

GUAM WATERWORKS AUTHORITY
"Better Water. Better Lives."

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May 31, 2018

Edwin J.C. Reyes
Administrator
Bureau of Statistics and Plans
Guam Coastal Management Program
P.O. Box 2950
Hagåtña, GU 96932

SUBJECT: Federal Consistency Certification Application:
GWA Upgrade to the Northern District Waste Water Treatment Plant Project

Buenas yan Saluda Mr. Reyes,

Enclosed, please find the Federal Consistency Application for Guam Waterworks Authority's (GWA) Upgrade to the Northern District Waste Water Treatment Plant. The project description, Assessment Forms and Summary of findings are included with this application.

As required by 15 CFR §930.57(b), GWA is submitting the following consistency certification statement:

GWA certifies that the proposed activities in the *Upgrade to the Northern District Waste Water Treatment Plant Project* comply with the enforceable policies of Guam Coastal Management Program (GCMP) and will be conducted in a manner consistent with such program.

A timely response to this request for certification of compliance would be appreciated. If you have any questions or comments, please contact Joseph Tadeo, GWA Management Analyst at (671) 300-6068 or via email at jtadeo@guamwaterworks.org.

Sincerely,



Paul J. Kemp
Acting General Manager

PMK/jat

CC: Thomas Cruz, GWA Chief Engineer
Prudencio Aguon, GWA Grants Administrator
Evangeline Lujan, GWA Senior Regulatory Analyst
Thomas Konner, USEPA Environmental Engineer

Enclosures:

- (1) Project Description
- (2) Assessment Forms
- (3) Summary of Findings

Project Description

The Northern District Waste Water Treatment Plant (NDWWTP) is located in Dededo on the northwestern coast of the island of Guam. The facility collects and treats wastewater from the regions of Dededo, Latte Heights, Perez Acres, Ypaopao, and Marianas Terrace, the Yigo Collector System, and other unincorporated subdivisions throughout Yigo and Dededo municipalities. The service area also includes U.S. military facilities (Air Force and Navy) within the areas of Dededo and Harmon Annex, and Anderson Air Force Base. The NDWWTP currently provides primary treatment for a population of approximately 76,000 people.

The existing NDWWTP is located on Lot 10184-7 on Tanguisson Road, Dededo. The Guam Waterworks Authority (GWA) acquired 17 acres from the Guam Ancestral Lands Commission to accommodate the secondary treatment improvements. The solids treatment facilities will reuse much of the existing plant site. The expansion of the plant will be located across the existing plant on Lot 10190-1. **See map Attachment A.**

The NDWWTP operates under the National Pollution Discharge Elimination Systems (NDPES) permit no. GU0020141 and is a Class III Wastewater Treatment Plant. The current average design treatment flow rate for the existing NDWWTP is 6.0 million gallons per day (mgd). Under the 2011 Court Order, the NDWWTP can process up to 7.5 mgd.

The improvements will upgrade the NDWWTP from chemically enhanced primary treatment to enhanced secondary treatment. The expansion will bring the GWA into compliance for secondary treatment as required under the NDPES permit. The upgraded NDWWTP will be constructed to treat an average flow rate of 9.0 mgd with the intention for future expansion to increase to 12 mgd if additional flow is required.

The upgrades will include liquid and solid treatment. The upgrade to secondary treatment at NDWWTP will consist of the following recommended components and processes:

- New septage receiving station or update existing station**
- Conversion of existing headworks to influent raw sewage pump station
- New headworks facility with preliminary treatment including screening, grit removal, and flow measurement
- New secondary treatment process:
 - New activated sludge process using an oxidation ditch as the reactor
 - New return and waste activated sludge pumping
 - New final clarification
- Conversion of chlorine contact basins to ultraviolet disinfection process
- Solids treatment:
 - New Autothermal Thermophilic Aerobic Digestion process**
 - New Gravity belt thickening
 - Conversion of primary clarifier for sludge storage
 - Centrifuge dewatering (additional centrifuges added to existing building)

- Landfill disposal of biosolids
- New laboratory facilities
- New administrative building**
- Size upgrade for the 27-inch force main from Southern Link pump station to NDWWTP
- Upgrade to pumps and other improvements for Southern Link pump station

In addition to the upgrade of the NDWWTP, additional improvements will be done to the collection system that feed into the NDWWTP. Raw sewage enters the treatment plant via a 42-inch-diameter gravity line from Andersen Air Force Base (AFB) and a 27-inch-diameter force main from the Southern Link Pump Station. The 27-inch force main is reaching its life expectancy and will require an upgrade to a larger diameter for reliability and anticipated growth. The Southern Link pumping station will require improvements to the existing pumps. All improvements will be done on the existing infrastructure site.

Although the Federal Consistency Determination is specifically for the upgrade to the Northern District Wastewater Treatment Plant, the treated effluent is discharged through a 36-inch-diameter outfall, into the Philippine Sea offshore from Tanguisson Point at a depth of approximately 140 feet. In 2009, GWA was approved to discharge primary treated wastewater through an outfall that was extended to approximately 1,958 feet long extending the point of discharge approximately 500 feet further offshore, however GWA delayed the installation of the multi-port diffuser which would extend the terminus of the outfall to 7,972 feet into the Philippine Sea. It is expected that the installation of the diffuser will be completed in 2018 prior to the completion of the upgraded NDWWTP.

The upgrade to the NDWWTP's treatment process together with the installation of the diffuser will improve water quality at the current outfall, reduce negative impacts to near shore marine resources, and protect the Northern Guam Lens Aquifer. The plant upgrade will also bring the plant's discharge into full compliance with local water quality standards.

GWA was able to secure funding for the project from a grant from Office of Economic Adjustment (OEA) to support additional flow expected from the increase in military and civilian population and development as part of the 2020 relocation of Marines to Guam.

**GUAM COASTAL MANAGEMENT PROGRAM
ASSESSMENT FORM**

DATE OF APPLICATION: May 31, 2018

NAME OF APPLICANT: Guam Waterworks Authority

ADDRESS: 688 Route 15
Gloria B. Nelson Public Service Building, Suite 200
Mangilao, GU 96913

PHONE NO.: (671) 300-6846 FAX NO.: (671) 648-3290 CELL NO.: _____

E-MAIL ADDRESS: mcbordallo@guamwaterworks.org

TITLE OF PROPOSED PROJECT:

Northern District Wastewater Treatment Plant Upgrade

COMPLETE FOLLOWING PAGES

FOR BUREAU OF STATISTICS AND PLANS ONLY:

DATE APPLICATION RECEIVED: _____

OCRM NOTIFIED: _____ LIC. AGENCY NOTIFIED: _____

APPLICANT NOTIFIED: _____ PUBLIC NOTICE GIVEN: _____

OTHER AGENCY REVIEW

REQUESTED: _____

DETERMINATION:

() CONSISTENT () NON-CONSISTENT () FURTHER INFORMATION REQUESTED

OCRM NOTIFIED: _____ LIC. AGENCY NOTIFIED: _____

APPLICANT NOTIFIED: _____

ACTION LOG:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

DATE REVIEW

COMPLETED: _____

**FEDERAL CONSISTENCY
SUPPLEMENTAL INFORMATION FORM**

Date: May 31, 2018

Project/Activity Title or

Description: Northern District Wastewater Treatment Plant

Location: Dededo, Yigo

Other applicable area(s) affected, if appropriate:

N/A

Est. Start Date: October 2018

Est. Duration: 24 Months

APPLICANT

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Agency/Organization: Guam Waterworks Authority

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CATEGORY OF APPLICATION (check one only)

- () I – Federal Agency Activity
() II – Federal Permit or License
(X) III – Federal Grants & Assistance

TYPE OF STATEMENT (check one only)

- (X) Consistency
() General Consistency (Category I only)
() Negative Determination (Category I only)
() Non-Consistency (Category I only)

APPROVING FEDERAL AGENCY (Categories II & III only)

Agency Office of Economic Adjustment

Contact Person Timothy B. Robert

Telephone No. during business hours:

Primary (916) 557-7315

Alternate

FEDERAL AUTHORITY FOR ACTIVITY

Title of Law

Section

OTHER GUAM APPROVALS REQUIRED:

[illegible]

SUMMARY OF FINDINGS

DEVELOPMENT POLICIES (DP):

DP1. Shore Area Development

Intent: To ensure environmental and aesthetic compatibility of shore area land uses.

Policy: Only those uses shall be located within the Seashore Reserve which:

- enhance, are compatible with or do not generally detract from the surrounding coastal area's aesthetic and environmental quality and beach accessibility; or
- can demonstrate dependence on such a location and the lack of feasible alternative sites.

Discussion:

The project is outside Guam's Seashore Reserve and will not impact the environmental and aesthetic quality of shore area land use. The existing Northern District Wastewater Treatment Plant (NDWWTP) was commissioned in 1979. The upgrade to the NDWWTP is located across the existing plant. The existing and the expansion of the facility are outside of the seashore reserve.

DP2. Urban Development

Intent: To cluster high impact uses such that coherent community design, function, infrastructure support and environmental compatibility are assured.

Policy: Commercial, multi-family, industrial and resort-hotel zone uses and uses requiring high levels of support facilities shall be concentrated within appropriate zone as outlined on the Guam Zoning Code.

Discussion:

This project will not result in any high density or new developments. The project will be an expansion of the existing facilities to manage flow from expansion from the residential and commercial; developments in Dededo and Yigo. This project will improve the capacity, serviceability and reliability of the sewer system for Guam's community. The upgrade to the plant is zoned Public Facility (PF) as the appropriate zone.

DP3. Rural Development

Intent: To provide a development pattern compatible with environmental and infrastructure support suitability and which can permit traditional lifestyle patterns to continue to the extent practicable.

Policy: Rural districts shall be designated in which only low density residential and agricultural uses will be acceptable. Minimum lot size for these uses should be one-half acre until adequate infrastructure including functional sewer is provided.

Discussion:

This project will not interfere with rural development patterns and will not result in any new high density developments. The project will provide an increase to the sewer capacity for the area to address increase in populations resulting from the relocation of Marines to Guam in 2020.

DP4. Major Facility Siting

Intent: To include the national interest in analyzing the siting proposals for major utilities, fuel and transport facilities.

Policy: In evaluating the consistency of proposed major facilities with the goals, policies, and standards of the Comprehensive Development and Coastal Management Plans, Guam shall recognize the national interest in the siting of such facilities, including those associated with electric power production and transmission, petroleum refining and transmission, port and air installations, solid waste disposal, sewage treatment, and major reservoir sites.

Discussion:

The NDWWTP is an existing facility that has already been sited and is located on government of Guam property. The expansion of the NDWWTP to accommodate the secondary treatment improvements, approximately 17 acres, is located across the existing facility. GWA purchased the property from the Ancestral Lands Commission to construct the liquid treatment facility. This project does not garner national interest since the intent is to improve the existing wastewater treatment facility to address increased capacity expected from the growth in population associated with direct and indirect development from the military build-up.

GWA, in conjunction with USEPA, has identified the need for this project to benefit the island waste water collection system and to come into compliance with its existing NDPES permit.

DP 5. Hazardous Areas

Intent: Development in hazardous areas will be governed by the degree of hazard and the land use regulations.

Policy: Identified hazardous lands, including flood plains, erosion-prone areas, air installations' crash and sound zones and major fault lines shall be developed only to the extent that such development does not pose unreasonable risks to the health, safety or welfare of the people of Guam, and complies with the land use regulations.

Discussion:

The project is not located in any known hazardous areas that may adversely affect the health, safety and welfare of the people of Guam. The project will include the expansion of the NDWWTP facilities. GWA sought appropriate legislative approvals for zoning to ensure that the project location complies with existing land use regulations.

DP 6. Housing

Intent: To promote efficient community design placed where the resources can support it.

Policy: The government shall encourage efficient design of residential areas, restrict such development in areas highly susceptible to natural and manmade hazards, and recognize the limitations of the island's resources to support historical patterns of residential development.

Discussion:

The project does not include or directly affect local housing. The project will increase the capacity of the sewer service areas by increasing the capacity of the wastewater treatment plant to accommodate additional residential and commercial development anticipated due to the military buildup.

DP 7. Transportation

Intent: To provide transportation systems while protecting potentially impacted resources.

Policy: Guam shall develop an efficient and safe transportation system, while limiting adverse environmental impacts on primary aquifers, beaches, estuaries, coral reefs and other coastal resources.

Discussion:

The project does not provide transportation for the island. Existing roadways will be utilized for ingress and egress to the construction site. During construction for the project, appropriate highway encroachment procedures will be adhered to based on an approved DPW Highway Encroachment permit.

If at any time the project requires complete or partial closures within Guam's roadways, the contractor shall take all necessary measures to maintain a normal flow of vehicular and pedestrian traffic, if any, in accordance with the standards and regulations established by Guam DPW.

DP 8. Erosion and Siltation

Intent: To control development where erosion and siltation damage is likely to occur.

Policy: Development shall be limited in areas of 15% or greater slope by requiring strict compliance with erosion, sedimentation, and land use regulations, as well as other related land use guidelines for such areas.

Discussion:

This project will be conducted on the existing facility and within two parcels (17.297 acres) immediately north of the currently fenced facility. The project area is not located on an area with a slope of 15% or greater. Best management practices for erosion control will be implemented during construction of the NDWWTP. Appropriate erosion control BMPs will be installed to mitigate and manage erosion and siltation.

The project will adhere to appropriate BMPs that mitigate and manage erosion control that follows local environmental policies.

RESOURCES POLICIES (RP):

RP1. Air Quality

Intent: To control activities to insure good air quality.

Policy: All activities and uses shall comply with all local air pollution regulations and all appropriate Federal air quality standards in order to ensure the maintenance of Guam's relatively high air quality.

Discussion:

The project will not release significant air pollution as a result of the construction of the NDWWTP.

RP2. Water Quality

Intent: To control activities that may degrade Guam's drinking, recreational, and ecologically sensitive waters.

Policy: Safe drinking water shall be assured and aquatic recreation sites shall be protected through the regulation of uses and discharges that pose a pollution threat to Guam's waters, particularly in estuaries, reef and aquifer areas.

Discussion:

The construction and operations of the NDWWTP for the project will not affect Guam's drinking, recreational, and ecologically sensitive waters.

The project is located on an existing facility with the upgrade to the facility located across the existing facility. It is not expected to impact the drinking, recreational and ecologically sensitive waters.

The expansion of the NDWWTP is located well away from the boundaries of the marine preserve areas (MPA) and other recreational and ecologically sensitive waters. If required, appropriate erosion control BMPs will be incorporated into the project design to ensure that there will not be any discharge to critical aquatic resources.

RP3. Fragile Areas

Intent: To protect significant cultural areas, and natural marine and terrestrial wildlife and plant habitats.

Policy: Development in the following types of fragile areas including Guam's Marine Protected Areas (MPA) shall be regulated to protect their unique character.

- historical and archeological sites
- wildlife habitats
- pristine marine and terrestrial communities
- limestone forests
- ravine forests
- mangrove stands and other wetlands
- coral reefs

Discussion:

The project does not interfere with any of the fragile areas.

The Archaeological Inventory Survey for Northern District Wastewater Treatment Plant Secondary Treatment Upgrade was completed in April 2018. Although two isolated artifacts were recorded during the pedestrian transect survey, subsurface testing produced no evidence of pre-contact or historic period deposition. The conclusion of the study is that the proposed project is unlikely to affect historic properties. No further archaeological work is recommended. The complete study is attached. *See Appendix B*

A Biological Assessment (BA) was also prepared. The results of the study indicated that no federally listed flora or fauna species were observed at the project site. The species observed were non-native and commonly found on Guam. The study also indicated that for the proposed action, there was "no affect" for significant wildlife habitat.

"No affect" determination for the proposed actions is recommended for listed fauna species: avifaunal species, terrestrial herpetological fauna, mammalian fauna, invertebrate fauna and for listed flora species. The complete study is attached. *See Appendix C.*

The report also determined that the three marine turtle species that are federally listed and occur in Guam's waters will not be directly or indirectly affected by the installation of the outfall diffuser.

Although the project is located outside the MPAs, appropriate erosion control BMPs will be incorporated during the project construction phase to ensure that coral reefs are not impacted from siltation during construction.

The upgrade to NDWWTP treatment process will improve the quality of effluent leaving the facility and will result in improved water quality.

RP4. Living Marine Resources

Intent: To protect marine resources in Guam's waters.

Policy: All living resources within the waters of Guam, particularly fish, shall be protected from over harvesting and, in the case of corals, sea turtles and marine mammals, from any taking whatsoever.

Discussion:

This project does not involve the harvesting or taking of any aquatic species. Although the project is located well away from the boundaries of the marine preserve areas (MPA), if excavation is required, appropriate erosion control BMPs will be incorporated into the project design to ensure that there will not be any discharge to Guam's marine environment. The expansion of the NDWWTP treatment process will improve the quality of effluent leaving the facility. Although not part of this project, the ocean outfall diffuser will result in improved ambient water quality. The marine turtle species and other marine resources will not be directly or indirectly affected by the NDWWTP or the outfall diffuser.

RP5. Visual Quality

Intent: To protect the quality of Guam's natural scenic beauty

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

Discussion:

This project will not interfere with scenic overlooks, highways, or trails. The project location is along Tanguisson Road in Dededo, Guam. The existing treatment plant is not in full view of the public. The expansion will neither be visible to the public nor affect the visual quality of Guam's scenic beauty. Upon completion of construction, the remaining open space will be landscaped similar to what is found in the existing NDWWTP.

RP6. Recreation Areas

Intent: To encourage environmentally compatible recreational development.

Policy: The Government of Guam shall encourage development of varied types of recreational facilities located and maintained so as to be compatible with the surrounding environment and land uses, adequately serve community centers and urban areas and protect beaches and such passive recreational areas as wildlife, marine conservation and marine protected areas, scenic overlooks, parks, and historical sites.

Developments, activities and uses shall comply with the Guam Recreational Water Use Management Plan (RWUMP).

Discussion:

This project will not develop any new recreational facilities. The existing and proposed upgrade to the NDWWTP facilities are not located on and do not interfere with Guam's recreational facilities.

RP7. Public Access

Intent: To ensure the right of public access.

Policy: The public's right of unrestricted access shall be ensured to all non-federally owned beach areas and all Guam recreation areas, parks, scenic overlooks, designated conservation areas and their public lands. Agreements shall be encouraged with the owners of private and federal property for the provision of releasable access to and use of resources of public nature located on such land.

Discussion:

Public access to the island's waste water infrastructure is prohibited. Public access poses safety and security risks that may hinder the system's operation.

The project is not located on a beach area or Territorial recreational area, park, scenic overlook, designated conservation area, or other public land. The projects will not hinder access to recreational areas, parks or public lands. During construction, appropriate highway encroachment procedures will be adhered to based on the approved DPW Highway Encroachment permit. Construction work will not impede the right of public access to adjacent public facilities.

RP8. Agricultural Lands

Intent: To stop urban types of development on agricultural land.

Policy: Critical agricultural land shall be preserved and maintained for agricultural use.

Discussion:

This project is not located on and will not affect agricultural lands.



Appendix A: Proposed Layout of the Northern District Wastewater Treatment Plant Upgrade

DRAFT

Phase I Archaeological Inventory Survey for the Northern District Wastewater Treatment Plant Secondary Treatment Upgrade, Dededo Municipality, Guam

Prepared For:

HIES, Inc.
70 Kihapai Street
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Prepared By:

Cacilie E. Craft, MA, RPA

Garcia and Associates
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GANDA Report No. 2391-2



5 April 2018

ABSTRACT

At the request of Hawai'i International Environmental Services, Inc., Garcia and Associates conducted a Phase I archaeological inventory survey for the Guam Waterworks Authority's Northern District Wastewater Treatment Plant Secondary Treatment Upgrade Project (RC2017-0191). This undertaking aims to upgrade and/or expand the existing wastewater treatment plant located on Tanguisson Road in Dededo, Guam. The objective of archaeological investigations was to identify, record, evaluate, and provide recommendations for any significant historic properties that may have been present in the undertaking's area of potential effects (which totals 12.45 hectares). The results of this study are intended to aid the U.S. Environmental Protection Agency in determining the effect this undertaking will have on historic properties, per Section 106 of the National Historic Preservation Act.

No National Register-eligible historic properties were encountered during archaeological investigations. Two isolated artifacts were recorded: an undiagnostic pre-Contact pottery sherd (ISO-1) and a 20th century glass bottle (ISO-2). Subsurface testing produced no pre-Contact or Historic Period deposition.

Based on the results of archival research and archaeological fieldwork, the APE has a low potential to contain archaeological deposits or historic resources. The proposed undertaking is unlikely to affect historic properties.

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1.0 INTRODUCTION

At the request of Hawai'i International Environmental Services, Inc. (HIES), Garcia and Associates (GANDA) conducted a Phase I archaeological inventory survey for the Northern District Wastewater Treatment Plant Secondary Treatment Upgrade in Dededo, Guam (RC2017-0191). The objective of the survey was to identify and record any significant historic properties that may have been present in the project's area of potential effects (APE). The results of the survey are intended to aid the U.S. Environmental Protection Agency in determining the effect this undertaking will have on historic properties, per Section 106 of the National Historic Preservation Act.

1.1 Description of the Undertaking

The objective of the undertaking is to upgrade and/or expand the existing Northern District Wastewater Treatment Plant (NDWTP) located on Tanguisson Road in Dededo, Guam (Figure 1). Improvements to the facility will include the construction of oxidation ditches, secondary clarifiers, an ultraviolet light disinfection unit and an anaerobic/aerobic digester. Modifications to the existing facility will also include new headworks, pump stations, sludge handling/pumping equipment, and an outfall connection.

1.2 Area of Potential Effect

The APE for the undertaking consists of two noncontiguous areas: Option 1 and Option 2 (Figure 2). Option 1 is an undeveloped parcel roughly 100 meters north of the existing NDWTP and is intended for possible expansion of the facility. This parcel is 6.33 hectares (15.65 acres). Option 2 consists of the existing NDWTP and associated utility easement, totaling 6.11 hectares (15.12 acres).

2.0 BACKGROUND

Environmental, historical, and archaeological background information is presented below with the aim of contextualizing the study area and the results of archaeological investigations.

2.1 Environmental Context

The project area lies on the west coast interior of the northern geological unit of Guam, a raised Pleistocene reef uplifted through tectonic and volcanic activity. This limestone plateau is largely void of fresh water sources, which are mostly concentrated along the shoreline in caves and sinks (Taboroši et al. 2005). In contrast, the southern half of the island is primarily comprised of volcanic hills with ravines and protected embayments (Tracey et al. 1964; Young 1988).

