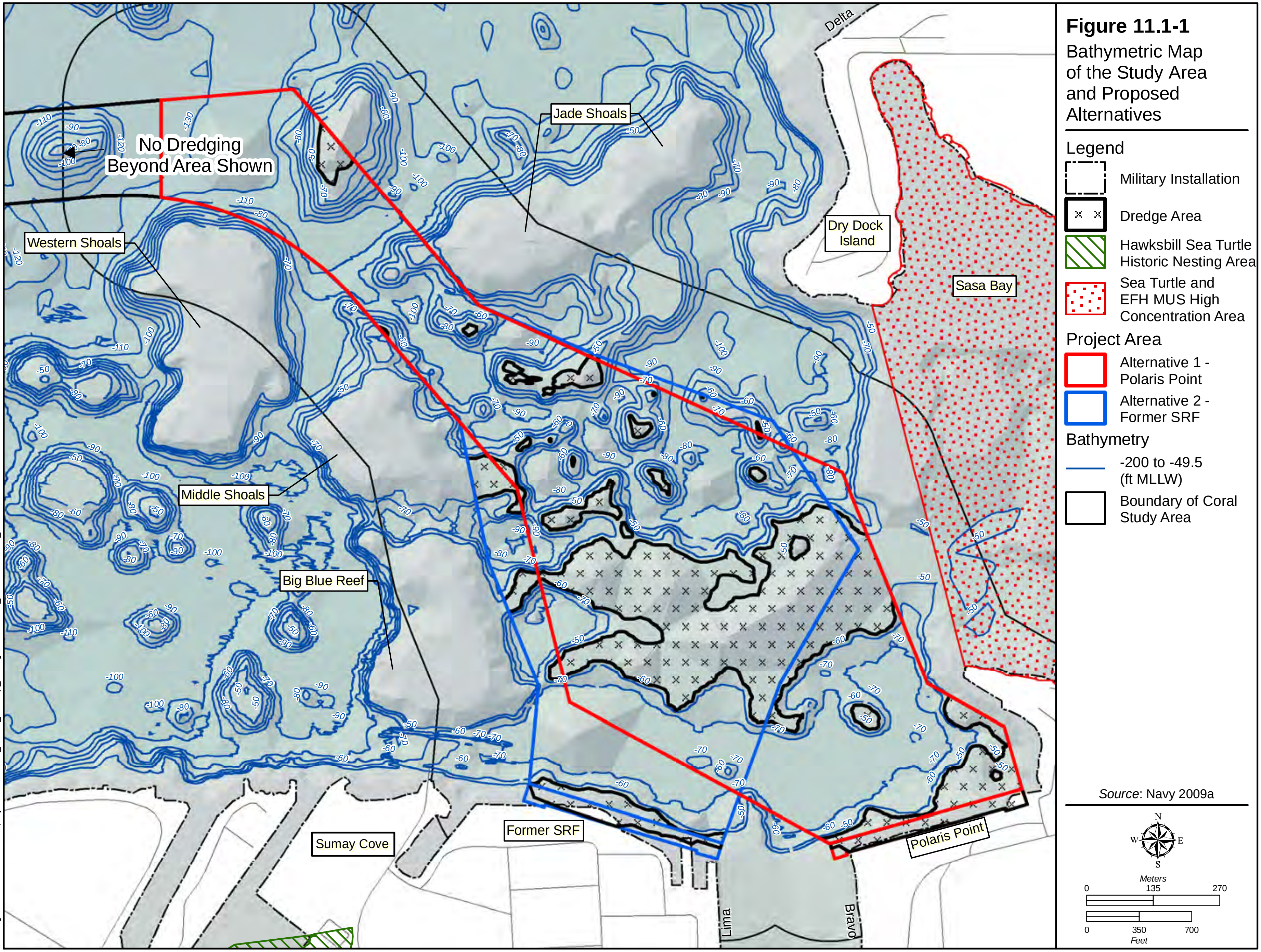
11.1 AFFECTED ENVIRONMENT

A description of the potentially affected environment for marine biological resources in Inner Apra Harbor is presented in Volume 2, Chapter 11. This chapter describes the potentially affected environment for marine biological resources in Outer Apra Harbor, where the proposed aircraft carrier berthing would occur. The Marine Biological Resources chapters of Volume 2 and Volume 4 should be read to understand the complete status of the existing marine environment in both Inner and Outer Apra Harbor.

Figure 11.1-1 shows a bathymetric map of the project area and the proposed aircraft carrier berthing alternatives (Alternative 1 Polaris Point and Alternative 2 Former Ship Repair Facility [SRF]). The proposed channel and turning basins are bordered by several large “patch reefs” or “shoal areas” that consist of shallow, flat-topped, and steep-sided features. The largest three of these reefs are Jade Shoals, Western Shoals, and Big Blue Reef (shoal areas). These reefs all consist of relatively flat and shallow upper surfaces that are covered primarily with muddy sand and rubble. The western facing slopes of Western Shoals and Big Blue Reef are almost completely covered with living corals to a depth of approximately 50 to 60 feet (ft) (15 to 18 meters [m]), where the slopes intersect the channel floor. Coral cover on the eastern slopes of these two reefs is much less compared to the western slopes. The Jade Shoals site, located to the northwest of Western Shoals and Big Blue Reef, does not show the same degree of asymmetrical coral growth on the western edge, with most of the shoal ringed by slopes with high coral cover (Navy 2009a).

The area demarcated as the project area and turning basin, including the proposed wharf area, presently does not contain any of the shallow shoal patch reefs. This area was dredged in 1946 to allow safe access to the newly completed Inner Apra Harbor. As a result, the shallowest depth within the channel and turning basin is about 40 ft (12 m). It is likely that the large flat area in the southern end of the turning basin was another shoal area similar to the surrounding reefs prior to the 1946 dredging. Dredging likely removed the shallow area, resulting in the present configuration. While the top of the deep reef is essentially flat at a depth of approximately 40 ft (12 m), the remaining edges slope relatively steeply to the channel floor (Dollar et al. 2009). The elapsed time since dredging of the original channel suggests that much of the coral within the depth zone to be dredged for the aircraft carrier project (-49.5 ft [-15 m] mean lower low water [MLLW] plus 2 ft [0.6 m] of overdredge) is regrowth, which would indicate a community with a maximum age of 62 years (Dollar et al. 2009).

Construction of the aircraft carrier wharf would involve placing fill material in approximately 3.6 acres (ac) (1.5 hectares [ha]) of nearshore and intertidal waters for either alternative. As described by Smith (2007), a substantial percentage of the coral at all depth contours off Polaris Point was growing on metallic and/or concrete debris, was of marginal quality, and showed the greatest signs of stress. This stress appeared to be due in part to high levels of total suspended solids (TSS) coming from Inner Apra Harbor.



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11.1.1 Navy Coral Assessment Methodology

As coral and coral habitat are extremely important resources, various reporting procedures are necessary to assess the extent of damage to or loss of these fragile resources when it occurs. When coral reefs held in United States public trust are injured by incidents such as vessel groundings or oil spills, a Natural Resource Damage Assessment (NRDA) may be conducted to quantify the resource service loss. Coral cover has been used as an indicator metric to represent lost services in Habitat Equivalency Analyses (HEA) for determination of compensatory restoration. Depending on the injury and habitat, however, lost services may be more comprehensively represented by alternative approaches such as composite metrics which incorporate other coral reef community characteristics, or a resource scale approach utilizing size-frequency distributions of injured organisms. Viehman et al. (2009) describe the evolving state of practice for capturing coral reef ecosystem services within the NRDA context, explore applications and limitations of current metrics, and suggest future directions that may increase the likelihood that NRDA metrics more fully address ecosystem services affected by an injury.

Coral reef restoration is currently an evolving field with new research methods continuously being developed. Few, if any, injuries to coral have been followed from impact to complete recovery as part of the NRDA process. Consequently, expert estimates about whether a site will recover in 30, 50, or 300 years, or not at all, are necessarily imperfect, but bear the responsibility of being the best available information at present. Almost all of the approaches detailed in Viehman (2009) rely heavily on expert opinion, which is unlikely to be universally accepted, and consequently, contributes to the adversarial nature of determining the extent and costs of restoration. Thus, the Viehman (2009) paper also provides encouragement for coral reef NRDAs to become a process that is objective (quantitative) rather than the current, often subjective process. As more informative data emerge from research, restoration monitoring, and HEA, the application should advance the NRDA process in conjunction with coral reef restoration science.

In its simplest form, the objective of coral reef restoration conducted through the NRDA process is to restore the services lost from the injuries caused by the responsible party. It is often difficult to know whether the trustee actions are sufficient to reach this objective given the current state of reef restoration science and NRDA practice. While the practical and measurable goals of restoration are to rapidly re-create the structure and functions of an injury habitat, the approaches for realizing this goal are continually evolving. There is a delicate balance between broad, general operating principles and site specificity. Careful selection of the theoretical NRDA approach (HEA-based using two-dimensional coral cover or composite metrics, or REA-based using size-frequency distributions) and metrics appropriate to both the degree and extent of injury and of habitat type will serve as a vital link between the damage assessment, recovery modeling, compensatory calculations, and recovery monitoring. An immense amount of information is necessary to fully understand the type and magnitude of ecological services provided by the injured coral reef in its baseline condition, the manner in which those ecological services will recover following the injury, and the relationship of those services with those provided via compensatory restoration projects. A nearly complete understanding of coral reef ecological services is required to objectively determine whether selected compensatory restoration projects adequately restore lost services for a given injury (Viehman 2009).

The description of baseline conditions of the coral and coral reef habitat within Apra Harbor relies on five recent studies summarized below. Those studies that were prepared specifically for this proposed action are included in Volume 9.

i. *Assessment of Benthic Community Structure in the Vicinity of the Proposed Turning Basin and Berthing Area for Carrier Vessels Nuclear (CVN) Apra Harbor, Guam* (Dollar et al. 2009) included in Volume 9, Appendix J.

   Survey data were collected from 67 transect points (Figure 11.1-2) to provide preliminary evaluation of the composition of benthic community structure within the area that would be affected by the proposed aircraft carrier wharf construction and operation. This was the primary source of affected environment and impact assessment information. The data were also used for inputs into the Habitat Equivalency Analysis (HEA). Volume 9, Appendix J provides detailed descriptions of survey methods, coral stress assessment, and remote sensing analysis. This report was peer reviewed by eight scientists and these reviews are also in Volume 9, Appendix J.

ii. *Ecological Assessment of Stony Corals and Associated Organisms in the Eastern Portions of Apra Harbor, Guam* (Smith 2007).

   The primary objective of this survey was to quantitatively assess the distribution and abundance of Scleractinian (stony) corals within seven selected portions of Apra Harbor. Data collection included determination of the presence of coral taxa, frequency of occurrence along transects (utilizing point-quarter methods), relative densities, size distribution, percentage of coral (hard and soft) coverage, and apparent "health." Qualitative and semi-quantitative data were also gathered on selected species of macroalgae and macrobenthic invertebrates, finfish, and sea turtles. Consideration was also given to Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPCs).

iii. *Habitat Equivalency Analysis (HEA) and Supporting Studies* (Navy 2009a).

   This study is included in its entirety in Volume 9, Appendix E. This document was peer reviewed by eight renowned coral scientists and the reviews are included in Volume 9, Appendix J. There are five sections (A through F) in the report and Sections B through F are considered stand-alone technical reports as referenced below:

   A. *Introduction*
   B. *Reconnaissance Surveys of the Marine Environment, Eastern Outer Apra Harbor, Guam, and Baseline Assessment of Marine Water Chemistry* (MRC 2009a).
   C. *Assessment of the Affected Marine Environment, Outer and Inner Harbor, Guam* (MRC 2009b).
   D. *Marine Ecosystem Impact Analysis CVN Project Outer Apra Harbor, Guam* (MRC 2009c).
   E. *Current Measurement and Numerical Model Study for CVN Berthing* (SEI 2009).
   F. *Habitat Equivalency Analysis (HEA) Mitigation of Coral Habitat Losses* (IEI 2009).

iv. *Quantitative Assessment of the Reef Fish Communities in Apra Harbor, Guam (University of Guam* [UoG] 2009)

   This study is also included in Volume 9, Appendix J. This assessment consisted of underwater surveys (Figure 11.1-2) to quantitatively assess species richness, abundance, and biomass of reef fish communities within and adjacent to the proposed project area. Multivariate analysis was performed on the data collected to determine groupings of fish communities based on depth/habitat gradient, diversity and biomass.

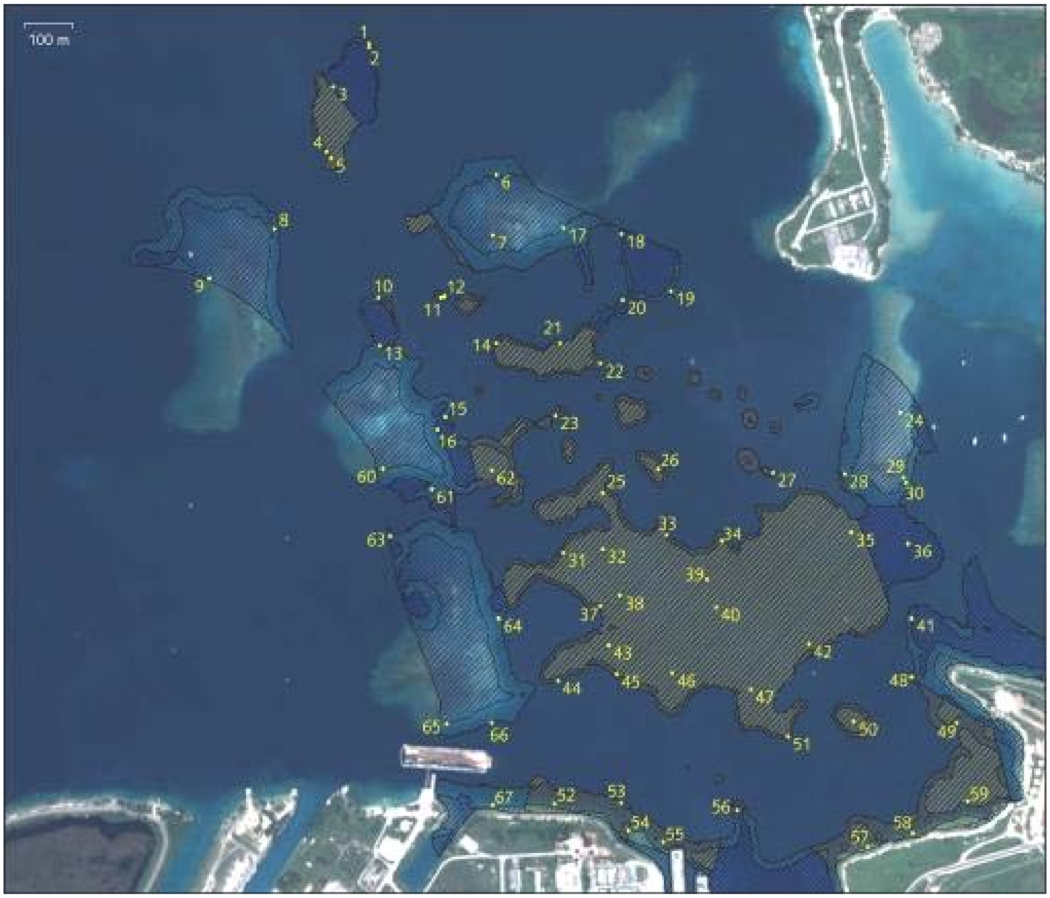

Figure 11.1-2. Outer Apra Harbor Showing 67 Data Points/Transect Stations for Coral Habitat Surveys

11.1.1.1 Resource Agency Preferred Methodology

The fifth study provided in Volume 9, Appendix J, *Comparison of a Photographic and an In Situ Method to Assess the Coral Reef Benthic Community in Apra Harbor, Guam* (Minton et al. 2009), documents a joint-resource agency (U.S. Fish and Wildlife Service [USFWS], Guam Coastal Management Program, UoG, and National Marine Fisheries Service [NMFS]) effort to compare an *in situ* quadrat method (ISM) and a photographic quadrat method (PM) using eight different data types collected on a heterogeneous coral reef in Apra Harbor. It is provided as supplemental material, but did not provide data for this EIS/OEIS.

11.1.2 Marine Flora, Invertebrates, and Associated EFH

Similar to the assessment in Volume 2, this chapter provides a description of marine flora and macroinvertebrates found within the ROI, including a more detailed description of coral and coral reef ecosystems. Organisms described include macroalgae (or seaweeds), sea grasses, emergent vegetation (plants that are rooted in the substrate beneath water, but grow tall enough to protrude above water or have leaves that float on the water), gastropods (snails), cephalopods (squid and octopus), crustaceans (lobsters and crabs), and sponges. These taxonomic groups are also included within the managed fisheries in the Western Pacific under five fisheries management plans (FMPs): (1) coral reef ecosystems (2) bottomfish and seamount groundfish, (3) crustaceans, (4) precious corals, and (5) pelagic species. Each of these FMPs identifies specific management unit species (MUS) managed under the respective plan (Western Pacific Regional Fisheries Management Council [WPRFMC] 2005). Essential Fish Habitats defined under each FMP are described further below. Coral and coral reef ecosystem impacts are addressed under the EFH environmental consequences section.

The structure of the marine benthic environment off the eastern shoreline in the vicinity of the aircraft carrier channel and turning basin is composed primarily of three major biotopes and eight secondary biotopes. A biotope is defined as an area that is relatively uniform in environmental conditions and in its distribution of its animal and plant life (i.e., also benthic community structure). These three major areas are: 1) large flat-topped reefs, 2) dredged reefs in the turning basin and entrance channel, and 3) soft sediment areas in the turning basin and entrance channel (Dollar et al. 2009). The eight secondary biotopes are described below with representative photos depicting examples of each secondary biotope. The photo captions also contain the approximate percentage of the proposed dredge area that would contain that particular type of biotope. The photos are not necessarily representative of conditions throughout each secondary biotope.

11.1.2.1 Eight Secondary Biotopes of the Survey Area

Data on biotopes in the ROI were summarized from Dollar et al. (2009). The survey area consists of a heterogeneous mix of a variety of several biotopes ranging from mud flats to algal meadows to a wide structural array of reef coral communities (in terms of both species assemblages and physical forms). Bray-Curtis similarity indices revealed seven distinct community groups with respect to the "general classes" of transect cover (e.g., algae, coral, sponges, sediment). When "detailed classes" containing all identified species and substratum types were analyzed, 16 distinct community groups emerge. Descriptions of these biotopes are summarized below. Transect locations are shown on Figure 11.1-2.

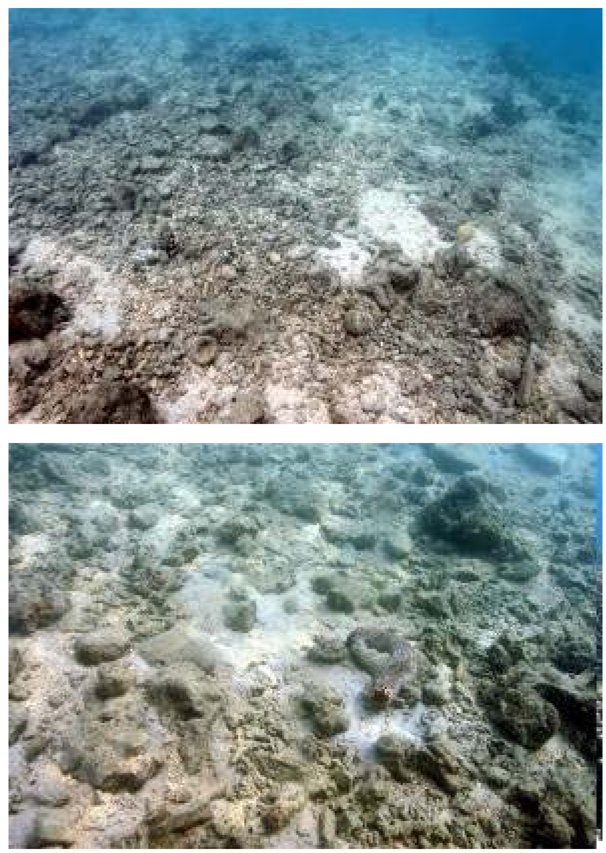

Figure 11.1-3. Sand-rubble bottom (0% coral coverage) at Transects 58 (upper) and 67 (lower) (both potential direct dredge impacted areas; 35% of the dredge area includes this bottom type).

<u>Rubble, Mud and Sand</u>

Many regions of the aircraft carrier berthing study area were not colonized by any epi-benthic biota. Approximately 46 ac (17 ha) totaling 35% of the total area fell within this category. Benthic cover in these areas consisted of plains of fine grained sand-mud (90% of the surficial sediments were very fine sand sized or coarser, and had a median grain size of approximately 0.1 mm [very fine to fine sand]) (NAVFAC Pacific 2006), primarily composed of calcium carbonate (Figure 11.1-3). Numerous burrows and mounds from infaunal organisms punctuated most of the sand-mud regions. In addition, the surface of the sediment was often covered with thin films of bacteria or micro-algae.

In addition to the sand-mud plains, some areas of the bottom were covered uniformly with a layer of mixed rubble and coarse sand. Most of the rubble is recognizable as dead coral fragments. The harbor floor associated with and fronting Polaris Point (Transects 57, 58, 35) and the Former SRF (Transects 52, 53, and 54), was composed almost entirely of rubble and sand (Figure 11.1-3).

Algal Beds

In addition to hermatypic corals, the other dominant benthic organisms within the study area are macroalgae, which consists of approximately 40% of the identified benthic cover. While there are biotopes that consist of "coral-algal mixes" (see mixed coral-algae below), there are also areas of essentially pure stands of algae. Three genera of algae are most prevalent, and in some areas are present in nearly monospecific meadows that extend over hundreds of square meters. The most common plant appears to be the brown alga *Padina* spp, which was found throughout the survey area. This alga is characterized by large, calcified, fan-shaped blades that grow in multiple clusters attached to rubble, sand or hard bottom (Figure 11.1-4). Also abundant is the calcareous green alga *Halimeda* spp., with fronds consisting of vertical series of connected flat segments. Much of the *Halimeda* observed in Apra Harbor was growing in dense beds over sandy bottoms. In these areas white calcified remains of plant segments form a component of the sandy substratum. The third dominant alga is *Dictyota* spp. which occurs as narrow, spirally twisting branches that are split on the ends. *Dictyota* was often seen in mats of mixed algae and mixed coral-algae, and was particularly abundant over sand-covered bottom.

Figure 11.1-4. Algae dominated areas of the CVN study area (0% coral coverage) include mats of *Padina* spp. (40% of the dredge area includes an algal bottom type).

Mixed Coral-Algae

Several biotopes which comprise the majority of benthic cover consist of combinations of two or more of the "pure" communities described above. One of these combination biotopes can be termed "mixed coral-algae." One such combination consisted of hemispherical heads of *Porites l utea* amid stands of *Padina* spp. on the shallow tops and sides of patch reefs (Figure 11.1-5). In the

Figure 11.1-5. Representative areas of mixed algae and coral on Transect 17 (a potentially indirectly [siltation only] impacted site) is representative of an area with 30% to <50% coral coverage.

deeper areas, particularly on the tops of the dredged platforms and pinnacles in the turning basin, combined algal-coral communities occurred in a variety of forms, including films of benthic bacteria on mud surfaces, short turfs on rubble fragments, and mats of *Halimeda* and *Dictyota* interspersed with colonies of *Porites*. A unique coral-algal assemblage occurred on Transect 9, where stands of living *Acropora aspera* were interspersed with sectors of dead branches encrusted with a layer of algal turf and cyanobacteria.

Patch Reef Margins – P. lutea Zone

P. l utea generally occurs as hemispherical or helmet shaped colonies and is a major component of benthic cover on the margins of the tops of patch reefs in the aircraft carrier berthing study area. Water depth of these flats is the shallowest of all biotopes, and is generally in the range of 3-7 ft (1-2 m). Within this zone, colonies of *P. lutea* are often densely packed together with adjacent colonies in contact with one another. Other dominant corals in this biotope included *P. cylindrica*, occurring in branched clusters, and *P. rus*, which occurred primarily of flat-topped clusters of densely packed branches (Figure 11.1-6). Moving off the flat surfaces of the patch reefs, community structure rapidly changes to a more uniform cover of *P. r us*, as described in the sections above.

Figure 11.1-6. Benthic cover of upper edges of patch reefs on Transect 21 (a potentially directly [dredged] impacted site) dominated by hemispherical colonies of *P. lutea* (represents 70% to <90% coverage) – 4.8% of this bottom type may be indirectly impacted.

Patch Reef Margins – *A. aspera* Mat

Transect 9, located on the top of the northwestern edge of Western Shoals, consisted entirely of a contiguous mat of the branching coral *A. aspera* (Figure 11.1-7). The field of *A. aspera* was limited to the top of the patch reef, and did not extend beyond a depth of approximately 3-7 ft (2-3 m), below which the benthic community was dominated by *Porites* species (Figure 11.1-7). This biotope was not observed in the vicinity of any of the other transects in the study area. The uniqueness of the biotope may be a result of orientation of the western edge of Western Shoals to the long axis of Outer Apra Harbor. During surveys, swells entering the Harbor mouth were breaking at the transect location. A distinctive characteristic of the *A. aspera* mat was the occurrence of large sections of dead branches that were encrusted with algae or cyanobacterial mats. As the dead portions of

Figure 11.1-7. Monospecific field of *A. aspera* with black sponge smothering coral located at Western Shoals, Transect 9 (a potentially indirectly [siltation only] impacted site).

these *Acropora* stands were completely intact, the cause of mortality cannot be attributed to any type of physical forces applied to the fragile branching matrix.

In addition, there were distinct boundaries between areas of apparently healthy branches and patches of dead branches. Within the dead patches, there were also clumps of "new" live branches with no sign of any abnormalities. The likely cause of the patchy mortality of the *Acropora* field is infestation of a black sponge that occurred within the coral thicket, completely covering branches (refer to Figure 11.1-7). While the smothering of live coral by the black sponge may be the cause of mortality, the presence of the sponge appeared ephemeral, as it was not evident in much of the area of algal-encrusted coral skeletons. In addition, the presence of patches of apparently healthy coral resulting from either planular settlement or vegetative spreading within the thickets of dead branches suggests that there is an ongoing dynamic process of coral-sponge interactions of mortality and recovery within the biotope (refer to Figure 11.1-7).

<u>Mixed Coral Communities</u>

Coral community structure on some areas of the flatter sections of patch reef slopes as well as deep reef flats consisted of higher cover of a more diverse community than in the areas dominated solely by *P. rus*. Along with *P. rus*, two branching species, *Porites cylindrica (P. cylindrica)* and *Pavona cactus*, comprise substantial proportions of bottom cover. *P. cylindrica* occurs as thin rounded upright branches, with individual branches separated by an encrusting matrix base. *Pavona c actus* occurs as thin, upright, contorted fronds, each attached to a solid base. Both of these corals grow in interconnected stands that can extend over large areas of the reef surface. In particular, on Transect 15, located on the eastern edge of the unnamed patch reef between Western Shoals and Big Blue Reef, *Pavona cactus, P. cylindrica*, and *P. rus* formed mixed complexes with substantial contributions from all three species. Thus, three of the four most abundant corals encountered in the aircraft carrier berthing area surveys (*P. rus, P. cylindrica* and *Pavona c actus*) often occur in what can described as indeterminate growth forms, in the form of supracolonies or spreading mats composed of multiple branches or fronds in the vicinity of Transect 15.

<u>*Porites rus* "Supracolonies"</u>

By far, the most common coral in Apra Harbor is *P. rus*. Colonies of *P. rus* can be massive, columnar, laminar, or branching and encrusting, and single colonies can contain multiple growth forms (Figure 11.1-8). It is also common to see growth forms that fit under the definition coined by Pichon (1978) of "supracolonies." By this definition, one "colony" is a formation originating from one planula. As new colonies in close proximity grow in size, they fuse. Such a phenomenon, when constantly repeated, leads to a continuous living coral formation, composed of elements belonging to different generations. These conglomerate colonial structures, or supracolonies, may extend over tens or hundreds of square meters. In some instances supracolonies may be so large as to represent a whole ecological identity (i.e., a sub-community).

While *P. rus* occurs throughout the survey area, it is particularly widespread on the outer (with respect to the aircraft carrier entry channel and tuning basin) sloping sides of the four large patch reefs (Jade, Western, Big Blue, and the unnamed reef). *P. rus* occurs in a variety of contiguous supracolony structural forms that dominate the benthic surface. Most of these structures are composed of multitudes of overlapping thin semi-circular plates. Supracolonies have the form of vertical walls, massive dome-shaped structures, conical spires, masses of fallacious cup-shaped and tabular plates. The upper photo of Figure 11.1-8 shows a "supracolony" of *P. r us* comprised of the amalgamation of numerous smaller colonies (39 ft [12 m] in length) at Transect 15. The middle photo shows overlapping amalgamated plates.

In addition, colonies and supracolonies of *P. r us* can assume a variety of branching forms that occur in contiguous thickets covering large sections of the benthic surface. It is also common to see multiple growth forms (branches growing out of laminar plates.)

<ins>Coral on Sediment</ins>

With the exception of stony coral skeletons, the substratum of the study area consists primarily of sediment of various grain sizes (mud, sand, rubble). As a result, an important aspect of coral community structure is the interaction between corals and soft sediment. Throughout the aircraft carrier berthing study area, and particularly in the deeper survey sites, corals are growing on, or out of the sediment surface. *P. rus*, in particular, occurs in a variety of growth forms that can be considered adapted to colonizing areas of soft sediment. Many of these colonies do not have a solid attachment to the bottom, with upper living areas overlying a base of dead skeletal material that is partially buried in the mud. In addition, many colonies growing in areas of abundant sediment had portions of the colonies covered with fine-grained sand or mud. Supracolonies of *P. r us* in many of the deeper survey locations were made up of complexes of laminar plates comprised of sections of both dead and living tissue. Much of the dead plated surfaces on these structures contain an accumulation of fine grained sediment.

Figure 11.1-8. Various plating and laminar growth forms of *P. rus*, including colonies with upper living surfaces partially covered with sediment.

11.1.2.2 Coral and Coral Reef Community Data

Assessment of B enthic Community St ructure i n t he Vicinity o f t he P roposed T urning B asin and Berthing Area for C arrier V essels N uclear (CVN) Apra Harbor, Guam (Dollar et al. 2009) is provided in Volume 9, Appendix J, and is the basis for the following summary, unless otherwise noted. This assessment is referred to hereafter as “the study.”

The study area is shown in Figure 11.1-9. Solid lines indicate the boundary of the direct impacts associated with dredging, and dashed lines indicate the outer boundary of the designated potential indirect impact area, which was set at a 656 ft (200 m) distance from the direct impact area boundary. As described later in this chapter, the 656 ft (200 m) distance represents a gross overestimate of the projected indirect impact area, and allows for collection of baseline data at the associated patch reef and shoal areas. As described in the SEI (2009) plume modeling summary discussed later in this chapter (Section 11.2.2.2 and Figures 11.2-2 and 11.2-3), only the area located 39 ft (12 m) beyond the direct dredge impact area is anticipated to receive cumulative sedimentation totaling at least 0.2 inches (in) (6 millimeters [mm]); 0.2 in (6 mm) was established as the cumulative sedimentation threshold for corals.

The study assumed a 60 ft (18 m) dredge depth, which is an overestimate of the proposed dredge depth of -49.5 ft (-15 m) plus 2 ft (0.6 m) overdredge MLLW, representing an approximate 10-15% increase in assessed benthic habitat in the dredged area. For this reason, the total dredged area as noted in Table 11.1-1 differs from the dredged area provided in Volume 4, Chapter 4. The 60-ft (18-m) contours are shown on Figure 11.1-9, and those contours within the direct impact area indicate the areas where dredging would be required. In the indirect impact area, these contours represent the depth limit of the coral assessment. There is a substantial amount of overlap between the two alternative aircraft carrier wharf project areas. The total dredge area (direct impact), as noted in Table 11.1-1, for Alternative 1 Polaris Point (referred to as Alternative 1) is 71.2 ac (28.8 ha) and for Alternative 2 Former SRF (referred to as Alternative 2) is 60.8 ac (24.6 ha). These are overestimates of the proposed projects' dredge footprints due to the use of a 60 ft (18 m) dredge depth. As described in Volume 4, Chapter 2 where the true dredge depth of -49.5 ft [15-m.] plus 2 ft [0.65-m] overdredge was used, total dredge area is 53.0 ac (21.4 ha) for Alternative 1 and 44.3 ac (17.9 ha) for Alternative 2.

The most relevant findings from the Dollar et al. (2009) study are the following.

- There are four large patch reefs (Jade, Western, Big Blue, and the unnamed reef) as shown on Figure 11.1-9. The project area where dredging would occur (direct impact area) does not contain shallow shoal patch reefs. This area was dredged in 1946 to allow safe access to the newly completed Inner Apra Harbor.
- Coral cover was dominated by a single species, *P. rus*, which accounted for about 74% of total coral cover. Along with *P. rus*, the next three most abundant species (*P. lutea, Pavona cactus*, and *P. cylindrica*) accounted for 95% of coral cover.
- Throughout the aircraft carrier study area, and particularly in the deeper survey sites, corals are growing on, or out of the sediment surface. *P. rus*, in particular, occurs in a variety of growth forms that can be considered adapted to colonizing areas of soft sediment. Many of these colonies do not have a solid attachment to the bottom, with upper living areas overlying a base of dead skeletal material that is partially buried in the mud. In addition, many colonies growing in areas of abundant sediment had portions of the colonies covered with fine-grained sand or mud.
- It is also evident that the area within the dredge boundaries contains relatively small areas of the densest classifications of very high cover (>50% coral). Areas that did contain the densest categories were generally along the sloping margins of the large patch reef outside of the dredge envelope. While the mapping results indicate that about 7-9% of bottom cover and 20% of coral cover for both alternatives is in the two highest cover classes (>50%), such areas are not concentrated in any particular biotope or region, but are spread across the dredge zones in relatively low densities.

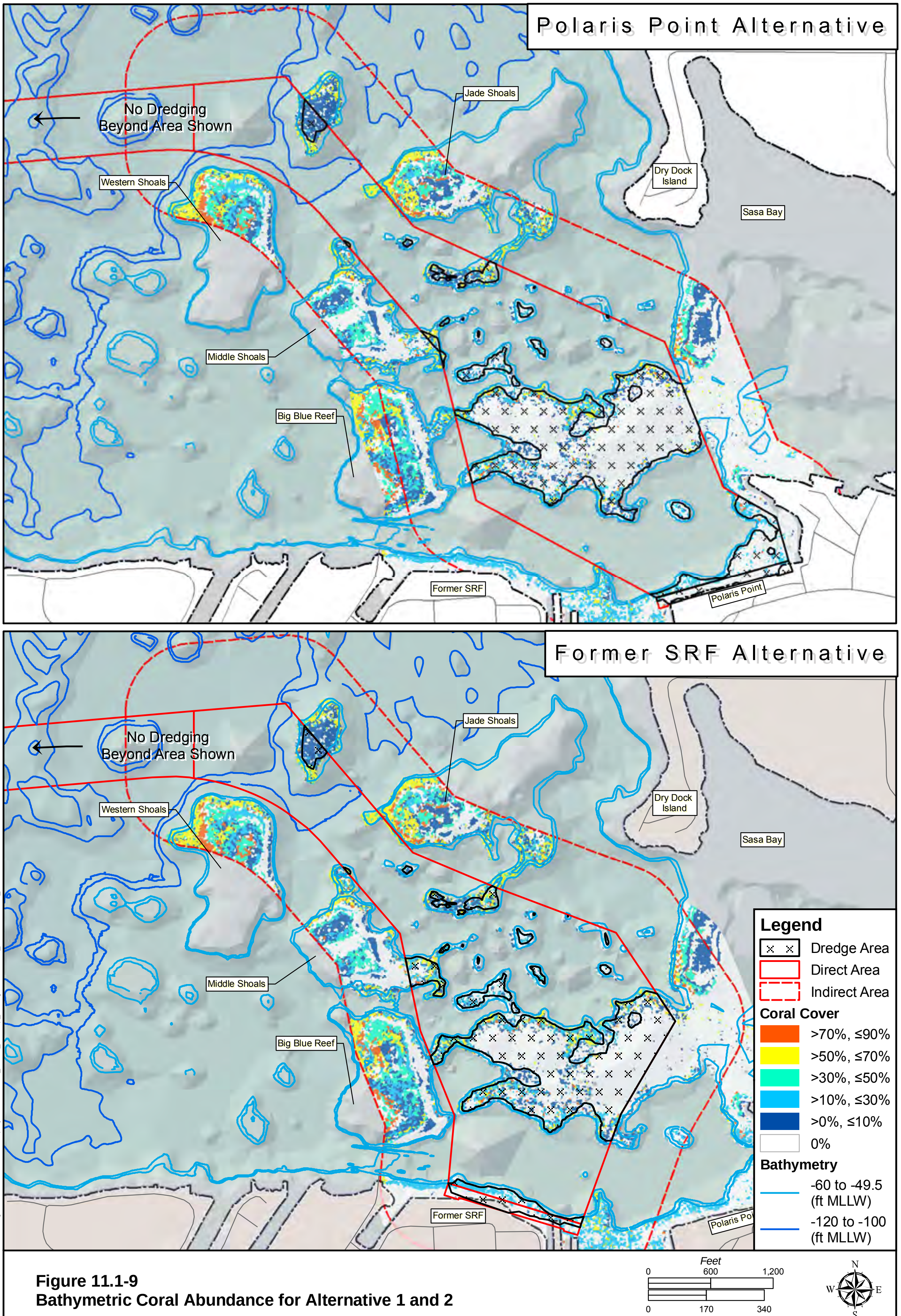

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Figure 11.1-9
Bathymetric Coral Abundance for Alternative 1 and 2

Table 11.1-1. Coral Cover in Six Levels for Direct and Indirect Areas at Polaris Point and Former SRF Alternative Aircraft Carrier Wharf Sites, Apra Harbor Guam

	Alternative 1 Polaris Point					
	Direct		*Indirect*		*Total*	
Coral Level	*ha*	*ac (% coral*)*	*ha*	*ac (% coral*)*	*ha*	*Ac (% coral*)*
Coral = 0%	**18.61**	**45.98**	**22.00**	**54.36**	**40.61**	**100.34**
0% < coral ≤ 10%	3.74	9.24 (37)	5.45	13.48 (29)	9.20	22.72 (32)
10% < coral ≤ 30%	2.61	6.44 (26)	3.85	9.52 (21)	6.46	15.96 (22)
30% < coral ≤ 50%	0.96	2.37 (9)	3.25	8.04 (17)	4.22	10.41 (15)
50% < coral ≤ 70%	1.80	4.44 (18)	4.19	10.35 (22)	5.99	14.79 (21)
70% < coral ≤ 90%	1.10	2.71 (11)	1.96	4.85 (11)	3.06	7.56 (11)
Total with Coral	**10.20**	**25.20**	**18.71**	**46.24**	**28.91**	**71.44**
Total dredge area with coral	**28.80**	**71.18**	**40.71**	**100.6**	**69.52**	**171.78**
Percent coral cover		**35%**		**46%**		**42%**
	Alternative 2 Former SRF					
	Direct		*Indirect*		*Total*	
Coral Level	*ha*	*ac (% coral*)*	*ha*	*ac (% coral*)*	*ha*	*ac (% coral*)*
Coral = 0%	**14.98**	**37.03**	**18.90**	**46.71**	**33.89**	**83.74**
0% < coral ≤ 10%	3.44	8.51(36)	5.34	13.20 (28)	8.79	21.72 (31)
10% < coral ≤ 30%	2.41	5.96 (25)	3.72	9.19 (20)	6.14	15.15 (21)
30% < coral ≤ 50%	0.93	2.29 (10)	3.45	8.53 (18)	4.38	10.82 (15)
50% < coral ≤ 70%	1.82	4.49 (19)	4.46	11.03 (23)	6.28	15.52 (22)
70% < coral ≤ 90%	1.01	2.48 (10)	2.13	5.25 (11)	3.13	7.74 (11)
Total with Coral	**9.61**	**23.74**	**19.10**	**47.21**	**28.71**	**70.95**
Total dredge area with coral	**24.59**	**60.77**	**38.06**	**93.92**	**62.60**	**154.69**
Percent coral cover:		**39%**		**50%**		**46%**

*Coral cover is rounded to the nearest percent and therefore may not total to 100%.
Source: NAVFAC Pacific 2009b.

As indicated in Table 11.1-1, within the direct impact areas for both the Former SRF and Polaris Point alternatives, the most represented class is that of the lowest non-zero coral cover (i.e., Class 2 [> 0% to ≤ 10%]). Of the areas in both alternatives that contain any coral, this class comprises about 38% of the total. For both alternatives, over half (~75%) of the areas with any coral cover are within Classes 2 and 3 (i.e., 0% < coral ≤ 30%).

Data analysis for the 67 transects was conducted "*ex situ*" using a visual basic program, Coral Point Count with excel extensions [CPCe], that has gained wide acceptance for coral reef monitoring studies. All benthic cover analyses were performed by three separate investigators and the final data set contained complete investigator agreement on all point counts. Calibration-validation data collected from 67 sites in the field to spectral signatures of remote sensing imagery was used to create a map of coral cover over the entire survey area. Figure 11.1-10 displays a satellite image of those points/transect stations that were surveyed for benthic community composition. Black- and blue-hatched areas delineate the potential direct and indirect impact areas, respectively.

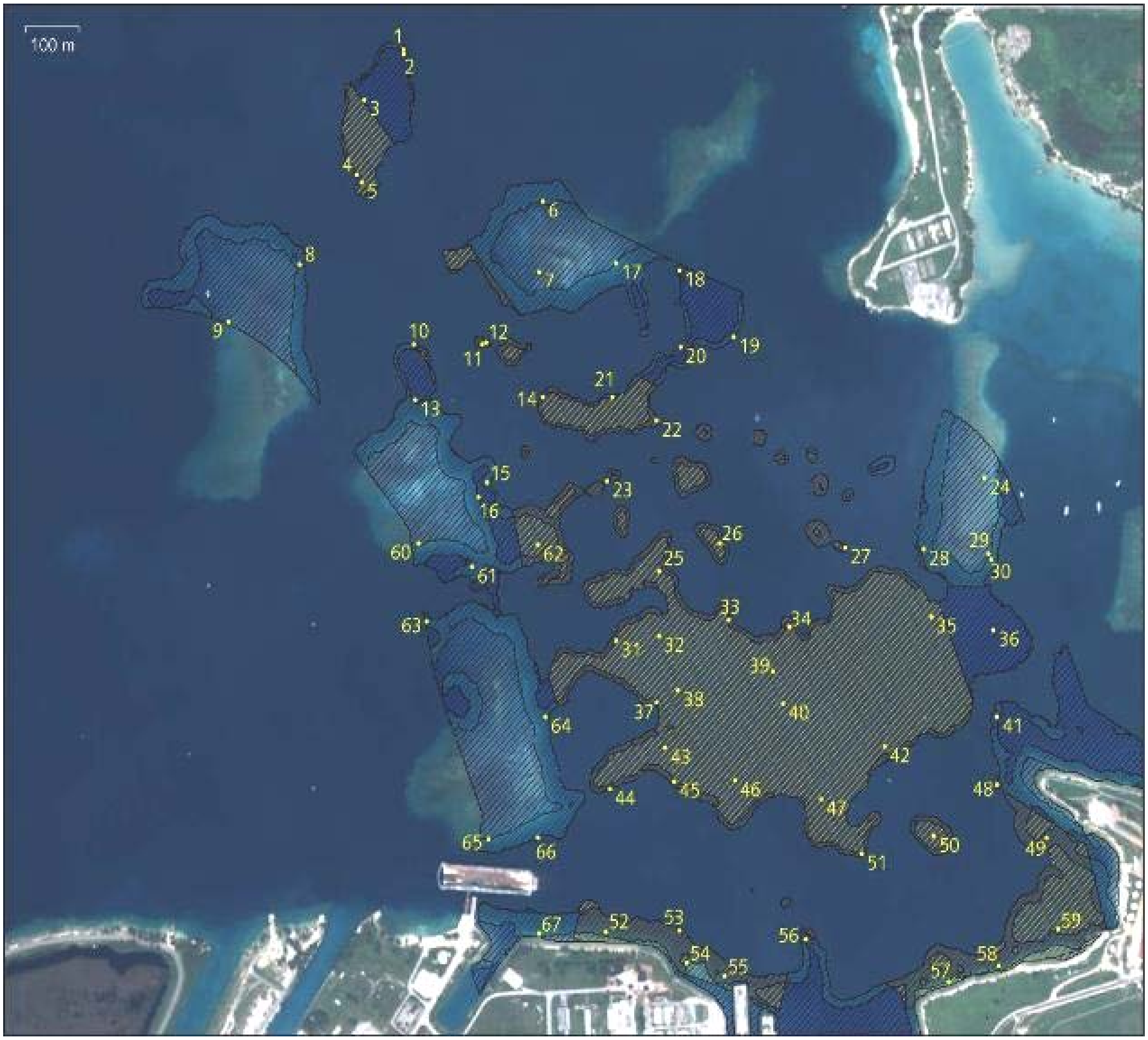

Figure 11.1-10. Outer Apra Harbor Showing 67 Ground-Truth Data Points/Transect Stations Used to Develop the Classification Scheme for Coral Habitat Mapping.

(black hatching = potential direct impacts; blue hatching = potential indirect impacts)

The resultant analysis produced tables and maps showing six classifications of coral cover:

Class 1: 0% coral	(See Figures 11.1-3 and 11.1-4 as an example)
Class 2: > 0% - ≤ 10%	
Class 3: >10% - ≤ 30%	
Class 4: >30% - ≤ 50%	(See Figure 11.1-5 as an example)
Class 5: >50% - ≤ 70%	
Class 6: >70% - ≤ 90%	(See Figure 11.1-6 as an example)

Calibration-validation data to support the classification scheme were collected using field data in the form of photographic quadrat transects. Table 11.1-1 lists the coverage area of each coral class for Alternatives 1 and 2. Also shown for each alternative is the percentage of each coral class with respect to the total area of coral coverage, and the percentage of coral potentially impacted (direct and indirect) with respect to the total dredge area. Figure 11.1-11 displays the resulting benthic habitat map. Spectral resolution of the image allowed for distinction of six bottom classifications according to coral cover as described above. The extent and density of coral cover is delineated to a degree that can be of value for potential mitigation of reef area altered by the aircraft carrier wharf project.

Examination of the coverage table (Table 11.1-1) and coral map (Figure 11.1-11) reveals several important points. The total area of potential direct and indirect impacts of the region with coral is approximately 71.44 ac (28.91 ha) for Alternative 1 (Polaris Point) and 70.95 ac (28.71 ha) for Alternative 2 (Former SRF). The total area of coral coverage of all classes associated with potential direct impacts is approximately 25 ac (19 ha) for the Polaris Point alternative and 24 ac (19 ha) for the Former SRF alternative. Hence, about 35% and 39% of the area to be dredged to reach the required depth presently contains some level of coral coverage for the Polaris Point and Former SRF alternatives, respectively. It is also evident that the area within the project boundaries, as well as within the dredge area boundaries, does not contain any of the continuous areas of very high cover (>70% coral) that is the dominant cover category on the western margins of the large shoal reefs bordering the project area. While the mapping results indicate that about 10% of coral for both alternatives is in the highest cover class (>70%), such areas are not concentrated in any particular biotope or region, but are spread across the dredge zones in relatively low densities, mainly at the edges of the dredge perimeters.

For both alternatives, the single highest percentage class with coral to be removed (37% for Polaris Point and 36% for Former SRF) is the lowest abundance class (>0 to 10% cover) . Additionally, 62% for Polaris Point and 60% for the Former SRF alternative, respectively, of coral cover is within the less than 30% cover classes (refer to Table 11.1-1).

Transect Sites Unique to Each Alternative

As identified in Table 11.1-1, the total area to be dredged is approximately 71 ac (29 ha) for Alternative 1, and 61 ac (25 ha) for Alternative 2. The total area of coral coverage of all classes is 25 ac (10 ha) for the Polaris Point alternative and 24 ac (10 ha) for the Former SRF alternative. Hence, about 35% and 39% of the area to be dredged at the Polaris Point and Former SRF alternatives, respectively, contains some level of coral coverage, Polaris Point having approximately 4% less coral to be removed.

Table 11.1-2 shows a similar assessment, including a representation of percent benthic cover within the direct removal footprint for each alternative. Of the 67 transect sites, 53 are co-located with Alternative 1 and 2 direct impact areas (i.e., benthic habitat that would be removed no matter which alternative is chosen), and 14 sites (8 from Alternative 1 and 6 from Alternative 2) are not associated with each other in regards to direct dredging activities (i.e., benthic habitat would only be indirectly impacted) (Figure 11.1-12).

The general benthic cover classes of these 14 sites are compared in Table 11.1-2, and show relative percentages of benthic cover within the direct foot print for both alternatives. If these numbers are compared with the total region to be dredged, the total percent coral coverage for all classes is approximately 10% for Alternative 1 and 17% for Alternative 2.

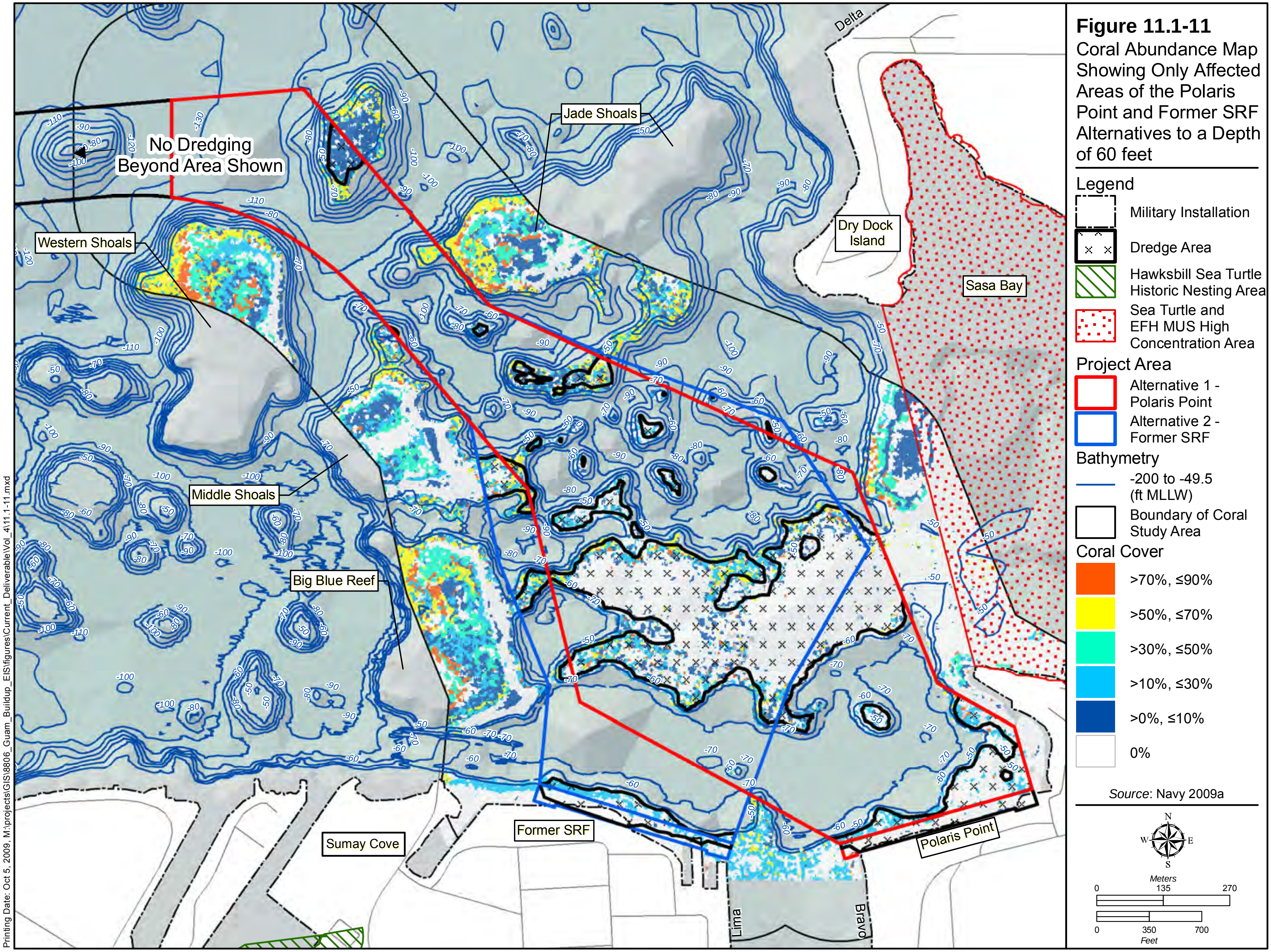
Figure 11.1-11
Coral Abundance Map Showing Only Affected Areas of the Polaris Point and Former SRF Alternatives to a Depth of 60 feet
Legend
Military Installation
Dredge Area
Hawksbill Sea Turtle Historic Nesting Area
Sea Turtle and EFH MUS High Concentration Area
Project Area
Alternative 1 - Polaris Point
Alternative 2 - Former SRF
Bathymetry
-200 to -49.5 (ft MLLW)
Boundary of Coral Study Area
Coral Cover
>70%, ≤90%
>50%, ≤70%
>30%, ≤50%
>10%, ≤30%
>0%, ≤10%
0%
Source: Navy 2009a
Meters
0 135 270
0 350 700
Feet
No Dredging Beyond Area Shown
Jade Shoals
Western Shoals
Middle Shoals
Big Blue Reef
Dry Dock Island
Sasa Bay
Sumay Cove
Former SRF
Polaris Point
Delta
Lima
Bravo
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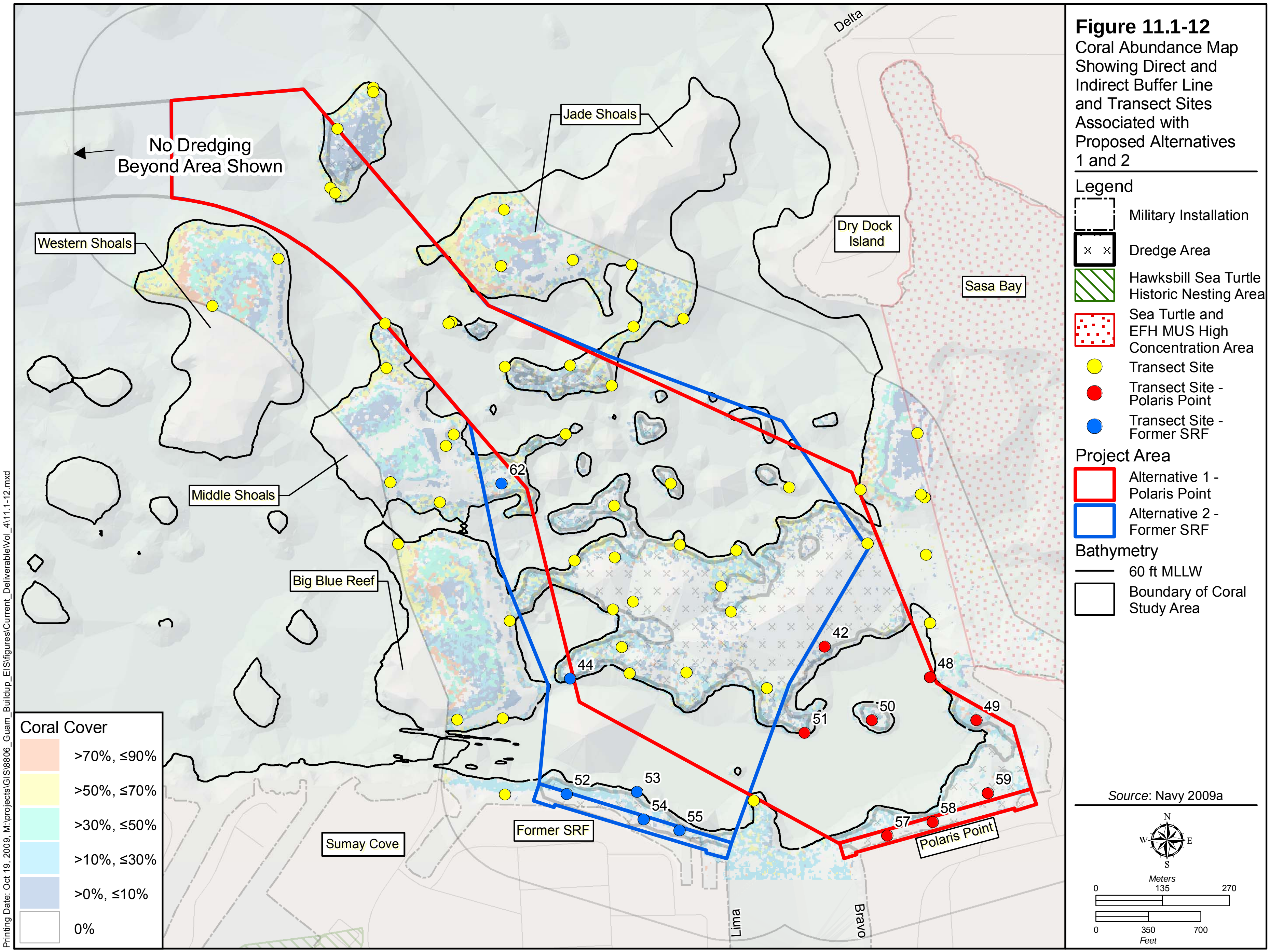

Figure 11.1-12
Coral Abundance Map Showing Direct and Indirect Buffer Line and Transect Sites Associated with Proposed Alternatives 1 and 2
Legend
Military Installation
Dredge Area
Hawksbill Sea Turtle Historic Nesting Area
Sea Turtle and EFH MUS High Concentration Area
Transect Site
Transect Site - Polaris Point
Transect Site - Former SRF
Project Area
Alternative 1 - Polaris Point
Alternative 2 - Former SRF
Bathymetry
60 ft MLLW
Boundary of Coral Study Area
Source: Navy 2009a
Meters
0
135
270
0
350
700
Feet
Coral Cover
>70%, ≤90%
>50%, ≤70%
>30%, ≤50%
>10%, ≤30%
>0%, ≤10%
0%
No Dredging Beyond Area Shown
Jade Shoals
Western Shoals
Middle Shoals
Big Blue Reef
Dry Dock Island
Sasa Bay
Delta
Sumay Cove
Former SRF
Polaris Point
Lima
Bravo
62
44
42
48
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Table 11.1-2. General Classes of Benthic Cover Percentages Exclusively Associated with Either Alternative 1 or Alternative 2 Direct Impact Areas

Transect Number	*Algae*	*Stony Coral*	*Soft Coral*	*Sponge*	*Ascidians*	*Echinoderm*	*Sediment*	*Total*
Alternative 1 Polaris Point								
42	1.08	0	0	0	0	0	98.92	100
48	37.07	6	0	0	0	0	59.93	100
49	18.80	48.13	0	3.47	0	0	29.60	100
50	82.67	0	0	0.53	0	0	16.80	100
51	86.15	0.46	0	0.62	0	0	12.77	100
57	50.67	0	0	0.40	0	0	48.93	100
58	26.40	0	0	2.27	0	0	71.33	100
59	19.33	24.53	0	1.47	0	0	54.67	100
Mean %	**40.27**	**9.89**	**0**	**1.19**	**0**	**0**	**49.14**	**100**
Alternative 2 Former SRF								
44	72.13	2.53	0	0.80	0	0	24.53	100
52	8.53	0	0	2.53	0	0	89.93	100
53	0	0	0	0	0	0	100	100
54	21.47	0	0	2.40	0	0	76.13	100
55	23.47	36.93	0	4.80	0	0	34.80	100
62	21	65.20	0	1.60	0	0	11.33	100
Mean %	**24.43**	**17.44**	**0**	**2.01**	**0**	**0**	**56.12**	**100**

Note: All benthic cover numbers are in percentages.
Source: Photo-quadrats from 67 transects was analyzed using CPCe software to obtain a quantitative dataset that can be used to describe the community (Dollar et al. 2009).

In comparison, when data from all 67 transects were combined and analyzed, algae accounted for about 40% of benthic cover, sediment (sand, mud, and rubble) 35%, coral 22%, and sponges 3%. Algae occurred on all but one transect, and corals were present at 52 of the 67 survey sites. On transects with sediment cover greater than approximately 75%, corals were not present. All transects containing coral also contained algae. Coral cover was dominated by a single species, *P. rus*, which accounted for about 74% of total coral cover. Along with *P. rus*, the next three most abundant species (*P. lutea, Pavona cactus*, and *P. cylindrica*) accounted for 95% of coral cover (Dollar et al. 2009).

