

CHAPTER 14.

MARINE TRANSPORTATION

14.1 AFFECTED ENVIRONMENT

14.1.1 Definition of Resource

Marine transportation refers to marine vessels and facilities used to support commercial, military, and recreational uses. The primary military, commercial, and recreational port facilities on Guam are located in Apra Harbor, the main berthing facility on the island. Apra Harbor provides deep water and protected loading and off-loading facilities. Apra Harbor consists of a commercial harbor, a naval complex, and a repair facility. The port handles both containerized and conventional cargo from the United States (U.S.) and other countries.

This chapter describes existing facilities in Apra Harbor and the activities that occur there. The possible effects on the capacity of the harbor to accommodate the increase in the number of ships and ship movements from the proposed relocation of Marines from Okinawa to Guam are also assessed and presented in the Environmental Consequences section (Section 14.2) of this chapter. This chapter covers marine transportation. See Volume 6 Chapter 4 for a discussion of on base and off base roadways and related ground transportation impacts.

14.1.2 North

No marine transportation occurs in the North area.

14.1.3 Central

14.1.3.1 Andersen South

No marine transportation occurs at this location.

14.1.3.2 Barrigada

No marine transportation occurs at this location.

14.1.3.3 Non-Department of Defense (DoD) Land

No marine transportation occurs at this location.

14.1.4 Apra Harbor

Apra Harbor is located on the western side of Guam. It is a natural harbor protected by Orote Peninsula on the south and Cabras Island and the Glass Breakwater on the north. The Glass Breakwater provides wind and wave protection from the Philippine Sea. The average height of the breakwater is approximately 15 feet (ft) (4.6 meters [m]) above mean sea level (msl).

Apra Harbor comprises both an outer harbor area (Outer Apra Harbor) and an inner harbor area (Inner Apra Harbor). Navy waterfront facilities are located in both the outer harbor and the inner harbor. Waterfront facilities for the U.S. Coast Guard (USCG) are located in the inner harbor, while commercial and recreational facilities are located in the outer harbor. Most of Outer Apra Harbor and the entire Inner Apra Harbor are under the jurisdiction of the Navy. Use of these waters is restricted because they are adjacent to Naval Base Guam facilities.

Inner Apra Harbor is located to the southeast of Outer Apra Harbor; it is separated from Outer Apra Harbor by the Guam Shipyard and Polaris Point. Outer Apra Harbor is the west-facing entrance way into Apra Harbor. The primary navigation channel is 1,500-ft (457-m) wide and has a natural depth of more than 100-ft (30.5-m). Although Outer Apra Harbor has many areas where depths exceed 100 ft (30.5 m), it also contains several shoal and reef areas, primarily in the eastern portion of the harbor close to the entrance to Inner Apra Harbor. While these shallow areas pose only a limited threat to normal operations, they represent a major hazard to navigation during periods of high winds. Outer Apra Harbor extends westerly from the harbor entrance toward Drydock Point. To avoid the shoal areas, the channel into the Harbor extends southeasterly to the entrance at Inner Apra Harbor and then due south; this channel was dredged in the 1940s. Outer Apra Harbor contains several mooring buoys and anchorages used by both military and commercial vessels.

Vessels entering Inner Apra Harbor are limited to a maximum draft of 32 ft (9.8 m). The primary channel from Outer Apra Harbor to Inner Apra Harbor is marked at the entrance with two lighted buoys. The centerline of this channel is defined for navigation by two entrance range lights.

More details on Apra Harbor facilities, including Kilo Wharf, are presented below in Section 14.1.4.2, Naval Base Guam.

14.1.4.1 Harbor

USCG

According to *Sector Guam Relocation Feasibility Study* (USCG 2007), Sector Guam is the center of USCG activities within the Territory of Guam and the Commonwealth of Northern Mariana Islands. It is the USCG base of operations for one 225-ft (69-m) buoy tender, two 110-ft (34-m) patrol boats, and several small response boats that are berthed at Victor Wharf. All Sector Guam facilities are located within a 13-acre (ac) (5.3-hectare [ha]) compound owned by the USCG adjacent to Victor Wharf.

Sector Guam serves a variety of missions including:

- Providing maritime security
- Enforcement of the Maritime Transportation Security Act of 2002
- Maritime safety
- Protection of natural resources and fisheries
- Foreign vessel inspections
- Vessel escorts
- Aids to navigation
- General defense duties in support of homeland security

Commercial Port Facilities

Guam's commercial port, Jose D. Leon Guerrero Commercial Port

(also known as the Port of Guam [Port]), is managed by the Port Authority of Guam (PAG 2008a). The PAG is a public corporation and autonomous agency of the Government of Guam (GovGuam). The main commercial port facilities are located on 74 ac (30 ha) of Cabras Island. The operation of commercial vessels in Outer Apra Harbor are regulated by the Harbor Rules and Regulations of the PAG (Public Law [PL] 26-172 [December 27, 2001]).

The Port of Guam consists of the following:

- Foxtrot 3 wharf is used for general cargo, passenger vessels, and fishing vessels. The wharf is 750 ft (229 m) long and has a water depth of 34 ft (10 m). An earthquake that hit Guam on August 8, 1993 caused minor damage to the berth; however, the berth can be used with restrictions on the use of mobile cranes and the storage of containers and bulk cargo. The berth is used by a mix of small fishing vessels.
- Foxtrot 4, 5, and 6 wharfs are used for container and general cargo. The wharf complex is 1,975 ft (602 m) long with a water depth of 34 ft (10 m). There is an obstruction 150 ft (46 m) in front of Foxtrot 6 which may prevent a ship from maneuvering into and out of this berth if a vessel is occupying Foxtrot 5 (MSDDC 2006). According to the PAG (Port Authority of Guam 2010a), the wharfs are dilapidated and in critical need of maintenance and repair.
- Foxtrot 1 (Shell) Pier is used by liquid bulk tankers; it is operated by Shell Oil, Guam. The pier is 370 ft (113 m) long. The water depth is 70 ft (21 m).
- Golf (Mobil) Pier is used by liquid bulk tankers; it is operated by Mobil Oil, Guam. The pier is 370 ft (113 m) long. The water depth is 50 ft (15 m).
- Hotel Wharf is used for passenger vessels, fishing vessels, and some general cargo. The wharf is 500 ft (152 m) long and has a water depth of 34 ft (10 m).
- Container Yard provides 26.5 ac (107 ha) for container storage.
- Gregorio D. Perez Marina, which has a capacity of 59 vessels.
- Agat Small Boat Marina, which has a capacity of 163 vessels.
- Five rail-mounted gantry cranes, two rubber tire gantry cranes, one mobile harbor crane, one top lifter, four side loaders, and a fleet of forklifts of various load capacities (Port Authority of Guam 2010b).