Guam's northern geological landscape consists predominantly of relatively shallow soils (ca. 20 to 40 centimeters thick) that formed on the porous coralline limestone. Young (1988:33) classifies the specific soil in the project area as Guam Cobbly Clay Loam, 3 to 7

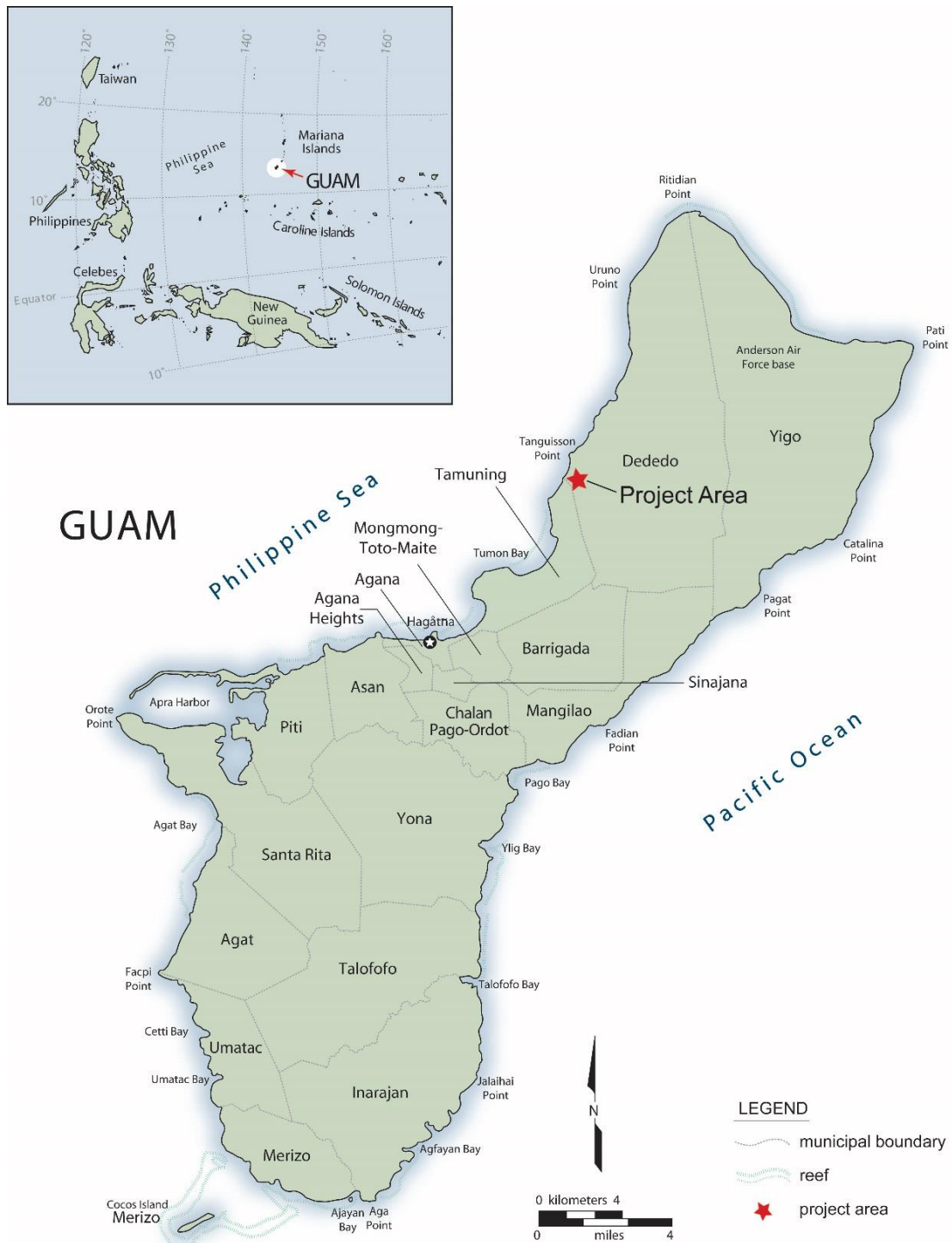
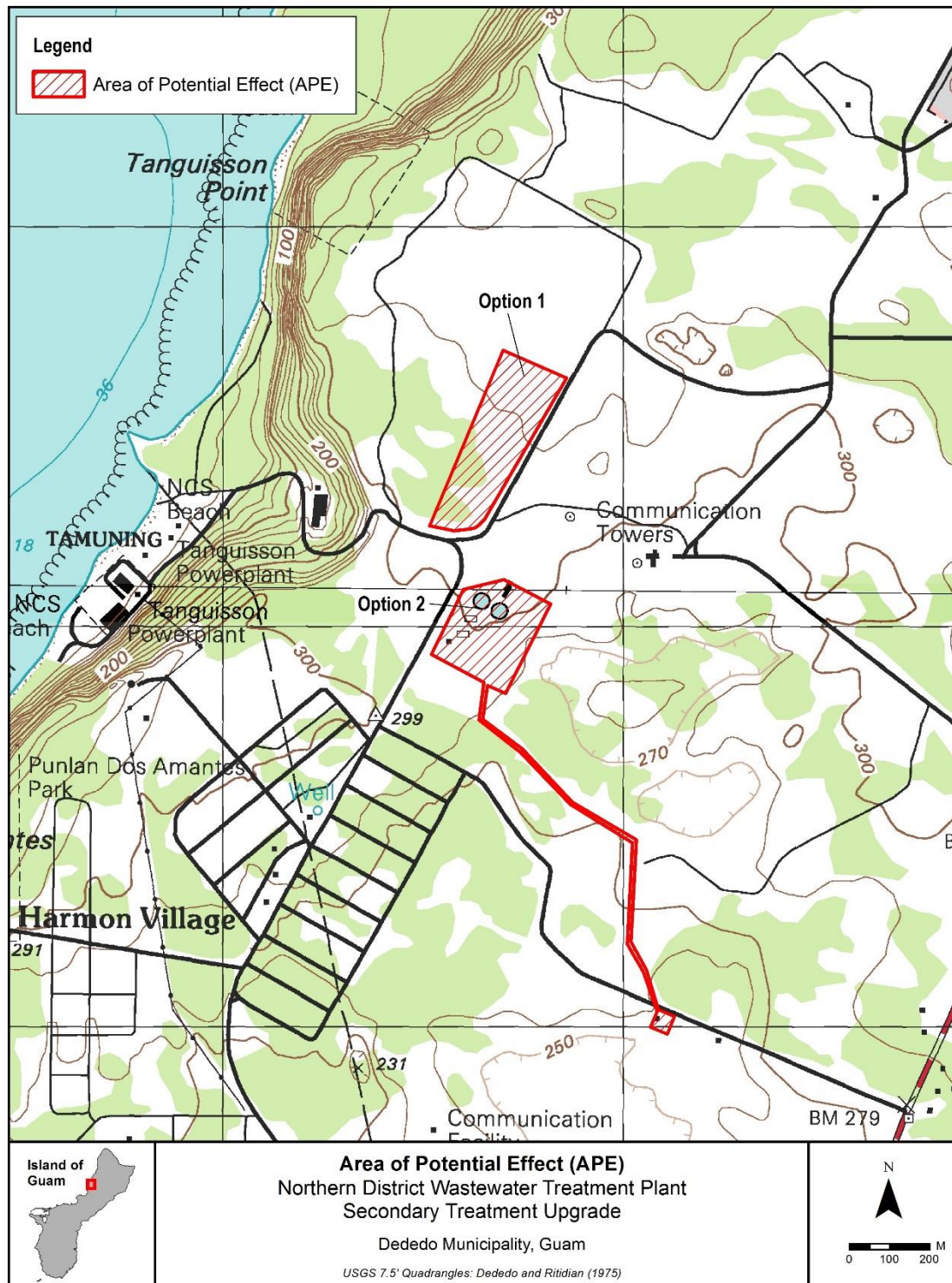


Figure 1. APE within the Western Pacific and the island of Guam.



percent slopes (Figure 3). This soil is gravelly and very shallow (limestone is typically reached within 20 centimeters), and very well drained with neutral to mild alkaline qualities. Some areas feature a thin layer of soft, fractured limestone below the subsoil (Young 1988:33).

A native limestone forest would have originally covered the APE, which is now largely comprised of introduced or disturbed secondary growth vegetation. The southeastern portion of Option 1 features *tangantangan*, scrub, and grass thickets, evidence of the extensive land clearing conducted by the U.S. military in the late-1940s and early-1950s. Vegetation in the remaining Option 1 area also features pioneer species found in disturbed scrub forests. Very dense thickets of *pågo* (*Hibiscus tiliaceus*), sword fern (*Nephrolepis hirsutula*), *lemonchina* (*Triphasia trifolia*), custard apple (*Annona reticulata*), and false rattan (*Flagellaria Indica*) hint at prior disturbance and degradation of the native forest community.

The Option 2 area, in contrast, is a developed parcel with little vegetation. Vegetation that does exist to the east of the treatment plant and on either side of the southern utility easement is dominated by *tangantangan*, scrub, and grass thickets.

2.2 Cultural History

Guam's cultural history is broadly divided into the pre-Contact and Historic eras. The pre-Contact era encompasses indigenous settlement of the Marianas during the pre-Latte and Latte Periods. Guam's Historic era is characterized by increasing influence by colonial powers during the Spanish Missionization and Colonial Period, First American Territorial Period, World War II Japanese Military Occupation, Post World War II and Second American Territorial Period, and Organic Act and Economic Development Period (GHRD 2014). These chronological divisions are used to structure the following overview of Guam's cultural history as it relates to the project area.

2.2.1 Pre-Latte Period (1500–800 CE)

The Pre-Latte Period, extending from 1500 BCE to 800 CE, includes the initial settlement of Guam and the Mariana Islands. Archaeological evidence, although sparse when compared to the subsequent Latte Period, indicates that the island's early settlers favored resource-rich coastal environments where they exploited reef flats for fish and shellfish. On the island's northwest coast, leeward embayments and smaller coves were occupied or utilized during this period, including Ague Cove and Pugua Point north of the APE (Hunter-Anderson et al. 2001; Olmo et al. 2000). Tumon Bay, south of the APE, supported extensive coastal habitation during this long period (Graves and Moore 1985). The limestone plateau abutting these coastal environments, including the APE, presumably did not support Pre-Latte habitation, although nearby populations may have exploited its native forest communities for food and other resources.

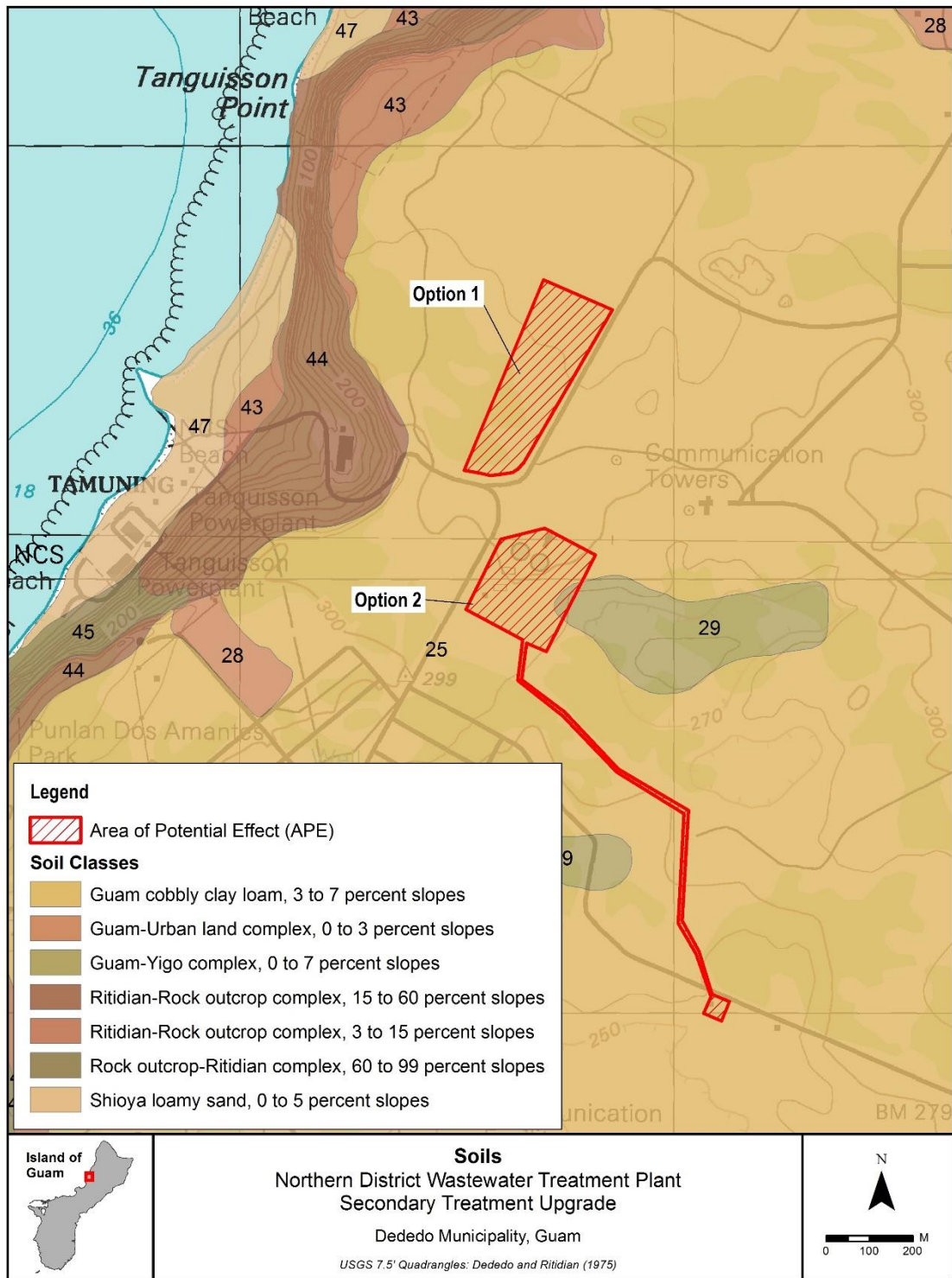


Figure 3. Soils in APE.

2.2.2 Latte Period (800–1521 CE)

The Latte Period (800–1521 CE) is differentiated from the Pre-Latte largely by the appearance of stone foundation structures called latte. Relatively few Latte Period habitation sites are documented in the northern interior of the island (Reinman 1977). And yet an increase in population densities during this period led to increased demands for “firewood, construction materials, forest fruits, and agriculturally produced foods,” which led to greater use of inland environments in the Marianas (Dixon et al. 2011:393). Latte Period pottery scatters, ubiquitously documented in lieu of long-term habitation sites in Guam’s northern interior, may represent inland field camps where coastal populations managed and collected from native forest communities and farmed arable soil (Dixon et al. 2011; Dixon et al. 2012; Moore 2005). Inland forest clearing and associated occupation (often brief or intermittent) of the northern interior is also represented archaeologically by dark middle soil, lithic and artifact scatters, rock walls and platforms, and stone mounds often situated directly above large coastal embayments (Dixon et al. 2011; Dixon et al. 2012; Liston 1996).

The current study area’s proximity to extensive coastal habitation sites, consisting of latte complexes, human burials, artifact scatters, and utilized caves and rockshelters, at Tumon, Hila’an, and Haputo, indicates that this portion of the limestone plateau may also have been occupied or utilized at least intermittently by nearby populations. Indeed, Latte Period pottery scatters are documented in the immediate vicinity of the APE (Welch 2010; Yee and Guerrero 2012).

2.2.3 Pre-Colonial European Trade Period (1521–1668 CE)

Magellan’s arrival in Guam in 1521 introduced the Marianas to the European world. Soon thereafter, foreign seafarers — Spanish galleons, whalers, and scientific expeditions — anchored in Guam and bartered for fresh provisions in exchange for foreign materials, iron being the local favorite. This early period of cross-cultural exchange between the indigenous population and European seafarers opened the chapter to a long history of post-Contact colonialism in the Marianas.

2.2.4 Spanish Colonial Period (1668–1898)

Indigenous settlement patterns had largely continued during the early phases of European encounters, but in 1668 a Jesuit mission, led by Pale Diego Luis de San Vitores, arrived in the Marianas on a mission to convert the local population to Christianity. The ensuing Spanish missionization and colonization of the Marianas disrupted traditional settlement patterns and transformed local villages into Spanish mission parishes. The Spanish cartographer, Alonso Lopez, recorded this transformation in an early map depicting Spanish villages and churches across the island (Figure 4). The main village of *Agadña* (later Agaña, now Hagåtña) and its church are shown, along with several subsidiary and mostly coastal villages. The project region on the northwest coast is shown only with a trail bracketed by church settlements along the coastline.



Figure 4. Seventeenth-century Spanish map of Guam, designating village names and locations (Le Gobien 1700).

The indigenous population had dwindled by the 1690s, after roughly two centuries of introduced disease and almost 30 years of confrontation with the Spanish missionaries and colonizers. The Spanish government ultimately relocated the archipelago's dwindling population into seven mission villages, none of which were located in the project vicinity (Rogers 1995). The dissolution of indigenous settlement practices thereby ended with the intensification of Spanish colonialism and missionization in the late seventeenth century.

By 1886, most of the island's population was concentrated in the Spanish capital at Hagåtña, which supported 5,979 people by that time (Garcia 2006:59). Spanish municipalities were largely confined to the coasts, particularly along the coastal route (*el Camino Real*) from the port of Umatac north to Hagåtña. Nonetheless, Chamorros maintained *lānchos* (ranches) in the island interior. The Spanish government encouraged cattle ranching in the northern interior by offering land grants to Chamorro-Spanish families to establish small ranches on the limestone plateau. Garcia's (2006:61) 1887 map indicates the bull-cart trails used to traverse the island interior, including the project region, during this period (Figure 5).

2.2.5 First American Period (1898–1941)

The United States acquired Guam, along with Puerto Rico and the Philippines, as a result of its expansionistic maneuvering with Spain at the turn of the nineteenth century, and ultimately, the signing of the Treaty of Paris in 1898. Guam was of little immediate interest to the United States until the turn of the twentieth century when a U.S. Naval government was installed on the island. The new naval administration was headquartered in Agaña and governed by a long line of short-term naval officers until the Japanese occupation in 1941.

Spanish-Chamorro traditions largely continued through this period. The bulk of the population maintained residences in Hagåtña or other major coastal villages and farmed, ranched, and hunted in the island interior. Maps from this period note the traditional place name of *Ukudu* in the project vicinity and show road and trail networks traversing the area, but no farms or ranches are recorded in the APE vicinity.

2.2.6 World War II and Japanese Occupation Period (1941–1944)

The United States neglected to invest in fortifications on Guam in the decades leading up to World War II, enabling Japan to easily invade and take possession of the island in 1941. Guam's Insular Force Guard and a few Americans attempted to defend the island at the Plaza de España in Hagåtña, but the invading troops quickly overran the local troops. Governor McMillin surrendered the island less than six hours after the Japanese had landed (Rogers 1995:156).

Japanese forces, numbering almost 6,000, overtook the capital and other major villages, occupying public buildings and many residences (Rogers 1995:158). Many Chamorros fled their main residences to *lānchos* in the island interior to avoid the Japanese.

Following the battle for Mount Santa Rosa and grueling reconnaissance of the island's northern plateau, General Geiger announced the end of organized resistance on Guam on August 10, 1944. The remaining Japanese forces, numbering more than 9,000, were dispersed and unorganized within the jungles of Guam, mostly in the northern interior. Reconnaissance operations necessitated considerable search efforts by U.S. forces. Small battles and confrontations occurred in the jungles, abandoned farms, and dilapidated roads of the interior long after the island was declared secure.

2.2.7 Second American Territorial Period (1944–1950)

After the American invasion, the U.S. military embarked on a rapid and extensive construction program to position Guam as a major forward operating base in the Western Pacific. Large plots of land were acquired and bulldozed to accommodate new airfields, depots, headquarters, and related facilities designed to support the final war effort against Japan. Specialized airfields were constructed at North Field and Northwest Field (Andersen Air Force Base) to support the long-range, high-altitude B-29 Superfortress, and Orote Peninsula and Apra Harbor were transformed into a major U.S. naval supply base.

The lands east of Dos Amantes and Tanguisson were acquired by the U.S. military for development of the Andersen Air Force Base Harmon Annex. U.S. Navy aerial photographs from the period show extensive bulldozing near the APE for the development of various support and cantonment facilities for Army Engineer Aviation Battalions (Figure 6). Finegayan, northeast of the APE, was developed by the Navy for a radio transmitting station. Land clearing associated with construction of a radio tower appears to have directly encroached on the APE during this time (Figure 7).

2.2.8 Organic Act and Economic Development Period (1950–Present)

Although bracketed by Finegayan radio facilities to the northeast and Harmon Village barracks to the south, no extensive development appears to have occurred in the direct APE until the late-1970s. A sole structure (possibly a post-war *lâncho*) is indicated within the Option 1 area of the APE on the Army Corps of Engineers 1954 map of the island (Figure 8).

The Northern District Wastewater Treatment Plant was constructed in 1975 in the southern portion of the APE and now comprises the entirety of the Option 2 area (Figure 2). Option 1 area appears to have remained undeveloped up to now.



Figure 6. U.S. Navy 1956 aerial photograph. Note land clearance in APE vicinity.

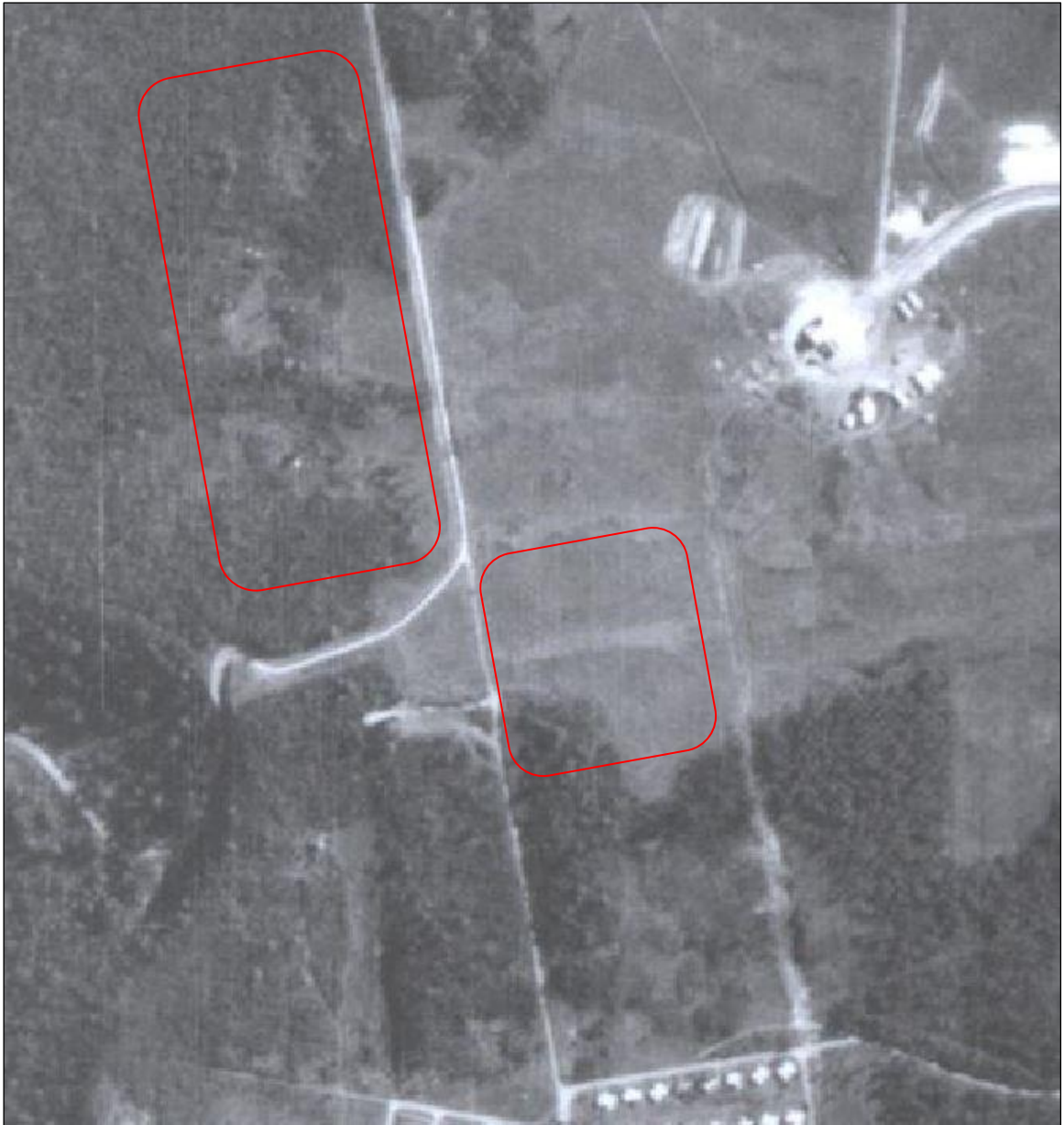


Figure 7. Previous figure zoomed in for detail of approximate APE (red outline).

