CHAPTER 2.
OVERVIEW OF BEST MANAGEMENT PRACTICES AND MITIGATION MEASURES

This chapter presents an overview of all Best Management Practices (BMPs) and mitigation measures discussed in Volumes 2 through 6 of this EIS/OEIS. BMPs are management actions implemented as part of Department of Defense (DoD) policies or standard operating procedures to comply with local, state or federal regulations to ensure environmental protection. BMPs are not considered mitigation procedures because they are ongoing, regularly occurring practices. BMPs from Volumes 2 through 6 are summarized in this volume.

Mitigation refers to actions implemented to avoid, minimize, rectify, reduce/eliminate, or provide compensation for a significant impact tan alternative. In 40 Code of Federal Regulations (CFR) 1508.20, the Council on Environmental Quality (CEQ) defines mitigation as:

- Avoidance: Avoids the impact by changing the action. Does not take certain actions that would cause the environmental effect.
- Minimization: Minimizes impacts by changing the intensity, timing, magnitude, or duration of the action and its implementation.
- Rectifying: Rehabilitating, repairing, or restoring damage that may be caused by implementing the proposed action.
- Reducing/Eliminating: Reduction or elimination of the impact over time.
- Compensation: Replacing damage and improving the environment elsewhere, or provide substitute resources such as funds to pay for the environmental impact.

Mitigation measures for the selected alternative will be identified in the Record of Decision (ROD). Mitigation measures identified in the ROD will be funded and efforts to ensure their successful implementation will be treated as compliance requirements and tracked as part of the Navy's post-ROD monitoring plan. Potential mitigation measures are identified and presented in Volumes 2 through 6 of this EIS/OEIS and are summarized and further discussed in this volume.

2.1 BEST MANAGEMENT PRACTICES (BMPS) ON GUAM AND TINIAN

For the purposes of this EIS/OEIS, BMPs are management actions that are implemented by the Navy on an ongoing basis as part of standard operating procedures. BMPs are considered in the impact analysis because they would provide for ongoing environmental protection. This section provides a summary of potential BMPs that may apply to protection of geologic, biologic and water resources, and human resources (i.e., public education and outreach and environmental justice). These BMPs are followed during construction and operations by the DoD and are embedded in their numerous policies and orders. Table 2.1-1 provides a summary of the potential BMPs regarding when or where they might be applied and the resources they are designed to protect. Following the table is a discussion of the plans or policies where the BMPs are included.

Table 2.1-1. Summary of Best Management Practices (Guam and Tinian)

Item	*BMP*	*Description*	*Activities*		*Geological Resources*	*Water Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Hazmat Resources*
			Construction	*Operation*					
1	Erosion Control	A range of BMPs are proposed to control erosion during construction and operations to eliminate and/or minimize nonpoint source pollution in surface waters due to sediment. Erosion control BMPs include the following procedures: **Construction:** • Erosion control through site approval process (whereby the Navy reviews each proposed project for its erosion potential, and involves the designated installation Natural Resource Specialist in the process). • Topsoil removed from the site should be placed in the immediate area and reused for re-compaction purposes (if appropriate, in accordance with geotechnical recommendations). • Soil exposed near water as part of the project would be protected from erosion with erosion control blankets (organic or synthetic fibers held together with net to cover disturbed areas) after exposure, and stabilized as soon as practicable (with vegetation matting, hydroseeding, etc.). • Flatten landfill slopes for increased soil stability. • Silt-containment (silt fences and haybales; barriers that intercepts runoff from drainage areas). • Re-vegetate as soon as possible after any ground disturbance or grading. • Minimize construction and grading during times of inclement weather. • Soil piles and exposed slopes should be covered during times of inclement weather. • Stockpiling of any excavated materials should occur behind impermeable berms and away from the influence of river waters and runoff. • Implement a re-vegetation program to ensure graded benches are fully vegetated as landfills mature. • Vegetation/mulch stabilization (applying coarse plant residue to cover soil surface. The vegetation/mulch should be free of invasive species viable reproductive parts, such as rhizomes, seeds, and plants).	X	X	X	X	X	X	X

Item	*BMP*	*Description*	*Activities*		*Geological Resources*	*Water Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Hazmat Resources*
			Construction	*Operation*					
		• Level spreader (non-erosive outlet for runoff to disperse flow uniformly across slope). • Rock outlet protection (rock protection placed at end of culverts). • Sediment basin (barrier that retains sediment from runoff). **Operation:** • Restrict vehicles in training areas (ensure that all training areas, including transit routes necessary to reach training areas, are clearly identified or marked. Restrict vehicular activities to designated/previously identified areas). • Control the carabao population (through hunting, etc.) in order to prevent soil erosion by feral ungulates. • Siting training locations (locate ground disturbing training activities on previously disturbed sites whenever possible). • Monitor erosion and drainage (monitor erosion and drainage at select locations). • Place a buffer zone of vegetation around sinkholes to prevent further erosion or expansion.							

Item	*BMP*	*Description*	*Activities*		*Geological Resources*	*Water Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Hazmat Resources*
			Construction	*Operation*					
2	Stormwater Management under the Clean Water Act (CWA): Stormwater Management Plan (SWMP)	In compliance with the federal CWA under Section 401, the proposed actions would require a SWMP. A SWMP is a document that describes the minimal procedures and practices used to reduce the surface flow and subsequent discharge of pollutants to storm drainage systems. Elements of a SWMP procedures include: • Check dams (small temporary stone dam across drainage). • Diversion dike/swale (berm or ditch that channels water to desired location). • Lined waterway (lined outlet for drainage). • Stormdrain inlet protection (permeable barrier around inlets reducing sediment let into storm drain). • Stormwater ponds and wetlands. • Infiltration practices (capture/temporarily store water before infiltrating into the soil). • Filtering practices (capture/temporarily store water and pass through filter beds of sand, organic matter, soil, or other media).	X		X	X	X	X	X
3	Stormwater Management under the CWA: Stormwater Pollution Prevention Plan (SWPPP)	• Facilities would be required to comply with the SWPPP during day-to-day operations to ensure that stormwater remains free of contaminants. • A SWPPP is a self-implementing plan for compliance with an installation's stormwater permit. It requires development of pollution prevention measures to reduce and control pollutants in stormwater discharge. • A site-specific SWPPP tailors the plan to the facility and associated activities most likely to have a negative impact on stormwater. Applicable SWPPPs would manage stormwater and erosion at each training location.	X	X	X	X	X	X	X

Item	*BMP*	*Description*	*Activities*		*Geological Resources*	*Water Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Hazmat Resources*
			Construction	*Operation*					
4	Water Quality Monitoring Plan (WQMPs)	• WQMPs evaluate the effectiveness of environmental permits and/or performance standards. Monitoring plans identify ambient or control conditions at a particular site and capture deviations from those conditions resulting from a project or operations of a facility. • WQMPs may range in complexity from visual inspections for sedimentation and protection measure failure to laboratory or field analysis of chemical and biological effects on water quality or organisms (acute/chronic bioassay), dependent on a given water resource.	X	X	X	X	X	X	X
5	BioSecurity Plan	The Navy has provided funding for a biosecurity plan. A comprehensive biosecurity plan details procedures to minimize the risk of the spread of invasive species. For example, a successful biosecurity plan for Guam and Tinian would identify required components of a brown tree snake (BTS) containment program (such as traps, toxicants, working dogs, and hand capture) based on a risk assessment. A *Micronesian Biosecurity Plan* is being developed in cooperation with regulatory agencies The plan would include design, installation, and operational processes to prevent BTS and other invasive species from passing through entry and exit points at Guam and Tinian.	X	X			X	X	
6	Leadership in Energy and Environmental Design (LEED) Certification	Current Navy/Marine Corps policy pursues and facilitates LEED Silver certification for bases. LEED is a voluntary point system tool that measures the degree of sustainability features incorporated into a development. Some LEED requirements include: • Reduction of electrical energy use in buildings by 10% to save power. • Construction materials: use of local sources, reuse/recycle a minimum of 10% recycled content. • Alternative transportation. • Increased water efficiency. • Renewable energy. The sustainability/LEED initiatives will reduce potable water use and should have	X	X	X	X	X	X	X

Item	*BMP*	*Description*	*Activities*		*Geological Resources*	*Water Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Hazmat Resources*
			Construction	*Operation*					
		an effect on wastewater demand.							
7	Low Impact Development (LID)	The Navy could implement LID design technology to make use of innovative methods to capture stormwater that would otherwise flow into nearby watersheds. Examples of LID design include: • Grassed channel (channel stabilized by vegetation to convey water down a slope). • Grassed vegetation maintained on berms. • Integrated pest management. • Native plant landscaping. • Avoidance of pesticides and fertilizers. • Bio-retention strips.	X	X	X	X	X	X	X
8	Energy Policy Act of 2005 (EPACT)	EPACT 2005 compliance includes analysis and life cycle cost analysis using a simulated model and the following energy conservation measures: • Buildings shall achieve an energy consumption level that is 30% below the level achieved by ASHRAE Standard 90.1. • Energy consuming products shall be either Energy Star-qualified or FEMP-recommended. • Optimize building orientation to reduce cooling loads or energy loads to cool the buildings • Optimize building insulation • Seal building envelope for air tightness • "Cool roof" • Use motion detectors to reduce lighting and to setback cooling in unoccupied buildings • Natural lighting							
9	Water Conservation	Implementation of a water conservation plan measures include: • Low-flow faucets	X	X		X			

Item	*BMP*	*Description*	*Activities*		*Geological Resources*	*Water Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Hazmat Resources*
			Construction	*Operation*					
	Plan	• Ultra-low-consumption toilets/urinals with electric flush sensors • Low-flow showerheads • Lower flow commercial-type "Energy Star" washing machines in housing units • Energy and water-saving dishwashers (Energy Star). • Use of water softeners only as needed. • Use of wastewater recycling in industrial washing and rinsing of aircrafts and vehicles. • Water-efficient cooling systems. • Minimal landscape irrigation and no irrigation at housing. • Rainwater collection and reuse. • Meters installed at all facilities and key locations within the water distribution system significantly improving the ability to quickly identify leaks and take corrective action. • Education of military population regarding practices that would conserve water (including full-load clothes washing).							
10	Hazardous Waste Management Program (HWMP)	HWMP includes waste minimization plans that provide protocols designed to encourage and promote the efficient use of hazardous substances, substitute products that are less toxic whenever feasible, minimization of their use, and promote recycling and reuse of hazardous substances. HWMPs include the following recommendations: • Update and implement the existing HWMP to include procedures for the transportation, storage, use, and disposal of hazardous waste. • DoD personnel training regarding facility-specific hazardous waste plans • Housekeeping protocol (improving overall hazardous waste housekeeping practices, keeping area free of trash, keeping area swept, wiping up spills, etc.) • Project hazardous waste disposal as it relates to operational requirements. • Using the Defense Reuse Marketing Office's capacity for hazardous	X	X					X

Item	*BMP*	*Description*	*Activities*		*Geological Resources*	*Water Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Hazmat Resources*
			Construction	*Operation*					
		substance storage, transportation, and disposal capacity prior to any expected increases • Ensure all federal, local, and DoD laws and regulations are being observed (i.e., inspection and surveillance); implement corrective actions as necessary. • Contractors would be required to manage, store, and dispose of hazardous wastes in accordance with applicable USEPA, RCRA, and HSWA requirements. • Contractors would be required to dispose of all petroleum, oil and lubricants (POL), polychlorinated biphenyls (PCBs), asbestos containing material (ACMs), and other hazardous substances in accordance with Guam Environmental Protection Agency (GEPA) regulations. • Contaminated topsoil removed from the site should be properly disposed of in an approved landfill in accordance with applicable regulatory requirements.							
11	Spill Prevention Control and Counter-measures Plans (SPCC) and Facility Response Plans (FRP)	• Update and implement existing SPCC plan to assess and respond to hazardous substance spills and/or releases. • Update and implement existing FRPs for responding to releases, leaks, or spills of hazardous substances. • Fuel transfers (petroleum transfers would be kept away from water bodies, and a contingency plan would be in place in the event of any petroleum spills). • Labeling (ensure proper labeling of all hazardous substance containers to prevent contamination). • Contaminant migration control (reducing contaminant migration pathways by preventing releases to drains, pipelines, and sewers and the use of absorbent pads and materials to prevent and control spills and releases).	X	X	X	X	X	X	X

Item	*BMP*	*Description*	*Activities*		*Geological Resources*	*Water Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Hazmat Resources*
			Construction	*Operation*					
		• Ensure that contaminants (i.e., oils, greases, lubrication fluids for heavy equipment) are properly stored at work sites and temporary construction staging areas to avoid spills and leaks). • Ensure that emergency response plans are in place for responding to releases, leaks, or spills of hazardous substances. • Minimize the risk of uncontrolled spills and releases through industry and Navy accepted methods for spill prevention, containment, control, and abatement. • Minimize the risk of human exposure to contaminated media through the use of a site-specific health and safety plan, engineering and administrative controls, and appropriate personal protective equipment (PPE) (e.g., indicating where eye-wash stations, fire extinguishers, etc., are located). •							
12	Hazardous Materials Management Plans (HMMP)	HMMP would describe implementation procedures for the transportation, storage, use, and disposal of hazardous materials. HMMPs would contain the following procedures: • Hazardous substance spill/release control (use of secondary containment and leak detection methods in operations involving liquid hazardous substances) • Construction materials (and all construction-related materials) should be free of leachable pollutants. • Train personnel (ensures DoD personnel and contractors 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 cleanup methods). • Perform all vehicle maintenance activities off the training range at existing DoD maintenance shops. • Implement routine firing range clearance operations (e.g., annually or as	X	X	X	X		X	X

Item	*BMP*	*Description*	*Activities*		*Geological Resources*	*Water Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Hazmat Resources*
			Construction	*Operation*					
		needed) to mitigate munitions and explosives of concern (MECs). • Implement land use controls, fencing, signage, and other means to ensure no unauthorized access to the firing ranges.							
13	Munitions and Explosives of Concern	• Reduce the potential exposure to unexploded ordnance (UXO), through surveys to identify and remove ordnance from the work site. Work would be conducted by qualified UXO specialists prior to the start of construction. • Train construction crews on identifying and responding to MECs encountered in the field. UXO personnel would be available to monitor earthmoving activities.	X			X		X	X
14	Land Use Planning and Project Design	Land Use Planning and Project Design BMPs include: • Minimize impacts through design, and incorporating site plans that attempt maximum land use efficiency. Place future industrial use sites in the vicinity of similar DoD industrial uses. • Use the community development planning process to minimize impacts to land use. • Maintain a perimeter buffer within DoD property boundaries. • Reduce seismic, liquefaction and ground shaking by following Unified Facility Code 3-310-04 Seismic Design for Buildings (USACE 2007). • Minimize land acquisitions. • Install utilities in existing corridors to the extent possible. • Avoid the acquisition of public facilities, such as park land (FHWA), to the extent practical.	X		X	X	X		
15	Natural Resource Management (Terrestrial and Marine Biology)	Terrestrial: Numerous measures are currently implemented and will continue to reduce impacts to terrestrial biology, such as the following: • No-Training Areas within a 328-ft (100-m) radius around Mariana swiftlet caves at Naval Munitions Site (NMS). • No-Training Areas around wetlands with known Mariana common moorhen nesting activity.	X	X			X	X	

Item	*BMP*	*Description*	*Activities*		*Geological Resources*	*Water Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Hazmat Resources*
			Construction	*Operation*					
		• BTS interdiction and control measures are implemented by a BTS Control and Interdiction or Management Plans (COMNAV Instruction 5090.10A, dated February 2005; Andersen AFB 36 WG Instruction 32-7004 dated March 2006). • Prevent the spread of invasive species by implementing a training SOP; troops would receive awareness training and would inspect all gear and clothing (e.g. boots, bags, weapons, pants) for soil accumulations, seeds, invertebrates, and possible inconspicuous stow away BTS. Trap BTS at swiflet caves. The Navy has been contracting with USDA Wildlife Services to trap BTS at the swiftlet caves. BTS are also trapped in housing areas. • Use the minimum lighting necessary to comply with navigation rule and best safety practices aboard vessels at sea. • Sea Turtle protections (see marine biology BMPs for other protection measures). During the period of nighttime dredging activities, observers would monitor the 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. Any activity that resulted, or might result in disturbance to the nesting or hatching, would be halted. Marine Biology: Sea Turtles: Navy would consider the following NOAA-recommended lighting and construction BMPs to minimize potential impacts on 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							

Item	*BMP*	*Description*	*Activities*		*Geological Resources*	*Water Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Hazmat Resources*
			Construction	*Operation*					
		voluntarily depart the area. • Inform construction personnel of the protected nature of these animals and procedures that should be implemented 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. • Use low-intensity light sources, where possible, that emit long wavelength light (yellow, red) and avoid sources that emit short wavelengths (ultraviolet, blue, green, white). • Use minimum lighting necessary aboard dredge-related tug, barge or scow vessels at sea to comply with navigation rules and best safety practices. • Deploy silt curtains 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. • Remove construction-related materials that may pose an entanglement hazard from the project site if not actively being used.							