The Port of Guam is located in the northern portion of Outer Apra Harbor. It is the only port on Guam, and more than 90% of all imported goods and materials come through the Port. This makes the Port an essential facility that supports the entire population of Guam. The proposed military relocation on Guam would create an increased demand for imported goods and materials (especially construction supplies, equipment, and materials) that would be shipped to Guam. Also, during the peak years of construction, goods and other supplies would be required to support the estimated off-island construction workers and induced population. Long-term operational impacts include the importation of supplies, goods, and materials that would support the additional permanent population created by the proposed action.

Since its construction in 1969, the Port has remained largely unchanged. With many areas near capacity or unusable, expanding the Port's facilities and equipment upgrades would create operational efficiencies and maximize Port capacity. Before the news of the proposed military relocation, Port improvements and expansion were under consideration; however, the military relocation created an additional impetus to implement planning studies and improvements to service the anticipated construction work and additional population.

In August 2007, work began to update the Port's master plan. The recommendations and updates address future expansion and development based on typical commercial growth, as well as the impending military relocation. Needs assessments for the proposed military relocation on Guam were based on preliminary information about cargo volumes and personnel relocation provided by the Joint Guam Program Office (JGPO). A final draft Port master plan was completed in April 2008 which updated master plan and set the road map for upgrading the facilities. The master plan for the Port calls for nearly \$200 million in capital improvement upgrades to the Port facilities to support the military relocation. The modernization

program, which was granted conditional approval from the Guam Legislature in December 2008, would address both Guam's expected growth without the proposed action and the anticipated increase in cargo volume resulting from the proposed action.

There are three phases to the port modernization program: IA, IB, and II (Rosenthal 2010), as follows:

- Phase IA: The focus is on productivity and efficiency improvements, such as new equipment, systems, and buildings, and terminal modernization and new yard capacity. Elements include demolition of buildings; installation of utilities; terminal yard paving and upgrade of pavement; installation of high mast lighting; installation of water, sewer, stormwater and fire protection systems including installation of new stormwater outfalls into Apra Harbor; installation of security systems; and new cargo handling and equipment systems. The project will significantly increase the operating efficiency and capacity of the terminal by an eastward extension of useable terminal area and through modernization of upland port facilities, equipment, utilities and systems including new gate systems with automated gate technology and modern truck scanning equipment (Rosenthal 2010).

Full funding is anticipated in 2011 and the National Environmental Policy Act (NEPA) process would be completed by the end of 2010. Preliminary design to be complete in June 2010 and construction will be completed in 2013.

- Preliminary design of the Phase IA Port expansion was recently completed. The Environmental Assessment for Phase IA is anticipated to be completed in August 2010; the preparation of permit applications is expected to be completed by the end of 2010. Full funding for the proposed work is anticipated in 2011 and construction will be completed in 2013 (Rosenthal 2010).
- Phase IB: The focus is on structural refurbishment of existing docks (F4, F5, and F6), modernization of terminal areas to the west and acquisition of cranes. It includes dredging to increase berth depths at F4 to F6 to -42 ft (-13 m) mean lower low water (MLLW) and security equipment and process improvements to meet International Ship and Port Facility Security Code (ISPS) requirements. Construction would last approximately two years. The preliminary design, preparation of permits and the NEPA process would start as soon as funding has been identified (Rosenthal 2010).
- Phase II: The focus is on construction of a new berth F7 and additional terminal capacity to the east to meet long-term organic growth. Creation of the new berth F7 would require some land reclamation (i.e., placement of fill in Apra Harbor), removal of existing derelict vessels, and the addition of 900 ft (274 m) of berthing/wharf space. Dredging would also be included. Execution of this phase is likely 20 or more years into the future and funding has not been identified (Rosenthal 2010).

Funding for the Port's improvements (modernization) and expansion is anticipated to come from various federal agencies, GovGuam, and private sources. The funds for capital improvements would likely be repaid through user fees that would then be passed on to consumers, businesses, and other entities (i.e., DoD). While DoD is not directing the Port improvements, an amendment to the 2010 Defense Appropriations Bill is proposed in Congress which calls for the transfer of \$50M of DoD FY10 funds to the Department of Transportation (DOT) to fund Phase I of the port improvements.

Guam Shipyard is a privately operated commercial ship repair yard located at the site of the former Navy Ship Repair Facility, on the west side of the entrance to Inner Apra Harbor. Guam Shipyard leases three floating dry docks from the Naval Sea Systems Command for the repair of Military Sealift

Command (MSC) ships and commercial vessels. The Guam Shipyard provides shore industrial support, repair, maintenance, overhaul, and dry docking services. These services are provided to ships from the Seventh Fleet, Commander Submarine Squadron 15, MSC, USCG, local federal agencies, and commercial businesses.

Aquaworld and Harbor of Refuge are private marinas located in the inner Cabras Island area, operated under a management agreement with the PAG. They provide piers for recreational and commercial vessels. In recent years, the sport fishing charter boat industry has increased significantly (GDAWR 2008).

The PAG tracks information on vessels and their cargo. Total vessel visits are known for the years 1995 through 2008 (Table 14.1-1). Vessel tallies are presented for the following categories: Container Ship, Breakbulk/roll on-roll off (RORO)/Bulk, Barges, Fishing, and Total. Breakbulk is cargo which is packed in cases, bales, cartons, drums, or carboys. RORO is roll-on roll-off (e.g. automobiles), and bulk is general cargo. The overall number of vessels calling on the Port of Guam steadily and substantially decreased between 1995 (2,924 vessels) and 2008 (1,022 vessels); a decrease between those years of about 65 percent (1,902 vessels). The numbers of barges and fishing vessels have shown the greatest amount of decrease. The number of barges decreased from 169 (1995) to 17 (2008) while fishing vessels went from 2,161 (1995) to 586 (2008).