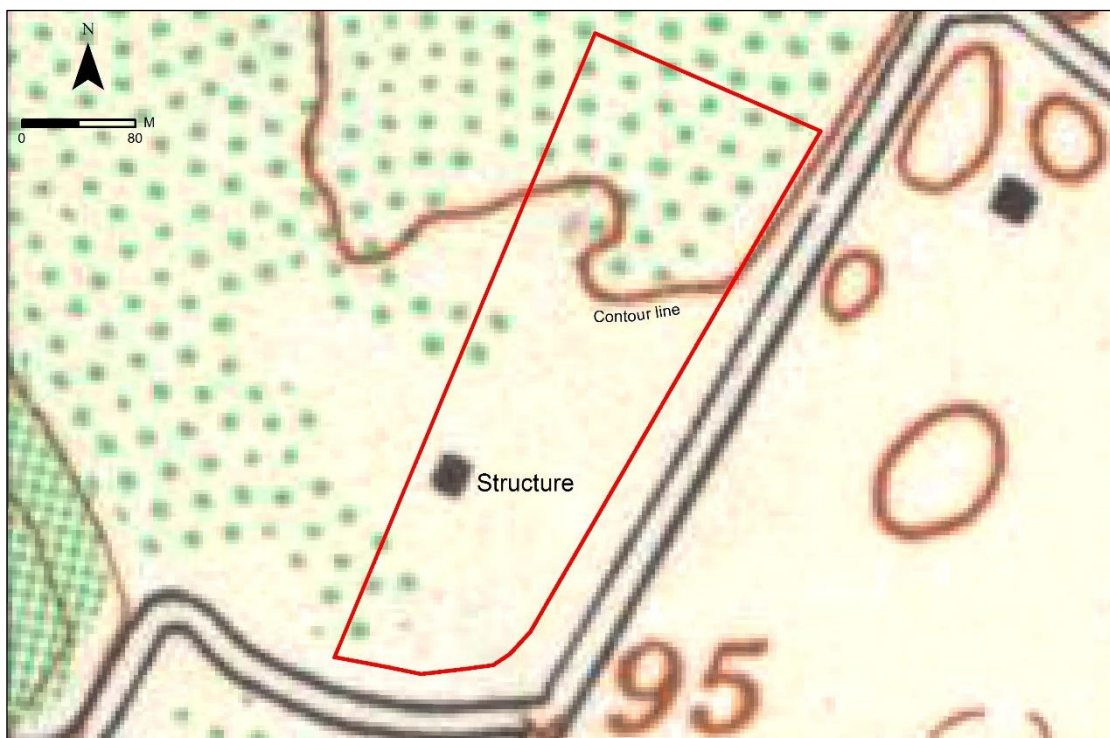


Figure 8. 1954 ACOE map of Guam (zoomed in for detail of APE Option 1).

2.3 Archaeological Context

Three archaeological studies have been conducted within a 0.5-mile/0.8-kilometer radius of the APE: Craft and Vernon (2012), Yee and Guerrero (2010), and Welch (2010) (Figure 9).

Garcia and Associates surveyed 6.3 hectares (15.56 acres) south of the APE for the Marianas Stone Company (Craft and Vernon 2012) (Figure 9). Extensive land clearing and bulldozer berms associated with the U.S. military's development of the Harmon Annex were noted. Additionally, three post-World War II U.S. military concrete foundation slabs (GHPI Sites 66-04-2547 and -2548) were recorded but were recommended as ineligible for National Register-listing. Shovel testing conducted during the survey exposed a thin layer (ca. 20-centimeter-thick) of light red to dark reddish brown cobbly clay loam overlying degrading limestone bedrock.

SWCA Environmental Consultants conducted survey and monitoring in association with construction of the 22.74-hectare (56.2-acre) Ukudu Workforce Village located to the south of the study parcels (Yee and Guerrero 2012) (Figure 9). Two pre-Contact sites were documented: GHPI Sites 66-04-2490 and 66-04-2491, which consisted of Latte Period sherd scatters and one fragment of a *lusong*. Several isolated pottery sherds and evidence of previous land clearing were also noted throughout the area. No National Register-eligible properties were recorded within the study area.



Figure 9. Previous archaeological investigations conducted in APE vicinity. Note that no previously recorded GHPI sites are within a quarter mile radius of the APE.

International Archaeological Research Institute, Inc. surveyed eight noncontiguous military-owned areas on Guam in support of a U.S. Navy Environmental Impact Statement (Welch 2010). One of the areas surveyed comprised a “GLUP 77” parcel, a 120-hectare (292-acre) parcel situated directly north of the current APE (Figure 9). Eight sites were documented, including Latte Period artifact scatters, a Spanish Period artifact scatter, Japanese World War II concrete foundations and defensive berms, and Post-World War II U.S. military concrete foundations and artifact scatters. Only two of these sites were recorded in the general vicinity of the current APE: Site 1059, which consisted of displaced Japanese World War II structural remains, and Site 1060, which consisted of Post-World War II U.S. military concrete foundations, structural remains, and bulldozed berms.

3.0 METHODOLOGY

Archaeological investigations for the APE included three primary work tasks:

- Preparation of research objectives based on historical research, previous archaeological investigations, and the environmental context of the project area.
- Survey of the APE and identification of historic properties.
- Evaluation of historic properties, preparation of archaeological recommendations for the APE, and production of a technical report.

Research objectives, methods, and protocols adhered to during archaeological investigations are detailed in the following sections.

3.1 Research Objectives and Archaeological Expectations

Archival research indicates that the U.S. military engaged in extensive land clearing in the APE’s immediate vicinity in the post-war period. Research objectives for the current study aimed to determine the extent to which these activities may have encroached into the current study area and its potential impacts to archaeological or cultural resources. These research goals focused primarily on the Option 1 portion of the APE since Option 2 was cleared and developed in the 1970s.

The eastern portion of Option 1 was assumed to have been disturbed to some extent by post-war activity, but the western portion was expected to still be intact. If this proved to be true, the study area’s proximity to the edge of the plateau, as well as the pre-Contact coastal habitation centers below, suggested that brief or intermittent use sites, represented by pottery and artifact scatters, may have been present. Such features would be expected to yield important information regarding pre-Contact utilization or occupation of the upland limestone plateau and information about how these sites compare or contrast with nearby coastal sites. The field survey also paid particular attention to the possibility of encountering dryland agricultural features, as encountered in other upland areas in the Marianas (Dixon et al. 2011; Dixon et al. 2012; Moore 2005).

Structural remains or boundary markers associated with farming and ranching in the Option 1 area of the APE were anticipated based on a structure (possible *lâncho*) visible on a 1954 map of the area. Evidence of World War II activities were not expected in the APE, although isolated artifacts and UXO may be encountered anywhere in Guam. Lastly, post-war U.S. military construction appears not to have occurred in the APE, although land clearing did encroach into the study area, as discussed above. As such, isolated artifacts from this period were anticipated, but structural remains were not.

3.2 Archaeological Field Methods

Archaeological fieldwork included a pedestrian transect survey and subsurface testing to determine the presence and nature of historic properties in the APE. The surface survey included transects spaced at approximately 10 meters (depending on vegetation and terrain) to inspect the ground surface for the presence of cultural resources in the form of artifacts and surface structures. Any cultural resources encountered during the survey were described, mapped, photographed, and recorded with a Trimble Global Positioning System (GPS) device with sub-meter accuracy (field data will be post-processed following fieldwork).

Fifteen 50- by 50-centimeter shovel tests were also placed across the APE to determine the presence of subsurface cultural deposition and to document a representative sample of project area soils. Shovel tests were manually excavated (i.e., by shovel and trowel) and terminated 30 centimeters into culturally sterile soil or at limestone bedrock. Excavated material was sieved through a ¼-inch mesh screen when possible. Stratigraphic profiles were recorded for each shovel test with soil and sediment descriptions prepared following U.S. Soil Conservation Service standards and the Munsell color notation system. Each shovel test was digitally photographed and recorded with a Trimble GPS following excavation.

3.2.1 Site Documentation

Documentation and analysis of archaeological sites and materials aimed to collect metric and descriptive data relevant to determining the age, nature, cultural affiliation, integrity, and depositional history of any sites encountered in accordance with the Secretary of the Interior's *Standards and Guidelines for Archaeological Documentation*. Any encountered sites were also assessed for National Register significance and eligibility. The location of all identified cultural resources were recorded with a sub-meter accurate GPS device. Photographs were taken of all cultural properties, including artifacts, and the surrounding terrain.

4.0 RESULTS

Two isolated artifacts were recorded during the pedestrian transect survey. Subsurface testing produced no pre-Contact or Historic Period deposition.

4.1 Surface Survey

The surface survey covered approximately 100 percent of the Option 1 portion of the APE, while only undeveloped portions of Option 2 were surveyed. Survey results are described separately for each option area below and in Figure 10 and Figure 11.

4.1.1 Option 1

The extensive land clearing conducted by the U.S. military in the late-1940s and early-1950s left noticeable traces on the eastern portion of Option 1. These traces include secondary growth vegetation (e.g., *tangantangan*, scrub, and grass thickets), small push piles, and scattered metal refuse (e.g., metal wire, miscellaneous fragments of metal). While perhaps not as ubiquitous, the western portion of Option 1 also features evidence of prior disturbance and degradation to the native forest community (see Section 2.1).

Two isolated artifacts were encountered on the ground surface (Figure 10): a weathered and undiagnostic pottery sherd (ISO-1) and a small glass bottle (ISO-2) (Table 1; Figure 12 and Figure 13). The base of the glass bottle is engraved “Fitch’s” (Figure 14). Fitch’s was a cosmetics company from Iowa that produced a hair tonic popular in the 1930s and 1940s (Longden n.d.).

No explicit evidence of the structure visible on the 1954 Army Corps of Engineers map (Figure 8) was encountered (e.g., surface structures, subsurface cultural deposits). However, a large mango tree was encountered about 40 meters south of the historical structure. An incredibly dense thicket of *lemonchina* was also encountered in the general area. While not conclusive evidence of the existence of a historic *lâncho*, a large fruit tree present in this scrub forest does appear to be rare and may have been intentionally planted.

4.1.2 Option 2

No sites or features were recorded in Option 2. This area exhibits widespread evidence of post-World War II and recent disturbance, including large pushpiles, modern rubbish heaps, and secondary growth vegetation (e.g., *tangantangan* thickets and scrub and grass fields). A large (30 by 40 meter) limestone depression on the east side of the southern terminus of Option 2 (Figure 11) is being used as a dumping ground. The area is filled with large amounts of modern rubbish (e.g., household appliances, tires, beverage cans and bottles).

Table 1. Isolated Artifacts Recorded during the Survey

ISO. No.	Time Period	Description
ISO-1	Pre-Contact	Pottery sherd (n=1)
ISO-2	20th century	Glass bottle (Fitch’s hair tonic)

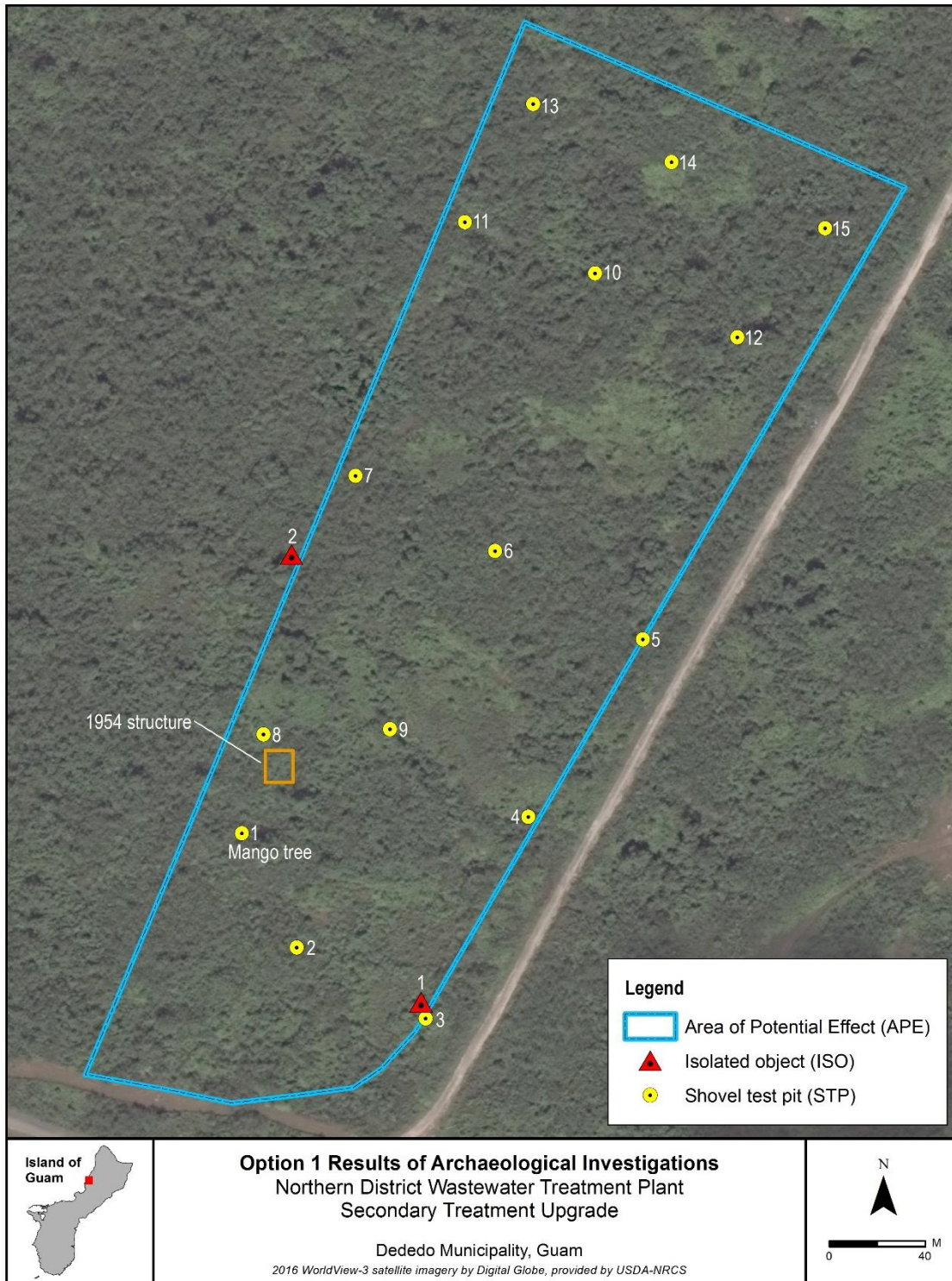


Figure 10. Archaeological results for Option 1 of APE (also showing relative location of 1954 structure).

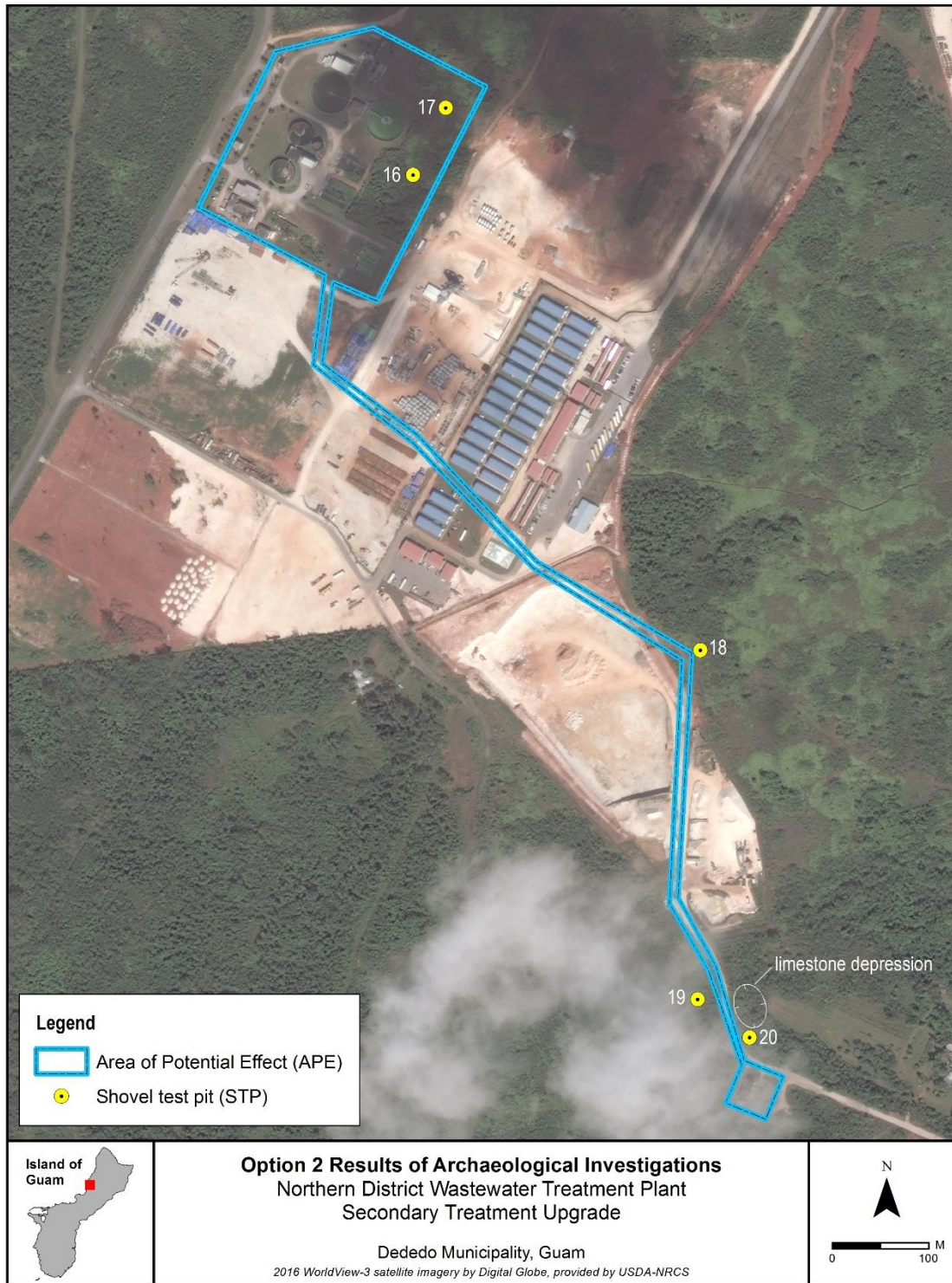


Figure 11. Archaeological results for Option 2 of APE.

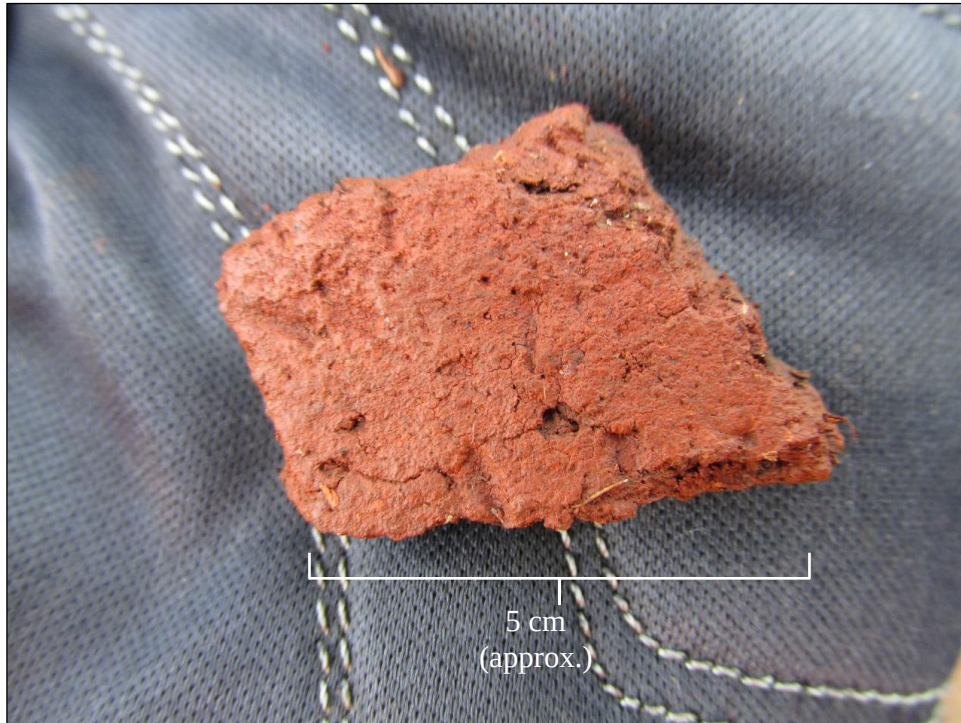


Figure 12. ISO-1, pre-Contact pottery sherd.



Figure 13. ISO-2, Fitch's glass bottle.



Figure 14. ISO-2, Fitch's maker's mark.

4.2 Subsurface Testing

Twenty STPs excavated throughout Option 1 and in undeveloped portions of Option 2 produced no evidence of subsurface cultural deposition (Figure 10 and Figure 11). All STPs exposed shallow clay soils ranging from 7 to 25 centimeters deep over weathered limestone bedrock (Table 2; see also Appendix A).

5.0 DISCUSSION AND CONCLUSION

Research objectives for the study were successful in determining the relative extent to which prior land clearing has encroached into the APE. The Option 2 area has clearly witnessed extensive disturbance from post-World War II activities as well as development related to the Northern District Wastewater Treatment Plant and its associated underground utilities. The Option 1 area, however, appears largely undeveloped, but small pushpiles and degradation of the original limestone forest community hint at prior disturbance in the area. The absence of pre-Contact cultural deposition (except for an isolated pottery sherd) may be a result of prior disturbance. It may also simply indicate the limited use of this area during the pre-Contact Period.