<u>Additional Survey Data in the Study Area</u>

Additional coral and coral reef community survey data are provided by Smith (2007). In general, coral development varies dramatically between sites and at different depths, with some locations supporting well developed complex coral reefs and other areas supporting only small patch reefs or sparsely scattered corals. Seventeen coral families were observed throughout the study area. The primary objective of the survey was to quantitatively assess the distribution and abundance of Scleractinian (stony) corals within seven selected portions of Apra Harbor. These seven areas included:

1. Mouth of Sumay Cove to mouth of Inner Apra Harbor
2. The Southeast component of the Western Shoals complex
3. Polaris Point and Polaris Bay
4. CVN turning basin between Inner Apra Harbor entrance, east side of Big Blue Reef, and south of Dry Dock Island
5. Fairway (navigation channel) shoals (Jade and Western)
6. Dry Dock Island

7. Delta/Echo Wharves on Dry Dock Island

Figure 11.1-13 shows the locations of dive survey sites in these seven areas. The major findings from the Smith (2007) study are the following:

- Only one site (Big Blue Reef east) contained all of the observed coral families. At all other survey sites, the number of families ranged from 5 to 13. Point-quarter transect data revealed that of the 1,908 quarters surveyed, 69% contained coral, with 49% of all corals measured consisting of the single species *P. rus*.
- Mean coral size (maximum measurement parallel to the sea floor) was relatively low for Turning Basin sample locations (8.6 in [22 centimeters (cm)]), for shoal areas (8.3 in [21 cm]), and for Polaris Point (6.3 in [16 cm]). Qualitative observations of coral health revealed no areas of extensive bleaching or disease. Some colonies with hemispherical growth forms (e.g., *P. lobata*) at survey sites within the dredge footprint (Polaris Point, Fairway, and Turning Basin) were observed secreting copious amounts of mucus. As these areas are within the active ship transit lanes, the mucous secretion may be a sediment rejection response related to increased sediment resuspension from current ship activities.
- With respect to existing anthropogenic impacts to reef structure, there is some evidence of anchor and/or anchor chain damage at all sites. Movement of mooring chains on the southern side of the floating dry dock have produced a significant rubble field, although mooring chains on the northern (outer) side of the floating dry dock do not appear to have caused similar damage.
- When reef survey zones were ranked according to variables that included coral coverage, diversity, rugosity, health, and size-frequency distribution, the areas within the proposed dredge footprint (Turning Basin, shoal areas and Polaris Point) ranked lowest on the scale, and were ranked consistently lower than the sites that are outside the project footprint. The highest ranking was given to Big Blue Reef west, owing to protection from exposure to poor water quality factors associated with Inner Apra Harbor and ship-induced sediment resuspension. The second highest ranking was given to the reefs off Dry Dock Island. Both Polaris Point and Dry Dock Island were artificially created during and shortly after World War II (WWII). While the two areas were created at essentially the same time, the coral communities are substantially different, suggesting that different environmental stressors have affected coral community development in the two areas. Potential differences in environmental stressors are the higher range of turbidity and suspended sediment originating from Inner Apra Harbor and the level of ship activities in the vicinity of Polaris Point relative to Dry Dock Island.
- The Polaris Point area, turning basin, Big Blue Reef east, navigation channel and Delta /Echo Wharves areas do not meet any of the HAPC criteria (See Volume 2, Section 11.1). However, Big Blue Reef west provides significant ecological function and is sensitive to human induced environmental degradation, thereby meeting two of the four criteria for HAPC designation.
- The coral habitat expected to be impacted by the proposed aircraft carrier project currently is, in general, “of marginal to modest ecological value.”
- When reef survey zones are "ranked" by scaling a variety of variables (percentage of sea floor covered by coral, reef complexity and rugosity, species diversity, coral health, size frequency distribution of coral colonies, diversity and abundance of sessile macro-benthos other than corals (e.g., sponges), diversity and abundance of mobile macro-invertebrates, and the

diversity and abundance of finfishes), the areas within the dredge footprint (Turning Basin, shoal areas and Polaris Point) rank lowest on the scale, and are consistently lower ranked than the sites that are outside the footprint. The highest ranking was given to the Big Blue Reef west, likely owing to protection from exposure to water quality factors associated with Inner Apra Harbor and ship-induced effects.

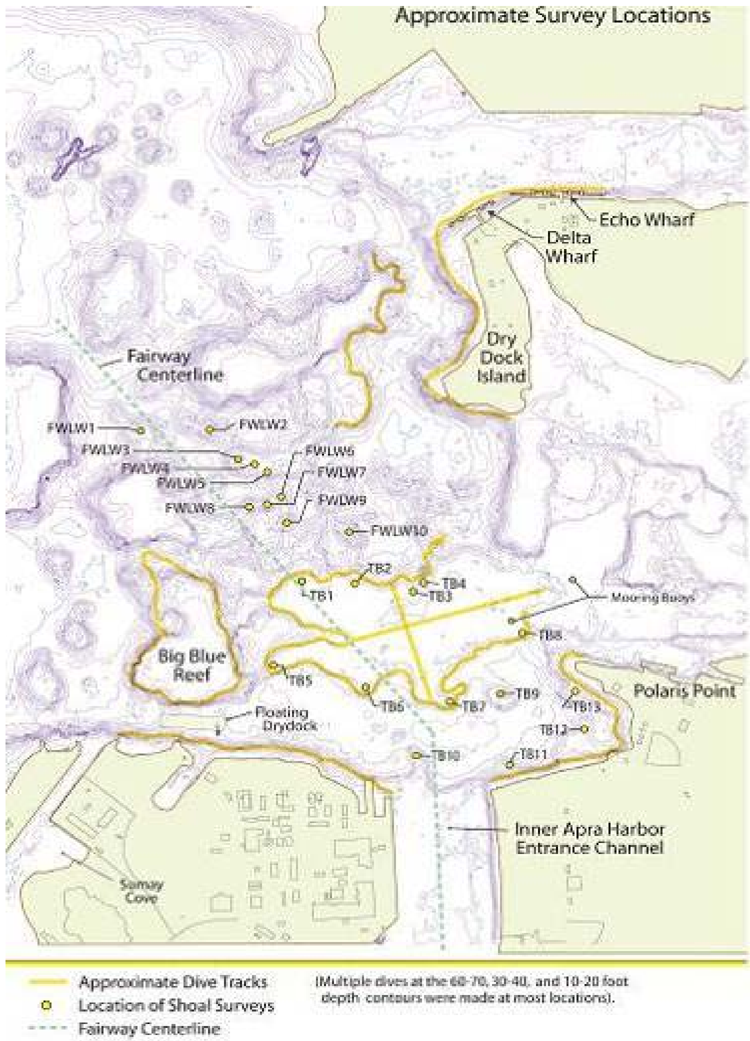

Figure 11.1-13. Dive Surveys and Transects (Smith 2007)

- When reef survey zones are "ranked" by scaling a variety of variables (percentage of sea floor covered by coral, reef complexity and rugosity, species diversity, coral health, size frequency distribution of coral colonies, diversity and abundance of sessile macro-benthos other than corals (e.g., sponges), diversity and abundance of mobile macro-invertebrates, and the diversity and abundance of finfishes), the areas within the dredge footprint (Turning Basin, shoal areas and Polaris Point) rank lowest on the scale, and are consistently lower ranked than the sites that are outside the footprint. The highest ranking was given to the Big Blue Reef west, likely owing to protection from exposure to water quality factors associated with Inner Apra Harbor and ship-induced effects.

- The coral reefs at the shoal areas and Turning Basin appear to be of marginal to modest ecological value, based upon the eight criteria.
- The coral reef in the Polaris Point/Bay segment is of marginal quality and showed the greatest signs of stress. This stress appeared to be due in part to high levels of TSS coming from Inner Apra Harbor.
- Coral diversity (as measured by relative densities) is low. Although multiple coral taxa were observed at sampling locations within the project area, *P. rus*, *P. cylindrica* and *Porites* spp. comprised a substantial majority of all coral observed
- Coral mean size (maximum measurement parallel to the sea floor) is relatively low, and some corals in the project area appear to show signs of stress.
- In the Polaris Point/Bay area, a substantial percentage of the coral at all depth contours was growing on metallic and/or concrete debris. It is arguable whether or not the Polaris Point/Bay community should be considered a coral reef. What is clear, however, is that more of the corals within the Polaris Point/Bay segment had copious mucous secretions and more algal overgrowth than at any other location in Apra Harbor evaluated during the current study or other recent Navy studies.

Other field data collected by Dollar et al. (2009) included spectral reflectance of representative corals to develop a "stress index," coral size-frequency analysis, and analysis of sediment samples to determine the composition of material that would affect communities during dredging operations. The results of these analyses are briefly described in the Sediment Characteristics and Loading Stress subsection, below.

<u>Sediment Effects on Coral</u>

On a global scale, increased sedimentation is one of the most common and serious anthropogenic influences on coral reefs (e.g., Grigg and Dollar 1990). The scientific literature includes numerous documented cases of impacts to coral reefs by sedimentation related to the activities of man (i.e., anthropogenic), as well as laboratory investigations that quantify impacts under controlled conditions. Reviews by Brown and Howard (1985), Grigg and Dollar (1990), Rogers (1990) and Fabricius (2005) provide comprehensive treatment of all aspects of the effects of sedimentation to coral reefs. Impacts associated with sedimentation and sediment burial include reduced photosynthesis and increased respiration (e.g., Riegl and Branch 1995; Philipp and Fabricius 2003; and Weber et al., 2006), tissue mortality (e.g., Rogers 1983), reduced growth (e.g., Dodge et al. 1974; Rice and Hunter 1992) and reduced fertilization, larval survivorship, and recruitment (e.g., Gilmour 1999; Smith 2006).

While it is clear that increased sedimentation can have a deleterious effect on corals, it is also apparent from the scientific literature that the deleterious effects are not uniform or consistent, with responses depending primarily on a variety of factors including coral growth form and physiological capabilities, duration of exposure, and physicochemical composition of the sediment. When evaluating the effects of human-induced sedimentation, it is important to consider that sediments are also resuspended by natural processes in many reef environments, and as a result, most corals are adapted to withstand some level of sediment load. It has been well documented since the pioneering work on environmental tolerances of reef corals that some taxa are more resilient to turbidity and sedimentation than others (e.g., Mayer 1915; Yonge 1930; Marshall and Orr 1931; Hubbard and Pocock 1972; Riegl 1995; Wesseling et al. 1999). It has also been shown that corals growing in waters of moderate to extremely high turbidity are not automatically more stressed than their clear-water counterparts (Roy and Smith 1971; Done 1982; Johnson and Risk 1987; Acker and Stern 1990; Riegl 1995; Kleypas 1996; McClanahan and Obura 1997; Larcombe et al. 2001). Sanders and Baron-Szabo (2005) describe "siltation assemblages" of corals that occur in turbid water and/or muddy reef environments as a result of resilience to sediment through either effective rejection mechanisms or physiological tolerance to intermittent coverage.

Sediment resistance is generally distinguished as occurring by two separate processes, sediment rejection and sediment tolerance, which are reviewed in detail by Sanders and Baron-Szabo (2005). Sediment rejection is the active removal of sediment particles by polyp expansion by water uptake and expulsion ("pumping"), tentacle movement, ciliary action, and mucous secretion. Of note, it has been found that for all corals, it is more difficult to reject sediment from a horizontal surface than from an inclined or vertical surface (e.g., Bak 1976), and on flat surfaces sediment may be pushed to "dump areas" on the corallum (Reigl 1995). Experiments (Anthony 1999) and field measurements (Anthony 2000) indicate that corals from turbid water reefs have a background rate of sediment rejection two to four times higher than their conspecifics in clear-water reefs (Anthony and Fabricius 2000). For sediment clearance, the growth form of a coral is crucial, with branched and erect-foliaceous forms by far the most effective in clearance of sediment of silt to coarse sands (Hubbard and Pocock 1972; Stafford-Smith and Ormond 1992; Stafford-Smith 1993).

The outcome of various levels of sediment tolerance, or the ability of a coral to withstand a coating of sediment, differs markedly, ranging from death to localized necrosis to survival without any signs of damage or stress (Hodgson 1989; Wesseling et al. 1999). Hodgson (1989) reported that for some massive corals, tissue necrosis remained confined to flat and concave surfaces veneered by sediment, whereas unveneered short columns and convex knobs on the same colonies remained in good condition. The acroporid *Montipora* is quite sediment tolerant, and may be veneered for weeks without signs of permanent physiological damage (Hodgson 1989). Similarly, *Porites* is highly tolerant of being sediment-veneered, and can recover even after complete burial for up to three days (Stafford-Smith and Ormond 1992; Stafford-Smith 1993; Wesseling et al. 1999). Sofonia and Anthony (2008) found that the coral *Turbinaria mesenterina* on nearshore reefs in the central Great Barrier Reef lagoon was tolerant to sediment loads an order of magnitude higher than the most severe sediment conditions occurring *in situ*. The likely mechanisms for such high tolerance were that corals were able to clear themselves rapidly, and that the sediment provides a particulate food source.

It has also been suggested that small colonies may be more resistant to prolonged sedimentation than large colonies, owing to higher efficiency in terms of energy expenditure in sediment-rejection behavior (Dodge and Vaisnys 1977). With respect to impacts of sediment stress as a function of frequency, Connell's (1997) pioneering long-term studies of coral reef response to both acute and chronic disturbances have shown that reef systems are more vulnerable to chronic disturbance than to acute, infrequent episodes of stress. Hence, recovery from acute episodes of elevated sedimentation may take place, while the same or even lower levels of sediment stress on a continual basis would result in more extensive, or even permanent detrimental change. Sanders and Baron-Szabo (2005) also report that pulses of a few hours to a few days of rapid sediment fallout exert less of a lasting influence than frequent or chronic sedimentation at lower rates.

While it is generally believed that corals can only survive in waters with low turbidity and suspended particulate loads, it has been documented that apparently flourishing coral communities are found in naturally turbid conditions, although these communities are generally very different than those found in clearer water. For example, a turbid lagoon at Fanning Island (Central Pacific) had an abundance of primarily branching colonies, although the coral community was less diverse than in the clear lagoon with mostly massive and encrusting corals (Roy and Smith 1971). Roy and Smith (1971) conclude that while there was a decrease in abundance of coral knolls from the clear to the turbid water (less than 6.5 ft [2 m] visibility), both areas had lush reef development. In a study of the distribution of coral communities located near two rivers in Guam, Randall and Birkeland (1978) concluded that observed decreases in natural sedimentation rates along a gradient from the river mouths to the open sea explained the increase in number of coral species, from less than 10 in the area exposed to high sedimentation to over 100 in the areas farthest from riverine influence. The authors predicted that sedimentation rates ranging from 162 to 216 milligrams per centimeter per day (mg/cm/d) would be associated with less than 10 total species in an area, while rates of 5 to 32 mg/cm/d (open ocean) would be associated with over 100 species in an area (data converted from original).

As summarized in Rogers (1990), the response to coral communities from dredging and other activities which increase sediments in the water can range from only localized or negligible effects on corals to long-term changes. Rogers (1990) makes the point that dredging often affects not only the portion of the reef which is actually removed or smothered, but also downstream areas where currents carry increased concentrations of fine suspended particles. However, impacts are not always severe and long-lasting. The dumping of 2,200 tons (1,996 metric tons) of kaolin clay cargo from a freighter grounded on a reef at French Frigate Shoals in the Northwestern Hawaiian Islands created large plumes of the suspended clay but had no apparent adverse effects beyond a radius of about 164 ft (50 m) from the grounding site (Dollar and Grigg 1981). Based on a brief qualitative survey, Sheppard (1980) suggested that dredging and blasting in Diego Garcia Lagoon (Indian Ocean) had resulted in variable and low coral cover but no reduction in coral diversity. Construction of Honokohau Harbor on the Island of Hawaii by dredging actually resulted in an overall increase in coral cover because of colonization of newly created harbor surfaces (USACE 1983). In 1979, work began to extend the runway of the airport at St. Thomas (U.S. Virgin Islands) 2,382 ft (726 m) into water 89 ft (27 m) deep. Monitoring over a period of 31 months of fish populations, seagrass beds and coral reefs in the vicinity revealed no significant deterioration attributable to the plume from the dredge and fill operation (Rogers 1982).

Pre- and Post-Monitoring of Dredging Sediment Effects on Coral Reefs

Although the effects of anthropogenic sedimentation on reef corals have been widely discussed and reviewed in the scientific literature, there are relatively few studies that specifically address the effects of dredging on reef corals at sites where the community has been monitored before, during and after the event. Marszalek (1981) surveyed reef areas before and after a large-scale dredging project off of Florida, where dredging took place for 3 months every year for 5 years. He reported no mass mortality of hard corals after short-term exposure to sediments (a few days), although several colonies showed partial mortality and excessive mucus secretion after prolonged exposure to suspended sediment. Marszalek (1981) suggested that prolonged turbidity was more detrimental than short-term accumulation of sediments. Brown et al. (1990) had the opportunity to utilize long-term ecological monitoring to conduct before, during and after studies of the effects of a 9-month dredging of a deep channel to adjacent reef flats at Phuket, Thailand. Reef corals, primarily massive heads of *Porites lutea*, showed as much as 30% reduction in living cover one year after the start of dredging, with a significant decline in diversity. However, after the termination of dredging, the reef recovered rapidly with coral cover values and diversity indices restored to former levels within approximately 22 months after dredging began. No significant changes in linear growth rate, calcification or skeletal density were measured in corals subjected to the increased sediment loads. The authors speculate that the rapid recovery was a result of regeneration of living tissue over formerly dead surfaces of colonies that suffered only partial mortality. The lack of change of growth rate, calcification rate and skeletal density was attributed to the short time that corals were subjected to fatally high concentrations of sediments (days to weeks). Changes that may have occurred during this short period may have been insufficient to affect the annual growth rate or calcification.

Sediment Characteristics and Loading on Coral Stress

Numerous studies have been conducted to evaluate the effects of sediment exposure to corals, and a universal theme is that impacts vary depending on a variety of factors such as oceanographic conditions, which coral species are present and their ability to adapt, the type of sediments being deposited, and the duration of exposure. The following text summarizes findings from some of the most informative and relevant studies with respect to the study area. An important consideration in the evaluation of sediment effects to corals is the duration of the stress. In an experimental design exposing corals to ten different sediment types at environmentally relevant concentrations (33-160 milligrams per square centimeter [mg/cm^2]), Weber et al. (2006) found that the highest stress levels (in terms of reduction of photosynthetic yield of the coral *Montipora peltiformis*) occurred from short-term (20 to 44 hours [hr]) exposure to nutrient-rich silts, whereas no effect was measurable after greater than 48-hr exposure to fine and medium sand and pure aragonite (calcium carbonate) silt. All treatments that showed reduction in photosynthetic yield from sediment loading also exhibited immediate reversal of the trend following removal of sediment exposure, although recovery was not complete within the 48-hr recovery period after experiments were terminated. These authors conclude that their findings suggest a fundamentally different outcome of corals exposed to sedimentation by sandy nutrient-poor sediments, such as storm resuspended marine carbonate sediments, compared to sedimentation of silt-sized sediments rich in organic matter and nutrients. Philipp and Fabricius (2003) also showed that the photosynthetic activity of *M. peltiformis* decreased linearly with both the amount of sediment and the time it remained on the tissues, which indicated that any threshold value for sedimentation tolerance should incorporate both amount and time. *M. peltiformis* was able to recover function to pre-stress levels if the duration of stress was short (< 24 hrs) or if doses were low. Wesseling et al. (1999) evaluated recovery of corals after full burial in field experiments in the NW Philippines where corals were buried for 0, 6, 20 and 68 hr. Species of *Porites* were not affected by 6-hr burial compared to controls, while increasing burial time had increasingly more serious effects in terms of discoloration and bleaching. Following removal of sediment, recovery took place, with time of recovery (2 to 4 weeks) proportional to time of burial. Colonies of *Acropora*, however, showed much more sensitivity, with all colonies dying after the 20-hr treatment.

Riegl and Branch (1995) measured the changes in physiological reactions to sediments. Under what was considered the observed sedimentation levels on South African reefs (200 mg/cm^2), corals that had been adapted to laboratory conditions for 6 weeks prior to the experiments in filtered seawater showed changes in energy balance by forcing respiratory losses up and photosynthetic production down, and displaying elevated mucus secretion. However, these experiments were not conducted with other varying sediment loads, and recovery was not measured following removal of the sediment.

Some corals have adapted to fluctuating levels of sedimentation. Lirman and Manzello (2009) documented the patterns of resistance and resilience of *Siderastrea radians* to sub-optimal salinity and sediment burial in a series of short-term, long-term, acute, chronic, single-stressor, and sequential-stressor experiments. Under conditions of no salinity stress, *S. radians* was very effective at clearing sediments, and >50% of the colonies' surfaces were cleared within 1 hr of burial. However, as burial periods increased, and colonies were covered at multiple chronic intervals, sediment burial resulted in extended photosynthetic recovery periods, reduced growth, and mortality.

It is important to note that effects from deposition of terrigenous sediments emanating from runoff can be substantially different than effects from sediments of marine origin. Te (2001) found that terrigenous sediments had a greater light extinction capability than carbonate (reef-derived) sediments. As noted above, Weber et al. (2006) found distinctly different responses depending on sediment composition, with substantially less effects from marine carbonates compared to organic-rich terrigenous sediments. Fine silts and sand composed of calcium carbonate have been shown to produce no negative effects on photosynthetic activity in one species of coral after more than 2 days of exposure (Weber et al. 2006).

Results of sediment core analysis reported by Weston Solutions (NAVFAC Pacific 2006) indicated that sediment in Outer Apra Harbor (within the aircraft carrier berthing action dredge footprint) and the entrance to Inner Apra Harbor were coarser-grained, comprised predominantly of gravelly sand. Analysis of twelve sediment samples collected within the aircraft carrier berthing action dredge footprint revealed that 79-96% of the samples by weight were composed of calcium carbonate, presumably of marine origin (Dollar et al. 2009). Hence, terrigenous (i.e., non-carbonate) muds are not a major component of the sediment in the proposed dredge area.

The effects to reef corals from increased sedimentation do not appear to result from any specific "threshold" level. Te (2001) states that "numerous forces in nature and the ability of corals to adjust to higher sediment loading levels makes it impossible to definitively state a generalized threshold level for sediment loading in corals." A summary of the existing scientific literature that categorizes the effects to reef corals, corresponding to the rates and exposure periods of sedimentation, is presented in Volume 9, Appendix J, Section D.

The range of effects to corals extends through the entire spectrum of stresses. As expected, the general trend is that the higher the deposition rate and the longer the period of deposition, the greater the effect. However, it is also apparent that this trend is very species specific. For instance, Hodgson (1989) found that under the same rates of sedimentation in both the field and in aquaria, the response varied considerably between species. Of 22 species exposed to a constant sedimentation rate of 40 mg/cm/d for 7 days in aquaria, 6 suffered mortality, 7 suffered sublethal tissue damage, and 9 did not incur visible damage. Of 36 species exposed to a sedimentation rate of 20.8 mg/cm^2/day for 120 days in the field, 7 suffered mortality, 12 experienced tissue damage, and 17 were not visibly affected.

Te (2001) developed a predictive model that tested the hypothesis that the lower the light level as caused by increased turbidity and sediment loads, the lower the photosynthetic production of corals. His work indicated that while light was the most influential force in coral growth and survival, field experiments in which transplanted corals were subjected to sedimentation rates of <1 mg/cm^2/d to greater than 300 mg/cm^2/d resulted in no mortality and showed no significant effect on growth rates or survivability. Corals used in his study were able to adjust and adapt to even the worst sediment loading levels achieved in the laboratory and the field. No corals subjected to the worst conditions died, and many grew at rates similar to corals growing in areas unaffected by sediment. Rather, strong waves caused by storm events were found to be more detrimental to coral growth and survival in the field than increased sediment loading. In addition, turbidity, as linked to light availability but not sediment deposition, was found to significantly affect coral growth rates, but not coral survival in both field and laboratory experiments. Te (2001) also found that corals exposed to moderate to high sediment loading, and those growing under shade conditions were able to photo-adapt by increasing light harvesting capacity as evidenced by greater chlorophyll content and increased photosynthetic ability. When re-introduced into conditions with high light intensities, however, corals underwent photo-inhibition that disrupted photosynthetic functions.

The overall conditions in the study conducted by Te (2001) are comparable to reported conditions in the Inner Apra Harbor Channel, adjacent to the aircraft carrier dredge area, as well as the aircraft carrier dredge area *per s e*. Observations in these areas indicate a layer of sediment on virtually all benthic surfaces that are not colonized by living organisms.

Marine Research Consultants (2005) and Smith (2004) have documented well-developed communities of reef corals in the northern portion of the Inner Apra Harbor Channel. Remote sensing using satellite imagery allowed mapping and quantification of the area coverage of the coral communities. Integrating the mapped area of coral cover revealed a total area of 3.32 ac (1.34 ha) of sparse coral and 6.8 ac (2.77 ha) of dense coral, for a total area of approximately 10.2 ac (4.11 ha) of coral cover in the Inner Apra Harbor Entrance Channel (Figure 11.1-14). The entire non-living benthic surface consists of calcareous sediment, ranging in grain size from fine silty muds to coral rubble. In addition, in areas where the predominant grain size is in the mud-silt range, sediment is easily re-suspended with subsequent re-deposition. As a result, all of the biotic components of the community must have the physiological adaptations to deal with a physical environmental characterized by soft bottoms (Dollar et al. 2009).

Index of Coral Stress

In situ spectral reflectance measured at the surfaces of the two most abundant species of coral (*P. rus*, *P. lutea*) were used to compute the Normalized Difference Vegetation Index (NDVI) for 27 sites in the aircraft carrier survey area. NDVI is a relative scale indicating amount of chlorophyll present; higher values indicate more chlorophyll, and therefore lower "stress." Although NDVI increased slightly with depth, there was no apparent trend in the horizontal spatial distribution of NDVI. The lack of a spatial pattern suggests no difference in chlorophyll between the direct and indirect strata, and hence no difference in relative stress.

Coral Size-Frequency Analysis

Coral site-frequency metrics were collected during the “Spring surveys” to represent resource agency concerns. Dollar et al. (2009) evaluated size-frequency of coral colonies from transect photo-quadrats using a built-in function of CPCe software to determine greatest chord length. Size-frequency distribution of the longest chord length of the four most abundant corals in the aircraft carrier survey area are provided and grouped into seven size classes (from x < 2 cm to x < 160 cm). Dollar et al. (2009) state “For all four corals in all four strata (Direct Flat, Direct Slope, Indirect Flat, and Indirect Slope), the least abundant size classes are the smallest (x<0.8 in [x<2 cm]) and largest (31.5 in [80 cm]≤ x < 63 in [160 cm])”. Of the four species, the largest size occurs predominantly for *P. rus*, and occasionally for the branching growth forms of *P. c ylindrica* and *Pavona cactus*. *P. l utea*, which occurs as discrete hemispherical or lobate colonies, was never encountered with a long dimension greater than 31.5 in (80 cm). While the mean number of colonies of *P. rus* varied within each size class in each stratum, the pattern of size class abundance was similar in all stratum (see Figure 11.1-15). In all strata, the two size classes with a lower bound of 2 in (5 cm) and an upper bound of 7.9 in (20 cm) were the most abundant. Size class distributions of the two branching species (*P. c ylindrica, P avona cactus*) were similar in all strata, although the mean number of small (4 in [<10 cm]) colonies of *Pavona cactus* was substantially higher on the slope of the direct impact area than elsewhere. *P. l utea*, which occurred very rarely in the direct impact area, had identical patterns of size-frequency distribution in both the flat indirect impact area and the slope indirect impact area (Figure 11.1-15). Histograms in figure 11.1-15 are arranged left-to-right by coral species and top-to-bottom by survey stratum and show mean values determined across all transects within a given stratum.

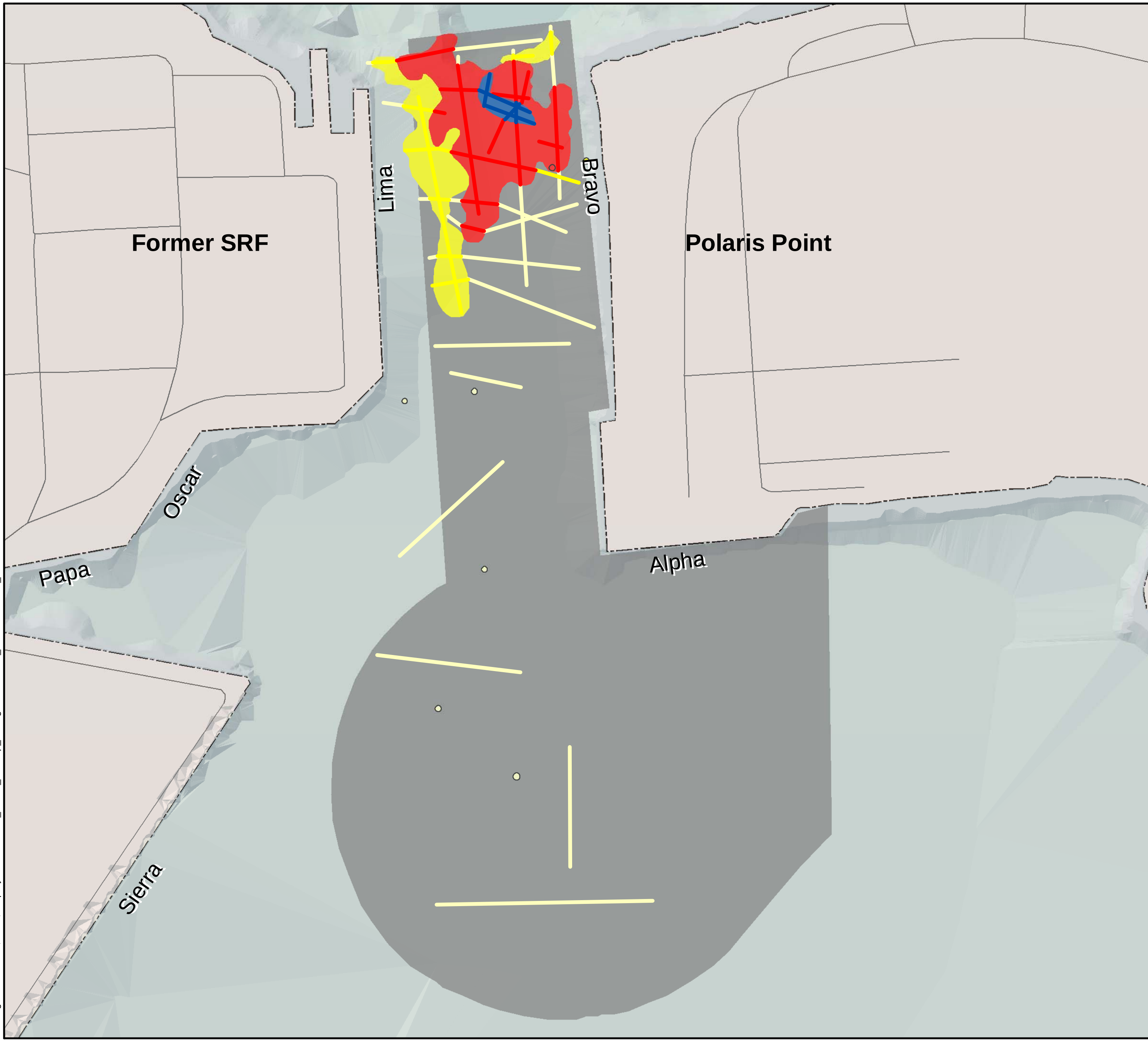

Figure 11.1-14
Coral Abundance
Inner Apra Harbor
Entrance Channel

Source: Navy 2003b

Printing Date: Oct 19, 2009, M:\projects\GIS\8806_Guam_Buildup_EIS\figures\Current_Deliverable\Vol_4\11.1-14.mxd

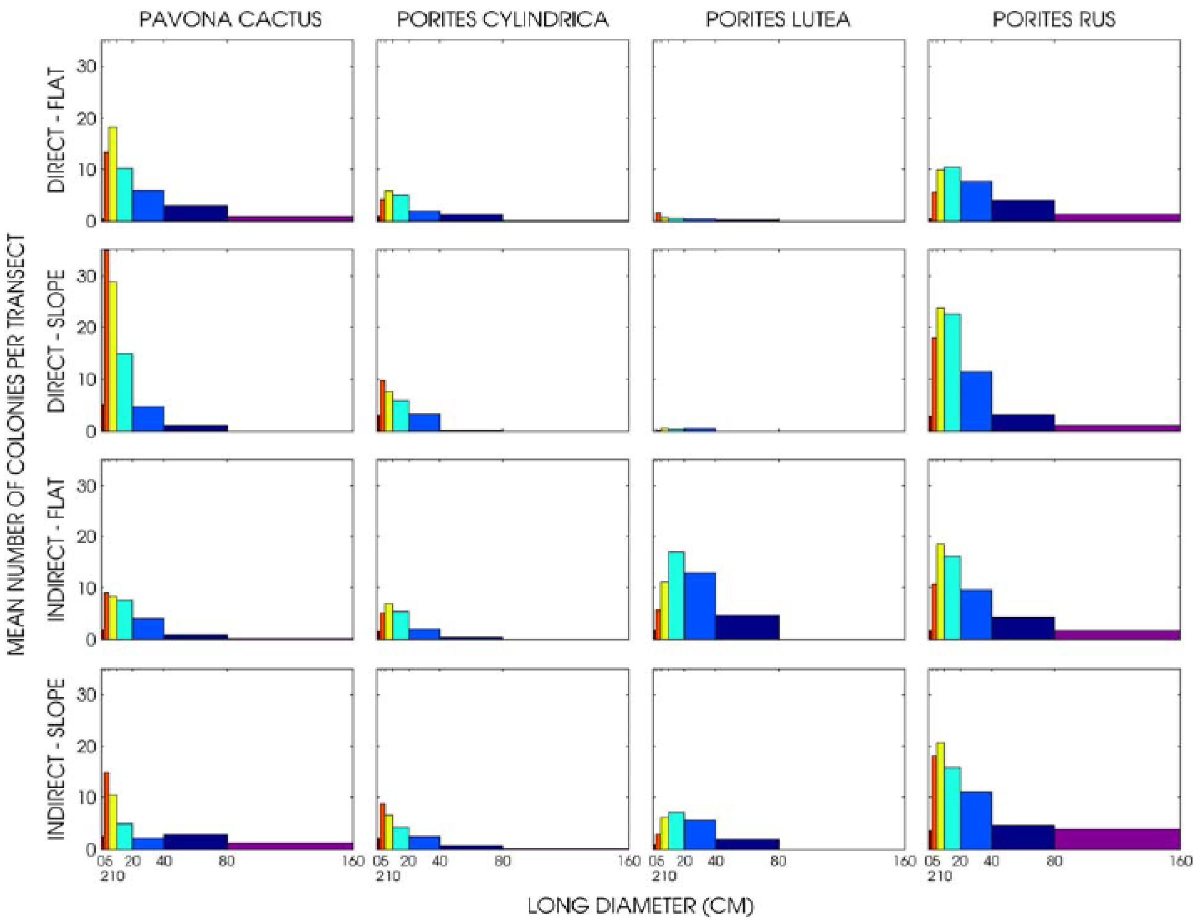

Figure 11.1-15. Size-frequency Distribution of the Four Most Abundant Corals for the Apra Survey Area

11.1.2.3 Evaluation of the Benthic Community Structure

Dollar et al. (2009) performed an evaluation of the benthic community structure of Outer Apra Harbor with respect to the 67 transect points associated with the aircraft carrier dredge area. A summary of the evaluation follows.

The general classes consisted of algae, stony coral, sponges, soft coral, ascidians, echinoderms and sediment. Sediment consisted of sand, mud and rubble. Algae and sediment each occurred on 66 transects, coral occurred on 52 transects, and sponges occurred on 55 transects. Ascidians occurred on three transects and echinoderms on four transects. In terms of ranges of cover of general classes, all classes had minimum cover of zero on at least one transect. Maximum transect cover of general classes were 100% for algae and sediment, 88% for coral, 24% for sponges, 9% for soft coral, 1% for echinoderms, and about 0.3% for ascidians. Cumulative means of general classes for each transect reveal the overall pattern of decreasing algae and sediment with increasing coral cover (Figure 11.1-16).

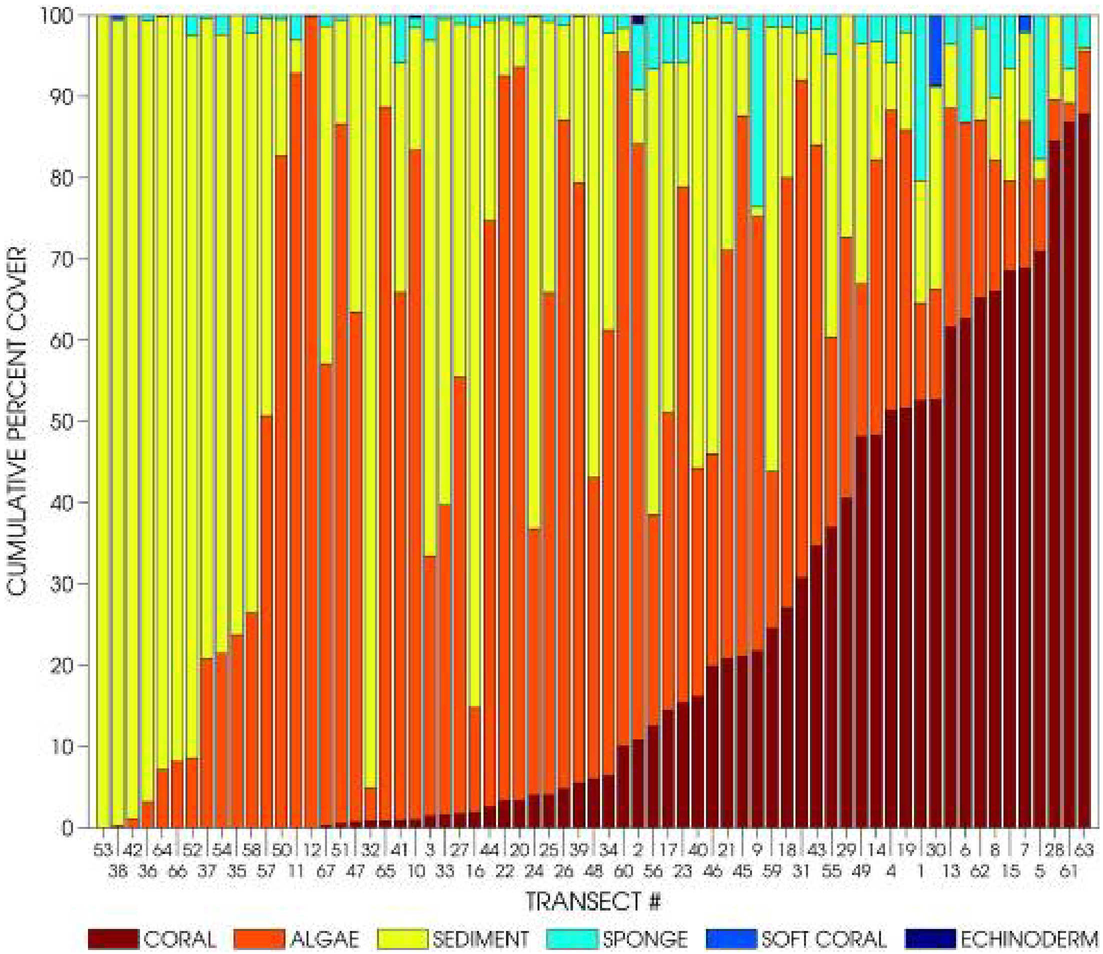

Figure 11.1-16. Stacked Bar Graph Showing Cumulative Percent Covers for Each General Class in Each Transect. Transects are Arranged in Order of Lowest to Highest Coral Cover.

The detailed classes of benthic cover consisted of 37 categories identified in transect photo-quadrats. The most prevalent class of biota was mixed macroalgae, which occurred on 65 transects with a maximum transect cover of 74%. In terms of occurrence of a single macroalgal species, the most common was *Halimeda*, which was present on 30 transects, with a maximum transect cover of 59%, followed by *Dictyota* (23 transects; max cover of 37%) and *Padina* (15 transects; max cover of 27%). With respect to distribution of corals, the most abundant was *P. rus* which appeared on 47 transects with a maximum transect cover of 85%, followed by *P. lutea* (26 transects; max of 37%), *P. cylindrica* (18 transects; max of 12%) and *Pavona cactus* (13 transects; max transect cover of 43%) (Dollar et al. 2009).

Figure 11.1-17 shows benthic cover of general classes separated into four strata (Direct-Flat, Direct Slope, Indirect Flat, Indirect Slope). Mean algal cover within strata varied from a low of 31% in the Indirect Slope stratum to a high of 48% on the Direct Slope transects. The mean coral cover trend was opposite the trend for algae, with the highest cover on the Indirect Slope (38%) and the lowest on the Direct Slope (14%). On the combined Direct strata transects, mean algal cover was 45%, while mean coral cover was 14%. On the combined Indirect transects, mean algal cover was 33% compared to mean coral cover of 32%. When all transects are combined, mean algal cover was 40% compared to mean coral cover of 22% (Dollar et al. 2009).

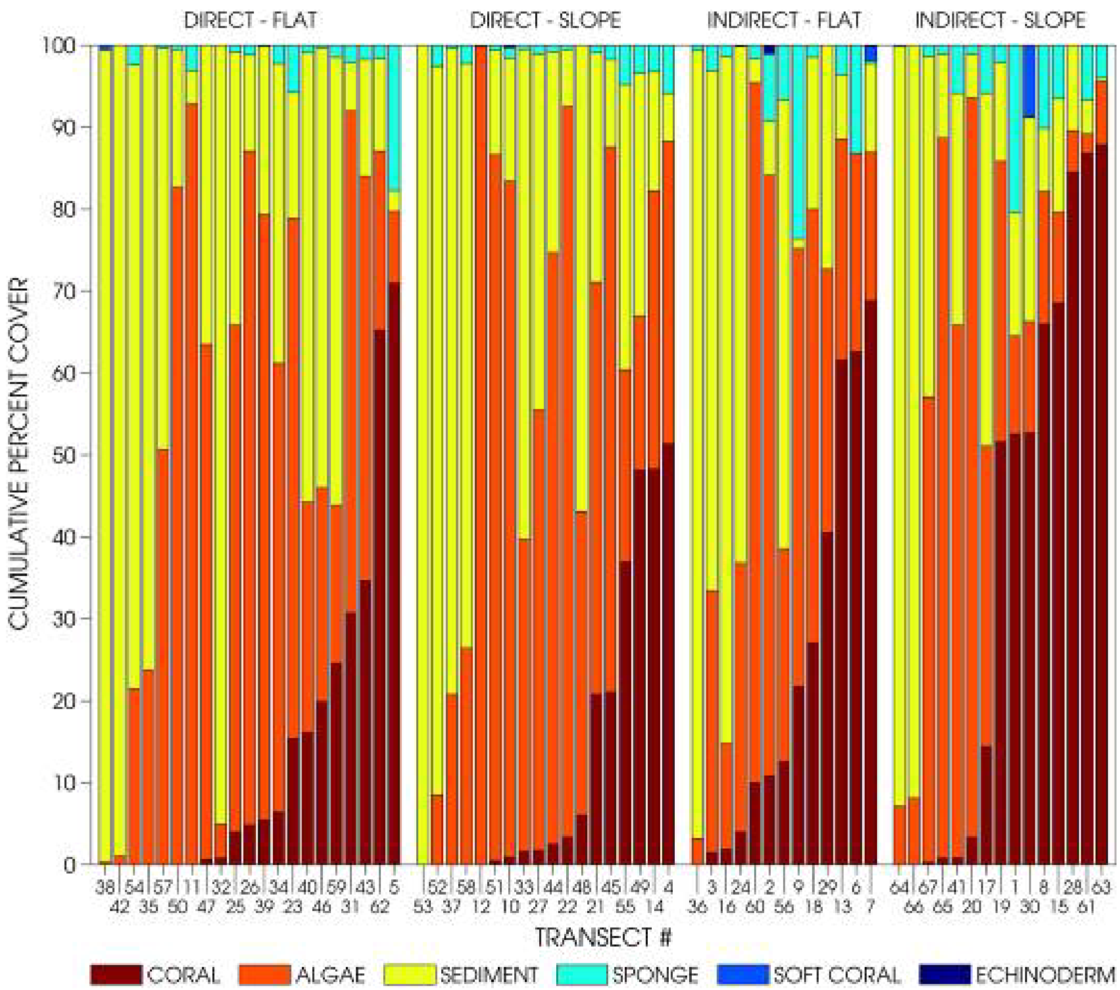

Figure 11.1-17. Cumulative Percent Covers for Each General Class in Each Transect, Arrange by Survey Stratum

When all species of coral are listed by order of abundance on transects, *P. rus* was an order of magnitude more abundant than any other species, accounting for 74% of all corals (Table 11.1-3). Along with *P. lutea*, *Pavona cactus*, and *P. cylindrica*, the four most abundant species comprise about 95% of coral cover of the aircraft carrier action survey area. When transects within a strata are ordered according to percent cover of *P. rus*, the overall pattern of coral cover is similar. In each zone, one-half of the transects had cover of *P. rus* less than 2% of bottom cover. Distribution of ranked order of *P. rus* throughout the other half of the transects within each strata occurred as a progressive increase with little overlap of mean cover up to the maximum value in each strata. As a result, the mean value of coral cover within any strata is influenced by both the relatively large number of transects with essentially no coral, as well as the steep gradient of increasing cover on transects that do contain coral (Dollar et al. 2009).

Table 11.1-3. Prevalence of All Coral Species from Photo-quadrat Transect Data

Coral Species	*Count*	*Fraction*	*Percentage*	*Cumulative Percentage*
Porites rus	7,935	0.745	74.458	74.458
Porites lutea	959	0.090	8.999	83.457
Pavona cactus	849	0.080	7.967	91.423
Porites cylindrica	409	0.038	3.838	95.261
Acropora aspera	147	0.014	1.379	96.641
Acropora nasuta	130	0.012	1.220	97.861
Herpolitha limax	69	0.006	0.647	98.508
Pachyseris speciosa	35	0.003	0.328	98.836
Astreopora myriophthalma	26	0.002	0.244	99.080
Lobophyllia corymbosa	25	0.002	0.235	99.315
Pocillopora damicornis	24	0.002	0.225	99.540
Lobophyllia hemprichii	17	0.002	0.160	99.700
Acrhelia horrescens	12	0.001	0.113	99.812
Astreopora randalli	5	0.000	0.047	99.859
Fungia echinata	5	0.000	0.047	99.906
Montipora verrucosa	4	0.000	0.038	99.944
Pavona varians	4	0.000	0.038	99.981
Lobophyllia (cf.) hataii	2	0.000	0.019	100.000
Total Coral Points	**10,657**			

To select the most important community components in terms of percent of total variance explained, Dollar et al. (2009) applied a principal component analysis (PCA) to the detailed class percent cover data. In PCA, the first principal component (PC) describes the highest proportion of variance in the data, the second PC describes the second highest proportion of variance, and so on. In the present data set, the first five PCs describe >90% of the variance, and virtually all of the variability in the data is described by the first 14 PCs. This result indicates that the data are essentially five-dimensional (as opposed to the 38 dimensions described by the individual detailed classes). By plotting the coefficient value for each PC against the individual detailed classes, it is possible to identify which detailed classes are responsible for each PC, and thus which detailed classes are responsible for the variance in the whole data set. For PC 1, the two detailed classes with the highest coefficient (absolute) values were mud and *P. rus*. In PC 2, the two most important classes, other than the two from PC 1 (mud, *P. rus*), were mixed algae and *Halimeda* sp. In PC 3, the two most important additional classes were rubble and *P. lutea*. In PC 4, the two most important additional classes were *Padina* sp. and cyanobacteria. Finally, in PC 5, the two most important additional classes were turf algae and *P. cactus*. Together, these 10 classes are the most important to describe variability in benthic cover in the data set.

There are several other methods used to demonstrate the relationship between the three major types of benthic cover (algae, sediment, coral), which are described in Dollar et al. (2009). Several findings of interest include the following: 1) when sediment cover exceeds approximately 75% of transect cover, there is essentially no coral cover; no coral occurs without the presence of algae; and there is a weak trend of increasing rugosity with increasing coral cover; and 2) where sediment cover is less than about 75% and coral cover above approximately 5%, there is a relatively even distribution between algae and coral throughout the survey area.

Additional Marine Flora, Invertebrates and Associated EFH Data

Several species of marine flora were identified during the Smith (2007) survey, although a specific algal survey was not conducted. The crests of many of the shoals were rubble and sand with dense brown algae (*Padina*). Calcareous green algae (*Halimeda*) was common at depths of less than 20 ft (6.1 m) at Big Blue Reef east. Marine floral species are discussed further below under the Special-Status Species section with regards to “preferred forage” for green sea turtles. Additional marine flora and invertebrate survey data are provided in Smith 2007.

Large sea cucumbers (*Thelenota annas*) were common on the seafloor at the shoal areas. Elephant ear sponges (*Ianthell basta*), as well as oval shaped free living corals (Family Fungidae) were common on the slopes of most shoals in the study areas. Other species of sea cucumbers were present at every study site and were abundant in the turning basin and shoal areas. Relatively few of the important harvested invertebrate species identified by Porter et al. (2005) were observed. Those that were observed were all at Big Blue Reef west and included octopus, top shell, spider conch, double-spined rock lobster, and xanthid reef crabs (Smith 2007).

The Navy surveys (Navy 2009a) yielded similar observations to Smith (2007) regarding the commonly harvested invertebrates identified by Porter et al. (2005). More specifically, octopus, top shell, spider conch, double-spined rock lobster, and xanthid reef crab “…were rarely seen during these surveys, and those that were observed were regarded as ‘small’ in size.” None of these species were observed at Polaris Point or adjacent areas, Turning Basin or shoal areas sampling locations. These observations support the conclusions of Porter et al. (2005) that overfishing is a significant problem on Guam, and that finfish and harvested invertebrate stocks are biologically depressed.

Dollar et al. (2009) summarized invertebrate data in terms of mobile and sessile species counts at each transect within each strata, and taxa richness for all invertebrates. Summaries of these data are as follows:

- A total of 55 mobile species from 45 genera were encountered. The grand totals of the mean occurrence of mobile species (individuals per 100 square meters [m^2]) were higher in both Indirect strata than Direct strata, and higher on the flats of each strata relative to the slopes. With one exception, the most abundant phylum in each strata was the Mollusca, followed in order by the Echinodermata, Crustacea, Platyhelminthes, and Cnidaria (the exception being slightly higher numbers of crustaceans than echinoderms in the Indirect Slope stratum). Overall, abundance of each phylum was also greater in the Indirect strata than Direct strata.
- A total of 62 sessile species from 34 genera were encountered during surveys. Unlike mobile species, the grand totals of the means (individuals per 25 m^2) were higher in both Slope Strata compared to both Flat strata. Overall, there was no consistent pattern of greater abundance between the Direct and Indirect areas. The overwhelmingly dominant phylum of sessile invertebrates in all strata was the Porifera, followed by the Ascidia, and with minor contributions from the Molluscs and Polycheates. Probably the most conspicuous member of the Porifera within the survey area was the "elephant-ear sponge" (*Ianthella* spp.), with individuals up to one meter in width commonly occurring in the deeper areas of the harbor floor.
- Invertebrate surveys were replicated at three transects (15, 49 and 61) during the day and night. The grand total of counts on the three transects was higher at night than during day. The greatest difference occurred on Transect 49, where a total of 144 individuals were counted at night compared to 10 during the day. The predominant difference was the occurrence of 117 crustacea at night compared to none during the day. Taxa richness at night

was also greater on all transects compared to daytime. The greatest difference again occurred on Transect 49 where 15 species of crustacea were encountered at night compared to none during the day.

- Counts of mobile invertebrates at all 67 transect sites revealed considerably higher mean density in the two Indirect strata (26 Flat; 24 Slope) compared to the Direct strata (12 Flat, 7 Slope). Mobile invertebrate species composition consisted primarily of molluscs, with smaller contributions from echinoderms and crustaceans. Populations of sessile macroinvertebrates (other than stony corals) consisted predominantly of a wide variety of sponges (Porifera), with smaller contributions from the ascidians, molluscs and polycheates. Mean values of sessile invertebrates were higher on the Slope strata (92 Direct, 119 Indirect) than the Flat strata (71 Direct, 86 Indirect).

11.1.3 Essential Fish Habitat

As discussed in Volume 2, Sections 11.1 and 11.2, all of Apra Harbor is considered EFH and Jade Shoals is a HAPC. Figures 11.1-3 – 11.1-7 in Volume 2, Chapter 11, show the EFH and HAPC designated within Guam waters for various life stages of Management Unit Species (MUS). Information pertaining to the affected environment for coral and coral reef habitat, which is an important EFH, was addressed in Section 11.1.2 above, including quantitative evaluation of the benthic community structure.

A brief summary of sensitive marine biological resources and habitats of Apra Harbor is provided below and in Figure 11.1-18. Five MUS are associated with EFH within Apra Harbor (Table 11.1-4):

- Napoleon or humphead wrasse (NMFS species of concern [SOC] and EFH-Currently Harvested Coral Reef Taxa [CHCRT])
- Bigeye scad (EFH-CHCRT)
- Scalloped hammerhead (EFH-Potentially Harvested Coral Reef Taxa [PHCRT])
- Sessile MUS (EFH-PHCRT), including stony corals, soft corals, sponges, algae, etc.
- Bumphead parrotfish (NMFS SOC and EFH-CHCRT)

Table 11.1-4. MUS Associated with EFH for Apra Harbor

Group	*Common Name/Chamorro Name*	*Status**	
		Federal	*Guam*
Coral Reef Ecosystem Fishery Management Plan (CRE FMP)			
Fish MUS	Napoleon wrasse/*Tanguisson*	SOC	SOGCN
	Bigeye scad/*Atulai*	EFH-CHCRT	SOGCN
	Scalloped hammerhead/*Halu'u* (general term)	EFH-PHCRT	SOGCN
	Bumphead parrotfish/*Atuhong*	EFH-CHCRT	SOGCN
Sessile Benthic MUS**	Stony coral/*Cho' cho'*	EFH-PHCRT	SOGCN

Notes: *E = endangered, T = threatened; SOC = NMFS Species of Concern; SOGCN = Species of Greatest Conservation Need. There is no critical habitat designation for any marine species on Guam.
** includes algae, sea grass, and assorted invertebrates (sponges, hard and soft corals, etc.)
Sources: WPFRMC 2005, USFWS 2009a, and NMFS 2009.

The Napoleon wrasse has been observed in the area from Orote Point to Sumay Cove; however, it was not identified in the recent quantitative fish survey (UoG 2009). The bigeye scad is present at two areas in high concentrations in Apra Harbor; however, it is not directly associated with the study area (NOAA 2005b).

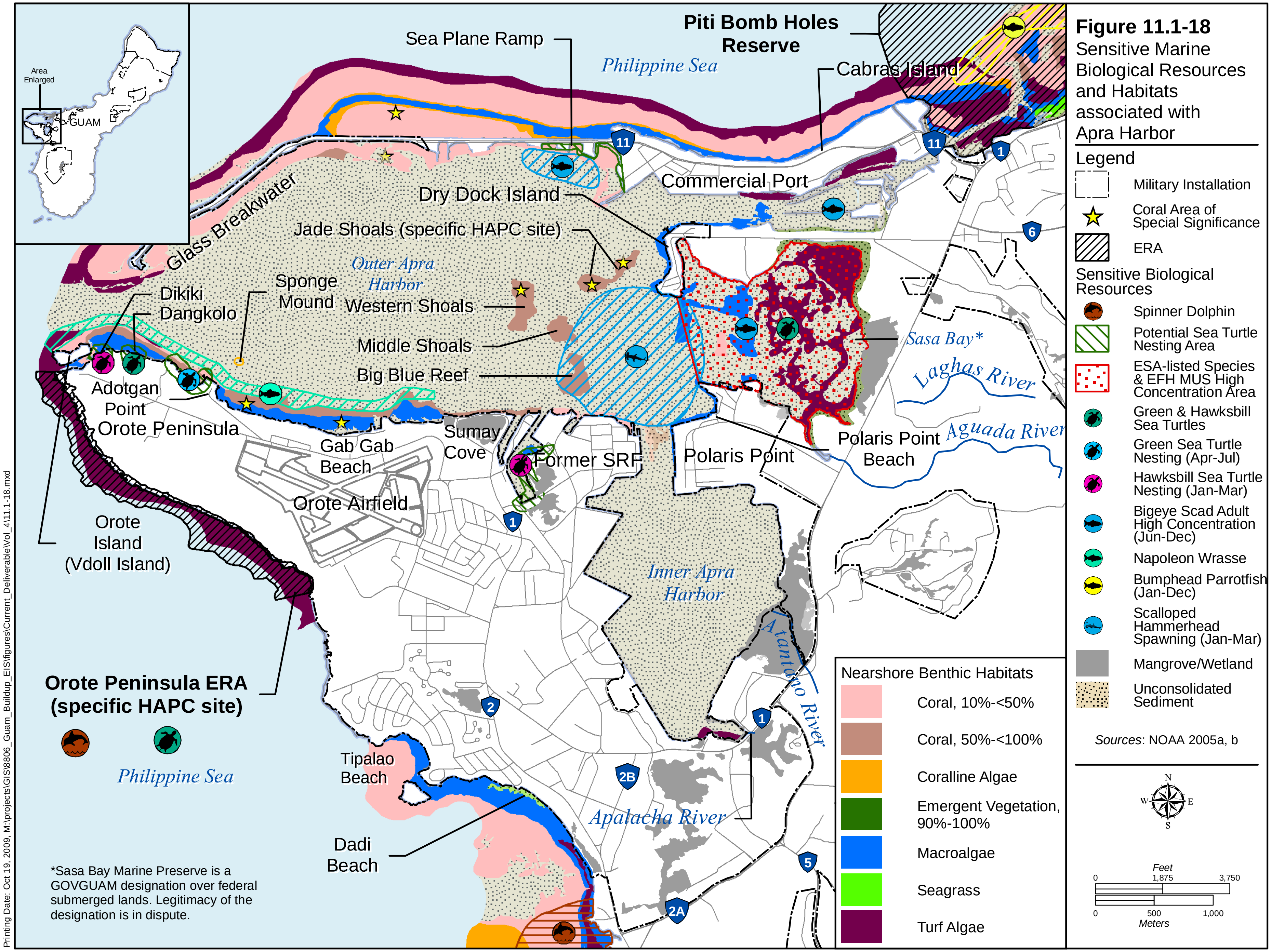

Figure 11.1-18
Sensitive Marine Biological Resources and Habitats associated with Apra Harbor
Legend
Military Installation
Coral Area of Special Significance
ERA
Sensitive Biological Resources
Spinner Dolphin
Potential Sea Turtle Nesting Area
ESA-listed Species & EFH MUS High Concentration Area
Green & Hawksbill Sea Turtles
Green Sea Turtle Nesting (Apr-Jul)
Hawksbill Sea Turtle Nesting (Jan-Mar)
Bigeye Scad Adult High Concentration (Jun-Dec)
Napoleon Wrasse
Bumphead Parrotfish (Jan-Dec)
Scalloped Hammerhead Spawning (Jan-Mar)
Mangrove/Wetland
Unconsolidated Sediment
Sources: NOAA 2005a, b
Nearshore Benthic Habitats
Coral, 10%-<50%
Coral, 50%-<100%
Coralline Algae
Emergent Vegetation, 90%-100%
Macroalgae
Seagrass
Turf Algae
Feet
0
1,875
3,750
0
500
1,000
Meters
N
E
S
W
Area Enlarged
GUAM
Piti Bomb Holes Reserve
Sea Plane Ramp
Philippine Sea
Cabras Island
Commercial Port
Dry Dock Island
Glass Breakwater
Jade Shoals (specific HAPC site)
Outer Apra Harbor
Sponge Mound
Western Shoals
Dikiki
Dangkolo
Middle Shoals
Big Blue Reef
Adotgan Point
Orote Peninsula
Sasa Bay*
Laghas River
Aguada River
Polaris Point Beach
Polaris Point
Sumay Cove
Former SRF
Gab Gab Beach
Orote Airfield
Orote Island (Vdoll Island)
Inner Apra Harbor
Atantano River
Orote Peninsula ERA (specific HAPC site)
Philippine Sea
Tipalao Beach
Dadi Beach
Apalacha River
*Sasa Bay Marine Preserve is a GOVGUAM designation over federal submerged lands. Legitimacy of the designation is in dispute.
Printing Date: Oct 19, 2009, M:\projects\GIS\8806_Guam_Buildup_EIS\figures\Current_Deliverable\Vol_4\11.1-18.mxd

The scalloped hammerhead is reported to spawn, although rarely (Navy 2009b), in areas outside the Inner Apra Harbor Entrance Channel (NOAA 2005b). This species typically spawns near structures (Navy 2009d). Stony corals are found in high concentrations in Outer Apra Harbor along with other sessile and motile invertebrates.

The bumphead parrotfish is reported nearby within Piti Bomb Holes Reserve (NOAA 2005b), however, no observations in Apra Harbor have been documented. Piti Bomb Holes Reserve is located approximately 4 mi (6 km) from Outer Apra Harbor Entrance Channel.

11.1.3.1 Finfish Assessment

Reef fish assemblages vary considerably over multiple spatial scales. This “patchy” nature of most reef fish communities is easily explained by the variability in environmental parameters, such as nutrient availability, water quality, and most importantly, habitat structure. Habitat structure plays a very important role in structuring reef fish communities because many species are dependent on certain habitats at both small and large spatial scales. Predicting the response of reef fish communities to habitat disturbance, however, is much more complicated. Such predictions rely on the magnitude of environmental impact and the mobility and site-fidelity of particular species. Reef fish are arguably less affected than other reef organisms to many physical disturbances. However, there are many species that are highly site-attached (have high site fidelity) and remain within a very small home range throughout their entire lives (UoG 2009). Marnane (2000) studied site fidelity and homing behavior in tagged coral reef cardinalfishes (*Apogon doe derlini*, *Cheilodipterus ar tus* and *Cheilodipterus qui nquilineatus*) and study results indicated that fish persisted to within an average of 14 to 39 in (36 to 79 cm) of their initial resting positions within One Tree Reef lagoon for over 8 months. In addition, 56–81% of tagged fish displaced approximately 3,280 ft (1,000 m) and 33–63% of tagged fish displaced 6,500 ft (2,000 m) returned to their point of collection within 3 days. Sale and Dybdahl (1975, 1978) repeatedly removed fish from a series of small isolated coral heads and followed recolonization. They concluded that the species of such small assemblages recolonized by almost entirely a matter of chance. They detected no fine-scale microhabitat discrimination, no mutual exclusion by pairs of species, and no separation of species by time of year at which recruitment occurred.

<u>Quantitative Assessment of Reef Fish Communities (UoG 2009)</u>

For the purposes of this EIS/OEIS, the abundance and occurrence of fish families were estimated quantitatively through finfish population surveys performed in July 2009 (UoG 2009). Other qualitative fish studies were used to supplement this information. For a detailed description of the UoG (2009) methodology, results and discussion, survey points, and tables and figures showing mean diversity, biomass, and species richness, see Volume 9, Appendix J. The following text summarizes the findings of the UoG study.

An assessment of reef fish communities within the Outer Apra Harbor dredge footprint was conducted to quantify species richness, abundance, and biomass of reef fish communities within and adjacent to the proposed project area. The survey also recorded the dominant habitat type at each site as either coral-dominated, macroalgae-dominated, rubble-dominated, or sand-dominated. One additional site, unique to all others and referred to as the “dump site,” was comprised entirely of cinder blocks that had been deposited onto the seafloor at approximately 50 ft (15 m), creating an artificial habitat.