Item	*BMP*	*Description*	*Activities*		*Geological Resources*	*Water Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Hazmat Resources*
			Construction	*Operation*					
		• Anchor lines from construction vessels would be deployed with appropriate tension to avoid entanglement with sea turtles. Other marine biology BMPS: • Maintain constant vigilance for the presence of ESA-listed species. • Alter course of vessels 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. • Avoid encircling or trapping marine mammals and sea turtles between multiple vessels or between vessels and the shore. • Do not attempt to feed, touch, ride, or otherwise intentionally interact with any protected species.							
16	Public Outreach/ Education	Develop and implement a Public Outreach Program to: • Inform residents, businesses, and service providers about the project schedule and other relevant information. • Implement public awareness education seminars and workshops regarding the dangers of munitions and explosives of concern (MEC) the importance of staying off firing ranges, and what to do if you observe what may be MEC. • Promote public meeting announcements by posting ads in multiple places. • Provide public meeting written materials translated in Chamorro and Filipino, supply and interpreter at public meetings. Mail announcements of public meetings to areas that may be disproportionately impacted by proposed actions (i.e., residents of Dededo, Yigo, Barrigada, Mangilao, Piti, Santa Rita, Agat, and Talofofo).	X		X		X	X	X

Item	*BMP*	*Description*	*Activities*		*Geological Resources*	*Water Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Hazmat Resources*
			Construction	*Operation*					
		• Mail announcements of public meetings to more rural areas in the south (i.e. Agat and Talofofo). • Hold public meetings in the southern region in accessible locations to as many people in that region as possible (public transportation may not be available in all rural areas). • Educate residents about the significance and danger of sinkholes.							
17	Army Corps of Engineers (USACE)	USACE permit conditions and BMPS from recent Apra Harbor projects (that minimize degradation of water quality and impacts to fish and wildlife resources) provide the following recommendations: • All project-related materials and equipment (dredges, barges, etc) placed in the water should be clear of pollutants prior to use; i.e., no project-related materials (fill, revetment rock, etc.) should be stockpiled in the water (intertidal zones, reef flats, etc.). • All debris removed from the marine/aquatic environment should be disposed at an approved upland or ocean-dumping site. • No contamination (trash or debris disposal, alien species introductions etc.) of adjacent marine/aquatic environments (reef flats, channels, open ocean, stream channels, etc.) should result from project-related activities. • Fueling of project-related vehicles and equipment should take place away from the water. • A contingency plan to control petroleum products accidentally spilled during the project should be developed. • Absorbent pads and containment booms should be stored on-site to facilitate the clean-up of accidental petroleum releases. • Any under-layer fills used should be protected from erosion with stones (or concrete cover layer units) as soon after placement as practicable. • Dredged material dewatering areas should be constructed and operated in accordance with all permit requirements. • Provide advanced public notice of dredging activities to minimize	X	X	X	X	X	X	

Item	*BMP*	*Description*	*Activities*		*Geological Resources*	*Water Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Hazmat Resources*
			Construction	*Operation*					
		conflicts with commercial shipping and recreational boating. • Additional ship traffic should be addressed through scheduling and communications between Port Operations and contractors.							
18	Transportation Federal Highway Administration -(FHWA) specific	Roadway project construction BMPs include the following recommendations: • Individual roadway projects should be designed and constructed in accordance with Safe, Accountable, Flexible, and Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) objectives. • Final roadway designs should avoid contaminated sites where possible. • Temporary equipment laydown or construction staging areas should be located in previously disturbed (e.g., paved) areas. • Material from demolition of existing road pavements should be stored in previously disturbed areas whenever possible. • Final roadway designs should include coordination with the responsible party to ensure that roadway construction does not interfere with ongoing remediation activities. • A Phase II environmental site assessment should be conducted for roadway projects with Right-of Way (ROW) acquisitions of non-residential property. • Individual roadway projects should be designed and constructed in accordance with recommendations of the project- and site-specific geotechnical investigation, and applicable geotechnical code requirements. • In accordance with Section 10106 (*General Requirements: Erosion and Sediment Control Plans*) of the GSESCR, an Erosion and Sediment Control Plan for roadway construction/work should be prepared, submitted to the GEPA for review and approval, and implemented in construction plans and practices to the maximum extent practicable. • Prevent leaks or spills of contaminants by ensuring all temporary	X		X	X	X		X

Item	*BMP*	*Description*	*Activities*		*Geological Resources*	*Water Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Hazmat Resources*
			Construction	*Operation*					
		equipment laydown or construction staging areas are constructed with secondary containment for storage of any hazardous or petroleum products (FHWA) • Locate temporary equipment laydown or construction staging areas in previously disturbed (e.g., paved) areas (FHWA)							
19	Noise Abatement	Noise abatement measures may include the following: • Reduction of construction noise impacts to nearby residences may include project sequencing or temporary (or permanent) sound walls. Berms could be built behind and adjacent to the live-fire training ranges. • Equipment noise control (roadway construction): o Ensure that all equipment items have the manufacturers' recommended noise abatement measures, such as mufflers, engine enclosures, and engine vibration isolators, intact and operational o Inspect all construction equipment at periodic intervals to ensure proper maintenance and presence of noise control devices (e.g., mufflers and shrouding) o Turn off idling equipment. Administrative measures (roadway construction) should include the following: • Implement a construction noise monitoring program to limit impacts. • Plan noisier operations during times of reduced receptor sensitivity. • Avoid scheduling construction during nighttime hours (10:00 p.m. to 7:00 a.m.) and on weekends. • Keep noise levels relatively uniform and avoid impulse noises. • Maintain good public relations with the community to minimize objections to the unavoidable construction impacts. Provide frequent activity updates of all construction activities.	X						
20	Utilities	For roadway projects, planning and continued coordination with utility providers during the preliminary engineering and final design, and construction stages of the	X						

Item	*BMP*	*Description*	*Activities*		*Geological Resources*	*Water Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Hazmat Resources*
			Construction	*Operation*					
		project should minimize or eliminate interruption in utility service to customers. • Where feasible, utility relocations should be undertaken prior to roadway construction activities.							

Stormwater Management under the Clean Water Act (CWA). The CWA established the National Pollution Discharge Elimination System (NPDES) Stormwater Program, which addresses three types of stormwater discharges:

- Municipal Separate Storm Sewer Systems (MS4s) - Operators of large, medium and regulated small MS4s may be required to obtain authorization to discharge stormwater.
- Construction Activities - Operators of construction sites that are 1 ac (0.4 ha) or larger (including smaller sites that are part of a larger common plan of development) may be required to obtain authorization to discharge stormwater under an NPDES construction stormwater permit. As the USEPA is the permitting authority in Guam, operators must meet the requirements of the USEPA's Construction General Permit (CGP) (i.e., The Island of Guam Permit No. GUR100000).
- Industrial Activities - Industrial sectors may require authorization via an NPDES permit for Stormwater Discharges from Industrial Activities. The USEPA is the permitting authority in Guam, therefore operators must meet the requirements of USEPA's Multi-Sector General Permit (MSGP) (i.e., The Island of Guam Permit No. GUR050000).

The MS4 Program contains elements called minimum control measures that result in a significant reduction in pollutants discharged into receiving waters. These minimum measures are often summarized in a stormwater management plan and include:

- Public Education/Outreach and Participation/Involvement - Describes BMPs that involve the public in developing, implementing, and reviewing MS4 management programs and describes ways to reduce stormwater pollution.
- Illicit Discharge Detection and Elimination (IDDE) - Describes BMPs for identifying and eliminating illicit discharges and spills to storm drain systems.
- Construction Site Runoff Control - Describes BMPs for MS4s and construction site operators to address stormwater runoff from active construction sites.
- Post-Construction Runoff Control - Describes BMPs for MS4s, developers, and property owners to address stormwater runoff after construction activities have ended.
- Pollution Prevention/Good Housekeeping Fact Sheets and Webcasts

NPDES permits (both construction and industrial activity) require the development of a SWPPP. With respect to construction activity, the SWPPP is a site-specific, document that identifies potential sources of stormwater pollution at the construction site, it describes practices to reduce pollutants in stormwater discharges from the construction site (reduction of pollutants is often achieved by controlling the volume of stormwater runoff, e.g., taking steps to allow stormwater to infiltrate into the soil), and identifies procedures the operator should implement to comply with the terms and conditions of a construction general permit. With respect to industrial activities, the SWPPP identifies the industrial activities conducted at the site, describes any structural controls or other practices which the industrial facility operator will implement to prevent pollutants from making their way into stormwater runoff, and provides descriptions of other relevant information (e.g., the physical features of the facility, BMPs, and procedures for spill prevention, conducting inspections, and training of employees). The SWPPP is intended to be a “living” document, updated as necessary; when industrial activities or stormwater control practices are modified or replaced, the SWPPP is similarly revised to reflect these changes.

Stormwater Pollution Prevention Plan. The SWPPP is a self-implementing plan for compliance with an installation's stormwater permit. It requires development of pollution prevention measures to reduce and control pollutants in stormwater discharge. Its schedule of activities, prohibition of practices, maintenance procedures, management practices, and engineering controls are intended to prevent or reduce pollution into receiving waters.

Water Quality Monitoring Plan. WQMPs evaluate the effectiveness of different environmental permits and/or performance standards. These monitoring plans are formulated to identify ambient or control conditions at a particular site, and to capture deviations from those conditions resulting from a project or operations of a facility. WQMPs may range in complexity from visual inspections for sedimentation and protection, to measure failure to laboratory or field analysis of chemical and biological effects on water quality or organisms (acute/chronic bioassay), and are dependent on a given water resource. WQMPs always include procedures for reporting results and observations to the GEPA and provisions for corrective actions. Water quality monitoring is a standard requirement for all dredging, industrial point source discharges, municipal wastewater treatment plant discharges, thermal discharges, marine and underwater construction activities, aquaculture effluent discharges, and mass clearing and grading projects.

Leadership in Energy and Environmental Design (LEED) Certification. Current Navy/Marine Corps policy is to pursue and facilitate LEED Silver certification for bases. LEED is a voluntary point system tool that measures the degree of sustainability features incorporated into a development. Examples are included in Table 2.1-1.

Low Impact Development (LID). LID is a design technology that makes use of innovative methods to capture stormwater that would otherwise flow into nearby watersheds. Reducing stormwater runoff from Navy installations helps reduce the level of contaminants, such as metals and nutrients that end up downstream, resulting in a cleaner, safer environment, and improved water quality. LID represents a cost-effective method of reducing the environmental footprint of Navy and Marine Corps installations and activities, using a combination of retention devices and vegetation to allow stormwater to be retained and managed at the source, rather than relying on downstream efforts to control the flow of water and contaminants.

As part of this EIS/OEIS, the Navy is preparing a stand-alone Low Impact Development (LID) study and a comprehensive drainage study to determine stormwater runoff quantities and qualities under the action alternatives. These two studies and the USEPA (2009b) BMP Performance Tool will be used to identify and implement the LID plan by utilizing a variety of natural and built features that reduce the rate of runoff, filter out pollutants, and facilitate the infiltration of water into the groundwater basins. This LID planning will ultimately provide the foundation for the basis of design for permanent stormwater infrastructure.

Reduced Use of Water. DoD entities are required to reduce demand for indoor water by as much as 30% and outdoor water use by 50% in the coming years. Water resource sustainability is addressed in two categories: minimize water demand from groundwater sources, and maximize quantity and quality of groundwater recharge resulting from stormwater runoff. 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

Biosecurity Plan. The U.S. Navy is providing leadership on the issue of biosecurity. Actions that prevent or control invasive species support the Executive Order 13112; Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq*.), as amended (ESA); National Invasive Species Act of 1996; Brown Tree Snake Control and Eradication Act of 2004; Sikes Act (16 U.S.C. 670a *et seq*.); Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855); and the Animal Damage Control Act of 1931, as amended (46 Stat. 1486; 7 U.S.C. 426-426c). Further instructions are found in DOD 4500.9-R (Chapters 505 and 506) and COMNAVMARIANASINST 5090.10A.

The U.S. Navy is collaborating with various agencies to develop a large scale Micronesia Biosecurity Plan (MBP). Experts from National Invasive Species Council, U.S. Fish and Wildlife Service(USFWS), U.S. Department of Agriculture, Guam Division of Aquatic and Wildlife Resources(GDAWR), Commonwealth of the Northern Mariana Islands Division of Fish and Wildlife, and other interested parties will develop an approach to integrate techniques involving exclusion, detection, eradication, and control of non-native and invasive organisms that can be readily implemented into Standard Operating Procedures (SOPs), covering routine logistical and movement matters, training instructions for operational forces, and specific measures for construction projects implementing the proposed actions. This comprehensive plan will identify and prioritize hazards and risks for species, pathways, and vectors which could include, but are not limited to, nuisance and noxious species, construction equipment, personal protective equipment, foot traffic, vehicles and vessels, and shipping material. Among the tools that will be used in the analysis of underlying risks is an internationally recognized Step Hazard Analysis and Critical Control Point (HACCP) planning method (ASTM E2590-08) for reducing or eliminating the spread of unwanted species. HACCP and other instructions will be implemented for projects included in this EIS/OEIS.

Pursuant to the ROD which implements the proposed actions, DoD will seek resources to implement management actions identified in the biosecurity plan that will reduce the risk of introduction and spread via DoD activities, including Guam and Tinian.

2.2 POTENTIAL MITIGATION ON GUAM AND TINIAN

Implementing the proposed actions from each volume of this EIS/OEIS would result in impacts to various resources either during construction or from steady-state operations after construction. This section discusses the potential mitigations that could be undertaken to reduce the impacts from either of these two activities. Generally, mitigation discussed in this EIS/OEIS falls within two categories:

- Mitigation within DoD control - DoD has statutory authority to implement actions taking place on lands under its control. DoD has limited statutory authority to implement natural and cultural resources mitigation on non-DoD land.
- Mitigation outside of DoD control - Except for the limited authority applicable to natural/cultural resources identified above, DoD does not have statutory authority to undertake mitigation measures on non-DoD land.

Examples of both DoD controlled mitigation and non-DoD controlled mitigation that would avoid, minimize, replace, or compensate impacts if implemented by Navy or non-DoD agencies are included in Table 2.2-1. Reasonable alternatives were developed based on a consideration for avoiding and minimizing potential impacts as a result of implementing the proposed alternatives.