Evidence of post-World War II ranching or farming was anticipated in the way of boundary markers or the structural remains of a *låncho*, neither of which were encountered.

A large mango tree in the general area of a 1954 structure may be all that remains from that occupational period.

5.1 Conclusion

Based on the results of archival research and the archaeological fieldwork presented above, the APE has demonstrated a low potential for containing archaeological deposits or historic resources, and the proposed undertaking is therefore unlikely to affect historic properties. Although two isolated surface artifacts were documented, archaeological investigations produced no evidence of surface or subsurface historic properties within the APE. Moreover, land use history in the surrounding area has resulted in extensive disturbance that encroached into Option 1 and is certainly present within Option 2. If cultural resources were present in the APE, they were likely removed during prior land clearing events.

5.2 Recommendations

No further archaeological work is recommended for the undertaking. However, if archaeological deposits or historic resource are inadvertently exposed during the undertaking, the Guam Historic Resources Division should immediately be notified, and further archaeological work may be required.

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APPENDIX A: SHOVEL TEST PROFILES

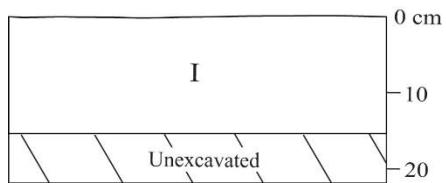


Figure 15. Profile 1.

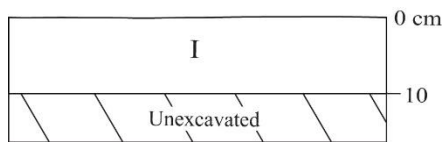


Figure 16. Profile 2.



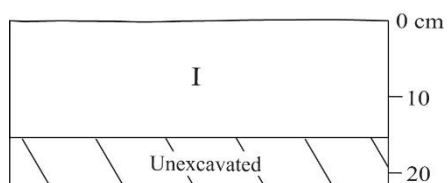


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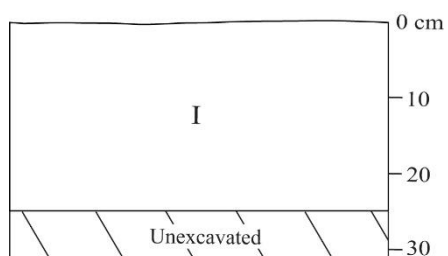


Figure 18. Profile 4.



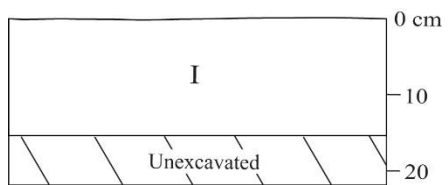


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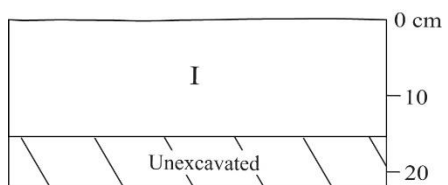


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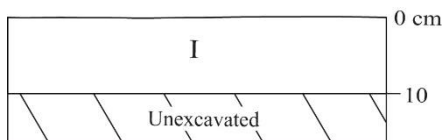


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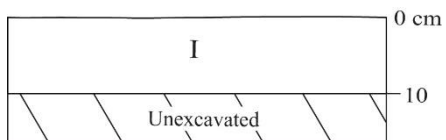


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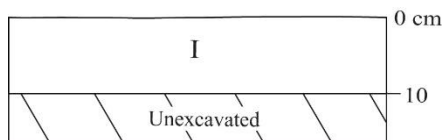


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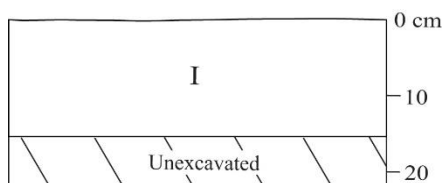


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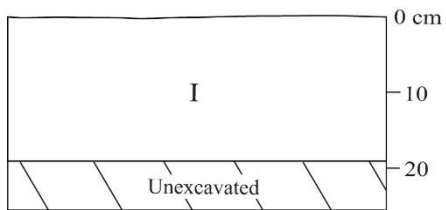


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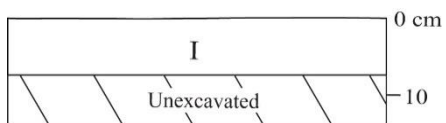


Figure 26. Profile 12.



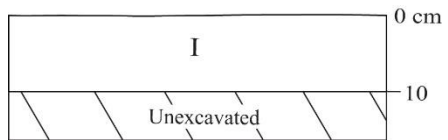


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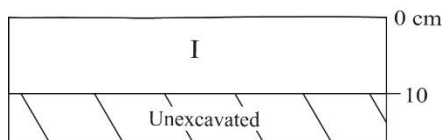


Figure 28. Profile 14.



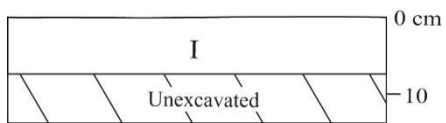


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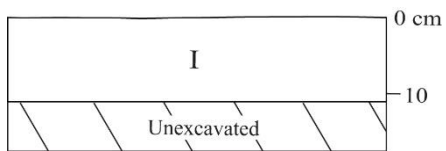


Figure 30. Profile 16.



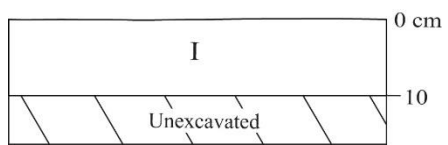


Figure 31. Profile 17.

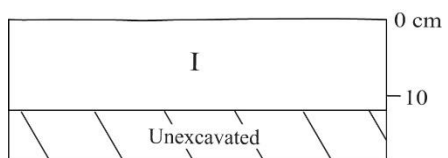


Figure 32. Profile 18.



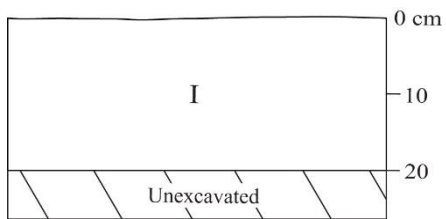


Figure 33. Profile 19.

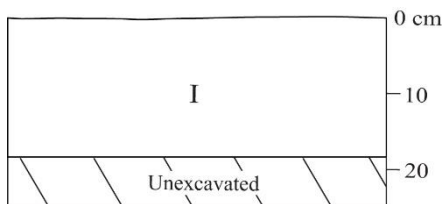


Figure 34. Profile 20.



Table 2. Stratigraphic Descriptions for Shovel Test Pits

<i>STP</i>	<i>Depth (cmbs)</i>	<i>Description</i>
1	0–15	Dark reddish brown (2.5YR 3/4) cobbly clay over limestone bedrock; medium roots common.
2	0–10	Dark reddish brown (2.5YR 2.5/4) cobbly clay over limestone bedrock; fine rootlets common.
3	0–15	Dark reddish brown (2.5YR 3/4) cobbly clay over limestone bedrock; few fine rootlets.
4	0–25	Dark reddish brown (2.5YR 3/4) cobbly clay over limestone bedrock; medium roots semi-common.
5	0–15	Very dusky red (2.5YR 2.5/2) cobbly clay over highly weathered and crumbly limestone bedrock; medium roots common.
6	0–15	Dark reddish brown (2.5YR 3/4) cobbly clay over undulating limestone bedrock; medium roots common.
7	0–10	Dark reddish brown (2.5YR 3/4) cobbly clay over undulating limestone bedrock; medium roots common.
8	0–10	Dark reddish brown (2.5YR 3/4) cobbly clay over weathered limestone bedrock; fine rootlets common.
9	0–10	Dark reddish brown (2.5YR 3/4) cobbly clay over limestone bedrock; fine and medium roots common.
10	0–15	Dark reddish brown (2.5YR 2.5/4) cobbly clay over highly weathered and crumbly limestone bedrock; fine and medium roots very common.
11	0–19	Dark reddish brown (2.5YR 2.5/4) cobbly clay over limestone bedrock; medium roots common.
12	0–7	Dark reddish brown (2.5YR 3/4) cobbly clay over limestone bedrock; fine rootlets semi-common.
13	0–10	Dark reddish brown (2.5YR 3/4) cobbly clay over limestone bedrock; medium roots semi-common.
14	0–10	Dark reddish brown (2.5YR 3/4) cobbly clay over limestone bedrock; medium roots common.
15	0–7	Dark reddish brown (2.5YR 3/4) cobbly clay over limestone bedrock; fine and medium roots common.
16	0–11	Dark brown (7.5YR 3/4) cobbly clay over limestone bedrock; fine rootlets common; contains plastic and metal rubbish.
17	0–10	Dark brown (7.5YR 3/4) cobbly clay over limestone bedrock; fine rootlets common.
18	0–12	Dark reddish brown (5YR 3/4) cobbly clay over limestone bedrock; fine rootlets very common; contains plastic rubbish.

Table 2. (cont.)

<i>STP</i>	<i>Depth (cmbs)</i>	<i>Description</i>
19	0–20	Dark reddish brown (5YR 3/4) cobbly clay over limestone bedrock; fine rootlets semi-common; contains <i>Partulid</i> sp. shell.
20	0–18	Dark brown (7.5YR 3/4) cobbly clay over limestone bedrock; fine rootlets common.

DRAFT
BIOLOGICAL ASSESSMENT

**COMPLIANCE WITH FEDERAL CIVIL CASE NO. 02-00035:
PROPOSED CONSTRUCTION OF
GUAM NORTHERN DISTRICT WASTE WATER TREATMENT
PLANT SECONDARY TREATMENT UPGRADE**

TANGUISSON POINT, GUAM

2018

for

Guam Waterworks Authority

PROVIDED BY:



HAWAI'I INTERNATIONAL ENVIRONMENTAL SERVICES, INC.

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I. INTRODUCTION

This Biological Assessment (BA) was prepared for inclusion into the Environmental Assessment (EA) developed for the proposed Northern District Waste Water Treatment Plant (NDWWTP) secondary treatment upgrade. The proposed action, a secondary treatment plant upgrade, is required by the Stipulated Order resulting from Civil Case No. 02-00035; U.S. vs. Guam Waterworks Authority (GWA) and Government of Guam. The NDWWTP facility is located near Tanguisson Point on the leeward side of Guam.

The NDWWTP operates under NPDES permit No. GU0020141 and is a Class III Wastewater Treatment Facility. The plant operated under a variance allowing primary treated wastewater discharge into the Philippine Sea via an ocean outfall until 2009, when a continuation was denied. The current permit requires upgrades to the treatment processes; therefore NDWWTP is currently out of compliance. The outfall requires a multi-port diffuser with a mixing zone that will achieve appropriate dilution.

II. PROPOSED ACTION: GUAM NORTHERN DISTRICT WASTEWATER TREATMENT PLANT (NDWWTP) SECONDARY TREATMENT UPGRADE

A. Project Description: Secondary Treatment Upgrade

The proposed action for the existing NDWWTP would include construction of oxidation ditches, secondary clarifiers, UV disinfection, and anaerobic/aerobic digesters at an expansion site outside the existing NDWWTP grounds, and modifications and upgrades to the existing facility. The proposed upgrades can be categorized into the following process stages: liquid treatment and solids treatment. Recommendations have been made by Brown and Caldwell (2017) for improvement to each stage, and the most important upgrades needed to bring the NDWWTP into permit compliance are discussed below. Installation of a multi-port diffuser to be added to the current ocean outfall will extend the terminus of the outfall by approximately 400 feet.

1. Liquid Treatment

It has been proposed that the entire existing headworks building be removed and replaced or extensively refurbished, due to major issues that must be addressed. The current headworks is in overall poor condition, with corrosion in the influent channels, non-compliance with NFPA 820 fire code requirements, manual screen inlet gates that are difficult to operate and dangerous to access, an automatic screen that is no longer in operation, inaccurate flow measurement at the influent flume, and grit/flocculation basins and equipment that need to be refurbished and/or are not in use. Brown and Caldwell (2017) recommend a new headworks facility with better screens and grit removal equipment and improved influent flow measurement and sampling capabilities. The primary clarifiers are in overall good condition and can be refurbished for continued

use. The chlorine disinfection system is currently being bypassed and all chlorination equipment have been removed. The contact tanks can be refurbished for use, but new equipment would need to be put in place.

2. *Solids Treatment*

The existing solids processing facilities were determined to be in acceptable condition and able to be used in some capacity in the upgraded NDWWTP, with some repair or replacement of components possibly required. The sludge holding tank is in overall good condition, though the condition of the submersible sludge mixer is unknown but assumed to be good. There is no redundancy in this system currently. The sludge dewatering building is in good condition with space for expansion to a third centrifuge. The centrifuge feed pumps are in good condition, as are the dewatering centrifuges, but capacity for performance in the upgraded sludge treatment system remains to be evaluated. The tanks for the anaerobic digesters will likely need to be cleaned of significant grit build-up, and the floating covers will need to be replaced. All digester equipment has been removed, and additional associated piping within the tanks will need to be removed if they are to be used in the upgraded facility. The sludge drying beds are in good condition and can continue to be used.

B. Outfall Diffuser

Brown and Caldwell (2017b) indicated that in 2009, GWA replaced the original 30-inch-diameter outfall with a 34-inch-outside-diameter HDPE pipe installed using horizontal directional drilling (HDD) construction methods to minimize underwater construction time and seafloor disturbance. During the replacement of the original ocean outfall, GWA had a new 400-foot multi-port diffuser designed and fabricated (in four sections), but it was never installed. The present ocean outfall terminates as an open-ended pipe at a water depth of approximately 140 feet below MSL. A multi-port diffuser will be added to the ocean outfall extending the terminus of the outfall by approximately 400 feet. The existing ocean outfall is approximately 1,960 feet long and is designed to discharge a peak-hour treated flow of 27 mgd. The multi-port diffuser is comprised of four 100-foot in-line HDPE pipe segments of descending diameters; 34-inch, 28-inch, 22-inch and 20-inches.

The installation of the 400-foot diffuser to the NDWWTP ocean outfall is intended to protect coral and essential fish habitat (EFH) through improved water quality to the area of the Philippine Sea off Tanguisson Point and reduce the risk of contamination of sea water and beaches. The area of concern includes Tanguisson Beach and the area spreading west into the Philippine Sea covering the old and new ocean outfalls.

The NPDES permit for the ocean outfall includes a list of narrative water quality requirements that are based on the Guam Water Quality Standards (GWQS). As specified in section 5102 of the Guam Water Quality Standards (GWQS), the coastal waters off Tanguisson Point are considered 'Category M-2 Good' marine waters. The beneficial uses for this category of waters are the propagation and survival of marine organisms, particularly shellfish and coral reefs. The

NPDES permit for the NDWWTP (issued in April 2013) establishes discharge limits consistent with secondary treatment levels and GWQS, including those for nutrients. A completed installation of the ocean outfall diffuser was assumed as the basis for EPA's NPDES limits. To achieve compliance with new discharge permit requirements, the diffuser will be attached to the ocean outfall and the NDWWTP will be upgraded to secondary treatment levels to meet its discharge limits.

The NPDES permit authorizes mixing zones at the point of discharge. The narrative water quality requirements apply at the edge of the mixing zone, after initial dilution has occurred. The authorized dilution ratio for the ocean outfall mixing zone is 200:1. The authorized dilution ratio was considered in conjunction with the narrative requirements for nutrients to determine the extent of nutrient removal that will be required by the NDWWTP.

C. Project Site Location

The existing NDWWTP facility is located on a plateau sited approximately 300 ft. above sea level near Tanguisson Point (Figure 1). The proposed upgrade areas are two parcels of NDWWTP land immediately outside the currently fenced facility (Figure 3), a pipeline easement corridor between the existing station and the Southern Link Pump Station (SLPS) (Figure 4), and 17.297 acres of what was formerly part of the Andersen Communication Annex No. 1, located north of the existing plant site (Figures 5a and 5b). The ocean outfall to receive the diffuser is located off shore terminating at -140 ft MLLW (Figures 1 and 2).

III. EXISTING TERRESTRIAL WILDLIFE RESOURCES AND ANTICIPATED IMPACTS

This section describes the existing habitat and wildlife species identified from the existing, fenced NDWWTP land, the undeveloped NDWWTP land outside the fence, the pipeline easement corridor leading to and including the SLPS, and the proposed area for the NDWWTP upgrades, north of the existing plant. The Area of Particular Effect (APE) for the NDWWTP upgrade encompasses the current NDWWTP property (Photo plate 1), 17.297 acres of undeveloped land to the north (Photo Plates 2, 3), the pipeline easement corridor and SLPS (Photo Plate 4). After project completion the undeveloped property would be similar to the current NDWWTP grounds, with mowed grassy areas and landscaping among the new plant facilities.

Results from this discussion will be used to assess potential project related impacts to existing wildlife habitat and resources.

A. Wildlife Habitat Resources

Terrestrial Resources

Soil maps of the NDWWTP and surrounding area show that the majority is classified as Guam Cobbly Clay Loam. Progressing west towards the coast line, the primary classification transitions to Ritidian-Rock Outcrop Complex and then Shioya Sandy Loam at the beach.

Engbring and Ramsey (1984) developed a habitat classification system for the major habitat types found during their 1981 Guam forest bird surveys. They identified eight non-aquatic habitat types in their study area on Guam: 1) primary limestone forest; 2) broken forest; 3) coconut forest; 4) scrub forest; 5) open field; 6) beach scrub; 7) agriforest; and 8) urban. Utilizing this classification system, the vegetative communities identified of the existing NDWWTP would be classified as urban within the fence, and open field or scrub forest outside the fence. The pipeline corridor and SLPS would be classified as open field or scrub forest and urban, and the undeveloped upgrade area would be classified as broken or scrub forest.

The urban cultivated portions within the fenced area of the NDWWTP are largely landscape and lawn with persistent occurrence of the same grass and prostrate herbaceous plants throughout. Some species variation was found within small overgrown patches within the fenced area, as well as along the fence itself. Small trees (primarily *Cocos nucifera*) also occur within the fenced area as part of the landscaping. Outside the fence is largely dominated by herbaceous weeds, ferns, grasses and vines, with some patchily distributed trees. The pipeline easement corridor and SLPS areas are dominated by herbaceous weeds, vines and small trees. No federally listed vegetation species were observed. A complete species list can be found in Appendices A and B.

The entirety of the roughly 17-acre upgrade area is undeveloped and can be characterized as broken or scrub forest, with large patches of grass and ferns interspersed throughout. The eastern boundary is accessible from an access road (Photo plate 3A). The forested areas (Photo Plate 2A) are predominately Pago (*Hibiscus tiliaceus*), Tangantangan (*Leucaena leucocephala*), Annonas (*Annona reticulata*), and Noni (*Morinda citrifolia*). The dense thickets of Pago leave very few understory species, primarily ferns (*Nephrolepis hirsutula*, and *Phymatosourus scolopendria*) and mosses. The open rangeland areas (Photo plate 2B) largely consist of either dense thickets of grasses such as *Pennisetum polystachion*, or the fern *Nephrolepis hirsutula*, with thick vine mats also common. There are some small open areas where additional herbaceous weeds and shrubs can be observed. At the southern end of the area, a mowed path runs east/west within the property boundary and consists of lawn/grass and prostrate herbaceous weeds similar to those found within the fenced area of the existing NDWWTP (Photo plate 3B). No federally listed vegetation species were observed. A complete species list can be found in Appendix C.

Potential Effects of the Proposed Action on Wildlife Habitat Resources

Once construction begins on the upgrade project for the NDWWTP, the existing vegetation will be mostly removed from the surveyed area. The upgrade will necessitate clearing large areas for the staging and construction of new facilities, particularly in the currently undeveloped area. The direct impact of these activities will be changes to the existing vegetation species. The current baseline conditions are broken forest, which will change to landscaped lawn similar to those currently found within the fenced NDWWTP. The species observed during this survey are non-native, and/or commonly found on Guam, making the impact of project activities “no effect” for significant wildlife habitat.

Construction activities in the upgrade areas will lead to multiple acres of exposed soil where the root systems of trees and grasses were previously growing, particularly within the undeveloped upgrade area. This could cause indirect impacts to adjacent areas from runoff and erosion, should best management practices to control these effects fail or not be adequately employed. If best management practices (BMP) for erosion and run off are adequately employed, the indirect impact could be “no effect”, or “may affect, not likely to adversely affect” if BMPs are not effective.

After construction is complete, the remaining green space of the undeveloped upgrade area will likely be lawn/landscaped, similar to what is found in the existing NDWWTP. Studies have shown that areas of frequent disturbance, such as mowed lawns, can encourage the propagation and establishment of hardy, non-native species (Radosевич et al. 2007). Compared to the baseline condition of the undeveloped vegetation, where forest and grass species were established, the new condition could cause a cumulative effect of increased occurrence of non-native plant species. This potential effect combined with the lack of significant wildlife habitat, the cumulative impact of project activities is determined to be “may affect, not likely, to adversely affect”.

Impacts to federally endangered/threatened species will be discussed elsewhere in this BA.

B. Wildlife Resources

Terrestrial Resources

Within the fenced and surrounding areas of the existing NDWWTP wildlife observations were primarily limited to cane toads (*Rhinella marina*). No avifauna was observed. Similar observations were made in the pipeline easement corridor and SLPS. No federally listed wildlife species were observed.

The most commonly observed wildlife or wildlife signs in the NDWWTP expansion area consisted of feral pig (*Sus scrofa*), butterflies (*Hypolimnas bolina*; *Papilio polytes*), various species of bees, wasps and spiders (*Ropalidia* sp., Vespidae spp., *Argiope appensa*, Arachnidae spp.), non-native snails (*Coniglobus* sp.), blue tailed skinks (*Emoia caeruleocauda*), and the Curious Brown skink (*Carlia fusca*). The avifauna

observations consisted of one yellow bittern (*Ixobrychus sinensis*), doves (*Streptopelia* sp.), feral chicken vocalizations (*Gallus gallus*), and Francolin vocalizations (*Francolinus francolinus*). Surveys included native snail species searches, but none were observed. No additional fauna were observed in the unfenced NDWWTP, pipeline easement corridor or SLPS. No federally listed flora or fauna species were observed.

Potential Effects of the Proposed Action on Wildlife Resources

The plant upgrade will necessitate clearing large areas for the staging and construction of new facilities, particularly in the currently undeveloped area. The direct impact of these activities will be changes to wildlife species from disturbance and altered available habitat. The current baseline conditions are wildlife associated with broken forest, which will change to landscaped lawn similar to those currently found within the fenced NDWWTP, where few wildlife resources were observed. The new vegetation classification will be associated with fewer wildlife species. The species observed during this survey are non-native, and/or commonly found on Guam, making the impact of project activities “no effect” for significant wildlife habitat.

Impacts to federally endangered/threatened species will be discussed elsewhere in this BA.

IV. EXISTING WETLAND RESOURCES AND ANTICIPATED IMPACTS

A. Wetland Resources

Wetlands are defined as areas that support “a prevalence of vegetation typically adapted for life in saturated soil conditions” (Clean Water Act (CWA) 33CFR 328.3). Wetlands serve as storm water retention ponds, improve water quality by filtration, and act as nurseries and habitat for many wildlife species. They are usually considered a limited natural resource. Because of this importance activities in wetlands, or “special aquatic sites”, are regulated through the CWA by the U.S. Army Corps of Engineers (USACE).