A total of 119 species representing 28 families were recorded. On average, the families Acanthuridae ("thorn tail" - is the family of surgeonfishes, tang, and unicornfishes), Caesionidae (fusilier fishes - related to the snappers, but adapted for feeding on plankton, rather than on larger prey), Lutjanidae (snappers), Scaridae (parrottfishes), and Lethrinidae (porgies, rudderfishes, scavengers, and emperors) had the highest biomass per transect, and the commercially important groupers of the family Serranidae were more common than anticipated, yet still rare. The most numerically dominant families were Pomacentridae (damselfishes and clownfishes), Scaridae, Caesionidae, and Acanthuridae. In this study, Pomacentrids represented 60% of the total fish abundance across the site.

Among the major habitat types surveyed, those dominated by coral and sand had the least similar fish communities, which is not surprising given that coral-dominated sites have high habitat complexity, while sand-dominated sites naturally lack fish habitat. Sites dominated by coral were generally the most speciose (comparatively rich in number of species) and diverse whereas the opposite was true for sand-dominated sites. The species most responsible for this difference were the staghorn damsel (*Amblyglyphidodon curacao)* and daisy parrotfish (*Chlorurus sordidus)*, whose abundance increased by an order of magnitude in coral-dominated sites, and the blue devil damsel (*Chrysiptera cyanea)*, whose abundance was greater in sand dominated sites. In general, the vast majority of species recorded increased in abundance at coral-dominated sites. The lone "dump site" stood out as a unique site with a high mean dissimilarity value compared with other habitats. This was due to the unusually high number of red breast wrasses (*Cheilinus fasciatus),* brassy trevally (*Caranx papuensis)*, and black-tailed snapper (*Lutjanus fulvus*), which apparently favored the artificial habitat, and a very low abundance of pomacentrid species (staghorn damsel [*Amblyglyphidodon curacao*], blue devil damsel [*Chrysiptera cyanea*], and the green chromis (*Chromis viridis*), which are very common in most other habitats.

Multivariate analyses indicated that fish assemblages were largely grouped along a depth/habitat gradient, and fish diversity and biomass were greatest at sites of high coral cover. Biomass of commercially important species is reported highest at the coral-dominated sites while those sites dominated by sand have depauperate fish communities. When analyses were performed with depth as a factor, there was a strong grouping among sites below 40 ft (12 m). The greater variability in fish assemblages among sites within the depth range of 40-60 ft (12-18 m) is likely explained by previous dredging of many of these sites. When sites were coded for their location with respect to future direct or indirect impacts of dredging, it can be seen that many of the low diversity sites would be directly affected. However, 50% (9 of 18) of the sites dominated by coral and having the most significant fish assemblages (identified above) would also be directly affected.

Water visibility during the Apra Harbor surveys is a major potential source of sampling bias, especially for quantification of fish communities. Water visibility was poor at several sites - three of those sites (56, 44 and 66) which were all associated with the Alternative 2 direct impact area, had to be removed from the study due to poor visibility. The sites are located as follows: Site 56 is just west of inner harbor entrance channel, Site 44 is near Big Blue Reef's eastern end, and Site 66 is located near Big Blue Reef's southern end (see Figure 11.1-11 above).

11.1.4 Special-Status Species

This section includes a brief summary of key points included within Volume 2, Chapter 11 as baseline information for this resource. A brief summary of special-status species is provided below. Sensitive marine biological resources and habitats of Apra Harbor are shown in Figure 11.1-18. The three special-status species potentially associated with Apra Harbor study area are the following (Table 11.1-5):

- Green sea turtle (Endangered Species Act [ESA]-listed as threatened)
- Hawksbill sea turtle (ESA-listed as endangered)
- Spinner dolphin (protected under the Marine Mammal Protection Act [MMPA])

A Marine Resources Biological Assessment is being prepared by the Navy and will address the potential effects of the proposed federal action on all threatened, endangered, and proposed species known or suspected to occur in the proposed action influence area. Threatened, endangered, and proposed species are managed under the authority of the federal Endangered Species Act (PL 93-205, as amended). The Endangered Species Act requires federal agencies to ensure that all actions which they "authorize, fund, or carry out" are not likely to jeopardize the continued existence of any threatened, endangered, or proposed species. Agencies are further required to develop and carry out conservation programs for these species.

Spinner dolphins are noted on a rare, but somewhat regular basis within Apra Harbor (personal communication, Roy Brown, September 2007 from COMNAV Marianas 2007b). Brown runs dolphin tours in Guam's waters and estimates that spinner dolphins are seen up to four times a year in Outer Apra Harbor near the entrance channel, which ranges from 7,500 - 11,250 ft (2,300 – 3400 m) away from the proposed action depending upon the stage of dredging. The pier construction would be at the furthest distance identified above.

Table 11.1-5. Special-Status Species Potentially Occurring within Apra Harbor

Common Name/Chamorro Name	*Status** *Federal*	 *Guam*
Green sea turtle/*Haggan bed'di*	T	T
Hawksbill sea turtle/*Hagan karai*	E	E
Spinner dolphin/*Toninos*	MMPA	SOGCN

Notes: *E = endangered, T = threatened, MMPA= Marine Mammal Protection Act, SOGCN= species of greatest conservation need. There is no critical habitat designation for any marine species on Guam.
Sources: USFWS 2009a, NMFS 2009.

The green and hawksbill sea turtles are the only special-status species reported in Apra Harbor, with observations of green sea turtles occurring on a more regular basis. Sasa Bay is a year round, high concentration area for sea turtles as identified by NOAA (2005b). Smith (2007) observed nine green sea turtles, five of which were on Big Blue Reef. All turtles sighted at Big Blue Reef were 15 to 23 in (40 to 60 cm) in length, with no visible fibropapilloma tumors or other signs of injury. No hawksbill sea turtles were observed. A cooperative effort between the Navy and resource agencies is ongoing for monitoring sea turtle nesting activity, however tagging programs and density information for sea turtles in Apra Harbor is deficient.

Algal species (and sea grass to a lesser degree) are reported at multiple other areas throughout Apra Harbor (NOAA 2005a, 2005b; Dollar et al. 2009), hence potential sea turtle foraging and resting areas are not limited. Although algal surveys were not conducted, Smith (2007) suggests that potential sea turtle resting habitat and preferred algal forage species were present on Big Blue Reef and the shoal areas, where most turtle sightings occurred. Balazs et. al (1987) identified ten genera of algae that he considered to be preferred forage for green sea turtles in Hawaii.

Preferred sea turtle forage species observed included green algae (*Dictyospheria* spp. and *Ulva* spp.), brown algae (*Sargassum* spp.), and red algae (*Gracillaria* spp., *Jania* spp., *Hypnea* spp., *Acanthophora spicifera* and *Laurencia* spp.). Green sea turtles are probably opportunistic feeders; however, within the preferred food items listed above, three species (*Dictyospheria versluysii*, *Sargassum obtusifolium*, *and Acanthophora specifera*) have been reported from Guam (Lobban and Tsuda 2003), and were tentatively identified on Big Blue Reef west and the shoal areas. None of the algae listed above were abundant at any of the study sites during recent surveys (Smith 2007).

The reef area in the aircraft carrier dredge footprint does not represent a unique or unusual habitat in comparison to the entire Apra Harbor reef complex, and does not contain an abundance of algal species that represent a major food source for sea turtles that cannot be found elsewhere in Apra Harbor. Smith (2007) reported that five of the nine green sea turtles observed during a 2-day survey in the project area were at Big Blue Reef. Dredging activities within the vicinity of Big Blue Reef and turning basin could last 2 to 4 months. Dredging activities within the channel fairway and bend are not anticipated to significantly affect sea turtles above existing conditions. Sasa Bay is reported as an area of high concentration for both ESA-listed sea turtle species (NOAA 2005b). Therefore, the alternative actions and associated underwater noise has the potential to affect sea turtle populations, in the area or in transit during aircraft carrier turning basin dredging and wharf construction activities, by temporarily changing their swimming or feeding patterns. Considering the presence of sea turtles in Outer Apra Harbor, the proposed in-water construction action (dredging and pile driving) and associated noise has the potential to affect the ESA-listed green sea turtle by temporarily changing their swimming or feeding patterns.

There have been limited studies on green sea turtle hearing capabilities, but the available data suggests hearing in the moderately low frequency range, and a relatively low sensitivity within the range they are capable of hearing (Bartol et al. 1999; Ketten and Bartol 2006). NOAA (2005b [pp 3-88 and 3-89]) identifies sea turtle hearing sensitivity, and includes the following information. The range of maximum sensitivity for sea turtles is 100 to 800 Hz, with an upper limit of about 2,000 Hz. Hearing below 80 Hz is less sensitive but still potentially usable to the animal (Lenhardt 1994). Green turtles are most sensitive to sounds between 200 and 700 Hz, with peak sensitivity at 300 to 400 Hz. They possess an overall hearing range of approximately 100 to 1,000 Hz (Ridgway et al. 1969). Sensitivity even within the optimal hearing range is apparently low—threshold detection levels in water are relatively high at 160 to 200 dB with a reference pressure of one dB re 1 μPa-m (Lenhardt 1994).

TEI (2006) gathered unpublished data on hearing thresholds for green sea turtles from an Office of Naval Research study at the New England Aquarium and combined these data with other information (Ruggero and Temchin 2002) to present the hearing thresholds in Table 11.1-6. These data shows results similar to those presented above and provide the best available estimates for the green sea turtle. The hearing bandwidth was relatively narrow, 50 to 1,000 Hz, with maximum sensitivity around 200 Hz. In addition, these animals have very high hearing thresholds at over 100 dB re 1 μPa in low frequencies where construction sound is concentrated.

Table 11.1-6. Hearing Thresholds and Bandwidth for Sea Turtles

Hearing Bandwidth 1/3 Octave Band (Hz)	*Hearing Threshold Sea Turtle (dB re 1 μPa*
50	149
63	142
80	131
100	119
125	118
160	117
200	115
250	119
315	123
400	130
500	136
630	144
800	154
1,000	166

Source: TEI 2006, NEA 2005, and Ruggero and Temchin 2002.

As mentioned in Volume 2, Chapter 11, sea turtles have been observed nesting during all months of the year on Guam; however, the peak of nesting activity occurs from April to July. Sea turtle nesting activity has been reported from three Apra Harbor locations (see Figure 11.1-18): Adotgan Dangkolo (Dangkolo) (green sea turtles), Adotgan Dikiki (Dikiki) (hawksbill sea turtles), and Kilo Wharf (green sea turtles). Historic records of sea turtle nesting include a hawksbill reported at a beach near Sumay Cove in 1997, and a general report of nesting at a beach near the Sea Plane Ramp (COMNAV Marianas 2007a) (refer to Figure 11.1-18.) No nesting activity has occurred at these areas since that time (COMNAV Marianas 2008; Navy 2009b). In general, sea turtles nest and hatch at night. They use natural light cues to orient toward the ocean. However, the bright lights from the dredging platforms may confuse nesting turtles and hatchlings, and result in them orienting away from the open ocean (COMNAV Marianas 2007a).

See Volume 2, Chapter 11, for more baseline information on special-status species.

Critical Habitat

There is no critical habitat designation for any marine species on Guam.

11.2 ENVIRONMENTAL CONSEQUENCES

11.2.1 Approach to Analysis

11.2.1.1 Methodology

The methodology for identifying, evaluating, and mitigating impacts to marine biological resources was based on federal laws and regulations including the ESA, MMPA, Magnuson-Stevens Fishery Conservation and Management Act or Magnuson-Stevens Act (MSA), Section 404(b)(1) Guidelines (Guidelines) of the Clean Water Act (CWA), and Executive Order (EO) 13089, *Coral Reef Protection*. Significant marine biological resources include all special-status species including species that are ESA-listed as threatened and endangered or candidates for listing under ESA, species protected under the MMPA, or species with designated EFH or HAPC established under the MSA. The MSA defines EFH as "...those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." 'Waters' include aquatic areas and their associated physical, chemical, and biological properties that are used by fish. 'Substrate' includes sediment, hard bottom, structures underlying the waters, and associated biological communities. 'Necessary' means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem, and 'spawning, breeding, feeding, or growth to maturity' covers a species' full life cycle (16 United States Code [USC] 1801 et seq.). Additionally, at least one or more of the following criteria established by the NMFS must be met for HAPC designation: 1) the ecological function provided by the habitat is important, 2) the habitat is sensitive to human-induced environmental degradation, 3) development activities are, or will be, stressing the habitat type, or 4) the habitat type is rare. It is possible that an area can meet one HAPC criterion and not be designated an HAPC. The Western Pacific Regional Fishery Management Council (WPRFMC) used a fifth HAPC criterion, not established by NMFS, that includes areas that are already protected, such as Overlay Refuges (WPRFMC 2005).

The Coral Reef Protection Guidelines include a Memorandum of Agreement (MOA) between the U.S. Environmental Protection Agency (USEPA) and U.S. Department of the Army (Army), to articulate policies and procedures to be used in the determination of the type and level of mitigation necessary to demonstrate CWA compliance. The MOA is specifically limited to the Section 404 regulatory program and does not change substantive Section 404 guidance. The MOA expresses the intent of the Army and USEPA to implement the objective of the CWA to restore and maintain the chemical, physical, and biological integrity of the Nation's waters, including special aquatic sites (SAS). SAS are those sites identified in 40 CFR 230, Subpart E (i.e., sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs, and riffle and pool complexes). They are geographic areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values. These areas are generally recognized as significantly influencing or positively contributing to the general overall environmental health or vitality of the entire ecosystem of a region.

In general, the main intentions of the four federal acts listed above are as follows:

- The ESA establishes protection over and conservation of threatened and endangered species and the ecosystems upon which they depend, and requires any action that is authorized, funded, or carried out by a federal entity to ensure its implementation would not jeopardize the continued existence of listed species or adversely modify critical habitat.
- The MMPA was established to protect marine mammals by prohibiting take of marine mammals without authorization in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S.
- The MSA requires NMFS and regional fishery management councils to minimize, to the extent practicable, adverse effects to EFH caused by fishing activities. The MSA also requires federal agencies to consult with NMFS about actions that could damage EFH.
- The CWA Guidelines set forth a goal of restoring and maintaining existing aquatic resources, including SAS (i.e., coral reefs, wetlands etc.).

The ESA, MMPA, and MSA require that NMFS and/or the USFWS be consulted when a proposed federal action may adversely affect an ESA-listed species, a marine mammal, EFH or HAPC. In addition, while all habitats are important to consider, 'coral reef ecosystems' are perhaps the most important habitats and the analysis is included under EFH. As a note, EO 13089 also mandates preservation and protection of U.S. coral reef ecosystems that are defined as "… those species, habitats and other natural resources associated with coral reefs in all maritime areas and zones subject to the jurisdiction and control of the United States."

In regard to dredging activities, the U.S. Army Corps of Engineers (USACE) first makes a determination that potential impacts have been avoided to the maximum extent practicable (striving to avoid adverse impacts); remaining impacts would be mitigated the extent appropriate and practicable by requiring steps to reduce impacts; and finally, compensate for aquatic resource values. This sequence is considered satisfied where the proposed mitigation is in accordance with specific provisions of a USACE-approved comprehensive plan that ensures compliance with the compensation requirements of the Guidelines.

11.2.1.2 Determination of Significance

This section analyzes the potential for impacts to marine biological resources from implementation of the action alternatives and the no-action alternative. The factors used to assess the significance of the effects to marine biological resources include the extent or degree that implementation of an alternative would result in permanent loss or long-term degradation of the physical, chemical, and biotic components that make up a marine community. The following significance criteria were used to assess the impacts of implementing the alternatives:

- The extent, if any, that the action would diminish suitable habitat for a special-status species or permanently lessen designated EFH or HAPC for the sustainment of managed fisheries.

- The extent, if any, that the action would disrupt the normal behavior patterns or habitat of a federally listed species, and substantially impede the Navy's ability to either avoid jeopardizing or to conserve and recover the species.
- The extent, if any, that the action would diminish population sizes or distribution of special status species or designated EFH or HAPC.
- The extent, if any, that the action would be likely to jeopardize the continued existence of any special-status species or result in the destruction or adverse modification of habitat of such species or designated EFH or HAPC.
- The extent, if any, that the action would permanently lessen physical and ecological habitat qualities that special-status species depend upon, and which partly determines the species' prospects for conservation and recovery.
- The extent, if any, that the action would result in a substantial loss or degradation of habitat or ecosystem functions (natural features and processes) essential to the persistence of native flora or fauna populations.
- The extent, if any, that the action would be inconsistent with the goals of the Navy's Integrated Natural Resources Management Plan (INRMP).

The MMPA generally defines harassment as Level A or Level B, and these levels are defined uniquely for acts of military readiness such as the proposed action. Public Law (PL) 108-136 (2004) amended the MMPA definition of Level A and Level B harassment for military readiness events, which applies to this action.

- Level A harassment includes any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild.
- Level B harassment is now defined as "any act that disturbs or is likely to disturb a marine mammal or marine mammal stock by causing disruption of natural behavioral patterns including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering to a point where such behaviors are abandoned or significantly altered." Unlike Level A harassment, which is solely associated with physiological effects, both physiological and behavioral effects may cause Level B harassment.

ESA specifically requires agencies not to "jeopardize" the continued existence of any ESA-listed species, or destroy or adversely modify habitat critical to any ESA-listed species. Under Section 7, "jeopardize" means to engage in any action that would be expected to reduce appreciably the likelihood of the survival and recovery of a listed species by reducing its reproduction, numbers, or distribution. Section 9 of the ESA defines "take" as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect.

Effects determinations for EFH are either "no adverse effect on EFH" or "may adversely affect EFH" (WPRFMC 2005). Pursuant to 50 CFR 600.910(a), an "adverse effect" on EFH is defined as any impact that reduces the quality and/or quantity of EFH. Adverse effects to EFH require further consultation if they are determined to be permanent versus temporary (NMFS 1999). To help identify Navy activities falling within the adverse effect definition, the Navy has determined that temporary or minimal impacts are not considered to "adversely affect" EFH. 50 CFR 600.815(a)(2)(ii) and the EFH Final Rule (67 FR 2354) were used as guidance for this determination, as they highlight activities with impacts that are more than minimal and not temporary in nature, opposed to those activities resulting in inconsequential changes to habitat. Temporary effects are those that are limited in duration and allow the particular environment to recover without measurable impact (67 FR 2354). Minimal effects are those that may result in relatively small changes in the affected environment and insignificant changes in ecological functions (67 FR 2354). Whether an impact is minimal would depend on a number of factors (Navy 2009c):

- The intensity of the impact at the specific site being affected
- The spatial extent of the impact relative to the availability of the habitat type affected
- The sensitivity/vulnerability of the habitat to the impact
- The habitat functions that may be altered by the impact (e.g., shelter from predators)
- The timing of the impact relative to when the species or life stage needs the habitat

The analysis of potential impacts to marine biological resources considered direct, indirect, and cumulative impacts. The *Council on Environmental Quality (CEQ), Section 1508.08 Effects,* defines direct impacts as those caused by the action and occur at the same time and place, while indirect impacts occur later in time or farther removed in distance, but are still reasonably foreseeable. CEQ defines cumulative impacts 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 action."

Direct impacts may include: removal of coral and coral reef habitat (a CWA special aquatic site), "taking" of special-status species, increased noise, decreased water quality, and/or lighting impacts resulting from construction or operation activities.

Indirect impacts, for the purposes of this evaluation, may include any sedimentation/siltation of coral reef ecosystems resulting from construction or operational activities (i.e., dredging resuspension of sediment), or recreational activities in the vicinity of the resource that may lead to impacts to special-status species and EFH.

If marine resources could be significantly impacted by proposed project activities, potential impacts may be reduced or offset through implementation of appropriate best management practices (BMPs) or mitigation measures. "Significantly" as used in NEPA (per 43 FR 56003, Nov. 29, 1978; 44 FR 874, Jan. 3, 1979) requires considerations of both context and intensity:

- Context. This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.
- Intensity. This refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action. The following should be considered in evaluating intensity:

    1. Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.
    2. The degree to which the proposed action affects public health or safety.
    3. Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.
    4. The degree to which the effects on the quality of the human environment are likely to be highly controversial.
    5. The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.

6. The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.
7. Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.
8. The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.
9. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.
10. Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

11.2.1.3 Issues Identified during Public Scoping Process

The following analysis focuses on possible effects to marine biological resources that could be impacted by the proposed action. As part of the analysis, concerns related to marine biological resources that were mentioned by the public, including regulatory stakeholders, during the public scoping meetings were addressed. A general account of these comments includes the following:

- Potential impacts on the Apra Harbor marine environment from aircraft carrier berthing, fully documenting impacts from dredging (acreage and ecosystem characteristics of affected area, depth of dredging operations, duration of effects)
- Potential impacts to endangered species (including nesting habitats), species of concern, and federal trust species such as corals and marine mammals
- Potential impacts from military expansion from all project sites on the marine resources, including removal or disturbance of the marine habitat
- Impacts to culturally significant marine-related areas for subsistence fishing and beliefs
- Increased “high impact” recreational use that would damage the ecosystem and impact fish habitat (e.g., Sasa Bay Marine Reserve)
- Increased land runoff impacting beaches and marine life (erosion and sediment stress)
- Increased anthropogenic factors impacting the coral reef ecosystem and concerns about the education and training that would be provided for newly arriving military and their dependants regarding reef protection
- Mitigation measures and non-structural alternatives to avoid and minimize impacts to coral reefs

11.2.2 Alternative 1 Polaris Point (Preferred Alternative)

11.2.2.1 Onshore

Alternative 1 Polaris Point (referred to as Alternative 1) has the potential to impact the quality and quantity of the surface runoff, during both the construction and operational phases of the project, without the application of appropriate BMPs. Both construction activities as well as long-term operation activities may cause erosion and sedimentation that can degrade coastal waters and potentially impact nearshore marine biological resources. In addition, the action alternatives would increase the potential for leaks and spills of petroleum, oil, and lubrications (POLs), hazardous waste, pesticides, and fertilizers. These potential impacts may affect the coastal waters and in turn the biological resources and habitats.

Construction

Proposed onshore construction activities would occur in an area that is composed of fill material. Embankment excavation would be required to expand the existing shoreline north of the proposed aircraft carrier berthing and the face of the wharf. While alterations to the onshore environment have the potential to result in indirect impacts that could alter the harbor water quality as described above (see also Chapter 4, Water Resources), these potential effects (short-term and localized disturbances from noise, subsurface reverberations, and siltation of marine biological resources adjacent to the site) would be minimized by complying with all applicable orders, laws and regulations, including low impact development stormwater management strategies and BMPs (Volume 7). There would be minimal, short-term and localized effects on all marine biological resources; therefore, there would be no significant impacts to marine flora and invertebrates, no adverse effects to fish and EFH, no significant impacts to special-status species (i.e., the action would not “jeopardize” or “take” an ESA-listed species per ESA Sections 7 and 9), and no serious injury or mortality of any marine mammal species is reasonably foreseeable. There would be no adverse effects on the annual rates of recruitment or survival of any of the species or stocks, and no major conduit exists for introduction of non-native species into the marine environment with implementation of Alternative 1.

Therefore, for onshore construction activities, Alternative 1 would result in less than significant impacts to marine biological resources.

Operation

While onshore operation activities have the potential to result in indirect impacts that could alter the harbor water quality as described above (also see Chapter 4, Water Resources), these potential effects (short-term and localized disturbances from noise, subsurface reverberations, and decreased water quality for marine biological resources adjacent to the site) would be minimized by complying with all applicable orders, laws and regulations, including industrial management strategies and BMPs (Volume 7). There would be minimal, short-term and localized effects to all marine biological resources; therefore, there would be no significant impacts to marine flora and invertebrates, no adverse effects to fish and EFH, no significant impacts to special-status species (i.e., the action would not “jeopardize” or “take” an ESA-listed species per ESA Sections 7 and 9), and no serious injury or mortality of any marine mammal species is reasonably foreseeable. There would be no adverse effects on the annual rates of recruitment or survival of any of the species and stocks, and no major conduit exists for introduction of non-native species into the marine environment with implementation of Alternative 1.

The operational phase of Alternative 1 would increase the area of impervious surface which would result in an associated relatively minor increase in stormwater discharge intensities and volume. This increase would be accommodated by stormwater infrastructure, and stormwater flow paths would continue to mimic area topography. Furthermore, stormwater would be pre-treated to remove contaminants prior to discharge into the harbor, as detailed in a design-phase plan that would cover the entire project area. It is the intent that all designs would result in 100% capture and treatment, if required, of stormwater runoff.

Therefore, for onshore operation activities, Alternative 1 would result in less than significant impacts to marine biological resources.

11.2.2.2 Offshore

<u>Construction</u>

The proposed dredging and fill activities under Alternative 1 would significantly impact and /or may adversely affect marine biological resources by permanently removing benthic substratum, including coral and coral reef habitat upon which marine flora and fauna are dependent. Construction of the aircraft carrier wharf would involve placing fill material in no more than 3.6 ac (1.5 ha) of nearshore/intertidal waters under the proposed wharf structure. Potential construction impacts to marine life are summarized below for each resource type.

Marine Flora, Invertebrates and Associated EFH

Potential impacts to marine flora and non-coral invertebrates include direct impacts to those organisms residing in the immediate dredge and fill areas. Organisms residing in the areas adjacent to and outside the dredged and fill impact areas could experience indirect impacts due to increased sedimentation from dredging activities. Coral and coral reef ecosystem impacts are addressed under Essential Fish Habitat. Physical impacts associated with this effort were estimated using the amount of the harbor bottom removed by dredging.

Figure 11.2-1 shows the approximate limits of proposed dredging activities and associated coral abundance within and in the vicinity of the project area. The proposed dredge area includes all areas shallower than –51.5 ft (–15.7 m) mean lower low water (MLLW) (-49.5 ft [-15 m] plus 2 ft [0.6 m] overdredge). While BMPs, such as the use of silt containment devices, would be employed during dredging operations, particulate material would be released by the breaking up of the reef surface, the re-suspension of particulate material contained within the fossil framework, and the leakage of sediment slurry out of the clamshell during uplift and transfer to scows for dredged material transport and disposal or reuse.

Those mobile organisms in the ROI that are not directly subjected to removal or fill activities could sustain impacts as a result of transport, suspension and deposition of dredging-generated sediments. Sessile organisms such as marine floral communities (macroalgae) have been found to be the predominant benthic community residing within the area to be dredged. Under Alternative 1, dredging and fill activities would have direct and permanent impacts to marine flora and sessile invertebrates in the dredged area through removal. Motile invertebrates would likely vacate the area due to the increased disturbance. Although some mortality would occur to marine flora and sessile invertebrates, new recruits would replenish these populations post-construction. Taylor Engineering, Inc. (TEI) (2009) performed a literature review of effects of beach nourishment, dredging and disposal projects on benthic habitat. The following paragraphs cite the reviewed articles and list the key findings related to benthos effects:

1. NOAA Benthic Habitat Mapping. 2007. Applying Benthic Data: *Dredging and Disposal of Marine Sediment*.
    a. “Benthic organisms living in shallow water estuarine and nearshore environments are well adapted to frequent physical disturbance”
    b. “Tides, currents, waves, and storms cause sediments to be lifted, deposited, or shifted”
    c. “The resilience of benthic organisms to these environmental changes allows them to recolonize areas of the seafloor affected by dredging”

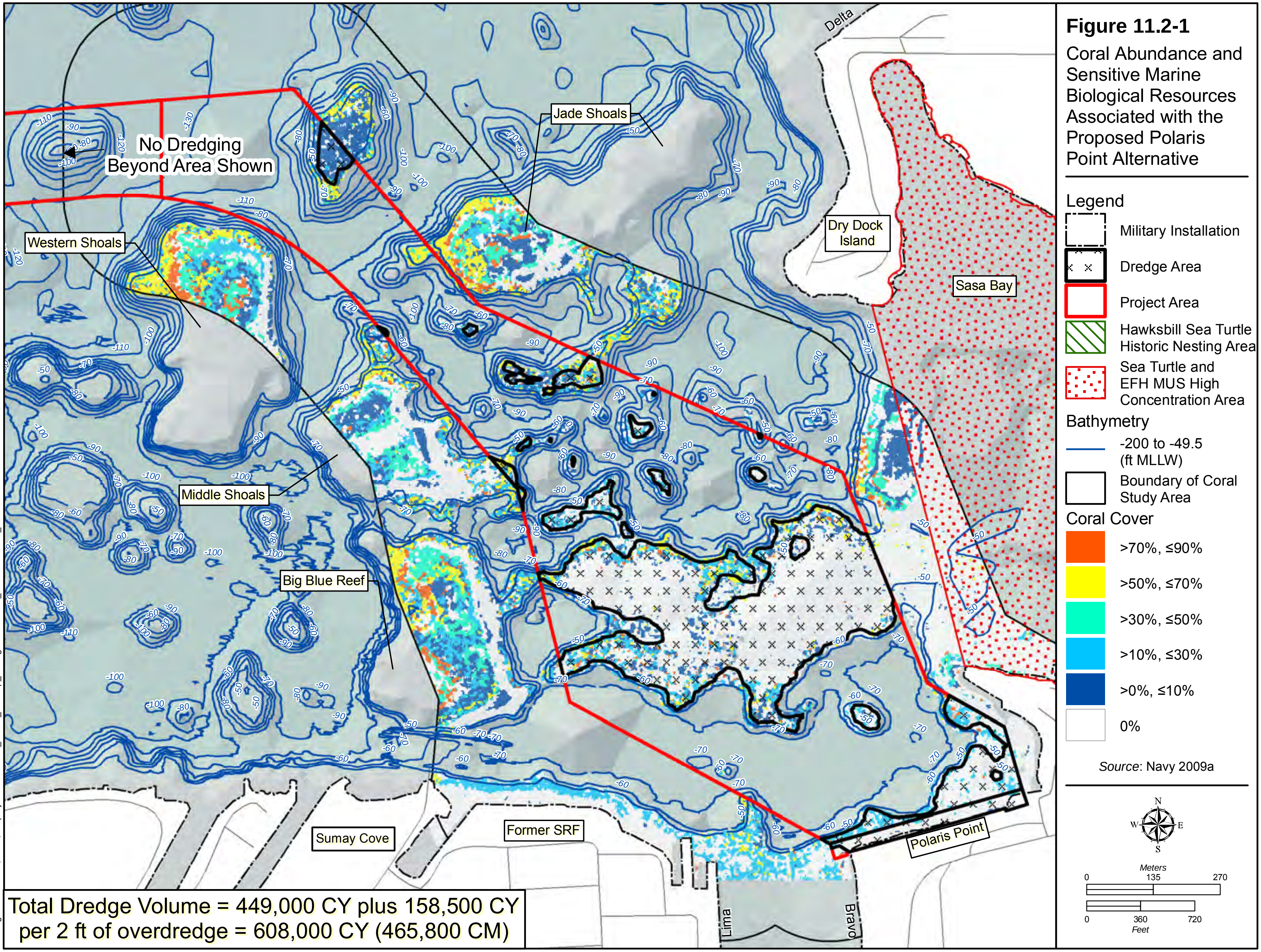

Figure 11.2-1
Coral Abundance and Sensitive Marine Biological Resources Associated with the Proposed Polaris Point Alternative

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2. Dredging Operations and Environmental Research (DOER). 2005. *Sedimentation: Potential Biological Effects of Dredging Operations in Estuarine and Marine Environments.*
    a. "most shallow benthic habitats in estuarine and costal systems are subject to deposition and resuspension events on daily or even tidal time scales"
    b. "Many organisms have physiological or behavioral methods of dealing with sediments that settle on or around them, ranging from avoidance to tolerance of attenuated light and/or anaerobic conditions caused by partial or complete burial"
3. Section 404(b) Evaluation, *Pinellas County Florida Beach Erosion Control Project Alternative Sand Source Utilization."*
    c. "Fill material will bury some benthic organisms."
    d. Most organisms in this turbid environment are adapted for existence in area of considerable substrate movement"
    e. Re-colonization will occur in most cases within one year following construction"
4. Atlantic States Marine Fisheries Commission. 2002. *Review of the Biological and Physical Impacts.*
    f. *"Studies from 1985-1996 report short-term declines in infaunal abundance, biomass, and taxa richness following beach nourishment, with recovery occurring between 2 and 7 months"*
    g. *"Studies from 1994-2001 reported recolonization of infauna occurred within two weeks"*
5. U.S. Army Corps of Engineers coastal Engineering Research Center. 1982. *Biological Effects of Beach Restoration with Dredge material on Mid-Atlantic Coasts*.
    h. "animals that spend their entire life cycle in the substrate were not seriously impacted by burying from beach nourishment"
    i. "nourishment destroyed or drove away the inertial macrofauna; but, based in other regional studies, recovery should occur within one or two seasons (i.e. 3-6 months)

TEI (2009) identified short-term impacts to benthic habitat after conducting a thorough literature review. Impacts were considered short-term because most benthic flora and fauna have the ability to adapt for existence in areas of considerable substrate movement. Although most of the studies TEI included in their review involved natural substrate movement as opposed to substrate movement caused by human activities, the recovery of organisms after such events provided useful information on impacts from short-term sediment disturbances.

A beneficial long-term impact for the recruitment of marine flora and invertebrates and the ecology of the immediate area is expected with the increased settlement potential provided by the cleared hard surfaces after dredging and the added aircraft carrier wharf armor rip rap and vertical pilings. The development of the pier would provide suitable habitat for species such as benthic invertebrates including sponges, sea urchins, starfish, and mollusks, which are poorly represented within Inner Apra Harbor and the entrance channel areas (COMNAV Marianas 2006).

Therefore, negative impacts to marine flora and invertebrates would be short-term and localized, thus there would be less than significant impacts as a result of implementing the offshore component of Alternative 1.

Essential Fish Habitat

As described in Volume 2, Chapter 11, all of Apra Harbor is considered EFH, which is defined as those waters and substrate necessary to fish (finfish, mollusks, crustaceans and other forms of marine animal and plant life other than marine reptiles, marine mammals and birds) for spawning, breeding, feeding, or growth to maturity (WPRFMC 2005). EFH for managed fishery resources is designated in the FMPs prepared by the local regional fisheries management council - WPRFMC - and in conjunction with the Guam Division of Aquatic and Wildlife Resources (GDAWR), which manages the fisheries resources in Guam. The WPRFMC is currently converting its FMPs to fishery ecosystem plans (FEPs). In other words, changing from species-based management to place-based management for the Pacific Region. The draft FEPs and Preliminary EIS are being reviewed and the Record of Decision for the associated Programmatic EIS is being prepared.

The Navy is consulting with the National Marine Fisheries Service (NMFS) on proposed activities that may adversely affect EFH. There are four steps in the EFH consultation process (NMFS 1999):

1. The federal agency provides a project notification to NMFS of a proposed activity that may adversely affect EFH.
2. The federal agency provides an assessment of the effects on EFH with the project notification. The EFH Assessment (EFHA) prepared as part of this EIS/OEIS includes: (1) a description of the proposed action; (2) an analysis of the effects, including cumulative effects, of the proposed action on EFH, the managed species, and associated species by life history stage; (3) the federal agency's views regarding the effects of the proposed action of EFH; and (4) proposed mitigation, if applicable.
3. NMFS provides EFH conservation recommendations to the federal agency. These recommendations may include measures to avoid, minimize, mitigate, or otherwise offset adverse effects on EFH and are to be provided to the action agency in a timely manner.
4. The federal agency provides to NMFS a detailed written response, within 30 days of receiving the NMFS EFH conservation recommendations (at least 10 days before final approval of the action for decisions that are rendered in fewer than 30 days).

Coral Reef Ecosystem and Fish Species. Coral and coral reef ecosystem is arguably one of the most important substrate habitat components of EFH within Apra Harbor. The coral reef ecosystem is highly complex, containing an incredible diversity of invertebrates, fishes, and some other vertebrate animals, such as sea turtles. Although reefs cycle some nutrients to and from other environments, they are to a large extent self-contained systems, and are densely populated with inhabitants. Individuals, both of different species and of the same species, interact with each other in various ways, as predators, prey, competitors, mates or cooperative partners.

Coral reef fish communities are extremely diverse and dense on many tropical reefs, more so than in any other aquatic habitat. Some families of fish, such as butterflyfishes and damselfishes, are adapted to live primarily on coral reefs, while others, such as wrasses, have many members living in other habitats. Coral reef fishes live not only among the reef-building corals, but also with sea fans and soft corals, sponges and sea anemones. Some fishes rest on patches of sand or peep out of holes in the reef, others hover above the reef or swim actively, and visitors from the open ocean come in to prey on the residents. Coral reefs can support so many fish communities because of the diverse lives that the fishes lead, specializing in various foods, and occupying different zones and habitats on and around the reef. The pressures of predation and competition are high and have given rise to immense variety in modes of life and behavioral ploys, and the physical adaptations needed to carry them out.

Coral reef fishes are not all active at the same time. Some feed during the daytime and retire to other sites to sleep at night, while others move out from daytime shelters to feed at night. Only a small minority are active on and off throughout day and night. When they are not feeding or breeding, most reef-dwellers hide from predators. Many fishes use the same refuges at different times of the day, making the most effective use of valuable space. Small fishes, such as blennies and gobies, do not tend to travel far, so their refuges and feeding sites are close together. Some large fishes, however, commute considerable distances--sometimes several kilometers--between resting and feeding places. Many form schools for safety when they are travelling, so that each individual fish runs less risk of being singled out by predators.

Jade Shoals, just west of Dry Dock Island, is a specific HAPC site. Potential effects to EFH may include direct or indirect impacts to the habitat and/or the individual species that occupy the habitat. These are evaluated as described in Section 11.2.1 Approach to Analysis.

The key assumptions for the assessment of coral impacts are as follows:

- Dredging is anticipated to last from 8 to 18 months to complete the entire proposed action based on dredging 24 hr/day; however, dredging frequency and duration would be determined at the final design stage.
- The impact analysis assumes that all areas less than 60 ft (18 m) deep within the dredged area would be removed, although in reality, the dredge or direct impact area would be at a depth of -49.5 ft [-15.1 m] plus 2 ft [0.6 m] overdredge and remove less coral than described in Table 11.2-1. The coral loss in the direct impact areas is assumed to be permanent.
- The indirect impact areas would be affected at varying degrees from sediment accumulation. The assessment of indirect impacts is a substantial overestimate of the actual indirect impact and based on a 656 ft (200 m) buffer zone. The actual indirect impact area would be a much smaller area than that based on the 40 ft (12 m) cumulative sediment deposition modeling.

During initial meetings with the agencies to determine the extent of the study area, the Navy suggested a 100 m “buffer zone” beyond the dredge footprint. USFWS suggested making it 200 m, which was agreed upon by the Navy. It is important to note that there was no actual basis for this number in terms of indirect impacts; it was simply to define a survey area that could encompass any potential indirect effects. It is in no way connected to the 40 ft (12 m) buffer that comes from the SEI (2009) cumulative plume modeling. It evolved into the "Indirect" impact area only because no one ever suggested that it be anything else, and that it can be stated with high certainty that it is indeed very conservative (Dollar 2009).

The following summarizes the direct and indirect impacts to corals from Alternative 1 actions (Table 11.2-1):

- Areas with the greatest coral abundance (>70 to $\leq$ 90%) would comprise the smallest portion (10%) of the total coral coverage category that would be lost due to proposed dredging.
- Areas with the least amount of coral coverage (0 – $\leq$10%) would comprise the largest portion (approximately 36%) of the total coral coverage category that would be lost due to proposed dredging.
- About 62% of the area proposed for dredging contains corals with a coverage of less than 30%. Approximately 3% of the total area proposed for dredging contains corals in the 70-90%, coverage category and 10% for the 50-90% range of coverage.

- The total area impacted is about 172 ac (69.52 ha), which includes direct and indirect impacts of 72 ac (28.80 ha) and 101 ac (40.71 ha), respectively. This equates to a percent coral cover impact of 42%, which includes direct (35%) and indirect (46%) impacts of the total area affected, respectively.

In general, approximately 35% of the proposed dredge area contains some coral coverage and virtually all of the area consists of reefs that were dredged 60 years ago during the creation of Inner Apra Harbor.

In addition to dredging and fill activities, direct impacts to benthic habitats may occur from construction activities related to securing or anchoring the dredge barge and supporting vessels. Anchor chains and mooring cables would not be placed on or over reef areas that support high percentages of coral cover or complex reef structures. Therefore, there would be unavoidable permanent significant impacts to coral and coral reef habitat from dredged removal of approximately 25 ac (10.20 ha) of live coral (all classes [>0% to ≤90%]) with the implementation of Alternative 1.

Table 11.2-1. Estimated Coral Area and Percentages Impacted by Proposed Dredging Activities with Implementation of Alternative 1

Coral Level	*Alternative 1 Polaris Point*					
	Direct		*Indirect*		*Total*	
	ha	*ac (% coral[1])*	*ha*	*ac (% coral[1])*	*ha*	*ac (% coral[1])*
coral = 0%	18.61	45.98	22.00	54.36	40.61	100.34
0% < coral ≤ 10%	3.74	9.24 (37)	5.45	13.48 (29)	9.20	22.72 (32)
10% < coral ≤ 30%	2.61	6.44 (26)	3.85	9.52 (21)	6.46	15.96 (22)
30% < coral ≤ 50%	0.96	2.37 (9)	3.25	8.04 (17)	4.22	10.41 (15)
50% < coral ≤ 70%	1.80	4.44 (18)	4.19	10.35 (22)	5.99	14.79 (21)
70% < coral ≤ 90%	1.10	2.71 (11)	1.96	4.85 (11)	3.06	7.56 (11)
Total with Coral	**10.20**	**25.20**	**18.71**	**46.24**	**28.91**	**71.44**
Total dredge area	**28.80**	**71.18**	**40.71**	**100.6**	**69.52**	**171.78**
Percent coral cover		**35%**		**46%**		**42%**

[1]Coral percents are rounded to the nearest percent and therefore may not sum to 100%
Source: Dollar et al. 2009

Indirect impact analysis, as described earlier, assessed a 656 ft (200 m) buffer zone. It important to restate that there is no basis for the 200 m buffer zone in relation to the indirect impact area, which is in no way connected to the 40 ft (12 m) actual indirect impact zone (SEI 2009). However, it can be stated with high certainty that the buffer zone is indeed very conservative (Dollar 2009).

Dredging of reef material within the aircraft carrier project area would result in elevated suspended sediments in the water column as a result of both leakage of excavated material from the dredge bucket, and the release of fine-grained calcium carbonate mud (micrite) from the interstitial reef framework (MRC 2009; Dollar et al. 2009). However, as described in Chapter 4 of this Volume, Water Resources, sediment grain size analyses indicate that sediments in the area of the navigation channel and proposed turning basin, in areas that do not contain coral, consist primarily of sand and rubble with silty sediments being found along the proposed berthing areas (NAVFAC Pacific 2006). The coarse grain size of the material to be dredged indicates that the majority of the resuspended sediment would settle out of the water column rapidly.

While sediment retention devices (i.e., silt curtains) would be deployed to minimize dispersal of this material, it is anticipated that some fraction would escape containment and potentially impact coral reef communities. In addition, breakage of coral by the dredge that is not removed from the seafloor can also result in impacts to the reef habitats that are bordering the dredge sites. For the purposes of this document, these effects are termed "potential indirect impacts."

It is well documented since the pioneering work on environmental tolerances of reef corals that some taxa are more resilient to turbidity and sedimentation than others (e.g., Mayer 1915; Yonge 1930; Marshall and Orr 1931; Hubbard and Pocock 1972; Riegl 1995; Wesseling et al. 1999). It has also been shown that corals growing in waters of moderate to extremely high turbidity are not automatically more stressed than their clear-water counterparts (Roy and Smith 1971, Done 1982, Johnson and Risk 1987, Acker and Stern 1990, Riegl 1995, Kleypas 1996, McClanahan and Obura 1997, Larcombe et al. 2001). Sanders and Baron-Szabo (2005) describe "siltation assemblages" of corals that occur in turbid water and/or muddy reef environments as a result of resilience to sediment through either effective rejection mechanisms or physiological tolerance to intermittent coverage. See Affected Environment, Section 11.2.2.2, Sediment Effects on Coral.

Review of the scientific literature to identify harmful sedimentation rates on corals revealed that there was no specific threshold level of sedimentation that resulted in coral mortality. The literature review (described in Volume 9, Appendix E, Section D) did reveal, however, that negative effects of sediment loading to reef corals were dependent on both the duration and the rate of sediment deposition. As expected, the general trend is that the higher the deposition rate, and the longer the period of deposition, the greater the effect. Threshold rates cited in the literature range from 5 milligrams per square centimeter (mg/cm^2) per day to 100 mg/cm^2 per day. The extent of this impact is species-specific based on tolerances, the location or organisms relative to the construction activities, and water currents during proposed construction and dredging activities. Since these parameters cannot be specified for each individual, it is assumed that the impact to EFH and FMP species would occur throughout the area potentially impacted by turbidity plumes with sediment deposition rates greater than or equal to 0.008 in (0.2 mm), or 1,000 mg/cm^2 (0.9 in [6 mm]) total, for the estimated dredging duration (Navy 2009a).

SEDIMENT DEPOSITION MODELS. The Current Measurement and Numerical Model Study for CVN Berthing (SEI 2009) is included in Volume 9, Appendix E, Section E. It presents the current modeling and sediment transport modeling specific to the proposed aircraft carrier project, including the details of methodology and the modeling graphics. The following summarizes the most relevant findings:

- Currents are predominantly wind-driven, and occur as a two-layer system. The surface layer flows in the direction of the wind, and the deeper layer flows in the opposite direction. During typical trade wind conditions, surface flow is to the west out of the harbor, while deeper flow is directed to the east, into the harbor. The exception to this is the entrance channel to Inner Apra Harbor, where currents may reverse with the tides. Local bathymetric features and pronounced reef shoals also control local current directions.
- Currents in the project vicinity are normally weak, which means sediment plumes will not be spreading appreciably.
- The highest current speed measured in Inner Apra Harbor was 0.12 knots (0.61 m/s), with east winds of 8 to 12 knots (4.1 to 6.2 m/s) during a high water slack tide. This example reveals that even with some wind, currents are weak.
- In Outer Apra Harbor, the fastest drogue current speed was 0.17 knots (0.86 m/s) with east wind of 12 knots (6.2 m/s), also during a high water slack tide. A two-layer flow was evident for some deployments. Most data showed that the surface layer moved in westerly directions and the deeper water layer deviated in speed and direction from the surface layer.

- Tidal effects are small in the harbor basins, but are important in the entrance channel to Inner Apra Harbor, where currents may reverse with the tides.

Twenty model cases were completed, bracketing a range of wind forcing conditions, dredging duration, production rates and dredge locations, and suspended sediment release. Model runs were completed for nine different locations throughout the project area. Silt curtain effectiveness was simulated based on 145 days of TSS measurements inside and outside of the silt curtain deployed for the Alpha-Bravo Wharves dredging project in Inner Apra Harbor. These measurements showed that the silt curtains retained 90% of the material inside of the curtain. Model computed TSS levels compared well with the Alpha-Bravo Wharves project measurements outside the silt curtain. Possible maximum adverse impacts conditions were simulated by approximating the highest 10% TSS levels recorded outside of the silt curtain during the Alpha-Bravo dredging project during strong trade wind conditions.

One of the scenarios that could result in the maximum potential adverse impact assumed the 24-hr per day dredging generating 1,800 cubic yards (cy) (1,376 cubic meters [m^3]) was located in an area close to Big Blue Reef. Figure 11.2-2 shows the contours of sediment deposition equal to 5, 10, 40, 100, 500 mg/cm^2/day and shows that virtually all of the plume at deposition rates of 500 and 100 mg/cm^2/day is retained within the dredge footprint. None of the plume extends past the dredged boundary (i.e., where the shovel impacts the hard surface) near Big Blue Reef for Alternative 1. Similar scenarios for the remaining model runs indicate little extension of the plumes beyond the project area (SEI 2009, Volume 9, Appendix E, Section E of this EIS/OEIS). The dispersion beyond the dredge area and cumulative deposition effects are based on several inter-related factors as described earlier and include wind speed, current speed, tide, dredging operation duration, and silt curtain effectiveness.

Results of the SEI (2009) modeling are summarized below:

- Sediment deposition resulting from the dredging would be largely confined to the immediate vicinity of the specific dredge site. Maximum sediment deposition of 1,742 mg cm^{-2}, or 0.4 in (10 mm), was calculated assuming 24 hr of dredging at a rate of 1,800 cy/day (1,376 m^3/day) (Model Case 6.3). The modeling indicated that sedimentation exceeding 40 mg/cm^2, a cited threshold for coral impacts, would extend an average distance of 144 ft (44 m) from the dredging.
- Thickness of substrate to be dredged is only 1.6 to 3.3 ft (0.5 to 1 m) throughout most of the project area. Dredging would therefore pass rapidly from site to site; a 75.5 x 75.5 ft (23 by 23 m) grid area would require only a half day for dredging. This means that exposure to sediment plumes and significant sedimentation (greater than 40 mg/cm2 per day) would be limited to only one or two days. The exception to this is at the Polaris Point coastline, where sediment thicknesses of 13 ft (4 m) or greater would be dredged.
- Analysis of possible total sediment accumulation during the project indicates that accumulations of greater than 1,000 mg/cm2, or 0.2 in (6 mm) (and adverse impact to EFH)), would be confined to within 75.5 ft (23 m) of the dredge limits at Polaris Point, and to within 32.8 ft (12 m) of the dredge limits in the rest of the project area.

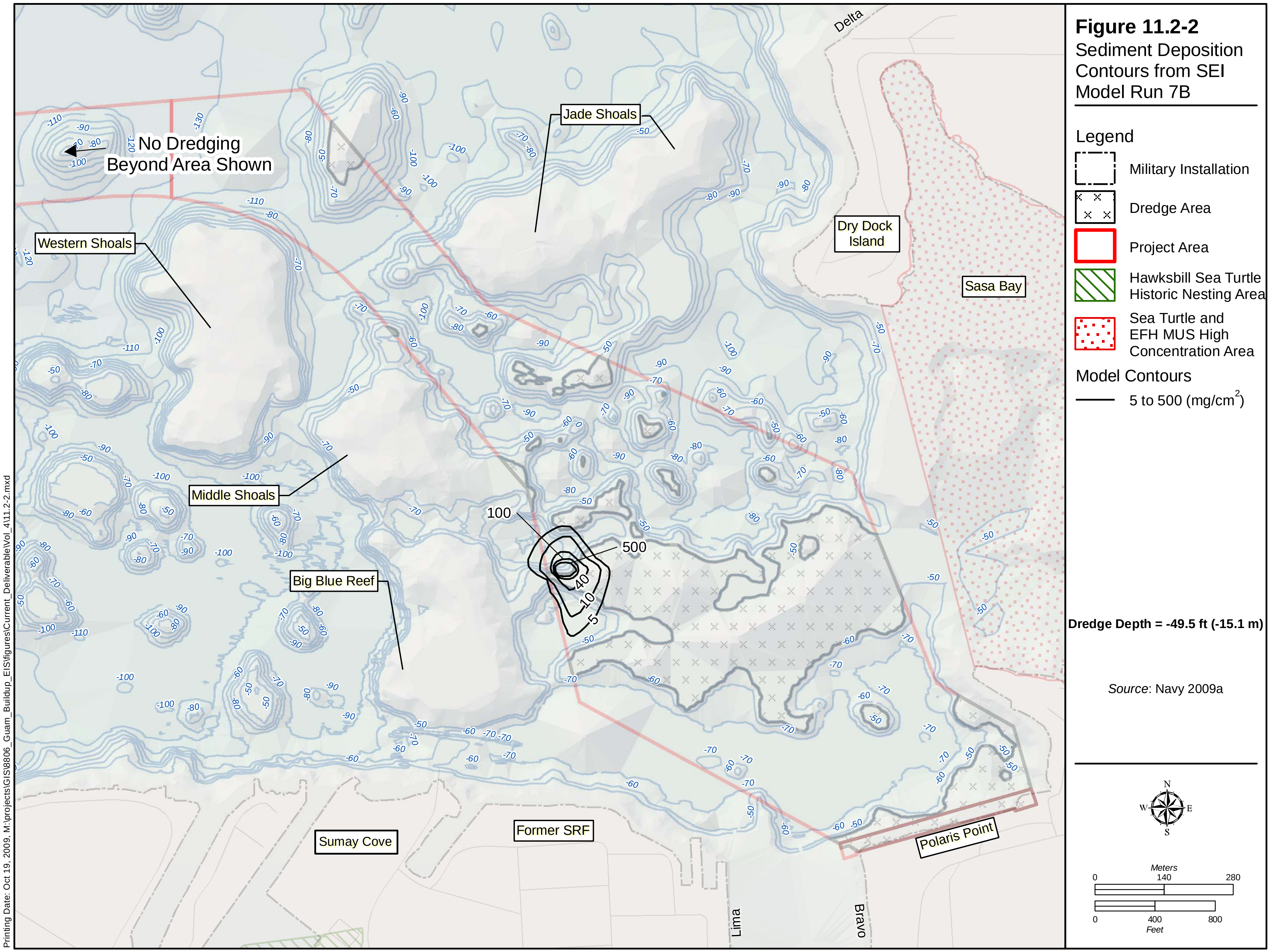

Figure 11.2-2
Sediment Deposition Contours from SEI Model Run 7B
Legend
Military Installation
Dredge Area
Project Area
Hawksbill Sea Turtle Historic Nesting Area
Sea Turtle and EFH MUS High Concentration Area
Model Contours
5 to 500 (mg/cm²)
Dredge Depth = -49.5 ft (-15.1 m)
Source: Navy 2009a
No Dredging Beyond Area Shown
Jade Shoals
Western Shoals
Middle Shoals
Big Blue Reef
Dry Dock Island
Sasa Bay
Sumay Cove
Former SRF
Polaris Point
Delta
Lima
Bravo
100
500
40
10
5
Meters
0
140
280
Feet
400
800
Printing Date: Oct 19, 2009, M:\projects\GIS\8806_Guam_Buildup_EIS\figures\Current_Deliverable\Vol_4\11.2-2.mxd

- Surface TSS plumes exceeding background levels of 0.0004 ounces/gallon (3 mg/L) are generally predicted to occur only directly at the dredge site. Plumes near the bottom would be more extensive because most of the suspended sediment would be released into the bottom layer, and it also receives all of the TSS contained by the silt curtain. Plume concentrations exceeding the background levels of 0.0004 ounces/gallon (3 mg/L) would typically extend 262.5 to 394 ft (80 to 120 m) from the dredge site. The plumes would dissipate rapidly following completion of the dredging.
- The maximum environmental adverse impact scenarios were simulated by increasing the sediment release rate from 1% to 2%, and decreasing silt curtain effectiveness by a factor of four. This approximates the highest 10% TSS measurements recorded outside the silt curtain during recent dredging at Alpha-Bravo Wharves. During these conditions, maximum sediment deposition at the dredge site would be 2,690 mg/cm2, or 0.6 in (16 mm), and deposition greater than 40 mg/cm2, or 0.008 in (0.2 mm), would occur to a distance of 262.5 ft (80 m) from the dredge site.

Surface and bottom TSS concentrations exceeding typical background levels of 3 mg/L would extend 262.5 to 328 ft (80 to 100 m) from the dredge site, respectively. This numerical analysis was designed to approximate, to the extent practical, the dredging that may occur during the aircraft carrier project. The circulation model was verified with actual current data recorded in the project area. The sediment grain size was derived from numerous bottom samples collected in the area.

CUMULATIVE SEDIMENT DEPOSITION MODEL. Possible cumulative sedimentation during the project was assessed by extrapolating in time and space the daily results, assuming a 24-hr dredging operation and dredging production of 1,800 cy (1,376 m^3) per day (SEI 2009 Model Cases 6.1 to 6.7). Throughout almost the entire dredge area, only 1.6 to 3.3 ft (0.5 to 1 m) of sediment would be removed. The exception is at the proposed Polaris Point Wharf area where the embankment would be dredged. Dredging operations at the rate identified above would proceed through two 75.5 by 75.5 ft (23 by 23 m) grids per day throughout all of the project area except the Polaris Point Wharf area. Such rapid passage of the dredging operation means that prolonged exposure to plumes and significant accumulation of sediment would not occur in most of the project area. In the area adjacent to Polaris Point, it is estimated that two to three days of dredging would be required for each 75.5 by 75.5 ft (23 by 23 m) grid, compared to a half of a day in the remainder of the project area.

Application of these dredging rates per model grid cell to the daily computed sediment loads provides an estimate of cumulative sedimentation. Sedimentation of 1,000 mg/cm^2, or 0.9 in (6 mm), was selected as a reasonable threshold of sediment accumulation over the duration of the dredging project (8 to 18 months). This thickness corresponds to less than 0.25 in (6 mm) for the duration of dredging, or less than an average of 0.04 in (1 mm) accumulation per month. Accumulation of sediment greater than 0.25 in (6 mm) thick for the duration of dredging activities would occur only within a distance of 39.4 ft (12 m) from the dredge limit in most of the project area, and within 75.5 ft (23 m) of the dredge limit adjacent to Polaris Point. Figure 11.2-3 illustrates the additional area (outlined in green) that may be impacted by this accumulated sediment.

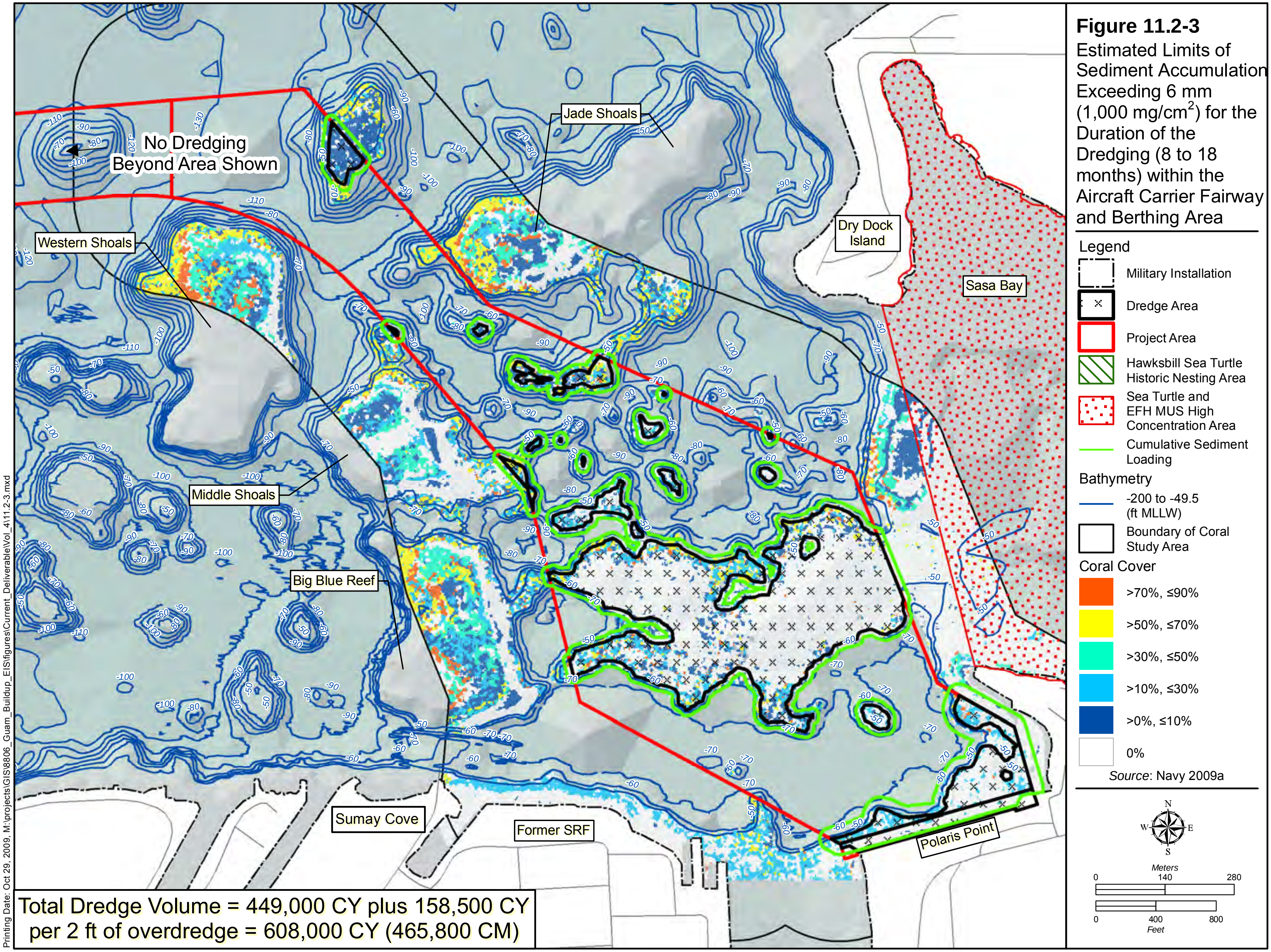
Figure 11.2-3
Estimated Limits of Sediment Accumulation Exceeding 6 mm (1,000 mg/cm2) for the Duration of the Dredging (8 to 18 months) within the Aircraft Carrier Fairway and Berthing Area
Legend
Military Installation
Dredge Area
Project Area
Hawksbill Sea Turtle Historic Nesting Area
Sea Turtle and EFH MUS High Concentration Area
Cumulative Sediment Loading
Bathymetry
-200 to -49.5 (ft MLLW)
Boundary of Coral Study Area
Coral Cover
>70%, ≤90%
>50%, ≤70%
>30%, ≤50%
>10%, ≤30%
>0%, ≤10%
0%
Source: Navy 2009a
Meters
0 140 280
0 400 800
Feet
No Dredging Beyond Area Shown
Jade Shoals
Western Shoals
Dry Dock Island
Sasa Bay
Middle Shoals
Big Blue Reef
Sumay Cove
Former SRF
Polaris Point
Total Dredge Volume = 449,000 CY plus 158,500 CY per 2 ft of overdredge = 608,000 CY (465,800 CM)
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PLUME MODELING SUMMARY. The plume modeling results suggest that cumulative sediment deposition during project construction totaling at least 1,000 mg/cm^2 (approximately 6 mm based on site-specific sediment characteristics) would accumulate up to 39.4 ft (12 m) beyond the area subject to direct impacts. This would be the maximum adverse effects on coral scenario under EFH.