Table 2.2-1. Summary of Potential Mitigation Measures (Guam and Tinian)

Potential Mitigation Measure		*Volume*				
		2	*3*	*4*	*5*	*6*
Geological and Soil Resources – No mitigation measures						
Water Resources – Within DoD Control						
WR-1	Attempt to avoid impacts to wetlands; if avoidance is not possible, then minimize potential impacts. Section 404 of the CWA requires mitigation of unavoidable wetland disturbances. Types of mitigation are: wetlands creation, restoration, enhancement or preservation.	X	X			
WR-2	Implement an in-stream monitoring program.	X				
WR-3	Attempt to avoid impacts to potentially jurisdictional cave and pool systems; if avoidance is not possible, minimize potential impacts.	X				X
WR-4	Sections 401 and 404 of CWA require certain procedures be followed to prevent short term and localized impacts of re-suspended sediments. Dredging is regulated under Section 10 of the Rivers and Harbors Act. Mitigation measures may include: • Physical barriers (such as silt curtains, bubble curtains) and no barge overflow during dredging • Dredging within seasonal windows to avoid impacts to coral, • Dredging rate limitations • Water quality monitoring	X		X		
WR-5	A Floodplain Evaluation is required under the National Flood Insurance Program (23 CFR 650, Subpart A Section 650). Measures to mitigate floodplain impacts could include: • Channel widening, channel lining, channel re-contouring • Pier placement/reconfiguration • Utility line relocation where utilities cause obstructions to flow • Debris removal, incorporation of debris noses upstream of piers and wingwalls	X				X
Air Quality – Refer to Utilities' mitigation						
Noise (Human Receptors) – No mitigation measures						
Airspace – No mitigation measures						
Land and Submerged Land Use – Within DoD Control						
LU-1	Negotiate long-term leases instead of purchase of non-federally controlled land.	X		X		
Land and Submerged Land Use – Outside DoD Control						
LU-2	Revise community plans to address proposed DoD land uses. May include buffers around federal-controlled property.	X				
Recreational Resources – Within DoD Control						
RR-1	Prepare a Recreational Carrying Capacity Management Plan that addresses recreational user use, demand, preference, conflicts, and conditions.	X				
RR-2	Offer resources in forms of time and donation or use of equipments to assist the volunteer conservation officer (VCO) at Andersen AFB.	X				
RR-3	Collaborate with the GDAWR to establish outreach programs and docent programs for the five marine preserves and other environmentally sensitive areas on Guam.	X				
RR-4	Marine Corps to provide for improvement and maintenance of Tanguisson Beach, along with the management of the coastline to the north of Hilaan that contains significant natural, cultural, scenic, and recreational resources.	X				

Potential Mitigation Measure		*Volume*				
		2	*3*	*4*	*5*	*6*
RR-5	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 air men have the ability to access comparable and/or alternate recreational resources off-base			X		
Terrestrial Biological Resources – Within DoD Control						
TB-1	Adopt the Andersen AFB aircraft operations monitoring program and adaptive management strategy for Mariana fruit bats and crows and modify as necessary for project-specific actions.	X				
TB-2	Translocate Guam tree snails at Navy Barrigada to another site on DoD lands after approval by USFWS (not required for preferred alternative).				X	
TB-3	Conduct biological surveys for the Mariana fruit bat and Mariana crow before clearing.	X			X	X
TB-4	Update the COMNAV Marianas Training Handbook with procedures to protect special-status species during project-specific training.	X	X			
TB-5	Use hooded lights on roads associated with the proposed new Andersen AFB access gate, truck inspection station, aircraft staging areas, and magazines.	X			X	
TB-6	Monitor fruit bat roost sites weekly in the project area until 1 year after the construction is completed with increased frequency after typhoon events.	X			X	
TB-7	Place additional restrictions on the use of Haputo beach and ERA.	X			X	
TB-8	Place controls on the use of the access road established for NMS training.	X				
TB-9	No ships would be allowed to enter Sasa Bay at night			X		
TB-10	Update the existing Navy Ungulate Management Plans to include the new lands proposed for training and cantonment areas	X			X	
TB-11	Update the existing Navy Fire Management Plan to include new lands proposed for training.	X	X			
TB-12	Establish high quality habitat with perimeter fencing to exclude invasive animals and for establishment of foraging plots.	X			X	X
TB-13	Install fencing or patrols to prevent poaching.	X			X	
TB-14	Conduct biological surveys for Endangered Species Act- (ESA) listed species before construction clearing		X			
TB-15	Monitor birds using "Tropical Monitoring of Avian Productivity and Survival" survey methodology.		X			
TB-16	Develop and implement a Tinian monarch management plan.		X			
TB-17	Reforest plots to improve habitat.		X			
TB-18	Designate new mitigation areas to compensate for Tinian monarch and other bird habitat loss due to the use of some of the existing designated FAA mitigation area.		X			
TB-19	A survey would be conducted in the Rt. 15 range footprint areas prior to clearing for *Heritiera longipetiolata* with subsequent translocation or propagation if found; mature trees identified in previous studies would not be removed	X				
TB-20	Establish Base policies, instructions, or orders to ensure that cats and dogs are documented and all pets are controlled and not allowed at Haputo ERA	X			X	
TB-21	Monitor the Mariana fruit bat, Micronesian kingfisher, and Mariana crow in areas surrounding demolition, breacher, and small arms training areas to determine potential noise impacts and if this monitoring determined that these species were being affected, techniques to reduce noise generation, such as noise barriers, would be employed.	X				
TB-22	Use Hazard Analysis and Critical Control Point (HACCP) planning for high-risk activities and construction projects.	X	X	X	X	
TB-23	Investigate invasive insect management options for the ESA-listed fire tree	X			X	

Potential Mitigation Measure		*Volume*				
		2	*3*	*4*	*5*	*6*
	and SOGCN cycad.					
TB-24	Establish or expand new ecological reserves and conservation areas	X			X	X
TB-25	Conduct sea turtle natural history studies to better understand the species and benefit long-term military mission planning	X		X	X	
TB-26	Limit construction period if Mariana crows are present during the day. No construction at night to avoid impacts to Mariana fruit bat.	X			X	X
TB-27	Monitor the Tinian monarch and Mariana common moorhen (Alternative 1 only for the moorhen) would be conducted in areas surrounding the ranges to determine potential disturbance impacts and, if impacted, noise reduction techniques would be employed.		X			
TB-28	Conduct additional surveys for the Pacific slender-toed gecko at NCTS Finegayan and, habitat enhancement at NMS if necessary	X			X	
TB-29	Establish greenbelt for watershed protection, wildfire control, and restoration of habitat	X				X
TB-30	Exclusion fencing and foraging plots would be set up for protection of wildlife and special-status species.	X			X	
TB-33	Natural resource awareness briefings would be conducted for construction personnel.	X				
Marine Biological Resources –Within DoD Control						
MB-31	Seasonal dredging prohibitions similar to those EPA suggested for the Kilo Wharf dredging activities.					
MB-32	No ships would be allowed to enter Sasa Bay at night.			X		
MB-33	Dredging/filling in the marine environment would be scheduled to avoid coral spawning and recruitment periods.			X		
MB-34	Provide marine biological resources education and training on Essential Fish Habitat (EFH), Endangered Species Act (ESA) and Marine Mammal Protection Act (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/ Natural Resource Handbook, distribution of natural resource educational materials to dive boat operators*), or a combination.	X		X		
MB-35	Consider a suite of compensatory mitigation project proposals for impacts to coral reef communities: • Artificial reefs • Watershed restoration and management projects (aforestation, enhancement of riparian areas, and stream bank stabilization) • Coastal water resources management (shallow water reef enhancement, upgrade wastewater management systems) • In-lieu fee or mitigation banking program			X		X
MB-36	Increased effort toward ERA enforcement (HAPUTO) and other ESA, MMPA, and EFH policies	X				
Cultural Resources – Within DoD Control						
CR-1	Data recovery of sites • Vol 2, Alternative 2 (preferred):1044, 1046, 1021, 1022, 1023, 1012, 238, 1020, 1024, 1026, 1033, 1034, 1678, 1681, 1063, 1065, T-9-1 and T-9-2 • Vol 2, Alternative 1 and 8 only:1044, 1046, 1021, 1022, 1023, 1012, 381, 1020, 1026, 1678, 1681, 1063, 1065, T-9-1, and T-9-2. • Vol 2, Alternative 3 only: 1044, 1046, 1021, 1023, 1012, 381, 1020, 1026, 1033, 1034, 1063, T-9-1 and T-9-2 • Vol 3, Alternative 1(preferred).Tinian sites: 86th Street, 3FII, 3aII-	X	X		X	

Potential Mitigation Measure		*Volume*				
		2	*3*	*4*	*5*	*6*
	G, 3g-I, 30, and 991 • Vol 3 Alternatives 2 and 3 only. Tinian sites: 30, 33,600, 1040, 942, 944, 985. • Vol 5:1021, 1023, and T-3-1					
CR-2	Update and execute Pagat Preservation Plan for 04-0021 and 04-0022.(All Alternatives).	X				
CR-3	Preservation of 04-0642 and 04-0024 sites. (All Alternatives).	X				
CR-4	Archival research and detailed mapping of 6 architectural resources. (All Alternatives).	X				
CR-5	Preserve site and upgrade sign for 811 (All Alternatives).	X			X	
CR-6	Documentation of site, brochure, signs for 08-007. (All Alternatives)	X				
CR-7	Cultural access would be granted to the Pagat site when Navy procedures are followed.	X				
CR-8	Relocation or curation of 1024 and 1032 (Alternatives 2, 3).	X				
CR-9	Impacts to traditional resources such as the nunu tree, dukduk tree, ifit tree, and da'ok tree, would be avoided if possible.	X			X	X
CR-10	Archaeological monitoring of medium archaeological probability areas during construction in consultation with the Historic Preservation Officer.	X	X		X	X
CR-11	Conduct cultural resources education training of Marines and soldiers to promote protection of sensitive sites. (Alternatives 1 and 3 for Volume 2; Alternative 1, 2 and 3 for Volume 3; all Alternatives for Volume 5)	X	X		X	
CR-12	Provide public educational materials and displays about the National Historic Landmark and the history of Tinian.		X			
CR-13	Avoidance of Mount Barrigada; public education regarding Mount Barrigada. (Alternative 3 for Volume 2 and Alternatives 2 and 3 for Volume 5).	X			X	
CR-14	For post review discoveries an assessment will be made for NRHP eligibility in consultation with the Historic Preservation Office.	X			X	X
CR-15	For areas or properties that have not been inventoried for historic properties, the DoD would record surface sites and, when necessary, areas would also be archaeologically sampled for subsurface sites.					X
CR-16	If NRHP-eligible sites are impacted, data recovery excavations will take place.	X			X	X
Visual Resources – Within DoD Control						
VR-1	Avoid impact by clearing only the areas directly associated with the proposed firing ranges.		X			
VR-2	Minimize impact by using native flora to create a natural-appearing "screen" around the cleared range areas, outside of the firebreaks/perimeter roads.	X	X			
VR-3	Establish and implement design guidelines for all buildings that are comparable to the Guam archetype (e.g., Spanish – stucco over concrete with stamped tile concrete roofs, muted and earthen color palette).				X	X
VR-4	Develop and implement a landscape plan focused on retention of mature specimen trees during construction (where possible) and the establishment of a full suite of vegetation representing Guam's native flora.	X			X	
VR-5	Grade landfill to mimic naturally occurring landform as much as technically feasible.					X
VR-6	Paint all facilities, including the exhaust stacks with neutral colors to blend with the surrounding environment.					X
VR-7	Implement buffer areas around surrounding residential development to decrease impacts of incompatible uses.					X
Visual Resources – Outside of DoD Control						
VR-8	Provide an open railing to the extent possible to provide improved views					X

Potential Mitigation Measure		*Volume*				
		2	*3*	*4*	*5*	*6*
	from bridges.					
VR-9	Develop an Aesthetics and Landscape Master Plan for the island's roadway corridors through a community-based effort that allows direct community input into the design process (i.e., Context-Sensitive Design Solutions).					X
VR-10	Screen utilities from the view on the bridge or adjacent land uses.					X
VR-11	To the extent feasible where roadways are widened, preserve existing trees or stands of vegetation by shifting the roadway alignment.					X
Transportation-Marine – No mitigation						
Transportation – Road – Within DoD Control						
TR-1	On-base roadways: • Mitigation measures for Andersen AFB and the Navy Base may include road widening, restriping, traffic signal and other traffic control devices. Off-base roadways: • No mitigation within DoD control would be required.					X
Transportation – Road – Outside DoD Control (Federal Highway Administration)						
TR-2	Create a detailed Traffic Management Plan which would identify and provide alternate traffic detour routes, construction materials hauling routes, bus stops, transit routes and operation hours, pedestrian routes, and residential and commercial access routes to be used during the construction period. Specific aspects of the Plan could include: • Travel demand management • Encourage moped and motorcycle use • Develop transportation demand measures to discourage single-occupant vehicle use • Stagger work hours • Provide corporate shuttles for local circulation • Better delivery system for purchases • Flextime – compressed work weeks • Promote trip reduction planning • Traffic management would follow the Manual on Uniform Traffic Control Devices, as deemed necessary and applicable • The Manual on Uniform Traffic Control Devices provides several examples on dealing with traffic through many different types of roadway construction activities • Whenever possible, construction would be phased to allow two lanes of traffic to remain open • If two lanes of traffic are not permissible, traffic would be reduced to one lane • Should it be required for all lanes of traffic to be closed, a detour route would be clearly signed • Appropriate measures would be taken to maintain access to businesses • Should construction require a business access to be closed, the business owner would be given reasonable notice of the construction activities and the estimated duration of closure • Pedestrian routes would remain open and clear of any debris • Should a pedestrian route be closed, a detour route would be clearly signed and maintained throughout construction to ensure pedestrian safety • All emergency services would be given sufficient notice of construction activities and relative detour routes as to not affect					X

Potential Mitigation Measure		*Volume*				
		2	*3*	*4*	*5*	*6*
	their response times • GovGuam DPW would develop a public outreach program about the project construction schedule, relocation plans and assistance programs, traffic-impacted areas and the Traffic Management Plan					
Utilities and Infrastructure – Within DoD Control						
UI/W-1	Develop a Memorandum of Understanding (MOU) to allow DoD to transfer excess groundwater production capacity to Guam Water Authority (GWA) to mitigate for Guam potable water supply impacts (if GWA has a water shortage). Set up additional physical interconnections.					X
UI/W-2	Rehabilitate existing wells that are currently out of service.					
UI/W-3	Carefully monitor the chloride concentrations in the sub-basins and shift pumpage to wells further from impacted sub-basins if high chloride concentrations are detected.					X
UI/W-4	Set up a joint GWA, CCU, and DoD Northern Guam Lens Aquifer (NGLA) advisory panel to include University of Guam [UOG], Water Engineering Resource Institute [WERI].					X
UI/W-6	Utilize a proper rate structure for DoD personnel that will reinforce the need to conserve water.					X
UI/W-7	The construction tempo could be reduced to reduce the peak water use of construction workforce. This is discussed further in Volume 7 under adaptive management.					X
UI/W-8	Incentivize construction to reduce on-island construction workforce requirements by using off-island prefabrication techniques and/or sequencing labor intensive construction activities in such a way to reduce the peak construction workforce needs.					X
UI/P-1	Assist Guam to develop a comprehensive energy management plan for Guam. The plan will focus on reducing the energy footprint of DoD infrastructure, a "Nega Watt" approach and the development of renewable energy sources for Guam. Nega Watt and renewable energy efforts will be coordinated closely with GPA.					X
UI/P-2	DoD will make available to GPA excess power capacity from existing DoD power plants on a case-by-case and as requested basis for periods of off-base high power demand (e.g., peak shaving) .					X
UI/P-3	The Navy could potentially include the following in the construction contracts: • Establish anti-idling requirements for construction vehicles that require vehicles to be shut down if not in use for a set period of time. • Pursue operational agreements that reduce or redirect work or shift times to avoid community exposures when sites are in proximity to vulnerable populations (e.g., schools). • Pursue technological improvements to equipment, such as off-road dump trucks and bulldozers. These could include particulate matter traps, oxidation catalysts, and other devices that provide an after-treatment of exhaust emissions	X				X
UI/P-4	Adding NO_x controls to the Orote power plant would eliminate potential exceedances of PSD SILs (does not apply preferred alternative).	X				X
UI/P-5	Improvements to source physical parameters would be made and/or cleaner fuel types would be used in DoD facilities.	X				X
Utilities and Infrastructure – Outside DoD Control						
UI/W-9	GWA could implement improvements to reduce water losses associated with unaccounted for water (UFW) (i.e., leakage of theft). GWA current					X

Potential Mitigation Measure		*Volume*				
		2	*3*	*4*	*5*	*6*
	UFW reduction plan is 20%.					
UI/W-10	GovGuam could implement control measures such as building permit approvals, to steer development to areas where utilities will be less impacted by induced population growth.	X				
UI/W-11	Through the workforce housing permit approval process, GovGuam could charge development impact fees that would go toward improving the GWA water system.					X
UI/W-12	Accelerate construction of new water supply and/or leak detection and repair to reduce unaccountable water (e.g., leakage or theft) on GWA systems.					X
UI/W-13	Accelerate development of new GWA supply wells and treatment and distribution (T&D) systems.					X
UI/W-143	Import water for industrial or other non-potable uses.					X
UI/W-15	Negotiate a water exchange between the DoD and GWA systems should one have a surplus and one a deficit.					X
UI/W-16	Use temporary small self contained desalination plants (reverse osmosis) to augment water supply, provided regulatory approvals would be received.					X
UI/W-17	GWA could assess system development charges to contractors to meet anticipated demands.					
UI/W-18	Incentivize water conservation on Guam.					X
UI/WW-1	Add chemical coagulants or increase the surface overflow rate (within the normal design range) of the clarifier to improve plant operations so that the primary clarifier would be able to treat the additional 0.8 MGd (2.8 mld) without adverse effects on the North District Wastewater Treatment Plant (NDWWTP). This would be done with advance regulatory approval.					X
UI/WW-2	Inspect and upgrade the collection system to minimize infiltration and inflow.					X
UI/WW-3	The construction workforce housing could be located where a different WWTP would support the wastewater treatment needs. This could reduce the demand at NDWWTP by 1.47 MGd (5.55 mld). This one mitigation would reduce the peak flow to the NDWWTP to 11.3 MGd (42.7 mld), within the design capacity of the NDWWTP. DoD does not control where this workforce housing would be established. This is in control of GovGuam through the permitting process					X
UI/P-6	Energy Policy Act of 2005 compliance measures include: • Energy conservation: o Buildings shall achieve an energy consumption level that is 30% below the level achieved by ASHRAE Standard 90.1 o Energy consuming products shall be either Energy Star - qualified or FEMP-recommended. o Optimize building orientation to reduce cooling loads or energy loads to cool the buildings o Optimize building insulation o Seal building envelope for air tightness o "Cool roof" o Use motion detectors to reduce lighting and to setback cooling in unoccupied buildings o Natural lighting • Energy compliance analysis and life cycle cost analysis using a simulated model					X
UI/P-7	Air quality improvement measures:					X