However, the number of container ships and the number of containers handled by the Port of Guam per year has remained relatively constant during the period of 1995 through 2006. The average annual number of container ships was 119; the average annual number of containers handled was 84,356. For the years 2007 and 2008, there was a substantial increase in the number of container ships to 153 (2007) and 165 (2008). The number of containers handled also increased substantially in 2007 (99,630) and 2008 (99,908). The number of break-bulk cargo ships has decreased substantially between 1995 (477) and 2008 (171).

Table 14.1-1. Port of Guam Vessel Visits 1995 through 2008

<i>Year</i>	<i>Container Ship</i>	<i>Breakbulk/RORO/Bulk</i>	<i>Barges</i>	<i>Fishing</i>	<i>Total</i>
1995	117	477	169	2,161	2,924
1996	124	296	138	2,351	2,909
1997	130	212	167	2,205	2,752
1998	151	365	106	2,107	2,765
1999	146	296	155	1,942	2,569
2000	114	295	112	1,906	2,529
2001	111	311	111	1,960	2,697
2002	105	310	102	1,481	2,139
2003	103	339	94	1,332	1,983
2004	109	280	97	1,044	1,648
2005	103	245	60	800	1,327
2006	109	299	17	771	1,289
2007	153	165	21	651	1,113
2008	165	171	17	586	1,022

Source: PAG 2008a and 2008b

Shipping

Vessel traffic in U.S. ports and harbors is governed by a system of traffic separation schemes. Traffic separation schemes are internationally recognized routing designations created by the USCG that separate opposing flows of vessel traffic into lanes (fairways), including a zone between lanes where traffic is to

be avoided (33 Code of Federal Regulations [CFR] 166). Safety fairways are lanes or corridors in which no artificial island or fixed structure, whether temporary or permanent, is permitted (33 CFR 167). These fairways, which are also delineated by a series of geographic coordinates, provide unobstructed approaches for vessels using U.S. ports. Vessels are not required to use the fairways, but failure to use one, if available, would be a major factor for determining liability in the event of a collision with another ship or an underwater structure. Shipping lanes (fairways) in the vicinity of Guam are shown on Figure 14.1-1.

Figure 14.1-2 shows the major shipping routes servicing Guam. Commercial ships travel from U.S. west coast ports (e.g. Ports of Long Beach, Los Angeles, Oakland, Tacoma) through the Port of Honolulu and on to the Port of Guam. Depending on the shipping line, ships depart from the Port of Guam for various port locations in China (Ports of Ningbao and Shanghai), Hong Kong, Taiwan (Ports of Kaoshiung and Keelung), Philippines (Port of Davao), Japan (Ports of Yokohama, Nagoya, Kobe), South Korea (Port of Busan). There is no direct service from U.S. mainland ports, although Horizon Lines, Matson, and Maersk have direct linkages from Hawaii to Guam. There is no direct service from Guam to Hawaii or any other U.S. port of entry. Shipments from Guam travel eastward on ships bound for Asia, then westward across the Pacific to U.S. west coast ports.

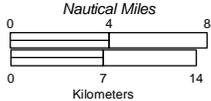
14.1.4.2 Naval Base Guam

Apra Harbor can accommodate the largest of Navy ships, including aircraft carriers. Guam Shipyard provides repair and maintenance facilities for these ships. The primary facility located in Outer Apra Harbor is Kilo Wharf, a munitions wharf. It is located on the south side of Outer Apra Harbor approximately 3,600 ft (1,100 m) east of the outer harbor entrance. This wharf is 400 ft (122 m) long. As a result of dredging, depths alongside Kilo Wharf are 45 to 50 ft (13.7 to 15.2 m). Kilo Wharf is the only deep water port in the western Pacific where a loaded munitions ship can berth at a pier to obtain repair and maintenance services. Apra Harbor currently supports an average of 2 Carrier Strike Group port visits per year for an average of 7 days per year, though actual port visits and duration are subject to change based upon Fleet operational requirements. Nuclear powered aircraft carriers berth at Kilo Wharf because it is the only wharf that meets their draft requirements. Kilo Wharf currently lacks full “hotel” utilities necessary to support the ship (MSDDC 2006).

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**Figure 14.1-1
Guam Shipping Lanes**