While these estimates of potential indirect impacts represent relatively small percentages of the total area of coral reef habitat, they are likely overestimates for several reasons:

1. The deposition rate of >0.008 in (0.2 mm)/day may be within the coral's physiological tolerance limit for sediment accumulation (e.g., Hubbard and Pocock 1972).
2. Sediment can be resuspended and removed from coral surfaces by physical processes such as wave and current action that occur within reef habitats. Currents in the project area are known to be weak, with surface currents during trade wind conditions typically 4 to 8 cm/second while bottom layer currents were typically 2 to 4 cm/second (SEI 2009). Brown et al. (1990) suggest that relatively slow current speeds (<3 cm/second) are often sufficient to remove the small aggregates from the tops and flanks of mound-shaped and branching corals. Modeling indicates that following the cessation of dredging, TSS in the water column would return to background levels within several hours SEI (2009). With TSS returning to background levels, sediment deposition to the reef surface would also return to background levels within a very short time. Such a scenario could result in regular periods where corals can utilize a physiological cleaning mechanism to shed deposited sediment MRC 2009c).
3. The slope of the reef faces for the majority of the proposed dredged footprint is steep. Most of the dredge area consists of the flattened tops of previously dredged pinnacles and patch reefs. These features all have steeply sloping margins that extend to the sandy harbor floor. While these reef slopes are among the areas of highest coral cover, indirect impacts from suspended sediment would be mitigated by downgradient flow with little accumulation on the steep reef face (MRC 2009c). Some larger-grained sediments generated by the dredging activity above have the potential to accumulate in depressions on plate forms of coral, causing negative impacts.

It is evident from the SEI (2009) modeling results that a large portion of the deposition plume contour would occur in habitats other than the coral reef slopes. A large percentage of the sediment plume contour would cover the coral platform within the dredge envelope, as well as the areas of the harbor floor that are not covered with coral. These areas without coral are characterized by substantial cover of "unconsolidated sediment" that is primarily sand and rubble. The composition of the sand and rubble in these habitats is reef material and is qualitatively similar to the sediment that would be generated by the dredging activity. Hence, while the deposition rate of suspended material may increase temporarily during the period of dredging, it is not likely that this would represent any qualitative change to the sand-covered habitats. Organisms that inhabit these habitats are either infaunal (living within the seafloor) or epifaunal (living on the surface of the seafloor), and the potential additional deposition of sediment associated with dredging would not represent a change in the integrity of this habitat. Any impact to infaunal or epifaunal organisms would be short-term and localized. In addition, during periods of substantial water motion (e.g., storm waves) and with ship movements in the channel, sand is episodically resuspended at levels that likely exceed the potential from proposed dredging activities (MRC 2009c).

CORAL DISLODGEMENT. An additional secondary or indirect effect at the dredge area boundaries is dislodgment of coral colonies by dredging operations without the collection of these colonies within the dredge bucket. These uncollected colonies may subsequently tumble down the sloping sides of the patch reefs and pinnacles. While such tumbling downslope is likely to result in some damage to other corals, possibly creating more fragments, there is also the possibility that not all the fragments would die. In fact, fragmentation as a mode of asexual reproduction in coral has been documented in the scientific literature. Highsmith (1982) states that fragmentation and subsequent cascading caused primarily by storm wave energy is "the predominant mode of reproduction in certain corals and an important mode in others." This review also points out that the ecological and geomorphological consequences of fragmentation can be "beneficial" in terms of expanding reef area to sand bottoms that cannot be colonized by larvae, and decreasing reef recovery time from disturbances over strictly sexual reproductive recovery. Highsmith (1980) found that the net effect of frequent storms on Caribbean reefs may be to maintain the reefs in the highest range of reef calcification through high survivorship of coral fragments.

Downward movement of coral fragments following hurricanes and tropical storms has been well-documented in French Polynesia (Harmelin-Vivien and Laboute 1986) and in Hawaii (Dollar 1982; Tsutsui et al. 1987; Dollar and Tribble 1993). In Hawaii, downslope movement of living coral fragments broken by intermediate intensity storm action appears to widen the narrow reef slope zone area, thereby increasing overall coral cover and adding suitable substratum for planular (flat, free-swimming, ciliated larva of coral) settlement and growth in areas that were previously sand. Other high intensity events in the same area of a magnitude that turned virtually all broken fragments into non-living coral rubble did not have the same effect of extending the horizontal margin of the reef (Dollar and Tribble 1993). Stimson (1978) has suggested that for branching corals in Hawaii and Eniwetok that apparently do not planulate, asexual reproduction by means of colony fragments may be the normal mode of reproduction. In Guam, Birkeland (1997) reported most colonies of staghorn coral (*A. aspera*) were derived from fragments, with 79% of colonies living unattached and the remainder, though attached, apparently originating from fragments. Fragmentation, combined with regeneration and fast growth rates, account for dominance of *A. aspera* and *A. acuminata* on inner reef flats in Guam (Highsmith 1982).

On a dredged coral knoll at Diego Garcia Lagoon, Sheppard (1980) found many fragments and detached corals had survived, and subsequent to the dredging many of these living fragments were found to have reattached, contributing significantly to consolidation of the dredge-produced talus. Lirman and Manzello (2009) found that the survivorship and propagation of *Acropora palmata (A. palmata)* was tied to its capability to recover after fragmentation. Survivorship was not directly related to size of fragments, but by the type of substratum, with the greatest mortality observed on sand. Fragments placed on top of live colonies fused to the underlying tissue and did not experience any loss. *A. palmata* is a Caribbean coral, which is typically found in high-wave-energy, generally shallow fore-reef type environments.

Due to the low-wave-energy environment at the base of the dredged area, it is not likely that unattached coral fragments would be moved to the extent of damaging other neighboring corals.

CORAL IMPACTS SIGNIFICANCE DISCUSSION. As described in the beginning of the chapter, an adverse effect is: 1) more than minimal, 2) not temporary, 3) causes significant changes in ecological function, and 4) does not allow the environment to recover without measureable impact. These criteria are used in the following text to determine the degree of impacts to coral.

Anticipated effects from the dredging associated with the proposed aircraft carrier project are not expected to exceed the "normal" conditions observed over several days in the Inner Apra Harbor Channel (MRC 2009c). There are distinct water quality differences (i.e., turbidity zones) in Apra Harbor. While turbid conditions in the Inner Apra Harbor Entrance Channel were not as poor as in the Inner Apra Harbor Basin, field observations during surveys indicated substantially higher turbidity in the Inner Apra Harbor

Entrance Channel than in the proposed aircraft carrier turning basin dredge area. It was also observed that ships transiting through the Inner Apra Harbor Entrance Channel created plumes of resuspended sediment that reached the surface directly over the area occupied by "dense coral communities" within the Inner Apra Harbor Entrance Channel (Smith 2005; MRC 2005; MRC 2009a; Dollar et al. 2009). Hence, these communities support the expectation that minimal indirect impacts would occur as a result of the proposed dredging. A major difference, however, is that the effects associated with the Inner Apra Harbor Entrance Channel communities are essentially continuous due to turbid discharges from the Apalacha and Atantano rivers into the southeastern portion of Inner Apra Harbor, while the proposed dredging associated with the aircraft carrier at any particular location would occur for only a matter of days (MRC 2009c; SEI 2009) (see Volume 9, Appendix E, Section E).

Based on previous fieldwork and studies, the primary limiting factor for coral recruitment and development in Apra Harbor is believed to be substrate rather than the suspended sediment levels. Where adult coral colonies presently exist, either recruitment of coral planulae (sexual reproduction and subsequent successful settlement and growth) or some mode of asexual reproduction (i.e., fragmentation) has resulted in the establishment of living coral communities. Results of reconnaissance surveys that have been conducted throughout the entirety of Inner and Outer Apra Harbor for the purpose of characterizing the distribution, abundance, and condition of reef corals indicate that at present, nearly all areas with suitable substratum in the form of hard bottom that is not subjected to sediment stress (either in the form of bottom cover or abrasion), are colonized by corals and associated reef organisms (MRC 2007b personal communication in COMNAV Marianas 2007b). In other words, corals are well developed in virtually all portions of Apra Harbor that contain suitable substrate (hard stable surfaces). In contrast, areas that do not presently contain coral communities are characterized by unsuitable substratum, primarily in the form of permanent sediment cover of the bottom. Areas that lack hard stable surfaces, such as sand, mud, and algae covered sea floor areas, do not support substantial coral growth. Many portions of the harbor are routinely subjected to moderate to high levels of TSS. Some areas, such as Dry Dock Island, have both suitable substrate and high TSS levels, and have well developed coral reefs. Other areas with lower levels of TSS that lack hard stable surfaces do not support coral growth. These areas are not expected to experience adverse effects on coral recruitment from the increased sedimentation during dredging because sedimentation does not appear to be the limiting factor for coral recruitment and growth in Apra Harbor (Smith 2007b personnel communication in COMNAV Marianas 2007b).

Notwithstanding the above description of coral growth in Apra harbor, there would be a significant and permanent direct impact to the CRE MUS, specifically hard corals, through direct removal that would also adversely affect EFH. The removal of the hard coral benthic community may adversely affect some high fidelity species that were dependent upon that habitat for refuge and forage. The area of potential effects comprises a relatively small fraction of the total live reef area mapped in Apra Harbor. Long-term, localized impacts to coral and coral reef habitats would not result in a significant change to the existing EFH conditions in Apra Harbor and would also not likely result in decreased reproductive potential (i.e., coral spawning) of the Apra Harbor reef community as a whole.

Based on the most environmentally adverse scenario model run, none of the projected contours of sediment deposition extend to the large patch reefs characterized as benthic communities with high coral coverage (i.e., Big Blue Reef, Jade Shoals, and Western Shoals). Additionally, the coral community in the potentially affected area is not comprised of unique species; almost two thirds (63%) of the area to be dredged contains coral coverage of less than 30%, the project area is previously disturbed, having been dredged in 1945, and although not "unhealthy," the coral in the project area is sediment-laden and not as healthy as coral at the shoal area further away from the channel (Dollar 2009).

Analysis of possible total sediment accumulation during the project (HEA Volume 9, Section E) indicated that accumulations of greater than 1,000 mg/cm^2, or ¼ in (6 mm), were confined to within 75 ft (23 m) of the dredge limits at Polaris Point, and to within 39 ft (12 m) of the dredge limits in the remainder of the project area. The modeling indicated that sedimentation exceeding 40 mg/cm^2 or 0.008 inch (0.2 mm) extended an average distance of 144 ft (44 m) from the dredging.

For an assessment of the maximum extent of indirect impacts it is assumed that the area of sediment deposition would be 656 ft (200 m) wide surrounding the direct impact dredge area. The area of coral within the indirect impact area that is shallower than 60 ft (18 m) is assumed to be temporarily lost due to indirect dredging impacts, including increased sediment in the water column. Compared to the modeled sediment dispersion contours described above, the size of this designated indirect impact area is approximately 16 times larger than the modeled indirect impact. Impacts are further assumed to be permanent.

As the Navy has based its impact conclusion on the 200 m (656 ft) buffer area, Alternative 1 may have initial adverse affects on EFH (25% loss in ecological services based on the HEA [Navy 2009a]). These adverse indirect impacts would be short-term and localized, recovery would be expected within five years, and compensatory mitigation would be provided by the Navy.

Potential Impacts to Finfish Including EFH. As identified in Table 11.2-1, there would be direct and indirect impacts from the proposed project. In regards to impacts to EFH and reef fish MUS designated under existing FMPs, in-water construction activities would result in direct impacts from dredging removal or fill activities, noise (from dredging and impact piling driving from wharf construction), and indirect impacts from degradation of water quality and sedimentation of habitat.

The removal of coral and coral reef habitat would reduce the structural complexity of Apra Harbor's reef system, resulting in fewer places of refuge for fish from predation. Predicting the impact on the fish communities at these sites is difficult and is highly dependent on the impacts to the benthic habitat and availability of adjacent habitat. Sites in close proximity to the dredged footprint would likely suffer more than others, although the effect on highly mobile species could be variable, but is expected to be negligible. Finfish species occupying habitats that would be permanently removed (coral-, macroalgae-, rubble-, or sand-dominated) would either be displaced to other adjacent sites and adapt, or perish due to habitat modification and loss. Site-attached species such as those from the families Pomacentridae and Chaetodontidae may be adversely affected by changes in habitat structure. Pomacentrids are commonly used to measure community change across sites because of their high abundance, small home ranges, and site specificity. It is anticipated that most displaced finfish species would recolonize other adjacent sites if available.

Some finfish would be directly impacted through habitat removal. Others would be indirectly impacted because of the loss of habitat. Some finfish species occupying habitats that would be temporarily displaced (e.g., habitats disturbed but remaining after dredging) would be expected to eventually return to those habitats or repopulate other habitat areas assuming vacant habitats are available.

Direct impacts from Alternative 1 dredging activities would have an adverse affect on EFH due to the permanent removal of coral habitat. Direct removal of other benthic habitat (0% coral with macroalgae, rubble, sand = 45.98 ac [18.61 ha]) would result in no adverse effect by itself, however when considered cumulatively, may adversely affect EFH. Implementation and enforcement of appropriate BMPs and potential mitigation measures would reduce the effects of dredging, possibly from adverse to no adverse effects. No adverse effects to EFH are expected from indirect impacts of sedimentation to coral habitat (>0% - 90% coral = 46.24 ac [18.71 ha]) and other benthic habitat (0% coral with macroalgae, rubble, sand = 54.36 ac [22.00 ha]) with appropriate implementation of dredging BMPs and potential mitigation measures.

Noise is another potential source of negative impacts associated with in-water construction activities. Noise disturbances would likely cause motile invertebrates and fish to disperse and leave the area. Noise from dredging activities (87.3 dB at 50 ft [15 m]) and pile driving (average 165 dB at 30 ft [9 m]) would be below levels determined by NMFS to harm fish hearing (> 180 dB). Sound levels would decline to ambient levels (120 dB) within approximately 150 ft (45.8 m) from in-water construction activities (NMFS 2008c). See Chapter 4 for more information on noise levels. Results of a recent study on three diverse species of fish determined that the 180 dB threshold level identified by NMFS was found to be very conservative, as harm to fish only occurred at markedly higher sound exposure levels (Popper et al. 2006). Short-term behavioral and/or physiological responses to finfish (e.g., swimming away and increased heart rate) would result for all in-water work, however, such responses would not be expected to compromise the general health or condition of individual fish. Therefore, due to the mobility of finfish and the short-term and localized nature of the disturbance, impacts would be temporary and minimal.

Construction vessel transport would increase during dredging activities. It is estimated that a tug and scow would make 1 round trip/day for 8 to 18 months for dredged material disposal. Wharf construction is anticipated to take three and a half years with some periodic vessel transport expected. (See Volume 2, Chapter 14, Marine Transportation for a detailed description.) The vessels would use the existing Outer Apra Harbor navigational channel to access the ocean dredge disposal site and return to Inner Apra Harbor. The noise associated with in-water construction activities and vessel movements would result in short-term and localized disturbances to organisms living in or on the shallow portions of the benthic substrate.

The EFH for planktonic eggs and larvae of all species as identified in the Coral Reef, Bottomfish, Pelagic Fish, and Crustacean FMPs may be impacted by Alternative 1 actions. These life stages typically are weak swimming forms and are carried about by local currents (COMNAV Marianas 2007b). Based on wind and current measurements (SEI 2009), planktonic larvae of many species most likely never leave the confines of the harbor. Some recruitment to Apra Harbor may occur from eggs and larvae being carried into the harbor by local currents, as well as by active recruitment (swimming into and settling in the area) by juveniles. The relative contributions from each of these sources of larvae are unknown, although recruits from outside Apra Harbor must pass through the relatively narrow entrance channel (relative to the volume of Apra Harbor). Therefore, the probability of their occurrence in the vicinity of the Alternative 1 action area is small. Nevertheless, the eggs and larvae of these and other FMP species in the water column of the project area would experience short-term and localized impacts. Based on the small coverage areas, these impacts would be negligible, and therefore, no adverse effects on EFH for planktonic eggs and larvae are anticipated. Potential impacts on EFH and sensitive MUS identified above are expected to be short-term, minimal and/or localized.

Table 11.2-2 shows the EFH areas within Apra Harbor and their potential construction-related impacts.

Table 11.2-2. EFH Areas Associated with Apra Harbor and Potential Construction-related Impacts with Implementation of Alternative 1

Habitat	*Area of Occurrence*	*Associated Activity*	*Impact*
Live/Hard Bottom	Outer Apra Harbor	Dredging of aircraft carrier channel, turning basin, and berth. Backfill and pile driving for wharf construction Increased vessel movements	Direct, permanent and localized removal. Indirect, short-term and localized.
Soft Bottom	Apra Harbor	Dredging of aircraft carrier channel, turning basin, and berth. Backfill and pile driving for wharf construction and increased vessel movements	Direct removal and indirect, periodic and localized resuspension of sediment. Benthic infaunal community is expected to reestablish themselves quickly from adjacent, undisturbed areas.
Corals/Coral Reef Habitat	Outer Apra Harbor Shoal Areas, Entrance Channel	Dredging of aircraft carrier channel, turning basin, and berth. Backfill and pile driving for wharf construction Increased vessel movements	Direct, permanent and localized removal. Indirect, short-term and localized increase in underwater noise, localized resuspension of sediments, and potential increase in pollutants. Sessile benthic community is expected to recolonize quickly from adjacent, undisturbed areas. Direct and indirect – short-term, localized resuspension of sediments, increase of noise and potential pollutants
Water Column	Apra Harbor	Dredging of aircraft carrier channel, turning basin, and berth. Backfill and pile driving for wharf construction and other in-water construction activities. Increased vessel movements	Direct and indirect – temporary and localized elevation of turbidity, noise, and potential pollutants Direct and indirect – short-term, localized resuspension of sediments, increase of noise and potential pollutants
Estuarine Emergent Vegetation	Apra Harbor, Sasa Bay	Dredging of aircraft carrier channel, turning basin, and berth. Backfill and pile driving for wharf construction. Increased vessel movements	No effects Short-term, localized increase of noise and resuspension of sediment. Potential increase of pollutants
Submerged Aquatic Vegetation	Apra Harbor, Sasa Bay	Dredging of aircraft carrier channel, turning basin, and berth. Increased vessel movements	Direct and indirect short-term localized removal or filling. Aquatic vegetation is expected to recolonize quickly No effects
Estuarine Water Column	Sasa Bay	Dredging of aircraft carrier channel, turning basin, and berth. Backfill and pile driving for wharf construction Increased vessel movements	Direct and indirect – temporary and localized elevation of turbidity, noise, and potential pollutants Direct and indirect – short-term, localized resuspension of sediments, increase of noise and potential pollutants

Table 11.2-3 shows the sensitive months for EFH MUS found in Apra Harbor, while Figure 11.2-4 identifies all sensitive marine biological resources and habitats in Apra Harbor. The seasonal spawning of scalloped hammerhead sharks, although reported to be extremely rare (Navy 2009c), and seasonal high concentrations of adult bigeye scad, may also be temporarily disturbed by increased vessel traffic and dredging activities. EFH for these PHCRT species would not likely be adversely affected with appropriate NMFS-recommended BMPs. The probability of collisions between vessels and adult fish, which could result in injury, would be extremely low due to this highly mobile life stage and slow moving vessels within the navigational channel and shipping lanes in the ROI (Navy 2009a).

Table 11.2-3. Sensitive Months for EFH MUS within Apra Harbor

Species	*Status*	*Location*	*Months*
Adult bigeye scad	EFH-CHCRT	See Figure 11.2-4	Jun – Dec
Scalloped hammerhead	EFH-PHCRT	Aircraft carrier turning basin - see Figure 11.2-4	Spawning (Jan – Mar)
Juvenile fish*	EFH	Sasa Bay and other nearshore areas	Nursery (Jan – Dec)
Hard corals	EFH-PHCRT	Apra Harbor	Full Moon Spawning (Jul-Aug)

Note: *Includes barracudas, emperors, goatfishes, groupers, mullets, parrotfishes, puffers, snappers, surgeonfishes, wrasses, and small-toothed whiptails. *Sources:* NOAA 2005b; WPFMC 2005

EFH Assessment Summary. Alternative 1 dredging impacts to EFH would be greatest for all life stages of coral and sessile reef species, and some crustacean MUS. Site-attached reef fish and pelagic egg/larval stages of bottomfish and pelagic MUS may also be affected. Coral reef habitat would be permanently lost and would be compensated for through mitigation. Dredging activities would cause turbidity plumes and underwater noise that would temporarily disturb FMP species. These indirect impacts to EFH would include effects from degradation of water quality as a result of suspended solids, reduction of light penetration and interference with filter-feeding benthic organisms. However, the increase in turbidity would be short-term and localized.

The proposed construction of the aircraft carrier wharf would change the bottom habitat of Polaris Point. However, considering that the area has been previously dredged and that dynamic physical conditions dominate the area, it is expected that pre-construction conditions would return relatively quickly. An exception to this would be the area changed by the presence of back fill and pilings, which would add benthic habitat suitable for colonization by sessile organisms. Impact pile driving would have effects similar to those of dredging activities, including noise and degradation of water quality, but these effects would be of shorter duration and more localized. The noise generated would be somewhat higher than that of dredging.

The placement of the aircraft carrier wharf and associated piles would introduce an artificial hard surface that opportunistic benthic species could colonize, as evidenced by inner harbor studies (Paulay et al. 2002) (see also Volume 2, Chapter 11). Minor changes in species compositions associated with soft bottom communities could also occur (Hiscock et al. 2002). Fish and invertebrates would likely be attracted to the newly formed habitat complex, and the abundance of seafloor organisms in the immediate vicinity of the pilings likely would be higher than in surrounding areas away from the structures (see Volume 2, Chapter 11).

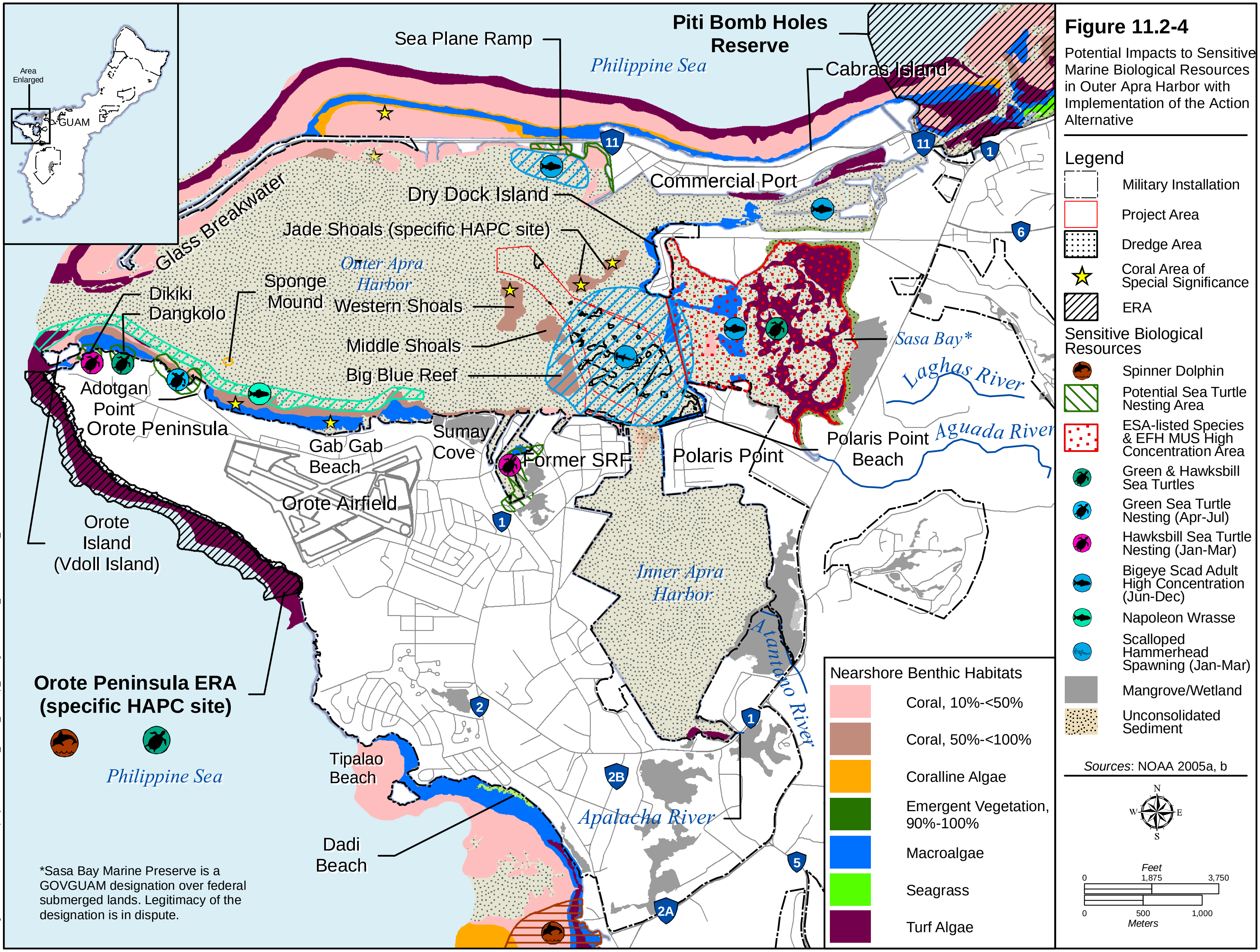

Figure 11.2-4
Potential Impacts to Sensitive Marine Biological Resources in Outer Apra Harbor with Implementation of the Action Alternative

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Due to the close proximity to Sasa Bay, juvenile fish might recruit from that area and establish themselves. The overall change in the habitat could result in beneficial changes in local community assemblages that would offset any potential short-term, localized negative impacts after the aircraft carrier wharf construction is complete and hard surfaces are populated. This would in essence offset any negative impacts to the currently depauperate (lacking species variety and not fully grown) benthic community.

The EFH Assessment (EFHA) prepared for Alternative 1 construction-related actions concluded that the action could result in the following:

- Permanent, localized destruction to 25.20 ac (10.20 ha) of live coral and coral reef habitat (all coverage >0% to ≤ 90%).
- Long-term disruption to coral reef habitat and displacement of species (could take years to recover)
- Permanent loss to some displaced, site-attached finfish species.
- Short-term and localized disturbance and displacement of mobile FMP MUS (fish and some invertebrates).
- Short-term and localized degradation to water quality (i.e., increases of siltation and turbidity).
- Short-term and localized minor indirect impacts to live coral and coral reef habitat (46.24 ac [18.71 ha]) from increased siltation and noise.
- Short-term and localized significant impacts to planktonic forms of eggs and larvae.
- Short-term and localized minor disturbances to coral reef ecosystems from increased vessel movements.
- Short-term seasonal disturbances to potentially spawning scalloped hammerhead sharks and high concentrations of adult bigeye scad.
- Aircraft carrier wharf structure would most likely result in an increase of community assemblages adequately offsetting the short-term, localized effects.

Based on this assessment, Alternative 1 may adversely affect EFH in Outer Apra Harbor. However, these direct impacts would be either offset or reduced through implementation and management of the BMPs.

Special-Status Species

Green and hawksbill sea turtles and spinner dolphins are the only special-status species reported in Apra Harbor. The green sea turtle is sighted on a regular basis, while hawksbills are less common, and spinner dolphins are rare. Based on the rarity of their presence within Apra Harbor, no serious injury or mortality of any marine mammal species (spinner dolphins) is reasonably foreseeable. No adverse effects on the annual rates of recruitment or survival of any of the species and stocks are expected with the implementation of Alternative 1. Table 11.2-4 shows the sensitive months for sea turtles within Apra Harbor, while Figure 11.2-4 identifies all sensitive marine biological resources and habitats in Apra Harbor.

Table 11.2-4. Sensitive Months for Sea Turtles within Apra Harbor

Species	*Status*	*Location*	*Months*
Green sea turtle	ESA- Threatened	See Figure 11.2-4	Nesting (Jan – Mar) Foraging (Jan – Dec)
Hawksbill Sea Turtle	ESA-Endangered	See Figure 11.2-4	Nesting (Apr – Jul) Foraging (Jan – Dec)

Legend: *E = endangered; SOGCN = Species of Greatest Conservation Need; T = threatened.
Sources: Navy 2005, GDAWR 2006, USFWS 2009a, NMFS 2009a.

As identified in the affected environment section, no sea turtle density information is available for Apra Harbor. The available data on sea turtle hearing suggests auditory capabilities in the moderately low frequency range, and a relatively low sensitivity within the range they are capable of hearing (Bartol et al. 1999; Ketten and Bartol 2006). Green turtles are most sensitive to sounds between 200 and 700 Hz, with peak sensitivity at 300 to 400 Hz (Ridgway et al. 1969). Sensitivity even within the optimal hearing range is apparently low—threshold detection levels in water are relatively high at 160 to 200 dB with a reference pressure of one dB re 1 µPa-m (Lenhardt 1994).

As described earlier, the ability of sea turtles to detect noise and slow moving vessels via auditory and/or visual cues would be expected based on knowledge of their sensory biology (Navy 2009a). Noise from dredging activities (87.3 dB at 50 ft [15 m]) and pile driving (average 165 dB at 30 ft [9 m]) would occur. Sound levels would decline to ambient levels (120 dB) within approximately 150 ft (45.8 m) from in-water construction activities (NMFS 2008c). (See Chapter 4 for more information on noise levels.)

Tech Environmental (2009) predicted underwater sound levels of pile driving perceived by sea turtles-all species (hearing threshold sound levels – dB_{ht} re 1 µPa) is 56 (at 500 m), 60 (at 320 m), and 80 (at 30 m). Research shows marine animals avoidance reactions occur for 50% of individuals at 90 dB_{ht} re 1 µPa, occur for 80% of the individuals at 98 dB_{ht} re 1 µPa, and occur for the single most sensitive individual at 70 dB_{ht} re 1 µPa. This threshold for significant behavioral response is consistent with NOAA/NMFS guidelines defining a zone of influence (i.e., annoyance, disturbance). For estimating the zone of injury for marine mammals, a sound pressure level of 130 dB_{ht} re 1 µPa (i.e., 130 dB above an animal's hearing threshold) is recommended (Nedwell and Howell 2004). Therefore the calculated zone of behavior response for significant avoidance reaction (i.e., distance where dB_{ht} = 90 dB re 1 µPa and avoidance reaction may occur) to pile driving for sea turtles-all species is <98 ft (<30 m) (Tech Environmental, Inc. 2006). In other words, no injury to any marine animals, including sea turtles, is predicted even if an individual were to approach as close as 30 m to pile driving because all dB_{ht} values at this minimum distance are well below specified thresholds.

To be protective of sea turtles, it is anticipated that NMFS-trained monitors would perform visual surveys prior to and during in-water construction work as part of the USACE permit conditions. If sea turtles are detected (within a designated auditory protective distance), in-water construction activities would be postponed until the animals voluntarily leave the area. In-water work can continue work fifteen minutes after the sea turtle submerges and is no longer seen. This practice is the same for turtle seen within or outside the silt curtains. These mitigation measures are currently being employed at Kilo Wharf, Apra Harbor and are described further in Volume 7.

Sea turtles are highly mobile and capable of leaving or avoiding an area during proposed dredging and in-water wharf construction (i.e., pile driving) activities. Sea turtles are expected to avoid areas of noise and disturbances. Dredging and pile driving activities would likely deter green sea turtles from closely approaching the work area. As a result, the likelihood that a green sea turtle would swim close enough to experience any effects is remote, especially with the silt curtain barriers and mitigation measures in place.

The Navy recognizes that there are many on-going and recent past studies on the subject of potential exposures to sea turtles and other marine species from pile driving actions. Further research and validation of these studies are necessary prior to being able to determine the applicability of the methodologies and results to the proposed action within this EIS/OEIS. The Navy would continue to research these studies and where appropriate, incorporate and apply methodologies, analysis, and results to the on-going impact analysis to sea turtles from the proposed action. Applicability of these studies would also be coordinated through consultations with the National Marine Fisheries Service. The Final

EIS/OEIS would contain revised sea turtle impact analysis as developed through the process described above.

Additionally, the Navy would comply with USACE permit conditions, which include resource agency recommended BMPs for sea turtle avoidance and minimization measures and protocols during in-water construction activities (dredging and pile driving) and vessel operations. These measures (including look outs, stop work policies when turtles approach the area, "ramping up" on pile driving activities, and others) are described in detail in the Mitigation Measures section, Volume 7, and are expected to considerably lessen any potential impacts to sea turtles in the area.

Potential impacts to sea turtles in the marine environment with implementation of Alternative 1 include short-term and isolated impacts through temporary disruption of normal behavioral patterns (swimming, resting or foraging behaviors at Sasa Bay and Big Blue Reef) during the following activities:

- Dredging activities for the wharf and turning basin areas anticipated to last 4 to 8 months. The total dredging duration is estimated at 8 to 18 months; however, work to widen and deepen portions of the existing channel near the bend would not be anticipated to affect sea turtles.
- Pile-driving and wharf construction (approximately 6-18 months).
- A 3.5 year duration has been estimated for all in-water construction activities.

It should be noted that sea turtles have not been observed foraging or resting within the proposed project area during multiple dive surveys performed there; it has been observed to function as a transit area to and from Sasa Bay (Navy 2009d).

There would be a short-term and localized minimal increase in potential for vessel strikes of sea turtles due to the proposed in-water construction increase in ship traffic. The implementation of BMPs and potential mitigation measures would minimize these potential effects to sea turtles to less than significant. Alternative 1 actions would not "jeopardize" or "take" ESA-listed sea turtles as defined under Sections 7 and 9 of the ESA.

In general, sea turtle nesting and hatching activities occur at night. They cue in on natural light to orient toward the ocean; however, the bright lights from the dredging platforms may confuse adult nesting turtles and hatchlings so that they orient away from the open ocean (COMNAV Marianas 2007b). Due to the distances of Adotgan Point, Kilo Wharf and the historic Seaplane Ramp nesting areas from the proposed action under Alternative 1, it is unlikely that any nesting-related activities would be affected by the action alternatives, including night work and the associated lights and noise. The Sumay Cove historic nesting site is in close proximity and adult nesting or hatchlings entering the water would potentially be disturbed or disoriented by lights used during nighttime construction operations. However, as mentioned previously, this site has not been active since a reported hawksbill nesting event in 1997.

In summary, the Navy recognizes that there are many on-going and recent past studies of potential noise exposures to sea turtles and other marine species from pile driving actions. Further research and validation of these studies are necessary prior to being able to determine the applicability of the methodologies and results to the proposed action within this DEIS/OEIS. The Navy would continue to monitor these studies and where appropriate, incorporate and apply methodologies, analyses, and results to the on-going impact analysis to sea turtles from the proposed action. Applicability of these studies would also be coordinated through consultations with the National Marine Fisheries Service. The Final EIS/OEIS will contain revised sea turtle impact analysis as developed through this process.

It is anticipated however, that through the results of consultation with NOAA, including implementation of BMPs and potential mitigation measures, the Alternative 1 proposed actions may affect, but are not likely to adversely affect the ESA-listed green sea turtles in Apra Harbor. The short-term dredging, pile driving activities, and episodic vessel movements associated with Alternative 1 actions may affect, but are not likely to adversely affect ESA-listed sea turtles. Alternative 1 would not “jeopardize” or “take” ESA-listed sea turtles as defined under Section 7 and 9 of ESA. Therefore, Alternative 1 would result in less than significant impacts on special-status species.

Non-Native Species

Although terrestrial introductions (exemplified by the brown tree snake) have received much attention, marine introductions had been minimally studied until five major marine biodiversity surveys were conducted on Guam between the mid-1990s and 2001. Approximately 5,500 non-native species were recorded in these surveys, of which most remain restricted to Apra Harbor (Paulay et al. 2002). Potential long-term impacts to the marine habitat within Apra Harbor from non-native marine organisms, pathogens, or pollutants taken up with ship ballast water (or attached to vessel hulls) are a real threat.

As discussed in Volume 2, Chapter 11, non-native species in Apra Harbor include both purposeful introductions for fisheries and agriculture, and inadvertent introductions of species that arrived with seed stock or by hull and ballast transport with shipping traffic. These species are found to be more prevalent on artificial structures than natural reef bottoms (Paulay et al. 2002), thus some non-native species recruitment from the inner harbor area to the new aircraft carrier wharf pilings may be expected. This may enhance the community assemblage and diversity of the area. Minor changes associated with softer sediments may also be expected to occur around pilings (Hiscock et al. 2002). There would be a need for additional requirements and hull inspection of vessels (e.g., dry docks, tugboats, barges, and dredging scows) before leaving/entering harbors after extended stays.

In addition, the Navy, in cooperation with USEPA, fully complies with the Uniform National Discharge Standards. National Discharge Standards regulate discharges incidental to normal vessel operation and apply out to 12 nautical miles (nm) (22.2 kilometers) from shore. All vessels are required to maintain a vessel-specific ballast water management plan. The Vessel Master is responsible for understanding and executing the management plan (COMNAV Marianas 2007b).

Less than significant impacts from construction-related actions associated with introduction of non-native species are anticipated from Alternative 1, if appropriate U.S. Coast Guard (USCG) and Navy ballast water and hull management policies are followed.

<u>Operation</u>

Marine Flora, Invertebrates and Associated EFH

Less than significant impacts would be expected to marine flora and invertebrates. Increased vessel traffic may disturb organisms living in the upper water column or in or on the sediments due to propeller wash and resuspension of sediments as described under the construction section and Volume 2, Chapter 11 operation section. Impacts to marine flora and invertebrates would be long-term, but episodic and minor, considering existing conditions. Therefore, Alternative 1 would result in less than significant impacts to marine flora and invertebrates.

Essential Fish Habitat

There would be long-term, localized and infrequent impacts associated with use of the aircraft carrier wharf at Polaris Point. The tugboats would disturb bottom sediments that could potentially be deposited on corals in and near the turning basin, including Big Blue Reef. However, analysis of grab samples collected within the turning basin area indicated that approximately 90% of the surficial sediments were very fine sand sized or coarser, and had a median grain size of approximately 0.1 mm (very fine to fine sand). Sediment cores from the same area classified the material as well-sorted sand consisting of 73% sand and gravel and 17% silt (NAVFAC Pacific 2006). These data suggest that most of the material on the seafloor in the turning basin area that may be resuspended by tug-assisted aircraft carrier maneuvering would be sand-sized or greater, thereby minimizing the extent and duration of possible plumes that may result from vessel operation. Additionally, as described earlier, research findings suggest a fundamentally different outcome for corals exposed to sedimentation by sandy, nutrient-poor sediments, such as vessel resuspended marine carbonate sediments found in Apra Harbor, compared to sedimentation of silt-sized sediments rich in organic matter and nutrients.

The operational indirect impacts would be far less than those modeled for 10 to 24 hours of dredging (Volume 9, Appendix E, Section E of this EIS/OEIS), as the deposition contours do not extend to Big Blue Reef. The use of the aircraft carrier wharf for other ships would result in fewer impacts than for the aircraft carrier because only two tugboats would be required. While the turning point would remain in the center of the turning basin, the ships would be much shorter and the tugboats would be further from Big Blue Reef.

Other ship traffic (including commercial vessels) would use the proposed aircraft carrier navigation channel, which would have the same centerline as the current channel, but be wider. Other ships would navigate along the centerline and would not use the full width of the aircraft carrier channel. There would be a long-term, although localized, increased potential for direct impacts to EFH and HAPC (Jade Shoals) from coral reef strikes due to an increase in harbor activities (e.g., aircraft carrier traffic, tugboats, ship berthing and unberthing). The aircraft carrier beam (most extreme width or breadth) at the water line is 134 ft (41 m). The narrowest passage within the aircraft carrier fairway is at Jade Shoals at approximately 551 ft (168 m), allowing for roughly a 210 ft (64 m) buffer on either side of the aircraft carrier at this point in the channel. This buffer zone, in addition to strict Navy ship operation protocols within the harbor, including navigating the centerline of the channel, would decrease the potential for direct impacts to Jade Shoals and other nearby areas. The indirect impacts of ship traffic within the proposed aircraft carrier channel on nearby coral shoals would be comparable to existing impacts for current ship traffic, which are minor and short-term.

Indirect disturbances of EFH for reef fish MUS may occur. The impacts would be similar to those described under the construction section above and in Volume 2, Apra Harbor construction and operation. However, the construction of the aircraft carrier wharf would likely provide refuge for finfish and invertebrates. A beneficial long-term impact to the recruitment of finfish and invertebrate MUS and the ecology of the immediate area would be expected with the added relief and settlement potential the aircraft carrier wharf vertical pilings and rip rap would provide. Short-term and periodic minor disturbances to these new recruits during aircraft carrier docking would be expected. Benthic invertebrates such as sponges, sea urchins, starfish, and mollusks, as well as finfish are poorly represented within Inner Apra Harbor, except for on vertical wharf structures (COMNAV Marianas 2006). Smith et al. (2008) identified that man-made structures (i.e., wharves, vertical pilings) provided considerable habitat for a diverse array of fishes compared to the reef at Abo Cove or the harbor floor offshore from the wharves. Benthic species, such as cardinalfishes, damselfishes, and gobies, favored corals, debris, sand, soft corals, and the wharf wall and pilings. Species that were active swimmers, such as butterflyfishes, emperors, snappers, surgeonfishes, sweetlips, trevallys and jacks, etc., were found in the water column directly adjacent to the wharves.

Fish within the Apra Harbor channel and associated nearby shoals and nurseries (Sasa Bay) may be disturbed by increased aircraft carrier and MEU embarkation and commercial ship movement through underwater noise or physical disturbances and resuspension of sediments from proposed dredging or propeller wash. However, there may also be additional recruitment potential of juvenile finfish from Sasa Bay to the aircraft carrier wharf as an extended nursery area. While fish may exit the immediate area during vessel movement, it is not likely that there would be any permanent impacts to the present populations.

The deeper channel resulting from dredging activities would cause decreased turbidity during current operations and would offset the potential increase in turbidity from carrier operations. Operation impacts to EFH for sensitive MUS potentially present (i.e., Napoleon wrasse, bigeye scad, and scalloped hammerhead) would be short-term and localized, and therefore, there would be no adverse affects to EFH for these species. As described within the EFH construction section above, the impacts to EFH for planktonic eggs and larvae of all species present in the upper water column could be impacted by Alternative 1 actions. However, based on the small coverage areas, these impacts would be negligible, and therefore, no adverse effect on EFH for planktonic eggs and larvae is anticipated.

EFH Assessment Summary. Alternative 1 operation activities, including an increase in vessel movements and operational pollutants could result in:

- Long-term, however, periodic and localized disturbance and displacement of motile species (fish) during in-water transit activities
- Long-term, however, periodic and localized increase of turbidity and pollutants (decreased water quality) in the water column from propeller wash and operation activities
- Long-term, however, periodic and localized increase in benthic sedimentation
- Long-term, however, periodic and localized potentially significant impacts to eggs and larvae in the upper water column from increased vessel traffic
- Seasonal disturbances to potentially spawning scalloped hammerhead sharks and high concentrations of adult bigeye scad

Based on this assessment, there would be no adverse effects to EFH from operation. Therefore, Alternative 1 would result in less than significant impacts to Essential Fish Habitat from Standard Navy operating procedures and BMPs to protect marine resources, as discussed in Volume 7. Measures would be implemented by vessels while underway within Apra Harbor. Table 11.2-5 summarizes the EFH present in the project area and potential effects with implementation of Alternative 1.

Special-Status Species Summary

The MMPA-protected species and fish species of concern are not expected to occur in the project area. There would be a long-term and localized increase in the potential for vessel strikes of sea turtles due to the proposed increased ship traffic associated with Alternative 1. Increased vessel movements associated with the aircraft carrier and MEU embarkation operation and commercial shipping traffic have the potential for increased sea turtle disturbances and strikes in route to and from Sasa Bay (a high turtle concentration area) within Apra Harbor. Potential impacts would be as described in the construction section above and the operation section of Volume 2, Apra Harbor.

Table 11.2-5. EFH Areas Associated with Apra Harbor and Summary of Overall Potential Impacts

Habitat	*Area of Occurrence*	*Associated Activity*	*Impact*
Live/Hard Bottom	Outer Apra Harbor	Dredging of aircraft carrier channel, turning basin, and berth. Backfill and pile driving for wharf construction Increased vessel movements and harbor operation	Direct, permanent and localized removal. Indirect, long-term, but periodic and localized.
Soft Bottom	Apra Harbor	Dredging of aircraft carrier channel, turning basin, and berth. Backfill and pile driving for wharf construction and increased vessel movements and harbor operation	Direct and indirect, periodic and localized resuspension of sediment. Benthic infaunal community is expected to reestablish themselves quickly from adjacent, undisturbed areas.
Corals/Coral Reef Habitat	Outer Apra Harbor Shoal Areas, Entrance Channel	Dredging of aircraft carrier channel, turning basin, and berth. Backfill and pile driving for wharf construction Increased vessel movements and harbor operation	Direct, permanent and localized removal. Indirect, short-term and localized increase in underwater noise, localized resuspension of sediments, and potential increase in pollutants. Sessile benthic community is expected to recolonize quickly from adjacent, undisturbed areas. Direct and indirect – long-term but periodic, localized resuspension of sediments, increase of noise and potential pollutants
Water Column	Apra Harbor	Dredging of aircraft carrier channel, turning basin, and berth. Backfill and pile driving for wharf construction Increased vessel movements and harbor operation	Direct and indirect – temporary and localized elevation of turbidity, noise, and potential pollutants Direct and indirect – long-term but periodic, localized resuspension of sediments, increase of noise and potential pollutants
Estuarine Emergent Vegetation	Apra Harbor, Sasa Bay	Dredging of aircraft carrier channel, turning basin, and berth. Increased vessel movements and harbor operation	No effects Long-term, localized potential increase of pollutants
Submerged Aquatic Vegetation	Apra Harbor, Sasa Bay	Dredging of aircraft carrier channel, turning basin, and berth. Backfill and pile driving for wharf construction. Increased vessel movements and harbor operation	Direct and indirect short-term localized removal or backfilling. Aquatic vegetation is expected to recolonize quickly from adjacent undisturbed areas. No effects
Estuarine Water Column	Sasa Bay	Dredging of aircraft carrier channel, turning basin, and berth. Backfill and pile driving for wharf construction Increased vessel movements and harbor operation	Direct and indirect – temporary and localized elevation of turbidity, noise, and potential pollutants Direct and indirect – long-term but periodic, localized resuspension of sediments, increase of noise and potential pollutants

The long-term, periodic impacts associated with Alternative 1 actions would be likely to affect, but are not likely to adversely affect ESA-listed sea turtles. Alternative 1 would not "jeopardize" or "take" ESA-listed sea turtles as defined under Sections 7 and 9 of ESA. Therefore, Alternative 1 would result in less than significant impacts to special-status species. Nesting sea turtles are addressed in more detail in Volume 2, Chapter 10 (Terrestrial Biological Resources).

The implementation of NOAA/NMFS-recommended BMPs (Volume 7) would be anticipated to reduce any potential impacts of vessel interactions with sea turtles. These BMPs would be implemented while vessels are underway within Apra Harbor and especially while in the vicinity of Sasa Bay and during nesting season. Additionally, general maritime measures in place by the military, including lookouts trained to sight marine mammals or sea turtles, are in use and designed to avoid collisions with protected species.

Non-Native Species Summary

Impacts would be similar to those described under the construction section above. Less than significant operation-related impacts associated with introduction of non-native species would be anticipated from Alternative 1, if appropriate USCG and Navy ballast water and hull management policies are followed.

BMPs and Avoidance and Minimization Measures

Implementation of Alternative 1 would result in potentially significant impacts to marine biological resources from proposed in-water and nearshore construction activities. Through project design, the Navy has taken significant steps to reduce these potential impacts to marine aquatic resources. Actions taken during the planning phase to avoid and minimize impacts included:

- Re-alignment of the initially proposed straight channel approach to use the existing commercial shipping channel and widening this channel to accommodate the aircraft carrier.
- Minimizing the turning basin diameter to the minimum needed to safely maneuver the aircraft carrier to lessen direct impacts to coral communities.
- Identification of Polaris Point as the least environmentally damaging of the two alternatives considering both construction and operational impacts (further away from Big Blue Reef)
- Reduction of the area to be dredged at the eastern end of the Polaris Point alternative to avoid removing coral communities.
- Adherence to Navy INRMP measures.

The potential impacts described previously are expected to be minimized by implementation of BMPs. Although a comprehensive list of BMPs is provided in Volume 7, the following are some BMPs specifically related to marine resources.

- Spill Prevention Control and Countermeasures (SPCC) plans are currently in place. Trained personnel would be present that maintain spill control and cleanup materials nearby within Apra Harbor for quick response to spills to be protective of natural resources.
- No in-water blasting would be allowed.
- If a sea turtle is sighted near any project activity, and should that activity have a potential to adversely affect the turtle, the action would be paused or modified to avoid any adverse affects.
- Use of appropriate silt curtains and/or other silt containment BMPs to fully enclose areas (maximum extent practicable and within performance levels of curtains) where in-water

operations are occurring along with frequent monitoring of their effectiveness to contain suspended sediments.

- Water quality would be monitored throughout the construction project.

Relative to impacts to resting and foraging of green and hawksbill turtles, the Navy will consider the following NOAA-recommended lighting and construction BMPs (COMNAV Marianas 2007b) to minimize the potential for adverse effects to sea turtles:

- Employ avoidance and minimization measures, including performance of a visual sweep of the project area prior to commencing in-water activities, if green turtles are seen, in-water activities would not commence until 15 minutes has passed or the animal has moved out of range, a ramping up of increased intensity in noise would be required during pile driving and dredging work allowing undetected animals to voluntarily depart the area.
- Construction personnel would be informed of the protected nature of these animals and procedures that would be employed should a sea turtle enter a construction area. For example, if a dredge-related tug, barge or scow vessel operator sees that the vessel is approaching a sea turtle, the speed would be reduced, the boat would be turned, or other actions would be taken to avoid the turtle.
- Avoid the use of artificial lighting near beaches, where possible, particularly during nesting and hatching seasons.
- Shield or redirect lights to reduce as much as possible the amount of light that can be seen from the nesting beach.
- Where possible, use low-intensity light sources that emit long wavelength light (yellow, red) and avoid sources that emit short wavelengths (ultraviolet, blue, green, white).
- Aboard dredge-related tug, barge or scow vessels at sea, use the minimum lighting necessary to comply with navigation rules and best safety practices.
- Silt curtains would be employed as part of the turbidity BMPs during dredging operations; however, precautions would be taken to ensure that curtains do not encircle turtles when put in place. If a turtle should enter the silt curtain area, work would be halted and the curtain lowered until the turtle voluntarily leaves the area.
- Observers would be present during dredging operations specifically for sea turtle identification. If a sea turtle is sighted near any project activity and deemed that the activity could potentially adversely affect the sea turtle, the action would be suspended or modified to avoid any adverse effect.
- Construction-related materials that may pose an entanglement hazard would be removed from the project site if not actively being used.
- Anchor lines from construction vessels would be deployed with appropriate tension to avoid entanglement with sea turtles.
- All in-water work would be postponed when turtles are within 100 yd (91 m), or other protected species are within 50 yd (46 m). Activity would commence only after the animal(s) depart the area.

Additionally, the Navy maintains the following general protective measures for marine resources in Apra Harbor including:

- Constant vigilance shall be kept for the presence of ESA-listed species.
- When piloting vessels, vessel operators shall alter course to remain at least 100 yards (yd) (91 m) from sea turtles and at least 50 yd (46 m) from other protected species.

- Reduce vessel speed to 10 knots or less when piloting vessels in the proximity of marine mammals.
- Reduce vessel speed to 5 knots or less when piloting vessels in areas of known or suspected turtle activity.
- Marine mammals and sea turtles should not be encircled or trapped between multiple vessels or between vessels and the shore.
- Do not attempt to feed, touch, ride, or otherwise intentionally interact with any protected species.
- If a visible plume is observed over sensitive coral habitat outside the silt curtains, the construction activity would stop, be evaluated, and corrective measures taken. Construction would not resume until the water quality returned to ambient conditions.
- Anchors, anchor chain, wire rope and associated anchor rigging would be restricted to designated anchoring areas, the sandy harbor bottom or within the area that would be permanently impacted.
- All construction-associated equipment would be operated and anchored to avoid contacting coral reef resources during construction activities or extreme weather conditions.

<u>Invasive Species Control</u>

The Navy is preparing a Regional Biosecurity Plan including a risk analysis with the overall goal to identify marine biosecurity risks associated with Department of Defense (DoD) build-up and training activities on Guam and the Commonwealth of the Northern Mariana Islands (CNMI). The Regional Biosecurity Plan will document measures for prevention, control and treatment measures for military operations. Volume 7 includes a more detailed description of a Regional Biosecurity Plan.

11.2.2.3 Summary of Alternative 1 Impacts

Table 11.2-6 summarizes Alternative 1 impacts.

11.2.2.4 Alternative 1 Potential Mitigation Measures

Potential avoidance and minimization measures that would be discussed during required consultations and permitting actions include the following. The results of consultations and permit discussions would form the basis of mitigation measures included by the Navy in its ROD implementing the proposed actions.

- Incorporate seasonal dredging prohibitions similar to those EPA suggested for the Kilo Wharf dredging activities.
  - Cessation of dredging operations during the period of peak coral spawning (7-10 days after the full moon in July) in consultation with the Guam Department of Water Resources (GDAWR).
  - Dredging or filling of tidal waters would not occur during hard coral spawning periods, usually around the full moons of June, July, and August.
- No ships would be allowed to enter Sasa Bay at night.
- Provide marine biological resources education and training on EFH, ESA, and MMPA. This may include Base Orders, natural resource educational training (i.e., watching of short Haputo Ecological Reserve Area video) and documentation (i.e., preparation of *Military Environmental/Natural Resource Handbook, distribution of natural resource educational materials to dive boat operators*), or a combination of all.

Table 11.2-6. Summary of Alternative 1 Impacts

Area	*Project Activities*	*Project Specific Impacts*
Onshore	Construction	Negligible, short-term and localized impacts associated with lighting, ground vibrations, noise, and a potential decrease in water quality from pollutant runoff.
	Operation	Negligible, short-term and localized impacts associated with lighting, ground vibrations, noise, and a potential decrease in water quality from pollutant runoff.
Offshore	Construction	Significant impacts, mitigated to less than significant impacts from direct and indirect effects associated with in-water construction (i.e., dredging and impact pile driving) activities on Essential Fish Habitat. Marine Flora, Invertebrates and Associated EFH: Less than significant direct and indirect impacts to marine flora and non-coral invertebrates. Injury and/or mortality to marine flora and sessile invertebrates from physical removal would occur within the dredged footprint. These organisms are anticipated to quickly reestablish themselves from adjacent areas after construction. Motile invertebrates would likely vacate the area due to the increased disturbance and find other habitat. Essential Fish Habitat: Unavoidable, long-term significant direct impacts from dredged removal of 25 ac (10 ha) of coral habitat (>0% to ≤ 90%) and 46 ac (19 ha) of benthic habitat (0% coral). Short-term and localized adverse indirect impacts from sediment accumulation on a portion of an additional 46 ac (19 ha) of coral habitat (>0% to ≤ 90%) and 54 ac (22 ha) of benthic habitat (0% coral) adjacent to, but outside of, the dredge footprint. Indirect impacts from sedimentation may adversely affect a portion of the site-attached finfish species. Limited injury or mortality to site-attached finfish and fish eggs and larvae is expected. Short-term and localized disturbance to water column is anticipated. There would be an insignificant long-term population-level effect or reduction in the quality and/or quantity of EFH for finfish with implementation of identified BMPs and potential mitigation measures. However, after all mitigation efforts, there still would remain unavoidable adverse impacts associated with coral and coral reef ecosystem removal (direct impact) and associated sedimentation (indirect impact). Compensatory mitigation would be required. The HEA assumed dredging impacts accounted for an initial 100% ecological loss from direct impacts and an initial 25% loss of ecological services from indirect impacts. Special-Status Species: Less than significant impact on special-status species from in-water construction activities. Short-term and localized effects on sea turtle behavior during the dredging and impact pile driving periods are expected, for example, temporarily altering their swimming, resting or feeding behaviors could be anticipated from elevated noise levels. However, there are many alternate sea turtle foraging and resting sites throughout Apra Harbor unassociated with the proposed action and potential mitigation measures would postpone operations if sea turtles approach the area. Through Section 7 consultation and the implementation of identified BMPs and potential mitigation measures, including USACE permit conditions, sea turtles would be affected, but not adversely affected by the proposed action. Non-native Species: Less than significant impacts are expected from introduction of non-native species since construction vessels would comply with USCG and Navy requirements for ballast water and hull management policies. The Navy would also prepare a Regional Biosecurity Plan with risk analysis (see Volume 7 for more details).

Area	*Project Activities*	*Project Specific Impacts*
	Operation	Less than significant impacts from direct and indirect effects associated with an increase in operational activities. Marine Flora, Invertebrates and Associated EFH: Long-term, localized and infrequent minor impacts from increased noise and resuspension of sediment during vessel movements, and the potential for increased discharges of pollutants into the water column. Essential Fish Habitat: Long-term, localized and infrequent impacts associated with increased vessel movements resulting in long-term, periodic and localized disturbance to water column and finfish through noise, potential increased discharge of pollutants into the water column, and re-suspension of sediments. Limited injury or mortality to fish eggs and larvae. Insignificant long-term populations-level effects or reduction in the quality and/or quantity of EFH. Special-Status Species: Short-term, periodic and localized minimal effects on sea turtle behavior during increased operation activities and vessel movements with implemented BMPs, potential mitigation measures, and Navy vessel policies. Non-native Species: Less than significant impacts from introduction of non-native species are expected as vessels operating within Apra Harbor would comply with USCG and Navy requirements for ballast water and hull management policies. The Navy would also prepare a Regional Biosecurity Plan with risk analysis (see Volume 7 for more details).

11.2.2.5 Potential Mitigation Projects for Coral Reefs

The proposed action would result in unavoidable impacts to coral communities and compensatory mitigation would be required. Compensatory mitigation is defined as the restoration, establishment, enhancement, and/or preservation of aquatic resources to offset unavoidable impacts to waters of the U.S. (including SAS such as coral reefs). After all efforts to minimize and avoid the impacts of the aircraft carrier project, there remain unavoidable adverse impacts associated with dredging coral reef ecosystems in Outer Apra Harbor. The compensatory mitigation is subject to approval by USACE, under the CWA, through the Section 404/10 permit requirements (USACE, USEPA, USFWS, and NOAA 2000).

As identified in the 10 April 2008 Federal Register, 40 CFR Part 230, the final USACE compensatory mitigation rule, permit applicants are required to mitigate to no net loss of ecological services and function. The regulations establish performance standards and criteria for the use of permittee-responsible compensatory mitigation, mitigation banks, and in-lieu programs to improve the quality and success of compensatory mitigation projects for activities authorized by Department of the Army permits. Habitat Equivalency Analysis is a tool that has been used in a variety of legal and technical contexts to quantify impacts to natural resources and the services/functions they provide, and quantify the amount of restoration/mitigation required to offset documented losses.

Habitat Equivalency Analysis (HEA)

Coral loss assessment, coral restoration and the parameters used in a HEA are an evolving science. HEA, like any model, relies on user-specified inputs and calculations that simplify complex processes, both of which can introduce uncertainties into model results. However, HEA applications have been published in peer-reviewed technical literature, courts have upheld the use of HEA in litigation, and HEA often underlies settlements reached on cases involving the impacts to and restoration/mitigation of natural resource services and functions. To address the concern of USFWS and USEPA that coral cover as a single metric is inadequate, the revised HEA model is based on percent coral cover plus rugosity (horizontal: vertical measurements) to capture the 3-D complexity of the reef.

The USACE has regulatory authority; compensatory mitigation would be developed during permitting and appropriate units for quantifying credits and debits would be determined by district engineers on a case-by-case basis. District engineers are encouraged to use science-based assessment methods for determining aquatic habitat condition, such as the index of biological integrity, where practicable.

One example of HEA use was to establish the appropriate scale of compensatory restoration in the context of damage assessments conducted under the 1990 Oil Pollution Act and the Comprehensive Environmental Response, Compensation and Liability Act. A HEA was used in other Navy dredging projects in Apra Harbor, including Kilo Wharf.

A HEA model was conducted for both aircraft carrier alternatives and a report entitled *Habitat Equivalency Analysis (HEA) Mitigation of Coral Habitat Losses* was prepared. It is included in Volume 9, Appendix E, Section F of this EIS/OEIS. The scientific basis for the affected environment description and many of the HEA assumptions is described in *Assessment of Benthic Community Structure in the Vicinity of the Proposed Turning Basin and Berthing Area for Carrier Vessels Nuclear (CVN)*, which is included in Volume 9, Appendix J of this EIS/OEIS.

The assessment of benthic communities report assumes a 60 ft (18 m) dredge depth, which is an overestimate of the proposed dredge depth of -49.5 ft (-15.1 m) MLLW plus 2 ft (0.6 m) overdredge, representing an approximately 10-15% increase in assessed benthic habitat in the dredged area. For this reason, the total dredged area differs from the dredged area provided in Volume 4, Chapter 4.

Although the indirect impacts were modeled and indicated that sedimentation exceeding 40 mg/cm^2 or 0.008 inch (0.2 mm) extended an average distance of 144 ft (44 m) from the dredging, the assessment of benthic communities (and the HEA) assumes an indirect impact distance of 656 ft (200 m) distance from the direct impact area boundary, which is an overestimate of the impact area. As previously noted in Section 11.1.2.2, this is an overestimate because the SEI (2009) plume modeling summary identifies only 39 ft (12 m) beyond the direct dredge impact area as anticipated to receive cumulative sedimentation totaling at least 0.2 inches (in) (6 millimeters [mm]), which was established as the cumulative sedimentation threshold for corals.

The total direct impact dredge area (as noted in Table 11.1-1) for Polaris Point - Alternative 1 is 71 ac (29 ha) and 61 ac (25 ha) for Former SRF - Alternative 2. As discussed above, this total dredged area assumes a 60 ft (18 m) depth. This is an overestimate of the proposed project's dredge footprint (-49.5 ft [-15.1 m] MLLW, plus 2 ft. (0.6) overdredge) noted in Volume 4, Chapter 2 where the total dredge area is 53 ac (21 ha) for Alternative 1 and 44 ac (18 ha) for Alternative 2, respectively.

The description below is a brief summary of a HEA that was created as an evaluation tool for this document. The findings for both the Polaris Point and the Former SRF Alternatives are provided together in this section to facilitate comparison.