The determination and mapping of the wetland\non-wetland boundary is known as wetland delineation. Wetland delineation criteria and procedures are described in the USACE Delineation Manual (USACE 1987). A determination whether a site is or is not a wetland is based on three criteria; (1) soils (i.e., the presence of hydric soils), (2) hydrology (i.e., presence of ponded surface waters or groundwater) and (3) vegetation (i.e., presence of hydrophytic plant species). Under normal (undisturbed) conditions all three criteria must be present for an area to be a wetland subject to regulation (jurisdictional wetland). The existing NDWWTP site and the proposed upgrade sites do not have standing water or vegetation indicative of wetland habitat, and do not contain “jurisdictional” wetlands.

B. Potential Effects of the Proposed Action on Wetland Resources

The work sites do not contain jurisdictional wetlands; therefore, the impact of project activities is determined to be “no effect.”

V. EXISTING MARINE BIOLOGICAL RESOURCES AND ANTICIPATED IMPACTS

This section describes the existing marine habitats identified in the near shore waters where the outfall diffuser is proposed to be located, as determined during the 2007 BA. Results from this discussion will be used to assess potential project related impacts to those marine resources.

A. Physical Environment and Marine Resources

Pro Marine Technology (Tamuning, Guam) obtained a video of the benthic substrate along the proposed diffuser alignment on 18 March 2007. A ROV was deployed in conjunction with an outboard vessel. A copy of the video was provided to the various review agencies.

The ROV survey started as close to the reef edge as possible in approximately -20 ft of water (N 13° 33.002' - E 144° 48.515') and tracked in a north-west direction along the outfall alignment. Once the outfall exit point (estimated) was reached (N 13° 33.091' - E 144° 48.417'), the ROV tracked due north along the -140-foot contour until the point was reached where the (estimated) terminus of the diffuser would be located (N 13° 33.174' - E 144° 48.445').

Some technical difficulties were encountered with the ROV display units that resulted in not having depth and compass readings available. Despite this shortcoming, it was believed the video footage would still provide adequate information on the benthic marine resources for agency review.

As described in the 2007 BA (MES 2007), the video shows a very gradual downward slope of a hard bottom fore-reef zone until a steep drop off that transforms into an extensive sand bottom. As expected, coral growth dominates the shallower waters with very little coral coverage in the sand bottom substrate. Instead of a written qualitative description of the benthic resources along the alignments, the video was viewed to assist in determining resources of importance. Though the video shows no depth recording, it was assumed that the last portion of the video showing the sand bottom habitat is the -140-foot MLLW contour where the diffuser would be installed.

Currently, the concentrated discharge of primary treated wastewater into the area of concern contains moderately high concentrations of organic materials, nitrogen compounds, including ammonia, phosphates and pathogens. The NDWWTP does not meet its discharge permit limits negatively impacts water quality off the Guam northeast coast near Tanguisson Point and this results in increased risk to coral and fish species

due to poor water quality near the current outfall. Installation of the diffuser will improve water quality in the area of concern by diffusing and thereby diluting the discharge from the NDWWTP and bring the discharge into compliance with the NPDES permit and local water quality standards.

B. Potential Effects of the Proposed Action on Benthic Marine Resources

EPA has concluded that using the applicant's proposed initial dilution of 200:1 is a conservative estimate of critical dilution. Since the proposed discharge will discharge farther away from the shoreline and at a greater depth, and incorporates additional diffuser ports, it is predicted to have higher dilution. The modeling supports the conclusion that the diffuser will create rapid and complete mixing, thereby minimizing the mixing zone to the zone of initial dilution in accordance with Guam water quality standards. The Zone of initial dilution (ZID) is the region of initial mixing surrounding or adjacent to the end of the outfall pipe or diffuser ports, provided that the ZID may not be larger than allowed by mixing zone restrictions in applicable water quality standards [40 CFR 125.58(d)]. Once the diffuser is installed and the plant is upgraded discharges through the ZID should fall below the permit limits for five-day Biochemical Oxygen Demand (BOD₅), Total Suspended Solids (TSS), pH, toxic pollutants, whole effluent toxicity, ammonia, nitrate-nitrogen, orthophosphate, oil and grease and temperature.

After considering avoidance and minimization measures, it has been determined that this project will have minimal adverse effects to EFH, and the NMFS agreed with that determination. NMFS has determined that the project activities will likely result in minimal adverse effects to EFH and MUS because there will be a loss of a small amount of foraging habitat and installation of the diffuser hardware will change the benthic structure. However, with careful project implementation and adherence to the conservation recommendations, this project should have minimal long-term impacts on EFH in the area and will likely result in long term benefits due to improved water quality.

The installation of the diffuser will result in improvements to the area of concern's ambient water quality and it is generally accepted that in combination with the concurrent upgrade to the NDWWTP's treatment process units, the installation will bring the effluent discharges into compliance with water quality standards.

VI. FEDERALLY ENDANGERED/THREATENED WILDLIFE AND PLANT SPECIES

The purpose of the Endangered Species Act (ESA) is to conserve "*the ecosystems upon which endangered and threatened species depend*" and to conserve and recover listed species. Those wildlife species which have been determined to have dangerously low population levels or are in imminent threat of extinction are protected by the U.S. Federal Government under authority of the ESA. Populations of those wildlife species requiring Federal protection are either classified as endangered or threatened. Endangered is defined in Section 3(6) of the ESA as species that are in danger of extinction through most or all of their range. Threatened species are those that are likely

to become endangered in the near future in most or all of their range.

The Federal Agencies responsible for determining which species are to be listed and enforcement of existing Endangered Species laws are the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS). To separate the shared responsibility, the USFWS manages land and freshwater species, while NMFS manages marine and anadromous fish species.

USFWS has listed eight avifaunal species which may occur or have historically occurred on Guam (USFWS 2015b): Mariana common moorhen (*Gallinula chloropus guami*), Mariana gray swiftlet (*Aerodramus vanikorensis bartschi*), Mariana crow (*Corvus kubaryi*), Micronesian kingfisher (*Todiramphus cinnamominus*), bridled white-eye (*Zosterops conspicillatus conspicillatus*), Guam rail (*Rallus owstoni*), nightingale reed-warbler (*Acrocephalus luscini*) and the Micronesian megapode (*Megapodius laperouse*). The USFWS considers the nightingale reed-warbler, Micronesian megapode, bridled white-eye, Micronesian kingfisher, and Mariana crow either extinct or extirpated on Guam. The Micronesian kingfisher continues as a captive population and the Guam rail exists in the wild as an experimental population on Cocos Island off the southern coast of Guam.

The USFWS also lists three mammals, the Mariana fruit bat (*Pteropus mariannus marrianus*), little Mariana fruit bat (*Pteropus tokudae*), and Pacific sheath-tailed bat (*Emballonura semicaudata rotensis*). Of these protected species, the little Mariana fruit bat and the Pacific sheath-tailed bat are considered extinct/extirpated on Guam. The Mariana fruit bat is primarily found in northern Guam, though some may still inhabit southern Guam.

Other animals listed for Guam include the endemic Guam tree snail (*Partula radiolata*), Slevin's skink (*Emoia slevini*), Mariana eight-spot butterfly (*Hypolimnas octocula marianensis*), Mariana wandering butterfly (*Vagrans egistina*), humped tree snail (*Partula gibba*), and fragile tree snail (*Samoana fragilis*).

Fifteen plant species are also listed for Guam: *Serianthes nelsonii* (Hayun lagoon), *Eugenia bryanii*, *Hedyotis megalantha* (Paudedo), *Phyllanthis saffordii*, *Psychotria malaspinae* (Aplokating-palaoan), *Tinospora homosepala*, *Bulbophyllum guamense* (Cebello halumtano), *Dendrobium guamense*, *Heritiera longipetiolata* (Ufa-halomtano), *Maesa walkeri*, *Nervilia jacksoniae*, *Solanum guamense* (Berenghenas halomtano), *Tabernaemontana rotensis*, *Tuberolabium guamense*.and *Cycas micronesica* (Fadang).

Critical habitat has been designated by the USFWS for the Mariana fruit bat and several of the bird species, however the NDWWTP project site is not included in any designated or proposed critical habitat areas.

The NMFS has identified fifteen listed endangered/threatened species in Guam and the Commonwealth of the Northern Mariana Islands (CNMI). Of these, the species determined to be possibly impacted in the 2007 BA (MES) as well as all newly listed species are discussed below. These include three marine reptiles: Green (*Chelonia mydas*), Hawksbill (*Eretmochelys imbricate*), and Leatherback (*Dermochelys coriacea*)

marine turtles; three marine mammals: Sperm (*Physeter microcephalus*), Humpback (*Megaptera novaeangliae*), and Blue (*Balaenoptera musculus*) whales; one fish: Scalloped Hammerhead shark (*Sphyrna lewini*); and three corals: *Acropora globiceps*, *Acropora retusa*, and *Seriatopora aculeata*. Critical habitat has not been designated nor is being proposed in Guam shoreline waters under NMFS jurisdiction. No additional wildlife or plant species are currently being proposed for Guam by either the USFWS or the NMFS.

A. Protected Terrestrial Species of Guam

1. Avifauna

Species accounts for Guam of federally listed avifaunal species that occur, or have occurred, on Guam and therefore may be potentially affected by the proposed action follow.

Nightingale reed-warbler (*Acrocephalus luscini*)

The nightingale reed-warbler is classified as Endangered and was listed by the USFWS on June 2, 1970 {50CFR 17; 35 FR 8495}. Although six islands within the Marianas archipelago have historically contained reed-warbler populations, Guam's population became extirpated during the late 1960's (USFWS 2015g). No critical habitat has been designated for this species.

Micronesian megapode (*Megapodius l. laperouse*)

The Marianas Islands Micronesian megapode subspecies was listed as an Endangered species by the USFWS on June 2, 1970 {50CFR 17; 35 FR 8491-8498}. To date, no critical habitat has been designated for this species. Megapodes are presently considered extirpated on Guam (USFWS 2016a).

Mariana moorhen (*Gallinula chloropus guami*)

The Mariana common moorhen is classified as an Endangered Species and was listed by the USFWS on August 27, 1984 {50 CFR 17; 49 FR 33885}. The *guami* subspecies is limited to the Marianas Archipelago and found presently in "natural wetland habitats" on Guam, Saipan, and Tinian. Critical habitat has not been established for this species; however, the moorhen relies on wetland habitat for food, cover and breeding (CNMI-DFW 1993). The 2001 Moorhen populations were estimated by Takano and Haig (2004) to be 90 individuals for the island of Guam, with no new population estimates provided as of the 2015 USFWS species review summary (USFWS 2015e).

Mariana swiftlet (*Aerodramus bartschi*)

The Mariana swiftlet was classified as an Endangered Species and listed by the USFWS on August 27, 1984 {50 CFR 17; 49 FR 33885}. Within the Marianas, swiftlet populations are limited to the southern islands of Guam, Saipan, Agiguan, and Tinian.

According to the recovery plan (USFWS 1991), this species has not been reported north of Saipan. 2010 population estimates for Guam are around 900 individuals (USFWS 2010). A specific population estimate for Guam was not provided in the USFWS 2015 5-year review, but the total Marianas population was estimated to be 6,750 individuals, with over 5000 on Saipan and 300-400 on Agiguan, indicating a population of over 1000 individuals on Guam (USFWS 2015f). No critical habitat has been designated for this species. Even with the restricted range, Chantler (1999) does not consider this species globally threatened.

Mariana Crow (*Corvus kubaryi*)

The Mariana Crow is classified as Endangered and was listed by the USFWS in 1984 {50 CFR 17; 49 FR 33881}. This species is the only Corvid in Micronesia and only occurs on the islands of Guam and Rota in the Mariana archipelago. Critical habitat was designated for the Mariana crow on Guam by the USFWS {69 FR 62944}.

Habitat related research on Guam indicates that crows use coconut plantations and forest areas (Baker 1951) and mature forest which is defined as native, mixed woodland and second growth (Wiles 1985, unpublished data). Both authors note that the crow is not generally found in areas of human habitation. As of the last USFWS 5-year review (2014b), the Mariana Crow is now considered extirpated on Guam, with the last captive reared crow sighting in 2012.

Micronesian Kingfisher (*Halcyon c. cinnamomina*)

Classified as endangered by the USFWS in 1984 {50 CFR 17; 49 FR}, this species is considered extirpated from Guam as the last sighting of a Micronesian Kingfisher was in 1989 (USFWS 2014d). It is believed that the brown tree snake was the primary cause of its disappearance. A captive breeding program was started in 1983 and currently there are approximately 50 individuals in captivity at various US mainland zoos. Critical habitat was designated for the Micronesian Kingfisher in 2004 and research shows that Kingfishers can inhabit various forest types as long as key elements are met such as closed canopy with large, dead trees, termite mud nests in the vicinity, and epiphytic fern root masses for nesting (69 FR 62948).

Guam Rail (*Rallus owstoni*)

The Guam rail, known locally as the ko'ko, is a flightless bird that is endemic to Guam. It was classified as endangered in 1984 {50 CFR 17; 49 FR}. The Guam rail was extirpated by the late 1980s due to predation by the brown tree snake. Guam's Division of Aquatic and Wildlife Resources are currently spearheading a successful captive breeding program. As noted in the USFWS species 5-year review summary (2014a), breeding pairs were released on Cocos Island, approximately 1 mile off the southern coast of Guam, between 2010 and 2012. Un-banded adults have been seen across the island, indicating breeding success.

Bridled white-eye (*Zosterops c. conspicillata*)

The bridled white-eye was listed as Endangered by the USFWS in 1984 {50 CFR 17; 49 FR}. The Nossa, as it is locally known, is a small light green colored bird that was typically found in most of the available habitats on Guam where it feeds primarily on insects (USFWS 2015a). This particular sub-species is endemic to Guam and is now considered extinct as the last observation was recorded during 1983. This active non-territorial flocking bird apparently nests year-round and lays 2 to 3 eggs per clutch. Very little is known on its' life history with respect to Guam.

In conclusion:

It is not believed any listed avifaunal species will be directly or indirectly affected from construction activities associated with the NDWWTP upgrade project. No optimal habitat of any substance would be impacted and none of these species are known from the immediate area. Therefore, a "*no affect*" determination for the proposed action is being recommended for these protected avifaunal species.

2. Herpetological Fauna

Slevin's skink (*Emoia slevini*)

Slevin's skink was listed as endangered by USFWS in 2015 {50 CFR 17; 80 FR 59423}. It is considered extirpated from the main island of Guam, but not from Cocos Island off the southern coast of Guam. This Cocos population is currently being investigated as a separate sub-species from the Slevin's skink found on the Northern Mariana Islands. No critical habitat has been designated at this time.

In conclusion:

The listed terrestrial herpetological fauna are not known to occur in the immediate area of the project sites, and no significant habitat is expected to be impacted. Therefore, a "*no affect*" determination for the proposed actions is being recommended for terrestrial herpetological fauna. Marine turtles will be discussed later in the federally listed marine reptile section.

3. Mammalian Fauna

Mariana fruit bat (*Pteropus mariannus mariannus*).

This species occurs throughout the Mariana Islands, however only the Guam population was federally listed as endangered in 1984 {50 CFR 17; 49 FR 33881}. With updated information, the USFWS has recently listed the Marianas fruit bat as threatened throughout its range, which includes the islands of the CNMI {70 FR 1190}.

Critical habitat has been designated for this species in Guam {69 FR 62994}. The Marianas fruit bat typically forages and roosts in association with native limestone forest, however they can occasionally be found in coconut groves and strand vegetation. Tree species primarily used for roosting include mature fig trees (*Ficus* spp.) and chopak (*Mammea odorata*). Other trees which have been used are: ironwood, *Macaranga thompsonii*, zebrawood (*Guettarda speciosa*) and fagot (*Neisosperma oppositifolia*).

Twenty-two species of plants have been documented as food sources in the Mariana Islands; foods consist of fruits (17 species), flowers (seven species) and leaves (one species). Primarily frugivorous, food sources include the following plants: breadfruit (*Artocarpus* spp.), papaya, cycad (*Cycas circinalis*), kafu (*Pandanus tectorius*), Pacific almond (*Terminalia catappa*), kapok (*Ceiba pentandra*), coconut palm, gaogao, and da'ok (*Calophyllum inophyllum*) (USFWS 1990).

Little Mariana fruit bat (*Pteropus tokudae*),

The little Mariana fruit bat was listed as endangered on 27 August 1984 {50 CFR 17; 49 FR 33881}. Thought to be endemic to Guam, very few specimens have been observed, with the last documented sighting in 1968 (USFWS 2015d). This species is currently believed to be extinct. Due to its rarity, there is a significant lack of information on this species.

Pacific sheath tailed bat (*Emballonura semicaudata rotensis*)

Listed as endangered by USFWS in 2015 {50 CFR 17; 80 FR 59439}, the Mariana subspecies of the Pacific sheath tailed bat was common on Guam at one time based on fossil records. However, the population is now extirpated on Guam and currently limited to a single population on Aguigan. No critical habitat has been designated at this time.

In conclusion:

It is not believed the listed mammalian fauna will be directly or indirectly affected from construction activities associated with the NDWWTP upgrade project. No optimal habitat of any substance would be impacted and none of these species are known from the immediate area or were observed during site surveys. Therefore, a "no affect" determination for the proposed action is being recommended for mammalian fauna.

4. Invertebrate Fauna

Mariana eight spot butterfly (*Hypolimnys octocula marianensis*)

This butterfly species is listed as endangered by USFWS in 2015 and is known only in the forests of Guam and Saipan, and may be extirpated from Saipan {50 CFR 17; 80 FR 59442}. The larvae feed on two native forest herbs found only on karst substrate (*Procris pedunculata* and *Elatostema calcareum*). These plants are no longer observed

where non-native ungulates can reach them easily for browsing. There are only 6 known populations of this species.

Mariana wandering butterfly (*Vagrans egistina*)

Found in forest habitat, this species is endemic to Guam and Rota. USFWS listed this species as endangered in 2015 {50 CFR 17; 80 FR 59442}. The larvae feed on *Maytenus thompsonii*, a plant endemic to the Marianas. The last observation of this species on Guam was in 1979, and it is considered likely extirpated from the island.

Humped tree snail (*Partula gibba*)

The Humped tree snail is listed as endangered by USFWS {50 CFR 17; 80 FR 59445}. This snail occurs in cool, shaded forest habitat, lives on bushes and trees, and feed on decaying material. It appears that they have adapted to living on non-native trees and shrubs. The number of confirmed individuals for Guam is fewer than 150.

Guam tree snail (*Partula radiolata*)

The Guam tree snail is endemic to forest ecosystems of Guam, and listed as endangered by USFWS {50 CFR 17; 80 FR 59446}. This species is found in small populations throughout the island, but is declining rapidly due to several pressures, including development and invasive species.

Fragile tree snail (*Samoana fragilis*)

This species, also in the Partulidae family and the only representative of the *Samoana* genus found in the Marianas, is listed by USFWS as endangered and is known only in forest ecosystems of Guam and Rota {50 CFR 17; 80 FR 59447}. Two colonies are currently known on Guam, with insufficient quantitative data to estimate population size.

In conclusion:

It is not believed the listed invertebrate fauna will be directly or indirectly affected from construction activities associated with the NDWWTP upgrade project. No optimal habitat of any substance would be impacted and none of these species are known from the immediate area or were observed during site surveys. Therefore, a "no affect" determination for the proposed action is being recommended for invertebrate fauna.

5. Terrestrial Flora

Serianthes nelsonii

This tree species was listed as Endangered in 1987 {50 CFR 17; 52 FR 4907} and occurs only on Guam and Rota (USFWS 1993). No critical habitat has been designated for this species. One adult tree (northern Guam) and some seedlings remain on Guam (USFWS 2016b). These numbers are thought to be decreasing due to mainly fungus

and pests such as mealy bugs and ungulate problems.

The remaining 14 plant species described below were all listed as threatened or endangered by USFWS in 2015 {50 CFR 17; 80 FR 59432-59497}. No critical habitat has currently been designated for any of the following species.

Psychotria melaspinae

Psychotria melaspinae is listed as endangered, and is only found on Guam. It is a shrub that inhabits forests and historically was found on the northeast and southwest sides of the island. There are an estimated five individuals in the wild, and possibly fewer as no historically known locations could not be reconfirmed during a rare plants survey in 2012.

Bulbophyllum guamense

This orchid species is listed as threatened. Once widespread, there are currently 12 known occurrences with an estimated fewer than 250 total individuals on Guam. Historically this species has inhabited the cliff lines of Guam as well as the slopes of Mt. Lamlam and Mt. Almagosa.

Cycas micronesica

This species is listed by USFWS as threatened. Once ubiquitous on Guam, the fairly recent introduction of the invasive insect *Aulacaspis yasumatsui* has caused rapid mortality. There are four known locations of occurrence, three in the northern limestone forests, and one in the south, totaling fewer than 516,000 individuals on Guam.

Dendrobium guamense

This threatened species is an epiphytic orchid once common on Guam. There are now 4 known occurrences on Guam totaling fewer than 250 individuals.

Eugenia bryanii

This species is listed as endangered and is only known on Guam. A small shrub typically found on windy, exposed cliffs, there are currently fewer than 420 individuals in five known locations.

Hedyotis megalantha

A perennial herb found in savannah grassland habitat, this species is listed as endangered. The only confirmed occurrences are on Guam, with some uncertain reports from other islands. There is currently one known occurrence totaling fewer than 1000 individuals in southern Guam.

Heritiera longipetiola

This tree is listed as endangered. It is found in forest ecosystems and endemic to the Mariana Islands. There are presently 4 occurrences known on Guam, totaling roughly 90 individuals.

Maesa walkeri

Listed as threatened, this shrub is endemic to the Mariana Islands and found in forest ecosystems of Guam. There are currently two known individuals on Guam, with a larger population found in the forest habitat of Rota. This species is found in forest gaps and along edges.

Nervilia jacksoniae

This herbaceous species is in the orchid family and is listed as threatened by USFWS. Found in forest ecosystems and endemic to the Mariana Islands, this species is known to occur in two locations totaling less than 200 individuals.

Phyllanthus saffordii

Phyllanthus saffordii is a small woody shrub, is endemic to Guam and occurs only in the southern half of the island. This species is listed as endangered by USFWS with 4 known occurrences totaling fewer than 1400 individuals.

Psychotria melaspiniae

This shrub or small tree is endemic to Guam and listed as endangered by USFWS. Historically occurring in scattered populations in the northeastern and southwestern forest ecosystems of Guam, *P. melaspiniae* is currently found at four locations, three of which are only known to contain one individual and that have not been observed for the past five years. The fourth occurrence was more recently discovered and contains three individuals.

Solanum guamense

Solanum guamense is endemic to the Mariana Islands and listed as endangered by USFWS. Currently one individual is known to occur in the forest ecosystem of Guam, with other occurrences on some Northern Mariana Islands a possibility.

Tabernaemontana rotensis

This small to medium tree species is found on Guam and Rota and is listed as threatened by USFWS. A new occurrence was discovered in 2007 on Andersen Air Force Base, totaling 21,000 individuals in all stages of development, representing the largest known population of this species.