Potential Mitigation Measure		*Volume*				
		2	*3*	*4*	*5*	*6*
	• Guam Power Authority(GPA) could develop and implement a Traffic Management Center to monitor traffic flow and congestion. Implement the addition of pollution control equipment to reduce emissions at the combustion turbine facility. Establish speed limit enforcement off DoD property create of buffer zones between new or expanded road alignments and areas of vulnerable populations. • Burn low sulfur diesel fuel in the Combustion Turbines (CT) • Provide the option of using low sulphur diesel fuel for construction and highway vehicles • As construction vehicle engines typically idle when not in use, establish anti-idling requirements for construction vehicles that require vehicles to be shut down if not in use for a set period of time. • Pursue operational agreements that reduce or redirect work or shift times to avoid community exposures when sites are in proximity to vulnerable populations (e.g., schools). • Pursue technological improvements to equipment, such as off-road dump trucks and bulldozers. These could include particulate matter traps, oxidation catalysts, and other devices that provide an after-treatment of exhaust emissions. • Measures would be implemented to cover odorous sources from sludge handling, such as aeration tanks. • Improvements to source physical parameters would be made and/or cleaner fuel types would be used at GovGuam facilities					
UI/P-8	Recondition GPA's combustion turbines located in northern Guam to increase the reliability of the IWPS and provide reliable sources of power generation to support the existing and future off-base populations during emergencies.					X
Socioeconomics and General Services – Within DoD Control						
SE-1	DoD can reduce construction and operations tempo to reduce the adverse impacts of a large increase in construction population on Guam – eliminating the population boom and bust effect identified in the analysis.	X			X	X
SE-2	Prohibit dependents from accompanying Marines until construction is complete.	X			X	X
SE-3	Assist GovGuam in seeking federal funding to expand the stock of low- to moderate-income housing on Guam, reduce impacts on housing availability and expense,.	X				
SE-4	DoD can implement: • Incentive programs for military spouses and dependents that apply for and are hired into GovGuam public service agency employment. • Volunteer programs for military, their spouses and dependents, linking them to long-term government of Guam (GovGuam) public service agency volunteer positions. • Collaborative efforts with the federal government and GovGuam to identify and provide grant writing assistance to Guam public service organizations and agencies that have existing AmeriCorps program, or have the potential to host an AmeriCorps program, to facilitate an increase in AmeriCorps service on Guam.	X			X	X
SE-5	Assist GovGuam in seeking federal funding for: • Necessary permanent number professional staff identified, as	X			X	X

Potential Mitigation Measure		*Volume*				
		2	*3*	*4*	*5*	*6*
	well as the number of administrative and supporting staff needed for these professions to perform their positions adequately. • An increase in the number of private staffing and service contractors currently working for service agencies, to match staffing requirements. • A one-time hiring bonus of 20% of base pay for all GovGuam agency positions, to increase interest in GovGuam agency employment and compete with wages offered by private offices.					
SE-6	Assist GovGuam with technical assistance, development and implementation of comprehensive data collection systems focused on: • Public services provided to FAS citizens in order to facilitate GovGuam access of Compact Impact and other related funding. • Public services provided to military individuals, in order to facility GovGuam access of TRICARE and other related funding. • Patient information, records, and services accessed, in order to facilitate appropriate care administered in a timely manner.	X			X	X
SE-7	Assist GovGuam in seeking federal funding for technical assistance, development, and implementation of a system of interpreters and translators available for the interpreting and translating needs of GovGuam public service agencies, to facilitate timely and appropriate provision of services for the English as a Second Language service population.	X			X	X
SE-8	Collaborate with GovGuam public safety agencies to develop a comprehensive and regular shore patrol system, and maintain a regular visible preventative presence.	X		X		
SE-9	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.	X		X		
SE-10	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.	X		X		
SE-11	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.	X		X		
SE-13	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.	X		X		
SE-14	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.	X		X		
SE-15	Enhance economic benefits and compensate for economic costs for local businesses, the Marine Corps would consider granting trainees some		X			

Potential Mitigation Measure		*Volume*				
		2	*3*	*4*	*5*	*6*
	liberty at the end of every training mission so that they might spend money in local establishments and interact with local residents.					
SE-16	To reduce Tinian residents' anxiety about the military limiting access to these areas, the Marine Corps would consider providing written clarification of training activities' effects on civilian access to San Jose harbor and the civilian airport at west field.		X			
Public Health and Safety – No mitigation. See table of BMPs						
Hazardous Materials and Waste – No mitigation. See table of BMPs						
Environmental Health and Safety – See mitigation for noise, socioeconomics and land use impacts **.**						

Various mitigation identified in this Draft EIS/OEIS would be implemented on land not under DoD control. Mitigation in these areas could be undertaken by the responsible entities that would lessen impacts to various resources. Examples of mitigation measures include improvements to various GovGuam utility and port facilities, public roadway improvements, management of Guam resources, and construction associated with the induced population growth.

The DoD has limited authority to implement mitigation measures on non-DoD land. Mitigation measures involving expansion or improvement to utilities, roadways, and other public services, for example, can be addressed by State and local governments using revenues from an expanded tax base, adjusted utility rates, connection fees, and other service charges. In fact, taxes, rates, fees, and service charges are the tools state and local governments normally use to address increased demand or improvements to public services they provide or control. Recognizing Guam's unique circumstances and world economic conditions may make it difficult for Gum to address mitigation on non-DoD lands using normal revenue sources; the Navy is committed to working with Guam and the full array of federal executive agencies to identify potential sources of funding to assist Guam in implementing mitigation measures on non-DoD land.

2.3 APPLICATION OF ADAPTIVE TECHNIQUES TO MITIGATION

2.3.1 Traditional Adaptive Management (Terrestrial/Marine Resources)

The concept of adaptive management has been around since the early 1900s and is rooted in the concept of scientific management pioneered by Frederick Taylor. In its purest form, adaptive management can be thought of as linking learning with policy and implementation. Although the idea of learning from experience and modifying subsequent behavior in light of that experience has long been reported in literature, the specific idea of adaptive management as a strategy can be traced back to the late 1970s.

Traditionally, adaptive management has been associated with implementation of natural resources management actions and/or decisions that affect natural resources. It has historically focused on learning and adapting, through partnerships of managers, scientists, and other stakeholders who learn together how to create and maintain sustainable resource systems. Examples of actions historically associated with adaptive management include the control of water releases from a dam, direct manipulation of plant or animal populations through harvesting, stocking or transplanting, and manipulation of ecosystems through physical changes to habitats. Adaptive management recognizes that even with sound assumptions and science, there is always uncertainty about how resources will respond to actions. Natural resources management involves decision-making characterized by multiple (often competing) objectives, constrained management authorities and capabilities, dynamic ecological and physical systems, and

uncertain responses to management actions. Natural resource managers have been able to successfully use adaptive management over the last three decades to make better resource-based decisions by:

- Exploring ways to meet management objectives
- Predicting the outcomes of alternatives based on the current state of knowledge
- Implementing one or more of these alternatives
- Monitoring impacts of those alternatives
- Using the results to update knowledge and adjust management actions

Department of Interior defines adaptive management as (DOI 2009):

> "Adaptive management [is a decision process that] promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process. Adaptive management also recognizes the importance of natural variability in contributing to ecological resilience and productivity. It is not a 'trial and error' process, but rather emphasizes learning while doing. Adaptive management does not represent an end in itself, but rather a means to more effective decisions and enhanced benefits. Its true measure is in how well it helps meet environmental, social, and economic goals, increases scientific knowledge, and reduces tensions between stakeholders."

2.3.2 Adaptive Management Techniques for Other Resource Areas Sensitive to Construction Tempo

Adaptive management techniques can also be applied to resources other than natural resources. The large construction program proposed on Guam lends itself well to such an approach because of the potential for significant impacts to various utility resources. These resources are sensitive to the short-term increases in population or demands brought about by this construction effort.

Adaptive management would be applied as mitigation in all resource areas in this Draft EIS/OEIS and used as an environmental planning-based approach that allows for adjusting program management/implementation strategies in response to actual monitoring of significantly impacted resource areas. By applying adaptive management methodology the Navy would monitor the impacts of its actions and evaluate the need to adjust its plan to implement the selected alternative plans to avoid and/or minimize environmental impacts. Avoidance of environmental impacts, where possible, is the Navy's preferred method of mitigation.

To successfully achieve the full relocation of Marines to Guam by 2014 as agreed between the Governments of the United States and Japan, the Navy proposes to complete an average of approximately $2 billion (B) of construction work per year, with a peak of approximately $2.8 B in 2014 (Volume I, Table 2.7-1). This amount of construction requires a large increase in construction workforce on Guam. The estimated increase in construction labor and induced population increases are in direct correlation to dollars expended at any given time, with approximately 75 construction workers and 99 induced populations correlating to $10 million (M) of construction. As indicated in Volume 6, during the height of construction there is a projected peak in utility demands. These peak utility demands may be significant and are directly related to the increased labor force and population levels and associated demands.

Volume 6 discusses the preferred interim and/or long-term alternatives for each resource. Only the preferred interim alternative for power, potable water, wastewater, and air quality is discussed below to

demonstrate how adaptive management techniques could be applied. Discussion of the preferred long-term alternatives as noted in Volume 6 is discussed on a programmatic level and would be evaluated further through tiered National Environmental Policy Act (NEPA) documents. If interim alternatives other than the preferred are selected in the ROD the same approach described in this section will be used for the selected interim alternatives.

Navy policy requires readable, understandable and consistent mitigation measures addressed in decision documents (Navy 2007). As part of this policy, the Navy is required to provide clearly written and defined mitigation procedures that succinctly specify: (1) what mitigation procedures are to be implemented, (2) how the mitigation procedures should be implemented, (3) when the mitigation measures should be implemented, and (4) who (action proponent, or designee) would be responsible for completing the mitigation measures.

As a matter of policy, the Navy adaptively manages all resource areas to ensure impacts are avoided using BMPs or instituted mitigation measures. A post-ROD monitoring plan will be developed to ensure additional mitigation is applied to all resource areas. In the event that adaptive management is selected as mitigation it will be included in the post-ROD monitoring plan and would be developed in cooperation with USEPA, GovGuam, GEPA, GWA, and GPA and other agencies as necessary, to identify roles and responsibilities and determine what monitoring criteria and data points will act as indicators of system stress. This plan would rely on a cooperative approach between DOD and GovGuam agencies to gather, share, and analyze data in a collaborative manner. Some of the adaptive management mitigation measures are within DoD control. For those actions that are outside of DoD control, DoD would work with the respective agency to facilitate the mitigative action.

The goals and objectives of the post-ROD monitoring plan specific to adaptive management would include, but not be limited to:

- Establish a means to ensure mitigation is occurring as specified in the ROD
- Establish roles and responsibilities for each agency participating in the management of the resource
- Develop a reporting system for each resource area, to include the following actions
  - Collect and monitor usage data for power, potable water, wastewater and air emissions
  - Designate where the data is maintained
  - Identify Navy and or GovGuam personnel who would be responsible for recording resource usage
  - Review of new civilian population data
  - Review of construction/other permit data for non-DoD related projects
  - Prepare trend analysis for determination of projected impacts
  - Establish of implementation procedures to avoid reaching a significant impact for each resource
  - Project changes in supply and demand
  - Other parameters related to water quality or air quality
  - Construction award values and actual construction work in place
  - Establish a standard process for DoD, GovGuam and other appropriate regulatory agencies to meet regularly and discuss the impacts to respective resources and changes in population (contractor off-island workforce, DoD personnel [military and civilian], and general civilian growth)

After examination of the applicability of adaptive management concepts, the Navy determined it would focus adaptive management techniques on the resource areas of power, potable water, wastewater, and air quality. These particular resources:

- Have the greatest potential for significant impacts
- Are sensitive to changes in peak populations
- Are resources that the Navy is able to adjust demands through altering construction contract awards

It is assumed that population increases will cause an increase in utility demands and traffic with the potential to impact air quality. These impacts may be significant or non-significant, depending on the resource area.

The Navy has identified "action points" and "tipping points" that need to be established in the post-ROD monitoring plan for resources. The tipping point represents an established indicator level that if exceeded, would result in a significant impact. The action point would consider an appropriate reserve or buffer, agreed upon by DoD and GovGuam. The action point identifies an early warning level indicator associated with each resource that once reached, signals the Navy to apply appropriate adaptive management techniques to address significant impacts.

By monitoring data on a regular basis and using trend analysis, DoD would be able to determine actual per capita usage rates correlated to population, construction work in place, and projected construction awards. When trend analysis forecasts that a tipping point may be reached, DoD would implement appropriate mitigation action and continue to monitor the effectiveness of that mitigation (see Figure 2.3-1).

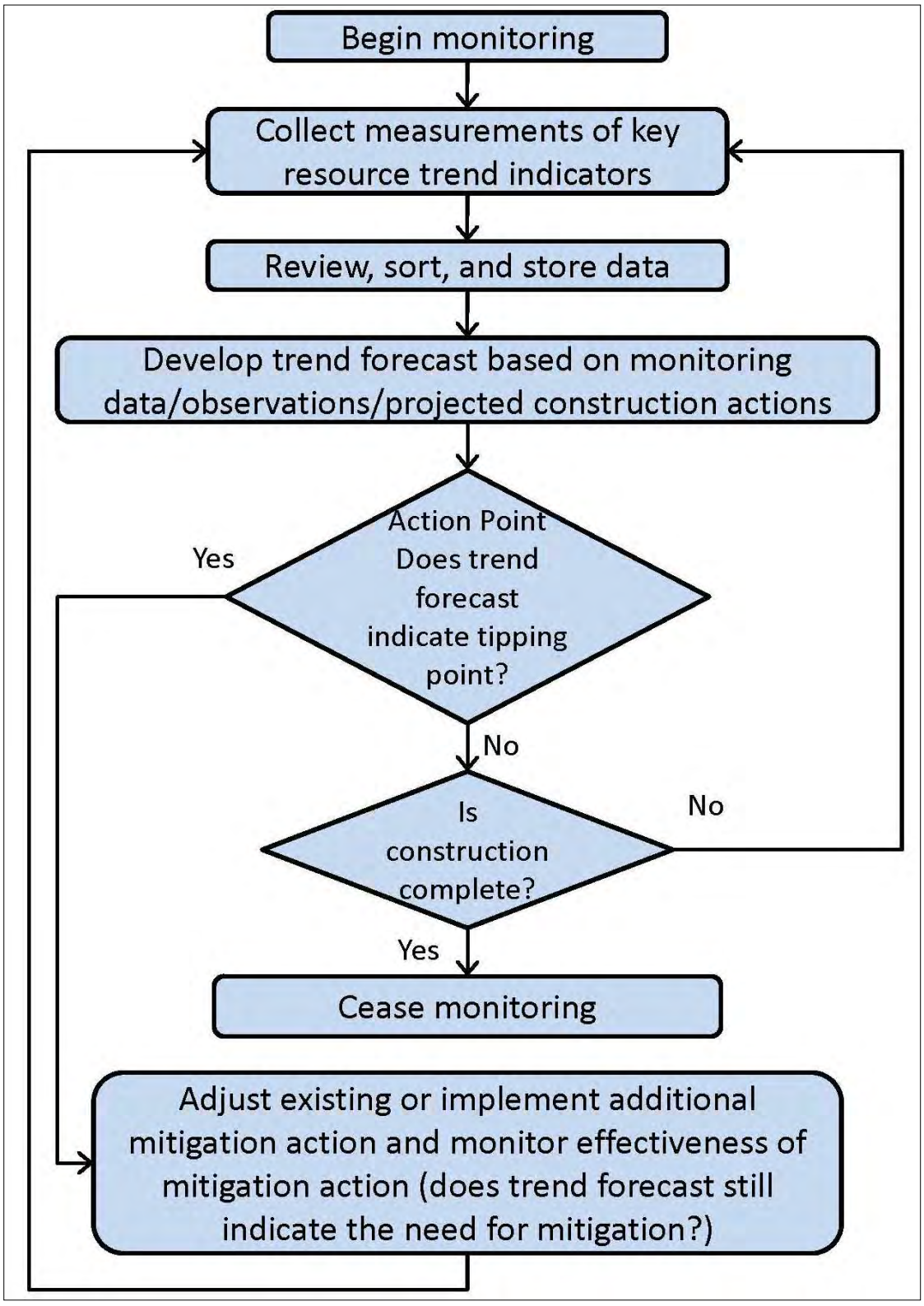

Figure 2.3-1. Monitoring Plan Flow Chart

As previously discussed, mitigation actions can be DoD controlled or non-DoD controlled (see Table 2.2-1). Potential mitigation measures as adaptive management mitigation can also be DoD and non-DoD controlled. DoD controlled adaptive management mitigation measures common to all resource areas discussed include:

- Alter the construction tempo. Construction tempo refers to the process of analyzing the correlations mentioned above, and altering the timing and/or execution of short term (planned within 0 to 3 months), mid-term (3 to 12 months), and long-term (12 to 24 months) construction contract awards to reduce population increases and thus mitigate for impacts to the resource area.
- Redirect the sequence of construction to areas requiring fewer construction workers, thus slowing the workforce population rate of increase and in turn reducing power demand.
- Use sustainability approaches and incentivize contractors to employ current sustainable approaches to construction, such as off-island pre fabrication techniques to reduce on-island work force requirements, employ water saving mechanisms for their construction work force housing, such as: waterless or ultra low consumption urinals: composting portable toilets: low flow faucets: showerheads and washing machines in housing units; water saving dishwashers; washwater recycling in industrial washing and rinsing of aircrafts and vehicles; water efficient cooling systems, minimal landscaping; rainwater collection and reuse.
- Adaptive management analysis for power, potable water, wastewater and air emissions as a result of implementing the proposed actions are discussed in the following sections.