The HEA addresses direct and indirect impacts to coral habitat arising from dredging to support aircraft carrier berthing and maneuvering in Outer Apra Harbor. The basic HEA steps include:

1. Loss calculation: Document and estimate the duration and extent of injury from the time of injury until the resource recovers to baseline, or possibly to a maximum level below baseline.
2. Restoration calculation: a) Document and estimate the services provided by the compensatory project over the full life of the habitat, and b) Calculate the size of the replacement project for which the total increase in services provided by the replacement project equals the total interim loss of services due to the injury.

Loss Calculation (Step 1)

As a first step in determining appropriate mitigation, HEA impact inputs to estimate potential coral habitat losses due to dredging were developed, based on currently available information. These inputs reflect site-specific data and analyses, information from relevant literature, and the professional judgment of technical experts familiar with the project plans, potentially affected habitats and biota, environmental impact assessment, and the HEA methodology.

The estimated input values for the variables needed to perform HEA loss calculations, included:

- The acreage of coral habitat expected to be affected by dredging, including direct (dredging) and indirect (dredging-related sedimentation) impacts. Based on pixel counts from the remote sensing map, the total area ("plan" view) with any level of coral coverage is about 25.20 ac (10.20 ha) for the Polaris Point Alternative and 23.74 ac (9.60 ha) for the Former SRF Alternative in the direct impact area.
- The coral habitat index was generated by merging Quickbird multispectral imagery, field survey habitat data (Dollar et al. 2009, Volume 9, Appendix J), and reef rugosity derived from bathymetric data (airborne LIDAR and boat hydrographic surveys). The coral habitat index is on a logarithmic scale. Ten categories of coral habitat index ranges were defined as shown in Table 11.2-7.

Table 11.2-7. Coral Habitat Index Ranges

Coral Habitat Index Category	*Coral Habitat Index Range of Values (log_{10})*
Category 1	0 to ≤ 0.235
Category 2	0.235 to ≤ 0.471
Category 3	0.471 to ≤ 0.706
Category 4	0.706 to ≤ 0.942
Category 5	0.942 to ≤ 1.177
Category 6	1.177 to ≤ 1.413
Category 7	1.413 to ≤ 1.648
Category 8	1.648 to ≤ 1.884
Category 9	1.884 to ≤ 2.119
Category 10	2.119 to ≤ 2.355

This analysis focused on the coral habitat expected to be either permanently lost due to dredging or temporarily affected by sedimentation. Much of the habitat within the dredge footprint is unconsolidated soft sediment with no coral cover (Smith 2007, Dollar et al. 2009). Soft bottom habitat was not addressed in the HEA.

The total area (three dimensional view) of habitat with some coral coverage is approximately 33 ac (13 ha) for Alternative 1 Polaris Point, and approximately 32 ac (13 ha) for Alternative 2 Former SRF.

Based on these inputs, an estimate was made of the discounted service acre-years expected to be lost due to aircraft carrier dredging-related activities. The "acre-year" metric allows the analysis to consider not only the number of acres lost, but also injury severity and recovery over time. A loss of one acre-year equates to a complete loss of ecological function provided by the identified habitat for one year. Such a loss could be arrived at in numerous ways (e.g., 50% degradation of two ac [0.8 ha] of habitat for one year, 10% degradation of five ac (2 ha) of habitat for two years, 5% degradation of one ac (0.4 ha) of habitat for 20 years, etc.).

The simplified examples above do not take into account the effects of discounting, which is applied in the HEA methodology to convert losses occurring in different years into a single, common year. A 3% annual discount rate is added to the calculations, which is the most common discount rate used in HEA applications and one that research indicates reasonably reflects society's general preference for current use and enjoyment of resources, compared to future resource use and enjoyment (NOAA 1999; Freeman 1993). The sum of these discounted losses across years represents the present value acre-years of ecological services lost.

Tables 11.2-8 and 11.2-9 summarize the data used in the HEA calculations to estimate aircraft carrier-related coral habitat impacts and the resulting loss estimates. As shown in these tables, Polaris Point (Table 11.2-8) is expected to result in a loss of approximately 1,048 discounted service acre-years (DSAYs) of coral habitat (across all coral habitat categories), approximately 996 DSAYs due to direct impacts and 52 DSAYs due to indirect impacts. The Former SRF Alternative is expected to result in a loss of approximately 1,023 DSAYs, 969 DSAYs due to direct impacts and 54 DSAYs due to indirect impacts.

Initial Service Loss and Duration of Injury. For direct impacts, the HEA assumed an initial 100% loss in ecological services (i.e., the resource suffers a complete loss of ecological function). For indirect impacts, affected habitat is expected to experience an initial 25% loss. This estimate is consistent with the expectation that cumulative sedimentation caused by dredging is expected to be low (i.e. < 0.40 in [< 1 cm]), and the relatively lower sensitivity of dominant corals in the affected area (*Porites rus* and *Porites cylindrica*) to such levels of sedimentation.

Areas directly impacted by dredging are considered permanently injured, and therefore experience a 100% loss in ecological services in perpetuity (i.e., no recovery). Any recovery would be lost during future maintenance dredging. Indirect impacts are expected to be temporary, and affected areas are expected to recover to baseline condition within five years, which the Navy believes to be a conservative assumption in light of the expected low level of initial impact and relevant literature described earlier in the EFH indirect impacts subsection above.

The shape of the recovery curve, the period over which losses are calculated, expected project timing and an appropriate discount rate.

<u>Restoration Calculation (Step 2)</u>

Step 2 requires a mitigation project and artificial reefs were the mitigation approach used in the HEA. There is a discussion later in this section on the rationale for using artificial reefs.

A typical pattern for Z-block placement utilized by the State of Hawaii deploys up to approximately 300 Z-blocks per ac (0.4 ha) of subtidal bottom in approximately six "sets" of 50 Z-blocks each, resulting in 15 ft (w) x 15 ft (l) x 12 ft (h) [4.5 m (w) x 4.5 m (l) x 3.7 m (h)] dimensions for each set (COMNAV Marianas 2007b). An alternate deployment proposed for the Kalaeloa artificial reef intended to mitigate impacts to coral reef habitat arising from the Ocean Pointe Marina project (also referred to as Hoakalei Marina) would place 350-400 Z-blocks in a single set with dimensions approximately 100 ft (30.5 m) in diameter and 20 ft (6 m) in height (HDAR 2007).

Applying the algorithm used to assign injuries to Habitat Index Categories, an ac (0.4 ha) of artificial reef (i.e., 300 Z-blocks deployed in a site-appropriate configuration) would be classified in Category 1. Therefore, the Navy utilizes a 1:1 ratio for artificial reef to injured Category 1 reef. Recognizing the greater coral cover, surface area, and/or rugosity of Category 2 habitat, the Navy assumes a 2:1 artificial reef to injured Category 2 reef, a 3:1 ratio artificial reef to injured Category 3 reef, and so on.

Table 11.2-8. HEA Loss Calculations for Direct Impacts Arising from the Aircraft Carrier Project

Project Alternative	*Habitat Index Category*	*Year Dredging Occurs*	*Estimated Post-Dredging Service Level (Initial)*	*Year Recovery Begins*	*Length of Recovery Period (years)*	*Shape of Recovery Curve*	*Post-Dredging Service Level*	*End of HEA Analysis Period*	*Estimated Loss (2009 DSYs)*
Direct Impacts									
Polaris Point	Category 1	2012 (a)	0% (b)	None (c)	No Recovery (c)	N/A (c)	0% (c)	Perpetuity (d)	303.93
	Category 2								243.99
	Category 3								179.40
	Category 4								163.39
	Category 5								71.23
	Category 6								26.92
	Category 7								7.17
	Category 8								0.35
	Category 9								0.00
	Category 10								0.00
	Subtotal								**996.37**
Former SRF	Category 1	2012 (a)	0% (b)	None (c)	No Recovery (c)	N/A (c)	0% (c)	Perpetuity (d)	288.95
	Category 2								232.69
	Category 3								178.32
	Category 4								166.13
	Category 5								70.06
	Category 6								26.15
	Category 7								5.88
	Category 8								0.18
	Category 9								0.00
	Category 10								0.00
	Subtotal								**968.36**

Notes:
a) Estimated year for dredging implementation.
b) Assumes complete loss of coral habitat services, beginning immediately after dredging.
c) Assumes ongoing maintenance of dredge channel would prevent significant re-establishment of coral in dredged areas.
d) HEA impacts calculated in perpetuity.
Refer to Table 11.2-6 for the Coral Habitat Index range per category.

Table 11.2-9. HEA Loss Calculations for Indirect Impacts Arising from the Aircraft Carrier Project

Project Alternative	*Habitat Index Ca*	*Year Dredging Occurs*	*Estimated Post-dredging Service level (Initial)*	*Year Recovery Begins*	*Length of Recovery Period (Years)*	*Shape of Recovery Curve*	*Post-Dredging Service Level*	*Estimated Loss (2009 DSYs)*
Indirect Impacts								
Polaris Point	Category 1	2012 (a)	75% (b)	2013 (c)	5 (d)	Linear (e)	100% (f)	10.31
	Category 2							9.46
	Category 3							11.75
	Category 4							7.79
	Category 5							5.09
	Category 6							3.82
	Category 7							2.42
	Category 8							0.80
	Category 9							0.21
	Category 10							0.13
	Subtotal							**51.79**
Former SRF	Category 1	2012 (a)	75% (b)	2013 (c)	**5** (d)	Linear (e)	100% (f)	10.70
	Category 2							9.48
	Category 3							12.04
	Category 4							8.28
	Category 5							5.45
	Category 6							4.24
	Category 7							2.80
	Category 8							0.97
	Category 9							0.23
	Category 10							0.13
	Subtotal							**54.32**

Notes:

a) Estimated year for dredging implementation.
b) A modest (25%) initial service level loss is consistent with the expectation that cumulative sedimentation caused by dredging is expected to be low (less than approximately 1 cm), and the expected low sensitivity of dominant corals in affected area (*P. rus* and *P. cyindrica*) to such levels of sedimentation.
c) Recovery is assumed to begin the year after the completion of dredging (i.e., 2013).
d) A 5-year recovery time is conservative in light of the expected low level of initial impact and relevant literature (e.g., Brown et al. (1990) study of dredging impacts on intertidal coral reefs at Ko Phuket, Thailand, which suggests a one to two year recovery period is reasonable for impacts of this type).
e) For simplicity (and in the absence of field data warranting a different approach), a linear recovery rate is utilized for HEA purposes.
f) Affected coral communities are expected to fully recover to baseline condition.

Refer to Table 11.2-7 for the Coral Habitat Index range per category

For simplicity (and in the absence of field data warranting a different approach), a linear recovery rate from the use of artificial reefs was utilized for HEA purposes. This implies an annual service gain of 10%, based on a 10-year period post-deployment for artificial reefs to provide comparable replacement functions and services. This type of artificial reef was estimated to provide ecological benefits for 100 years. This estimate was based on the two-block design described above, and the inclusion of substantial maintenance and contingency allowances in the project budget.

Some soft bottom habitat would be lost due to the placement of an artificial reef. That is, the habitat directly underlying the footprint of the reef structure and its corresponding ecological services would be permanently altered. This would be offset by placing the reefs in areas with limited ecological contributions. Although the HEA assumes permanent loss of habitat due to dredging, in reality there would be coral regrowth that would provide minor functions/services in the dredged areas. This could offset losses of habitat on which artificial reefs are placed.

The HEA was used to develop an estimate of the discounted service acre-years (DSAYs) gained per acre of artificial reef, discounted in the same manner as HEA loss calculations. Given a total expected loss of 1,048 DSAYS, a total of approximately 123 ac (49.8 ha) of artificial reef would be required to compensate for coral habitat impacts expected due to the Polaris Point Alternative. Results indicate that each acre of artificial reef would provide approximately 22.1 DSAYs. Approximately 121 ac (49.0 ha) of artificial reef would be required for mitigation of impacts due to Alternative 2.

11.2.2.6 Implementation of Coral Restoration

Within DoD, regulatory agencies and the Military Civilian Task Force on Guam there is support for the use of In-Lieu-Fee or mitigation banking programs to manage, implement and monitor the success of natural resource compensatory mitigation projects on Guam. These programs are not yet established on Guam and would have to be developed in a timely manner to the satisfaction of the USACE. Direct mitigation by the Navy is the alternative to these programs.

Regardless of whether the Navy implements the potential mitigation project directly or provides funds to a In-Lieu-Fee or Mitigation Bank program, all mitigation projects require a mitigation plan approved by USACE that would include the following components:

- Objective(s) of the compensatory mitigation project
- Site protection instrument to be used
- Baseline information (impact and compensation site)
- Mitigation work plan
- Maintenance plan
- Ecological performance standards
- Monitoring requirements
- Financial assurances
- Site selection information
- Number of credits (fee) to be provided
- Long-term management plan
- Adaptive management plan

11.2.2.7 Development of Potential Mitigation Proposals

The *HEA and Supporting Studies* report (Volume 9, Appendix E, Section A) provides background on the mitigation proposals discussed among regulatory agencies and DoD. Many ideas were proposed at a HEA workshop that was hosted by USFWS in 2008 (Guam agencies were unable to attend due to scheduling difficulties). Regulatory agencies prefer a watershed management approach to the use of artificial reefs as potential mitigation, as agencies believe that watershed management projects would result in greater beneficial impacts to the marine environment; however, as described further below, the effectiveness of either artificial reefs or upland watershed management schemes to replace coral loss have been studied and conclusions concerning success differ. Guidelines for project acceptability were:

- Project would replace the loss functions and services of coral reef ecosystems
- Scientific data are available that the project would, in fact, have the desired result of in-kind replacement. In other words, there must be confidence in the success of the project
- The ratio of restoration to loss is quantifiable
- The project is legal
- The project is feasible
- Project may enhance but not replace activities that are already occurring or be used to achieve ongoing mandated responsibility

All proposals discussed would benefit the environment, but some were dismissed outright for not meeting CWA requirements for compensatory mitigation including the guidelines above. The dismissed ideas and the primary reason for dismissal are listed below:

- Increase enforcement of existing marine protected areas. Dismissed because transferring DoD funds to other federal agencies or local agencies to support policing action may encounter fiscal law constraints and enforcement is a pre-existing mandated responsibility.
- Purchase land for new preserve or to prevent future development that could degrade water quality. Dismissed because it is not feasible in a reasonable time-frame and it would be difficult to demonstrate that coral restoration would be the result.
- Prepare management plans for submerged lands and lands, DoD property or island wide. Dismissed because compensatory mitigation cannot be used to achieve other mandated responsibility as in the case of DoD lands. Plans by themselves do not restore ecological function; therefore, they are not considered suitable mitigation.
- Pursue aquaculture to increase biomass. Dismissed because it would not replace or restore coral function.

<u>Potential Mitigation Options</u>

The Navy is considering a suite of potential options for compensatory mitigation for the loss of coral in Outer Apra Harbor as shown below and discussed in more detail in the text.

Compensatory mitigation for unavoidable coral community impacts includes the following options:

Option 1: Artificial Reefs within Apra Harbor or Other Locations

Option 2: Watershed Restoration and Management

- *Aforestation*
- *Apra Harbor and/or Philippine Sea Riparian Enhancement*
- *Stream bank stabilization component*

Option 3: Coastal Water Resource Management

- *Shallow Water Reef Enhancement*
- *Upgrade Wastewater Management Systems*

Option 4: In-Lieu Fee or Mitigation Banking Program

The final conceptual determination would not be made until the Record of Decision on this EIS/OEIS. More detailed identification of potential mitigation would be done during the USACE permit process. Both artificial reefs and watershed management projects would be considered as potential compensatory mitigation, and it is possible that a combination of those potential mitigation efforts that are listed below would be appropriate. The Navy has not advanced a proposal at this time and specific mitigation measures would be subject to the permitting action/mitigation decision of the USACE.

The effectiveness of either artificial reefs or upland watershed management schemes to replace coral loss have been studied and conclusions concerning success differ. Section A of the *HEA and Supporting Studies* report (Volume 9, Appendix E, Section A) summarizes key points of discussion that were raised during review of the draft HEA, including relative merits (pros and counterpoints/cons) of artificial reefs and watershed management projects (HEA Section A, 3.3.4, Table 2 and 3, respectively). Compensatory mitigation for unavoidable coral community impacts includes the following options.

Option 1: Artificial Reefs within Apra Harbor or Other Locations

Description: An artificial reef is a man-made, underwater structure, typically built for the purpose of promoting marine life in areas of generally featureless bottom. Artificial reefs can be created by a number of different methods. Many reefs "are built" by deploying existing materials in order to create a reef (e.g., sinking oilrigs, scuttling ships, or by deploying rubble, tires, or construction debris). Other artificial reefs are purpose built (e.g., the reef balls) from PVC and/or concrete. Regardless of construction method, artificial reefs are generally designed to provide hard surfaces to which algae and invertebrates attach, which in turn attracts fish species providing food habitat for fish assemblages. Car and Hixon (1997) found that artificial reefs with structural complexity and other abiotic and biotic features similar to those of natural reefs would best mitigate in-kind losses of reef fish populations and assemblages from natural reefs – specifically they compared colonization and subsequent assemblage structure of reef fishes on coral and artificial (concrete block) reefs where reef size, age, and isolation were standardized.

This option would be a direct application of a HEA derived artificial reef project in Apra Harbor. The Navy would install an artificial reef in approximately 80+ ft (24.4 + m) of water (to ensure its survival even in a super-typhoon) using one or more agreed upon artificial reef concepts. Reef alternatives may include "Z blocks" (used in Hawaii), Biorock, and Reefballs. Suggestions of other artificial reef options would be welcomed. Placement would be on the harbor floor and would not affect hard substrate. A potential mitigation site would be located within the ESQD arc of Kilo Wharf (to prevent the reef from being used as a Fish Aggregation Device that would invite recreational or commercial fishing or diving activities). As part of the artificial reef proposal, the HEA restoration project would include the potential use of transplanted coral as part of its compensation strategy.

Success criteria would be based on a replacement of benthic structure and on percent coral cover, as a proxy to ecosystem function. Long-term monitoring would be implemented to measure success. Potential Guam INRMP projects associated with the artificial reef could include assessment of functions these structures provide. Artificial reefs, though quantitatively easier to scale for a ratio between replacement and function lost than watersheds, have been criticized as being primarily fish aggregating devices that do not increase coral community productivity. In other words, the replacement of structure does not necessarily equate to a restoration of coral community function.

Option 2: Watershed Restoration and Management

Description: Watershed restoration and management is a collective term to describe a variety of projects that would remove or diminish anthropogenic stresses on receiving coastal waters in order to improve water quality, resulting in recolonization or improved growth of existing coral in those coastal waters. Restoration of a watershed returns the ecosystem to as close an approximation as possible of its state prior to a specific incident or period of deterioration and restores the ability of the ecosystem to function. Watershed restoration can be complicated because an ecosystem has a myriad of interactions. These include interactions between the watershed's inhabitants, water level and flow, nutrient cycling, and the inevitable, natural changes that occur over time that change ecosystem dynamics (e.g., soil erosion and replacement). When deterioration of a watershed occurs gradually, restoration can require rigorous scientific protocols and involve lengthy, complicated, and costly investigations.

The approach to watershed restoration/conservation is to address reef degradation from discharge of eroded sediments from upland sources. Restoring vegetation to barren areas to reduce soil runoff and subsequent discharge into coastal waters is a major step in watershed restoration and improvement of coastal waters. Most potential watershed restoration projects would involve planting native seedlings in grasslands and badland areas as well as in fertile valley areas of watersheds. Other important elements of a successful watershed restoration project include but are not limited to animal control, monitoring and continuous watershed management.

EPA looks at the watershed restoration process as consisting of the following major steps: (1) build partnerships, (2) characterize the watershed to identify problems, (3) set goals and identify solutions, (4) design an implementation program, (5) implement the watershed plan, (6) measure progress and make adjustments (EPA 2008)

The following projects could be used separately or in conjunction to develop a conceptual mitigation plan for watershed restoration:

Aforestation. Coastal marine waters and associated rivers and watersheds on Guam have been recommended by resource agencies for potential compensatory mitigation for coral reef impacts. The approach to restoration/conservation of sites rather than a detailed assessment is described to address on-going problems of reef degradation from discharge of eroded sediments from upland sources.

The Navy has held several conversations with Federal and Guam resource agencies on coral impact assessment and compensatory mitigation methods associated with the Guam Military Relocation EIS/OEIS. Resource agencies have recommended coastal marine waters and associated rivers and watersheds as restoration candidates for potential compensatory mitigation for coral reef impacts. USFWS has recently provided the following potential sites for a watershed aforestation coral reef restoration option (USFWS 2009). The information below is also supplemented by information from GEPA (2008).

- Achugao Subwatershed – Coastal waters and beach south of Achugao Point located in the southwestern portion of Guam. This beach is the discharge point for *Agaga River* associated with the Cetti Watershed.
- Fouha Subwatershed – Coastal waters at the head of Fouha Bay, located south of Cetti Bay, in the southwestern portion of Guam. Fouha Bay is the discharge point for the *La Sa Fua River* associated with Umatac Watershed in the southwestern portion of Guam.

- Geus Watershed – Coastal waters and marine bay (5 mi^2 [13 km^2]) associated with Cocos Lagoon located at the southern tip of Guam. The *Geus River,* associated with the Geus Watershed, discharges into the Cocos Lagoon.
- Ajayan Subwatershed – Coastal waters and intermittent beach at Ajayan Bay located east of Cocos Lagoon. The *Ajayan River*, associated with the Manell Watershed, discharges into Ajayan Bay.

The recommended watersheds have not been fully evaluated to determine their suitability, but are being considered by the Navy as options for potential mitigation. These watersheds are associated with reefs that are degraded by sedimentation, but were healthy a few decades ago (USFWS 2009).

Additional restoration/enhancement projects as recommended in Guam Bureau of Statistics and Plans (BSP) (2009) include the following Project Locations: Apra, Tumon, Tamuning, Piti, Asan, Fonte, Southern Agat, Togcha, Ylig, Pago, and Ugum. Project objectives would be to improve water quality and forest habitat restoration in these watersheds as they flow into waters that host marine preserves and other valuable marine resource areas. Most of the potential restoration projects would involve the planting of native seedlings in grasslands and badland areas as well as in fertile valley areas of watersheds. Other important elements of a successful watershed restoration project include but are not limited to animal control, monitoring and continuous watershed management.

Guam BSP (2009) provided figures delineating the boundary of the watershed area in which the listed projects would occur (Figures 11.2-5 through 11.2-8 provided below without modification, except for the addition of a location map.). The watershed area on the figures is approximately 4,694,980 ac (1,900,000 ha) along the southwestern coast of Guam, extending from south of Naval Base Guam to the southern point of Guam and Cocos Island. The watershed area was selected because there is evidence that coral communities have previously existed in the receiving coastal waters. Under improved water quality conditions, these coral communities could be restored.

The Talofofo watershed associated with the Ordnance Annex is located on Navy-owned land. The watershed currently suffers from soil erosion which manifests itself in sediment transfer to various streams that feed into Talofolo Bay. The Ordnance Annex Watershed of savanna grassland vegetation would be restored and protected within the northeastern portion to address an on-going problem of reef degradation in Talofofo Bay from the transport of eroded sediments.

The potential for watershed restoration on privately owned lands would be limited as these types of projects require full control of the land and its uses to be successful. A Cetti Bay watershed restoration project was attempted as compensatory mitigation for coral loss at Kilo Wharf. Because land use was not totally controlled and management agreements could not be concluded, the project has not been successful. It may be possible, however, to have a combination of reforestation/aforestation on some smaller scale when done in conjunction with watershed restoration project on Navy-owned lands, artificial reef installation within Apra Harbor or other areas, and/or riparian enhancement that would benefit fish, corals, and other marine organisms.

Apra Harbor and/or Philippine Sea Riparian Enhancement. This option would include mangrove and/or wetlands enhancement in the Apra Harbor area. This may be based on BSPs developed system of reference wetlands as a baseline for future classification and to establish a basis for ecological function when formulating the scope and extent of potential compensatory mitigation.

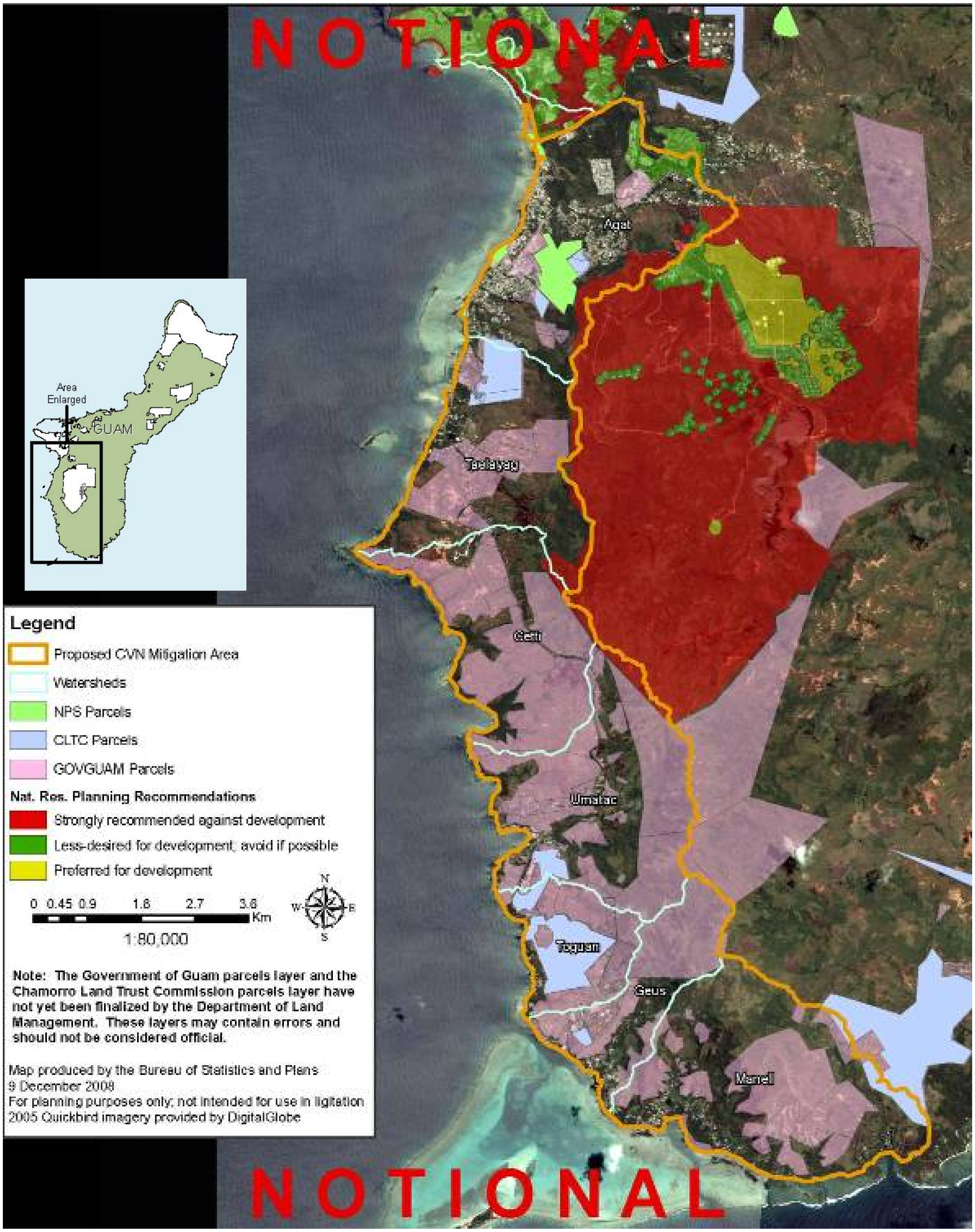

Figure 11.2-5. Boundary of Guam Agency Proposed CVN Potential Mitigation Area

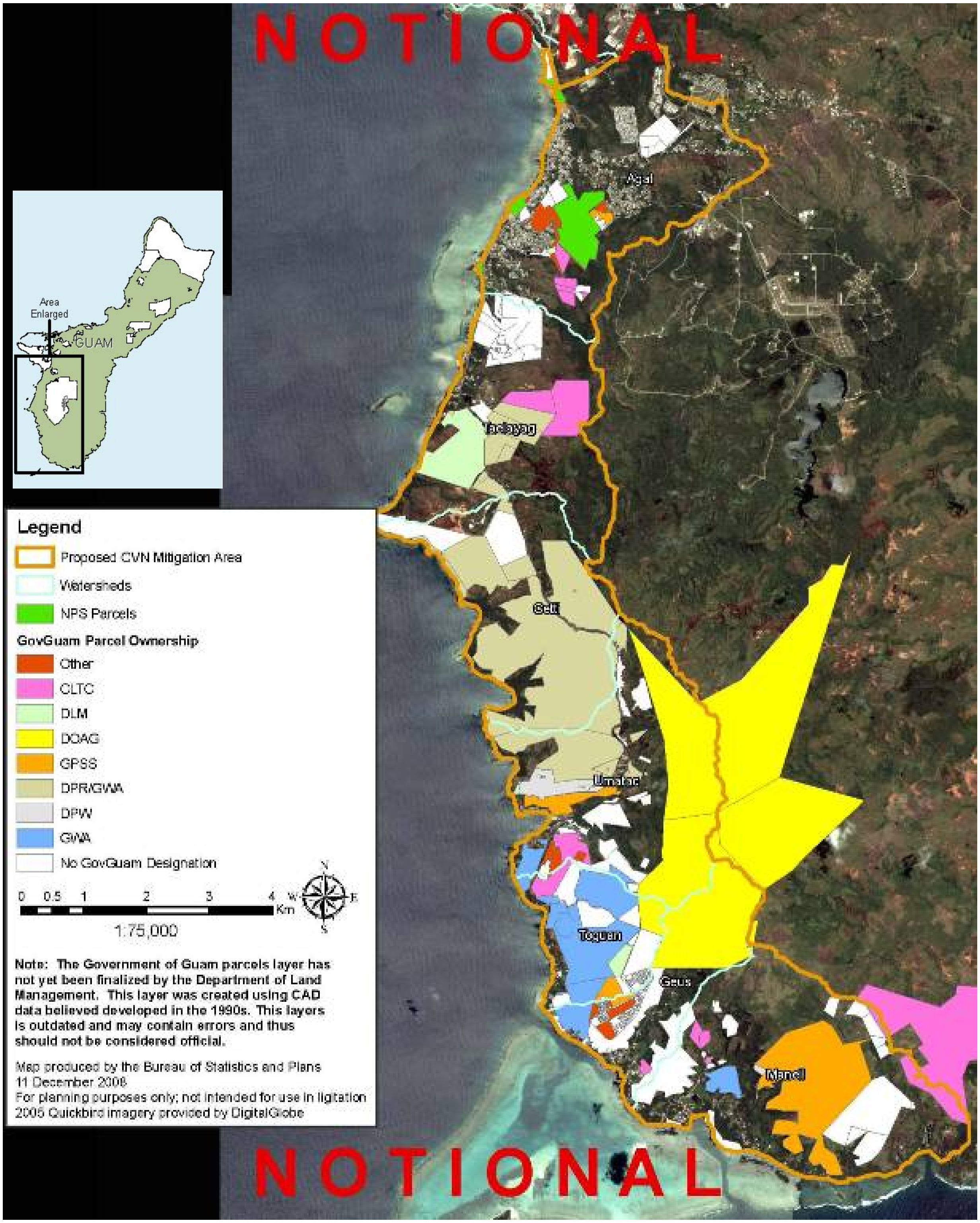

Figure 11.2-6. Potential Mitigation Area, GOVGUAM Parcel Ownership

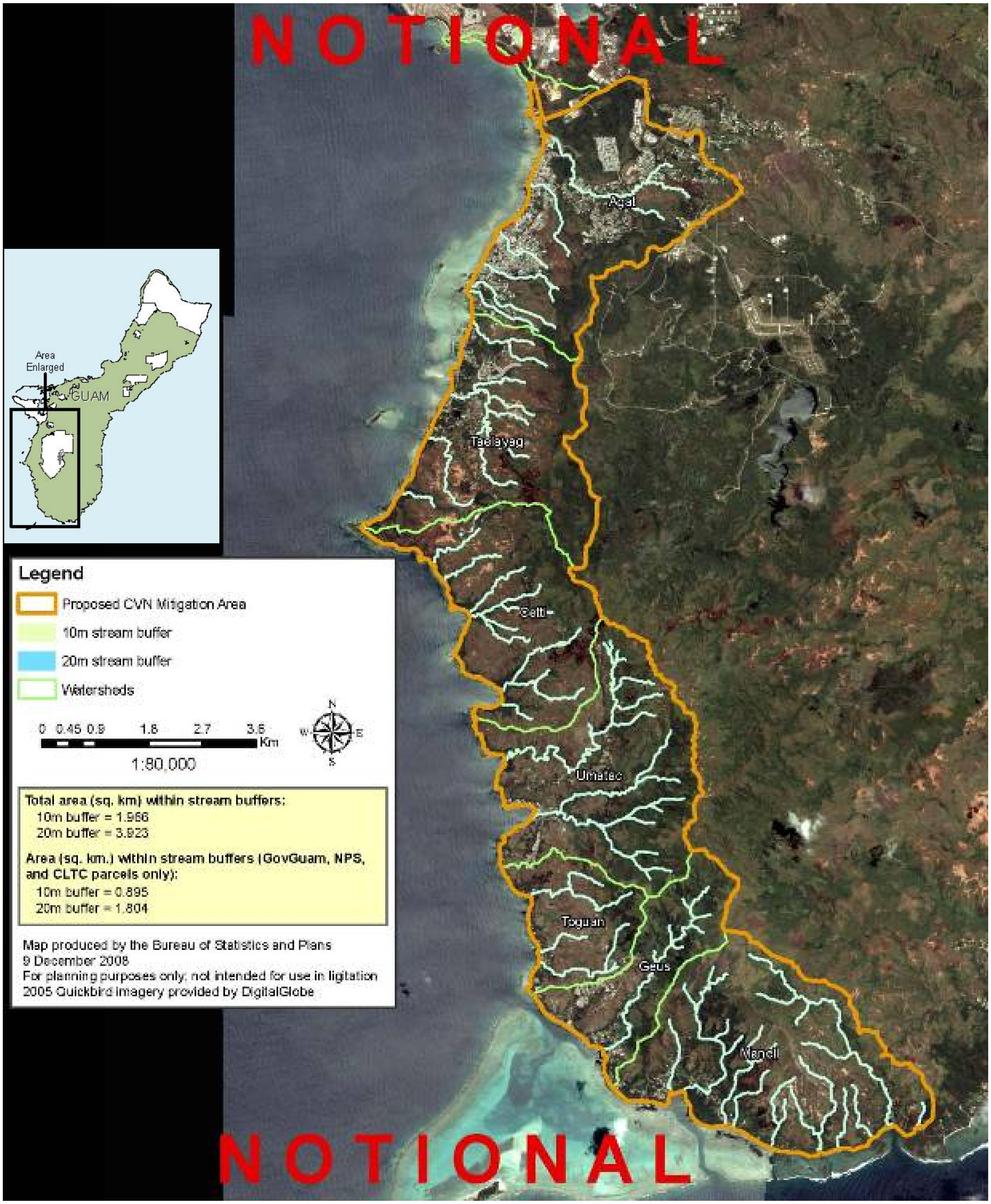

Figure 11.2-7. Potential Mitigation Area, Riparian Buffers for Stream

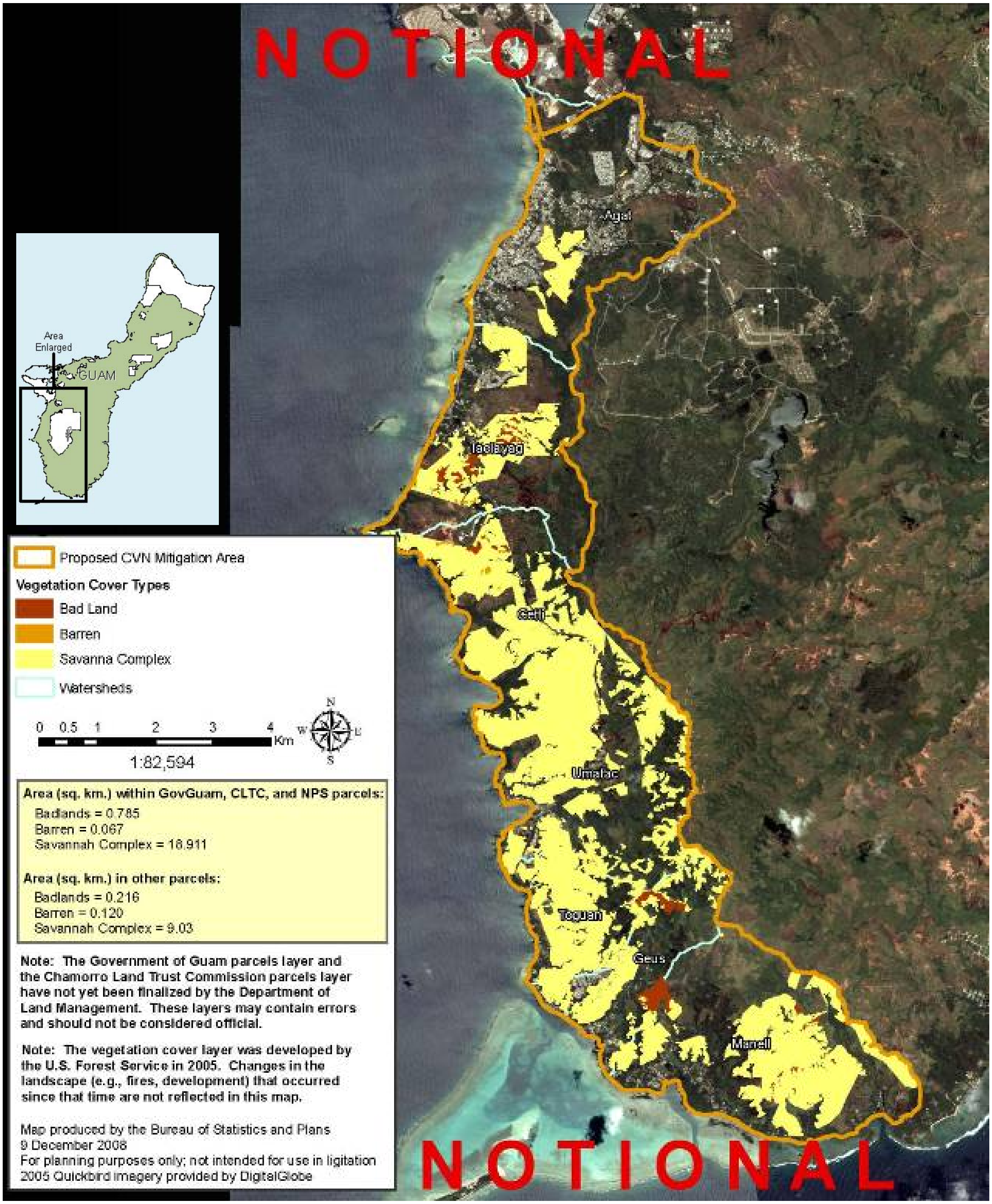

Figure 11.2-8. Potential Mitigation Area Vegetation Types

Stream bank stabilization component. This option would involve stabilization of stream banks within watersheds that would involve the placement of vegetative and/or mechanical rip rap revetment on banks of rivers and streams to minimize erosion and sediment laden run-off from entering sensitive riverine systems. The design would include major factors including: a) capability of conveying peak runoff flows produced by major storms and b) maintenance crew accessibility to structural BMPs for vegetation maintenance (i.e., through cutting vs. spraying) and rip rap/revetment repair.

Option 3: Coastal Water Resources Management

Shallow Water Reef Enhancement. This option would include the transplanting of a significant quantity of coral that would be removed by the proposed dredging project. The objective of shallow water reef enhancement is to minimize coral colony mortality by transplanting coral to several new sites on Navy submerged lands in outer Apra Harbor. Transplantation site selection criteria would include physical, chemical, and biological factors. Studies have shown that larger intact colonies survive transplanting much better than small or fragmented colonies. Larger colonies also have far greater reproductive potential than small ones. Therefore, these types of projects often focus on transplanting large specimens. A detailed transplantation plan would be prepared which would include methods for moving large colonies, techniques for stabilizing the colonies at the transplant site, and monitoring protocols.

A direct and predictable relationship between a specific watershed project(s) and replacement of coral function is difficult to determine. Therefore, it would be difficult to predict how many watershed projects and of what type would be required to restore the productivity lost due to dredging. On the other hand, the effectiveness of artificial reefs would be more readily quantified as to its success in replacing lost coral function and value. However, all potential mitigation options are under consideration at this time.

Coastal Water Resource Management – Upgrade Wastewater Management Systems. This option would involve upgrading Guam treatment plants and ocean outfalls to have secondary treated effluent to improve coastal water quality that would in turn enhance coral health in the coastal zone of Guam. This option is an alternative for the Northern District Wastewater Treatment Plant under consideration within this EIS/OEIS.

Option 4: In-Lieu Fee or Mitigation Banking Program

Within the HEA Administrative Working Group, DoD, and the Military Civilian Task Force on Guam, there is support for the use of In-Lieu Fee or mitigation banking programs to manage, implement and monitor the success of natural resource compensatory mitigation projects on Guam. Revised regulations by the USACE and EPA in March 2008 govern compensatory mitigation for authorized impacts to waters of the U.S. under Section 404 of the CWA. In-lieu fee mitigation and mitigation banks would be included in this 2008 compensatory mitigation rule as endorsed Federal programs. These programs have not yet been established on Guam.

Under mitigation banks, units of restored, created, enhanced, or preserved resources are expressed as "credits" which may subsequently be withdrawn to offset "debits" incurred at a project development site. Ideally, mitigation banks are constructed and functioning in advance of development impacts, and are seen as a way of reducing uncertainty in the USACE Regulatory program by having established compensatory mitigation credit available to an applicant.

In-Lieu-Fee mitigation occurs in circumstances where a permittee provides funds to an In-Lieu-Fee sponsor instead of either completing project-specific mitigation or purchasing credits from an approved mitigation bank. The program sponsor periodically funds a consolidated mitigation project from the proceeds of the accumulated In-Lieu-Fees. A memorandum of understanding would be executed among

DoD, regulators and stakeholders that establishes an In-Lieu-Fee Mitigation Sponsor (typically a non-government organization) and a Review Team to determine how the bank would work.

The In-Lieu-Fee amount is based upon the compensation costs that would be necessary to restore, enhance, create or preserve coral ecosystems or other habitats with similar functions or values to the one affected. The fee is banked in an investment account until a project is approved for implementation. The In-Lieu-Fee mitigation bank would be managed by the In-Lieu-Fee Mitigation Sponsor (Sponsor) that uses the accumulated funds to implement projects that restore, enhance, or preserve ecosystems with similar functions and values that are located within the same biophysical region as the permitted disturbance. Key stakeholders, including regulatory agencies, DoD and the Sponsor, form an advisory committee that determines the projects that would be implemented. The Sponsor is responsible for implementing the project according to an approved work plan.

Development of Compensatory Mitigation Plan

A USACE permit would be required for the construction of the aircraft carrier wharf due to alteration of navigable waters and discharge of fill materials into the water. This permit would be the vehicle through which compensatory mitigation would be implemented. The project would be designed to avoid coral reef impacts and to minimize any unavoidable impacts. Unavoidable impacts would be mitigated through implementation and/or funding of mitigating measures to compensate for the resulting loss of ecological functions and/or services. Selection, scaling, and implementation of appropriate compensatory mitigation actions are being carried out in consultation with USACE, NOAA, USFWS, USEPA and GOVGUAM resource agencies. The HEA presented is a tool designed to equate impact habitat services to potential mitigation habitat services. The financial aspect does not come into consideration until after the mitigation project has been selected (e.g., execution costs of the mitigation project). As more information is gathered on the likely impacts and costs of the compensatory mitigation projects under consideration, a more detailed mitigation plan would be developed to comply with requirements of the USACE-EPA 2008 Compensatory Mitigation Rule.

11.2.3 Alternative 2 Former SRF

11.2.3.1 Onshore

Similar to Alternative 1, proposed activities under Alternative 2, Former SRF (referred to as Alternative 2) would include construction activities in an onshore area that is composed of fill material. Impact analysis would be similar to Alternative 1.

11.2.3.2 Offshore

Offshore activities associated with Alternative 2 would be similar to those of Alternative 1. Volume 4, Section 2.6 describes this Alternative.

<u>Construction</u>

Marine Flora, Invertebrates and Associated EFH

The anticipated impacts to these resources resulting from implementation of Alternative 2 are similar to the those described for Alternative 1. Under Alternative 2, dredging activities would have direct and permanent impacts to marine flora and invertebrates (not including coral and coral reefs which are discussed in more detail under EFH), particularly to sessile organisms. Motile invertebrates would likely vacate the area due to the increased disturbance. Although some mortality would occur to marine flora and sessile invertebrates, these organisms would be anticipated to quickly reestablish once project activities cease. Therefore, impacts to marine flora and invertebrates would be less than significant as a result of implementing the offshore component of Alternative 2.

Essential Fish Habitat

The anticipated impacts to this resource resulting from the implementation of Alternative 2 are similar to the impacts described for Alternative 1. There are minor differences in the location of dredging activities and in coral removal acreages and percent removals. Under Alternative 2, as with Alternative 1, impacts to EFH would be greatest for all life stages of coral and sessile reef species, some crustacean MUS and site-attached reef fish. Pelagic egg/larval stages of bottomfish and pelagic MUS may also be affected.

Based on the assumptions described in the *Assessment of the Benthic Community Structure in the Vicinity of the Proposed Turning Basin and Berthing Area for Carrier Vessel Nuclear (CVN) Apra Harbor, Guam,* Alternative 2 (Figure 11.2-9) would require the dredging of approximately 61 ac (25 ha) as compared to 71 ac (29 ha) for the Polaris Point Alternative (Table 11.2-10). The total area impacted is about 155 acres (63 ha), which includes direct and indirect impacts of 61 ac (25 ha) and 94 ac (38 ha), respectively. This equates to a percent coral cover impact of 46%, 39% direct and 50% indirect impacts of the total area affected, respectively. The indirect area extends 656 ft (200 m) from the direct area boundary as was described for the Polaris Point Alternative.

Table 11.2-9 summarizes the direct and indirect impacts of dredging to corals based on coral coverage categories with the implementation of Alternative 2. Similar to Alternative 1, areas with the greatest coral abundance (>70 to <u><</u>90%) would comprise the smallest portion (10%) of the total coral coverage category that would be lost due to the proposed dredging. Areas with the least amount of coral coverage (0 – ≤10%) would comprise the largest portion (approximately 36%) of the total coral coverage category that would be lost due to the proposed dredging. About 62% of the area proposed for dredging contains corals with a coverage of less than 30%. Approximately 3% of the total area proposed for dredging contains corals in the 70-90% coverage category and 10% in the 50-90% range of coverage.

Table 11.2-10. Estimated Coral Area and Percentages Impacted by Proposed Dredging Activities with Implementation of Alternative 2

Coral Level	*Alternative 2 Former SRF*					
	Direct		*Indirect*		*Total*	
	ha	*ac (% coral[1])*	*ha*	*ac (% coral[1])*	*ha*	*ac (% coral[1])*
coral = 0%	14.98	**37.03**	18.90	**46.71**	33.89	**83.74**
0% < coral ≤ 10%	3.44	8.51(36)	5.34	13.20 (28)	8.79	21.72 (31)
10% < coral ≤ 30%	2.41	5.96 (25)	3.72	9.19 (20)	6.14	15.15 (21)
30% < coral ≤ 50%	0.93	2.29 (10)	3.45	8.53 (18)	4.38	10.82 (15)
50% < coral ≤ 70%	1.82	4.49 (19)	4.46	11.03 (23)	6.28	15.52 (22)
70% < coral ≤ 90%	1.01	2.48 (10)	2.13	5.25 (11)	3.13	7.74 (11)
Total with Coral	**9.61**	**23.74**	**19.10**	**47.21**	**28.71**	**70.95**
Total dredge area	**24.59**	**60.77**	**38.06**	**93.92**	**62.60**	**154.69**
Percent coral cover:		**39%**		**50%**		**46%**

[1]Coral percents are rounded to the nearest percent; therefore total coral % may not sum to 100%
Source: Derived from Classified Habitat Map Using Quickbird Satellite Imagery.

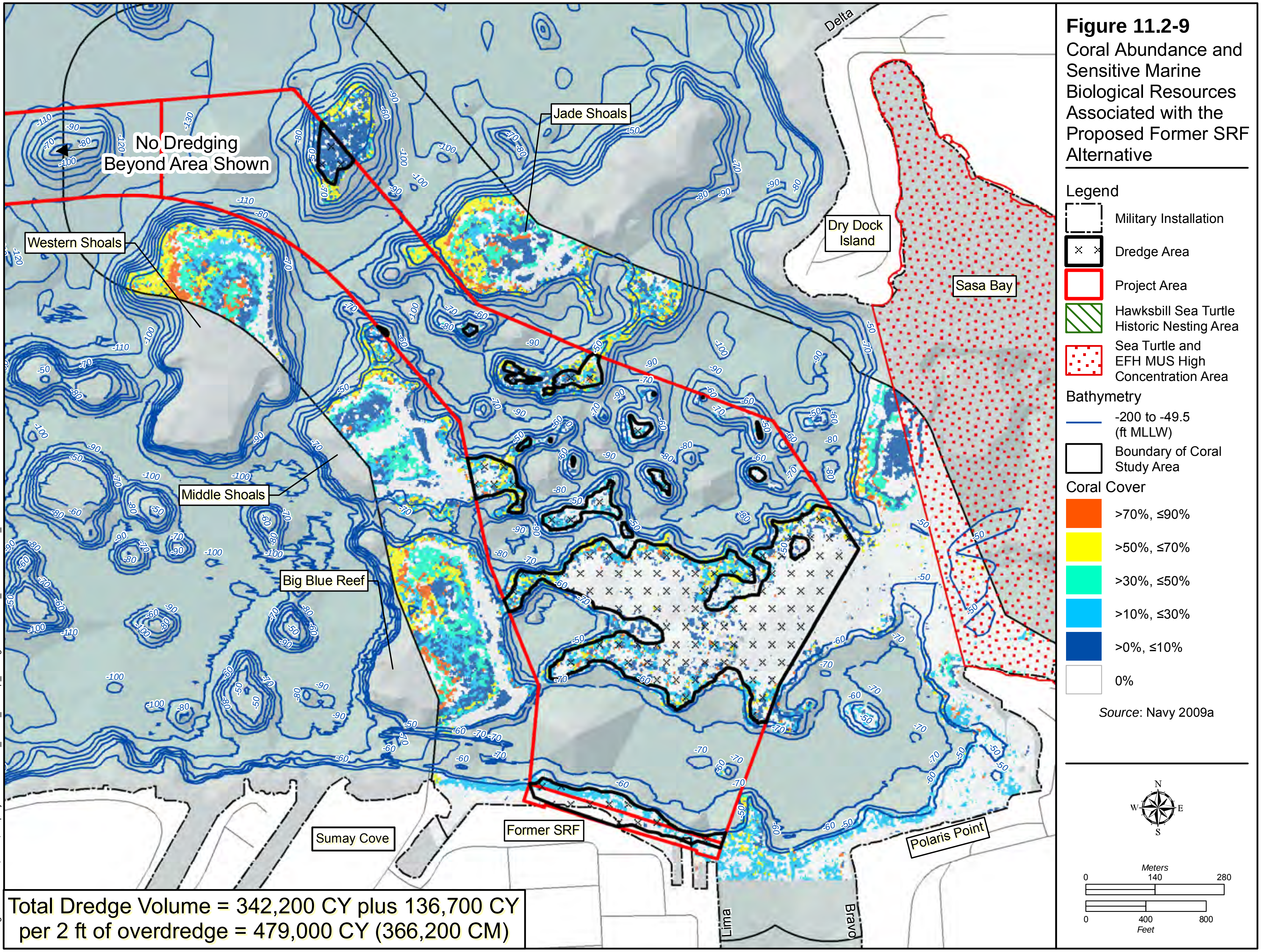

Figure 11.2-9
Coral Abundance and Sensitive Marine Biological Resources Associated with the Proposed Former SRF Alternative

Printing Date: Oct 29, 2009, M:\projects\GIS\8806_Guam_Buildup_EIS\figures\Current_Deliverable\Vol_4\11.2-9.mxd

Adverse affects to EFH for reef fish MUS may occur due to the direct removal of coral habitat (>0% - 90% coral = 23.74 ac [9.61 ha]). Direct removal of other benthic habitat (0% coral with macroalgae, rubble, sand = 37.03 ac [14.98 ha]) would result in no adverse effects to EFH.

Short-term adverse effects to EFH are expected from indirect impacts from sedimentation to coral habitat (>0% - 90% coral = 47.21 ac [19.10 ha]) and other benthic habitat (0% coral with macroalgae, rubble, sand = 46.71 ac [18.90 ha]) even with appropriate implementation of in-water BMPs and mitigation measures. A 25% initial loss was assumed based on sediment impacts, which is consistent with the estimate that cumulative sediment caused by dredging would be low (i.e. < 0.40 in [< 1 cm]) and the relatively low sensitivity of dominant corals in the affected area (i.e., *Porites rus* and *Porities cylindrica*) to such levels of sedimentation.

Alternative 2 impacts to Essential Fish Habitat would be similar to those described for Alternate 1. The removal of habitat would decrease the structural complexity of Apra Harbor's reef system, resulting in fewer places of refuge for fish from predation. Finfish species occupying habitats that would be permanently removed would either be displaced to other adjacent sites and adapt or parish due to habitat modification and loss. Site-attached species such as those from the families Pomacentridae and Chaetodontidae may be adversely affected by changes in habitat structure, however it is anticipated that most displaced species would relocate to other adjacent sites if available.

Direct impacts from Alternative 2 dredging activities would be long-term and significant, and therefore may adversely affect essential fish habitat. Implementation and enforcement of appropriate BMPs and mitigation measures would reduce effects, possibly from adverse to no adverse affects. Indirect impacts from Alternative 2 actions would be similar to those described under Alternative 1. Therefore, potential indirect effects on EFH and sensitive MUS are expected to be adverse, however short-term and localized; therefore, implementation of Alternative 2 may adversely affect EFH.

Table 11.2-11 summarizes the EFH present in the project area and potential dredging-related effects with implementation of Alternative 2, which would be the same as Alternative 1.

Table 11.2-11. EFH Areas Associated with Apra Harbor and Potential Construction-related Effects with Implementation of Alternative 2

Habitat	*Area of Occurrence*	*Associated Activity*	*Effect*
Live/Hard Bottom	Outer Apra Harbor	Dredging of aircraft carrier channel, turning basin, and berth. Backfill and pile driving for wharf construction Increased vessel movements	Direct, permanent and localized removal. Indirect, short-term and localized.
Soft Bottom	Apra Harbor	Dredging of aircraft carrier channel, turning basin, and berth. Backfill and pile driving for wharf construction and increased vessel movements	Direct removal and indirect, periodic and localized resuspension of sediment. Benthic infaunal community is expected to reestablish themselves quickly from adjacent, undisturbed areas.
Corals/Coral Reef Habitat	Outer Apra Harbor Shoal Areas, Entrance Channel	Dredging of aircraft carrier channel, turning basin, and berth. Backfill and pile driving for wharf construction	Direct, permanent and localized removal. Indirect, short-term and localized increase in underwater noise, localized resuspension of sediments, and potential increase in pollutants. Sessile benthic community is expected to recolonize quickly from adjacent,

Habitat	*Area of Occurrence*	*Associated Activity*	*Effect*
		Increased vessel movements	undisturbed areas. Direct and indirect – short-term, localized resuspension of sediments, increase of noise and potential pollutants
Water Column	Apra Harbor	Dredging of aircraft carrier channel, turning basin, and berth. Backfill and pile driving for wharf construction and other in-water construction activities. Increased vessel movements	Direct and indirect – temporary and localized elevation of turbidity, noise, and potential pollutants Direct and indirect – short-term, localized resuspension of sediments, increase of noise and potential pollutants
Estuarine Emergent Vegetation	Apra Harbor, Sasa Bay	Dredging of aircraft carrier channel, turning basin, and berth. Backfill and pile driving for wharf construction. Increased vessel movements	No effects short-term, localized increase of noise and resuspension of sediment. Potential increase of pollutants
Submerged Aquatic Vegetation	Apra Harbor, Sasa Bay	Dredging of aircraft carrier channel, turning basin, and berth. Increased vessel movements	Direct and indirect short-term localized removal or filling. Aquatic vegetation is expected to recolonize quickly No effects
Estuarine Water Column	Sasa Bay	Dredging of aircraft carrier channel, turning basin, and berth. Backfill and pile driving for wharf construction Increased vessel movements	Direct and indirect – temporary and localized elevation of turbidity, noise, and potential pollutants Direct and indirect – short-term, localized resuspension of sediments, increase of noise and potential pollutants

Under Alternative 2, impacts to EFH would be greatest for all life stages of coral and sessile reef species, and some crustacean MUS. Site-attached reef fish and pelagic egg/larval stages of bottomfish and pelagic MUS may also be affected. The EFHA prepared for Alternative 2 construction-related actions found the action could result in the following:

- Permanent, localized destruction to 24 ac (10 ha) of live coral and coral reef habitat (all coverage >0% to ≤ 90%).
- Long-term disruption to coral reef habitat and displacement of species (could take years to recover)
- Permanent loss to some displaced, site-attached finfish species.
- Short-term and localized disturbance and displacement of mobile FMP MUS (fish and some invertebrates).
- Short-term and localized degradation to water quality (i.e., increase in siltation and turbidity).

- Short-term and localized indirect impacts to live coral and coral reef habitat (47 ac [19 ha]) from increased siltation and noise.
- Short-term and localized significant impacts to eggs and larvae.
- Short-term and localized disturbances to coral reef ecosystems from increased vessel movement.
- Short-term seasonal disturbances to potentially spawning scalloped hammerhead sharks and high concentrations of adult bigeye scad.
- Total coral coverage impacted (direct and indirect) is 71 ac (29 ha).

Based on this assessment, Alternative 2 may adversely affect EFH. However, these impacts would be offset and mitigable to no adverse affect through implementation and management of the BMPs and compensatory mitigation measures as described under Alternative 1.

Special-Status Species

The anticipated impacts to this resource resulting from implementation of Alternative 2 are similar to the impacts described for Alternative 1. Green sea turtles would be affected, however not adversely affected through appropriate NOAA consultation and implementation of avoidance and minimization BMPs and mitigation measures. Less than significant impacts to special-status species, specifically sea turtles, would occur with implementation of Alternative 2.

Non-Native Species

The anticipated impacts of non-native species resulting from implementation of Alternative 2 would be similar to the impacts described for Alternative 1. Less than significant impacts from non-native species introductions would occur under Alternative 2, with the implementation of appropriate Navy and USGS maritime protocols.

Operation

Marine Flora, Invertebrates, and Associated EFH

Alternative 2 impacts to these resources would be similar to those described under Alternative 1.

Essential Fish Habitat

Alternative 2 direct and indirect impacts to this resource would be similar to those described under Alternative 1.

EFH Assessment Summary. Alternative 2 operation activities, including an increase in vessel movements and operational pollutants, would be as described for Alternative 1 and could result in:

- Long-term; however, periodic and localized disturbance and displacement of motile species (fish) during in-water transit activities
- Long-term; however, periodic and localized increase of turbidity and pollutants (decreased water quality) in the water column from propeller wash and operation activities
- Long-term; however, periodic and localized increase in benthic sedimentation
- Long-term; however, periodic and localized potentially significant impacts to eggs and larvae in the upper water column from increased vessel traffic
- Seasonal disturbances to potentially spawning scalloped hammerhead sharks and high concentrations of adult bigeye scad

Based on this assessment, there would be no adverse effects to EFH from operation. Therefore, Alternative 2 would result in less than significant impacts to Essential Fish Habitat from operation.

Standard Navy operating procedures and measures to protect marine resources, as discussed in Volume 7, would reduce any potential impacts. Measures would be implemented by vessels while underway within Apra Harbor.

Special-Status Species

Alternative 2 impacts to this resource would be similar to those described under Alternative 1.

Non-native Species

Alternative 2 impacts from non-native species would be similar to those described under Alternative 1.

11.2.3.3 Summary of Alternative 2 Impacts

Table 11.2-12 summarizes Alternative 2 impacts, which would be similar to those of Alternative 1.