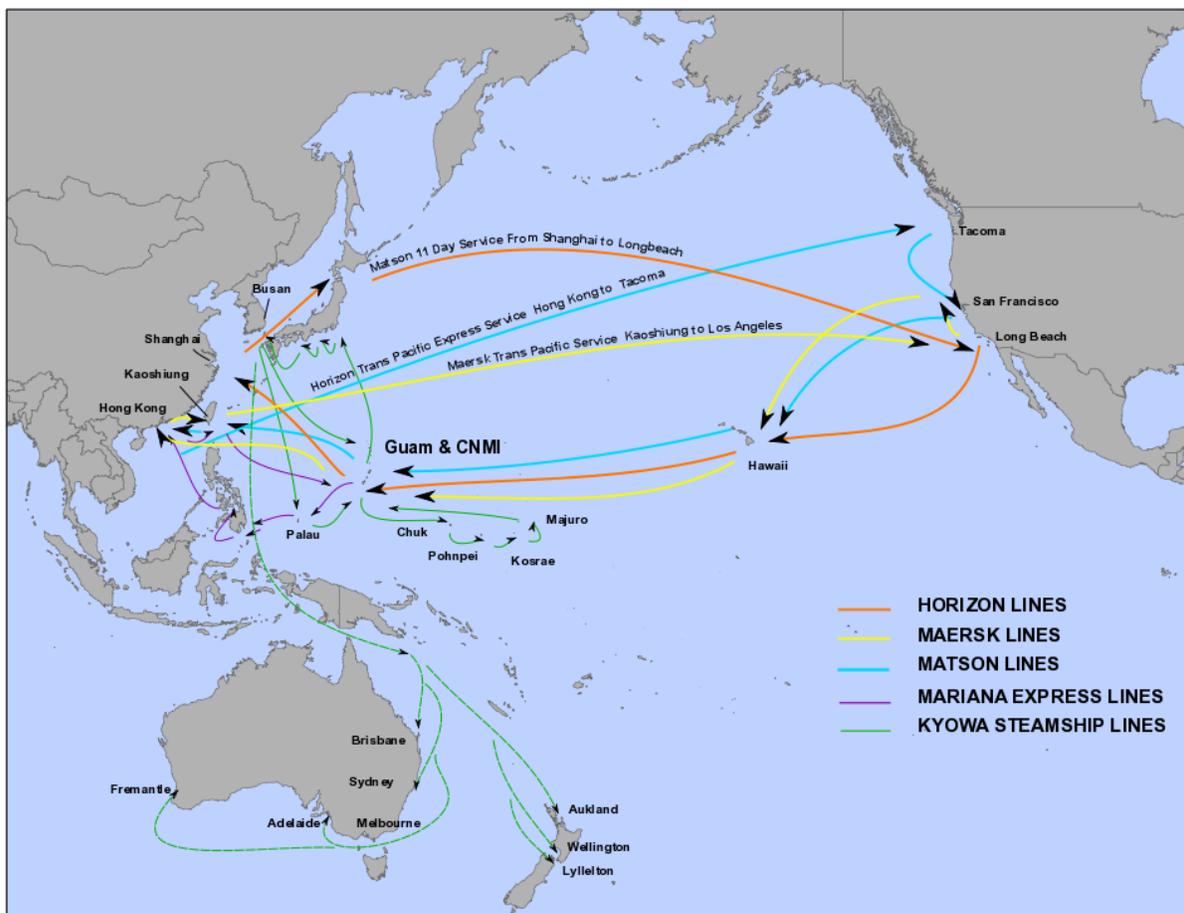


Figure 14.1-2. Commercial Shipping Routes to Guam and CNMI

The existing facilities located in Inner Apra Harbor include the following:

- Alpha and Bravo Wharves are 32 ft (10 m) deep and located at the site of the former Navy Ship Repair Facility on the west side of the entrance to Inner Apra Harbor. These wharves are used for submarine berthing.
- Romeo and Sierra Wharves provide berthing services to Navy ships. Sierra Wharf was extensively damaged in the 1993 earthquake so only the southwest half of the wharf is now usable. The water depth at these wharves is 35 ft (11 m).
- Tango Wharf is 35 ft (11 m) deep; however, the wharf has been damaged and is currently not used.
- Uniform Wharf, which was damaged in the 1993 earthquake and is still unusable.
- Victor Wharf is used as the primary wharf for visiting combatant ships, MSC, foreign navy vessels, and the USCG. The wharf provides about 700 linear ft (213 m) of berthing space with a depth of 32 ft (10 m).

A summary of the number of Navy ships recently visiting Apra Harbor was prepared by the Navy in May 2008 (Navy 2008). Information was provided on ship movements: a ship transit into and back out of the harbor is counted as two movements and as one visit. In 2007, 100 ships visited Outer Apra Harbor. From

January through May 2008, 50 ships visited Outer Apra Harbor. For Inner Apra Harbor, 220 ships visited in 2007, and 115 ships visited during the first 5 months of 2008.

14.1.5 South

14.1.5.1 Naval Munitions Site

No marine transportation occurs at this location.

14.1.5.2 Non-DoD Land

No marine transportation occurs at this location.

14.2 ENVIRONMENTAL CONSEQUENCES

14.2.1 Approach to Analysis

The primary concern regarding marine transportation is the impact of the proposed action and alternatives on the military, commercial, and recreational navigational usage 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 action and the no-action alternative have been evaluated based upon the magnitude and duration of impacts to navigation. For activities that would have an adverse impact on navigation, appropriate mitigation measures would be required. Although organized by the Main Cantonment alternatives, a full analysis of Waterfront actions is presented beneath the respective headings. A summary of impacts specific to each alternative, Airfield, and Waterfront is presented at the end of this chapter. See Volume 6 Chapter 4 for a discussion of on base and off base roadways.

14.2.1.1 Methodology

Apra Harbor is the only DoD harbor that could accommodate the ships required for the relocation of the Marines to Guam; no other alternatives are feasible.

To determine the impacts of the proposed action on marine transportation, the anticipated annual number of vessels that would visit Apra Harbor is compared to the annual number of vessels that have visited Apra Harbor since 1995. Based upon the maximum number of vessels that visited the harbor during the period of 1995 through 2008, a comparison is made with the anticipated maximum number of vessels that would visit the harbor during the period of 2008 through 2018 (the embarkation period).

14.2.1.2 Determination of Significance

If the maximum annual number of vessels that would visit the harbor during the embarkation period exceeds the annual maximum since 1995, then a significant impact to marine transportation may occur. If the maximum annual number of vessels that would visit the harbor during the embarkation period is equal to or less than the annual maximum number of vessels since 1995, then there would be a less than significant impact to marine transportation.

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 potential access restrictions to areas in Outer Apra Harbor as a result of increased military vessel traffic.

14.2.2 Alternative 1

14.2.2.1 North

Andersen AFB

Construction

No impacts on marine transportation resulting from the proposed action and alternatives are expected.

Operation

No impacts on marine transportation resulting from the proposed action and alternatives are expected.

Finegayan

Construction

No impacts on marine transportation resulting from the proposed action and alternatives are expected.

Operation

No impacts on marine transportation resulting from the proposed action and alternatives are expected.

Non-DoD Land

Construction

No impacts on marine transportation resulting from the proposed action and alternatives are expected.

Operation

No impacts on marine transportation resulting from the proposed action and alternatives are expected.

14.2.2.2 Central

Andersen South

Construction

No impacts on marine transportation resulting from the proposed action and alternatives are expected.

Operation

No impacts on marine transportation resulting from the proposed action and alternatives are expected.