2.3.3 Power

Power on Guam is supplied by the integrated GPA island-wide power system (IWPS). The system is on an island-wide grid system, thus power demand can be considered as a single source. Accordingly, the power demand is independent of the location on Guam where the action takes place. DoD has no separate power system except for some emergency generators including somewhat large systems at Orote and NCTS. Utilizing those generators to meet normal daily DoD power demand associated with this action is not planned under the preferred alternative.

This section is derived from analysis found in Volume 6. For a full discussion of supply or demand calculations or alternatives analysis for power, please refer to Volume 6; this section will provide only applicable portions to demonstrate how adaptive management techniques would be applied as mitigation to the preferred alternative.

Interim Alternative 1 is the preferred alternative to meet the increased power demands as a result of implementing the proposed actions on Guam. The preferred interim alternative for power would recondition up to four existing permitted GPA combustion turbines to restore the system to its original design capacity, and support interim-load demands with no modifications to air permits. This alternative would recondition up to four existing combustion turbines that are not current in their maintenance requirements and cannot be reliably used to their permit limits. Units to be reconditioned would include the combustion turbines at Yigo, Dededo Units No. 1, Marbo, and Macheche. An additional combustion turbine (Dededo Unit No. 2) was recently reconditioned by GPA and would also be utilized under this alternative.

2.3.3.1 Projected Supply and Demand

Implementing the proposed actions on Guam would create an increased power demand. Table 2.3-1 lists the anticipated demand for each component of the proposed military buildup. The estimated total future

peak DoD demand is 123.63 megawatts (MW) (existing, transient, and future). The total peak demand is anticipated to occur as early as 2015, when all planned facilities would be in service and operational. Each of the demand values in Table 2.3-1 is based on the Unified Facility Code (UFC) planning criteria for facility demand and does not include any additional spare capacity, as is typically used in power generation planning.

Table 2.3-1. Estimated Department of Defense Power Demand for Guam

Demand Description	*Demand (MW)*			
	Existing DoD Demand	*Other Planned DoD Demand*	*Marine Corps Increased Demand*	*Total DoD Future Planned Demand*
Andersen AFB	18.10	8.64	0.46	27.20
Andy South	1.00	0.00	0.00	1.00
NCTS Finegayan (plus utilities)	1.20	2.82	14.47	18.50
South Finegayan Housing Area	1.50	0.00	5.87	7.37
Barrigada	1.30	0.00	0.00	1.30
Naval Hospital	3.20	1.66	0.00	4.86
Naval Base Guam	20.75	1.12	0.14	22.01
Total Demand (excludes transient)	**47.55**	**15.32**	**20.94**	**83.81**
Naval Base Guam (max. transient demand) a				**39.82**
Total Electrical Demand (MW) b				**123.63**

Legend: AFB = Air Force Base; DoD = Department of Defense; MW = megawatts; NCTS = Naval Computer and Telecommunications Station.

[a] Represents maximum demand on any given day for aircraft carrier and associated escort ships (Navy), or Expeditionary Strike Group (ESG) (Marine Corps) (not in port on the same days) .

[b] For 19 service locations.

Source: NAVFAC Pacific 2008b.

A transient power demand will occur when either the proposed berthing/embarkation of a transient aircraft carrier and escorts, or the Expeditionary Strike Group (ESG) are in port. It is not anticipated that the transient aircraft carrier and its associated escort ships would be in port at the same time as an ESG; therefore, the power demand for the transient aircraft carrier and an ESG is not combined. The higher demand number related to the transient aircraft carrier was considered in demand projections and is part of the total estimated future demand of 123.63 MW.

In addition to the DoD power demand, two other types of demand are expected to increase overall power demand on Guam. One is induced civilian growth and the other is construction workers. Table 2.3-2 indicates the anticipated demand requirements considering DoD, construction workers, general population growth projections, and population growth induced by the proposed DoD buildup on Guam.

Table 2.3-2. Power Supply and Demand on Guam

GPA Power System	*Demand (MW)*									
	Interim Period without 25% Growth Factor					*Long-Term without 25% Growth Factor*				
	2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*
Island-wide, including anticipated growth (existing DoD and GPA baseline projected growth included)										
Existing Guam	281	287	294	299	303	306	309	312	315	318
Guam Induced Civilian Increase (induced growth caused by military increase)	4.93	12.25	19.99	23.44	29.24	22.08	11.23	7.75	7.75	7.88
Construction Worker Increase	1.18	2.99	5.19	6.51	6.70	4.43	1.38	0.00	0.00	0.00
DoD Increase (less 39.8MW load from transient aircraft carriers)	1.83	2.18	5.04	11.35	17.99	33.31	35.29	35.29	35.29	36.26
Total Demand	**288.94**	**304.42**	**324.21**	**340.29**	**356.93**	**365.82**	**356.90**	**355.03**	**358.03**	**362.14**
Total Available Supply	**490.00**	**490.00**	**550.00**	**550.00**	**550.00**	**630.00**	**630.00**	**630.00**	**630.00**	**630.00**
Future Supply Accounting for 1.52 Reliability Factor	322.37	322.37	361.84	361.84	361.84					
Future Supply Accounting for 1.52 Reliability Factor						414.47	414.47	414.47	414.47	414.47
Supply – Demand (net excess or shortfall without transient loads)	33.43	17.95	37.63	21.55	4.91	48.66	57.58	59.44	56.44	52.33
Transient Load (Highest requirement with CVN group)						39.82	39.82	39.82	39.82	39.82
Supply – Demand (net excess or shortfall with transient loads)	33.43	17.95	37.63	21.55	4.91	8.84	17.76	19.62	16.62	12.51

Legend: MW = megawatts.
Source: NAVFAC Pacific 2008d. Guam Power Authority Integrated Resource Planning (IRP 2008) for existing Guam growth projections

The Public Utilities Commission (PUC) requires that GPA maintain a generation reliability standard as a "reserve" power supply. To meet this requirement, GPA has identified that 1.52 times the system's peak demand level is required to provide the necessary reserve margin. During the interim period the peak load for the IWPS is projected to reach 357 MW, applying the 1.52 reserve capacity, GPA would need a generation capacity of 543 MW to meet the PUC requirement. GPA has an installed generation capacity of 550 MW. To reach its installed capacity, GPA will need to recondition existing generation units and return them to full service capability.

Planning indicates that new power generation capacity would be available by 2015 to support the additional demand and power supply required for long-term power consumption. This new power capacity would be approximately 80 MW generated from a new power plant.

As shown in the table, there is no power supply shortfall anticipated as a result of implementing the proposed action(s).

2.3.3.2 Projecting Tipping Point(s) and Action Point(s)

Monitoring real time data for power should include the daily demand curves averaged over a workweek and weekends, GPA supply capacity, and population rate projections. This data should be used to identify trends correlating with the buildup/construction. With this correlation, revised projections of future demand would be calculated. In-progress refurbishments would be taken into account when forecasting power supply, as should operational limitations in the permits.

Both the tipping point and the action point would be identified and agreed upon by the agencies participating in developing the post-ROD monitoring plan. By monitoring the data described above, the tipping point and action point could be identified using trend analysis. The action point would need to be identified far in advance so that mitigation actions could be implemented to prevent the tipping point from occurring. For power, the reserve capacity should be included in action point and tipping point determination, so as to preserve that margin of safety.

2.3.3.3 Potential Impacts and Mitigation

Potential impacts of exceeding available power supply would be rolling blackouts or brownouts, a reduction in the reliability of the supply system (may also cause blackouts), or utilization of GPA interruptible supply agreements with certain customers. As previously stated the post-ROD Monitoring Plan would identify mitigation to address significant impacts as a result of the proposed action. Some of these mitigation measures are within DoD control. For those actions that are outside of DoD control, DoD would work with the respective agency to facilitate the mitigative action

Mitigation action employing an adaptive management approach to address the significant impact of excess power demand must recognize that the projected demand numbers are estimates and forecasts based on many assumptions, such as population projections and demand calculations. Adaptive management would proactively monitor the implementation of the interim preferred alternative power demand and supply data in real time to allow effective mitigation action.

Reaching an action point would trigger the need to implement one or more mitigation measures. All of the DoD-controlled mitigation measures related to utilities in Table 2.2-1 or DoD controlled adaptive management techniques described in Section 2.3.2 above could reduce impacts. With respect to the DoD-controlled adaptive management mitigation technique of altering the construction tempo, should a power demand exceed the future supply (without utilizing the reserve capacity) the Navy could slow the construction tempo, reducing the construction worker and induced civilian populations, thus reducing the power demand. In addition to the DoD-controlled adaptive management mitigation measures described previously, DoD would request GPA to implement their interruptible power supply agreements with current customers, whereby they use temporary power generators instead of drawing power from GWA's system, thus reducing demand.

Mitigation outside DoD control include rearranging workforce hours to smooth peak power demand requirements.

2.3.4 Potable Water

Potable water supply is provided via two water systems on Guam: the DoD system and the GovGuam system. The DoD system is split into subsystems and includes groundwater in northern Guam and surface water sources in southern Guam. GovGuam obtains its water from groundwater from NGLA in northern

Guam and has an allotment to purchase an additional 4 MGd (15.1 mld) from DoD's surface water in southern Guam. Both DoD and GWA groundwater systems utilize the NGLA solely and thus are both incentivized to properly manage this aquifer. The aquifer has numerous sub-basins with different sustainable yields. The proposed military buildup on Guam would be located at Andersen AFB, Naval Computer and Telecommunications Station (NCTS) Finegayan, South Finegayan, Andersen South, Barrigada, and Naval Base Guam. These areas are currently served by the DoD potable water systems of Andersen AFB and Navy. The Navy's surface water system would not be altered, so it will not be discussed, except to the extent needed to provide adequate context for overall water availability.

This section is derived from analysis found in Volume 6. For a full discussion of supply or demand calculations or alternatives analysis for potable water please refer to Volume 6, as this section below will provide only applicable portions to demonstrate how adaptive management techniques would be applied as mitigation.

The preferred alternative (Alternative 1) for meeting the potable water demand includes installation of new water supply wells (up to 22 wells at Anderson AFB) in the northern area utilizing the NGLA, rehabilitation of existing wells, new/replacement of treatment and distribution systems, and interconnection with GWA. This alternative was developed to support the Main Cantonment at Finegayan (i.e., Main Cantonment Alternatives 1 and 2, Volume 2). The new DoD supply wells would provide additional water supplies to northern Guam area and the ability to transfer to southern Guam via the island-wide Navy system as needed.

Development of groundwater resources would require coordination between DoD, GWA, and the GEPA. This coordination is a necessary part of the well permitting and construction process, and proper management of the NGLA, a designated sole source aquifer. During use of the wells, coordination would continue between DoD and GWA. Groundwater monitoring for pumping rates and chloride content would continue to be measured as an indicator of saltwater intrusion and over pumping in the NGLA. Modification of well usage would be evaluated jointly to maximize use of the resource.

According to a 1991 report (Barrett Consulting Group 1991) that was reviewed and validated in a 2009 report commissioned by DoD and performed by UOG, the WERI (NAVFAC PAC 2009) estimated the sustainable yield of the aquifer to be 80 MGd (302 mld). Thus, the overall NGLA capacity is sufficient provided the wells are properly managed. Development of new DoD supply wells would be coordinated with GWA to ensure the sustainability of the aquifer. Thus, the overall elements of concern for potable water supply are:

- DoD potable water supply system (primarily wells in the NGLA).
- GWA potable water supply system (wells in the NGLA and associated infrastructure).
- Overall sustainable yield of the NGLA.

2.3.4.1 Projected Supply and Demand

DoD Water System

Implementing the proposed actions on Guam would create an increase in potable water demand on the DoD water system over the long term, as additional DoD personnel arrive in Guam. The DoD water system has a current supply of 18.8 MGd (71.1 mld)available to meet the current DoD maximum daily demand of 12.4 MGd (46.9 mld)and a 4 MGd (15.1 mld) allotment that is available for transfer to GWA when needed per the current memorandum of understanding. The current water supply and additional supply required to meet future on-base DoD demands are summarized below in Table 2.3-3 and Table 2.3-4. Table 2.3-3 is derived from calculations using current UFC criteria that do not include new DoD

policy to incorporate sustainability principles that would reduce potable water usage. As shown, DoD would develop new water supply wells to add 11.1 MGd (42 mld) and rehabilitate an existing well to add an additional 0.5 MGd (1.9 mld) supply to the DoD system to meet future Marine Corps, Army, Air Force, and Navy demands would be required for the military buildup. The resulting planned supply of 27.1 MGd (102.4 mld) would meet the overall projected maximum daily demand of 27.1 MGd (102.4 mld) on the DoD system. Given the 1.3 MGd (4.9 mld) shortfall that would occur specifically for the Navy water system, a long term alternative would be necessary to resolve that specific shortfall. Alternatively the shortfall could be addressed through transfer of excess water from the Marine Corps base through the Navy island wide system and maintenance that would allow transfer of excess water in the Anderson AFB system to the Navy IWWS.

Table 2.3-3. Basic Alternative 1-Proposed DoD Water Supply and Demand

Water Supply Sources(Existing and Proposed)	*Water Supply (in MGd)*			
	Marine Corps Finegayan	*Andersen AFB*	*Navy*	*Total*
Main Cantonment Alternatives 1 and 2				
Current Surface Water Supply			11.0	11.0
Current Groundwater Supply		4.7	3.1	7.8
Development of new water supply wells	11.1			11.1
Rehabilitation of existing Navy well			0.5	0.5
GWA Transfer Projected Need in 2019[a]			-3.3	-3.3
Planned Supply Cantonment Alternatives 1 and 2	**11.1**	**4.7**	**11.3**	**27.1**
Maximum Daily Demand Using UFC Guidance	10.5	4.0	12.6	27.1
Planned Supply Cantonment Alternatives 1 and 2 Using Sustainability Principals	**6.9**	**4.7**	**11.3**	**22.9**
Maximum Daily Demand Using Sustainability Principals	**6.3**	**2.8**	**10.1**	**19.2**

Notes: [a] Per current memorandum of agreement, GWA has access to up to 4MGd allotment of water from Navy system. It is projected that GWA may use 3.3 MGd of this allotment.
Source: NAVFAC Pacific 2008c

Table 2.3-4 presents the DoD water supply and demand estimates assuming reductions for compliance with the executive orders regarding water conservation and sustainability efforts for this project. As shown, the sustainability principles would reduce demand estimates at Marine Corps Finegayan to only 6.9 MGd (26.1 mld) (compared to 11.1 MGd [42 mld] when calculated using current UFC [Table 2.3-3]). This reduction would allow DoD to reduce its supply. Thus, using an estimate of the revised UFC values and if water conservation measures are implemented, the planned 22.9 MGd (86.6 mld) water supply is sufficient to meet the overall maximum daily demand of 19.2 MGd (72.6 mld) and to meet demand requirements at each base.