Tinaspora homosepala

This species is a vine, endemic to Guam and listed by USFWS as endangered. There are currently 30 known individuals occurring on Guam, and all individuals are thought to be males that are reproducing clonally, reducing genetic diversification of the offspring.

Tuberolabium guamense

An epiphytic orchid, this species is endemic to the Mariana Islands and listed as threatened by USFWS. There is currently one occurrence of one individual in the forest ecosystem on Guam, with additional occurrences on Rota. It appears that this species exclusively occurs on native canopy tree species.

In conclusion:

It is not believed these species will be directly or indirectly affected by construction activities associated with the NDWWTP upgrade project. All known site locations for the species listed above are limited to areas outside the project areas and no individuals were observed during the site surveys. Therefore, a "*no affect*" determination for the proposed action is being recommended for listed flora species.

6. Candidate Species

A candidate species is a plant or animal species for which USFWS or NMFS has on file sufficient information on biological vulnerability and threats to support a proposal to list as endangered or threatened, but has not yet done so. A candidate species receives no statutory protection under the ESA, however USFWS or NMFS encourages planners to conserve these species that may warrant future protection under the ESA. Information on Candidate Species can be obtained from the USFWS Environmental Conservation Online System (ECOS), and when accessed on 8 February 2018, no candidate or proposed species are currently listed for Guam.

B. Protected Marine Species of Guam

Species accounts of federally listed marine turtle, mammal and coral species that occur in Guam waters and therefore may be potentially affected by the proposed action follow.

1. Herpetological Fauna

In accordance with the 18 July 1977 MOU between the USFWS and NMFS, the NMFS was given responsibility for sea turtles when in the marine environment, which constitutes the majority of the lifespan of a marine turtle, while the USFWS retains jurisdiction during terrestrial nesting activities.

Green sea turtle (*Chelonia mydas*)

In response to a decline in population levels, the green turtle was listed as threatened under the Endangered Species Act, except for the Florida and Pacific coast of Mexico breeding populations, which are listed as endangered, on 28 July 1978 {50 CFR 17; 43 FR 32800}. In 2016, different populations of green sea turtle were given independent ratings, and the central West Pacific population, which includes Guam, was given a status of endangered {81 FR 20057}. Critical habitat was identified by the NMFS on 2 September 1998 {63 FR} for Puerto Rico. No critical habitat has been designated for the central West Pacific region.

After leaving the nesting beach, young sea turtles are believed to occupy open ocean pelagic habitat, perhaps associated with sargassum rafts. It is generally assumed that at this life stage they are omnivorous with a strong tendency toward carnivory. An ontogenetic shift from a pelagic life form to benthic foraging occurs after reaching a carapace size of 20-25 cm in the Western Atlantic or 35 cm carapace length in Hawaii and Australia. A change to an herbivorous diet also occurs during this time, primarily sea grasses and algae, although they also consume jellyfish, salps and sponges (Lutz and Musick 1997).

Hawksbill sea turtle (*Eretmochelys imbricata*)

Population declines resulted in the hawksbill turtle being listed as endangered on 2 June 1970 {50 CFR 17; 35 FR 8495}. Critical habitat was identified by the NMFS on 2 September 1998 {63 FR} in Puerto Rico. Although certain authors (Carr 1952) separate the species into two sub-specific populations (Indo-Pacific and Atlantic subspecies), the USFWS is treating the recovery of this species as a single taxonomic entity.

Hawksbill turtles have a circum-tropical distribution, occurring from 30° N to 30° S latitude within the Atlantic, Pacific, and Indian oceans. In the Central Pacific nesting is widely distributed in very low numbers. Foraging hawksbills are observed from virtually all the island groups in Oceania, from the Galapagos Islands in the eastern Pacific to the Republic of Palau in the Western Pacific. Hawksbills nest on the islands and mainland of Southeast Asia, from China and Japan, throughout the Philippines, Malaysia, and Indonesia, to Papua New Guinea, the Solomon Islands and Australia (USFWS 1998).

As with other sea turtle species, after leaving the nest the turtle is pelagic. The ontogenetic change to benthic foraging occurs in the Caribbean at a carapace length between 20 to 25 cm (straight) and in Australia at a carapace length of 35 cm (curved). Data indicates that hawksbills forage most often over coral reef areas and rock outcroppings although they also feed in seagrass meadows in mangrove-fringed bays. Although generally accepted that hawksbill sea turtles are primarily spongivores, other items consumed include: sea grasses, tunicates, bryozoans, coelenterates, molluscs and soft corals. Hawksbills are believed to undergo a period of omnivorous feeding in benthic habitats prior to adopting the specialized spongivory known from larger juveniles

and adults (Lutz and Musick 1997).

Leatherback sea turtle (*Dermochelys coriacea*)

Although the leatherback sea turtle is believed to be the most pelagic of all the sea turtles throughout its life, it is occasionally found foraging in coastal waters and has been documented from water less than 4 meters (m) in depth. As would be expected from a primarily pelagic animal, leatherback distribution is correlated with food sources; namely scyphomedusae, pelagic tunicates and other gelatinous organisms. These turtles also feed throughout the water column, at least to a documented depth of 84 m. In contrast to other species of sea turtles, the leatherback does not apparently experience an ontogenetic shift in diet at certain carapace lengths. This is believed to be related to the fact that this species apparently inhabits the pelagic zone throughout their life and the ability to capture/consume the gelatinous prey species is not size dependent and therefore, no reason for a diet shift between the various size classes.

Overview of potential impacts:

- The outfall diffuser area could be utilized as foraging grounds where appropriate benthic resources are present.
- The near shore coastal area between the edge of the fringing reef and outfall diffuser could be utilized as a transit zone by marine turtles.

In conclusion:

The upgrade to the NDWWTPs treatment process will improve the quality of the effluent leaving the facility and installation of the ocean outfall diffuser will result in improvements to the area of concern's ambient water quality. In combination, these activities should bring the effluent discharge into compliance with water quality standards. The three marine turtle species will not be directly or indirectly affected by the diffuser installation. Therefore, a "is not likely to adversely affect" determination is recommended for these three species of marine turtles.

2. Mammalian Fauna

All species information provided in the following species accounts was obtained directly from the NMFS website.

Humpback whale (*Megaptera novaeangliae*)

The humpback whale was listed as endangered throughout its range on June 2, 1970 {35 CFR 18319}, and maintained that status within the Distinct Population Segment (DPS) of the western North Pacific in 2016 {81 FR 62259}. No critical habitat in this range has been designated. Prior to commercial whaling the worldwide population is thought to have been in excess of 125,000 (NOAA 2017). Between 1805 and 1907 and the total North Pacific catch was estimated to be 28,000. According to the most recent species status review (Bettridge et al. 2015) the DPS of the western North Pacific contains approximately 1,000 individuals.

During summer, humpback whales in the North Pacific migrate and feed over the continental shelf and along the coasts of the Pacific Rim, from Point Conception, California north to the Gulf of Alaska, Prince William Sound and Kodiak Island. Humpback whales spend the winter in three separate wintering grounds: the coastal waters along Baja California and the mainland of Mexico; the main islands of Hawaii; and the islands south of Japan which include the Marianas.

Blue whale (*Balaenoptera musculus*)

The blue whale was listed as endangered throughout its range on June 2, 1970 under the Endangered Species Conservation Act of 1969 {35 FR 18319}; no critical habitat has been designated.

Blue whales are found in all oceans worldwide and are separated into populations from the North Atlantic, North Pacific, and Southern Hemisphere (NOAA 2016). Although blue whales are seen in coastal waters of the St. Lawrence, Gulf of California, Mexico, and California, they are found predominantly offshore. This species inhabits and feeds in both coastal and pelagic environments. Blue whales are frequently found on the continental shelf (e.g., in areas off the California coast) and also far offshore in deep water (e.g., in the northeastern tropical Pacific). It is assumed that blue whale distribution is governed largely by food requirements and that populations are seasonally migratory. Poleward movements in spring allow the whales to take advantage of high zooplankton production in summer. Blue whales appear to feed almost exclusively on krill worldwide in areas of cold current upwellings. Movement toward the subtropics in the fall allows blue whales to reduce their energy expenditure while fasting, avoid ice entrapment in some areas, and engage in reproductive activities in warmer waters of lower latitudes.

For management purposes, blue whales that occupy U.S. waters are divided into three stocks: the western North Atlantic stock; the eastern North Pacific stock; and the Hawaiian stock. The entire North Pacific stock is estimated at approximately 2,500 individuals.

Sperm whale (*Physeter macrocephalus*)

The sperm whale was listed as endangered throughout its range on June 2, 1970 under the Endangered Species Conservation Act of 1969 {35 FR 8495}. During the past two centuries, commercial whalers took about 1,000,000 sperm whales (NOAA 2015e). Despite this high level of take, the sperm whale remains the most abundant of the large whale species. The present world abundance is estimated at 2,000,000 individuals, which is over eight times greater than the combined total population estimates of the other endangered large whale species.

Sperm whales inhabit the deep waters of all oceans of the world, though they seldom approach polar ice fields and are most common in temperate and tropical latitudes. They have also been seen occasionally near coastlines in the Gulf of Mexico, where they were once quite common. Their distribution is dependent on their food source and suitable conditions for breeding, and varies with the sex and age composition of the group. Sperm whales tend to inhabit areas with a water depth of 600 m or more, and are uncommon in waters less than 300 m deep.

Overview of potential impacts:

- The coastal area near the outfall diffuser could, though highly unlikely, be utilized as a transit zone by listed marine mammals. These waters (≤ 140 ft MLLW) are generally considered too shallow for these species and are neither optimal calving grounds nor foraging areas. Sightings of these species are rare in the near shore waters of Guam.

In conclusion:

The upgrade to the NDWWTPs treatment process will improve the quality of the effluent leaving the facility and installation of the ocean outfall diffuser will result in improvements to the area of concern's ambient water quality. In combination, these activities should bring the effluent discharge into compliance with water quality standards. These marine mammal species will not be directly or indirectly affected by the diffuser installation. Therefore, a "no affect" determination is recommended for these marine mammal species.

3. Ichthyological Fauna

*Scalloped hammerhead shark (*Sphyrna lewini*)*

The scalloped hammerhead shark was listed as threatened in the Indo-Pacific DPS in 2014 {79 FR 53851}. This is a coastal pelagic species often found at sea mounts or along continental and insular shelves adjacent to deeper water (NOAA 2015c). It is found at depths ranging from shallow estuaries to as deep as 1000m. Population numbers are not available for the Indo-Pacific DPS, but a trend survey shows the northern Atlantic population is in steep decline from 1981 levels.

Overview of potential impacts:

- The coastal area near the outfall diffuser could, though highly unlikely, be utilized as a transit zone by this shark species. These waters are not a typical foraging area. Sightings of this species are rare in the near shore waters of Guam.

In conclusion:

The upgrade to the NDWWTPs treatment process will improve the quality of the effluent leaving the facility and installation of the ocean outfall diffuser will result in improvements to the area of concern's ambient water quality. In combination, these activities should bring the effluent discharge into compliance with water quality standards. This shark species will not be directly or indirectly affected by the diffuser installation. Therefore, a "no affect" determination is recommended for this shark species.

4. Benthic Invertebrate Fauna Including Coral

Acropora globiceps

This species of coral was listed as threatened in 2014 {79 FR 53851}. In the most recent surveys this species has been listed as occurring on Guam (NOAA 2015a). This species grows on upper reef slopes, reef flats and adjacent habitats at a depth of 0-8 m (approximately 0-26 ft).

Acropora retusa

This species was listed as threatened in 2014 {79 FR 53851}. There is one sample reported from Guam from 2012, and other tentative reports of this species occurring on Guam (NOAA 2015b). It is found in shallow reef slope and back-reef areas, with a depth range of 0-5 m (approximately 0-16 ft).

Seriatopora aculeata

This species was also listed as threatened in 2014 {79 FR 53851} and is known to occur in Guam (NOAA 2015d). It can occur in a wide range of habitats and is found at depths from 3-40 m (approximately 10-131 ft).

Overview of potential impacts:

- The depth of the diffuser installation is below the known depths that each listed coral occurs, with *S. aculeata* possibly occurring the nearest to the diffuser depth.
- None of the listed species have been shown to occur near the diffuser installation, and benthic video footage does not indicate that these species are nearby.

In conclusion:

The upgrade to the NDWWTPs treatment process will improve the quality of the effluent leaving the facility and installation of the ocean outfall diffuser will result in improvements to the area of concern's ambient water quality. In combination, these activities should bring the effluent discharge into compliance with water quality standards. Coral species will not be directly or indirectly affected from installation of the diffuser as no listed corals are known to exist in the adjacent areas.

5. Candidate Species

A candidate species is a plant or animal species for which USFWS or NMFS has on file sufficient information on biological vulnerability and threats to support a proposal to list as endangered or threatened, but has not yet done so. A candidate species receives no statutory protection under the ESA, however USFWS or NMFS encourages planners to conserve these species that may warrant future protection under the ESA. Information on Candidate Species can be obtained from the USFWS Environmental Conservation Online System (ECOS), and when accessed on 8 February 2018, no candidate or proposed species are currently listed for Guam.

C. Potential Effects of the Proposed Action on Listed Species

The Information provided above indicates that:

- No listed terrestrial species of Guam (avifauna, herpetological, mammalian, invertebrate, and flora) will be directly or indirectly affected by activities associated with the NDWWTP secondary treatment upgrade. A "*no effect*" determination is recommended for all listed terrestrial avifauna, herpetological fauna, mammalian fauna, invertebrate fauna, and flora species (see Table 1).

- No listed marine mammalian and ichthyological species of Guam will be directly or indirectly affected by activities associated with the NDWWTP secondary treatment upgrade. A "*no effect*" determination is recommended for all listed marine mammalian and ichthyological species (see Table 1).
- No listed marine turtles and listed coral species will be directly or indirectly affected by activities associated with the NDWWTP secondary treatment upgrade that includes an ocean outfall diffuser. An "*is not likely to adversely affect*" determination is recommended for listed marine turtles and listed coral species (see Table 1).

TABLE 1: RECOMMENDED AFFECT DETERMINATIONS FOR FEDERALLY LISTED TERRESTRIAL AND MARINE SPECIES THAT MAY BE AFFECTED BY THE PROPOSED ACTION

FEDERALLY LISTED SPECIES		RECOMMENDED EFFECT DETERMINATION	
Common Name	Scientific Name	Facility site	Outfall diffuser site
AVIFAUNA			
Mariana common moorhen	<i>Gallinula chloropus guami</i>	No effect	Not applicable
Micronesian megapode	<i>Megapodius laperouse</i>	No effect	Not applicable
nightingale reed-warbler	<i>Acrocephalus luscini</i>	No effect	Not applicable
Mariana swiftlet	<i>Aerodramus vanikorensis bartschi</i>	No effect	Not applicable
Bridled white-eye	<i>Zosterops conspicillatus conspicillatus</i>	No effect	Not applicable
Guam rail	<i>Rallus owstoni</i>	No effect	Not applicable
Mariana crow	<i>Corvus kubaryi</i>	No effect	Not applicable
Micronesian kingfisher	<i>Todiramphus cinnamominus</i>	No effect	Not applicable
MAMMALS			
Mariana fruit bat	<i>Pteropus mariannus mariannus</i>	No effect	Not applicable
little Mariana fruit bat	<i>Pteropus tokudae</i>	No effect	Not applicable
Pacific sheath-tailed bat	<i>Emballonura semicaudata rotensis</i>	No effect	Not applicable
Humpback whale	<i>Megaptera novaeangliae</i>	Not applicable	No effect
blue whale	<i>Balaenoptera musculus</i>	Not applicable	No effect
sperm whale	<i>Physeter macrocephalus</i>	Not applicable	No effect
REPTILES			
Slevin's skink	<i>Emoia slevini</i>	No effect	Not applicable
green sea turtle	<i>Chelonia mydas</i>	No effect	Is not likely to adversely affect
hawksbill sea turtle	<i>Eretmochelys imbricata</i>	No effect	Is not likely to adversely affect
leatherback sea turtle	<i>Dermochelys coriacea</i>	No effect	Is not likely to adversely affect
INVERTEBRATES			
Mariana eight spot butterfly	<i>Hypolimnas octocula marianensis</i>	No effect	Not applicable
Mariana wandering butterfly	<i>Bagrans egistina</i>	No effect	Not applicable
Guam tree snail	<i>Partula radiolata</i>	No effect	Not applicable

TABLE 1 (cont.): RECOMMENDED AFFECT DETERMINATIONS FOR FEDERALLY LISTED TERRESTRIAL AND MARINE SPECIES THAT MAY BE AFFECTED BY THE PROPOSED ACTION.

FEDERALLY LISTED SPECIES		RECOMMENDED AFFECT DETERMINATION	
Common Name	Scientific Name	Facility site	Outfall diffuser site
<i>INVERTEBRATES (cont.)</i>			
Fragile tree snail	<i>Samoana fragilis</i>	No effect	Not applicable
Humped tree snail	<i>Partula gibba</i>	No effect	Not applicable
no common name	<i>Acropora globiceps</i>	Not applicable	Is not likely to adversely affect
no common name	<i>Acropora retusa</i>	Not applicable	Is not likely to adversely affect
no common name	<i>Seriatopora aculeata</i>	Not applicable	Is not likely to adversely affect
<i>PLANTS</i>			
Cebello halumtano	<i>Bulbophyllum guamense</i>	No effect	Not applicable
Fadang	<i>Cycas micronesica</i>	No effect	Not applicable
no common name	<i>Dendrobium guamense</i>	No effect	Not applicable
no common name	<i>Eugenia byranii</i>	No effect	Not applicable
Ufa-halomtano	<i>Heritiera longipetiolata</i>	No effect	Not applicable
Paudedo	<i>Hedyotis megalantha</i>	No effect	Not applicable
no common name	<i>Maesa walkeri</i>	No effect	Not applicable
no common name	<i>Nervilia jacksoniae</i>	No effect	Not applicable
no common name	<i>Phyllanthus saffordii</i>	No effect	Not applicable
Aplokating-palaoan	<i>Psychotria malaspinae</i>	No effect	Not applicable
Berenchenas halomtano	<i>Solanum guamense</i>	No effect	Not applicable
Hayun lago	<i>Serianthes nelsonii</i>	No effect	Not applicable
no common name	<i>Tabernaemontana rotensis</i>	No effect	Not applicable
no common name	<i>Tinospora homosepala</i>	No effect	Not applicable
no common name	<i>Tuberolabium guamense</i>	No effect	Not applicable

D. Potential Effect of the Proposed Action on Candidate Species

A candidate species is a plant or animal species for which USFWS or NMFS has on file sufficient information on biological vulnerability and threats to support a proposal to list as endangered or threatened, but has not yet done so. A candidate species receives no statutory protection under the ESA, however USFWS or NMFS encourages planners to

conserve these species that may warrant future protection under the ESA. Information on Candidate Species can be obtained from the USFWS Environmental Conservation Online System (ECOS), and when accessed on 8 February 2018, no candidate or proposed species are currently listed for Guam.

VII. COMPLIANCE WITH MAGNUSON-STEVENSON ACT: IMPACTS TO ESSENTIAL FISH HABITAT

The following section covers the information provided in the 2007 BA, with updates as necessary. On October 11, 1996, the Sustainable Fisheries Act (Public Law 104-297) became law. This action amended the habitat provisions of the Magnuson Act. The re-named Magnuson-Stevens Act (MSA) calls for direct action to stop or reverse the continued loss of fish habitats. Toward this matter, Congress mandated the identification of habitats essential to managed species and measures to conserve and enhance this habitat. The MSA requires cooperation among NMFS, Regional Fishery Councils, fishing participants, Federal and state agencies, and others in achieving the essential fish habitat (EFH) goals of habitat protection, conservation, and enhancement.

Briefly, EFH consultation is the process of satisfying the Federal agency consultation and response requirements of section 305(b)(2) and 305(b)(4)(B) of the MSA, and the EFH conservation recommendation requirement of section 305(b)(4)(A) of that Act. When completed, an EFH consultation generally consists of: 1) notification to NMFS of a Federal action that may adversely affect EFH, 2) an EFH assessment provided to NMFS, 3) EFH conservation recommendations provided by NMFS to the Federal action agency, and 4) the Federal agency's response to NMFS's EFH conservation recommendations.

The consultation requirements of 305(b) of the MSA (16 U.S.C. 1855(b)) provide that: Federal agencies must consult with the Secretary of Commerce (i.e., through NMFS) on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH. Federal actions included under this consultation process include issuance of Clean Water Act sections 402 NPDES and 404 permits, and Rivers and Harbors Act section 10 permit. The section 404 and section 10 permits would be issued by the USACE, while the section 402 NPDES permit would be issued by the U.S. Environmental Protection Agency (USEPA). These federal permits would be required for the proposed Northern District STP ocean outfall project.

Adverse effect is defined as any impact which reduces the quality and/or quantity of EFH. Adverse effects may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey, or reduction in species' fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). If the USACE determines that an adverse action may occur from the issuance of any particular permit, consultation with the NMFS becomes mandatory. During the consultation process, the Secretary of Commerce shall provide recommendations (which may include measures to avoid, minimize, mitigate, or

otherwise offset adverse effects on EFH) to conserve EFH to Federal (or state) action agencies for activities that would adversely affect EHF. It should be noted that the consultation requirements only require Federal agencies to consult with NMFS about pending federal actions that may adversely affect EFH.

The trigger for an EFH consultation is a Federal action agency's determination that an action or proposed action, funded, authorized or undertaken by that agency may adversely affect EFH. If a Federal agency makes such a determination, then EFH consultation is required. If a Federal action agency determines that an action does not meet the "*may adversely affect*" EFH test (i.e., the action will not adversely affect EFH), no consultation is required.

As defined in section 3(10) of the MSA, EFH are those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. Examples of "*waters*" that may be considered EFH include open waters and wetlands, estuarine and riverine habitats, wetlands hydrologically connected to productive water bodies. Water quality is interpreted to be a component of this definition. EFH should consider water to provide the appropriate parameters of quality such as physical, chemical, and biological properties. This may address nutrient levels, oxygen concentrations, turbidity levels, among others. The interpretation of "*substrate*" includes artificial reefs and shipwrecks if those areas provide EFH. Substrate may also include entirely or partially submerged structures, such as jetties. "*Biological communities*" could include mangroves, tidal marshes, mussel beds, cobble with attached fauna, mud and clay burrows, coral reefs, and submerged aquatic vegetation. Migratory routes such as rivers and passes serving as passageways to and from anadromous fish spawning grounds should be considered EFH. The definition of EFH may include habitat for an individual species or an assemblage of species, whichever is appropriate within each Fishery Management Plan (FMP).

A. EFH in the immediate vicinity of the proposed outfall diffuser

The proposed outfall diffuser is oriented seaward in a north-westerly direction from the beach below Tanguisson Point (Figures 1, 2) and terminates at a depth of -140 ft MLLW. At the time of survey, the depth display was not working on the benthic habitat video, however it can be assumed that the sandy habitat shown at the end of the video was obtained along the -140-foot contour where the outfall exit hole would be located and where the diffuser would be installed.