Barrigada

Construction

No impacts on marine transportation resulting from the proposed action and alternatives are expected.

Operation

No impacts on marine transportation resulting from the proposed action and alternatives are expected.

Non-DoD Land

Construction

No impacts on marine transportation resulting from the proposed action and alternatives are expected.

Operation

No impacts on marine transportation resulting from the proposed action and alternatives are expected.

14.2.2.3 Apra Harbor

14.2.2.4 Harbor

Construction

To facilitate the berthing of the escort combatant ships, it would be necessary to dredge Sierra Wharf to remove about 508,900 cubic yards (CY) (386,000 cubic meters [m³]) of sediment. It has not been determined whether the dredged material would be disposed in the proposed ocean dredged material disposal site offshore of Guam, or one or more upland placement sites with or without possible beneficial re-use on Navy land on Guam or a combination of all disposal options. If the dredged material is disposed at the ocean disposal site, there would be an increase in the use of the Apra Harbor navigation channels by the vessels transporting the dredged material. It is anticipated that, due to the hard substrate to be dredged, that about 2,000 CY of dredged material would be dredged each day over a period of about 6 to 9 months. One tug would tow a 4,000 CY (3,053 m³) scow filled with dredged material to the ocean disposal site and then return to the dredging site. The vessel carrying the dredged material from Apra Harbor would travel along existing shipping lanes and be subject to USCG rules and regulations. A total of about 127 trips would be needed to the ocean disposal site to transport the dredged material from Sierra Wharf. In consideration of the number of vessels that visit the Port of Guam each year (1,022 vessels in the year 2008), the addition of 127 vessel trips by the tug and scow would total 1,149 vessel visits to the Port of Guam during that year (a 12% increase). This number of vessels is much less than the number that visited the Port of Guam in 1995 (2,924 vessels). It is expected that the addition of about 127 vessel trips to transport the dredged material over the period of 6 to 9 months would result in a less than significant impact on marine transportation in Apra Harbor.

Operation

The relocation of Marine Corps forces to Guam would result in frequent embarkation operations. The Navy's amphibious task forces and the Marine Expeditionary Units (MEU) are transient forces that have traditionally come to Guam for port visits and training. These transient port calls do not represent a new mission but an increase in frequency with the proposed relocation.

Typically, there would be three ships carrying amphibious vessels, and sometimes an additional four combatant ships as escort. The amphibious ships would deploy amphibious craft (Landing Craft Air Cushion [LCAC], Landing Craft Utility [LCU], Amphibious Assault Vehicle, or small reconnaissance boats) in either the Outer or Inner Apra Harbor; the craft would then travel to an amphibious laydown area. The duration of each amphibious task force visit would range between 6 and 21 days. No amphibious beach training is planned within Inner Apra Harbor. The MEU training would occur at a minimum of two times per year for three weeks duration each visit on Guam. In consideration of the substantial reduction in the number of annual visits by vessels to the Port of Guam since 1995 (as described above), it is expected that the number of visits of amphibious vessels and combatant ships would result in less than a significant impact on marine transportation in Apra Harbor.

The projected number of containers to be handled in the Port of Guam during the years 2008 through 2018 is presented in Table 14.2-1. The average number of containers to be handled per year during this period is 153,636 with the highest projected total in 2015 (190,000). After 2018, the annual number of military containers is projected to remain at 38,000 until at least 2027 (PAG 2008c).

Table 14.2-1. Port of Guam Total Containers to be Handled 2008 through 2018

<i>Year</i>	<i>Commercial*</i>	<i>Military</i>	<i>Total</i>	<i>Number of Ships</i>
2008	85,000	19,000	104,000	147
2009	87,000	21,000	108,000	153
2010	90,000	39,000	129,000	183
2011	91,000	58,000	149,000	211
2012	94,000	78,000	172,000	244
2013	97,000	81,000	178,000	252
2014	97,000	85,000	182,000	258
2015	101,000	89,000	190,000	269
2016	104,000	76,000	180,000	255
2017	106,000	46,000	152,000	215
2018	108,000	38,000	146,000	207

Notes: * Includes trans-shipment and local/tourist volumes.

Source: PAG 2008c.

The projected average number of containers to be handled each year during the period of 2008 through 2018 is about twice the average number of containers handled during the period of 1995 through 2008 (86,558). The average number of container ships that visited the Port of Guam each year over the period of 1995 through 2008 is 124. However, it is not expected that there would be twice as many visits by container ships to the Port of Guam during the embarkation period because the capacity of container ships has been increasing (Global Security 2009). The maximum number of containers to be handled during the period of 2008 through 2018 is 190,000 (in the year 2015). If the number of containers per ship remains the same as during the period of 1995 through 2008 (average of 706 containers per ship), there would be approximately 269 container ships visiting the Port of Guam during 2015.

A similar analysis was conducted to determine the number of ships carrying break-bulk cargo that would visit the Port of Guam each year during the years 2008 through 2018. The tonnage of break-bulk cargo to be handled by the Port of Guam during this period is presented in Table 14.2-2. The average tonnage of break-bulk cargo to be handled per year during this period is 180,409 with the highest projected tonnage in 2012 (291,400). After 2018, the tonnage of break-bulk cargo is projected to increase gradually each year to 121,400 tons in 2027 (PAG 2008c).

Table 14.2-2. Port of Guam Inbound Break-bulk Tonnage to be Handled 2008 through 2018

<i>Year</i>	<i>Domestic</i>	<i>Foreign</i>	<i>Total</i>	<i>Number of Ships</i>
2008	16,000	100,100	116,100	212
2009	18,700	114,300	133,000	243
2010	22,600	135,600	158,200	289
2011	36,900	209,500	246,400	450
2012	44,000	247,400	291,400	532
2013	42,800	241,500	284,300	519
2014	41,800	236,100	277,900	507
2015	20,100	123,200	143,400	262
2016	14,700	94,200	108,900	199
2017	15,100	96,900	112,000	204
2018	15,200	97,700	112,900	206

Source: PAG 2008c and 2010b.