Table 2.3-4. Potable Water Basic Alternative 1 Proposed DoD Water Supply and Demand Assuming Water Conservation and Sustainability Factor

Water Supply Sources(Existing and Proposed)	*Water Supply (in MGd)*			
	Marine Corps Finegayan	*Andersen AFB*	*Navy*	*Total*
Main Cantonment Alternative 1 & 2				
Current Surface Water Supply			11.0	11.0
Current Groundwater Supply		4.7	3.1	7.8
Development of new water supply wells	6.9			6.9
Rehabilitation of existing Navy well			0.5	0.5

Water Supply Sources(Existing and Proposed)	*Water Supply (in MGd)*			
	Marine Corps Finegayan	*Andersen AFB*	*Navy*	*Total*
GWA Transfer Projected Need in 2019[a]			-3.3	-3.3
Planned Supply Cantonment Alternative 1 & 2	**6.9**	**4.7**	**11.3**	**22.9**
Maximum Daily Demand using Executive Order Compliance and Sustainability Principles	6.3	2.8	10.1	19.2
Projected Excess (Supply minus Demand)	0.6	1.9	1.2	3.7

Notes: [a] Per current memorandum of agreement, GWA has access to up to 4MGd allotment of water from Navy system. It is projected that GWA may use 3.3 MGd of this allotment.
Source: NAVFAC Pacific 2008c

GWA Water System

The GWA water system is not a component of the Alternative 1 water supply. The Navy would continue to transfer up to 4 MGd (15 mld) to GWA under the current memorandum of understanding. As noted above, it is projected that the amount transfer amount in 2019 will be reduced to 3.3 MGd (12.5 mld) due to GWA planned water system expansion.

Projected initial water demands on the GWA water system are summarized in Table 2.3-5, which summarizes the existing demand on the GWA water system (including projected increases in civilian demand related to natural population growth), projected increases associated with the imported construction workforce, and civilian increases in demand that would result from induced growth as a result of the military buildup. Demand projections are then compared to the planned GWA potable water supply to identify whether shortfalls would be expected during the construction phase.

Table 2.3-5. Projected Water Supply and Demand on the GWA Water System

GWA Water System	*Year*									
	2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*
Potable Water Demand[a]										
Existing Guam Civilian[b]	48.9	49.3	49.8	50.2	50.6	51.1	51.5	51.9	52.3	52.7
Construction Workforce	0.6	1.5	2.7	3.3	3.4	2.3	0.7	0.0	0.0	0.0
Induced Civilian Increase	1.2	3.1	5.1	5.9	7.4	5.6	2.8	2.0	2.0	2.0
Total Projected Demand	50.7	54.0	57.5	59.5	61.5	58.9	55.0	53.9	54.3	54.7
Potable Water Supply										
Existing GWA Supply[c]	48.4	48.4	48.4	48.4	48.4	48.4	48.4	48.4	48.4	48.4
Projected Excess before Expansion (Supply-Demand)	-2.3	-5.6	-9.1	-11.1	-13.1	-10.5	-6.6	-5.5	-5.9	-6.3
GWA Planned Expansion[d]	0	0	7	7	7	7	7	7	7	7
Total Planned Supply	48.4	48.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4
Projected Excess after Expansion (Supply-Demand)	-2.3	-5.6	-2.1	-4.1	-6.1	-3.5	0.4	1.5	1.1	0.7

Notes: All units are MGd. This table does not include GWA's effort to detect and fix leaks, unaccounted for water (UFW).
[a] Demand is based on calculations using the UFC, 50% UFW rate, and population estimates provided in Volume 6, Table 2.2-3
[b] Includes projected increases in civilian demand related to natural population growth.
[c] Assumes 4 MGd transferred from Navy to GWA.
[d] GWA Draft Capital Improvement Plan 2010-2014
Source: GWA 2007

As summarized in Table 2.3-5, the total civilian demand on the GWA water system (including demand associated with the construction workforce and induced civilian growth) is projected to exceed available GWA supply by 2.3 MGd (8.7 mld) and a maximum of 6.1 MGd (23.1 mld) in 2014. This changes to a surplus from 2016 through 2019. The GWA water system currently has the capacity to supply 48.4 MGd (183.2 mld) of potable water. Planned GWA expansions would add 16 potable wells with combined capacity of 7 MGd (26 mld) to increase that capacity to 55.4 MGd (209.7 mld). However, there are shortfalls during the construction period even with GWA's planned expansion. Although GWA currently has plans to drill wells starting in 2012, much of this new water will offset wells that are being shutdown or subjected to reduced pumping due to high chlorides. GWA has indicated that they do not possess the financial resources to drill new wells in time to meet the early demands expected as a result of the buildup. In the CIP, well construction is identified in 2012. An option to supply this potential water shortfall would be that DoD could transfer excess water production capacity to GWA, if requested, as a mitigation measure. Current assessments indicate the Andersen Air Force Base water system has excess well production capacity of 3 MGd that could be transferred to assist GWA with potential shortalls in northern Guam. Navy surface water resources from Fena Resevoir may also be available to GWA in addition to the current allotment of up to 4 MGd to further mitigate the shortfalls. The sustainable yield of the NGLA can support the withdraw and transfer of water from DoD wells to GWA during the shortfall years.

NGLA Sustainable Yield

The overall sustainable yield of the NGLA approximately 80 MGd (302 mld) is sufficient for short- and long-term projections and would not exceed the rate at which groundwater could be continuously withdrawn from the aquifer at acceptable quality or the quantities if the preferred alternative for the relocation action is implemented.

Figure 2.3-2 shows the anticipated average daily demand (ADD) versus the entire sustainable yield for the NGLA at several different unaccounted for water (UFW) rates for the GWA and DoD system. Demand calculations for the DoD water system (Tables 2.3-3 and 2.3-4) were calculated assuming 15% UFW rate based on the condition of the DoD T&D system, while the GWA system demand calculations (Table 2.3-5) were calculated assuming 50% UFW based on its deteriorated condition. As shown, based on a maximum UFC of 50%, combined DoD and GWA demand would be peak at approximately 65 MGd (245.7 mld), well below the 80 MGd (302 mld) sustainable yield of the NGLA. As future improvements are made to the T&D systems, UFW rates would be reduced, thus total demand would also be reduced.

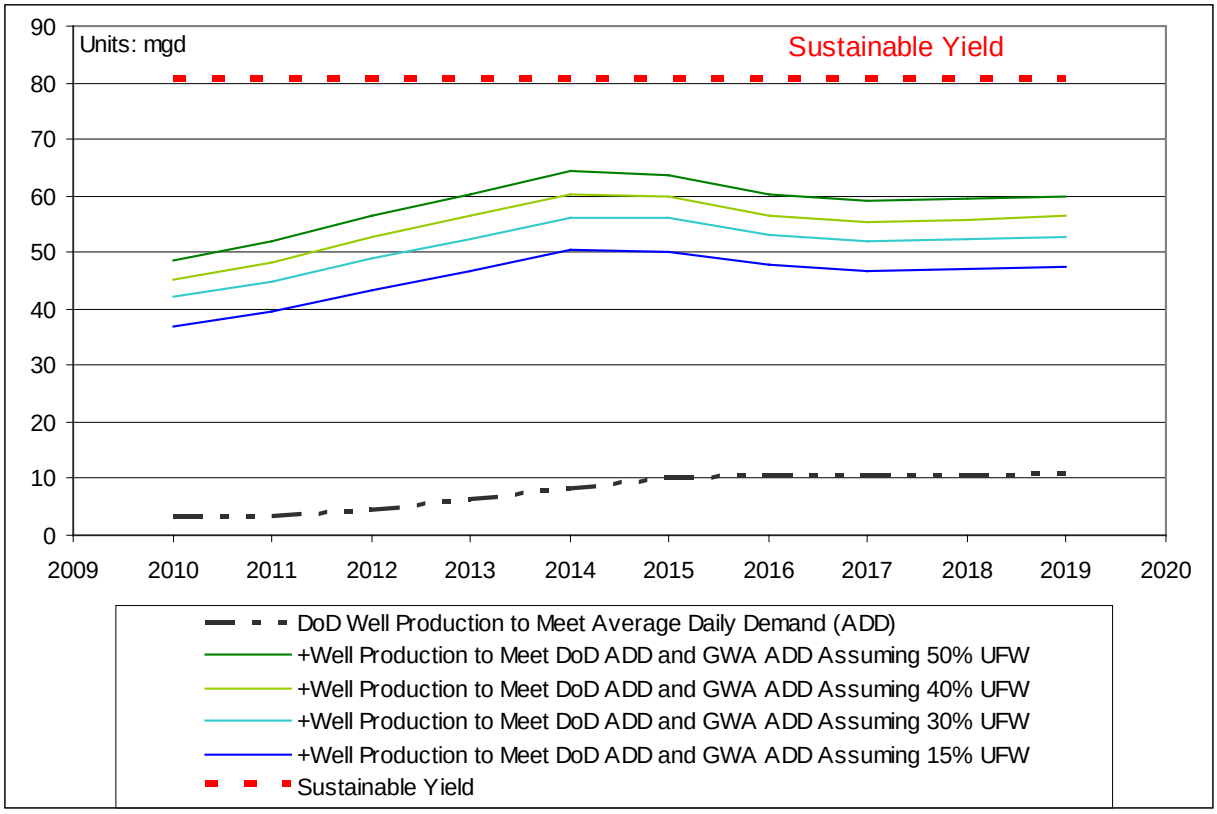

Figure 2.3-2. Well Production to Meet DoD Average Daily Demand and GWA Average Daily Demand (15-50% UFW for GWA)

2.3.4.2 Projecting Tipping Point(s) and Action Point(s)

There are many variables which could impact both supply and demand of potable water. Each should be monitored to assess potential impacts to the availability of adequate potable water. Supply side elements include:

- T&D Systems
- Sustainable yield at individual wells and sub-basins (acceptable quality and quantity)
- Pace of construction of water system facilities
- Reduction in UFW (fixing leaking distribution)
- Unexpected weather damage to existing facilities (such as wells, pump stations, etc.)
- Seasonal variations and weather trends

Demand side elements include:

- Population changes that may deviate from plan
- Metering current un-metered uses (linked to UFW)
- Further degradation of the distribution system leading to an increase in UFW
- Construction peaks affecting water pressure locally or throughout the distribution system

Monitoring real-time data for potable water should include all individual wells for total available supply, quality, capacity of the treatment and distribution systems, and sustainable yield of the NGLA and

population rate projections. These data should allow for trends identification correlating with the buildup/construction. With this correlation, revised projections of future demand would be calculated. A preliminary monitoring and mitigation strategy would be based on the information in the McDonald and Jenson report (June 2003) which establishes acceptable chloride limits regarding salt-water intrusion. Wells would be monitored at agreed upon intervals for chloride. Experts on the NGLA such as McDonald and Jenson as well as U.S. Geological Service (USGS) would be consulted by the Navy during the development of an appropriate salinity monitoring plan and its periodic resulting data.

Supply would be forecast for both the DoD and GWA water systems based on trends from the supply wells and knowledge of planned new supply wells and T&D construction. Each well would be reviewed to determine a most probable allowable pumping rate. All the wells would be totaled to provide current and future potential supply. As discussed previously, to be able to effect new facilities or construction tempo forecast of potential problems must be identified in a timely manner. Recent weather trends, forecasted weather patterns, and known seasonal variations must also be taken into consideration.

The demand side would be monitored based on metered usage where possible. UFW also would be monitored to assist in assessing how well the distribution system is working and whether or not there are leaks or un-metered usage occurring.

The tipping points for potable water systems would be identified in the post-ROD Monitoring Plan and are defined as when the potable water demand exceeds an agreed upon percent of the available potable water supply. The action point will be set as a percent of supply at which the trend analysis indicates that the tipping point may be reached.

2.3.4.3 Potential Impacts and Mitigation

The potential impacts of exceeding the water supply include water outages or reduced water pressure conditions in parts of the water systems, rationing, poor water quality due to potential salt water intrusion, and violations of regulatory requirements. Water outages or low water pressure can result in microbiological and other contaminants entering the distribution system, potentially resulting in illness. Water outages or low water pressure can also potentially prevent effective fire fighting and degrade the basic sanitary needs of the population. These are significant impacts with potentially serious implications to the Guam population.

Any mitigation action employing adaptive management techniques to potentially reduce significant impacts of excess demand must recognize that the projected demand numbers are estimates and forecasts based on many assumptions such as projected population increases. Adaptive management would require real time monitoring the potable water supply and demand associated with the implementation of the interim preferred alternative and would enable DoD to make adjustments in contract execution to potentially avoid significant impacts.

In analyzing mitigation for water, an island-wide approach considering both DoD and GWA water systems must be pursued. Both systems draw from the same aquifer thus DoD and GWA must work together to provide the necessary mitigations. This will likely require a financial obligation from both parties to ensure that both sufficient and high quality potable water is provided to customers located in the northern area of Guam which relies on groundwater. These relationships would be carefully defined in the post-ROD Monitoring Plan.

Reaching an action point would trigger the need to implement one or more mitigation measures. All of the DoD controlled mitigation measures related to utilities in Table 2.2-1 or DoD controlled adaptive management mitigation techniques described in Section 2.3.2 could reduce impacts.

Although control of where temporary housing for construction workers is located resides with construction contractors and Gov Guam through its planning process, DoD is interested in avoiding adverse impacts through effective planning. Contractors proposing workforce housing will be responsible for coordinating site approvals and permits with local Guam planning and zoning agencies, and with GWA. DoD can require minimum housing standards for worker housing through contract provisions and selection criteria, which should guide the contractors to select locations with adequate utility infrastructure.

If enough new planned GWA wells are not brought online by 2010, the proposed project has the potential to result in significant impacts on the Guam water supply. To mitigate those impacts, DoD could transfer excess water production capacity to GWA, if requested. Current assessments indicate the Andersen Air Force Base water system has excess well production capacity of 3 MGd that could be transferred to assist GWA with potential shortalls in norhtern Gaum. Navy surface water resources from Fena Resevoir may also be available to GWA in addition to the current allotment of up to 4 MGd to further mitigate the shortfalls. GWA would need to formally request this support through the Navy Region Marianas Utilities Department, who would determine water availability and appropriate rates reimbursement. The DoD expects that GWA or the developer requesting additional water would install the necessary piping to make the interconnections with DoD water systems.

With respect to the DoD controlled adaptive management mitigation technique of altering the construction tempo, should a projected potable water demand trend toward exceeding projected supply, the Navy could slow the construction tempo which would reduce construction worker and induced civilian populations, which would in turn reduce the rate of increase in potable water demand. An example of how this might work can be demonstrated using the projected 6.1 MGd (23 mld) deficit on the GWA water system in the year 2014 (see Table 2.3-5 above). One mitigation approach to eliminating this deficit would be to slow the construction tempo and reduce the rate of increase in construction workers and induced civilian population. As previously established, for each $10 M reduction in construction work, there would be an estimated reduction of 75 construction workers and associated 99 induced population reduction, which would result in 3,263 gpd (0.003263 MGd) reduction for every $1M of construction[1]. To achieve a reduction of 6.1 MGd (23 mld), DoD would need to reduce construction tempo by approximately $1.9B in that year[2]. This level of impact to the construction tempo would likely not be acceptable and a variety of mitigations would be adopted, in addition to construction tempo adaptive management.

An additional DoD controlled mitigation measure would be to accelerate construction of new water supply and/or leak detection and repair to reduce UFW. Non-DoD mitigation measures that could also be implemented are:

- Accelerate construction of new water supply and/or leak detection and repair to reduce UFW on GWA systems
- Accelerate development of new GWA supply wells and T&D systems

[1] Average potable water demand calculation for each $1M worth of construction: The demand for additional civilians utilizing the GWA water system is estimated at 187.5 gpcd, assuming a UFW rate of 50% (see Volume 6 Section 2.2.2.2). The assumption has also been made that all construction workers (75 per $10M of construction) and all induced civilian population (99 per $10M of construction) would live in northern or central Guam (which is served by well water). Thus, for each reduction of $10M worth of construction, the population being served by well water would be reduced by 174 people, representing 32,625 gpd demand reduction, or 0.003263 MGd per $1M construction.

[2] Projected 2014, supply deficit would be 6.1 MGd. Dividing 6.1 MGd deficit by 0.003263 MGd per $1M equals approximately $1.9B.

- Import water for industrial or other non-potable uses
- Work out a water exchange between the DoD and GWA systems to allow transfer of excess DoD water capacity to GWA
- Use temporary small self contained desalination plants (reverse osmosis) to augment water supply, provided regulatory approvals would be received

2.3.5 Wastewater

There are three wastewater treatment plants (WWTP) servicing the northern and central portions of Guam affected by the proposed action:

- North District Wastewater Treatment Plant (NDWWTP) - The NDWWTP is owned and operated by Veolia under contract with GWA. The treatment plant treats wastewater flows from civilian populations and DoD installations that are located in northern Guam: Andersen AFB, NCTS Finegayan, and South Finegayan. The NDWWTP is a primary treatment plant designed for an average daily flow of 12.0 MGd (45.4 mld) and a peak capacity of 27 MGd (102 mld). Communication with GWA has indicated that the current average daily flow to the NDWWTP from civilian and military sources is approximately 5.7 MGd (22 mld) (GWA 2008a). The NDWWTP had received a 301(h) modified permit (NPDES Permit No. GU0020141) that expired on June 30, 1991 that authorized the NDWWTP to discharge a maximum daily flow of 6 MGd (23 mld). Based on plant operation performance and data provided by GWA on the actual discharged wastewater qualities, USEPA denied GWA's application for a renewed variance from full secondary treatment on September 30, 2009, and concluded that the CWA 301(h) criteria have not been met at the NDWWTP.
- Apra Harbor WWTP - The Apra Harbor wastewater collection and treatment system is Navy owned and operated. It services the Naval facilities at the Naval Base Guam, Apra Heights, and NMS. The Apra Harbor wastewater system also collects and treats discharged sludge flow from the Navy's Fena WTP. The Apra Harbor WWTP is a secondary treatment facility designed to treat an average daily flow of 4.3 MGd (16 mld) and a peak flow of 9 MGd (34 mld). The treatment plant currently receives an average daily flow of approximately 2.9 MGd (11 mld). Treated effluent is discharged through an ocean outfall into Tipalao Bay under NPDES Permit No. GU0110019. This permit authorizes the Apra Harbor WWTP to discharge an average monthly flow of 4.3 MGd (16.3 mld). A military construction project to rehabilitate/upgrade the existing Apra Harbor WWTP is currently under way.