Table 11.2-12. Summary of Alternative 2 NEPA Impacts

Area	*Project Activities*	*Project Specific Impacts*
Onshore	Construction	Negligible, short-term and localized impacts associated with lighting, ground vibrations, noise, and a potential decrease in water quality from pollutant runoff.
	Operation	Negligible, short-term and localized impacts associated with lighting, ground vibrations, noise, and a potential decrease in water quality from pollutant runoff.
Offshore	Construction	Significant impacts, mitigated to less than significant impacts from direct and indirect effects associated with in-water construction (i.e., dredging and impact pile driving) activities. Marine Flora, Invertebrates and Associated EFH: Less than significant direct impacts to marine flora and non-coral invertebrates. Injury or mortality to these resources from physical removal would occur within the dredge footprint, but reestablishment is anticipated to be quick after construction. Motile invertebrates would likely vacate the area due to the increased disturbance. Essential Fish Habitat: Unavoidable, long-term significant direct impacts from dredged removal of 24 ac (10 ha) of marine benthic habitat. Short-term and localized adverse indirect impacts from sediment accumulation (at least 6 mm) to a portion of an additional 47 ac (19 ha) of coral habitat (all coverage classes) and 46 ac (19 ha) of benthic habitat (0% coral) adjacent to, but outside of, the dredge footprint. Short-term and localized disturbance to water column and finfish. Limited injury or mortality to fish eggs and larvae. Insignificant long-term population-level effects or reduction in the quality and/or quantity of EFH. Indirect impacts from sedimentation would be the same as under Alternative 1: may adversely affect a portion of the site-attached finfish species. Limited injury or mortality to site-attached finfish and fish eggs and larvae is expected. Short-term and localized disturbance to the water column is anticipated. There would be an insignificant long-term population-level effects or reduction in the quality and/or quantity of EFH for finfish with implementation of identified BMPs and mitigation measures. However, even with potential mitigation efforts, there would still remain unavoidable adverse impacts associated with coral and coral reef ecosystem removal (direct impact) and associated sedimentation (indirect impact); compensatory mitigation would be required. The HEA assumed dredging impacts accounted for an initial 100% ecological loss from direct impacts and an initial 25% loss of ecological services from indirect impacts. Special-Status Species: Similar to Alternative 1, except short-term construction

Area	*Project Activities*	*Project Specific Impacts*
		operation would be closer to Big Blue Reef. Less than significant impact. Short-term and localized effects on sea turtle behavior during the dredging and impact pile driving periods would be expected, but turtle foraging and resting sites would not be impacted. Potential mitigation measures would postpone operation if sea turtles approach the construction area. Through Section 7 consultation and the implementation of identified BMPs and potential mitigation measures, including USACE permit conditions, sea turtles would be affected, but not adversely affected by the proposed action. Non-native Species: Same as for Alternative 1. Less than significant impacts from introductions are expected as construction vessels would comply with USCG and Navy requirements for ballast water and hull management policies.
	Operation	Same as Alternative 1 impacts, except long-term operational activities would be closer to Big Blue Reef. Less than significant impacts from direct and indirect effects associated with an increase in operational activities. Marine Flora, Invertebrates and Associated EFH: Long-term, localized and infrequent minor impacts from increased noise and resuspension of sediment during vessel movements, and the potential for increased discharges of pollutants into the water column. Essential Fish Habitat: Long-term, localized and infrequent impacts associated with increased vessel movements resulting in long-term, periodic and localized disturbance to water column and finfish through noise, potential increased discharge of pollutants into the water column, and re-suspension of sediments. Limited injury or mortality to fish eggs and larvae. Insignificant long-term population-level effects or reduction in the quality and/or quantity of EFH. Special-Status Species: Short-term, periodic and localized minimal effects on sea turtle behavior during increased operational activities and vessel movements, with implemented BMPs, potential mitigation measures, and Navy vessel policies. Non-native Species: Less than significant impacts from introduction of non-native species are expected since vessels operating within Apra Harbor would comply with USCG and Navy requirements for ballast water and hull management policies. The Navy would also prepare a Regional Biosecurity Plan with risk analysis (see Volume 7 for more details).

11.2.3.4 Alternative 2 Potential Mitigation Measures

Proposed potential mitigation measures for Alternative 2 would be the same as for Alternative 1. As part of the potential mitigation evaluation process, a cost estimate for an artificial reef mitigation project was developed though the HEA and a suite of watershed management projects were identified for potential evaluation. The cost estimates cover all stages of the projects, including: planning, site selection and design, construction, acquisition and deployment, monitoring and maintenance, coral transplantation, contingency, and oversight. Approximately 121 acres (48.97 ha) of artificial reef would be required for mitigation of impacts due to the Former SRF Alternative.

11.2.4 No-Action Alternative

Under the no-action alternative, no construction, dredging, or operation associated with the aircraft carrier berthing would occur. Existing operations at Polaris Point, as a military training and recreational facility, and the Former SRF, as a commercial ship repair facility, would continue. Therefore, the no-action alternative would not have significant impacts to marine biological resources, other than those (if any) that were previously documented through other reports.

11.2.5 Summary of Alternative 1 and Alternative 2 Impacts

Table 11.2-13 summarizes the potential impacts of each action alternative and the no-action alternative. A text summary is provided below.

11.2.5.1 Summary of EFH Assessment

The EFHA, comparing Alternative 1 and 2, is summarized in Table 11.2-14 and brief text description of coral reef impacts follows. Table 11.2-15 shows the estimated coral area and percentages impacted with implementation of Alternative 1 and 2 proposed dredging activities.

Both alternatives require the removal of coral from within the project footprint and would result in unavoidable significant direct impacts requiring compensatory mitigation approval by the USACE under the CWA, through the Section 404/10 permit requirements (USACE, USEPA, USFWS, and NOAA 2000). About 35% (Alternative 1) and 39% (Alternative 2) of the total area to be dredged to reach the required depth contains some level of coral coverage.

The following is a summary of direct and indirect impacts to coral and coral reef habitat:

Direct impacts to EFH in the proposed dredging area can be summarized as follows:

- Permanent localized destruction to live coral reef benthos
- Long-term disruption to coral reef habitat (recovery could take years)

Indirect impacts to EFH adjacent to the proposed dredging area can be summarized as follows:

- Short-term and localized disturbance and displacement of mobile FMP MUS (fish and some invertebrates) during in-water construction activities
- Short-term and localized degradation of water quality (i.e., increase of siltation and turbidity) due to in-water construction activities
- Short-term and localized significant impacts to eggs and larvae
- Short-term and localized indirect impacts to live coral reefs from siltation

There are other considerations when assessing the scale of the potential impacts. The coral community to be dredged is not pristine because it lies within an existing navigation channel that was first dredged during the creation of the Inner Apra Harbor some 60 years ago. Dive surveys indicate that overall coral community composition within the dredge area are of marginal to modest ecological value, based upon eight criteria (i.e., percentage of sea floor covered by coral, reef complexity and rugosity, species diversity, coral health, size frequency distribution of coral colonies, diversity and abundance of sessile macro-benthos other than corals [e.g., sponges], diversity and abundance of mobile macro-invertebrates, and the diversity and abundance of finfish).

Although multiple coral taxa were observed at sampling locations within the project area, *P. rus*, *P. cylindrica* and *Porites spp*. comprised the large majority of coral at all sites within the dredge footprint. Some corals in the project area appear to show signs of stress. Hemispherical species, such as *P. lobata* were observed to have copious secretions of mucous. It has been shown that corals increase mucus secretion to remove fine particles when turbidity levels are high. These areas are routinely subject to high levels of TSS; therefore, this response to turbidity is not surprising, and may indicate that these corals are stressed.

Table 11.2-13. Summary of Impacts

Alternative 1	*Alternative 2*	*No-Action Alternative*
Marine Flora, Invertebrates and Associated EFH		
LSI • Insignificant adverse impacts due to localized removal of non-unique species and habitat during construction activities. Species are expected to re-populate quickly. • Long-term, localized and infrequent minor impacts from increased vessel movements.	LSI • Insignificant adverse impacts due to localized removal of non-unique species and habitat during construction activities. Species are expected to re-populate quickly. • Long-term, localized and infrequent minor impacts from increased vessel movements. Long-term operational activities would be closer to Big Blue Reef and may have increased indirect impacts from turning basin maneuvers.	• NI
Essential Fish Habitat		
SI-M • Significant, long-term direct adverse effects to coral and coral reef ecosystems, mitigated to less than significant. • Short-term and localized potential indirect less than significant impacts from sediment accumulation during dredging activities. • Short-term and localized less than significant disturbance to water column and finfish, limited injury or mortality to fish eggs and larvae from construction activities. • Insignificant long-term and infrequent disturbances to water column and finfish, limited injury or mortality to fish eggs and larvae with no population-level effects or reduction in the quality and/or quantity of EFH from operational activities. • Beneficial long-term impacts to finfish and invertebrate MUS and the ecology of the immediate area with the added hard surfaces and settlement potential the aircraft carrier wharf boulder rip rap and vertical pilings would provide. • Similarly, additional recruitment potential of juvenile finfish from Sasa Bay to the aircraft carrier wharf area as an extended nursery area.	SI-M • Significant, long-term direct adverse effects to coral and coral reef ecosystems, mitigated to less than significant. Short-term and localized potential indirect less than significant impacts from sediment accumulation during dredging activities. Dredging operations would be closer to Big Blue Reef and may have increased indirect impacts on coral and coral reef ecosystem. • Short-term and localized less than significant disturbance to water column and finfish, limited injury or mortality to fish eggs and larvae from construction activities. • Insignificant long-term and infrequent disturbances to water column and finfish; limited injury or mortality to fish eggs and larvae with no population-level effects or reduction in the quality and/or quantity of EFH from operational activities. Long-term operational activities would be closer to Big Blue Reef and may have increased indirect impacts on coral and coral reef ecosystem from resuspension of sediment during turning basin maneuvers. • Beneficial long-term impacts to finfish and invertebrate MUS and ecology of the area with the added hard surfaces and increased settlement potential the aircraft carrier boulder rip rap and wharf vertical pilings would provide.	• NI
Special-Status Species		
SI-M • Significant adverse effect from in-water construction and operation activities, mitigated (including dredging and impact pile driving BMPs) to less than significant.	SI-M • Significant adverse effect from in-water construction and operation activities, mitigated (including dredging and impact pile driving BMPs) to less than significant.	• NI
Non-native Species		
LSI	LSI	• NI

Alternative 1	Alternative 2	No-Action Alternative
• Expected because vessels would comply with USCG and Navy requirements for ballast water and hull management policies.	• Expected because vessels would comply with USCG and Navy requirements for ballast water and hull management policies	

Legend: SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact, BI = Beneficial impact

Table 11.2-14. EFHA Summary for Alternative 1 and Alternative 2 Proposed Actions

Project Activities	*Alternative 1- Polaris Point*	*Alternative 2 – Former SRF*
Construction	The proposed action would have direct and indirect impacts from noise, turbidity, decreased water quality, and other disturbances on EFH and FMP species during dredging and in-water construction activities, including dredged spoils tug and scow movements through Outer Apra Harbor to the ocean disposal site. Direct and Indirect Impacts from dredging activities, which are shown in Table 11.2-14, include: • Removal of approximately 46 ac (19 ha) of benthic substrate (0% coral) with a no adverse affects to EFH. • Unavoidable permanent significant direct impacts to coral reefs from removal of approximately 25 ac (10 ha) of live coral (all classes [>0% to ≤90%]), which may adversely affect EFH and coral MUS. Compensatory mitigation is being implemented to offset this impact. • Unavoidable permanent direct impacts to benthic habitat (0% coral) from removal of approximately 46 ac (19 ha), resulting in no adverse affect to EFH. No compensatory mitigation would be implemented to offset this impact. • Unavoidable short-term and localized indirect impacts to coral and coral reef ecosystem from siltation. Approximately 46.24 ac (18.71 ha) of live coral (all classes [>0% to ≤90%]) may be impacted, resulting in no adverse affect on EFH. • Total area impacted is 171.78 ac (69.52 ha), which includes direct and indirect impacts of 71.18 ac (28.80 ha) and 100.60 ac (40.71 ha), respectively. This equates to a percent coral cover impacted of 42%, which includes direct and indirect impacts accounting for 35% and 46% of the total area affected, respectively. • Approximately 35% of the proposed dredge area contains some coral coverage and virtually all of the area consists of reefs that were dredged	The proposed action would have direct and indirect impacts from noise, turbidity, decreased water quality, and other disturbances on EFH and FMP species during dredging and in-water construction activities, including dredged spoils tug and scow movements through Outer Apra Harbor to the ocean disposal site. Direct and Indirect Impacts from dredging activities, which are shown in Table 11.2-14, include: • Removal of approximately 37 ac (15 ha) of benthic substrate (0% coral) with a no adverse affects to EFH. • Unavoidable permanent significant direct impacts to coral reefs from removal of approximately 23.74 ac (9.61 ha) of live coral (all classes [>0% to ≤90%]), which may adversely affect EFH and coral MUS. Compensatory mitigation is being implemented to offset this impact. • Unavoidable permanent direct impacts to benthic habitat (0% coral) from removal of approximately 37.03 ac (14.98 ha), resulting in no adverse affect to EFH. No compensatory mitigation would be implemented to offset this impact. • Unavoidable short-term and localized indirect impacts to coral and coral reef ecosystem from siltation. Approximately 47.21 ac (19.10 ha) of live coral (all classes [>0% to ≤90%]) may be impacted, resulting in no adverse affect on EFH. • Total area impacted is 154.69 ac (62.60 ha), which includes direct and indirect impacts of 60.77 ac (24.59 ha) and 93.92 ac (38.01 ha), respectively. This equates to a percent coral cover impacted of 46%, which includes direct and indirect impacts accounting for 39% and 50% of the total area affected, respectively. • Approximately 39% of the proposed dredge area contains some coral coverage and virtually all of the area consists of reefs that were

Project Activities	*Alternative 1- Polaris Point*	*Alternative 2 – Former SRF*
	60 years ago during the creation of Inner Apra Harbor. The EFHA for Apra Harbor found that the construction-related activities could result in: • Long-term, permanent removal of flora and sessile invertebrates, including coral. • Short-term and localized disturbances and displacement of motile species during dredging activities and in-water work. Some eggs and larvae and site attached finfish mortality may be seen, however most finfish species are expected to return to the area after impact to their area subsides or seek other adjacent habitat. • Short-term, periodic, and localized disturbance and displacement of motile species (finfish) during in-water transit activities. • Short-term, periodic, and localized increase of turbidity (decreased water quality) in the water column from propeller wash. • Short-term, periodic, and localized increase in benthic sedimentation. • Short-term, periodic, and localized potentially significant impacts to eggs and larvae in the upper water column from increased vessel traffic. • Seasonal disturbances to spawning coral reef species and scalloped hammerhead sharks, which would be mitigated. • Beneficial effect to local community assemblages after the aircraft carrier wharf construction is complete and hard surfaces are populated. This would in essence offset any effects to the depauperate community. Based on this assessment, the Navy has determined that these long-term impacts associated with Alternative 1 may adversely affect EFH. However, with the implementation of BMPs and potential mitigation measures (including compensatory) these impacts would be decreased to no adverse affects to EFH.	dredged 60 years ago during the creation of Inner Apra Harbor. The EFHA for Apra Harbor found that the construction-related activities could result in: • Long-term, permanent removal of flora and sessile invertebrates, including coral. • Short-term and localized disturbances and displacement of motile species during dredging activities and in-water work. Some eggs and larvae and site attached finfish mortality may be seen, however most finfish species are expected to return to the area after impact to their area subsides or seek other adjacent habitat. • Short-term, periodic, and localized disturbance and displacement of motile species (finfish) during in-water transit activities. • Short-term, periodic, and localized increase of turbidity (decreased water quality) in the water column from propeller wash. • Short-term, periodic, and localized increase in benthic sedimentation. • Short-term, periodic, and localized potentially significant impacts to eggs and larvae in the upper water column from increased vessel traffic. • Seasonal disturbances to spawning coral reef species and scalloped hammerhead sharks, which would be mitigated. • Beneficial effect to local community assemblages after the aircraft carrier wharf construction is complete and hard surfaces are populated. This would in essence offset any effects to the already depauperate community. Based on this assessment, the Navy has determined that these long-term impacts associated with Alternative 2 may adversely affect EFH. However, with the implementation of BMPs and potential mitigation measures (including compensatory) these impacts would be decreased to no adverse affects to EFH.
Operation	The proposed action would have direct, indirect and cumulative impacts from noise, resuspension of sediment, decreased water quality, and other disturbances to EFH and FMP species due to increased vessel movements in Outer Apra Harbor.	The proposed action would have direct, indirect and cumulative impacts from noise, resuspension of sediment, decreased water quality, and other disturbances on EFH FMP species due to increased vessel movements in Outer Apra Harbor.

Project Activities	*Alternative 1- Polaris Point*	*Alternative 2 – Former SRF*
	The EFHA for Outer Apra Harbor found that the increased movement of aircraft carrier and MEU support vessels could result in: • Long-term, however, periodic and localized disturbance and displacement of motile species (fish) during in-water transit activities. • Long-term, however, periodic and localized increase of turbidity (decreased water quality) in the water column from propeller wash. • Long-term, however periodic and localized increase in benthic sedimentation. • Long-term, however, periodic and localized potentially significant impacts to eggs and larvae in the upper water column from increased vessel traffic. • Seasonal disturbances to spawning coral reef species and scalloped hammerhead sharks, which would be mitigated. Based on this assessment, the Navy has determined that these temporary and/or minimal impacts associated with Alternative 1 would result in no adverse effects on EFH with the implementation of BMPs and potential mitigation measures.	The EFHA for Outer Apra Harbor found that the increased movement of aircraft carrier and MEU support vessels could result in: • Long-term, however, periodic and localized disturbance and displacement of motile species (fish) during in-water transit activities. • Long-term, however, periodic and localized increase of turbidity (decreased water quality) in the water column from propeller wash. • Long-term, however periodic and localized increase in benthic sedimentation. • Long-term, however periodic and localized potentially significant impacts to eggs and larvae in the upper water column from increased vessel traffic. • Seasonal disturbances to spawning coral reef species and scalloped hammerhead sharks, which would be mitigated. Based on this assessment, the Navy has determined that these temporary and/or minimal impacts associated with Alternative 2 would result in no adverse effects on EFH with the implementation of BMPs and potential mitigation measures.

Table 11.2-15. Estimated Coral Area and Percentages Impacted with Implementation of Alternative 1 and 2 Proposed Dredging Activities

Coral Level	*Alternative 1 Polaris Point*					
	Direct		*Indirect*		*Total*	
	ha	*ac (% coral[1])*	*ha*	*ac (% coral[1])*	*ha*	*ac (% coral[1])*
Coral = 0%	**18.61**	**45.98**	**22.00**	**54.36**	**40.61**	**100.34**
0% < coral ≤ 10%	3.74	9.24 (37)	5.45	13.48 (29)	9.20	22.72 (32)
10% < coral ≤ 30%	2.61	6.44 (26)	3.85	9.52 (21)	6.46	15.96 (22)
30% < coral ≤ 50%	0.96	2.37 (9)	3.25	8.04 (17)	4.22	10.41 (15)
50% < coral ≤ 70%	1.80	4.44 (18)	4.19	10.35 (22)	5.99	14.79 (21)
70% < coral ≤ 90%	1.10	2.71 (11)	1.96	4.85 (11)	3.06	7.56 (11)
Total with Coral	**10.20**	**25.20**	**18.71**	**46.24**	**28.91**	**71.44**
Total dredge area	**28.80**	**71.18**	**40.71**	**100.6**	**69.52**	**171.78**
Percent coral cover:		**35%**		**46%**		**42%**
Coral Level	*Alternative 2 Former SRF*					
	Direct		*Indirect*		*Total*	
	ha	*ac (% coral[1])*	*ha*	*ac (% coral[1])*	*ha*	*ac (% coral[1])*
Coral = 0%	**14.98**	**37.03**	**18.90**	**46.71**	**33.89**	**83.74**
0% < coral ≤ 10%	3.44	8.51 (36)	5.34	13.20 (28)	8.79	21.72 (31)
10% < coral ≤ 30%	2.41	5.96 (25)	3.72	9.19 (20)	6.14	15.15 (21)
30% < coral ≤ 50%	0.93	2.29 (10)	3.45	8.53 (18)	4.38	10.82 (15)
50% < coral ≤ 70%	1.82	4.49 (19)	4.46	11.03 (23)	6.28	15.52 (22)
70% < coral ≤ 90%	1.01	2.48 (10)	2.13	5.25 (11)	3.13	7.74 (11)
Total with Coral	**9.61**	**23.74**	**19.10**	**47.21**	**28.71**	**70.95**
Total dredge area	**24.59**	**60.77**	**38.06**	**93.92**	**62.60**	**154.69**
Percent coral cover:		**39%**		**50%**		**46%**

[1]Coral percents are rounded to the nearest percent; therefore total coral % may not sum to 100%

Source: Derived from Classified Habitat Map Using Quickbird Satellite Imagery.

Essential Fish Habitat for all FMP species, with the exception of the coral reef ecosystem species (specifically hard corals under EFH-PHCRT [sessile MUS]), could be negatively impacted, although impacts would be minor. It is not likely that early life stages of pelagic and bottomfish FMP species would be present in the area impacted by the proposed activity. Both alternatives would result in significant impacts to hard corals under EFH-PHCRT. However, these impacts would be mitigated to less than significant through the identified BMPs and through compensatory mitigation measures. Both alternatives would result in less than significant impacts to all other EFH and FMP species.

11.2.5.2 Summary of Impact Analysis Considerations

The project area is previously disturbed; most of the coral that would be dredged is marginally to modestly healthy (Smith 2007; Dollar 2009) and consists of "re-growth" on the bared reef surfaces that were dredged approximately 60 years ago during the creation of Inner Apra Harbor (Navy 2009a).

Potential indirect impacts were overestimated in the coral reef assessment and the HEA relative to the sediment deposition modeling results. It is unlikely that the project's indirect impacts would result in a significant overall decrease of reproductive potential (i.e., coral spawning) of the Apra Harbor community. The modeled area of potential effects comprises a relatively small fraction of the total reef area of Apra Harbor, composed in large part of soft sediment that is not a suitable substratum for coral planular settlement. The duration of dredging and increased sedimentation at a given particular location is expected to be short (a day or less), and turbidity plumes restricted in size, so that potential impacts to reproductive cycles would not be prolonged.

It is also possible that the area of actual indirect effect would be smaller than the area of potential indirect effect analyzed due to a combination of factors including:

- Inherent physiological tolerance of corals to sediment, including the ability to remove sediment from living tissue
- Likely sediment composition that would be released during dredging (i.e., sand and limestone silt) have been shown to have low impact to corals
- Short duration (~1 day) of dredging at a particular location 990 ft2 [92 m2]
- Current velocity sufficient to aid in sediment resuspension and removal
- Relatively steep reef slopes that promote removal of sediment rather than accumulation

To date, the coral community in the potentially affected area has not been documented to be comprised of unique species that could be lost from the Apra Harbor system. As the project area was dredged in 1946, the existing community is the time-integrated response to the previous impact. Hence, the existing coral community structure provides an estimate of the expected pattern of response to the proposed action.

While fish and sea turtles may exit the immediate area adjacent to construction activities, it is not likely that there would be a permanent effect to the present populations as a result of the alternative actions. Impacts on most reef fish populations would be short-term and localized. It is anticipated that associated coral communities (i.e., marine flora, invertebrates, fish, etc.) would repopulate or move back into the areas after in-water dredging activities cease. Some mortality may be seen in site attached species (e.g., damselfishes) that have lost their habitat.

Impacts to infaunal or epifaunal organisms and water quality would be short-term, periodic and localized. No significant impacts to these resources were identified and no compensatory mitigation is proposed.

11.2.6 Summary of Potential Mitigation Measures

Table 11.2-16 summarizes the potential mitigation measures.

Table 11.2-16. Summary of Potential Mitigation Measures

Alternative 1	*Alternative 2*
Construction Activities	
Potential avoidance and minimization measures that would be discussed during required consultations and permitting actions include the following. The results of consultations and permit discussions would form the basis of potential mitigation measures included by the Navy in its ROD implementing the proposed actions. • Incorporate seasonal dredging prohibitions similar to those EPA suggested for the Kilo Wharf dredging activities. o Cessation of dredging operations during the period of peak coral spawning (7-10 days after the full moon in July) in consultation with the Guam Department of Water Resources. o Dredging or filling of tidal waters would not occur during hard coral spawning periods, usually around the full moons of June, July, and August. • No ships would be allowed to enter Sasa Bay at night. An additional potential measure that could be implemented includes: • Provide marine biological resources education and training on EFH, ESA, and MMPA: this may include Base Orders, natural resource educational training (i.e., watching of short Haputo Ecological Reserve Area (ERA) video required before entering reserve areas [e.g., Hanauma Bay]) and documentation (i.e., preparation of *Military Environmental/ N atural R esource Handbook, distribution of natural resource educational materials to dive boat operators*), or a combination of all. The Navy is proposing a suite of potential mitigation option for impacts to coral reefs. Both artificial reefs and watershed management projects are being considered as potential compensatory mitigation, and the final determination may not be made until after the ROD on this EIS/OEIS and during the USACE regulatory process. It is possible that a combination of the mitigation efforts would be appropriate. The various options are listed below. Option 1: Artificial Reefs within Apra Harbor or Other Locations Option 2: Watershed Restoration and Management • Aforestation • Apra Harbor and/or Philippine Sea Riparian Enhancement • Stream bank stabilization component. Option 3: Coastal Water Resource Management • Shallow Water Reef Enhancement • Upgrade Wastewater Management Systems Option 4 : In-Lieu Fee or Mitigation Banking Program Within DoD, regulatory agencies and the Military Civilian Task Force on Guam there is support for the use of In-Lieu-Fee or mitigation banking programs to manage, implement and monitor the success of natural resource compensatory mitigation projects on	The same potential mitigation measures identified for Alternative 1 would apply to Alternative 2.

Alternative 1	*Alternative 2*
Guam. These programs are not yet established on Guam and would have to be developed in a timely manner to the satisfaction of the USACE. Direct mitigation by the Navy is the alternative to these programs. Regardless of whether the Navy implements the mitigation project directly or provides funds to a In-Lieu-Fee or Mitigation Bank program, all potential mitigation projects require a mitigation plan approved by USACE that would include the following components: • Objective(s) of the compensatory mitigation project • Site protection instrument to be used • Baseline information (impact and compensation site) • Mitigation work plan • Maintenance plan • Ecological performance standards • Monitoring requirements • Financial assurances • Site selection information • Number of credits (fee) to be provided • Long-term management plan • Adaptive management plan • Comparison of Artificial Reef and Watershed Management Mitigation Projects.	
Operational Activities	
No potential mitigation measures have been identified in addition to the existing federal, Guam, and military orders, laws, BMPs, and regulations.	Same as Alternative 1.

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CHAPTER 12.
CULTURAL RESOURCES

12.1 INTRODUCTION

This chapter contains a discussion of the potential environmental consequences associated with implementation of the alternatives within the region of influence for cultural resources. For a description of the affected environment, refer to the respective chapter of Volume 2 (Marine Corps Relocation – Guam). The locations described in that Volume include the region of influence for the aircraft carrier berthing component of the proposed action (Apra Harbor), and the chapters are presented in the same order as the resource areas contained in this Volume.

12.2 ENVIRONMENTAL CONSEQUENCES

12.2.1 Approach to Analysis

12.2.1.1 Methodology

The methodology for identifying, evaluating, and mitigating impacts to cultural resources (archaeological, architectural, and traditional cultural properties) has been established through federal laws and regulations including the National Historical Preservation Act (NHPA) and the Archaeological Resource Protection Act (ARPA).

A significant resource is a cultural resource eligible for or listed on the National Register of Historic Places (NRHP). A project affects a significant resource when it alters the resource's characteristics, including relevant features of its environment or use that qualify it as significant according to NRHP criteria. Adverse effects may include the following: physical destruction, damage, or alteration of all or part of the resource; alteration of the character of the surrounding environment that contributes to the resource's qualifications for the NRHP; introduction of visual, audible, or atmospheric elements that are out of character with the resource; neglect of the resource resulting in its deterioration or destruction; and transfer, lease, or sale of the property without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historical significance (36 Code of Federal Regulations [CFR] 800.5(a) (2)).

Analysis of potential impacts to cultural resources considers both direct and indirect impacts. Direct impacts are those that may occur during the construction phase of the project. They may be the result of increased noise or ground disturbing activities involving construction, modification, or the use and maintenance of facilities. Indirect impacts are those that may occur as a result of the completed project such as increased vehicular or pedestrian traffic in the vicinity of the resource that may lead to vandalism or increased erosion. Vandalism is considered to be a significant impact because it damages the integrity of the site, which is the major determinant of NRHP-eligibility. The evidence left in archaeological sites is finite and cannot renew itself once it has been disturbed. For this reason, federal activities that open areas up to the public or that involve personnel traveling through an area may have an adverse effect if vandalism occurs to NRHP-eligible or listed resources in the vicinity.

12.2.1.2 Determination of Significance

A historic property is a property that is eligible for or listed on the NRHP. For cultural resources a significant adverse impact is one that disturbs the integrity of a historic property. If a project disturbs the characteristics that make the property eligible for or listed on the NRHP, then it is also considered to be a significant adverse impact.

The Integrated Cultural Resources Management Plan (ICRMP) for Navy property in Guam has established Standard Operating Procedures (SOPs) for protecting known NRHP-eligible or listed cultural resources; procedures for managing the inadvertent discovery of archaeological resources, inadvertent discovery of human remains, and inadvertent disturbance to historic properties; and distributing permits for archaeological investigations (Tomonari-Tuggle et al. 2005). In addition, agreements on limitations to training have been made as part of the Mariana Islands Training Range Complex Environmental Impact Statement Programmatic Agreement Areas and would be incorporated into any project descriptions; limited or no training stipulations at Apra Harbor are presented in Figure 12.2-1 of Volume 2.

As part of the Section 106 consultation process for this Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS), a Programmatic Agreement (PA) for all military training activities, construction, and operation proposed under the proposed action that includes additional potential mitigation measures and procedures is being prepared. Current signatories to this PA are: the Department of Defense (DoD) (Joint Region Marianas; DoD Representative Guam, Commonwealth of the Northern Mariana Islands [CNMI], Federated States of Micronesia, and Republic of Palau; Marines; Navy; Army; Air Force), other federal agencies (United States [U.S.] Environmental Protection Agency [USEPA], Advisory Council for Historic Preservation [ACHP], the National Park Service [NPS]), and local government agencies (Guam Historic Preservation Officer [HPO], CNMI). The signed PA will be incorporated into the Final EIS/OEIS. Stipulations in the PA include the following:

- The DoD would ensure that the identification and evaluation of historic properties within the area of potential effect is completed for the project prior to the initiation of any part of the project with the potential to impact historic properties.
- For areas or properties that have not been inventoried for historic properties, the DoD would record surface sites and, when possible, areas would also be archaeologically sampled for subsurface sites when easily obtainable (i.e., without having to demolish existing facilities or infrastructure).
- Archaeological probability maps have been generated for all current DoD installations on the Island of Guam. For all other areas and islands impacted by the project, archaeological probability maps would be generated that predict the probability of encountering subsurface cultural resources in three categories (no/low, medium, and high). These maps would be compiled using previous archaeological investigations, maps, interviews, and ethnohistoric accounts, and in consultation with the HPOs and the NPS.
- No to Low Probability areas contain no surface sites and include reclaimed fill lands or heavily disturbed areas. No to Low Probability areas are also areas that have been previously tested and were found not to contain subsurface archaeological resources based on known social practices or history of the area.
- Medium Probability areas have not been surveyed and may have the potential to contain sites (surface and/or subsurface), or are areas that contain no surface sites.
- High Probability areas contain known surface and/or subsurface sites or are areas where old maps, documents, or legends indicate former villages, towns, or other types of similar activity.

- Any properties not evaluated would be assessed for NRHP eligibility. These historic properties would be incorporated into existing ICRMPs as they are revised or updated, or if a new ICRMP is developed in consultation with the appropriate HPOs.

Any updates to the existing geographical information system (GIS) cultural resource layers, such as shape files showing the locations of known archaeological sites and buildings and structures, would be shared with the appropriate HPO or NPS (if a property is associated with a National Historic Landmark (NHL) in accordance with 36 CFR 800.11(c)). The HPOs and the NPS recognize that these layers may contain sensitive information and would not disseminate or make them available to the public without obtaining permission of the appropriate agency whose jurisdiction that historic property is under. Maps of all areas with archaeological potential and sensitivity for the presence of NRHP-eligible or listed resources would be appended to the PA. No further review under Section 106 is required for areas designated as no to low probability areas. Potential mitigation measures for medium and high probability areas are stipulated as follows:

- For High Probability Areas, sites would be avoided if possible. If sites are impacted, a mitigation plan would be developed and reviewed by the appropriate HPO and then data recovery excavations would take place.
- Medium Probability Areas would be subject to monitoring or testing. Prior to any disturbance or excavation, work plans would be developed and reviewed by the appropriate HPO.

In recognition of the significance that many historic properties within the footprint of the Joint Guam/CNMI Build Up has to various cultural groups, the DoD would generally look favorably on affording access to archaeological sites to individuals and organizations that attach significance to these historic properties where security requirements are not prohibitive. The PA also provides stipulations for treatment in case of emergency discoveries, the review process, and report requirements. The SOPs in the current Regional ICRMP would be updated and would be attached to the PA. Although probability maps would be generated based on the likelihood of archaeological resources, treatment of known architectural resources and traditional cultural properties as a result of the proposed action would also be stipulated in the PA.

12.2.1.3 Issues Identified during Public Scoping Process

The following analysis focuses on possible impacts to cultural resources: archaeological, architectural, and traditional cultural properties that could be affected by the proposal. As part of the analysis, concerns relating to cultural resources that were mentioned by the public, including regulatory stakeholders, during scoping meetings were addressed. These include:

- Access to cultural sites and traditional coastal resource collection areas
- Construction impacts to cultural resources
- Thorough and adequate data collection
- Public participation in the planning process relating to cultural resources

12.2.2 Alternative 1 Polaris Point (Preferred Alternative)

12.2.2.1 Onshore

Onshore activities associated with Alternative 1 Polaris Point (referred to as Alternative 1) include construction of a wharf/staging area with ground disturbance of approximately 5.8 acres (ac) (2.3 hectares [ha]), a Morale, Welfare, and Recreation (MWR) area of 2.4 acres (1 ha), security structures including a 50 foot (ft) [15 m] watch tower, and various buildings including Port Operations, substation, water treatment facilities, and a pump station. As part of the project, four existing structures (Buildings 4407 [lifeguard tower, built 1969], 4408 [cabana, built 1972], 4409 [cabana, built 1972], and an existing guard tower) would be demolished. A 300 ft [91 m] roadway would be demolished and replaced with a new access road to connect Polaris Point Drive to the staging area. Figure 12.2-1 provides a summary of the proposed project location in relation to the archaeological probability areas.

Construction

The proposed construction would occur in an onshore area that is composed of fill material and does not contain NRHP-eligible or listed archaeological resources. Overall, this area is considered to be a No to Low Probability area. None of the buildings to be demolished are eligible for or listed on the NRHP. No traditional cultural properties are known from this area.

Operation

Because no NRHP-eligible or listed archaeological sites, architectural properties, or traditional cultural properties occur in the Area of Potential Affect (APE), no impacts would result from onshore operations associated with Alternative 1.

12.2.2.2 Offshore

Offshore activities associated with Alternative 1 include dredging of the berthing area, the turning basin, and the channel bend; construction of a wharf at Polaris Point; and the operations associated with the berthing of the aircraft carrier.

Construction

Thirty-one known locations of shipwreck sites and submerged objects are located in Outer Apra Harbor. These include 29 shipwrecks consisting of fishing boats, yachts, barges, tugboats, landing craft utility vessels, British passenger ships, World War II (WWII) Japanese freighters or transport ships, and two plane wrecks with a total of three planes (Navy 2007). None of these resources are located adjacent to Polaris Point or within the area of the proposed turning basin or entrance channel. Because none of these resources are located within the APE, dredging and construction would not have a direct adverse impact on submerged resources. Overall, this area is considered to be a No to Low Probability area. Because best management practices would be implemented to reduce sedimentation from dredging (see Volume 7), it is not likely to indirectly impact submerged resources in the vicinity.

Operation

No traditional cultural properties are located within Outer Apra Harbor; therefore, none would be adversely impacted by offshore activities including indirect impacts due to restricted access associated with the aircraft carrier berthing. Because of a lack of NRHP-eligible or listed resources within the APE, vessel traffic would not have a direct adverse impact on submerged resources.

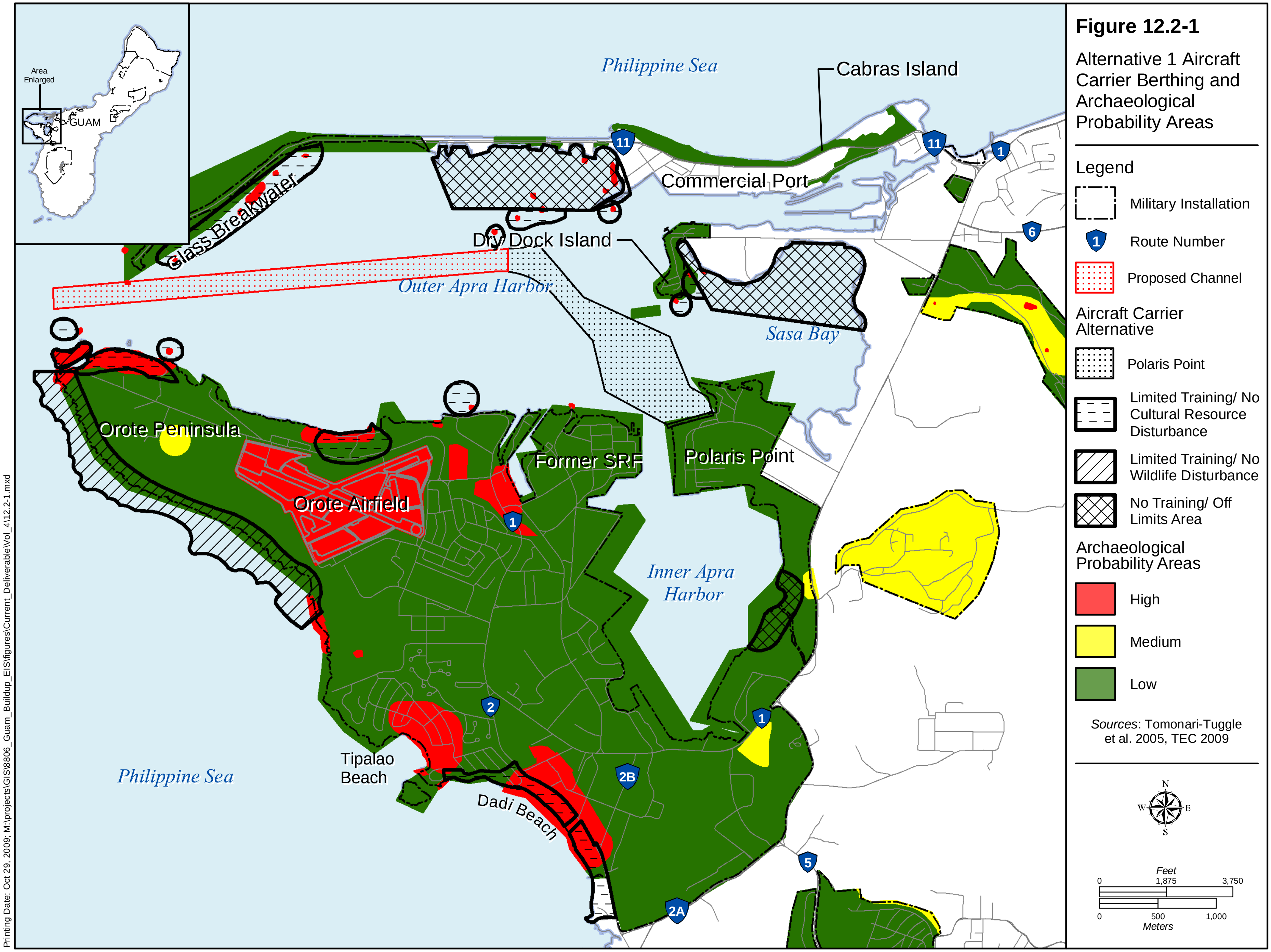
Figure 12.2-1
Alternative 1 Aircraft Carrier Berthing and Archaeological Probability Areas
Legend
Military Installation
Route Number
Proposed Channel
Aircraft Carrier Alternative
Polaris Point
Limited Training/ No Cultural Resource Disturbance
Limited Training/ No Wildlife Disturbance
No Training/ Off Limits Area
Archaeological Probability Areas
High
Medium
Low
Sources: Tomonari-Tuggle et al. 2005, TEC 2009
Feet
0
1,875
3,750
0
500
1,000
Meters
Philippine Sea
Cabras Island
Commercial Port
Glass Breakwater
Dry Dock Island
Outer Apra Harbor
Sasa Bay
Orote Peninsula
Orote Airfield
Former SRF
Polaris Point
Inner Apra Harbor
Tipalao Beach
Dadi Beach
Area Enlarged
GUAM
Printing Date: Oct 29, 2009; M:\projects\GIS\8806_Guam_Buildup_EIS\figures\Current_Deliverable\Vol_4\12.2-1.mxd

12.2.2.3 Summary of Alternative 1 Impacts

Table 12.2-1 summarizes the potential impacts of each component of the proposed action.

Table 12.2-1. Summary of Alternative 1 Impacts

Area	*Project Activities*	*Project Specific Impacts*
Apra Harbor		
Onshore	Construction	No impacts to NRHP-eligible or listed archaeological or architectural resources or traditional cultural properties
	Operation	No impacts to NRHP-eligible or listed archaeological or architectural resources or traditional cultural properties
Offshore	Construction	No impacts to NRHP-eligible or listed archaeological or architectural resources or traditional cultural properties
	Operation	No impacts to NRHP-eligible or listed archaeological or architectural resources or traditional cultural properties

Therefore, Alternative 1 would result in no significant impacts to archaeological, architectural, or submerged resources or objects or traditional cultural properties in the onshore or offshore areas.

12.2.2.4 Alternative 1 Potential Mitigation Measures

In accordance with the PA under Section 106, because the potential for impacts in the construction area is low, no potential mitigation measures or further review under Section 106 are required for archaeology.

12.2.3 Alternative 2 Former Ship Repair Facility (SRF)

12.2.3.1 Onshore

Onshore activities associated with Alternative 2 Former SRF (referred to as Alternative 2) include construction of a wharf/staging area with ground disturbance of approximately 6 ac (2.4 ha), a MWR area of 4 ac (1.6 ha), and various buildings including Port Operations, substation, water treatment facilities, and a pump station. As part of the project, nine existing structures (93-1 [built 1944], 2004 [built 1991], 2005 [NEEACT Shop, built 1944], 2006 [administrative office, built 1944], 2009 [general storage, built 1993], 2013 [built 1944], 2014 [temporary hazardous waste storage, built 1991], 2108 [office, built 1964], and 2072 [built 1987]) would be demolished. A 600 ft [183 m] portion of E Street would be demolished and replaced south of the staging area (Tomanari-Tuggle et al. 2005).

Refer to Table 12.2-2 for a summary of the potential impacts of each component of the alternative. Figure 12.2-2 provides a summary of the proposed project location in relation to the archaeological probability areas.

<u>Construction</u>

The proposed construction would occur in an onshore area that is composed of fill material and does not contain NRHP-eligible or listed cultural resources. Similar to the Polaris Point area, this area is considered to be a No to Low Probability area. None of the buildings to be demolished are eligible for or listed on the NRHP. No traditional cultural properties are known from this area.

<u>Operation</u>

Since no NRHP-eligible or listed archaeological sites, or traditional cultural properties occur in the APE, no impacts would result from onshore operations associated with Alternative 2.

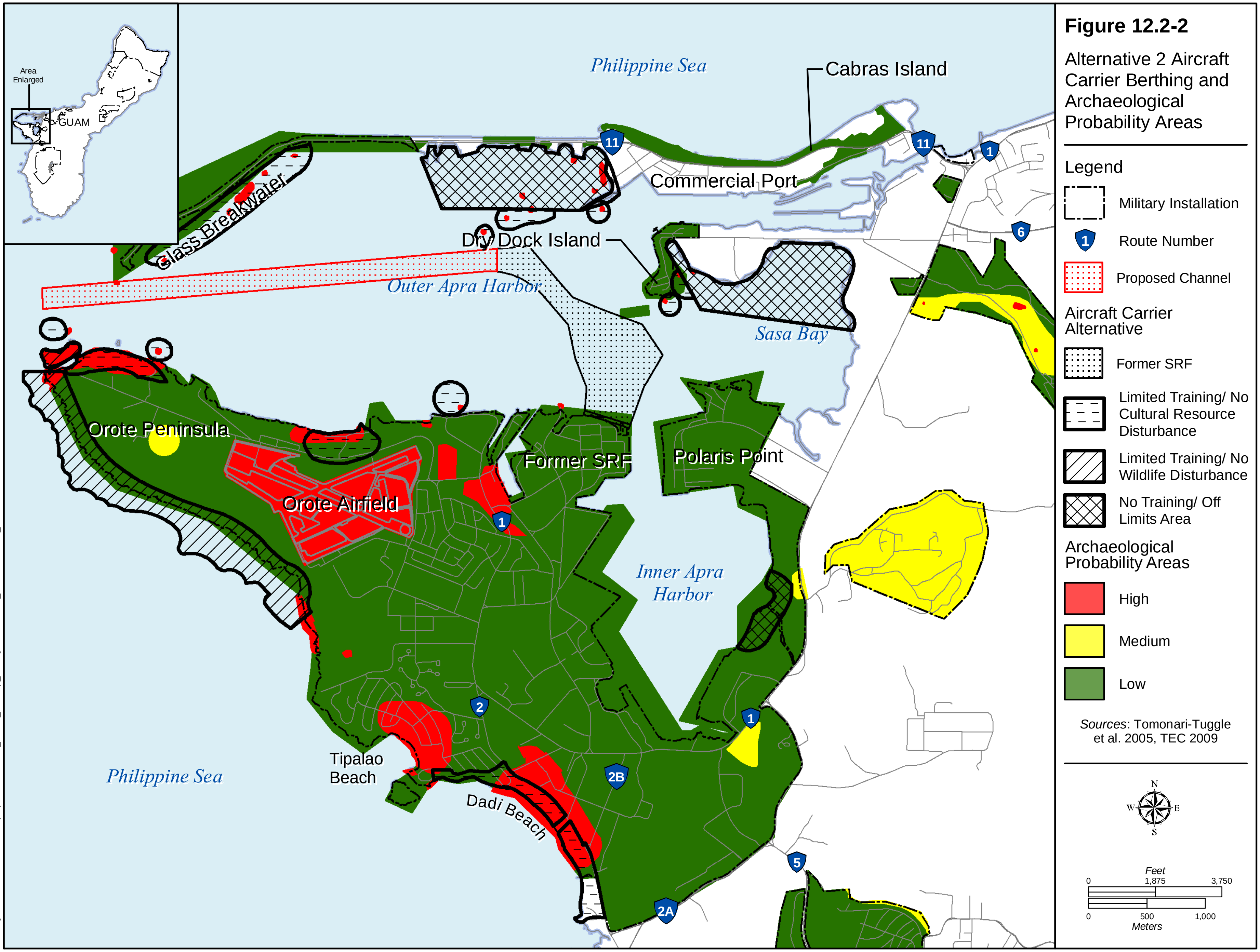

Figure 12.2-2

Alternative 2 Aircraft Carrier Berthing and Archaeological Probability Areas

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12.2.3.2 Offshore

Offshore activities would be the same as for Alternative 1. No NRHP-eligible or listed submerged resources or objects or traditional cultural properties would be adversely impacted either directly or indirectly by the implementation of Alternative 2.

Construction

Impacts would not differ from those of Alternative 1.

Operation

Impacts would not differ from those of Alternative 1.

12.2.3.3 Summary of Alternative 2 Impacts

Table 12.2-2 summarizes Alternative 2 impacts.

Table 12.2-2. Summary of Alternative 2 Impacts

Area	*Project Activities*	*Project Specific Impacts*
Apra Harbor		
Onshore	Construction	No impacts to NRHP-eligible or listed archaeological or architectural resources or traditional cultural properties
	Operation	No impacts to NRHP-eligible or listed archaeological or architectural resources or traditional cultural properties
Offshore	Construction	No impacts to NRHP-eligible or listed archaeological or architectural resources or traditional cultural properties
	Operation	No impacts to NRHP-eligible or listed archaeological or architectural resources or traditional cultural properties

Therefore, Alternative 2 would result in no significant impacts to archaeological, architectural or submerged resources or objects, or traditional cultural properties in the onshore or offshore areas.

12.2.3.4 Alternative 2 Potential Mitigation Measures

In accordance with the PA under Section 106, the potential for impacts in the construction area is low; no potential mitigation measures or further review under Section 106 are required for archaeology.

12.2.4 No-Action Alternative

Under the no-action alternative, no construction, dredging, or operation associated with the aircraft carrier berthing would occur. Existing operations at Polaris Point, as a military training and recreational facility, and the Former SRF, as a commercial ship repair facility, would continue. Therefore, the no-action alternative would not have significant impacts to cultural resources.

12.2.5 Summary of Impacts

Table 12.2-3 summarizes the impacts. A text summary is provided below.

Table 12.2-3. Summary of Impacts

Alternative 1	*Alternative 2*	*No-Action Alternative*
Archaeological Resources		
NI • No adverse impacts to NRHP-eligible or listed archaeological resources	NI • No adverse impacts to NRHP-eligible or listed archaeological resources	NI • No adverse impacts to NRHP-eligible or listed archaeological resources
Architectural Resources		
NI • No adverse impacts to NRHP-eligible or listed architectural resources	NI • No adverse impacts to NRHP-eligible or listed architectural resources	NI • No adverse impacts to NRHP-eligible or listed architectural resources
Submerged Resources		
NI • No adverse impacts to NRHP-eligible or listed submerged resources or objects	NI • No adverse impacts to NRHP-eligible or listed submerged resources or objects	NI • No adverse impacts to NRHP-eligible or listed submerged resources or objects
Traditional Cultural Properties		
NI • No adverse impacts to NRHP-eligible or listed traditional cultural properties	NI • No adverse impacts to NRHP-eligible or listed traditional cultural properties	NI • No adverse impacts to NRHP-eligible or listed traditional cultural properties

Legend: SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact, BI = Beneficial impact

No NRHP-eligible or listed archaeological sites, architectural resources, submerged resources or objects, or traditional cultural properties would be significantly impacted by either Alternative 1 or Alternative 2.

12.2.6 Summary of Potential Mitigation Measures

There are no necessary mitigation measures associated with this action.

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CHAPTER 13.
VISUAL RESOURCES

13.1 INTRODUCTION

This chapter describes the potential environmental consequences associated with implementation of the alternatives within the region of influence for visual resources. For a description of the affected environment, refer to the respective chapter of Volume 2 (Marine Corps Relocation – Guam). The locations described in that Volume include the region of influence for the aircraft carrier berthing component of the proposed action (Apra Harbor), and the chapters are presented in the same order as the resource areas contained in this Volume.

13.2 ENVIRONMENTAL CONSEQUENCES

13.2.1 Approach to Analysis

13.2.1.1 Methodology

Information on visual resources was gathered at public scoping meetings in April 2007 and via subsequent on-site visits and background research (EDAW 2007a, 2007b, 2009, and Google Earth 2008). As noted below, there were no concerns raised during the public scoping meetings regarding visual resources. The analysis of potential impacts to visual resources is based on the long-term (operational) effects – i.e., after construction has occurred. Construction-related activities related to the development of the aircraft carrier facilities would be short-term in duration and minimal in their impacts (i.e., work in an active harbor environment).

13.2.1.2 Determination of Significance

For the purpose of this Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS), the proposed action would cause a significant impact to visual resources if they:

- Would substantially alter the views or scenic quality associated with particularly significant and/or publicly recognized vistas, viewsheds, overlooks, or features
- Would substantially change the light, glare, or shadows within a given area
- Would substantially affect sensitive receptors – i.e., viewers with particular sensitivity (or intolerance) to a changed view (e.g., a hillside neighborhood with views of a relatively undisturbed, naturally-appearing landscape)

Significant impacts that cannot be mitigated to less than significant levels are considered unavoidable.

A discussion is presented for each significance criterion listed that would be triggered by the alternatives.

13.2.1.3 Issues Identified during Public Scoping Process

No visual resource issues regarding the proposed action were raised at the April 2007 public scoping meetings.

13.2.2 Alternative 1 Polaris Point (Preferred Alternative)

13.2.2.1 Onshore

Onshore activities associated with Alternative 1 Polaris Point (referred to as Alternative 1) include construction of a wharf/staging area with ground disturbance of approximately 5.8 acres (ac) (2.34

hectares [ha]), a Morale, Welfare, and Recreation (MWR) area of 2.4 ac (0.97 ha), security structures including a 50 foot (ft) (15.2 meter [m]) watch tower, and various buildings including a Port Operations Building, a substation, water treatment facilities, and a pump station on an existing military operating port facility. As part of the project, four existing structures (buildings 4407, 4408, 4409, and an existing guard tower) would be demolished. A 300 ft (91.4 m) roadway would be demolished and replaced with a new access road to connect Polaris Point Drive to the staging area.

Onshore construction related disturbances would be evident from offshore locations within Outer Apra Harbor, and to a lesser degree to nearby onshore areas. These activities would introduce some new elements into the landscape and remove others; with the most substantial being – from a visual perspective –a 50 ft (15.2 m) watch tower that would be visible from some distant views. However, all of these activities would occur in, and new features would be added to, a fully developed military base including an industrial area and harbor environment. Therefore, no adverse impacts to visual resources are anticipated from onshore activities.

13.2.2.2 Offshore

Offshore activities associated with Alternative 1 include dredging of the berthing area, the turning basin, and the channel bend; construction of a wharf at Polaris Point; and the operations associated with the berthing of the aircraft carrier.

During construction, pile-driving equipment, shoreline alteration activities (cut/fill), and dredging activities (barges and cranes) would alter the existing landscape. The most evident post-construction landscape feature would be a changed shoreline – i.e. from an uneven, rip-rap water's edge to a wharf raised 12 ft (3.6 m) above mean sea level that could be up to 1,325 ft (404 m) in length. The construction activities would be short-term and would not impact sensitive receptors or appreciably alter the light, glare or shadows because all proposed activities would be within an active commercial port.

During the aircraft carrier visits (approximately 63 total days per year up to 21 days per visit), the most significant visual feature would be the aircraft carrier itself, with its bridge deck and associated towers reaching 215 ft (66 m) high. No sensitive receptors were identified in the area. There would be minor changes to the light, glare, or shadows due to the new facilities with no appreciable impact on visual resources because the proposed activities would be located within an active military and commercial port. The submarine compound would experience a change in shadow pattern, but it would not interfere with their mission. The aircraft carrier would have the most impact on Naval Base Guam visitors and waterfront personnel. Most visitors to the Naval Base would not consider an aircraft carrier a negative impact to the Navy harbor view plane. The operational activities would take place within an active industrial Naval harbor environment. Therefore, these new activities and features would not be expected to have an adverse impact to visual resources.

13.2.2.3 Summary of Alternative 1 Impacts

Table 13.2-1 summarizes Alternative 1 impacts.

Table 13.2-1. Summary of Alternative 1 Impacts

Area	*Project Activities*	*Project Specific Impacts*
Onshore	Construction	No adverse impacts to visual resources are anticipated from onshore activities
	Operation	New elements would be introduced into the existing landscape and remove others, with the most substantial being a 50 ft (15.2 m) watch tower, that would be visible from some distant views.
Offshore	Construction	No adverse impacts to visual resources are anticipated from offshore activities

Area	*Project Activities*	*Project Specific Impacts*
	Operation	The most evident post-construction landscape feature would be a changed shoreline – i.e. from an uneven, rip-rap water's edge to a wharf raised 12 ft (3.6 m) above mean sea level that could be up to 1,325 ft (404 m) in length. During the aircraft carrier visits, the most significant visual feature would be the aircraft carrier itself, with its bridge deck and associated towers reaching 215 ft (66 m) high.

13.2.2.4 Alternative 1 Potential Mitigation Measures

There are no mitigation measures required.

13.2.3 Alternative 2 Former Ship Repair Facility (SRF)

13.2.3.1 Onshore

Onshore activities associated with Alternative 2 Former SRF (referred to as Alternative 2) include construction of a wharf/staging area with ground disturbance of approximately 6 ac (2.43 ha), an MWR area of 4 ac (1.62 ha), and various buildings including Port Operations Building, a substation, a water treatment facility, and a pump station. As part of the project, 10 existing structures (93-1, 2004, 2005, 2006, 2009, 2010, 2013, 2014, 2108, and 2072) would be demolished. A 600 ft (183 m) portion of E Street would be demolished and replaced south of the staging area.

As the Former SRF site is a port industrial area with no sensitive receptors, construction of the proposed facilities at the Alternative 2 location would not be expected to result in adverse impacts to visual resources.

13.2.3.2 Offshore

Offshore activities associated with Alternative 2 include dredging of the berthing area, the turning basin, and the channel bend; construction of a wharf at the Former SRF site; and the operations associated with the berthing of the aircraft carrier.

As the Former SRF site is a port industrial area, construction of the proposed facilities at the Alternative 2 location would not be expected to result in adverse impacts to visual resources. No adverse impacts to the view plane would result, as described under Alternative 1.

13.2.3.3 Summary of Alternative 2 Impacts

Table 13.2-2 summarizes Alternative 2 impacts.

Table 13.2-2. Summary of Alternative 2 Impacts

Area	*Project Activities*	*Project Specific Impacts*
Onshore	Construction	No adverse impacts to visual resources are anticipated from onshore activities
	Operation	No adverse impacts to visual resources are anticipated from onshore activities
Offshore	Construction	No adverse impacts to visual resources are anticipated from offshore activities
	Operation	No adverse impacts to visual resources are anticipated from offshore activities

13.2.3.4 Alternative 2 Potential Mitigation Measures

There are no mitigation measures required.

13.2.4 No-Action Alternative

Under the no-action alternative, no construction, dredging, or operations associated with the proposed aircraft carrier berthing would occur. Existing operations at Polaris Point, as a military training and recreational facility, and the Former SRF, as a commercial ship repair facility, would continue. Therefore, the no-action alternative would not have adverse impacts to visual resources.

13.2.5 Summary of Impacts

The visual impacts are similar for both alternatives, which are located in an industrial harbor. Construction impacts would be minor and temporary. The transient nuclear powered aircraft carrier capability-related changes to Apra Harbor would result in shoreside modifications to the visual environment at the two sites. The difference is the Former SRF site was previously developed and the Polaris Point site is under developed; however, they are both in industrial areas and the facilities would be consistent with the other waterfront facilities in the vicinity. The affected area would be within an active military base and military harbor facility surrounded by existing commercial port infrastructure. No adverse impacts are anticipated. Table 13.2-3 summarizes the potential impacts of each action alternative and the no-action alternative.

Table 13.2-3. Summary of Impacts

Alternative 1	*Alternative 2*	*No-Action Alternative*
Onshore Viewshed		
LSI • New elements would be introduced into the existing landscape and others removed, with the most substantial being a new 50 ft (15.2 m) watch tower that would be visible from some distant views.	NI	NI
Offshore Viewshed		
LSI • The most evident post-construction landscape feature would be a changed shoreline – i.e., from an uneven, rip rap water's edge to a wharf raised 12 ft (3.6 m) above mean sea level that could be up to 1,325 ft (404 m) in length. • During the aircraft carrier visits, the most notable visual feature would be the aircraft carrier itself, with its bridge deck and associated towers reaching 215 ft (66 m) high.	NI	NI

Legend: SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact, BI = Beneficial impact

13.2.6 Summary of Potential Mitigation Measures

As previously discussed, mitigation measures would not be required for either alternative.

CHAPTER 14. TRANSPORTATION

14.1 INTRODUCTION

This chapter contains the discussion of the potential environmental consequences associated with implementation of the alternatives within the region of influence for marine transportation resources as it relates to the aircraft carrier berthing. For a description of the affected environment, refer to Volume 2, Chapter 14 (Marine Corps Relocation – Guam). The locations described in that Volume include the region of influence for the aircraft carrier berthing component of the proposed action (Apra Harbor), and the sections here are presented in the same order as the resource areas contained in Volume 2.

14.2 ENVIRONMENTAL CONSEQUENCES

For a full description of the affected environment and environmental consequences for on-base and off-base road traffic, refer to Volume 6: Related Actions – Utilities and Roadway Projects. Although this Chapter focuses on marine transportation, a brief discussion is included on additional truck traffic that would occur from transportation of dredged material from barges to upland disposal sites.

14.2.1 Approach to Analysis

14.2.1.1 Methodology

The primary military, commercial, and recreational port facilities on Guam are located in Apra Harbor. It is critical that navigational access to the channels be maintained for these users. The consequences of the alternatives for the proposed project and the no-action alternative were evaluated based upon the magnitude and duration of impacts to navigation. For activities within an alternative that would have an adverse impact on marine transportation (navigation), appropriate mitigation measures have been identified. The analysis of the alternatives addresses the potential impacts to navigation from the proposed berthing of the aircraft carrier.

14.2.1.2 Determination of Significance

For marine transportation, the significance of impacts is determined by the potential interference to marine vessel navigation from the proposed berthing of the aircraft carrier.

14.2.1.3 Issues Identified during Public Scoping Process

As part of the analysis, the concerns relating to navigation that were identified by the public, including regulatory stakeholders, during scoping meetings were reviewed. These concerns related to the potential restrictions to access areas in Outer Apra Harbor as a result of the movement of military vessels.

14.2.2 Alternative 1 Polaris Point (Preferred Alternative)

14.2.2.1 Onshore and Offshore

<u>Construction</u>

Activities proposed in Outer Apra Harbor associated with Alternative 1 Polaris Point (referred to as Alternative 1) include: construction of a new wharf at Polaris Point; dredging of about 608,000 cubic yards (cy) (464,850 cubic meters [m^3]) from the berthing area, the turning basin, and the channel bend; relocation of a buoy and range lights; installation of floating security barriers around the aircraft carrier while it is at the wharf; and a change in the number and duration of visits by the aircraft carrier and its associated Carrier Strike Group (CSG). The proposed activities that would have an impact on navigation are: 1) the dredging that would be conducted in or adjacent to the main channel, 2) the relocation of the buoys, 3) the relocation of the range lights for Outer Apra Harbor, 4) the security barrier installed around the aircraft carrier, and 5) restrictions on navigation during aircraft carrier transits into and out of Apra Harbor in accordance with security requirements.

There are alternatives being considered for the design of the new wharf at Polaris Point. The Record of Decision (ROD) would not include a decision on structural design, because it is unlikely that the final design would be available for inclusion in the Final Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). It is likely that construction of the wharf would result in less than significant impacts to marine transportation.

Dredging could be conducted by hydraulic or mechanical dredge. The environmentally most conservative case is generally believed to be mechanical dredging. The daily work cycle (24 hours per day), weather, and other variables affect the efficiency of the dredging operation. The total duration of dredging would be between 8 months to 18 months. Dredging is not required in the east-west aligned navigation channel or Outer Apra Harbor. In the sharp southward bend in the channel, there is a discrete area of dredging that would take approximately a week to complete. During that period, use of certain sections of the main navigation channel would be restricted due to the presence of the dredging equipment; this would result in less than significant impacts to marine transportation. The majority of the dredging would occur just north of Inner Apra Harbor and there would be impacts to ship traffic transiting to/from Inner Apra Harbor. To minimize impacts of the proposed dredging on the maritime community, a Notice to Mariners would be published prior to the start of the dredging to identify the location and duration of dredging, and temporary navigational aids may be deployed.

The proposed widening of the Outer Apra Harbor shipping channel to 600 feet (ft) (183 meters [m]) would require relocation of three buoys and range lights. A Notice to Mariners would be published prior to the relocation of the buoys and range lights to identify the new locations and the dates when the buoys and range lights would be moved. The relocation of the buoys and range lights would result in no impact to marine transportation.