The projected average tonnage of break-bulk cargo to be handled each year during the period of 2008 through 2018 (180,409) is about 45 percent more than the tonnage of break-bulk cargo that was handled during the period of 2003 through 2008 (125,565). The average number of break-bulk cargo ships that visited the Port of Guam each year over the period of 1995 through 2008 is 290. The maximum tonnage

of break-bulk cargo to be handled during the period of 2008 through 2018 is 291,400 (in the year 2012). If the tonnage of break-bulk cargo carried by each ship remains the same as during the period of 2003 through 2008 (average of 548 tons per ship), there would be approximately 532 break-bulk ships visiting the Port of Guam during 2012.

The peak years for shipment of containers and break-bulk cargo to the Port of Guam do not coincide. As presented above, the peak year for the shipment of break-bulk cargo is 2012 while the peak year for shipment of containers is in 2015. In 2015, the number of vessels shipping break-bulk cargo will reduce from the peak of 532 (in 2012) to 262.

As indicated in Table 14.1-1, the total number of commercial (non-fishing) vessels visiting the Port of Guam has decreased substantially from 1995 (763 vessels) to 2008 (436 vessels). Assuming a channel occupancy time of one hour for passage of a vessel into and out of the harbor, channel occupancy has declined from 17% to 9.7%. Even after allowing for military vessels (including priority vessels such as aircraft carriers) and weather interruptions, the harbor's navigation channels appear to have a substantial capacity for additional vessels. 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 up to 145 container vessels and 242 break-bulk vessels above the average visiting the Port of Guam over a one year period would result in less than a significant impact on marine transportation in Apra Harbor.

In response to Draft EIS comments from the PAG, the following presents an estimate of the ship air emissions based on the projected vessel port calls that would result due to the proposed actions. It is important to note that the Port is controlled by the PAG and that DoD does not monitor commercial or private vessel traffic within the Port. Further, there are limited data available for quantifying the vessel air emissions generated as a result of the relocation. Therefore, as discussed in Chapter 5, Air Quality, any increase in air emissions associated with increased vessel traffic in Guam is not under DoD control.

The rough order of magnitude (ROM) for vessel air emissions is based on the estimated number of container and break-bulk/roll-on roll-off (RORO) ships that are presumed to visit Guam as a result of the relocation and various assumptions set forth below. Table 14.2-3 presents the estimated ship numbers.

Table 14.2-3. Port of Guam Estimated Number of Vessel Calls

<i>Year</i>	<i>Container Ships</i>	<i>Breakbulk/RORO Ships</i>	<i>Total</i>
1995*	117	477	594
2008	147	212	359
2009	153	243	396
2010	183	289	472
2011	211	450	661
2012	244	532	776
2013	252	519	771
2014	258	507	765
2015	269	262	531
2016	255	199	454
2017	215	204	419
2018	207	206	413

Source: Tables 14.1-1, 14.2-1, 14.2-2

* Historical Data (PAG 2008).

The estimated number of ships from the Marine Corps relocation for the years 2010 through 2014 were compared to the year 1995 (historical data) as shown in Table 14.2-4.

Table 14.2-4. Estimated Number of Vessels Resulting from the Marine Relocation (Using 1995 Historical Data)

<i>Year</i>	<i>Container Ships</i>	<i>Breakbulk/RORO Ships</i>	<i>Tugboats*</i>
2010	66	-188	-122
2011	94	-27	67
2012	127	55	182
2013	135	42	177
2014	141	30	171

*Assumes one assist tugboat for each ship for maneuvering

The following assumptions were used for the ROM estimation:

- Types of ships: Container ships and Break-bulk/RORO ships; Assist tugboat for each ship for maneuvering.
- Port ship movements: Maneuvering and hotelling; Auxiliary engines and boilers with Marine Diesel Oil (MDO) are used for ships; Main engines for assist tugboats.
- Activity (A) in port (each ship): 24 hours (2 hours for maneuvering and 22 hours for hotelling).
- The estimate was calculated using power values, load factors, and emission factors related to diesel ships/vessels obtained from *U.S. EPA Current Methodologies in Preparing Mobile Source Port-related Emission Inventories* (EPA April 2009).
 - Power (P): Table 2-4 for container ships (6800 kilowatts) and break-bulk/RORO ships (2850 kilowatts); Table 3-10 for assist tugboats (2 engines at 1540.1 kilowatts each).
 - Load Factor (LF): Table 2-7 for ships [container ships: 0.48 (maneuvering) and 0.19 (hotelling); break-bulk/RORO ships: 0.45 (maneuvering) and 0.26 (hotelling)]. Assume 1 for assist tugboats.
 - Emission Factor (EF): Table 2-16 for auxiliary engines; Table 3-8 for assist tugboats (tier 0 engines, category 2).
 - Boiler Energy (BE): Table 2-17 for container ships (506) and break-bulk/RORO (109).
 - Steam Turbine Emission Factors (ST EF): Table 2-9 for ST using MDO.
 - Conversion Factor (CF): 0.0000011 (1 ton/2000 pounds x 1 pound/454 grams)
 - Engine Emissions (tons) = $P \times LF \times A \times EF \times CF$
 - Boiler Emissions (tons) = $BE \times A \times ST \text{ EF} \times CF$

Based upon the above noted information and assumptions, vessel air emissions resulting from the Marine Corps relocation by pollutant type is shown in Table 14.2-5. These air emissions estimates are based on the current 2014 relocation schedule. Note that with the PAG's Port Improvement Project, reductions in emissions of CO₂, NO_x and PM for each hour of port operation are expected for all vessels, including the vessels resulting from the Marine Corps relocation. Also, the air emissions could be reduced through implementation of the Adaptive Program Management and/or Force Flow Reduction mitigation measures discussed in Volume 7.

**Table 14.2-5. Air Emissions Estimated from Vessels at Port of Guam
Resulting from the Marine Relocation**

<i>Year</i>	<i>Nitrogen Oxides (NO_x)</i>	<i>Particulate Matter 10 (PM₁₀)</i>	<i>Particulate Matter 2.5 (PM_{2.5})</i>	<i>Hydrocarbons (HC)</i>	<i>Carbon Monoxide (CO)</i>	<i>Sulfur Dioxides (SO_x)</i>	<i>Carbon Dioxide (CO₂)</i>
2010	-29	-1	-1	1	4	20	3,514
2011	51	3	1	1	4	20	3,514
2012	104	5	3	3	8	38	6,732
2013	104	5	3	3	8	38	6,799
2014	103	5	3	3	8	38	6,800

Naval Base Guam

Construction

No impacts on marine transportation resulting from the proposed action and alternatives are expected.