This section is derived from analysis found in Volume 6. For a full discussion of supply or demand calculations or alternatives analysis for wastewater please refer to Volume 6, as this section will provide only applicable portions to demonstrate how adaptive management techniques would be applied as mitigation to the preferred alternative.

Alternative 1 has two options for meeting wastewater demands as a result of implementing the proposed actions. Basic Alternative 1a (preferred alternative) supports the proposed Main Cantonment Alternatives 1 and 2 and Basic Alternative 1b supports the proposed Main Cantonment Alternatives 3 and 8. Both Basic Alternatives 1a and 1b include NDWWTP actions: upgrading primary treatment facilities and expansion to secondary treatment. Basic Alternative 1b has an additional requirement for a new sewer line from Barrigada housing to NDWWTP. Since this additional requirement does not impact supply or demand, it will not be discussed in this section. Only the NDWWTP Basic Alternative 1a will be analyzed for adaptive management since all flows from the current and proposed future military buildup

at Andersen AFB and the proposed Marine Corps relocation at Finegayan would be conveyed to the NDWWTP.

2.3.5.1 Projected Supply and Demand

Table 2.3-6 summarizes existing civilian and peak DoD flows for northern Guam for Main Cantonment Alternatives 1 and 2. Included in this table are projected increases in northern Guam's civilian flows as a result of natural population growth, projected DoD increases associated with the military buildup, increases associated with the imported construction workforce, and civilian increases that could result from induced population growth in northern Guam. The table includes projected increases in flows from Guam civilians related to natural population growth, projected DoD increases associated with the military buildup, increases associated with the imported construction workforce, and induced civilian increases under Main Cantonment Alternatives 1 and 2.

Table 2.3-6. Projected Peak Wastewater Flows for Main Cantonment Alternatives 1 and 2

Source of Wastewater Flow	*Year*					
	2010	*2011*	*2012*	*2013*	*2014*	*2015*
Northern District Wastewater Treatment Plant						
Existing Guam Civilian	5.20	5.20	5.20	5.20	5.20	5.20
Existing DoD	0.53	0.53	0.53	0.53	0.53	0.53
Guam Civilian Increase	0.42	0.64	0.85	1.06	1.26	1.47
DoD Increase	0.24	0.48	0.53	0.57	2.71	2.95
Construction Workforce	0.26	0.66	1.14	1.43	1.47	0.97
Subtotal Direct DoD and Guam Civilian	**6.65**	**7.50**	**8.25**	**8.79**	**11.17**	**11.11**
Induced Civilian Increase	0.27	0.66	1.08	1.27	1.58	1.19
Total Average Daily Flow—all sources	**6.92**	**8.16**	**9.33**	**10.05**	**12.75**	**12.31**
Total Peak Daily Flow—all sources	**15.56**	**18.37**	**20.99**	**22.62**	**28.69**	**27.69**

Legend: measurements given in million gallons per day (Mgd).

As shown above in Table 2.3-6, wastewater flows to the NDWWTP from military and civilian sources are projected to increase to a peak of 12.8 MGd (48.3 mld) in 2014, which is somewhat more than the design capacity of 12.0 MGd (45 mld). The prior permit (currently expired) limit of 6 MGd would require that GWA reach agreement with GEPA and EPA on the ability to process the greater estimated demand. In addition, the current physical condition of the NDWWTP would require refurbishment to once again attain the original design capacity in order to meet the demand. The slight excess demand over original design capacity would be handled by adding chemical coagulants or increasing the surface overflow rate (within the normal design range) of the clarifier to improve plant operations so that the primary clarifier would be able to treat the projected additional flow without adverse effects on the NDWWTP, with regulatory approval.

2.3.5.2 Projecting Tipping Point(s) and Action Point(s)

Monitoring real time data for wastewater should include the maximum daily demand and the average daily demand curves and population rate increases. These data should be used to identify trends correlating with the buildup/construction. With this correlation, revised projections of future demand would be calculated. In-progress refurbishments would be taken into account when forecasting wastewater demands, as should operational limitations in the permits.

Both the tipping point and the action point would be identified and agreed upon by the agencies participating in developing the post-ROD monitoring plan. By monitoring the data described above, the tipping point and action point could be identified using trend analysis. The action point would need to be identified far in advance so that mitigation actions could be implemented to prevent the tipping point from occurring. For wastewater, the water quality at the discharge point should be included in action point and tipping point determination, so as to avoid permit violations.

2.3.5.3 Potential Impacts and Mitigation

Potential impacts as a result of exceeding the capacity of the NDWWTP include degradation of water quality which would impact public health and safety. Additionally, recreational uses such as fishing, boating or swimming could potentially be impacted if located near the discharge points where these activities occur. Socioeconomic impacts related to tourism could result if mitigation implementation is delayed.

Any mitigation action employing adaptive management techniques to potentially reduce significant impacts of excess demand must recognize that the projected demand numbers are estimates and forecasts based on many assumptions such as projected population increases. Adaptive management would require real time monitoring of the wastewater demand, capacity requirements and permit limitations associated with implementation of the interim preferred alternative and would enable DoD to make adjustments in contract execution to potentially avoid significant impacts.

Reaching an action point would trigger the need to implement one or more mitigation measures. All of the DoD-controlled mitigation measures related to utilities in Table 2.2-1 or DoD controlled adaptive management mitigation techniques described in Section 2.3.2 could reduce impacts.

With respect to the DoD controlled adaptive management mitigation technique of altering the construction tempo, should a projected wastewater demand trend toward exceeding capacity, the Navy could slow the construction tempo which would reduce construction worker and induced civilian populations, which would in turn reduce the rate of increase in wastewater demand. An example of how this might work is to take the projected flows for year 2014. The projected wastewater demand is an average daily demand of 12.75 MGd, or 0.75 MGd in excess of the anticipated permit level. As previously established, for each $10 M reduction in construction work, there would be an estimated reduction of 75 construction workers and associated 99 induced population reduction, which would result in 996 gpd (0.000996 MGd) reduction for every $1M of construction[3]. To achieve a reduction of 0.75 MGd, then DoD would need to reduce construction tempo by approximately $753 M in that year[4]. With that reduced construction tempo, the anticipated wastewater demand for year 2014 would equal 12 MGd, exactly the anticipated permitted allowance.

In addition to the DoD-controlled adaptive management mitigation discussed in Section 2.3.2, DoD would:

- Work with GWA to expedite the planned improvements and request for a NPDES permit modification to increase the effluent discharge limitation from 6.0 MGd (22.7 mld) to 12.0 MGd (45.4 mld), then comply with its modified NPDES permit requirements

[3] Average wastewater demand calculation for each $1M worth of construction: The demand for additional civilians is estimated at 120 gpcd. The assumption has also been made that two-thirds of the construction workers (2/3 of 75, or 50 per $10M of construction) and 1/3 of the induced civilian population (1/3 of 99, or 33 per $10M of construction) would live in the NDWWTP service area. Thus, for each reduction of $10M worth of construction, the population being served by NDWWTP would be reduced by 83 people, representing 9960 gpd demand reduction per $10M, or 0.000996 MGd per $1M construction.

[4] Supply deficit is 0.75 MGd. Dividing 0.75 MGd deficit by 0.000996 MGd per $1M equals approximately $753M.

- Work with GWA and EPA and GEPA in advance to obtain a provisional permit variance to allow for short term exceedances of the permitted flow limits
- Work with and assist GWA in checking for infiltration of water into DoD collection system and repair as necessary
- Work with GovGuam to divert induced civilian growth and construction worker growth to be housed in areas feeding wastewater to other treatment facilities
- Utilize tanker trucks to ship excess wastewater from the NDWWTP to other treatment facilities on Guam
- Require construction contractor to use a cruise ship or hotel barge docked at a commercial pier and be used as housing instead of areas that feed wastewater to NDWWTP

Potential non-DoD mitigation:

- Adding chemical coagulants or increasing the surface overflow rate (within the normal design range) of the clarifier to improve plant operations so that the primary clarifier would be able to treat the projected additional flow without adverse effects on the NDWWTP

2.3.6 Air Quality

Air quality is not a utility and therefore is not discussed here in terms of supply and demand. However, population increases cause increases in operation of stationary, mobile, and area air emission sources and results in impacts to air quality. Air quality is discussed in terms of permitted activities for stationary sources and impacts to the National Ambient Air Quality Standards (NAAQS) or mobile source air toxics (MSATs).

Even though the air quality impacts discussed in Volume 6 show that major stationary source permit limits will not be exceeded and no significant air quality impacts were predicted in Volumes 2-6 under the preferred alternatives, air quality will decline as a result of implementing the proposed actions. As with the utilities sections above, only the preferred alternatives are discussed in this section.

2.3.6.1 Background

The USEPA, under the requirements of the 1970 Clean Air Act (CAA), as amended in 1977 and 1990 (Clean Air Act Amendments [CAAA]), has established NAAQS for six contaminants, referred to as criteria pollutants (40 CFR 50): carbon monoxide (CO), nitrogen dioxides (NO_2), ozone (O_3) (with nitrogen oxides [NO_x] and volatile organic compounds [VOCs] as precursors), particulate matter (PM) (PM_{10}—less than 10 microns in particle diameter; $PM_{2.5}$—less than 2.5 microns in particle diameter), lead (Pb), and sulfur dioxide (SO_2).

Areas where concentration levels are below the NAAQS for a criteria pollutant are designated as being in "attainment." Areas where a criteria pollutant level equals or exceeds the NAAQS are designated as being in "nonattainment." Based on the severity of the pollution problem, nonattainment areas are categorized as marginal, moderate, serious, severe, or extreme. Where insufficient data exist to determine an area's attainment status, it is designated as either unclassifiable or in attainment. Guam is in attainment with the primary NAAQS, with the exception of sulfur dioxide in two areas: a 2.2-mi (3.5-km) radius of the Piti Power Plant and a 2.2-mi (3.5-km) radius of the Tanguisson Power Plant. (Figure 2.3-3). An emissions inventory shows that the power plants are the major source of SO_2 on Guam.

Both areas are designated nonattainment for sulfur dioxide as a result of monitored and modeled exceedences in the 1970's prior to implementing changes to power generation facilities. In the 1990's both plants were rebuilt, upgrading their emission controls. Guam has submitted a re-designation request to

USEPA. That pending re-designation request shows that they are now in attainment; however, USEPA has not re-designated these areas as attainment for SO_2 to date. Both plants are on the western side of the island. The trade winds blow persistently from east-to-west, further lessening the impact of the SO_2 emissions on the people of Guam from the power plants.

Because SO_2 is a criteria pollutant and the two areas around the power plants are in non-attainment for SO_2, the *de minimis* level established by USEPA applicable to the two non-attainment areas is 100 TPY of SO_2. If the total direct and indirect emissions of a pollutant are above the *de minimis* level, a formal general conformity determination is required for that pollutant. The net increase in SO_2 emissions with potential to emit from the proposed action within the two SO_2 nonattainment areas was predicted for operational and construction activities with potential to occur. As summarized in Chapter 3,Table 3.3-8 annual SO_2 emissions under the preferred alternatives would not exceed the *de minimis* criterion of 100 TPY of SO_2 in both the Tanguisson and the Piti nonattainment areas and a formal conformity determination is not required. A Record of Non-Applicability will be included in the Final EIS.

As discussed in Volume 2, Chapter 5, Air Quality, the EIS/OEIS selected the "major stationary source" definition (250 TPY or more of any air pollutant subject to regulations under the CAA from the Prevention of Significant Deterioration (PSD) program as the threshold for locations that are in attainment for determining the potential significance of air quality impacts from these sources. Neither the PSD permitting program nor the General Conformity Rule (GCR) are applicable to 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 the alternatives under NEPA. However, since the 250 TPY threshold is selected in the context of the *de minimis* threshold established in the GCR providing only an

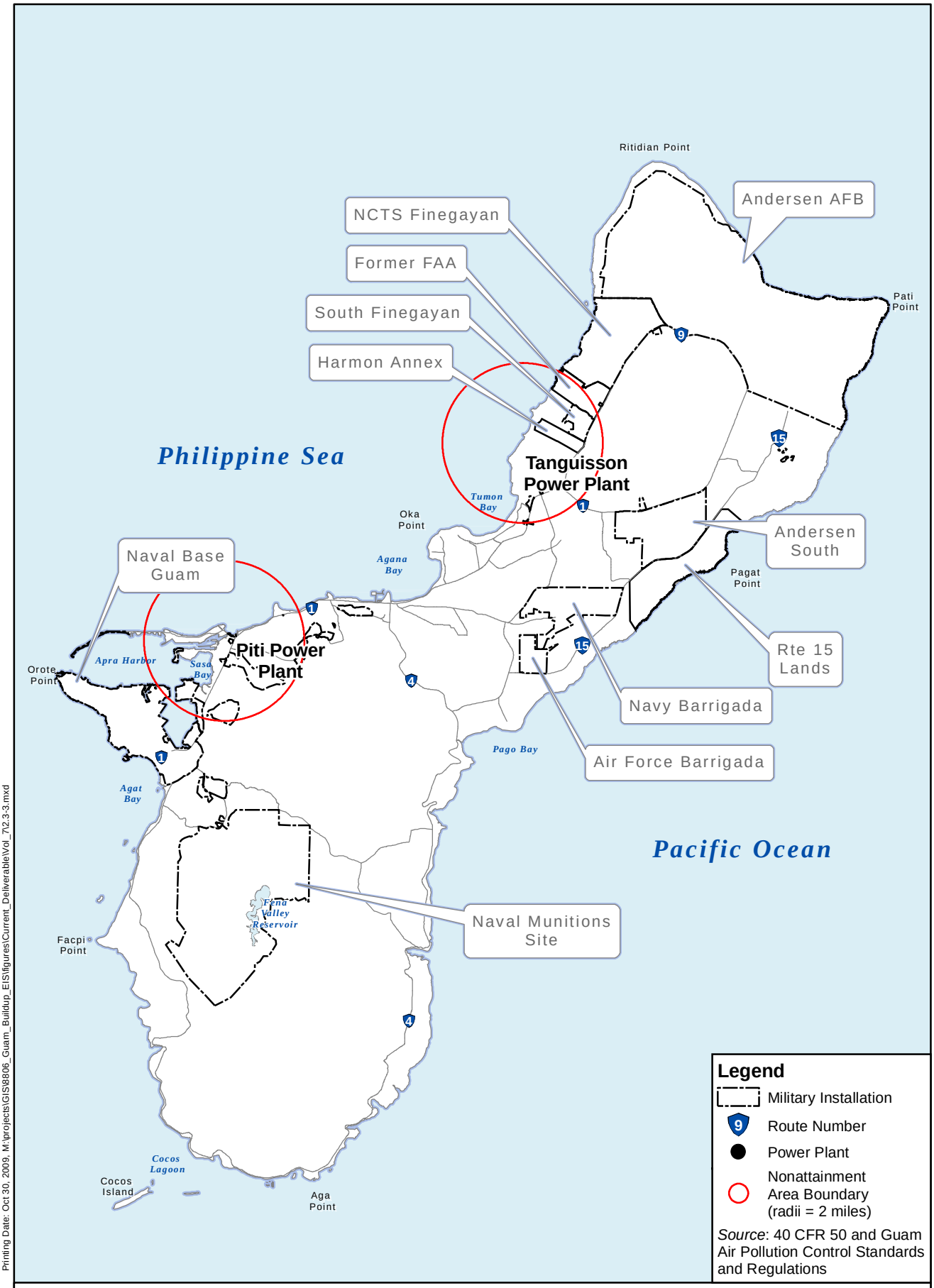

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Figure 2.3-3
Guam SO_2 Non-Attainment Areas

indication of potential significant impact, a further formal impact analysis should be conducted if such threshold is exceeded, where appropriate.