Four dredged material disposal options are considered in this EIS/OEIS: 100% ocean disposal, 100% upland placement, 100% beneficial reuse, and 20-25% beneficial reuse/75-80% ocean disposal. For the 100% ocean disposal option, one tugboat would tow a 4,000 cy (3,053 m^3) scow filled with dredged material to the ocean disposal site and then return to the dredging site. One to two trips per day is estimated based on an anticipated dredge production rate of 1,800 cy (1,376 m^3) per 24-hr construction day. This rate is based on recent dredging of similar material near Bravo Wharf (Volume 9, Appendix E, Section E). The tugboat and scow transporting the dredged material from the project site would travel along existing shipping lanes and be subject to United States Coast Guard (USCG) rules and regulations. A total of about 150 trips to the ocean disposal site would be conducted to transport the dredged material from Polaris Point. Additional ship traffic would be addressed through scheduling and communications between Port Operations and the contractors.

Assuming 100% upland placement of the dredged material, the dredged material from the scow would likely be offloaded to sealed-end dump trucks at an Inner Apra Harbor wharf; Uniform Wharf has historically been used for this purpose. If the Polaris Point upland placement site is selected, the material would likely be offloaded at Polaris Point with surface transport limited to the Polaris Point area. The remaining candidate sites for upland placement are located on the Orote side of Naval Base Guam. The travel distance to these sites from Uniform Wharf is shown Table 14.2-1. The routes from Uniform Wharf to the upland placement sites are paved. The Sumay Drive portion is in an industrial waterfront area. The route to Field 3 would require additional transport through the central retail area of the base. Assuming a dump truck capacity of 18 cy (14 m^3), there would be 100 round-trip truck trips per 24-hour period. Approximately half of these trips would occur during retail business hours and there would be impacts to retail traffic. If Field 3 is the designated upland placement site, then there are opportunities to use a less direct route to the site to avoid impacts to retail shoppers. There would be traffic impacts to the submarine compound personnel that would be addressed through scheduling. Supply trucks and shuttle bus schedules would avoid peak morning and afternoon traffic through the security gate.

Table 14.2-1. Travel Distance to Upland Placement Sites

Upland Placement Site	*Distance miles (m)/(kilometers [km])*	*Route from Uniform Wharf*
Field 3	1.7 (2.8)	Sumay Drive, cross Marine Drive to road between the Commissary and the Exchange
Field 4	1.2 (1.9)	Sumay Drive
Field 5	1.2 (1.9)	Sumay Drive
PWC	0.5 (0.8)	Sumay Drive

<u>Operation</u>

Under the proposed action for a transient aircraft carrier wharf, there would be a cumulative total of up to 63 visit days per year, with an anticipated length of 21 days or less per visit. The 2008 CSG visiting schedule was 4 visits of 4 days duration for a total of 16 days in Apra Harbor with the aircraft carrier berthed at Kilo Wharf.

As is currently the case during aircraft carrier visits, the movement of the aircraft carrier to the Polaris Point wharf would require up to four assist tugboats to maneuver the aircraft carrier that would provide its own forward propulsion. Aircraft carriers transiting through Outer Apra Harbor restrict other uses in the channel for security and safety reasons. The movement of the aircraft carrier would result in less than significant impacts to marine transportation.

While the aircraft carrier is at the wharf, there would be floating security barriers placed to prevent an attack on the aircraft carrier by a boat. This structure would restrict access to Inner Apra Harbor. The floating security barrier would result in a less than significant impact to marine transportation in Outer Apra Harbor.

When high security alerts force protection, condition (FPCON) Charlie and Delta are declared. There would be a significant impact to marine transportation and access to Inner Apra Harbor. This restriction to navigation would only affect military operations since access to the inner harbor is restricted to military vessels controlled by Naval Base Guam. FPCON Charlie describes a situation when an instance occurs or when intelligence reports that there is terrorist activity imminent. FPCON Delta describes a situation when a terrorist attack is taking place or has just occurred. FPCON Delta usually occurs only in the areas that are most vulnerable to or have been attacked. The primary difference between FPCON Charlie, and FPCON Delta, is that FPCON Delta references a specific, known threat, whereas FPCON Charlie is used to prepare for imminent threats of a general, non-targeted nature. FPCON Charlie can also be maintained for a significant length of time, several weeks, while FPCON Delta is generally only maintainable for several days. It is understood that Navy and U.S. Coast Guard security boats would be positioned in Apra Harbor less than two nautical miles from either of the alternative carrier locations for security response.

Under Alternative 1, there would be a cumulative total of up to 63 visit days per year, with an anticipated length of 21 days or less per visit. The aircraft carrier would berth at Polaris Point. This would allow additional access to Kilo Wharf for the loading of ammunition by other ships. The change in the number and duration of the visits by the CSG would result in no impacts to marine transportation.

In addition to the approximately 150 trips by tugboats and scows over an 8 to 18 month period to transport dredged material to the ocean disposal site, there would be 149 container vessels above the average (124 container ships) visiting the Port of Guam over the peak activity year (2015) to transport the equipment and supplies for the relocation of the Marines to Guam. During the period of construction, the 150 vessel trips by tugboats and scows and 149 additional container ships would be added to the number of vessels that visit the Port of Guam each year (1,022 vessels in the year 2008). Because the annual number of vessels visiting the Port of Guam has decreased by 1,902 vessels over the period of 1995 to 2008, it is expected that the addition of about 300 vessels per year would have a less than significant impact on marine transportation in Apra Harbor.

14.2.2.2 Summary of Alternative 1 Impacts

Table 14.2-2 summarizes the impacts for Alternative 1.

Table 14.2-2. Summary of Alternative 1 Impacts

Area	*Project Activities*	*Impacts to Transportation*	*Impacts*
Onshore	Construction	Construction of a new wharf at Polaris Point	LSI
		Dredging of about 608,000 cy (464,850 m^3) from the berthing area, the turning basin, and the channel bend	LSI
		Relocation of buoys and range lights	NI
		Installation of floating security barriers around the aircraft carrier while it is at the wharf	LSI
		Change in number and duration of visits by the Carrier Strike Group	NI
		Transport of equipment and supplies by ship	LSI
		Shoreside Traffic	LSI
Onshore	Operation	Movement of the aircraft carrier to the Polaris Point wharf	LSI
		Placement of floating security barriers	LSI
		Transport of dredged material from the dredging site within the harbor	LSI
Offshore	Operation	Transport of dredged material from the harbor to the ocean disposal site	LSI

Legend: SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact, BI = Beneficial impact

14.2.2.3 Alternative 1 Potential Mitigation Measures

No mitigation measures would be required.

14.2.3 Alternative 2 Former Ship Repair Facility (SRF)

14.2.3.1 Onshore and Offshore

Activities proposed in Apra Harbor associated with Alternative 2 Former SRF (referred to as Alternative 2) include: construction of a new wharf at the SRF; dredging of about 479,000 cy (366,000 m^3) from the berthing area, the turning basin, and the channel bend; relocation of a buoy and two range lights; installation of floating security barriers around the aircraft carrier while it is at the wharf; and a change in the number and duration of visits by the CSG. The proposed activities that would have an impact on navigation are: the dredging that would be conducted in or adjacent to the main channel, the relocation of the buoy and range lights for Outer Apra Harbor, and the security barrier installed around the aircraft carrier Table 14.2-3).

<u>Construction</u>

Construction impacts on navigation would be as described for Alternative 1 except there would be less dredged volume generated. The number of trips by the tugboat and scow to transport the dredged material would be about 120 trips over a 6 to 9 month period. The impacts to Inner Apra Harbor traffic are as described under Alternative 1. To minimize impacts of the proposed dredging on the maritime community, a Notice to Mariners would be published prior to the start of the dredging to identify the location and duration of dredging, and temporary navigational aids may be deployed.

If Field 3 is the designated upland placement site, then there are opportunities to use a less direct route to the site to avoid impacts to retail shoppers. There would be traffic impacts to the submarine compound personnel that would be addressed through scheduling. Supply trucks and shuttle bus schedules would avoid peak morning and afternoon traffic through main base gates and Guam Shipyard access routes.

Therefore, Alternative 2 would result in less than significant impacts to marine transportation.

<u>Operation</u>

Marine transportation impacts under Alternative 2 would be similar to those under Alternative 1. Therefore, Alternative 2 would result in less than significant impacts to marine transportation.

Traffic generated under Alternative 1 would be similar to that under Alternative 2. The differences include more on-base traffic and main gate traffic. In addition, because of the proximity to main base amenities there is likely to be an increase in pedestrian traffic. There would be no impact on Polaris Point operations. The shipyard repair facilities at Former SRF would be consolidated and segregated from the aircraft carrier area. The access routes would be shared and there would be impacts on workers at the shipyard.

Additional ship traffic would be addressed through scheduling and communications between Port Operations and the contractors. With implementation of these measures, Alternative 2 would have no significant impact.

14.2.3.2 Summary of Alternative 2 Impacts

Table 14.2-3 Summary of Alternative 2 Impacts

Area	*Project Activities*	*Impacts to Navigation*	*Impacts*
Onshore	Construction	Construction of a new wharf at the Former SRF	LSI
		Dredging of about 479,000 cy (366,000 cubic meters) from the berthing area, the turning basin, and the channel bend	LSI
		Relocation of a buoy and two range lights	NI
		Installation of floating security barriers around the aircraft carrier while it is at the wharf	LSI
		Change in number and duration of visits by the Carrier Strike Group	NI
		Transport of equipment and supplies by ship	LSI
		Shoreside Traffic	LSI
Onshore	Operation	Movement of the aircraft carrier to the new wharf	LSI
		Placement of floating security barriers	LSI
		Transport of dredged material from the dredging site within	LSI

		the harbor	
Offshore	Operation	Transport of dredged material from the harbor to the ocean disposal site	LSI

Legend: SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact, BI = Beneficial impact

14.2.3.3 Alternative 2 Potential Mitigation Measures

No mitigation measures would be required.

14.2.4 No-Action Alternative

Under the no-action alternative the new wharf would not be constructed, and there would be no dredging or relocation of the buoys or range lights. Aircraft carriers would continue to visit Apra Harbor and berth at Kilo Wharf. There would be security restrictions, including security barriers, at Kilo Wharf that would restrict navigation at the entrance to Outer Apra Harbor. Therefore, the no-action alternative would not have significant impacts to marine transportation.

14.2.5 Summary of Impacts

Table 14.2-4 summarizes the potential impacts of each action alternative and the no-action alternative. A text summary is provided below.

Table 14.2-4 Summary of Impacts

Alternative 1	*Alternative 2*	*No-Action Alternative*
Apra Harbor-Offshore		
• LSI	• LSI	• LSI
Apra Harbor-Onshore		
• LSI	• LSI	• LSI

Legend: SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact, BI = Beneficial impact

Under all alternatives including the no-action alternative, there are less than significant operational impacts to navigation and onshore traffic. The construction activities under the two action alternatives would be the same, except for less volume of dredged material under Alternative 2.

14.2.6 Summary of Potential Mitigation Measures

No mitigation would be required for Alternative 1 or Alternative 2.

CHAPTER 15.
UTILITIES

For a complete look at utilities, please see Volume 6.

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CHAPTER 16.
SOCIOECONOMICS AND GENERAL SERVICES

16.1 INTRODUCTION

This chapter contains the discussion of the potential environmental consequences associated with the implementation of the alternatives within the region of influence for socioeconomic resources. For a description of the affected environment for all resources, refer to the respective chapter of Volume 2 (Marine Corps Relocation – Guam). The locations described in that Volume include the region of influence for the aircraft carrier berthing component of the proposed action (Apra Harbor), and the chapters are presented in the same order as the resource areas contained in this Volume.

Socioeconomic impacts would be island wide in nature with little difference in effects among alternatives. Therefore, the summary of impacts presented below cover both of the action alternatives for aircraft carrier berthing; the no-action alternative is assessed separately in Section 16.2.4.

16.2 ENVIRONMENTAL CONSEQUENCES

16.2.1 Methodology

Refer to the corresponding section of Volume 2.

16.2.1.1 Determination of Significance

Refer to the corresponding section of Volume 2.

16.2.1.2 Issues Identified During Public Scoping Process

Refer to the corresponding section of Volume 2.

16.2.2 Alternative 1 Polaris Point (Preferred Alternative)

The proposed action covered in this Volume includes the following factors/assumptions for this socioeconomic analysis:

- The Navy would not transfer any permanent shoreside operational personnel or dependents to Guam for this action, nor would it transfer any federal civilian workers.
- Post-construction operational impacts flow from the increased number of aircraft carrier days in port (port-days).
- Under the proposed action for a transient aircraft carrier wharf, there would be a cumulative total of up to 63 visit days per year, up to 21 days per visit.
- Most of the impacts of the transient visits come from personal expenditures in the Guam economy (as opposed to expenditures made on base) by personnel while vessels are in port.
- A smaller source of impacts would be Navy expenditures made in the Guam economy to provide goods and services to the vessel while in port. These expenditures generally are more linked to the number of dockings than to the total in-port days. However, because that number is unavailable due to operational variability, it is assumed that expenditures would more than triple over existing Navy expenditures for carrier visits.
- The "direct operational jobs" discussed in this chapter are all in the private sector, flowing from the above types of direct expenditures.

16.2.2.1 Population Impacts

Project Related Population

There would be no direct population increases attributed to this action though there would be induced population increases as a result of this action. Refer to Volume 2 for additional information.

Approach to Analysis

Table 16.2-1 provides assumptions made in conducting analyses for the construction phase, as well as the source of, or rationale for, those assumptions.

Table 16.2-1. Construction Component Assumptions for Project Related Population Impacts

Assumption	*Assumed Value*	*Source/Rationale*
Average number of dependents for in-migrating direct, on-site, construction jobs	0.20 - 0.35	Estimate based on contractor interviews (Appendix F SIAS)
Average number of dependents for in-migrating direct from purchases jobs	0.95 - 1.0	U.S. Census national data on persons per jobs (U.S. Census Bureau 2000) and Guam Department of Labor (GDoL) interviews (Appendix F SIAS).
Average number of dependents for in-migrating indirect/induced jobs	0.95 - 1.0	U.S. Census national data on persons per jobs (U.S. Census Bureau 2000) and GDoL interviews (Appendix F SIAS).

Table 16.2-2 provides assumptions made in conducting analysis for the operation phase, as well as the source of, or rationale for, those assumptions.

Table 16.2-2. Operational Component Assumptions for Project Related Population Impacts

Assumption	*Assumed Value*	*Source/Rationale*
Average number of dependents for in-migrating direct from purchases jobs	0.95 - 1.0	U.S. Census national data on persons per jobs (U.S. Census Bureau 2000) and GDoL interviews (Appendix F SIAS).
Average number of dependents for in-migrating indirect/induced jobs	0.95 - 1.0	U.S. Census national data on persons per jobs (U.S. Census Bureau 2000) and GDoL interviews (Appendix F SIAS).

Impacts

Table 16.2-3 indicates the peak construction total impact would peak at 1,478 people in 2012. By 2015 the increase would stabilize at 386 people, related to economic activity created by the spending of transient personnel.

Table 16.2-3. Estimated Population Increase Related to Navy Proposed Action

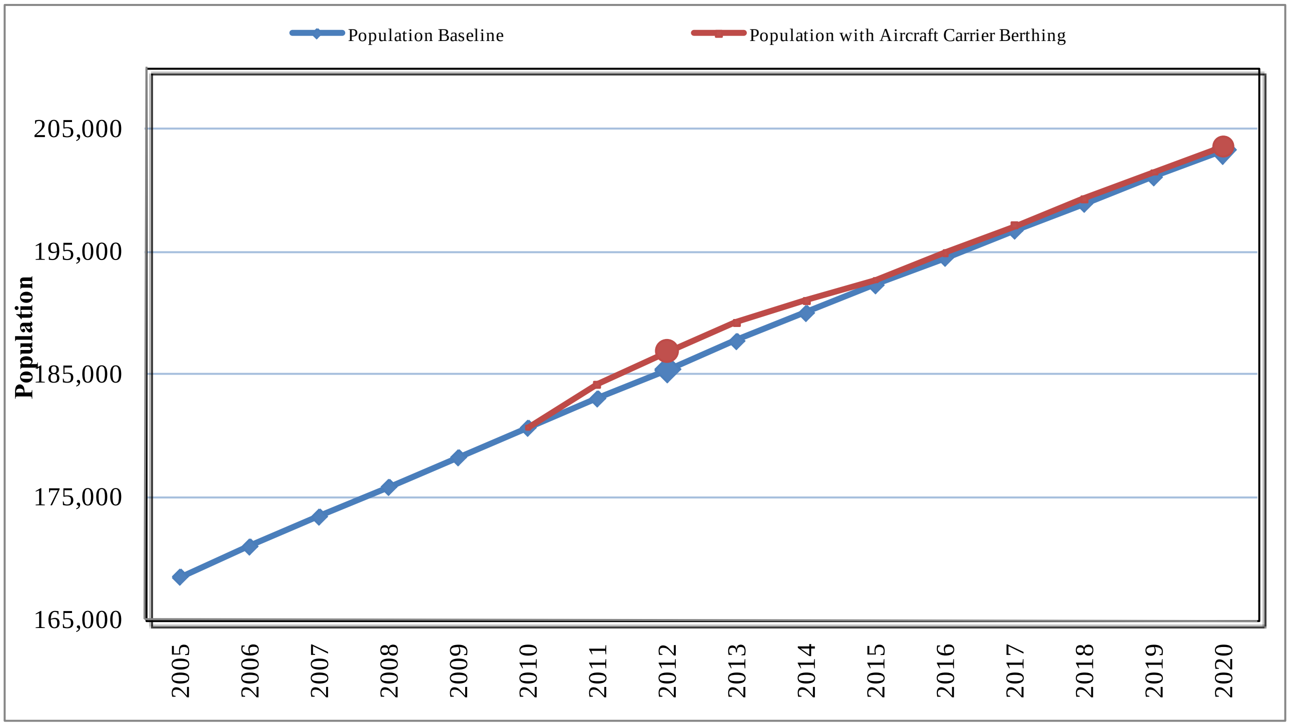
	2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Combined Total Impact	0	1,108	1,478	1,455	968	386	386	386	386	386	386

Notes: Population figures exclude existing Guam residents who obtain employment as a result of the proposed action. The amount of population from active-duty military personnel and dependents is also provided there for each year.

Figure 16.2-1 suggests population would slightly exceed the baseline trend by about 1% at the 2012 construction peak and by less than 1% thereafter.

This does not meet the 2% threshold for significance being used for this analysis.

Figure 16.2-1. Population With and Without Proposed Action



<u>Demographic Characteristics</u>

Refer to the corresponding section of Volume 2 for introductory statements, approach to analysis (including data sources) and analysis.

<u>Household Characteristics</u>

Refer to the corresponding section of Volume 2 for introductory statements, approach to analysis (including data sources) and analysis.

16.2.2.2 Economic Impacts

<u>Employment and Income</u>

Refer to the corresponding section of Volume 2 for introductory statements, approach to analysis (including data sources) and analysis.

Civilian Labor Force Demand - Impacts

Table 16.2-4 shows a combined total civilian labor force demand for 1,094 full-time equivalent (FTE) workers in the peak construction years of 2012 and 2013, declining to a stable figure of 232 from 2015 on after construction ceases.

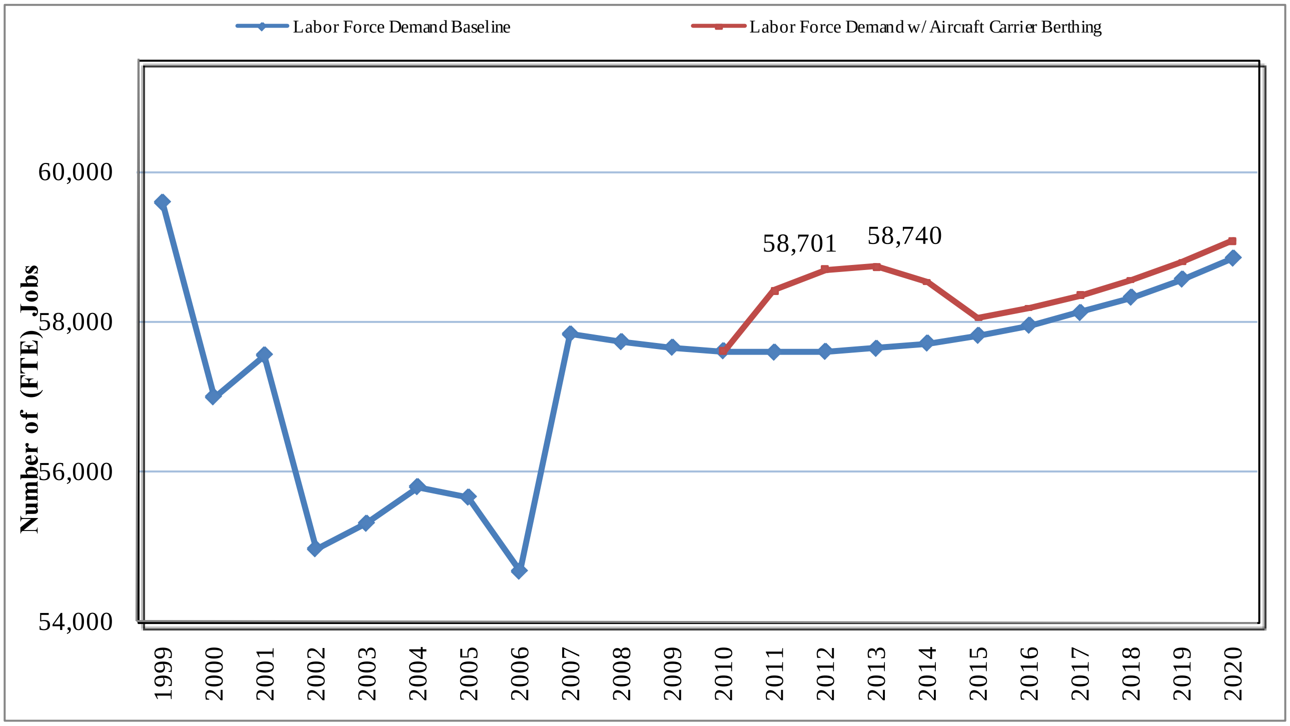
Table 16.2-4. Impact on Civilian Labor Force Demand (Full-Time Equivalent Jobs)

	2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Combined Total Impact	0	822	1,094	1,093	820	232	232	232	232	232	232

Notes: Demand is in terms of FTE jobs. Portion assumed to be filled by Guam residents is not subtracted from these figures.

Figure 16.2-2 shows estimated labor force demand with and without the proposed action. During the peak years of 2012-2013, labor force demand is about 2% above the baseline trend. After construction, labor force demand is only 0.5% above where it would be without the proposed action.

Figure 16.2-2. Labor Force Demand (FTE Jobs) With and Without CVN Proposed Action



Note: In this analysis, a 2% increase over baseline trend at the construction peak is considered sufficiently significant and beneficial to merit a calculation of the total value. In this and other following figures, where that 2% threshold is reached, the numbers shown at the 2012-2013 peak are the sums of the projected baseline trend – what would happen without the project – plus the estimated combined total impact from the foregoing table. This does not include the other military buildup projects.

Civilian Labor Force Supply - Impacts

Table 16.2-5 shows the probable labor force supply for direct onsite military construction jobs.

Table 16.2-5. Estimated Origin of Workers Constructing Naval Facilities

	2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*
TOTAL	0	460	613	613	460	0	0
GUAM	0	74	89	78	59	0	0
OFF-ISLAND	0	386	525	535	401	0	0
H-2B Workers	0	267	366	376	282	0	0
Philippines	0	227	311	320	240	0	0
Other	0	40	55	56	42	0	0
CONUS/HI/Japan	0	71	95	95	71	0	0
Supervisor (U.S., Japan)	0	2	3	3	2	0	0
Labor	0	69	92	92	69	0	0
Other Pacific Islands	0	48	64	64	48	0	0

Table 16.2-6 estimates the share of non-military construction direct and indirect jobs, going to Guam residents versus off-island workers.

Table 16.2-6. Estimated Numbers of On-Island Workers for Various Job Categories Other Than Direct On-Site Construction

	2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Guam Workers	0	51	62	67	56	33	78	196	196	196	196
Off-Island Workers	0	310	419	412	304	198	154	36	36	36	36

Note: Demand is in terms of FTE jobs, and assumes one worker per FTE job.

Civilian Labor Force Income - Impacts

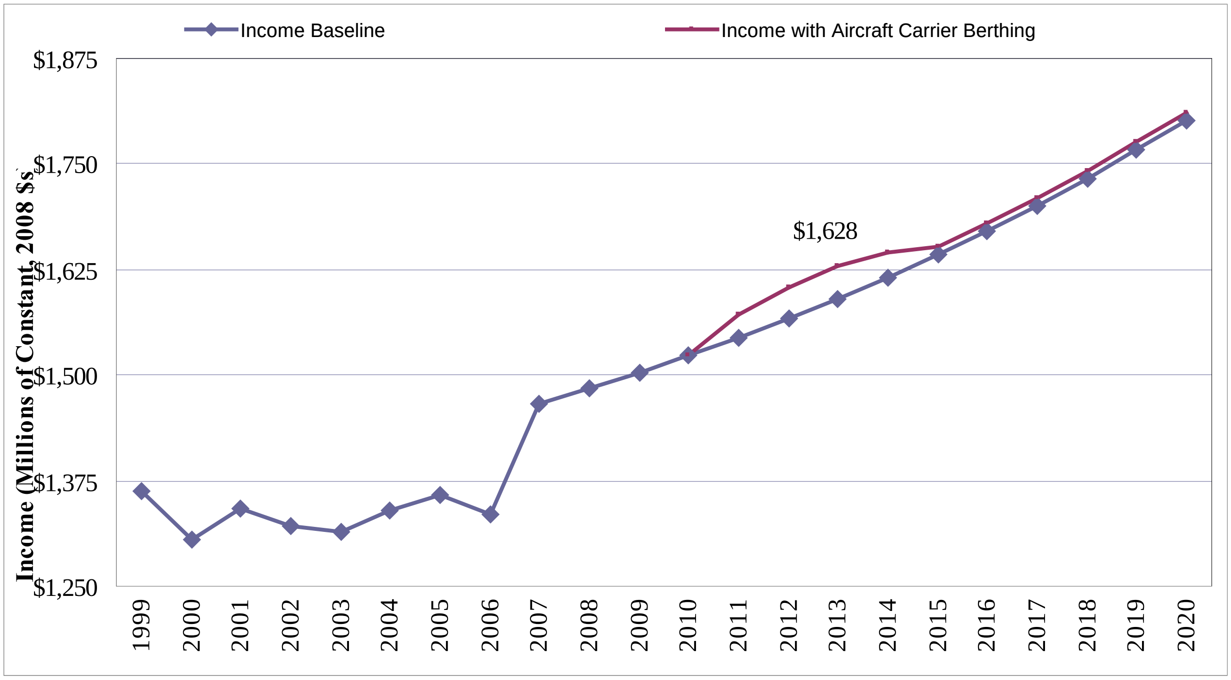
Civilian labor force income amounts apply to the additional labor force as a whole, rather than to the situation of individual workers. Table 16.2-7 shows that the peak figure for this analysis is $38 million, falling back to $9 million for the permanent operation stage from 2015 and beyond.

Table 16.2-7. Impact on Civilian Labor Force Income (Millions of 2008 $s)

	2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Combined Total Impact	$0	$28	$38	$38	$28	$9	$9	$9	$9	$9	$9

Figure 16.2-3 adds the combined total impact figures to the baseline trend in order to show significant long-term positive effects on income. Labor force income is about 2% over the baseline trend at the construction peak and about 0.5% thereafter in the steady-state phase. The 2% figure meets the criterion used in this analysis for a beneficial significant impact.

Figure 16.2-3. Labor Force Income (Millions of 2008 $s) With and Without Proposed Action



Standard of Living - Impacts

Refer to the corresponding section of Volume 2 for a general discussion.

Unemployment - Impacts

Refer to the corresponding section of Volume 2 for a general discussion.

Housing

Refer to the corresponding section of Volume 2 for introductory statements and approach to analysis (including data sources).

Impacts

Refer to the corresponding section of Volume 2 for a general discussion of housing supply.

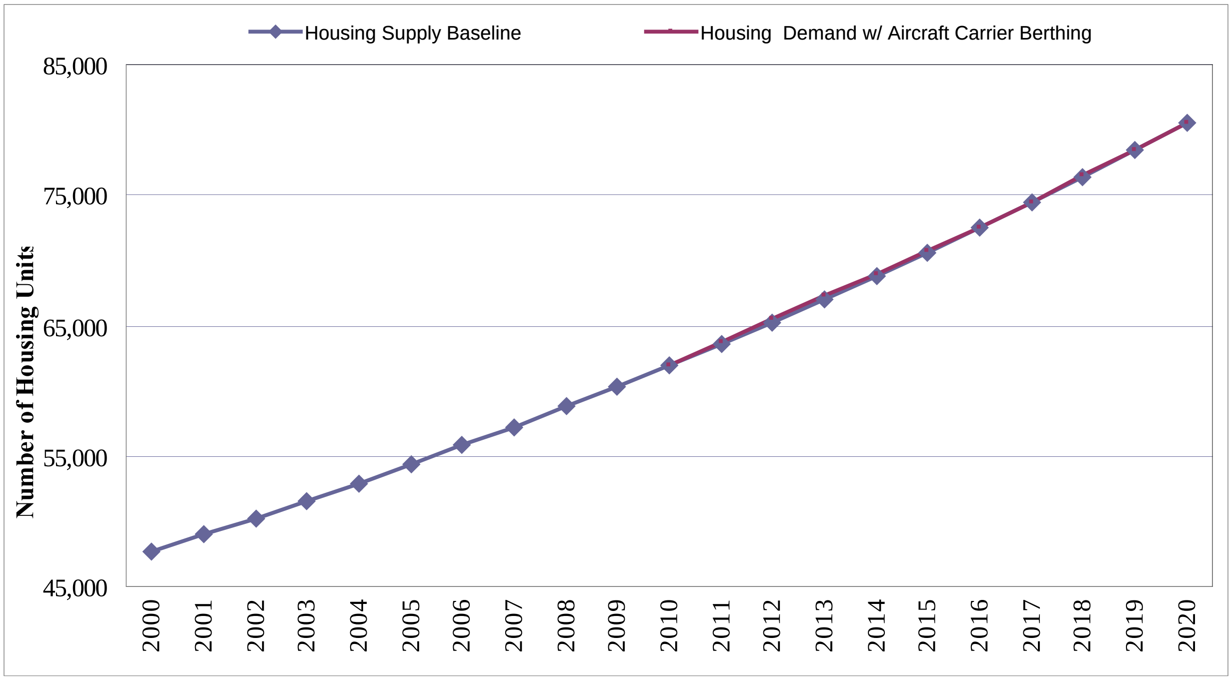
Table indicates the combined total impact of the proposed action would be a demand for 286 new civilian housing units in the construction peak year of 2012, falling to 99 after construction ends/operation begins in 2015.

Table 16.2-8. Demand for New Civilian Housing Units

	2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Combined Total Impact	0	216	286	277	176	99	99	99	99	99	99

Figure 16.2-4 projects a baseline trend in housing supply based on historical rates of development. The proposed action would push housing demand over the baseline trend minimally and the impact would be considered less than significant.

Figure 16.2-4. Civilian Housing Demand with Proposed Action and Housing Supply



Local Government Revenues

Refer to the corresponding section of Volume 2 for introductory statements and approach to analysis (including data sources).

Note that this is not intended as a comprehensive estimate of all revenues, but only of primary ones. Tax revenue sources analyzed here include Gross Receipts Tax, Corporate Income Tax and Personal Income Tax.

Impacts

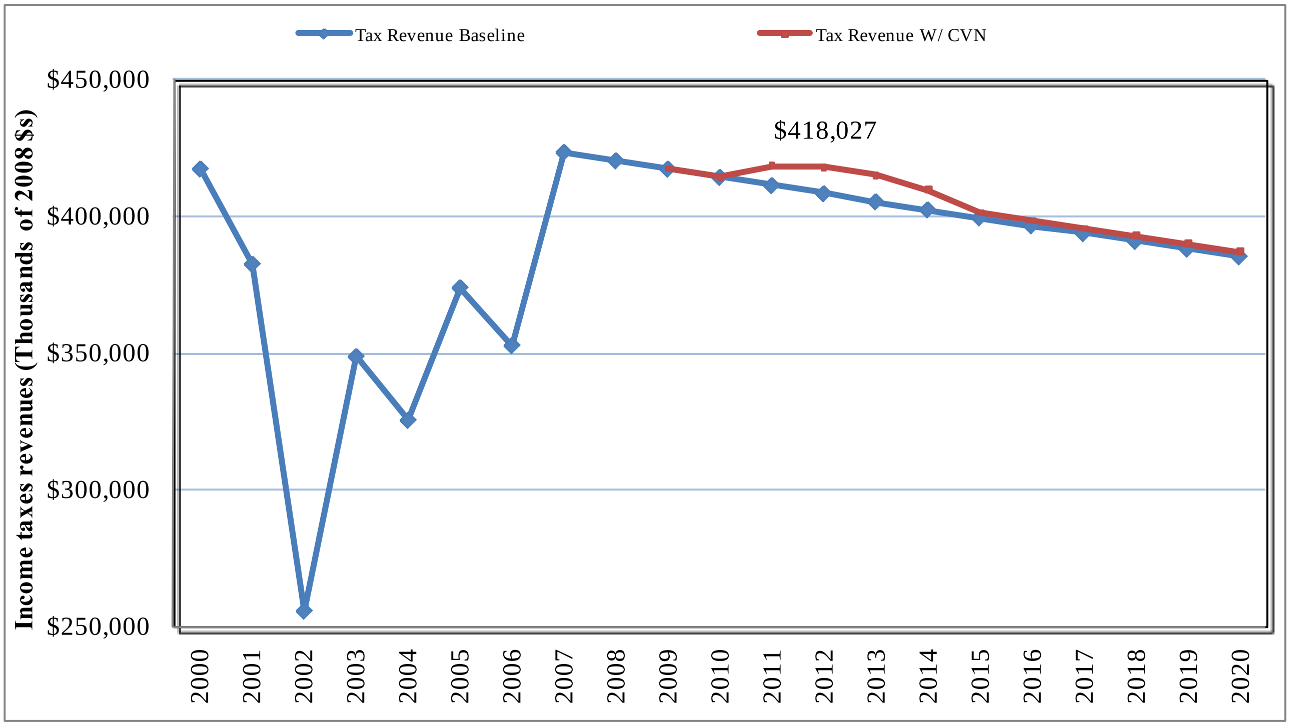
Table 16.2-9 shows the combined total impacts for each of the three primary revenue sources. Revenues from personal income taxes would be the highest of the revenue sources estimated, reaching $4.5 million during the construction peak in 2012-2013 and falling to $1 million after construction. Gross Receipts Tax would bring in about $4 million per year from 2012 to 2013 and falling to $680,000 after construction. Corporate income tax revenues would reach $1 million in 2012-2013 and decline to $173,000 after construction.

Table 16.2-9. Impact on Selected Tax Revenues (1,000s of 2008 $s)

	2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Gross Receipts Tax	$0	$3,010	$4,011	$4,009	$3,007	$680	$680	$680	$680	$680	$680
Corporate Income Tax	$0	$768	$1,023	$1,022	$767	$173	$173	$173	$173	$173	$173
Personal Income Tax	$0	$3,400	$4,526	$4,519	$3,390	$1,061	$1,061	$1,061	$1,061	$1,061	$1,061
Total	$0	$7,177	$9,560	$9,551	$7,163	$1,914	$1,914	$1,914	$1,914	$1,914	$1,914

Figure 16.2-5 shows the projected total tax revenues from the three sources with and without the proposed action. The baseline trend for GovGuam tax revenues is declining based on existing data from 1997-2007. The chart shows revenues above the baseline trend by about 2% at construction peak and less than 1% above trend thereafter. This meets the criterion used in this analysis for a beneficial significant impact (though the long-term operational impact alone does not).

Figure 16.2-5. Gross Receipts Tax Revenue With and Without Proposed Action



<u>Gross Island Product</u>

Refer to the corresponding section of Volume 2 for introductory statements and approach to analysis.

Impacts

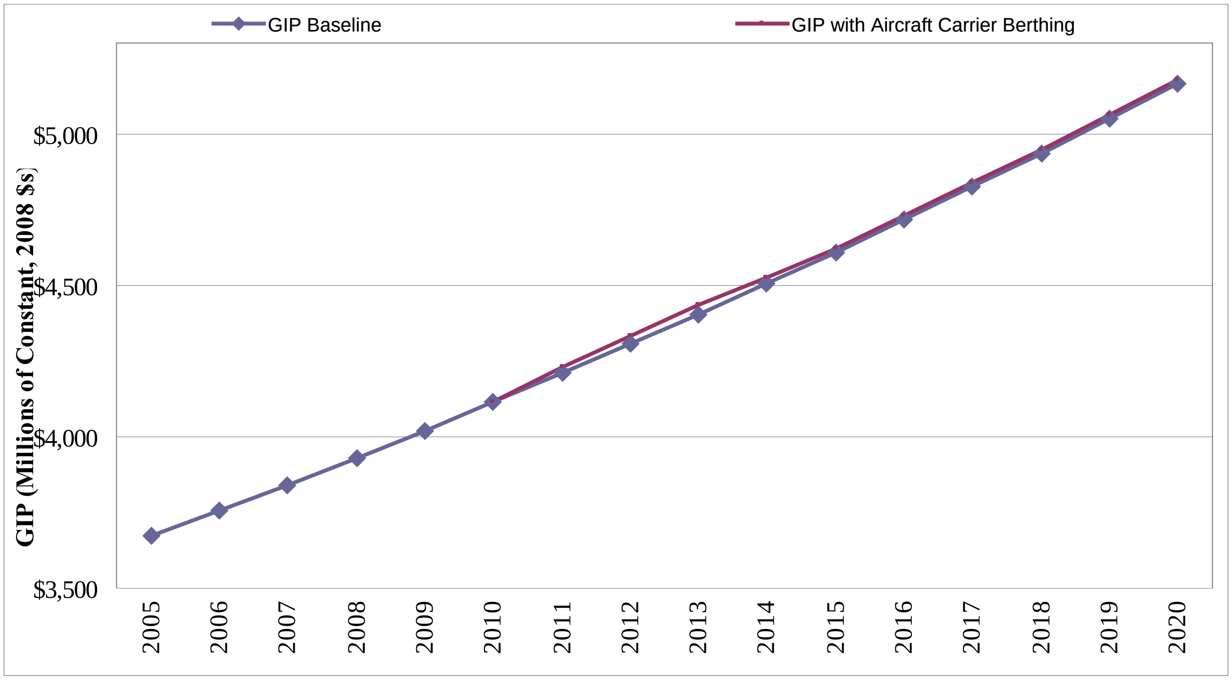
Table 16.2-10 shows that the combined impact of military activities alone would add a stable amount of $13 million to the Gross Island Product (GIP) by 2015, when port calls increase and economic activity generated by transient personnel is taking place. During the construction phase, combined total impacts range between $21 and $28 million.

Table 16.2-10. Impact on Gross Island Product (Millions of 2008 $s)

	2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Combined Total Impact	$0	$21	$28	$28	$21	$13	$13	$13	$13	$13	$13

Figure 16.2-6 shows the projected total GIP with and without the proposed action. The figure shows the GIP slightly (less than 1%) above the baseline trend during construction years. Beginning in 2015, when transient personnel presence increases, the GIP would remain less than 1% over the baseline trend. This is a beneficial impact but does not meet the 2% threshold for significance being used for this analysis.

Figure 16.2-6. Gross Island Product (Millions of 2008 $s) With and Without Proposed Action



<u>Local Business Contracts</u>

Refer to the corresponding section of Volume 2 for general discussion.

The Aircraft Carrier Berthing action in Apra Harbor would warrant less construction activity than the Marine Corps relocation; however, as noted therein, local businesses would still experience benefits. The operational phase for this Naval project would present far fewer opportunities than Marine Corps activities.

<u>Tourism</u>

Refer to the corresponding section of Volume 2 for a general discussion.

Almost all of the impacts described in Volume 2 for the Marine Corps relocation would be supplemented by the berthing of a Navy carrier at Apra Harbor, though the carrier alone, in the absence of any Marine Corps relocation, would have less impact in and of itself. Table 16.2-11 details the impacts that would be specifically generated by the berthing of a Navy carrier at Apra Harbor. The bolded impact is the only impact during the operation phase that would be a result of the Navy action only (and not the Marine Corps or Army actions).

Table 16.2-11. Topics for Tourism Impact Analysis (Aircraft Carrier Berthing)

Construction	*Operation*
Impacts on ocean-based tourism from environmental degradation.	**Impacts on hotel revenues and occupancy taxes from timing of large-scale exercises.**
	More airline and hotel business from military friends and family, R&R, military business travelers.
	Impacts on ocean-based tourism from greater competition between activities.

The four items above merit Navy-specific discussion below, although only one of them, impact on hotels from timing of large-scale exercises, was not also discussed in Volume 2.

Impacts on Ocean-Based Tourism within Apra Harbor: Because of rough waters outside the harbor and in many other parts of Guam's shoreline close to the main resort area of Tumon Bay, Apra Harbor is the single most popular site for both recreational divers and commercial (mainly tourist-oriented) diving operation. Economic impacts on ocean-based tourism within Apra Harbor correlate to degradation of the environment. Siltation from dredging already affects visibility and has diving business operators concerned about possible permanent coral loss. Disturbance from construction activities would be short term and localized. Long-term operational effects on tourism would include force protection restrictions during carrier ingress and egress restricting diving and tourist operation. However, these economic impacts to tourism would be somewhat mitigated or compensated for by increased tourism from military personnel.

Increased Operation-Related Business and Leisure Travel: Tourism organizations and hoteliers were surveyed to collect data on this proposed action. These organizations stated that past carrier visits have always contributed positively to their occupancy levels, as friends and families fly to Guam to visit the off-duty personnel. They welcome the prospect of more carrier operations for this reason. Historically, there have also been positive economic impacts on ocean-based tourism. Dive companies fly instructors out to carriers to initiate basic instruction for open-water certifications (the entry-level step for novice scuba divers), allowing what is normally a week-long process to be completed during the Sailors' time on Guam.

Impacts on Ocean-Based Tourism within Apra Harbor from More Population and Competition: Positive effects on ocean-based tourism volume would be countered by the prospect of increased congestion in the Apra Harbor area. Tourism-based companies such as commercial submarines utilize a mooring at the Port Authority of Guam, but utilize submerged lands and resources within Naval Base Guam for their operations. Guam's two major dive companies, as well as many of the smaller ones, launch their boats out of Apra Harbor and dock at Port Authority of Guam small boat basin. Military and tourist operations have conflicted in the past. Increases in military operations may increase this conflict.

Impacts on Hotels from Timing of Large-Scale Exercises: Large-scale military exercises do not necessarily involve aircraft carriers but often do. An issue set forth by some industry representatives (Guam Chamber of Commerce 2008) is that active-duty military personnel on Guam on temporary orders are exempt from hotel occupancy taxes when their stay at the hotel is strictly related to their military duties. This generally only occurs when transient billeting onboard military installations exceeds capacity. During these infrequent exercises, military personnel who qualify for tax exempt status may displace tourists who are required to pay the occupancy tax. The relative importance of this for the industry and for GovGuam depends on the season. It is problematic in the peak tourist seasons, but less so in the industry's off-peak seasons, such as spring.

16.2.2.3 Public Services Impacts

Refer to the corresponding section of Volume 2 for introductory statements.

The primary input for estimating staffing impacts during the operational phase was the permanent population associated with economic spin-offs from the increased number of carrier in-port days, not the increased presence of transient personnel. The latter factor might conceivably impact only a relatively small number of GovGuam agencies, such as police or some health agencies. Such possibilities were determined through interviews because of the lack of specific data.

Public Education

Refer to the corresponding section of Volume 2 for introductory statements, approach to analysis (including data sources) and qualitative analysis.

Table 16.2-12 and Table 16.2-13 provide an overview of the proposed action's impacts on Guam Public School System (GPSS) staffing for the action's peak year and steady-state.

Table 16.2-12. GPSS Student Population Impacts Summary

Agency	*Baseline Service Population*	*Peak Year*	*Peak Year Additional Service Population*	*Peak Year Percentage Increase*	*Steady Additional Service Population (going forward)*	*Steady Requirements Percentage Increase*
GPSS Elementary	14,436	2014	98	<1%	34	<1%
GPSS Middle	6,887	2014	41	<1%	14	<1%
GPSS High	9,661	2014	55	<1%	19	<1%

Table 16.2-13. Primary and Secondary Education Teacher Requirements Impacts Summary

Agency	*Baseline Teacher Numbers*	*Peak Year*	*Peak Year Additional Teacher Requirements*	*Peak Year Percentage Increase*	*Steady State Additional Teacher Requirements (going forward)*	*Steady Requirements Percentage Increase*
GPSS Elementary	1,035	2014	7	<1%	2	<1%
GPSS Middle	504	2014	3	<1%	1	<1%
GPSS High	514	2014	3	<1%	1	<1%

Table 16.2-14 and Table 16.2-15 provide an overview of the proposed action's impacts on Guam Community College (GCC) and University of Guam (UoG) student populations and non-adjunct faculty requirements for the action's peak year and steady-state.

Table 16.2-14. Higher Education Student Population Impacts Summary

Agency	*Baseline Service Population*	*Peak Year*	*Peak Year Additional Service Population*	*Peak Year Percentage Increase*	*Steady Additional Service Population (going forward)*	*Steady Requirements Percentage Increase*
GCC	1,806	2014	13	<1%	4	<1%
UoG	3,282	2014	23	<1%	8	<1%

Table 16.2-15. Higher Education Faculty Requirement Impacts Summary

Agency	*Baseline Non-adjunct Faculty Numbers*	*Peak Year*	*Peak Year Additional Non-adjunct Faculty Requirements*	*Peak Year Percentage Increase*	*Steady State Additional Non-adjunct Faculty Requirements (going forward)*	*Steady Requirements Percentage Increase*
GCC	100	2014	1	<1%	<1	<1%
UoG	185	2014	1	<1%	<1	<1%

<u>Public Health and Human Services</u>

Refer to the corresponding section of Volume 2 for introductory statements, approach to analysis (including data sources) and qualitative analysis.

Table 16.2-16 provides an overview of the proposed action's impacts on Guam Memorial Hospital Authority (GMHA), Guam Department Public Health and Social Services (GDPHSS), Guam Department of Mental Health and Substance Abuse (GDMHSA) and Guam Department of Integrated Services for Individuals with Disabilities (GDISID) service populations for the action's peak year and steady-state.

Table 16.2-16. Impact on Public Health and Human Services, Service Population Summary

Agency	*Baseline Service Population*	*Peak Year*	*Peak Year Additional Service Population*	*Peak Year Percentage Increase*	*Steady Additional Service Population (going forward)*	*Steady Requirements Percentage Increase*
GMHA	160,797	2014	1,478	<1%	386	<1%
GDPHSS	65,954	2014	554	<1%	145	<1%
GDMHSA	65,954	2014	545	<1%	145	<1%
GDISID	169,209	2014	1,478	<1%	368	<1%

Table 16.2-17 provides an overview of the proposed action's impacts on various public health and human services agency staffing requirements for the action's peak year and steady-state.

Table 16.2-17. Public Health and Human Services Impact Summary

Agency and Staffing Type	*Baseline Staffing Numbers*	*Peak Year*	*Peak Year Additional Staffing Requirements*	*Peak Year Percentage Increase*	*Steady Additional Staffing Requirements (going forward)*	*Steady Staffing Requirements Percentage Increase*
GMHA Physicians	57	2014	<1	<1%	<1	<1%
GMHA Nurses and Allied Health Professionals	355	2014	3	<1%	1	<1%
GDPHSS - Primary Care Medical Providers and Nursing Staff	44	2014	<1	<1%	<1	<1%
GDPHSS – BCDC Communicable Disease Prevention Professionals	33	2014	<1	<1%	<1	<1%
GDPHSS - BFHNS Nurses	22	2014	<1	<1%	<1	<1%
GDMHSA – Mental Health Professionals	130	2014	1	<1%	<1	<1%
GDISID Social Workers and Counselors	14	2014	<1	<1%	<1	<1%

Public Safety Services

Refer to the corresponding section of Volume 2 for introductory statements, approach to analysis (including data sources) and qualitative analysis.

Table 16.2-18 provides an overview of the proposed action's impacts on Guam Police Department (GPD), Guam Fire Department (GFD), Guam Department of Corrections (GDoC), and Guam Department of Youth Affairs (GDYA) service populations for the action's peak year and steady-state.

Table 16.2-18. Impact on Public Safety Service Population Summary

Agency	*Baseline Service Population*	*Peak Year*	*Peak Year Additional Service Population*	*Peak Year Percentage Increase*	*Steady Additional Service Population (going forward)*	*Steady Requirements Percentage Increase*
GPD	160,797	2014	1,478	<1%	386	<1%
GFD	175,877	2014	1,660	<1%	386	<1%
GDoC	1,035	2014	7	<1%	1	<1%
GDYA	24,987	2014	149	<1%	52	<1%

Table 16.2-19 provides an overview of the proposed action's impacts on various public safety services agency staffing requirements for the action's peak year and steady-state.

Table 16.2-19. Public Safety Services Staffing Impacts Summary

Agency and Staffing Type	*Baseline Staffing Numbers*	*Peak Year*	*Peak Year Additional Staffing Requirements*	*Peak Year Percentage Increase*	*Steady Additional Staffing Requirements (going forward)*	*Steady Staffing Requirements Percentage Increase*
GPD – Police Officers	309	2014	3	<1%	1	<1%
GFD - Firefighters	190	2014	2	<1%	<1	<1%
GDoC – Custody and Security Personnel	188	2014	1	<1%	<1	<1%
GDYA – Youth Service Professionals	79	2014	<1	<1%	<1	<1%

<u>Other Selected General Services</u>

Refer to the corresponding section of Volume 2 for introductory statements, approach to analysis (including data sources) and qualitative analysis.

Table 16.2-20 provides an overview of the proposed action's impacts on Guam Department of Parks and Recreation (GDPR), Guam Public Library System (GPLS) and Guam Judiciary key staffing requirements for the action's peak year and steady-state.

Table 16.2-20. Impact on Other Selected General Service Agency Service Population

	Baseline Service Population Numbers	*Peak Year*	*Peak Year Additional Service Population*	*Peak Year Percentage Increase*	*Steady Additional Service Population Numbers (going forward)*	*Steady Service Population Percentage Increase*
GDPR, GPLS, and Judiciary Service Population	160,797	2014	1,478	<1%	386	<1%

Table 16.2-21 provides an overview of the proposed action's impacts on GDPR, GPLS and Guam Judiciary key staffing requirements for the action's peak year and steady-state.

Table 16.2-21. Other Selected General Service Agency Impacts Summary

Agency and Staffing Type	*Baseline Key Staffing Numbers*	*Peak Year*	*Peak Year Additional Key Staffing Requirements*	*Peak Year Percentage Increase*	*Steady Additional Key Staffing Requirements (going forward)*	*Steady Requirements Percentage Increase*
GDPR – General Staff	90	2014	<1	<1%	<1	<1%
GPLS – General Staff	28	2014	<1	<1%	<1	<1%
Judiciary - Judges	6	2014	<1	<1%	<1	<1%

<u>Growth Permitting and Regulatory Agencies</u>

Refer to the corresponding section of Volume 2 for introductory statements, approach to analysis (including data sources) and qualitative analysis.

Table 16.2-22 shows the estimated number of key professional staff required due to the proposed action. Absolute numbers in the table are low, but proportionate increases would be high or at least notable for a few agencies with small reported baseline levels. The peak requirement would represent a 26% increase in the Guam Department of Labor (GDoL) - Alien Labor Processing and Certification Division (ALPCD) baseline staffing level and 4% for the Coastal Management Program [CMP], with others ranging from 0% to 3%. After construction ends, the required staffing levels from 2017 on are all just 0% to 2% greater than baseline levels. Although a few agencies would be significantly affected, based on the criteria used for this analysis, the overall effect would be a less than significant impact for the proposed action alone, except in conjunction with the aggregate action.

Table 16.2-22. Additional Growth Permitting Staff Required

	2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
GDPW Permitting Staff	0.1	0.1	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
GDLM Permitting Staff	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GEPA Permitting Staff	1.1	1.1	1.6	1.5	1.0	0.1	0.1	0.1	0.1	0.1	0.1
CMP Permitting Staff	0.4	0.4	0.3	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1
GPA Permitting Staff	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GWA Permitting Staff	0.5	0.3	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0
GFD Permitting Staff	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GDPHSS - DEH Permitting Staff	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
GDPR - HPO Permitting Staff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GDoL - ALPCD Permitting Staff	0.0	0.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

16.2.2.4 Sociocultural Impacts

Refer to the corresponding section of Volume 2 for introductory statements.

Most sociocultural impacts would be due to the overall volume of the proposed action, not the unique attributes of any particular service (i.e., Marines, Navy, or Army). However, during the operation phase, the Navy component of the proposed action would be of a more concentrated nature than the Marine Corps component, as it consists of shore leave components. This would result in slightly different crime and social order impacts.

Social/Cultural Considerations

The increase in the numbers of port-days of CSG personnel on shore leave associated with the operational phase of the transient berthing of the CVN has the potential to have adverse sociocultural impacts. Overall, the occupational setting is one that is characterized by alternating periods of being at sea for lengthy periods of time experiencing "… intense activity, gruelingly long work hours …", followed by "…periods of recreation in U.S. or foreign ports" (Ames et. al. 2009). It is this period of recreation where Sailors tend to "blow off steam" (Russ and Ames 2006).

One important aspect of Navy shore leave is the consumption of alcoholic beverages. Young Sailors are often under the legal drinking age, and have a relative lack of drinking experience (Ames et. al. 2009). During deployment, Navy policy does not allow any drinking of alcohol onboard ship while at sea, except under certain tightly regulated situations. The docking of ships at ports for periods of "liberty" or "shore leave" often leads to heavy and/or binge drinking activities (Federman et al. 2000), and anecdotal evidence indicates that this is the case currently when carriers dock at Guam's port (GDYA Interview – Appendix D).

Finally, although quantitative measures of the current impact of Navy shore leave on Guam's crime and social order environment were not available, GovGuam agency interviews suggested that any increase in port-days or number of Sailors on shore leave on Guam would require additional enforcement from both civilian and military public safety agencies (GDoC, GPD, and U.S. Naval Security Interviews – Appendix D). The Public Safety Services impact section of this study provides additional discussion of this topic.

Chamorro Issues

Refer to the corresponding section of Volume 2.

Community Cohesion

Refer to the corresponding section of Volume 2 for general discussion.

There remains a measure of community apprehension about the increased pulses of Sailors arriving on Guam for shore leave and how their presence might cause discomfort in the community. Most of the community apprehension comes from uncertainties regarding possible changes in the sociocultural framework of Guam because of the influx of the 18 to 45 age group. The ultimate impact on community cohesion that might occur would be dependent on how successful intercultural education programs are in mitigating this apprehension.

16.2.3 Summary of Impacts

The impacts in this chapter are calculated under a scenario that assumes there would be no constraints (blockages) to the rapid development of spin-off private-sector economic activity driven by the military construction and permanent military operational stages. Most impacts would be characterized by a burst of activity and impacts in the 2013-2014 timeframe, followed by relatively much lower impacts when only permanent operations (increased number of port-days) are implemented.

16.2.3.1 Population Impacts

Although there would be no permanent transfer of active-duty Navy personnel and dependents, the economic spin-off activity from the proposed action would add about 1,480 residents to Guam's population at the 2012 construction peak and a subsequent more stable population of about 390 during the operational period.

16.2.3.2 Economic Impacts

Most long-term economic benefits would clearly be beneficial though small. The construction activity for the aircraft carrier berth would contribute to less than significant population influx and housing demand.

Including all the spin-off activity, the proposed action would provide jobs for about 1,100 civilian workers at the 2012-13 peak and 230 on a more permanent basis. Guam residents are estimated to capture about 90 of the direct on-site construction jobs for aircraft carrier berthing facilities at the 2012 peak, as well as approximately 70 spin-off jobs that year and a more permanent 200 jobs a few years thereafter.

Cost of living increases, particularly during the construction phase, would negatively affect households on fixed incomes, though other households would benefit from rising wages; however, this would come more from the Apra Harbor construction's additive effects to other military actions than this Naval action alone.

Although a more detailed fiscal impact assessment would be done by GovGuam using output from this EIS/OEIS, preliminary estimates in this chapter suggest revenues from the three most important tax sources: gross receipts, corporate income, and personal income, would exceed $9.5 million in 2012-2013 and stabilize at about $1.9 million thereafter.

Civilian housing unit demand would peak at about 290 units in 2012, falling to about 100 for the operational period.

Guam construction businesses are expected to benefit from various opportunities.

Tourism would be positively impacted as there would be more days that aircraft carrier personnel book hotel rooms for themselves and/or visiting family members, although some industry leaders are concerned that timing of exercises during the industry's peak season could displace tourists who pay hotel taxes. Many military personnel are exempt from these taxes.

Guam's GIP, the total market value of all final goods and services produced in a given year, would see a beneficial increase of $28 million (2008 dollars) in the 2012-13 construction peak and about $13 million a year from 2015.

16.2.3.3 Public Service Impacts

GovGuam's public service agencies would generally need to make only minor staffing increases to service new population associated with the proposed action alone, though the impacts would be more notable during the construction timeframe. Most of these agencies would need to expand their services and staff slightly during the 2012-2013 peak, and then cut them back as construction ends.

For public education services, the GPSS, GCC and UoG together would need to hire a combined 15 teachers/faculty for the 2012-13 construction peak, falling to a combined five after construction ends.

For health and human services, this chapter considered impacts on various aspects of GMHA, GDPHSS, GDMHSA, and GDISID. These agencies would need a combined six new key professional workers for 2012-13, dropping to a combined two for 2015.

Public safety agencies: Police, Fire, Corrections, and Youth Affairs would also require a combined seven key professionals in 2012-13, falling to a combined two for 2015.

Other selected general service agencies: Parks and Recreation, Libraries, and the Judiciary would require a combined one key professional in 2012-13, falling to less than one after construction ends.

Other agencies that deal with permitting and regulating growth are affected more by the initial requests for permits and then subsequent inspections and monitoring. Development permitting agencies on Guam would experience very low increases in demands for their services because the amount of housing and commercial space needed to serve this small population and employment increment would be below the existing stock of vacancies. GEPA and ALPCD (these agencies process H-2B worker permits, not developer permits) would be the only agencies whose increased workloads would peak at more than one FTE (about 1.5, and 1, respectively).

16.2.3.4 Sociocultural Impacts

The limited construction activity related to this component of the proposed action would likely not have significant impacts on the local community.

In terms of assessing the possible impacts of the operational phase of the component, data on the current impacts of aircraft carrier berthing on the island's crime and social order, or community cohesion are not available. Studies of Naval shore leave behavior, however, indicate possible impact on these areas, especially as they are related to excessive alcohol consumption or irresponsible sexual activity. There is also potential for increased fighting between different branches of the military.

The long-term impacts of increased shore days taken would depend on how much military security increases the amount of shore patrol during times of aircraft carrier berthing, as well as how effectively civilian and military security agencies collaborate.

The greatest driver for impacts on the Chamorro community on Guam would be the potential surges of populations that are not familiar with the Chamorro culture on the island of Guam.

Table 16.2-23 provides a summary assessment of the potential impacts of each action alternative and the no-action alternative. Some topics are seen as inherently mixed (as indicated by the SI/BI designation). In addition, a text summary follows.

Table 16.2-23. Summary of Impacts

Impact Area	*Alternatives 1 and 2*
Population	LSI • Less than significant direct and indirect impacts – of mixed beneficial/adverse nature – due to construction effects peaking at 1,478 additional population in 2012 and final operational impacts of 386 civilian population; also, increase of up to 47 port-days during when up to 7,200 transient personnel would be present on Guam.
Civilian Labor Force Demand	BI • Beneficial impacts due to provision of permanent jobs on Guam.
Civilian Labor Force Income	BI • Significant beneficial impacts due to permanent infusion of income into the Guam economy.
Standard of Living	NI • No significant impact from the proposed action construction or operation.
Selected Local Government Revenues	BI • Significant beneficial impacts due to increase in local government revenue.

Impact Area	*Alternatives 1 and 2*
Civilian Housing Demand	LSI • Less than significant direct and indirect impact of demand for civilian (private-market, excluding temporary construction workforce housing) housing units peaking at 813 units in 2014, with permanent operational demand for 147 civilian housing units from 2016 on (Note: combined total impact peaks in 2015 at demand for 920 units).
Gross Island Product	BI • Significant operational phase beneficial impacts due to permanent increased GIP strengthening the Guam economy.
Local Business Opportunities	BI • Beneficial impacts due to increased military service contract opportunities for local Guam businesses.
Tourism	BI • Mixed set of diverse impacts due to various factors. On balance, the beneficial impacts are expected to outweigh the adverse impacts.
Public Service Agencies Influenced by Population Increases	LSI • Public service agencies would see increased service populations but these impacts, for the most part, represent less than a 1% increase over current service populations.
Growth Permitting and Regulatory Agencies	LSI • Less than significant construction-related adverse impacts due to difficulty in meeting fluctuating staffing requirements with an existing environment of staffing and budget shortfalls and recruitment complications.
Crime and Social Order	SI- M • Potential direct and indirect significant adverse impacts due to increased overall crime, prostitution, and substance abuse – though of unpredictable magnitude and possibly just related to population increases rather than to actual increased rates of offenses.
Chamorro Issues	NI • No impacts from the proposed project alone.
Community Cohesion	SI-M • Little or no construction impact, but mixed set of direct and indirect significant beneficial impacts and adverse impacts, with outcome dependent on success of standard law enforcement programs and education of personnel prior to port stops.

Legend: BI = Beneficial impact; SI = Significant (adverse) impact; SI-M = Significant impact mitigable; LSI = Less than significant impact; NI = No impact

16.2.4 No-Action Alternative

The assumed no-action alternative is that all parts of the aggregate action, not just the proposed action covered in this Volume, but also other components addressed in other Volumes would not occur. Therefore, the no-action conclusions given below are identical to those in Volume 2 for the Marine Corps relocation and/or Volume 7 for the aggregate action. The references below to substantial impacts with the proposed action would in fact apply more to those Volumes than to this Volume 4 covering the CVN action, as CVN impacts alone sometimes would not attain significance.