Operation

No impacts on marine transportation resulting from the proposed action and alternatives are expected.

14.2.2.5 South

Naval Munitions Site

Construction

No impacts on marine transportation resulting from the proposed action and alternatives are expected.

Operation

No impacts on marine transportation resulting from the proposed action and alternatives are expected.

Non-DoD Land

Construction

No impacts on marine transportation resulting from the proposed action and alternatives are expected.

Operation

No impacts on marine transportation resulting from the proposed action and alternatives are expected.

14.2.2.6 Summary of Impacts

There would be additional commercial vessels visiting the commercial port at Apra Harbor as a result of the proposed relocation of Marines from Okinawa to Guam. Additional container and break-bulk cargo ships would be required to transport the equipment and supplies necessary to support the relocation. Approximately 145 additional container ships would be required in 2015 (the peak year of container shipments) above the annual average of 124 container ships. Approximately 242 additional break-bulk ships would be required in 2012 (the peak year of break-bulk cargo shipments) above the annual average of 290 break-bulk ships. In addition, there would be about 127 trips over a period of 6 to 9 months by a tug and scow to dispose of dredged material from Sierra Wharf. Because there has been a steady and substantial decline in the number of commercial vessels visiting the Port of Guam from 1995 through 2008 (2,924 to 1,022 vessels), the addition of up to 514 vessels is still well below the total number of vessels visiting the Port of Guam in 1995. These additional vessel trips would result in less than a significant impact on marine navigation in Apra Harbor.

14.2.2.7 Proposed Mitigation Measures

No mitigation measures are needed.

14.2.3 Alternative 2 (Preferred Alternative)

14.2.3.1 North

Andersen AFB

Construction

The impacts for Alternative 2 are the same as Alternative 1.

Operation

The impacts for Alternative 2 are the same as Alternative 1.

Finegayan

Construction

The impacts for Alternative 2 are the same as Alternative 1.

Operation

The impacts for Alternative 2 are the same as Alternative 1.

Non-DoD Land

Construction

The impacts for Alternative 2 are the same as Alternative 1.

Operation

The impacts for Alternative 2 are the same as Alternative 1.

14.2.3.2 Central

Andersen South

Construction

The impacts for Alternative 2 are the same as Alternative 1.

Operation

The impacts for Alternative 2 are the same as Alternative 1.

Barrigada

Construction

The impacts for Alternative 2 are the same as Alternative 1.

Operation

The impacts for Alternative 2 are the same as Alternative 1.

Non-DoD Land

Construction

The impacts for Alternative 2 are the same as Alternative 1.

Operation

The impacts for Alternative 2 are the same as Alternative 1.

14.2.3.3 Apra Harbor

Harbor

Construction

The impacts for Alternative 2 are the same as Alternative 1.

Operation

The impacts for Alternative 2 are the same as Alternative 1.

Naval Base Guam

Construction

The impacts for Alternative 2 are the same as Alternative 1.

Operation

The impacts for Alternative 2 are the same as Alternative 1.

14.2.3.4 South

Naval Munitions Site

Construction

The impacts for Alternative 2 are the same as Alternative 1.

Operation

The impacts for Alternative 2 are the same as Alternative 1.

Non-DoD Land

Construction

The impacts for Alternative 2 are the same as Alternative 1.

Operation

The impacts for Alternative 2 are the same as Alternative 1.

14.2.3.5 Summary of Impacts

The impacts for Alternative 2 are the same as Alternative 1. The additional vessel trips due to construction, dredging, and operations would result in less than a significant impact on marine navigation in Apra Harbor.

14.2.3.6 Proposed Mitigation Measures

No mitigation measures are required.

14.2.4 Alternative 3

14.2.4.1 North

Andersen AFB

Construction

The impacts for Alternative 3 are the same as Alternative 1.

Operation

The impacts for Alternative 3 are the same as Alternative 1.

Finegayan

Construction

The impacts for Alternative 3 are the same as Alternative 1.

Operation

The impacts for Alternative 3 are the same as Alternative 1.

Non-DoD Land

Construction

The impacts for Alternative 3 are the same as Alternative 1.

Operation

The impacts for Alternative 3 are the same as Alternative 1.

14.2.4.2 Central

Andersen South

Construction

The impacts for Alternative 3 are the same as Alternative 1.

Operation

The impacts for Alternative 3 are the same as Alternative 1.

Barrigada

Construction

The impacts for Alternative 3 are the same as Alternative 1.

Operation

The impacts for Alternative 3 are the same as Alternative 1.

Non-DoD Land

Construction

The impacts for Alternative 3 are the same as Alternative 1.

Operation

The impacts for Alternative 3 are the same as Alternative 1.

14.2.4.3 Apra Harbor

Harbor

Construction

The impacts for Alternative 3 are the same as Alternative 1.

Operation

The impacts for Alternative 3 are the same as Alternative 1.

Naval Base Guam

Construction

The impacts for Alternative 3 are the same as Alternative 1.

Operation

The impacts for Alternative 3 are the same as Alternative 1.

14.2.4.4 South

Construction

The impacts for Alternative 3 are the same as Alternative 1.

Operation

The impacts for Alternative 3 are the same as Alternative 1.

Non-DoD Land

Construction

The impacts for Alternative 3 are the same as Alternative 1.

Operation

The impacts for Alternative 3 are the same as Alternative 1.

14.2.4.5 Summary of Impacts

The impacts for Alternative 3 are the same as Alternative 1. The additional vessel trips due to construction, dredging, and operations would result in less than a significant impact on marine navigation in Apra Harbor.

14.2.4.6 Proposed Mitigation Measures

No mitigation measures are required.