2.3.6.2 Summary of Preferred Alternatives Air Impacts

The Cumulative Impacts chapter of this Volume (Chapter 4) discusses the impacts of all preferred alternatives when combined together, both construction and operations. Please refer to Chapter 3 for a full analysis of air quality impacts on the summary of preferred alternatives.

As discussed in the Cumulative Impacts chapter, the only pollutant that exceeds the 250 TPY threshold is CO for operations in the North area. As discussed in Volume 6 for roadway projects, vehicular CO emissions are of local (microscale) concern with potential impacts concentrated around heavily congested intersections. Although the CO emissions are predicted to exceed 250 TPY under operational conditions, further microscale dispersion modeling performed at the intersections that are likely to have the greatest air quality impacts (Volume 6) indicated that no exceedances of the CO NAAQS would occur. Therefore, potential CO impacts would be less than significant under the preferred alternatives. Volume 7, Chapter 3, Table 3.3-9 lists the intersections and results of CO analysis on Guam that are likely to have the greatest impact on air quality. These intersections showed no exceedances of the CO NAAQS under the preferred alternative.

Additionally, the preferred alternative for power (reconditioning the four combustion turbines) would not exceed the existing permitted capacity established in the CAA Title V permit for the major stationary sources. Therefore, implementation of the preferred power alternative would be in compliance with all required CAA regulations and standards resulting in no significant air quality impacts.

2.3.6.3 Projecting Tipping Point(s) and Action Point(s)

There are no permit exceedences or threshold exceedences anticipated from implementing the proposed actions on Guam. However, it is anticipated that overall air quality will generally decline on Guam as a result of implementing the proposed action due to increased population, increased power usage (increased burning of high sulphur fuels), increased construction and related traffic.

The GovGuam has not collected ambient air quality data since 1991. Therefore, no existing ambient air quality data is available to represent current air quality conditions with respect to the criteria pollutants for which the NAAQS were established. Therefore determining an action point or tipping point as it relates to ambient air quality is not possible.

An action point or tipping point could best be determined by monitoring the data collection effort discussed in the power section of adaptive management. The monitoring data discussed in that section, included testing for fuel sulfur content, weekly monitoring for opacity, and a continuous monitoring system to monitor fuel consumption and the ratio of water-to-fuel being fired in the CTs. This data when added to the population rate projections and the data collected in the power plant itself relating to supply and demand should be used to identify trends correlating with the buildup/construction.

For mobile sources, preliminary coordination with the USEPA has resulted in their request to perform an mobile source air toxic (MSAT) analysis based on the methodology described in the research report "*Analyzing, Documenting, and Communicating the Impacts of Mobile Source Air Toxic Emissions in the NEPA Process*" prepared for the American Association of State Highway and Transportation Officials (ASHTO) (ICF International 2007). To comply with USEPA's request as part of the NEPA process, additional traffic analysis will be conducted to generate the information necessary to assess traffic volumes, particularly at intersections, and vehicle-hours for idling heavy duty diesel trucks during peak

construction. The MSAT analysis and results using the method based on the ASHTO report will be presented in the Final EIS, along with the MSAT analysis based on the FHWA guidance that is included in this Draft EIS/OEIS. If the results of the MSAT analysis indicate an adverse air quality impact, potential mitigation measures could be implemented to reduce the impacts.

2.3.6.4 Potential Impacts and Mitigation

Potential impacts associated with a decline in air quality include health risks, visibility and nuisance.

As previously stated, the post-ROD Monitoring Plan would identify mitigation to address significant impacts as a result of the proposed action. Some of these mitigation measures are within DoD control. For those actions that are outside of DoD control, DoD would work with the respective agency to facilitate the mitigative action. Mitigation action employing an adaptive management approach to address the adverse impact on air quality are based on assumptions such as population projections and demand calculations.

Because air quality is not a utility like power, potable water and wastewater, mitigation measures are more difficult to define. However, any mitigation related to reducing power and mobile source emissions would intuitively reduce the impacts to air quality. With respect to the DoD controlled adaptive management mitigation technique of altering the construction tempo, if the Navy slowed the construction tempo reducing population increases associated with construction workers and induced civilian populations, the air emissions would be reduced. The pending MSAT analysis results would also be used as a consideration for avoiding potential significant health risks from on-road vehicle operations during construction periods.

Other potential DoD controlled mitigation includes:

- In cooperation with GEPA, short-term air monitoring sampling for pollutants such as particulate matter and VOC could be considered to monitor potential construction air quality impact around major construction sites in the sensitive neighborhood with lengthy construction duration.
- Assist GovGuam and/or other agencies to determine ways to reduce air emissions as described in the Non-DoD controlled mitigation below.
- The Navy could potentially include the following in the construction contracts:
    - Establish anti-idling requirements for construction vehicles that require vehicles to be shut down if not in use for a set period of time
    - Pursue operational agreements that reduce or redirect work or shift times to avoid community exposures when sites are in proximity to vulnerable populations (e.g., schools)
    - Pursue technological improvements to equipment, such as off-road dump trucks and bulldozers. These could include particulate matter traps, oxidation catalysts, and other devices that provide an after-treatment of exhaust emissions

Non-DoD controlled mitigation includes:

- EPA could cancel waivers allowing GPA to use of high sulphur fuels.
- GovGuam could:
    - Develop and implement a Traffic Management Center to monitor traffic flow and congestion

- Implement the addition of pollution control equipment to reduce emissions at the combustion turbine facility
- Establish speed limit enforcement off DoD property
- Create of buffer zones between new or expanded road alignments and areas of vulnerable populations
- Burn low sulfur diesel fuel in the CTs
- Provide the option of using low sulfur diesel fuel for construction and highway vehicles
- As construction vehicle engines typically idle when not in use, establish anti-idling requirements for construction vehicles that require vehicles to be shut down if not in use for a set period of time
- Pursue operational agreements that reduce or redirect work or shift times to avoid community exposures when sites are in proximity to vulnerable populations (e.g., schools)
- Pursue technological improvements to equipment, such as off-road dump trucks and bulldozers. These could include particulate matter traps, oxidation catalysts, and other devices that provide an after-treatment of exhaust emissions

2.4 POTENTIAL BENEFITS TO OTHER RESOURCE AREAS NOT AS SENSITIVE TO CONSTRUCTION TEMPO

The Navy determined it would focus on the resource areas of power, potable water, wastewater, and air quality for adaptive management techniques because these resources are most likely to be significantly impacted, and are sensitive to changes in peak population during the construction period. If determined to be necessary, the Navy is able to commit to adjusting the intensity and duration of the construction tempo to influence significant impacts for these resource areas as discussed above in Section 3.2. By implementing an adaptive management strategy as a mitigation measure, the Navy may reduce significant impacts on power, potable water, wastewater, and/or air quality as appropriate. Certain other resource areas may also benefit to some degree from the alteration of construction tempo. Still other resource areas may not be affected at all by a reduction in construction tempo. The remaining resource areas are discussed below to indicate how an adaptively managed construction tempo may potentially change the projected impacts previously discussed throughout this EIS/OEIS.

2.4.1 Geological and Soil Resources

The proposed action involves construction of a large number of facilities throughout Guam and other islands. Each of the respective construction actions would involve some degree of changes to geology and/or soils. The impacts of disturbance are related to the locations and amount of construction proposed not the construction tempo. Managing the construction tempo to change construction workforce or induced population would not result in significant changes to the impacts on geology and soils already discussed in this EIS/OEIS.

2.4.2 Water Resources

The proposed action involves construction that would result in some degree of erosion and stormwater runoff. Managing the construction program to alter tempo would influence the amount of erosion and stormwater runoff occurring at any one time, but would not change the overall amount. Erosion and stormwater BMPs and construction permit requirements would result in control and minimization of the impacts for the duration of construction activities. Managing the construction tempo to change construction workforce or induced population would not result in significant changes to the impacts on water resources already discussed in this EIS/OEIS.

2.4.3 Noise

There are two potential noise issues associated with the proposed action: noise associated with construction activities and noise associated with long-term operations after construction is complete. Construction noise is directly related to the intensity of construction. The use of heavy equipment at a construction site has a noise impact on nearby citizens and wildlife. Altering the construction tempo would likely change the amount of noise experienced at any given time, but could have an undesired effect of prolonging local exposure to that construction related noise. Likewise changes in construction tempo would also have a corresponding change in intensity and duration of noise impacts along roadways used by construction vehicles. Operational noise is not directly related to construction tempo or associated short-term population increases, therefore, managing the construction tempo to change construction workforce or induced population would not result in significant changes to the operational noise impacts already discussed in this EIS/OEIS.

2.4.4 Airspace

Impacts to airspace relate to restrictions placed on the use of that space caused by the creation of special use airspace (SUA) associated with aircraft operations and flight paths. The second restriction is from surface danger zones (SDZs) associate with training activities on ranges. Each of these restrictions is associated with the proposed operations taking place as a result of the proposed action, not the construction tempo or population. Managing the construction tempo to reduce construction workforce or induced population would not result in significant changes to the impacts on airspace already discussed in this EIS/OEIS.

2.4.5 Land and Submerged Land Use

Significant impacts on land use primarily result from proposed land acquisitions and required relocations necessary for new infrastructure development. Regardless of construction tempo, the end-state land use impacts would remain the same as discussed in the EIS/OEIS. Analysis of short-term construction impacts in the EIS/OEIS is based on all proposed construction occurring simultaneously to evaluate the maximum potential environmental effects. Managing the construction tempo to reduce construction workforce or induced population would spread out the timing of certain construction projects but would not change the end-state land uses, and thus, would not result in significant changes to the impacts on land and submerged land use already discussed in this EIS/OEIS.

2.4.6 Recreational Resources

Recreational resources both within DoD-controlled property and within the civilian community would be significantly impacted with the implementation of the proposed action. Foreseeable impacts include inadequate or overly crowded facilities such as parking, picnic shelters, restrooms, showers, boat mooring facilities, golf courses, dive spots, etc. These impacts would result from long-term population increases, as well as the short-term construction workforce and related induced population increases. Impacts on these resources are very sensitive to population changes, but given the wide variety of specific resources to monitor, recreational resources is not a good candidate as a driver for adaptive management mitigation techniques. Because it is unknown which specific resources would be impacted or to what degree by the increased construction tempo related population; it is difficult to establish a direct correlation between increase population and impact to a specific recreational resource. However, it is recognized that managing the construction tempo to reduce construction workforce or induced population generally would lessen the impacts already discussed in this EIS/OEIS.

2.4.7 Terrestrial Biological Resources

Potential impacts to terrestrial biological resources would occur from implementing the proposed action. The impacts to the natural environment (e.g. various forested communities and wetlands) would generally be the same regardless of construction tempo as these impacts are associated with actual construction or operational activities. However, the change in construction tempo could lessen the potential impacts to some species. The reduction in construction tempo could provide species a better chance to adapt to construction activities. Other species could benefit from a seasonal change in construction tempo. Still, for other species, the impacts would generally be the same regardless of construction tempo. Therefore, adaptively managing the construction tempo could potentially have an ancillary benefit to some species.

2.4.8 Marine Biological Resources

Potential impacts to marine biological resources would occur from implementing the proposed action. The impacts to the natural environment (e.g., coral and seagrass beds) would generally be the same regardless of construction tempo as these impacts are associated with actual construction or operational activities. However, the change in construction tempo could lessen the potential impacts to some species. The reduction in construction tempo could provide species a better chance to adapt to construction activities. Other species could benefit from a seasonal change in construction tempo. Still, for other species, the impacts would generally be the same regardless of construction tempo. Adaptively managing the construction tempo could potentially have an ancillary benefit to some species; however, it could also result in adverse effects to other species due to prolonged construction activities.

2.4.9 Cultural Resources

It is anticipated that cultural resources would be impacted as a result of direct construction activities and some impact during training activities. Neither of these activities is a function of construction tempo nor construction-related population increases. Managing the construction tempo to reduce construction workforce or induced population would not result in significant changes to the impacts on cultural resources already discussed in this EIS/OEIS.

2.4.10 Visual Resources

A number of construction projects would have substantial impacts on view sheds that are mitigated to less than significant. The impacts are not a function of construction tempo or short-term changes in population. Thus, managing the construction tempo to reduce construction workforce or induced population would not result in significant changes to the impacts on visual resources already discussed in this EIS/OEIS.

2.4.11 Traffic and Marine Transportation

There are two types of transportation that could be impacted by the proposed action: land and marine transportation (not sport fishing, see recreational resources). Marine related transportation impacts are associated with the port and harbor area and the ability to adequately accommodate the increase in container ship traffic. It is understood that any long-term increase in population would require a greater throughput of material at the port; however, the requirement for imported construction related material would also have a greater impact on harbor operations. The degree of impact is more closely related to the construction tempo, not the associated increase in population. Therefore managing the construction tempo to reduce construction workforce or induced population generally would also reduce the throughput of construction materials and lessen the marine transportation impacts already discussed in this EIS/OEIS.

Land based transportation impacts are subject to both construction tempo and population. Changes in construction tempo would correspondingly change the volumes of construction related traffic (equipment and trucks hauling material) on various roads and at intersections. Changes in population as a result of construction tempo would also change the volume of vehicles. Therefore managing the construction tempo to reduce construction workforce or induced population generally would also reduce the materials delivery traffic and work force traffic, lessening the traffic impacts already discussed in this EIS/OEIS.

2.4.12 Solid Waste

The Navy Sanitary Landfill at Apra Harbor has the potential to provide 14 years of capacity and the GovGuam Layon Landfill is scheduled to be completed and begin accepting waste in July 2011. The construction tempo would gradually increase to a peak in year 2014. It is anticipated that existing landfill capacity would accommodate the first two years of construction. As documented in a signed letter with GovGuam, the Navy intends to enter into a contractual arrangement for the use of the Layon Landfill. With the availability of these two landfills and their capacity to handle the anticipated solid waste generated during the construction phase the impacts to solid waste disposal are not considered sensitive to the construction tempo. Managing the construction tempo to reduce construction workforce or induced population would not result in significant changes to the impacts on solid waste already discussed in this EIS/OEIS.

2.4.13 Socioeconomics

There are both beneficial and significant adverse island-wide impacts on the socioeconomics of Guam. The impacts peak in the years 2013 and 2015 timeframe and are made significant in large part due to the overlap in the construction and operation phases of the proposed action. Impacts would entail substantial growing pains related to rapid population influx, housing and public service shortages, and cost of living increases, among others. Impacts on socioeconomic resources are very sensitive to population changes, but given the wide variety of specific resources to monitor, socioeconomic resources is not a good candidate as a driver for adaptive management mitigation techniques. However, it is recognized that managing the construction tempo to reduce construction workforce or induced population generally would lessen the adverse socioeconomic impacts already discussed in this EIS/OEIS. A reduced construction tempo could provide GovGuam and the private sector a longer period of time to increase available public services for the increased short-term population increase which may also help alleviate initial shortfalls for the projected long-term population increase.

2.4.14 Hazardous Material/Waste

The proposed action would result in increased transportation, handling, use, and disposal of hazardous materials and hazardous waste. Through the use of best BMPs and standard operating procedures, the Navy would be instituting various controls and safeguards for handling these hazardous materials and wastes and no additional specific mitigation is proposed. The usage/generation of hazardous materials and hazardous wastes is primarily a function of the magnitude of DoD activities, as such, the construction tempo would impact the quantities of materials used and disposed of for any given time period. However, overall quantities and handling would remain the same and there would not be a reduction in total hazardous materials or wastes should the construction tempo change. Therefore, managing the construction tempo to reduce construction workforce or induced population would not result in significant changes to the impacts on hazardous materials and hazardous waste already discussed in this EIS/OEIS.

2.4.15 Public Health and Safety

There are a number of public health and safety issues associated with operational aspects of implementing the proposed action. However based on the various procedures and safeguards that are part of BMPs and standard operating procedures, impacts on public health and safety would not be considered significant. Health and safety impacts from long-term operations are not sensitive to construction tempo. Similarly, potential impacts associated with the increase in construction related population and induced population, such as diseases, other illness, and traffic mishaps that are sensitive to population changes, are not considered significant. While managing the construction tempo to reduce construction workforce or induced population would generally reduce certain public health and safety impacts, it would not result in significant changes to the impacts on public health and safety already discussed in this EIS/OEIS.

2.4.16 Environmental Justice and Protection of Children

The proposed action would have significant impacts or impacts mitigated to less than significant on traffic, cultural resources, noise, water quality, and socioeconomics that have potential to affect low income or children populations. The proposed action, however, would not have any disproportionate impacts on low-income populations or children. While managing the construction tempo to reduce construction workforce or induced population could generally lessen the short-term impacts, it would not result in significant changes to the impacts on Environmental Justice and Protection of Children already discussed in this EIS/OEIS.