The test on whether EFH exists for the purposes of compliance with the MSA, is whether the present habitat is utilized by federally managed species, or Management Unit Species (MUS) as identified by the Western Pacific Regional Fishery Management Council (WPRFMC).

B. Assessment of Potential Impacts on Management Unit Species identified in Western Pacific Fishery Management Plans

At a minimum, effects on EFH should be described generally and the following information included: number of actions (actual or estimated); range of impact size; type of impacts, both direct and indirect; and any mandatory mitigation measures. If available, additional information should be included on the following: cumulative effects of the program; cumulative (of program and non-program) effects within watersheds; and effects on fish populations.

To assess impacts on EFH, Management Unit Species (MUS) were identified from each of the four existing Fishery Management Plans (FMP) for the Marianas; Bottom fish, Coral Reef Ecosystems, Precious Corals and Crustaceans, and the Pacific pelagic FMP. These FMP's were developed by the WPRFMC and approved by the NMFS. Based on best available information, project related impacts were assessed for each of the MUS in the five FMP's.

The bottom fish MUS species identified in Table 2 can be generally divided into a deep-water complex (ex., sea bass and snappers) and a shallow-water complex (ex., emperors, grouper, and trevally jacks). The EFH for bottom fish is not well defined or known, especially with respect to larvae and juvenile habitat requirements. In general, the deep-water complex occurs at water depths much greater than the -140 ft MLLW outfall diffuser depth; therefore, these species are not likely to be affected. The shallow-water complex can occur within the depth zone where the outfall diffuser would be sited; however, it appears that optimal hard bottom habitat is not present at the diffuser site and therefore this species complex will not likely be affected.

TABLE 2: ANTICIPATED PROJECT IMPACTS TO BOTTOM FISH MUS (BMUS)¹

SCIENTIFIC NAME	COMMON NAME	ANTICIPATED IMPACTS TO EFH
<i>Aphareus rutilans</i>	red snapper/silvermouth	- none -
<i>Aprion virescens</i>	gray snapper/jobfish	- none -
<i>Caranx ignobilis</i>	giant trevally/jack	- none -
<i>C. lugubris</i>	black trevally/jack	- none -
<i>Epinephelus fasciatus</i>	blacktip grouper	- none -
<i>Etelis carbunculus</i>	red snapper	- none -
<i>E. coruscans</i>	red snapper	- none -
<i>Lethrinus rubrioperculatus</i>	Redgill emperor	- none -
<i>Lutjanus kasmira</i>	blueline snapper	- none -
<i>Pristipomoides auricilla</i>	yellowtail snapper	- none -
<i>P. filamentosus</i>	pink snapper	- none -
<i>P. flavipinnis</i>	yelloweye snapper	- none -
<i>P. seiboldi</i>	Pink snapper	- none -
<i>P. zonatus</i>	Snapper	- none -
<i>Seriola dumerili</i>	Amberjack	- none -
<i>Variola louti</i>	lunartail grouper	- none -

NOTE: ¹ BMUS species list was obtained directly from the *Mariana Archipelago Fishery Ecosystem Plan* provided on the WPRFMC website (<http://www.wpcouncil.org/managed-fishery-ecosystems/mariana-archipelago/>).

Cumulative impacts are likely insignificant as outfall structures will always be few (1 existing and 2 planned for Guam) and spaced great distances apart. Additionally, physical impacts to benthic habitat associated with outfall diffuser installation are likely to be the only construction type conducted at these depths. The overall impact that the proposed action may have to bottom fish MUS is considered insignificant.

The EFH for the numerous coral reef MUS species (Table 6) can also be considered broadly and include virtually all nearshore marine waters found adjacent to Guam. The majority of the coral reef MUS species occur in shallower waters, depending upon their life stage. These MUS species forage within the water column, in the coral reef substrate, or in the sandy areas adjacent to reefs. As discussed in the description of the video footage above, there is a hard-bottom fore-reef zone with coral, followed by a steep drop off into a flat sandy zone where the outfall extension will be placed. There is some possibility that coral reef MUS transit through and possibly forage in this sandy

zone, but this sandy area lacks sufficient relief to be suitable habitat for most coral reef species. In conclusion, the proposed action is not expected to adversely affect the EFH of coral reef MUS.

TABLE 3: ANTICIPATED PROJECT IMPACTS TO CORAL REEF MUS (CMUS)¹

SCIENTIFIC NAME	COMMON NAME	ANTICIPATED IMPACTS TO EFH
<i>Acanthurus xanthopterus</i>	Yellowfin surgeonfish	<i>not likely to adversely affect</i>
<i>A. triostegus</i>	Convict tang	<i>not likely to adversely affect</i>
<i>A. lineatus</i>	Lined surgeonfish	<i>not likely to adversely affect</i>
<i>Acanthurus</i> spp.	Surgeonfish	<i>not likely to adversely affect</i>
<i>Naso literatus</i>	Orangespine unicornfish	<i>not likely to adversely affect</i>
<i>Naso</i> spp..	Unicornfish	<i>not likely to adversely affect</i>
<i>Ctenochaetus</i> spp.	Bristle-tooth tangs	<i>not likely to adversely affect</i>
<i>Zebrasoma flavescens</i>	Yellow tang	<i>not likely to adversely affect</i>
<i>Balistoides viridescens</i>	Titan triggerfish	<i>not likely to adversely affect</i>
<i>B. conspicillum</i>	Clown triggerfish	<i>not likely to adversely affect</i>
<i>Balistipus undulatus</i>	Orange-lined triggerfish	<i>not likely to adversely affect</i>
<i>Melichthys vidua</i>	Pinktail triggerfish	<i>not likely to adversely affect</i>
<i>M. niger</i>	Black triggerfish	<i>not likely to adversely affect</i>
<i>Pseudobalistes fuscus</i>	Blue triggerfish	<i>not likely to adversely affect</i>
<i>Rhinecanthus aculeatus</i>	Lagoon triggerfish	<i>not likely to adversely affect</i>
<i>Sufflamen fraenatum</i>	Masked triggerfish	<i>not likely to adversely affect</i>
<i>Selar crumenophthalmus</i>	Bigeye scad	<i>not likely to adversely affect</i>
<i>Decapterus macarellus</i>	Mackerel scad	<i>not likely to adversely affect</i>
<i>Characharhinus</i> spp.	Sharks	<i>not likely to adversely affect</i>
<i>Triaenodon obesus</i>	White tip reef shark	<i>not likely to adversely affect</i>
<i>Myripristis</i> spp.	Soldier fish	<i>not likely to adversely affect</i>
<i>Sargocentron</i> spp.	Squirrelfishes	<i>not likely to adversely affect</i>
<i>Neohiphon</i> spp.	Squirrelfishes	<i>not likely to adversely affect</i>

TABLE 3 (cont.): ANTICIPATED PROJECT IMPACTS TO CORAL REEF MUS (CMUS)¹

SCIENTIFIC NAME	COMMON NAME	ANTICIPATED IMPACTS TO EFH
<i>Kuhlia mugil</i>	Five-bar flagtail	<i>not likely to adversely affect</i>
<i>Kyphosus cinarascens</i>	Blue sea chub	<i>not likely to adversely affect</i>
<i>K. vaigienses</i>	Brassy chub	<i>not likely to adversely affect</i>
<i>K. biggibus</i>	Brown chub	<i>not likely to adversely affect</i>
<i>Cheilinus cholorourus</i>	Floral wrasse	<i>not likely to adversely affect</i>
<i>C. trilobatus</i>	Tripletail wrasse	<i>not likely to adversely affect</i>
<i>Cheilinus</i> spp.	Wrasses	<i>not likely to adversely affect</i>
<i>Oxycheilinus</i> spp.	Wrasses	<i>not likely to adversely affect</i>
<i>Xyrichtys</i> spp.	Wrasses	<i>not likely to adversely affect</i>
<i>Hymigymnus</i> spp.	Wrasses	<i>not likely to adversely affect</i>
<i>Halichoeres</i> spp.	Wrasses	<i>not likely to adversely affect</i>
<i>Thalasoma</i> spp.	Wrasses	<i>not likely to adversely affect</i>
<i>Cheilio inermis</i>	Cigar wrasse	<i>not likely to adversely affect</i>
<i>Hologymnosus doliatus</i>	Pastel ringwrasse	<i>not likely to adversely affect</i>
<i>Novaculichthys taeniourus</i>	Rockmover wrasse	<i>not likely to adversely affect</i>
<i>Mulloidichthys vanicolensis</i>	Yellowfin goatfish	<i>not likely to adversely affect</i>
<i>M. flaviolineatus</i>	Yellowstripe goatfish	<i>not likely to adversely affect</i>
<i>Mulloidichthys</i> spp.	Goatfish	<i>not likely to adversely affect</i>
<i>Parupeneus barberinus</i>	Dash-and-dot goatfish	<i>not likely to adversely affect</i>
<i>P. bifasciatus</i>	Doublebar goatfish	<i>not likely to adversely affect</i>
<i>Parupeneus</i> spp.	Goatfish	<i>not likely to adversely affect</i>
<i>Upeneus arge</i>	Bandtail goatfish	<i>not likely to adversely affect</i>
<i>Mugil cephalus</i>	Flathead grey mullet	<i>not likely to adversely affect</i>
<i>Moolgarda engeli</i>	Kanda	<i>not likely to adversely affect</i>
<i>Neomyxus leuciscus</i>	Acute-jawed mullet	<i>not likely to adversely affect</i>
<i>Crenimugil crenilabis</i>	Fringelip mullet	<i>not likely to adversely affect</i>
<i>Gymnothorax</i> spp.	Eels	<i>not likely to adversely affect</i>

TABLE 3 (cont.): ANTICIPATED PROJECT IMPACTS TO CORAL REEF MUS (CMUS)¹

SCIENTIFIC NAME	COMMON NAME	ANTICIPATED IMPACTS TO EFH
<i>Octopus</i> spp.	Octopuses	<i>not likely to adversely affect</i>
<i>Polydactylus sexfilis</i>	Threadfin	<i>not likely to adversely affect</i>
<i>Heteropriacanthus cruentatus</i>	Glasseye	<i>not likely to adversely affect</i>
<i>Priacanthus hamrur</i>	Lunar-tailed bigeye	<i>not likely to adversely affect</i>
<i>Bolbometopon muricatum</i>	Bumphead parrotfish	<i>not likely to adversely affect</i>
<i>Scarus</i> spp.	Parrotfish	<i>not likely to adversely affect</i>
<i>Hipposcarus longiceps</i>	Longnose Parrotfish	<i>not likely to adversely affect</i>
<i>Gymnosarda unicolor</i>	Dogtooth tuna	<i>not likely to adversely affect</i>
<i>Siganus argenteus</i>	Streamlined spinefoot	<i>not likely to adversely affect</i>
<i>Siganus spinus</i> .	Little spinefoot	<i>not likely to adversely affect</i>
<i>Siganus</i> spp.	Spinefoot/ Rabbitfish	<i>not likely to adversely affect</i>
<i>Sphyraena</i> spp.	Barracuda	<i>not likely to adversely affect</i>
<i>Turbo</i> spp.	Green snail	<i>not likely to adversely affect</i>

NOTE: ¹ CMUS species list was obtained directly from the *Mariana Archipelago Fishery Ecosystem Plan* provided on the WPRFMC website (<http://www.wpcouncil.org/managed-fishery-ecosystems/mariana-archipelago/>).

The Precious Corals FMP recognizes pink, gold, bamboo and black corals as MUS (Table 4). The first three species are generally found between 350 and 1,500 m while black corals occur in shallower waters, typically between 30 and 100 m in depth. Precious corals require specific depth ranges and areas of solid substrate with strong to moderate currents to help prevent the accumulation of sediments, which would otherwise smother young coral colonies and prevent settlement of new larvae.

TABLE 4: ANTICIPATED PROJECT IMPACTS TO PRECIOUS CORAL MUS ¹

SCIENTIFIC NAME	COMMON NAME	ANTICIPATED IMPACTS TO EFH
<i>Corallium secundum</i>	Pink coral (= red coral)	- none -
<i>Corallium regale</i>	Pink coral (= red coral)	- none -
<i>Corallium laauense</i>	Pink coral (= red coral)	- none -
<i>Gerardia spp.</i>	Gold coral	- none -
<i>Narella spp.</i>	Gold coral	- none -
<i>Calyptraphora spp.</i>	Gold coral	- none -
<i>Lepidisis olpa</i>	Bamboo coral	- none -
<i>Acanella spp.</i>	Bamboo coral	- none -
<i>Antipathes dichotoma</i>	Black coral	- none -
<i>Antipathes grandis</i>	Black coral	- none -
<i>Antipathes ulex</i>	Black coral	- none -

NOTE: ¹ Precious Coral MUS species list was obtained directly from the *Mariana Archipelago Fishery Ecosystem Plan* provided on the WPRFMC website (<http://www.wpcouncil.org/managed-fishery-ecosystems/mariana-archipelago/>).

The outfall diffuser would be located at a depth of -140 ft MLLW, fairly shallow to support precious coral MUS. The video shows sandy substrate in the vicinity of the diffuser and this habitat type is not conducive to sustain precious coral growth. There is no precious coral industry collecting raw coral product on Guam, nor is there information on whether precious coral beds are found near the proposed outfall diffuser site.

The Crustacean FMP identifies spiny lobsters, slipper lobsters, kona crab and three species of deepwater shrimp as MUS (Table 5). The EFH for the lobster species is known to occur in shallow water coral reef environments, especially along rocky outcroppings and areas with three-dimensional relief. The outfall diffuser depth of -140 ft MLLW is dominated by sandy habitat and is not believed to be conducive for lobster MUS. Kona crab is found in sandy habitat near adjacent reefs in areas with strong currents at a depth of 2-200 m. While the exit point for the outfall diffuser is shown to be in sandy substrate, it is not known if nearby rocky and coral substrate is sufficient for this sandy area to act as kona crab habitat, therefore the project is not likely to adversely affect Kona crab EFH. Deepwater shrimp are found at depths of 200-1200 m, making the outfall diffuser exit location too shallow to likely affect these species.

TABLE 5: ANTICIPATED PROJECT IMPACTS TO CRUSTACEAN MUS

SCIENTIFIC NAME	COMMON NAME	ANTICIPATED IMPACTS TO EFH
<i>Panulirus spp.</i>	Spiny lobsters	- none -
Fam. – Scyllaridae	Slipper lobsters	- none -
<i>Ranina ranina</i>	Kona crab	<i>not likely to adversely affect</i>
<i>Heterocarpus spp.</i>	Deepwater shrimp	- none -

NOTE: ¹ Crustacean MUS species list was obtained directly from the *Mariana Archipelago Fishery Ecosystem Plan* provided on the WPRFMC website (<http://www.wpcouncil.org/managed-fishery-ecosystems/mariana-archipelago/>).

The EFH for the numerous pelagic MUS species (Table 6) can also be considered broadly and include virtually all offshore marine waters found adjacent to Guam. Though the majority of the pelagic MUS typically are found in waters deeper than -140 ft MLLW, there are several MUS species that may occur in the shallower waters, depending upon their life stage. With a few exceptions, most of these MUS species forage within the water column and rarely feed off the bottom. In conclusion, the proposed action is not expected to affect the EFH of pelagic MUS.

TABLE 6: ANTICIPATED PROJECT IMPACTS TO PELAGIC MUS (PMUS)¹

SCIENTIFIC NAME	COMMON NAME	ANTICIPATED IMPACTS TO EFH
<i>Coryphaena</i> spp.	Mahimahi (dolphinfishes)	- none -
<i>Acanthocybium solandri</i>	Wahoo	- none -
<i>Makaira mazara</i>	Indo-Pacific blue marlin	- none -
<i>Makaira indica</i>	Black marlin	- none -
<i>Tetrapturus audax</i>	Striped marlin	- none -
<i>T. angustirostris</i>	Shortbill spearfish	- none -
<i>Xiphias gladius</i>	Swordfish	- none -
<i>Istiophorus platypterus</i>	Sailfish	- none -
Families: Alopiidae, Sphyrnidae, Lamnidae, Carcharhinidae	Oceanic sharks	- none -
<i>Thunnus alalunga</i>	Albacore	- none -
<i>T. obesus</i>	Bigeye tuna	- none -
<i>T. albacares</i>	Yellowfin tuna	- none -
<i>T. thynnus</i>	Northern bluefin tuna	- none -
<i>Katsuwonus pelamis</i>	Skipjack tuna	- none -
<i>Euthynnus affinis</i>	Kavakava	- none -
<i>Gymnosarda unicolor</i>	Dogtooth tuna	- none -
<i>Lampris</i> spp.	Moonfish	- none -
Family: Gempylidae	Oilfish family	- none -
Family: Bramidae	Pomfret	- none -
<i>Auxis</i> spp., <i>Scomber</i> spp., <i>Allothunus</i> spp.	Other tuna relatives	- none -

NOTE: ¹ PMUS species list was obtained directly from *Pelagic Fisheries of the Western Pacific Region - 2013 Annual Report* (WPRFMC 2015).

In summary, it is believed that the proposed NDWWTP ocean outfall diffuser would not adversely affect EFH of Bottomfish, Coral Reef, Precious Coral, Crustacean or Pelagic MUS.

VIII. SUMMARY OF ANTICIPATED PROJECT ASSOCIATED IMPACTS AND SUGGESTED MITIGATION

A summary of the anticipated impacts to various biological and regulatory variables are shown in Table 7.

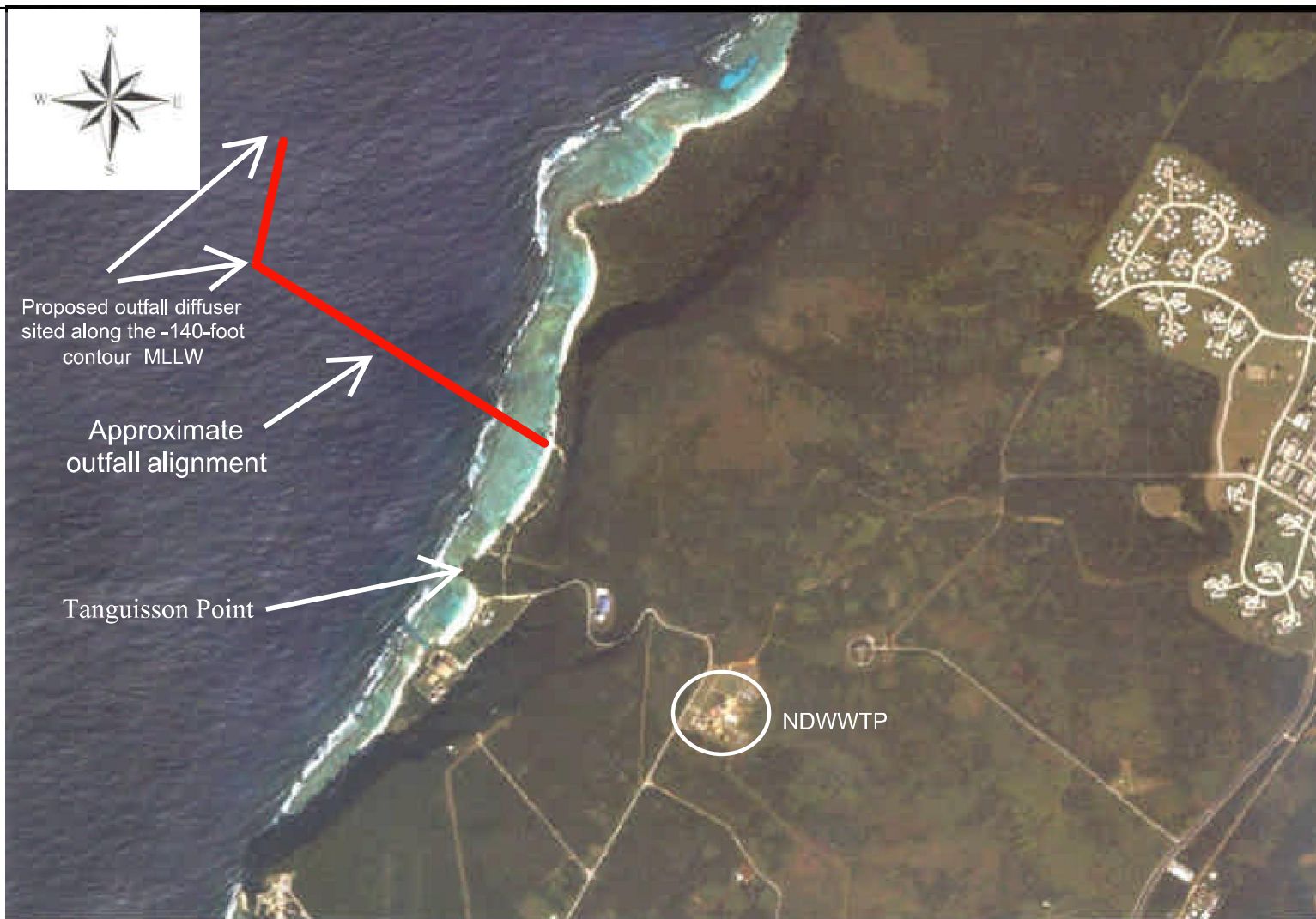
TABLE 7: SUMMARY OF ANTICIPATED IMPACTS ON BIOLOGICAL RESOURCES ASSOCIATED WITH CONSTRUCTION OF THE PROPOSED ACTION

VARIABLES	ANTICIPATED EFFECTS
WILDLIFE HABITAT	
Terrestrial Wildlife Habitat	<i>Minor and insignificant</i>
Jurisdictional Wetlands	<i>None</i>
Marine Benthic Habitat	<i>None</i>
WILDLIFE SPECIES	
Native Terrestrial Wildlife Species	<i>None</i>
Native Marine Wildlife Species	<i>Minor and insignificant</i>
Candidate Species (Endangered Species Act)	<i>None</i>
FEDERAL CONSULTATIONS	
Designated and/or Proposed Critical Habitat (Endangered Species Act)	<i>None</i>