14.2.5 Alternative 8

14.2.5.1 North

Andersen AFB

Construction

The impacts for Alternative 8 are the same as Alternative 1.

Operation

The impacts for Alternative 8 are the same as Alternative 1.

Finegayan

Construction

The impacts for Alternative 8 are the same as Alternative 1.

Operation

The impacts for Alternative 8 are the same as Alternative 1.

Non-DoD Land

Construction

The impacts for Alternative 8 are the same as Alternative 1.

Operation

The impacts for Alternative 8 are the same as Alternative 1.

14.2.5.2 Central

Andersen South

Construction

The impacts for Alternative 8 are the same as Alternative 1.

Operation

The impacts for Alternative 8 are the same as Alternative 1.

Barrigada

Construction

The impacts for Alternative 8 are the same as Alternative 1.

Operation

The impacts for Alternative 8 are the same as Alternative 1.

Non-DoD Land

Construction

The impacts for Alternative 8 are the same as Alternative 1.

Operation

The impacts for Alternative 8 are the same as Alternative 1.

14.2.5.3 Apra Harbor

Harbor

Construction

The impacts for Alternative 8 are the same as Alternative 1.

Operation

The impacts for Alternative 8 are the same as Alternative 1.

Naval Base Guam

Construction

The impacts for Alternative 8 are the same as Alternative 1.

Operation

The impacts for Alternative 8 are the same as Alternative 1.

14.2.5.4 South

Construction

The impacts for Alternative 8 are the same as Alternative 1.

Operation

The impacts for Alternative 8 are the same as Alternative 1.

Non-DoD Land

Construction

The impacts for Alternative 8 are the same as Alternative 1.

Operation

The impacts for Alternative 8 are the same as Alternative 1.

14.2.5.5 Summary of Impacts

The impacts for Alternative 8 are the same as Alternative 1. The additional vessel trips due to construction, dredging, and operations would result in less than a significant impact on marine navigation in Apra Harbor.

14.2.5.6 Proposed Mitigation Measures

No mitigation measures are required.

14.2.6 No-Action Alternative

Under the no-action alternative, Marine Corps units would remain in Japan and would not relocate to Guam. No construction, dredging, training, or operations associated with the military relocation would occur. Existing DoD operations on Guam would continue. Therefore, implementation of the no-action alternative would maintain existing conditions, and result in no impacts. The number of military vessels

visiting Guam would not change from current conditions. The number of non-military vessels visiting the Port of Guam would continue to decline or remain at about the current level. There would be no dredging of Sierra Wharf to accommodate the escort ships. Therefore, the no-action alternative would result in no impact on marine transportation. Implementation of the no-action alternative would not meet the mission, readiness, national security and international treaty obligations of the U.S.

14.2.7 Summary of Impacts

Tables 14.2-6, 14.2-7, and 14.2-8, and 14.2-9 summarize the potential impacts of each action alternative (Alternatives 1, 2, 3, and 8) associated with the Main Cantonment, firing range training, ammunition storage, and Naval Munitions Site (NMS) access roads. Table 14.2-10 summarizes the potential impacts of other training, airfield, and waterfront components of the proposed action. A text summary is provided below.

Table 14.2-6. Summary of Main Cantonment Impacts – Alternatives 1, 2, 3 and 8

<i>Main Cantonment Alternatives 1, 2, 3, and 8</i>	
Construction	
NI	<ul style="list-style-type: none"> No impacts on marine transportation are expected.
Operation	
NI	<ul style="list-style-type: none"> No impacts on marine transportation are expected.

Legend: NI = No impact.

Table 14.2-7. Summary of Training Impacts – Firing Range Alternatives

<i>Firing Range Alternatives A and B</i>	
Construction	
NI	<ul style="list-style-type: none"> No impacts on marine transportation are expected.
Operation	
NI	<ul style="list-style-type: none"> No impacts on marine transportation are expected.

Legend: NI = No impact.

Table 14.2-8. Summary of Training Impacts – Ammunition Storage Alternatives

<i>Ammunition Storage Alternatives A and B</i>	
Construction	
NI	<ul style="list-style-type: none"> No impacts on marine transportation are expected.
Operation	
NI	<ul style="list-style-type: none"> No impacts on marine transportation are expected.

Legend: NI = No impact.

Table 14.2-9. Summary of Training Impacts – NMS Access Roads Alternatives

<i>Access Road Alternatives A and B</i>
Construction
NI <ul style="list-style-type: none"> No impacts on marine transportation are expected.
Operation
NI <ul style="list-style-type: none"> No impacts on marine transportation are expected.

Legend: NI = No impact.

Table 14.2-10. Airfield and Waterfront Component Impacts

<i>Other Training (North/Central/South)</i>	<i>Airfield (North)</i>	<i>Waterfront (Apra Harbor)</i>
Construction		
NI <ul style="list-style-type: none"> No impacts on marine transportation are expected. 	NI <ul style="list-style-type: none"> No impacts on marine transportation are expected. 	LSI <ul style="list-style-type: none"> Adequate capacity to accommodate increased vessel traffic would result in less than significant impacts on marine transportation at Apra Harbor
Operation		
NI <ul style="list-style-type: none"> No impacts on marine transportation are expected. 	NI <ul style="list-style-type: none"> No impacts on marine transportation are expected. 	LSI <ul style="list-style-type: none"> Adequate capacity to accommodate increased vessel traffic would result in less than significant impacts on marine transportation at Apra Harbor

Legend: LSI = Less than significant impact, NI = No impact.

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 number of vessels visiting the harbor has decreased steadily and substantially between the period of 1995 to 2008. The proposed relocation of the Marines would result in an increase in the number of vessels using Apra Harbor primarily during the period of 2010 through 2017. It is expected that the increased vessel traffic could be accommodated by the navigation channels in the harbor since the annual number of vessels visiting the harbor during even the peak year of container and break-bulk shipments would be less than the number of vessels visiting the harbor in 1995. Therefore, the proposed relocation of the Marines would result in less than significant impacts on marine transportation in Apra Harbor.

14.2.8 Summary of Proposed Mitigation Measures

No significant impacts on marine transportation would result from the proposed action and alternatives. No mitigation measures are required.

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