Unlike physical resources, socioeconomic systems do not tend to remain completely at baseline conditions if a proposed action is not implemented. Economies and population levels change due to other reasons as well. The various foregoing exhibits showing baseline trends for economic and demographic variables indicate long-term trends expected to continue without the proposed action, and Volume 7 lists a number of specific socioeconomic changes expected to occur independent of the proposed action. Furthermore, the announcement of the proposed action has already had socioeconomic consequences, such that a 2010 decision not to follow through on the military buildup would have short-term effects associated with a reversal of those existing consequences.

16.2.4.1 Population/Economic Impacts

In the short term, a decision not to implement the proposed action would deflate any current speculative activity attributable the proposed action. Real estate values in particular would likely drop, hurting investors but increasing the affordability of housing. The contrast between the business community's expectations and a negative Record of Decision would likely produce a period of pessimism about Guam's economic future, especially if the current national and international economic crisis has not yet abated. These effects, though, would be attributable to an unstable world economic landscape and poor decision making by investors – not to the proposed action.

Long term, the island's prospects would remain linked to international economic conditions and the health of its tourism industry. Conceivably, a smaller military profile might remove some barriers to growing the potential Chinese tourism market. Growth would resume, though probably with the same volatility experienced in recent decades.

16.2.4.2 Public Service Impacts

In the case of the no-action alternative, the specific agencies discussed earlier in this chapter would not face the listed pressures to expand professional staffing, and agencies involved in planning and regulating growth would not experience such a sharp increase in workload. Although this was not specifically covered in the foregoing analysis, it may also be noted that agencies that are required to implement major infrastructure developments, such as the ports and highways, would have substantially more time to implement long-term plans rather than having to achieve much of their objectives over the next few years.

However, at the broader level, the no-action alternative and the elimination of prospective long-term revenues expected from the proposed action still would leave GovGuam agencies in the difficult financial condition described in Volume 2, Section 16.22.11. At least for the foreseeable future, this would negatively impact the various service agencies because of budget cuts, and would probably represent the most important overall consequence for GovGuam.

16.2.4.3 Sociocultural Impacts

Crime rates would be likely to rise in the short term to the extent that Guam experiences recession (Pugh 2009). The political importance of some Chamorro issues would likely recede as the militarization of Guam is stabilized at something close to present levels. Military-civilian relations would likely remain at the current generally positive level.

The incentive for increased in-migration from the Freely Associated States of Micronesia (FAS) would decrease, reducing sociocultural issues associated with assimilating that population. However, the current incentives for providing those populations, both on Guam and the Micronesian states themselves, would also be lessened, with detrimental implications for those populations.

16.2.5 Summary of Potential Mitigation Measures

A review of the above impacts shows that the proposed action has the potential to have primarily beneficial socioeconomic impacts on Guam. Sociocultural impacts have the potential to be significantly adverse, but mitigable. For this reason the potential mitigations identified below are focused in the Sociocultural: Crime and Social Order and Community Cohesion arenas.

Table 16.2-24 summarizes potential mitigation measures.

Table 16.2-24. Summary of Potential Mitigation Measures

Impact Area	*Adverse Impacts*	*Potential Mitigation Measures*
Social/Cultural Considerations –Crime and Social Order, and Community Cohesion	• Potential direct and indirect significant adverse impacts due to increased overall crime, prostitution, and substance abuse – though of unpredictable magnitude and possibly just related to population increases rather than to actual increased rates of offenses • Little or no construction impact, but mixed set of direct and indirect significant beneficial impacts and adverse impacts, with outcome dependent on success of standard law enforcement programs and education of personnel prior to port stops	• To minimize the impact of the increase in military population, DoD would collaborate with GovGuam public safety agencies to develop a comprehensive and regular shore patrol system, and maintain a regular visible preventative presence. • Develop community outreach task forces aimed at addressing community crime and social order concerns. These task forces would provide ongoing review, improvement and implementation of military policies related to such offenses or concerns. Members of these task forces would partner with existing civilian groups with similar concerns to share information regarding current policies and programs. The task forces would also implement volunteer programs for military spouses and dependents to link them to long-term volunteer positions at these civilian groups or similar non-profit entities on Guam. • Assist GovGuam in seeking federal funding for collaborative efforts with FSM governments and relevant federal agencies to educate in-migrants on the laws and cultures of the Island of Guam, focused areas where there are known cultural differences. • Implement an orientation course on Guam local culture and history, designed in conjunction with the Guam Department of Chamorro Affairs, to be attended by all arriving active-duty DoD personnel and dependents. • Assist GovGuam in seeking federal funding for technical assistance to identify, translate and produce all necessary GovGuam informational brochures and materials likely to be accessed by in-migrant groups. • Minimize local community perceptions of separation of local resident and military communities. DoD will consider developing a mayoral outreach task force aimed at developing military-civilian relationships. The task force would work with each mayor and their staff to integrate military participation in existing cultural or recreational community events, expand on existing military outreach activities, and develop new civilian-military collaborative projects as determined by the task force and mayors.

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CHAPTER 17.
HAZARDOUS MATERIALS AND WASTE

17.1 INTRODUCTION

The potential impacts that hazardous materials and waste have is largely dependent upon their types, quantities, toxicities, and management practices. This chapter contains a discussion of potential environmental consequences associated with implementation of the alternatives within the region of influence under the proposed action. For a description of the affected environment for all resources, including current hazardous substance handling, storage, transportation, and management plans, techniques, approaches, and potential mitigation measures refer to the respective chapter of Volume 2 (Marine Corps Relocation – Guam). The locations described in that volume include the region of influence for the aircraft carrier berthing component of the proposed action (Apra Harbor), and the chapters are presented in the same order as the resource areas contained in this Volume.

17.2 ENVIRONMENTAL CONSEQUENCES

17.2.1 Approach to Analysis

17.2.1.1 Methodology

This section describes potential hazardous materials and waste impacts and potential mitigation measures as they relate to the proposed increase in the number of days for aircraft carrier berthing in Apra Harbor. This berthing is planned to be increased from an average of 16 to 63 days annually. Specifically, these impacts were assessed for the general public as well as various media (i.e., soils, surface water, groundwater, air, and biota) relative to offshore and onshore activities.

17.2.1.2 Determination of Significance

The determination of significance was based upon existing hazardous substance management practices, potential mitigation measures, and expected or potential impacts and environmental consequences with the planned actions. This determination evaluated the overall ability to mitigate or control environmental impacts and consequences to soils, surface water, groundwater, air, and biota. This determination considered current conditions and potential consequences relative to the anticipated ability of the hazardous substance management infrastructure system to accommodate added hazardous substance demand on the overall system. Specifically, for hazardous substances to be considered a significant impact, the following would have to occur:

- Leaks, spills, or releases of hazardous substances to environmental media (i.e., soils, surface water, groundwater, air, and/or biota) resulting in unacceptable risks to the environment
- Violation of applicable federal, state, or local laws or regulations regarding the transportation, storage, handling, use, or disposal of hazardous substances

17.2.1.3 Issues Identified During Public Scoping Process

Major issues identified during the public scoping process, which also involves input from regulatory stakeholders, included the desire to:

- Address management practices for hazardous substances including hazardous wastes, toxic substances, hazardous materials, and ordnance

- Describe the potential overall impacts of hazardous substances from construction and operation of proposed projects
- Identify the projected hazardous waste types and volumes
- Identify expected hazardous substance storage, disposal, and management plans
- Evaluate measures to mitigate generation of hazardous waste including pollution prevention
- Discuss how hazardous substances on land and from ships would be managed
- Discuss the potential for impacts to environmental media from spills, accidents, and/or releases of hazardous substances
- Identify existing installation restoration sites

17.2.2 Alternative 1 Polaris Point (Preferred Alternative)

17.2.2.1 Hazardous Materials

The proposed increase in aircraft carrier berthing days would result in increased opportunities for adverse environmental consequences related to petroleum, oils, and lubricants (POL) hazardous materials. POL includes gasoline, aviation fuels, diesel, oil and grease, kerosene, and other related products. It is expected that these products primarily would be used as part of ongoing operation and maintenance functions. The quantity of hazardous materials generated by these activities over a cumulative total of approximately 63 days per year is estimated to be 160 pounds (lbs) (73 kilograms [kg]).

Due to the projected increase in the volume of hazardous materials, Alternative 1 Polaris Point (referred to as Alternative 1) could result in an impact (i.e., to soils, surface water, groundwater, air, or biota). However, the increase in hazardous materials would be handled and disposed of per applicable regulations and best management practices (BMPs) (see Volume 7); therefore, the increase in volume would not result in significant impacts.

17.2.2.2 Toxic Substances

The primary toxic substances being addressed on Guam prior to any DoD expansion include: asbestos containing materials (ACM), lead-based paint (LBP), polychlorinated biphenyls (PCB), and radon. LBP and PCBs in Guam are transported by licensed transporters and disposed of in accordance with applicable federal, state, and local laws and regulations. ACM is disposed of at federal facilities on Guam. The collection, transportation, and disposal of these toxic substances is arranged for by the Defense Reutilization and Marketing Office (DRMO).

There would be negligible environmental consequences because in 1979, the USEPA banned most uses of PCBs and LBP was banned in 1978. In addition, ACM would not be generated during the increased aircraft carrier berthing events. If existing toxic substances are encountered during Alternative 1 activities, specialty contractors would be used to dispose of these substances in accordance with applicable laws and regulations. Therefore, toxic substances would not result in significant impacts as a result of Alternative 1 activities and no potential mitigation measures would be required.

17.2.2.3 Hazardous Waste

Increased days of aircraft carrier berthing would result in an increase in the transport and/or transfer of hazardous waste. Increases in the transport/transfer of solvents, adhesives, lubricants, corrosive liquids, aerosols, and other hazardous wastes would be expected. The volume of hazardous wastes generated from Alternative 1 activities is estimated to be 1,500 lbs (680 kg) per year. Due to this projected increase in the volume of hazardous waste generated, Alternative 1 could result in significant impacts (i.e., to soils, surface water, groundwater, air, or biota). However, the increase in hazardous waste would be handled and disposed of per applicable regulations and BMPs and SOPs (see Volume 7); therefore, the increase in volume would not result in significant impacts.

17.2.2.4 Radiological Material Operation

Emergency response, emergent repair and radioactive waste management capabilities exist at Polaris Point. There would be less than significant impacts on the existing operations, and the slight increases in hazardous substances would be managed in accordance with existing BMPs and SOPs. All radioactive waste management operations would be in conformance with Naval Sea Systems Command (NAVSEA) regulations. No radioactive waste would be brought ashore on Guam, therefore, these activities would result in a less than significant impact.

17.2.2.5 Summary of Alternative 1 Impacts

Table 17.2-1 summarizes Alternative 1 impacts.

Table 17.2-1. Summary of Alternative 1 Impacts

Area	*Project Activities*	*Project Specific Impacts*
Onshore	Construction	No significant adverse impacts to soils, surface water, groundwater, air, and/or biota related to construction activities
	Operation	No significant adverse impacts to soils, surface water, groundwater, air, and/or biota related to operation activities
Offshore	Construction	No significant adverse impacts to soils, surface water, groundwater, air, and/or biota related to construction activities
	Operation	No significant adverse impacts to soils, surface water, groundwater, air, and/or biota related to operation activities

17.2.2.6 Alternative 1 Potential Mitigation Measures

No potential mitigation measures are identified. Table 17.2-2 summarizes effects, impacts, and potential BMPs and SOPs related to Alternative 1.

Table 17.2-2. Hazardous Materials Consequences, BMPs, and SOPs

Potential Activity (Cause)	*Potential Effect*	*Potential Impacts*	*BMPs and SOPs*
• Hazardous materials associated with increased aircraft carrier berthing days	• Increased transport of hazardous materials to Guam • Increased hazardous materials transfer and use within Guam	• Spill or release impacts during transport/transfer between DoD locations resulting in increased risks of environmental media contamination (soil, surface water, and groundwater) • Adverse impacts and increased risks to human health and/or the environment including terrestrial and marine ecosystems	• Update/implement hazardous materials management plans and facility response plans • Update/implement spill prevention, control and countermeasure plans (training, spill containment and control procedures, cleanup, notifications, etc.). Also, ensure personnel are trained in accordance with spill prevention, control, and cleanup methods • Implement aggressive hazardous materials minimization plans that substitute hazardous materials for non-hazardous materials as applicable • Ensure DoD personnel are trained as to proper labeling, container, storage, staging, and transportation requirements for hazardous materials • As necessary, expand DRMO's hazardous materials storage, transportation, and disposal capacity prior to any expected increases • Verify through surveillance and inspections

Potential Activity (Cause)	Potential Effect	Potential Impacts	BMPs and SOPs
			full compliance with federal, local, and DoD laws and regulations and implement corrective actions as necessary

Legend: DRMO = Defense Reutilization and Marketing Office, HMMP = Hazardous Material Management Plan, SPCC = Spill Prevention Control and Countermeasures.

The BMPs and SOPs would be used to:

- Prevent, contain, and/or clean up spills and leaks to protect human health and the environment
- Provide personnel training and operational protocol and procedures to protect human health and the environment
- Ensure DMRO ability to properly manage and dispose of anticipated hazardous materials
- Protect overall human health, welfare, and the environment

Table 17.2-3 summarizes potential hazardous waste impacts associated with proposed increased berthing. No potential mitigation measures are identified; however, BMPs and SOPs would be used to reduce the possibility of hazardous waste impacts.

Table 17.2-3. Hazardous Waste Consequences, BMPs, and SOPs

Potential Activity (Cause)	Potential Effect	Potential Impacts	BMPs and SOPs
Hazardous waste transport to Guam and transfer within Guam	• Increased transport of hazardous waste to Guam	• Spill or release impacts during transport/transfer between DoD locations resulting in increased risks of environmental media contamination (soil, surface water, and groundwater) • Adverse impacts and increased risks to human health and/or the environment including terrestrial and marine ecosystems	• Update/implement hazardous waste management programs and facility response plans • Update/implement spill prevention, control and countermeasure plans (training, spill containment and control procedures, cleanup, notifications, etc.) Also, ensure personnel are trained in accordance with spill prevention, control, and cleanup methods • Ensure DoD personnel are trained as to proper labeling, container, storage, staging, and transportation requirements for hazardous waste • Implement aggressive hazardous waste minimization plans that substitute hazardous waste for non-hazardous waste as applicable • As necessary, expand DRMO's hazardous materials storage, transportation, and disposal capacity prior to any expected increases • Verify through surveillance and inspections full compliance with federal, local, and DoD laws and regulations and implement corrective actions as necessary

Legend: DRMO = Defense Reutilization and Marketing Office, HMMP = Hazardous Materials and Management Plan, SPCC = Spill Prevention Control and Countermeasures.

The BMPs and SOPs would be used to:

- Prevent, contain, and/or clean-up spills and leaks to protect human health and the environment
- Provide personnel training and operational protocol and procedures to protect human health and the environment
- Ensure DMRO ability to properly manage and dispose of anticipated hazardous waste
- Protect overall human health, welfare, and the environment

17.2.3 Alternative 2 Former Ship Repair Facility (SRF)

The potential increased opportunity for adverse impacts relative to hazardous materials, toxic substances, and hazardous waste primarily would be a function of the number of aircraft berthing days and not a function of the various berthing options. Variances between the alternatives would result in negligible differences in the overall potential hazardous substance impacts.

17.2.3.1 Summary of Alternative 2 Impacts

Refer to Alternative 1 above for an assessment of potential impacts that are applicable to Alternative 2 Former SRF (referred to as Alternative 2.)

17.2.3.2 Alternative 2 Potential Mitigation Measures

Refer to Alternative 1 above for an assessment of potential mitigation measures that are applicable to Alternative 2.

17.2.4 No-Action Alternative

The no-action alternative means that there would be no increase in aircraft carrier visits and the current tempo would continue at Kilo Wharf. Hazardous materials and wastes, toxic substances, and emergency response to radioactive incidents would be comparable to the action alternatives, but the volume of waste generated would be less.

17.2.5 Summary of Impacts

Table 17.2-4 summarizes the potential impacts of each action alternative and the no-action alternative. A text summary is provided below.

Table 17.2-4. Summary of Impacts

Alternative 1	*Alternative 2*	*No-Action Alternative*
Soils, Surface Water, Groundwater, Air, and/or Biota Impacts		
LSI • No significant adverse impacts are anticipated • As with all operations using hazardous substances, there is a possibility for an inadvertent leak, spill, or release • BMPs and SOPs would keep the frequency and magnitude of the potential leaks, spills, and releases low	LSI • No significant adverse impacts are anticipated • As with all operations using hazardous substances, there is a possibility for an inadvertent leak, spill, or release • BMPs and SOPs would keep the frequency and magnitude of the potential leaks, spills, and releases low	NI • No impacts

Legend: LSI = less than significant impact; NI = no impact.

The proposed increase in aircraft carrier berthing days would result in increased opportunities for adverse environmental impacts. These potential impacts could occur due to increased transportation, handling, use, and disposal of hazardous materials and hazardous wastes. However, there are various controls in place to prevent unintended releases of these substances. These controls include:

- Spill prevention control and countermeasures plans
- Facility response plans
- Waste management plans
- Stormwater pollution prevention plans
- Hazardous material/waste management plans (e.g., asbestos management plans and lead-based management plans, etc.)
- Mandatory personnel hazardous material and hazardous waste training
- Waste minimization plans
- Waste labeling, storage, packaging, staging, and transportation procedures
- DoD waste regulations
- Federal and territorial laws and regulations

Despite expected increases in hazardous materials and hazardous wastes, no significant impacts are anticipated as long as the controls discussed above are properly implemented and related plans and procedures updated and modified as appropriate to meet the potential increased demand upon DRMO regarding hazardous substance transportation, handling, storage, use, and disposal.

17.2.6 Summary of Potential Mitigation Measures

No potential mitigation measures are identified. Table 17.2-5 summarizes the BMPs and SOPs that would be used for both offshore and onshore aircraft carrier activities.

Table 17.2-5. Summary of BMPs and SOPs

Alternative 1	*Alternative 2*
Onshore and Offshore Activities	
• Update/implement HMMP's and HWMP's. • Update/implement facility response plans. • Update/implement SPCC plans (training, spill containment and control procedures, clean up, notifications, etc.). • Ensure DoD personnel are trained as to proper labeling, container, storage, staging, and transportation requirements for hazardous substances. Also, ensure they are trained in accordance with spill prevention, control, and clean-up methods. • Implement aggressive hazardous waste minimization plans that substitute hazardous waste for non-hazardous or less toxic waste as applicable and use LEEDS criteria. • As necessary, expand DRMO's sufficient hazardous materials storage, transportation, and disposal capacity prior to any expected increases. • Verify through surveillances and inspections that federal, local, and DoD laws and regulations are being observed and implement corrective actions as necessary. • Minimize the risk of uncontrolled spills and releases through industry accepted methods for spill prevention, containment, control, and abatement.	• Update/implement HMMP's and HWMP's. • Update/implement facility response plans. • Update/implement SPCC plans (training, spill containment and control procedures, clean up, notifications, etc.). • Ensure DoD personnel are trained as to proper labeling, container, storage, staging, and transportation requirements for hazardous substances. Also, ensure they are trained in accordance with spill prevention, control, and clean-up methods. • Implement aggressive hazardous waste minimization plans that substitute hazardous waste for non-hazardous or less toxic waste as applicable and use LEEDS criteria. • As necessary, expand DRMO's sufficient hazardous materials storage, transportation, and disposal capacity prior to any expected increases • Verify through surveillances and inspections that federal, local, and DoD laws and regulations are being observed and implement corrective actions as necessary. • Minimize the risk of uncontrolled spills and releases through industry accepted methods for spill prevention, containment, control, and abatement.

Legend: HMMP = Hazardous Materials Management Plan; HWMP = Hazardous Waste Management Plan

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CHAPTER 18.
PUBLIC HEALTH AND SAFETY

18.1 INTRODUCTION

This chapter contains a discussion of the potential environmental consequences associated with implementation of the alternatives within the region of influence for public health and safety. For a description of the affected environment for all resources, refer to the respective chapter of Volume 2 (Marine Corps Relocation – Guam). The locations described in that Volume include the region of influence for the aircraft carrier berthing component of the proposed action (Apra Harbor), and the chapters are presented in the same order as the resource areas contained in this Volume.

Under the proposed action for a transient aircraft carrier wharf, there would be a cumulative total of up to 63 visit days per year, with an anticipated length of 21 days or less per visit. To provide some additional background information on operational requirements of a nuclear powered aircraft carrier, a discussion of radiological substances is provided below for these types of vessels. Environmental consequences of the proposed action are discussed in Section 18.2.

18.1.1 Radiological Substances

The Final Environmental Impact Statement for the proposed homeporting of additional surface ships at Naval Station Mayport, FL (NAVFAC 2008) was used to supply background information regarding radiological concerns relative to nuclear powered warships.

Nuclear aircraft carriers that would visit Guam include Nimitz Class (CVN 68) and Ford Class (CVN 78) vessels. The source of energy for powering a Naval nuclear ship originates from fissioning uranium atoms within a reactor core. Pressurized water circulating through a closed primary piping system transfers heat from the reactor core to a secondary steam system isolated from the reactor cooling water. The heat energy is then converted to mechanical energy to propel the ship, and provides electrical power to the rest of the ship. Nuclear propulsion provides virtually unlimited high-speed endurance without dependence on tankers and their escorts.

18.1.1.1 Naval Nuclear Propulsion Program

The Naval Nuclear Propulsion Program (NNPP) regulates radioactivity associated with Naval nuclear propulsion work. The policies of the NNPP are applied consistently to all locations where nuclear powered ships are berthed or maintained. The NNPP is a joint Navy/Department of Energy (DOE) organization responsible for all matters pertaining to Naval nuclear propulsion pursuant to Presidential Executive Order (EO) 12344 and Public Law 98-525 (42 United States Code [USC] 7158).

Because radioactive material is an inherent by-product of the nuclear fission process, its control has been a central concern for the NNPP since its inception. All features of design, construction, operation, maintenance, and personnel selection, training, and qualification have been oriented toward minimizing environmental effects and ensuring the health and safety of workers, ships' crew members, and the public. Conservative reactor safety design has been a hallmark of the NNPP.

The history of safe operation of the Navy's nuclear powered ships is a matter of public record. This record shows a long history of the NNPP's activities having no adverse effect on the environment or public health. Environmental monitoring results published yearly provide a comprehensive description of environmental performance for all NNPP facilities. This record confirms that the procedures used by the

Navy to control radioactivity from United States (U.S.) Naval nuclear powered ships are effective in protecting the environment and the health and safety of Sailors, workers, and the general public.

NNPP reactor designs receive independent evaluations from the Nuclear Regulatory Commission and the Advisory Commission on Reactor Safeguards. These reviews are conducted as a means to provide confirmation and added assurance that nuclear propulsion plant design, operation, and maintenance pose no undue risk to public health and safety.

Key radiological control practices used by the NNPP to provide assurance that positive control of radioactivity is maintained include the following.

- A radioactive materials accountability system is used to ensure that no radioactive material is lost or misplaced.
- All radioactive materials are specially packaged, sealed, and tagged with yellow and magenta tags bearing the standard radiation symbol and the measured radiation level. The use of yellow packaging material is reserved solely for radioactive material.
- Access to radiological facilities is controlled by trained radiological control personnel. In addition, all personnel entering radiological work and storage areas are required to wear dosimetry devices.
- Only specially trained personnel are authorized to handle radioactive materials.
- Radiological surveys are conducted by qualified radiological control personnel inside and outside of facilities and ships where radiological materials are handled. This is a check to verify that the methods used to control radioactivity are effective.
- Written procedures are used to perform all radiological work.
- Radioactive material or radioactive waste transported off-site is packaged and shipped per Department of Transportation regulations. Specially trained personnel accomplish this function.
- Technical problems encountered during radiological work are documented and corrected before work is allowed to continue.

The safety record of U.S. Naval nuclear propulsion plants aboard nuclear powered warships is well known; there has never been a reactor accident in over 50 years since the first Naval reactor began operation, a record comprising over 5,900 reactor-years of experience. There has never been any release of radioactivity that has had an adverse effect on the public or the environment.

18.1.1.2 Emergency Preparedness

Naval reactors are designed and operated in a manner that is protective of the crew, the public, and the environment. All NNPP activities have plans in place that define NNPP responses to a wide range of emergency situations. These plans are regularly exercised to ensure that proficiency is maintained. These exercises consistently demonstrate that NNPP personnel are well prepared to respond to emergencies regardless of the location. Actions are taken to continually evaluate and improve emergency preparedness at all NNPP activities.

If there ever were a radiological emergency, civil authorities would be promptly notified and kept fully informed of the situation. With the support of NNPP personnel, local civil authorities would determine appropriate public actions, if any, and communicate this information via their normal emergency communication methods.

Pursuant to Section 8506(7) of the Government Code of Guam, the Governor shall utilize the services and facilities of existing Government of Guam (GovGuam) agencies for the purposes of responding to all phases of any emergency or disaster. The Guam Emergency Response Plan outlines the procedures and responsibilities for responding to any emergency or disaster. The Plan incorporates the National Incident Management System of operation, which entails an organized response to emergency situations utilizing the services and resources of all GovGuam agencies. Each GovGuam agency has specific roles and responsibilities. Some would be primary responders or lead agencies, while others would provide support to the response effort lending manpower, staff resources, and supplies and equipment to meet the needs of the emergency. The Unified Command of all organizations addressing these functions would be located at the Emergency Operations Center at the Office of Civil Defense (GovGuam 2005).

Due to the unique design and operating conditions of U.S. nuclear powered ships, civil emergency response plans that are sufficient for protecting the public from industrial and natural events (e.g., chemical spills or typhoons) are also sufficient to protect the public in the unlikely event of an emergency onboard a nuclear powered ship. Response plans have been a part of the Guam emergency management planning for over 50 years as Navy nuclear power ships have traditionally been stationed in Inner Apra Harbor.

18.2 ENVIRONMENTAL CONSEQUENCES

18.2.1 Approach to Analysis

18.2.1.1 Methodology

Potential effects to public health and safety from implementation of the proposed aircraft carrier berthing alternatives were derived based upon information detailed in the descriptions of each alternative. Public health and safety concerns were addressed based on anticipated changes in the population of Guam, both from natural increases and from military personnel and their dependents moving to Guam. Average per capita incidents for notifiable diseases, mental illness, and traffic accidents were used to calculate the potential increase in these incidents as a result of the aircraft carrier berthing alternatives. Safety of construction workers would be the same as outlined in Volume 2. Proposed construction activities supporting aircraft carrier berthing activities would be conducted in accordance with federal and local safety guidelines to ensure a safe work environment.

With construction activities, there is a potential for standing water and water based vectors such as mosquitoes and related diseases. Most mosquitoes require quiet, standing water or moist soil where flooding occurs to lay their eggs. Removal of standing water sources and/or promotion of drainage would eliminate potential breeding sites. To limit the amount of standing water at construction sites, stagnant water pools, puddles, and ditches would be drained or filled; containers that catch/trap water (e.g., buckets, old tires, cans) would be removed; and if necessary, pesticide application (e.g., *Bacillus thuringensis*) could be used to help control mosquitoes. Implementing these best management practices (BMPs) would reduce the opportunities for an outbreak of water-related diseases.

Public health and safety concerns from proposed aircraft carrier berthing activities result primarily from ground disturbing and nearshore dredging activities. Public health and safety concerns to be addressed in this Volume are related to environmental/social safety (including noise, water quality, air quality, hazardous substances, health care services, and public services), unexploded ordnance (UXO), and radiological substances.

18.2.1.2 Determination of Significance

Factors considered in determining whether an alternative would have a significant public health and safety impact include the extent or degree to which implementation of the proposed aircraft carrier berthing alternatives would subject the public to an increased risk of contracting a disease or experiencing personal injury.

18.2.1.3 Issues Identified during Public Scoping Process

The following analysis focuses on possible effects to public health and safety that could result from the proposal. As part of the analysis, concerns related to public health and safety that were mentioned by the public, including regulatory stakeholders, during the public scoping meetings were addressed. The following public health and safety concerns were raised during public scoping meetings regarding the proposed relocation of military personnel and their families to Guam:

- Potential increases in diseases including:
- Acquired Immune Deficiency Syndrome (AIDS)
- Cholera
- Dengue
- Hepatitis C
- Malaria
- Measles
- Rubella
- Tuberculosis
- Typhoid Fever
- Sexually Transmitted Diseases (STDs) other than AIDS
- Potential increases in mental illness
- Potential increases in traffic incidents
- Potential contact with UXO

18.2.2 Alternative 1 Polaris Point (Preferred Alternative)

18.2.2.1 Environmental/Social Safety

<u>Noise</u>

Construction and operational noise emissions associated with aircraft carrier berthing is discussed in Volume 4, Chapter 6. Although pile driving activities would generate high noise levels at the source, the noise level at the nearest receptor is well within acceptable limits. Noise impacts due to the aircraft carrier berthing would be less than significant.

<u>Water Quality</u>

Construction and operational activities associated with aircraft carrier berthing activities would be implemented in accordance with SOPs and BMPs, and in accordance with applicable regulations. Therefore, impacts to water quality from construction and operational activities would be less than significant.

<u>Air Quality</u>

As discussed in Volume 4, Chapter 5, increased pollutants associated with construction and operational activities associated with aircraft carrier berthing would be less than significant. Although increased emissions would be less than significant, construction and operational activities would result in a measured increase in pollutant emissions, which could result in health impacts to individuals on Guam. Air pollution can harm individuals when it accumulates in the air in high enough concentrations. People exposed to high enough levels of certain air pollutants may experience:

- Irritation of the eyes, nose, and throat
- Wheezing, coughing, chest tightness, and breathing difficulties
- Worsening of existing lung and heart problems
- Increased risk of heart attack

In addition, long-term exposure to air pollution can cause cancer and damage to the immune, neurological, reproductive, and respiratory systems. In extreme cases, it can even cause death.

Some groups of people are especially sensitive to common air pollutants such as particulates and ground-level ozone. Sensitive populations include children, older adults, people who are active outdoors, and people with heart or lung diseases, such as asthma (Massachusetts Department of Environmental Protection [MDEP] 2009).

It is anticipated that Guam clinics and hospital would increase staffing to meet current health care service ratios and would be capable of handling a potential increase in air quality-related illnesses; therefore, less than significant impacts would be anticipated as a result of increased emissions from construction and operational activities.

Hazardous Substances

Activities associated with aircraft carrier berthing would result in an increase in the use, handling, storage, transportation, and disposition of hazardous substances. These activities would be conducted in accordance with applicable hazardous material and waste regulations, and established BMPs and SOPs to ensure the health and safety of workers and the general public is maintained. BMPs and SOPs include:

- Implementing Hazardous Materials Management Plans
- Implementing Facility Response Plans
- Implementing Spill Prevention Control and Countermeasures plans (training, spill containment and control procedures, clean up, notifications, etc.) and ensuring personnel are trained in accordance with spill prevention, control, and cleanup methods
- Implementing hazardous materials minimization plans
- Ensuring DoD personnel are trained as to proper labeling, container, storage, staging, and transportation requirements for hazardous materials
- Ensuring that DRMO has sufficient hazardous materials storage, transportation, and disposal capacity prior to any expected increases
- Verifying full compliance with federal, local, and DoD laws and regulations and implement corrective actions as necessary

Because hazardous substance management activities would be conducted in accordance with applicable regulations and established BMPs and SOPs, no impacts to public health and safety are anticipated.

Health Care Services

Volume 4, Chapter 16 discusses the impact of an increased patient to health care provider ratio as a result of population growth associated with the aircraft carrier berthing. It is anticipated that short- and mid-term medical staffing requirements would increase over current requirements as a result of increased population. During the peak construction year (2014) less than 1 additional doctor (<1% increase) and 3 additional nurses (<1% increase) would be required to maintain the current service ratios; the number of additional doctors would be less than 1 (<1% increase) and nurses drops to 1 (<1% increase) after construction activities are completed. These additional health care professionals would be hired in order to maintain current service ratios. Without corresponding increases in health care providers potential health and safety impacts could include:

- Longer wait/response times for patients
- Fewer or no available providers on island for chronic or acute issues
- Complications or death from delayed treatment, and/or
- Requirements for patients to travel off-island to receive adequate treatment

Because corresponding increases in doctors and nurses are anticipated to occur to maintain existing service conditions, no impact to health care services is anticipated.

Public Services

Police Service

Volume 4, Chapter 16 discusses staffing requirements for GPD necessary to cope with population increases associated with aircraft carrier berthing. It is anticipated that short- and mid-term GPD staffing requirements would increase over current requirements as a result of increased population. During the peak construction year (2014) the GPD would require 3 (<1% increase) additional officers to maintain the current service ratio; the number of additional officers drops to 1 (<1% increase) after construction activities are completed. The GPD would hire these additional personnel in order to maintain current service ratios. Without increases in police services (i.e., more police officers) to compensate for population increases, it would be expected that crime rates and police response times would also increase. As a result, the severity of consequences associated with crimes may worsen (i.e., there may be increased injury and or death associated with delayed police responses).

Because corresponding increases in GPD personnel are anticipated to occur to maintain existing service conditions, no impact to police service are anticipated.

Fire Service

Volume 4, Chapter 16 discusses staffing requirements for GFD necessary to cope with population increases associated with aircraft carrier berthing. It is anticipated that short- and mid-term GFD staffing requirements would increase over current requirements as a result of increased population. During the peak construction year (2014) the GFD would require 2 (<1% increase) additional firefighters to maintain the current service ratio; the number of additional firefighters drops to less than 1 (<1% increase) after construction activities are completed. The GFD would hire these additional personnel in order to maintain current service ratios. Without increases in fire protection services (i.e., more firemen, trucks and stations) to compensate for population increases, it is anticipated that response times to incidents would increase. As a result, increases in property damage and injuries/deaths could be expected.

Because corresponding increases in GFD personnel are anticipated to occur to maintain existing service conditions, no impact to fire service are anticipated.

18.2.2.2 Notifiable Diseases

Analysis of potential impacts from increased notifiable diseases is provided in Volume 2. Alternative 1 Polaris Point (referred to as Alternative 1) proposed aircraft carrier berthing activities would result in no impact to public health and safety from notifiable diseases.

18.2.2.3 Mental Illness

Analysis of potential impacts from increased mental illness is provided in Volume 2. Alternative 1 for proposed aircraft carrier berthing activities would result in no impact to public health and safety resulting from mental illness.

18.2.2.4 Traffic Incidents

Analysis of potential increases in traffic incidents is provided in Volume 2. Proposed aircraft carrier berthing activities are not anticipated to have an adverse effect on the health and safety of the citizens of Guam from traffic incidents.

The Navy has used focus group sessions with personnel at several bases to strategize potential measures to reduce the number of liberty incidents, including traffic incidents. Several common factors appear to contribute to liberty incidents including young personnel, late nights, impaired driving, and alcohol/drugs. Some of the measures that would be implemented to reduce traffic incidents during liberty include:

- Increase awareness training regarding the consequences of drugs and alcohol use
- Increase awareness and enforcement by military law enforcement personnel targeting operation of motor vehicles under the influence
- Use of the inter-service disciplinary control board for review of requests to declare specific off-base bars/clubs “off-limits” to military personnel
- Increase community policing efforts to include appropriate use of Shore Patrol activity to reduce alcohol related injuries
- Continued use of free shuttle bus runs to/from town
- Restrictions on obtaining rental of vehicles by age and command restrictions on rental of motorized two wheeled conveyances, would reduce potential safety and health concerns raised by transient personnel use of rentals

Therefore, Alternative 1 for proposed aircraft carrier berthing activities would result in no impact to public health and safety from traffic incidents.

18.2.2.5 UXO

The Island of Guam was an active battlefield during World War II. As a result of the invasion, occupation, and defense of the island by Japanese forces and the assault by Allied/American forces to retake the island, unexploded military munitions may still remain. On shore excavation and grading activities and dredging for wharf construction and establishing navigational channels and turning basins could encounter unexploded military munitions in the form of UXO, Discarded Military Munitions (DMM) and/or materials potentially presenting an explosive hazard. Exposure to these Munitions and Explosives of Concern (MEC) could result in the death or injury to workers or to the public. To reduce the potential hazards related to the exposure to MEC, a review of historical records and other information would be performed. If there is reason to believe MEC may be found in the area, qualified UXO personnel would perform surveys to identify and remove potential MEC items prior to the initiation of ground disturbing or dredging activities. Additional safety precautions would include UXO personnel supervision during earth moving and dredging activities, and providing MEC awareness training to construction personnel involved in excavations and dredging prior to and during construction activities. The identification and removal of MEC prior to initiating construction activities and training construction personnel as to the hazards associated with unexploded military munitions would ensure that potential impacts would be minimized and would be less than significant.

Therefore, Alternative 1 for proposed aircraft carrier berthing activities would result in less than significant impacts to public health and safety from UXO.

18.2.2.6 Radiological Substances

As of July 2007, U.S. Naval reactors have accumulated over 5,900 reactor-years of operation and have steamed over 137 million miles (mi) (220 million kilometers [km]) and there has never been a reactor accident, nor any release of radioactivity that has had an adverse effect on human health or the quality of the environment.

Because naval reactors must fit aboard a warship, they are smaller and have a much lower power rating than commercial reactors. Also, because reactor power is directly linked to propulsion requirements, naval reactors typically operate at low power or shut down entirely when the warship is in port. In the event of a nuclear reactor emergency, the ship can be rigged and towed away from populated areas, which is not the case for a land-based reactor.

Nearly all (99%) of the radioactive atoms in a nuclear reactor are found in two forms: 1) the uranium fuel itself or 2) fission products created by the nuclear chain reaction. The remaining radioactive atoms present in a Naval nuclear reactor are encountered in two forms. The majority of the remaining radioactive atoms (99.9% of the remaining 1%) are part of the metal of the reactor plant piping and components. The balance (0.1% of the remaining 1%) is in the form of radioactive corrosion and wear products originating from metal surfaces in contact with reactor coolant.

Corrosion and wear products in Naval nuclear reactor plants include the following radionuclides with half-lives of about 1 day or greater: tungsten-187, chromium-51, hafnium-181, iron-59, iron-55, nickel-63, niobium-95, zirconium-95, tantalum-182, manganese-54, cobalt-58, and cobalt-60. The predominant radionuclide is cobalt-60 that has a 5.2 year half-life and emits gamma radiation that is one of the most penetrating forms of radiation. Cobalt-60 also has the most restrictive concentration limit in water as listed by organizations that set radiological standards for these corrosion and wear radionuclides. Therefore, cobalt-60 is the primary radionuclide of interest for Naval nuclear propulsion plants.

Radiological Environmental Monitoring Program

To provide additional assurance that procedures used by the Navy to control radioactivity are adequate to protect the environment, the Navy conducts environmental monitoring in harbors frequented by its nuclear powered ships. Samples from each harbor monitored are also checked at least annually by a DOE laboratory to provide a further check on the quality of the environmental sample analyses as a check of Navy results. The DOE laboratory findings have been consistent with those of the Navy.

Marine monitoring consists of analyzing harbor water, sediment, and marine life for radioactivity associated with Naval nuclear propulsion plants. This monitoring is supplemented by shoreline surveys. Sampling harbor water and sediment on a quarterly basis is emphasized since these materials would be the most likely to be affected by releases of radioactivity.

Sediment samples are collected and analyzed specifically for the presence of cobalt-60, which is the predominant radionuclide of environmental interest resulting from Naval nuclear reactor operation. Surveys for cobalt-60 sampling in 2006 show that most harbors do not have detectable levels of cobalt-60 in sediment. Low levels of cobalt-60, less than three millionths of a microcurie per gram, were detected around a few operating base and shipyard piers where nuclear powered ship maintenance and overhauls were conducted in the early 1960s. These low levels were well below the naturally occurring radioactivity levels in these harbors. Since 1970, nuclear powered warship operations have not caused any increase in the general background radioactivity in the environment.

Harbor water is also sampled each quarter in areas where nuclear powered ships are berthed, and from upstream and downstream locations. No cobalt-60 has been detected in any of the water samples from the harbors monitored.

Marine-life samples, such as mollusks, crustaceans, and plants have been taken from harbors monitored. No buildup of cobalt-60 has been detected in these samples of marine life. Shoreline areas uncovered at low tide are surveyed to determine if any radioactivity from bottom sediment has washed ashore. The results of these surveys are consistent with natural background radiation levels in these regions. Thus, there is no evidence that these areas are being affected by nuclear powered ship operation.

Results of Environmental Monitoring

The Navy issues an annual report that describes the Navy's policies and practices regarding such issues as disposal of radioactive liquid, transportation and disposal of radioactive materials and solid wastes, and monitoring of the environment to determine the effect of nuclear powered warship operation. This report is provided to Congress and to cognizant federal, state, and local officials in areas frequented by nuclear powered ships. This report shows that the total amount of long-lived gamma radioactivity released into harbors and seas within 12 mi (19 km) of shore has been less than 0.002 curies during each of the last 36 years.

Nuclear Regulatory Commission regulation (10 Code of Federal Regulations [CFR] 20) lists water concentration limits for discharge of radioactivity in effluents. These limits are based on limiting the dose to members of the public from continuous ingestion of the activity discharged to 50 millirem per year. The control of radioactive liquid discharges at Navy facilities is much more stringent than at facilities that comply with the limits of 10 CFR 20, such as commercial nuclear power plants. The total combined radioactivity discharged from all Navy nuclear powered vessels annually within 12 mi (19 km) of shore is less than one hundredth of the amount of radioactivity released by one typical commercial nuclear power plant.

As a measure of the significance of this data, if an individual were able to drink the entire amount of radioactivity discharged into any harbor in any of the last 36 years by U.S. nuclear powered warships, that person would not exceed the annual radiation exposure permitted for an individual worker by the Nuclear Regulatory Commission.

Emergency Planning

Naval reactors are designed and operated in a manner that is protective of the crew, the public, and the environment. NNPP activities have plans in place that define NNPP responses to a wide range of emergency situations. If there ever were a radiological emergency, civil authorities would be promptly notified and kept fully informed of the situation. With the support of NNPP personnel, local civil authorities would determine appropriate public actions, if any, and communicate this information via their normal emergency communication methods as outlined in the Guam Emergency Response Plan (GovGuam 2005).

Due to the unique design and operating conditions of U.S. nuclear powered ships, civil emergency response plans that are sufficient for protecting the public from industrial and natural events (e.g., chemical spills or typhoons) are also sufficient to protect the public in the unlikely event of an emergency onboard a nuclear powered ship.

Incident Response

Although the risk of a radiological incident of significant consequence is small, emergency plans are in place at all Naval nuclear facilities to minimize the impacts of an emergency. These plans include activation of emergency control organizations throughout the NNPP to provide on-scene response as well as support for the on-scene response team. Realistic training exercises are conducted periodically to ensure that the response organizations maintain a high level of readiness and to ensure that coordination and communication lines with local authorities and other federal and state agencies are effective. Emergency response measures include provisions for immediate response to any emergency at any naval site, identification of the accident conditions, and communication with civil authorities providing radiological data and recommendations for any appropriate protective action. In the event of an incident involving radioactive or mixed-waste materials, workers in the vicinity of the incident would promptly seek shelter to minimize exposure and aid in emergency response consistent with the site's emergency plan for responding to fires and hazardous material incidents. This typically occurs within minutes of the incident and reduces the hazard to workers.

While the Navy would recommend appropriate actions to protect the public if needed based on federal guidance (EPA 400-R-92-001), local officials would be responsible for determining and implementing protective actions for the general public outside of the Naval base. In the highly unlikely event that some radioactivity escapes from the Naval base, the radioactivity would still only affect areas close to the release, and the exposure to the public would be localized and not severe. As such the need for local officials to take protective actions is extremely low. However, in the unlikely event that some action were necessary, existing civil emergency response plans in place for handling industrial and natural events (e.g., chemical spills or typhoons) are more than sufficient to protect the public in response to a radiological emergency originating from a Naval base.

Upon notification that an emergency exists, the Administrator of the Office of Civil Defense would activate the emergency response system outlined in the Guam Emergency Response Plan. The Administrator would notify and instruct all GovGuam agency heads and acting on behalf of the Governor of Guam, mobilize all response activities necessary. The National Incident Management System would be initiated to respond to all emergencies. In the event that the capability and resources of GovGuam become inadequate to effectively cope with an emergency, the Governor would request supplemental assistance from the federal government or activate the Emergency Management Assistance Compact.

The record of the NNPP's environmental and radiological performance at operating bases and shipyards presently used by nuclear powered warships demonstrates the continued effectiveness of this management philosophy. Through the entire history of the NNPP, the Navy has logged over 5,900 reactor years of operation and more than 137 million mi (220 million km) steamed on nuclear power with no reactor accidents or any release of radioactivity that has had an adverse effect on human health or the quality of the environment. Therefore, Alternative 1 for proposed aircraft carrier berthing activities would result in no impact to public health and safety from radiological substances.

18.2.2.7 Summary of Alternative 1 Impacts

Table 18.2-1 summarizes Alternative 1 impacts.

Table 18.2-1. Summary of Alternative 1 Impacts

Area	*Project Activities*	*Project Specific Impacts*
Onshore	Construction	Less than significant impacts due to noise and air quality No impacts to public health and safety from water quality, hazardous substances, health care services, public safety services, notifiable diseases, mental illness, traffic incidents, UXO, or radiological substances
	Operation	Less than significant impacts due to noise and air quality No impacts to public health and safety from water quality, hazardous substances, health care services, public safety services, notifiable diseases, mental illness, traffic incidents, UXO, or radiological substances

18.2.2.8 Alternative 1 Potential Mitigation Measures

No mitigation measures would be required.

18.2.3 Alternative 2 Former Ship Repair Facility (SRF)

Potential impacts to public health and safety (i.e., disease, mental illness, traffic incidents, UXO, and radiological sources) from implementation of aircraft carrier berthing activities would be the same as those discussed under Alternative 1. Alternative 2 Former SRF (referred to as Alternative 2) for proposed aircraft carrier berthing activities would result in no impact to public health and safety.

18.2.3.1 Summary of Alternative 2 Impacts

Table 18.2-2 summarizes Alternative 2 impacts.

Table 18.2-2. Summary of Alternative 2 Impacts

Area	*Project Activities*	*Project Specific Impacts*
Onshore	Construction	Less than significant impacts due to noise and air quality No impacts to public health and safety from water quality, hazardous substances, health care services, public safety services, notifiable diseases, mental illness, traffic incidents, UXO, or radiological substances
	Operation	Less than significant impacts due to noise and air quality No impacts to public health and safety from water quality, hazardous substances, health care services, public safety services, notifiable diseases, mental illness, traffic incidents, UXO, or radiological substances

18.2.3.2 Alternative 2 Potential Mitigation Measures

No mitigation measures would be required.

18.2.4 No-Action Alternative

Analysis of potential impacts to public health and safety from implementation of the no-action alternative is provided in Volume 2. No impact to the health and safety of the citizens of Guam resulting from implementing the no-action alternative is anticipated.

18.2.5 Summary of Impacts

Table 18.2-3 summarizes the potential impacts of each action alternative and the no-action alternative. A text summary is provided below.

Table 18.2-3. Summary of Impacts

Potentially Impacted Resource	*Alternative 1*	*Alternative 2*	*No-Action Alternative*
Environmental/Social Safety	LSI	LSI	NI
Notifiable Diseases	NI	NI	NI
Mental Illness	NI	NI	NI
Traffic Incidents	NI	NI	NI
UXO	LSI	LSI	NI
Radiological Substances	NI	NI	NI

Legend: SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact, BI = Beneficial impact

The potential increase in noise and air quality emissions would be less than significant; therefore, overall potential impacts to human health and safety would be less than significant. Corresponding increases in health care professionals, GPD, and GFD personnel are anticipated to occur to maintain existing service conditions; therefore, no impact to health care, police, or fire service is anticipated. No impact to public health and safety are anticipated from water quality concerns and management of hazardous substances.

The potential increases in disease occurrences and mental illness as a result of proposed aircraft carrier berthing activities are low and not likely to impact the resources of the citizens of Guam. The potential increase in the number of traffic accidents and fatalities would also be minimal and no adverse impact on the health and safety of the citizens of Guam from traffic incidents is anticipated.

Onshore excavation and grading activities and dredging for wharf construction and establishing navigational channels and turning basins could encounter unexploded military munitions. To reduce the potential hazards related to the exposure to MEC, a review of historical records and other information would be performed. If there is reason to believe MEC may be found in the area, qualified UXO personnel would perform surveys to identify and remove potential MEC items prior to the initiation of ground disturbing or dredging activities. Additional safety precautions would include UXO personnel supervision during earth moving and dredging activities, and providing MEC awareness training to construction personnel involved in excavations and dredging prior to and during construction activities. The identification and removal of MEC prior to initiating construction activities and training construction personnel as to the hazards associated with unexploded military munitions would ensure that potential impacts would be minimized and would be less than significant.

The risk of a radiological incident of significant consequence is small and emergency plans would be in place to minimize the impacts of an emergency. The Navy has not experienced a reactor accident or any release of radioactivity that has had an adverse effect on human health or the quality of the environment; therefore, no impact to public health and safety from radiological substances is anticipated.

18.2.6 Summary of Potential Mitigation Measures

No potential mitigation measures have been identified or would be required for either alternative.

CHAPTER 19. ENVIRONMENTAL JUSTICE AND THE PROTECTION OF CHILDREN

This chapter focuses on the potential for racial and ethnic minorities, low income populations, or children to be disproportionately affected by project-related impacts. Normally an analysis of environmental justice is initiated by determining the presence and proximity of these segments of the population relative to the specific locations that would experience adverse impacts to the human environment. The situation on Guam is unique in this regard because racial or ethnic minority groups (as defined by the U.S.) comprise a majority of the Guam population, and the proportions of people living in poverty or who are under 18 years of age are also substantially higher than in the general U.S. population. The analysis is further complicated by the fact that Guam is a relatively small and isolated island, and certain types of impacts would be experienced island-wide. Accordingly, the analysis of environmental justice described in this chapter acknowledges the unique demographic characteristics of the island population and assumes that the project effects could disproportionately affect disadvantaged groups and children because they comprise relatively high proportions of the population. By the same logic, potential mitigation measures that would reduce the severity of any significant project impacts to a less than significant level would be expected to effectively mitigate the associated environmental justice impacts to a less than significant level. Consequently, a distinction is made between potential significant impacts that would be mitigated and those for which no potential mitigations have been identified. The focus of this analysis is on the latter type of impacts.

19.1 INTRODUCTION

This chapter contains a discussion of the potential environmental consequences of the proposed action with regard to environmental justice and protection of children. For a description of the affected environment and a definition of the resource, refer to the respective chapter of Volume 2 (Marine Corps Relocation – Guam). The locations described in that volume include the region of influence (ROI) for the aircraft carrier berthing component of the proposed action and the chapters are presented in the same order as the resource areas contained in this Volume.

The Environmental Justice chapter focuses on disproportionate impacts to racial minorities, low-income populations, and children. For an analysis of potential island-wide impacts to these populations, please see the Socioeconomics Chapter of this Volume (Chapter 16).

19.2 ENVIRONMENTAL CONSEQUENCES

19.2.1 Approach to Analysis

19.2.1.1 Methodology

Volume 4 of this EIS/OEIS examines the potential impacts that each alternative would potentially have on various environmental and human resources. Based on the conclusions reached in each resource chapter, the analysis of environmental justice sought to identify the adverse impacts that would disproportionately affect racial minorities, children, and/or low-income populations, based on the following assumptions.

- Environmental justice policies are intended to analyze disproportionate impacts of potentially harmful environmental impacts on minority or other special status populations. However, the island of Guam is unique in that the majority of the population is a racial or ethnic minority, and low-income and child populations also comprise a relatively large proportion of the population (compared to the U.S.). Consequently, in this analysis it is assumed that any adverse impact that would affect the island as a whole, and any localized adverse impact that would affect a particular concentration of special-status residents, would have a disproportionate effect in terms of environmental justice.
- The ROI is defined as the area in which the principal effects arising from the implementation of the proposed action or alternatives are likely to occur. Those who may be affected by the consequences of the alternatives are often those who reside or otherwise occupy areas immediately adjacent to the alternative locations.
- Because the proposed action is related either to construction or operation, impacts to the ROI would likely be either "spill over" effects that extend beyond an installation's boundary line into the surrounding community, or impacts that directly affect minority populations in the ROI.

The analysis involved the application of three tiers of criteria to assess the environmental justice implications of each adverse effect identified in the relevant resource chapters:

- Tier 1: Are there any racial minorities, low-income, or children populations adjacent to the proposed action site?
- Tier 2: Are the applicable disadvantaged groups disproportionately affected by the negative environmental consequences of the proposed action(s)?
- Tier 3: Would the disproportionate adverse effects be significant?

19.2.1.2 Determination of Significance

According to Section 1508.27 of the Council on Environmental Quality (CEQ) Regulations for Implementing NEPA (CEQ 1979), determining the level of significance of an environmental impact requires that both context and intensity be considered. These are defined in Section 1508.27 as follows:

- "Context. This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant."
- "Intensity. This refers to the severity of the impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action. The following should be considered in evaluating intensity:
  - Impacts that may be both beneficial and adverse. A significant effect may exist even if the federal agency believes that on balance the effect would be beneficial.
  - The degree to which the proposed action affects public health or safety.
  - Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.
  - The degree to which the effects on the quality of the human environment are highly uncertain or involve unique or unknown risks.

- o The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.
- o Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.
- o The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.
- o The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined critical under the Endangered Species Act of 1973.
- o Whether the action threatens a violation of federal, state, or local law or requirements imposed for the protection of the environment."

19.2.1.3 Issues Identified during Public Scoping Process

As part of the analysis, concerns relating to environmental justice or the protection of children that were mentioned by the public, including regulatory stakeholders, during scoping meetings were addressed. These included:

- Concerns that disruption to family lives and cultural values would ultimately, "jeopardize the future of [indigenous] children."
- Concerns from the Micronesian Youth Services Network about ensuring that, "the transition of personnel on our islands will not disrupt our family lives and our cultural values..."
- Concerns that indigenous people of Guam are treated as second-class citizens. One commenter from Saipan indicated that, "these are their islands, and the locals' culture and related artifacts which still can be found...are also deserving of respect."
- Sanctuary, Incorporated, a non-profit organization focused on youth and their families, recommended using the Social Impact Assessment Guide and Principles as a basis for conducting the social impact study for this EIS/OEIS.
- The Chamorro Studies Association requested, "protect the people of Guam and their human rights."
- The CMTF Social and Cultural Subcommittee submitted a comprehensive paper on the subject of Chamorro interests (see Appendix G). That subcommittee recommends that the EIS identify issues and concerns that must be addressed to minimize negative social impacts and allow local and military communities to live in harmony.

19.2.1.4 Best Management Practices

The following measures are designed to address issues that often complicate the public participation of low-income people. These issues include lack of transportation, language barriers, and internet/computer access. The following measures are recommended for public meetings and participation for actions proposed in this Volume. In addition, potential mitigation measures identified in Chapter 4 of this Volume are recommended.

- Public meetings should be held in locations along major public transportation routes so they are accessible to people without a car.
- Public meeting notices, announcements, and documents should be posted in paper form as well as online and be located in multiple, frequently accessed public places.

- Written materials would be provided in the Chamorro language and a Chamorro-speaking interpreter would be used during meetings.

19.2.2 Alternative 1 Polaris Point (Preferred Alternative)

19.2.2.1 Onshore

Alternative 1 Polaris Point (referred to as Alternative 1) proposes to construct a wharf and supporting infrastructure and facilities at Polaris Point on Naval Base Guam. This section focuses on the adverse impacts anticipated from onshore construction of supporting infrastructure and facilities.

<u>Noise</u>

The proposed action at Polaris Point includes site clearing and construction of a staging area at the back of the wharf and construction of temporary Morale, Welfare, and Recreation (MWR) facilities and infrastructure. According to Chapter 2 of this Volume, the project would use specialized heavy equipment, including a dredger and a large floating crane barge with pile driving equipment (if piles are specified in the final design), and smaller cranes, concrete pumps, small barges, tugboats, and other excavation equipment. According to Chapter 6 of this Volume, the construction-related noise would not be above acceptable thresholds and would not have any long-term adverse impacts. Therefore, construction-generated noise impacts would be less than significant and no significant environmental justice impacts would be generated.

<u>Traffic</u>

The major roadway leading to Apra Harbor is Route 1. According to the FHWA study, construction-related traffic along Route 1 is not projected to reach the level of congestion by 2014. Therefore, the construction-related traffic impact would be less than significant for racial minorities and low-income populations living along Route 1. There would be no disproportionate impact to children.

19.2.2.2 Offshore

According to Chapter 6 of this Volume, proposed offshore actions include dredging and pile driving that would last for at least 8 to 18 months and up to 24 hours a day. The village in proximity to the harbor is Piti. Offshore recreational impacts may occur that are inter-related with socioeconomics and are discussed below.

<u>Socioeconomics</u>

Chapters 4, 9, and 16 of Volume 4 discuss potential impacts to local recreational tourism as a result of Alternative 1. Potential impacts are related to ocean-based recreation and tourism in the local area due to the silting from dredging that clouds and degrades the water environment and due to increased congestion in Apra Harbor. These are construction-related impacts that are considered short-term. With implementation of potential mitigation measures in Chapter 4 of this Volume, impacts due to dredging would be reduced to less than significant. Chapter 16 of this Volume describes a range of socioeconomic impacts, most of which are beneficial or less than significant. Chapter 16 also describes potential impacts related to crime and social order issues and community cohesion, but recommended potential mitigation measures would reduce impacts to a less than significant level. Accordingly, these impacts would not have a corresponding impact with regard to environmental justice and protection of children.

19.2.2.3 Summary of Alternative 1 Impacts

Table 19.2-1 summarizes the environmental justice impacts of Alternative 1.

Table 19.2-1. Summary of Alternative 1 Impacts

Potential Impacts on Guam by Resource
Noise
While there would be construction-generated noise under Alternative 1, Chapter 6 of this Volume determined that the impact would be less than significant, including with regard to environmental justice and protection of children.
Onshore Traffic
The FHWA study predicts that construction-related traffic would not increase traffic to the level of congestion along Route 1 by 2014. Therefore, the impact would be less than significant for the racial minorities and low-income populations living near Route 1. There would be no disproportionate impact to children.
Socioeconomics
A mix of adverse and beneficial impacts associated with socioeconomics (some stemming from water quality and recreational resource issues) would result from the proposed action. None of the impacts would be significant (in some cases due to implementation of potential mitigation measures) There would be no significant environmental justice impacts to disadvantaged populations or children.
Alternative 1
Impact Summary: <u>Onshore Noise</u> • LSI (Racial Minorities) • LSI (Low-Income) • NI (Children) <u>Onshore Traffic</u> • LSI (Racial Minorities) • LSI (Low-Income) • NI (Children) <u>Socioeconomics</u> • SI-M (Racial-Minorities) • SI-M (Low-Income) • NI (Children)

Legend: SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact, BI = Beneficial impact

19.2.2.4 Alternative 1 Potential Mitigation Measures

The following potential mitigation measures would limit impacts to a less than significant level: potential mitigations identified in Chapter 4, Water Resources in this Volume to reduce impacts to offshore water quality, and potential mitigations identified in Chapter 16 with regard to social order issues and community cohesion.

19.2.3 Alternative 2 Former Ship Repair Facility (SRF)

19.2.3.1 Onshore

The effects would be the same as Alternative 1.

19.2.3.2 Offshore

The effects would be the same as Alternative 1.

19.2.3.3 Summary of Alternative 2 Impacts

Table 19.2-2 summarizes the environmental justice impacts of Alternative 2.

Table 19.2-2. Summary of Alternative 2 Impacts

Potential Impacts by Area
Onshore Noise
The potential impacts for Alternative 2 are the same as for Alternative 1.
Onshore Traffic
The potential impacts for Alternative 2 are the same as for Alternative 1.
Socioeconomics
The potential impacts for Alternative 2 are the same as for Alternative 1.
Alternative 2
The potential impacts for Alternative 2 are the same as for Alternative 1.

19.2.3.4 Alternative 2 Potential Mitigation Measures

The potential mitigation measures would be the same as those for Alternative 1.

19.2.4 No-Action Alternative

Under the no-action alternative, no construction, dredging, or operation associated with the aircraft carrier berthing would occur. Existing operations at Polaris Point, as a military training and recreational facility, and the Former Ship Repair Facility (SRF), as a commercial ship repair facility, would continue. Therefore, the no-action alternative would not have impacts on minority, low-income, or children populations.

19.2.5 Summary of Impacts

Table 19.2-3 summarizes the potential impacts of each action alternative and the no-action alternative. A text summary is provided below.

Table 19.2-3. Summary of Impacts

Alternative 1	*Alternative 2*	*No-Action Alternative*
Onshore Noise: • LSI (Racial Minorities) • LSI (Low-Income) • NI (Children) Onshore Traffic: • LSI (Racial Minorities) • LSI (Low-Income) • NI (Children) Socioeconomics: • SI-M (Racial Minorities) • SI-M (Low-Income) • NI (Children) Offshore Traffic: • LSI (Racial Minorities) • LSI (Low-Income) • NI (Children)	• Impacts are the same as for Alternative 1.	NI

Notes: SI = Significant impact; SI-M = Significant impact mitigable to less than significant;
LSI = Less than significant impact; NI = No impact; BI = Beneficial impact

In summary, this chapter examined potentially adverse environmental effects related to noise and traffic impacts during construction and socioeconomic impacts (related to water quality/dredging issues, social order issues and community cohesion) that could affect local businesses near the harbor. However, with implementation of potential mitigation measures described in Chapter 4, 9, and Chapter 16 of this Volume, the impacts would be reduced to less than significant. Chapter 6 of this Volume and the FHWA study indicate that noise and traffic impacts would be less than significant. There would be no significant environmental justice impacts associated with the proposed carrier berthing action.

19.2.6 Summary of Potential Mitigation Measures

There would be no mitigation measures required aside from those measures that were identified in Chapter 4, Water Resources, Chapter 9, Recreation, and Chapter 16, Socioeconomics, in this Volume. These potential mitigation measures would mitigate impacts to less than significant.

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