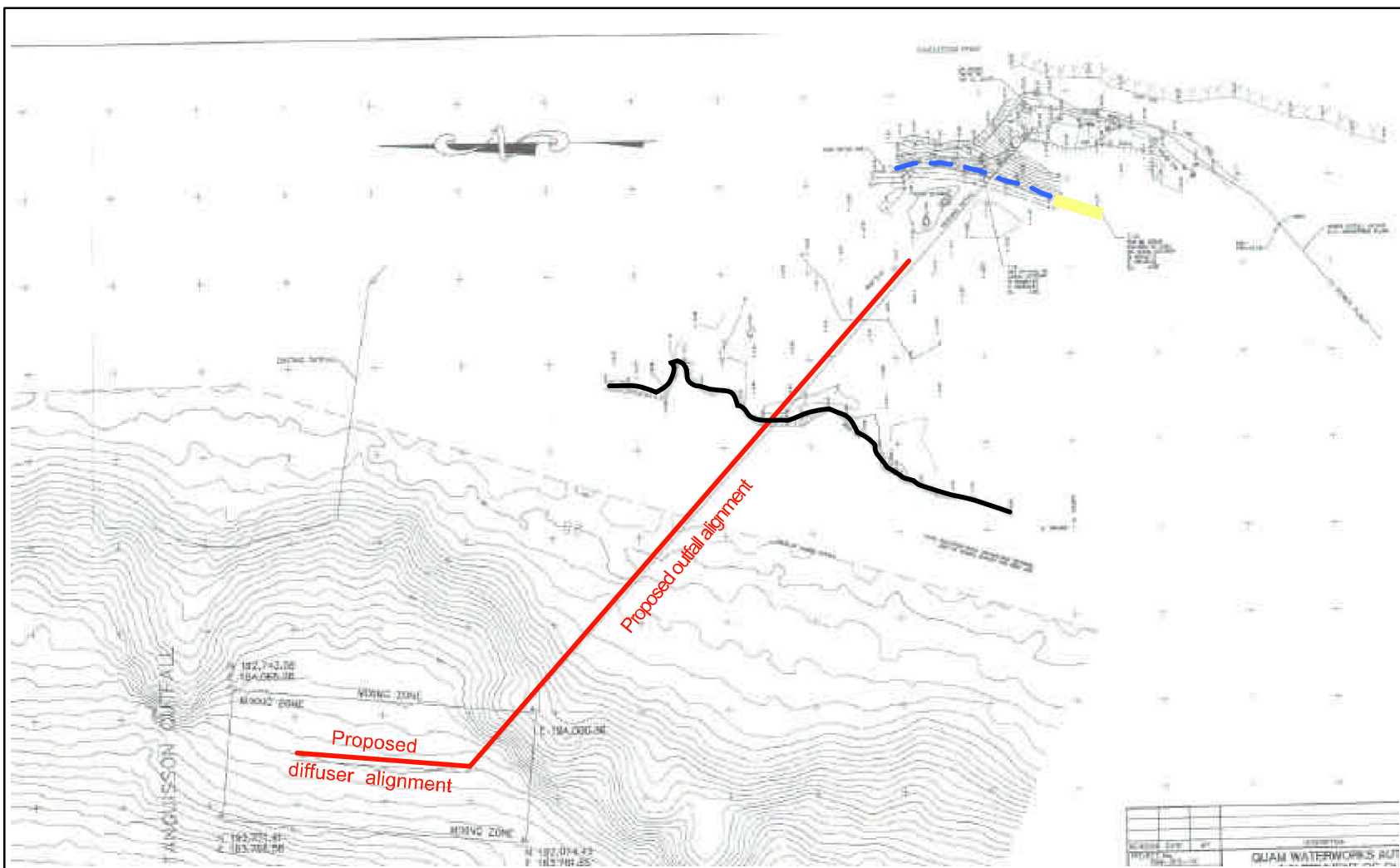
TABLE 7 (cont.): SUMMARY OF ANTICIPATED IMPACTS ON BIOLOGICAL RESOURCES ASSOCIATED WITH CONSTRUCTION OF THE PROPOSED ACTION

VARIABLES	ANTICIPATED EFFECTS
Endangered/Threatened Species (Endangered Species Act)	Though unlikely, in-water work involving diffuser installation may have the potential for marine turtle interactions.
Impacts to Essential Fish Habitat (EFH) (Magnuson-Stevens Act)	<i>Minor and insignificant</i>

IX. FIGURES AND PHOTO PLATES



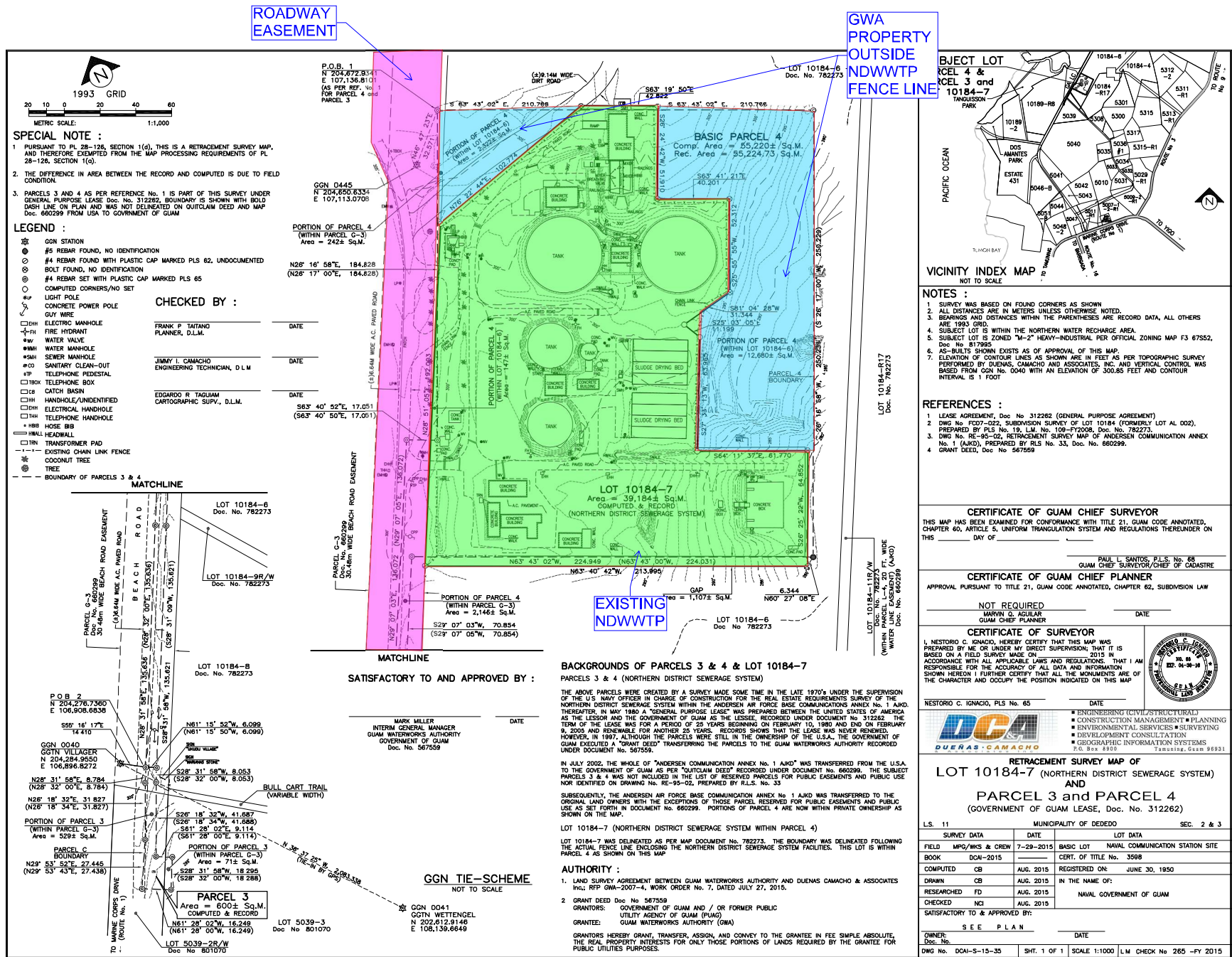
Outfall Diffuser Proposed Alignment Schematic

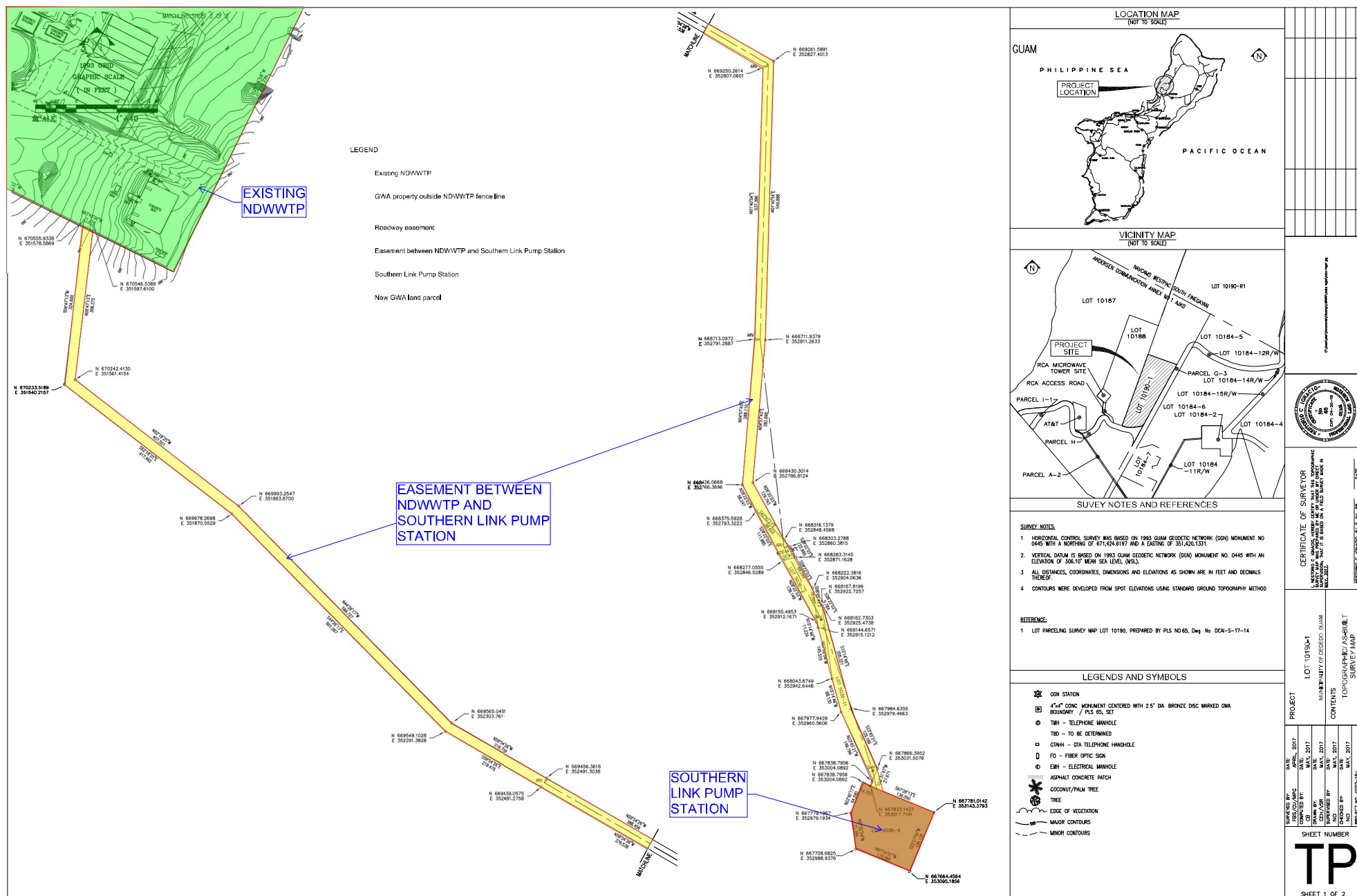


**NDWWTP – Outfall Diffuser
Proposed Alignment Plan**

ARC *Environmental Services*

Figure No.
2





Pipeline Easement Corridor Between NDWWTP and Southern Link Pump Station

Figure No.

4

1A



1B



1A: Existing WWTP facility near front gate, landscaped and mowed areas shown.

1B: WWTP facility fence showing grown-up vegetation.

HIES, Inc.

Photo Plate

1

1C



1D



1C: Unfenced NDWWTP property, fern and weed dominated area.

1D: Unfenced NDWWTP property, small trees and grasses.

HIES, Inc.

Photo Plate



2A: Example of forested areas within undeveloped upgrade area.

2B: Example of grassy areas of undeveloped upgrade area.

HIES, Inc.

Photo Plate

2

3A



3B



3A: Access road running north along E boundary of upgrade area.

3B: Mowed path proceeding east near S boundary.

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Photo Plate

3

4A



4B



4A: Representative Easement Corridor vegetation
4B: Southern Link Pump Station

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Photo Plate

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Appendix A: Current NDWWTP Species List

FLORA (fenced WWTP)		FAUNA (WWTP)	
Scientific Name	Common Name	Scientific Name	Common Name
<i>Achyranthes aspera</i>	chaff-flower	<i>Blattodea</i> sp.	cockroach
<i>Alysicarpus vaginalis</i>	white moneywort	<i>Carlia fusca</i>	curious brown skink
<i>Amaranthus viridis</i>	slender amaranth	<i>Melantis leda</i>	common evening brown
<i>Antigonon leptopus</i>	coral vine	<i>Papilionoidea</i> spp.	butterflies
<i>Bacopa monnieri</i>	water hyssop	<i>Rhinella marina</i>	cane toad
<i>Bidens alba</i>	beggartick		
Bryophyta spp.	mosses		
<i>Buchnera floridana</i>	blueheart		
<i>Cenchrus echinatus</i>	southern sandbur		
<i>Chamaesyce hirta</i>	pillpod sandmat		
<i>Chamaesyce hypericifolia</i>	graceful sandmat		
<i>Chamaesyce prostrata</i>	prostrate sandmat		
<i>Chloris barbata</i>	swollen fingergrass		
<i>Chromolaena odorata</i>	jack in the bush		
<i>Chrysopogon aciculatus</i>	golden false beardgrass		
<i>Cocos nucifera</i>	coconut		
<i>Conyza canadensis</i>	Canadian horseweed		
<i>Cyanthillium cinereus</i>	little ironweed		
<i>Cynodon dactylon</i>	Bermudagrass		
<i>Cyperus ligularis</i>	swamp flatsedge		
<i>Cyperus odoratus</i>	fragrant flatsedge		
<i>Desmodium incanum</i>	Spanish clover		
<i>Desmodium triflorum</i>	black clover		
<i>Euphorbia cyathophora</i>	wild poinsettia		
<i>Euphorbia heterophylla</i>	Mexican fireplant		
<i>Eustachys petraea</i>	pinewoods fingergrass		
<i>Fimbristylis dochotoma</i>	forked fimbry		
Fungi spp	fungus		
<i>Hedyotis corymbosa</i>	parpat		
<i>Kyllinga nemoralis</i>	whitehead spikesedge		
<i>Lepidium virginicum</i>	least pepperwort		
<i>Leucanea leucocephala</i>	tangan tangan		
Lichen	lichen		

Appendix A: Current NDWWTP Species List

FLORA (fenced WWTP cont.)	
Scientific Name	Common Name
<i>Mimosa pudica</i>	sensitive plant
<i>Morinda citrifolia</i>	Noni
<i>Nephrolepis hirsutula</i>	scaly swordfern
<i>Oxalis corniculata</i>	creeping woodsorrel
<i>Panicum maximum</i>	Guinea grass
<i>Paspalum setaceum</i>	thin paspalum
<i>Passiflora foetida</i>	bush passion fruit
<i>Passiflora suberosa</i>	corksystem passionflower
<i>Phyla nodiflora</i>	tangle frogfruit
<i>Phyllanthus amarus</i>	stonebreaker
<i>Phymatosaurus scolopendria</i>	monarch fern
<i>Pilea microphylla</i>	artillery plant
Plantae sp. 1	unidentified plant species 1
Plantae sp. 2	unidentified plant species 2
Plantae sp. 4	unidentified plant species 4
Plantae sp. 5	unidentified plant species 5
Poaceae sp. 1	unidentified grass species 1
Poaceae sp. 2	unidentified grass species 2
<i>Polypremum procumbens</i>	juniperleaf
<i>Premna serratifolia</i>	headache tree
<i>Psidium guajava</i>	common guava
<i>Pteris vittata</i>	Chinese brake
<i>Pyrrosia lanceolata</i>	lanceleaf tongue fern
<i>Ramalina moss</i>	Spanish moss
<i>Saccharum spontaneum</i>	wild sugarcane
<i>Senna alata</i>	candle bush
<i>Spermacoce assurgens</i>	woodland false buttonweed
<i>Spermacoce</i> sp.	false buttonweed
<i>Stachytarpheta jamaicensis</i>	blue porterweed
<i>Stylosanthes</i> sp.	pencilflower
<i>Tridax procumbens</i>	coat buttons
<i>Veitchia merrillii</i>	Christmas palm

Appendix A: Current NDWWTP Species List

FLORA (unfenced)	
Scientific Name	Common Name
<i>Alysicarpus vaginalis</i>	white moneywort
<i>Antigonon leptopus</i>	coral vine
<i>Asplenium nidus</i>	bird's nest fern
Basidiomycota spp.	shelf fungus
<i>Bidens alba</i>	beggartick
<i>Buchnera floridana</i>	blueheart
<i>Carica papaya</i>	wild papaya
<i>Casuarina equisetifolia</i>	ironwood
<i>Chamaesyce hirta</i>	pillpod sandmat
<i>Chamaesyce hypericifolia</i>	graceful sandmat
<i>Chromolaena odorata</i>	jack in the bush
<i>Cocos nucifera</i>	coconut
<i>Columbrina asiatica</i>	leatherleaf
<i>Conyza canadensis</i>	Canadian horsetweed
<i>Corchorus aestuans</i>	jute
<i>Cyperus ligularis</i>	swamp flatsedge
<i>Cyperus polystachios</i>	many spike flatsedge
<i>Cyperus rotundus</i>	nut sedge
<i>Eleusine indica</i>	Indian goosegrass
<i>Euphorbia cyathophora</i>	wild poinsettia
<i>Euphorbia heterophylla</i>	Mexican fireplant
<i>Fimbristylis dichotoma</i>	forked fimbry
<i>Flagellaria indica</i>	false rattan
Fungi spp.	fungus
<i>Hibiscus tiliaceus</i>	Pago
<i>Ipomoea triloba</i>	littlebell
<i>Jasminum</i> sp.	jasmine
<i>Lantana camara</i>	wild sage
<i>Leucaena leucocephala</i>	tangan tangan
Lichen	lichen
<i>Luffa acutangula</i>	ridge gourd
<i>Mikania micrantha</i>	mile-a-minute
<i>Mimosa pudica</i>	sensitive plant
<i>Momordica charantia</i>	bittermelon
<i>Morinda citrifolia</i>	Noni
<i>Muntingia calabura</i>	strawberry tree
<i>Nephrolepis hirsutula</i>	scaly swordfern
<i>Papaya carica</i>	papaya

Appendix A: Current NDWWTP Species List

FLORA (unfenced cont.)	
Scientific Name	Common Name
<i>Paspalum setaceum</i>	thin paspalum
<i>Passiflora foetida</i>	bush passion fruit
<i>Passiflora suberosa</i>	corksystem passionflower
<i>Pennisetum polystachion</i>	mission grass
<i>Phyla nodiflora</i>	tangle frogfruit
<i>Phyllanthus amarus</i>	stonebreaker
<i>Phymatosorus scolopendria</i>	monarch fern
Plantae sp 14	unidentified plant species 14
Plantae sp 15	unidentified plant species 15
Poacea sp 6	unidentified grass species 6
<i>Polygala paniculata</i>	orosne
<i>Premna serratifolia</i>	headache tree
<i>Psidium guajava</i>	common guava
<i>Pteris vittata</i>	Chinese brake
<i>Pyrrosia lanceolata</i>	lanceleaf tongue fern
<i>Rhynchelytrum repens</i>	Natal grass
<i>Saccharum spontaneum</i>	wild sugarcane
<i>Sida rhombifolia</i>	Cuban jute
<i>Spathodea campanulata</i>	African tuliptree
<i>Spermacoce assurgens</i>	woodland false buttonweed
<i>Spermacoce exilis</i>	Pacific false buttonweed
<i>Stachytarpheta jamaicensis</i>	blue porterweed
<i>Stylosanthes</i> sp.	pencilflower
<i>Tabebuia pallida</i>	pink trumpet tree
<i>Tridax procumbens</i>	coat buttons
<i>Vitex parviflora</i>	smallflower chastetree
<i>Waltheria indica</i>	sleepy morning

Reference sources: McConnell and Gutierrez 2006; Miller 1968; Moore and McMakin 1979; Raulerson and Rinehart 1991, 1992; Reddy 2011; Reichel and Glass 1991; Rinehart and Raulerson 1991; Schreiner and Nafus 1997; Whistler 1995

Appendix B: Pipeline Easement Corridor and Southern Link Pump Station Species List

FLORA (Pipeline Easement Corridor)	
Scientific Name	Common Name
<i>Alysicarpus vaginalis</i>	white moneywort
<i>Axonopus compressus</i>	savannah grass
Basidiomycota spp.	shelf fungus
<i>Bidens alba</i>	beggartick
<i>Bothriochloa bladhii</i>	Caucasian bluestem
<i>Buchnera floridana</i>	blueheart
<i>Cenchrus echinatus</i>	southern sandbur
<i>Chamaechrista nictitans</i>	sensitive partridge pea
<i>Chamaesyce hirta</i>	pillpod sandmat
<i>Chamaesyce hypericifolia</i>	graceful sandmat
<i>Chloris barbata</i>	swollen fingergrass
<i>Chromolaena odorata</i>	jack in the bush
<i>Conyza canadensis</i>	Canadian horseweed
<i>Cyperus ligularis</i>	swamp flatsedge
<i>Cuscuta campestris</i>	common dodder
<i>Desmodium tortuosum</i>	dixie ticktrefoil
<i>Desmodium triflorum</i>	black clover
<i>Digitaria ciliaris</i>	southern crabgrass
<i>Eleusine indica</i>	Indian goosegrass
<i>Euphorbia cyathophora</i>	wild poinsettia
<i>Euphorbia heterophylla</i>	Mexican fireplant
<i>Fimbristylis dichotoma</i>	forked fimbry
Fungi spp.	fungus
<i>Heliotropium procumbens</i>	fourespike heliotrope
<i>Hibiscus tiliaceus</i>	Pago
<i>Indigofera suffruticosa</i>	wild indigo
<i>Ipomoea triloba</i>	littlebell
Lichen	lichen
<i>Lucaena leucocephala</i>	tangan tangan
<i>Macroptilium atropurpureum</i>	purple bush-bean
<i>Mimosa pudica</i>	sensitive plant
<i>Morinda citrifolia</i>	Noni
<i>Nephrolepis hirsutula</i>	scaly swordfern
<i>Paspalum paniculatum</i>	angel grass
<i>Passiflora foetida</i>	bush passion fruit
<i>Passiflora suberosa</i>	corksystem passionflower

FLORA (Pipeline Easement Corridor cont.)	
Scientific Name	Common Name
<i>Pennisetum polystachion</i>	mission grass
<i>Phyla nodiflora</i>	tangle frogfruit
Poacea sp 6	unidentified plant species 6
<i>Polygala paniculata</i>	orosne
<i>Polyprenum procumbens</i>	juniperleaf
<i>Premna obtusifolia</i>	false elder
<i>Psidium guajava</i>	common guava
<i>Pteris vittata</i>	Chinese brake
<i>Saccharum spontaneum</i>	wild sugarcane
<i>Sida rhombifolia</i>	Cuban jute
<i>Spermacoce assurgens</i>	woodland false buttonweed
<i>Spermacoce exilis</i>	Pacific false buttonweed
<i>Sporobolus diander</i>	Indian dropseed
<i>Stachytarpheta jamaicensis</i>	blue porterweed
<i>Stylosanthes</i> sp.	pencilflower
<i>Tridax procumbens</i>	coat buttons
<i>Vitex parviflora</i>	smallflower chastetree
<i>Waltheria indica</i>	sleepy morning

Appendix B: Pipeline Easement Corridor and Southern Link Pump Station Species List

FLORA (SLPS)	
Scientific Name	Common Name
<i>Amaranthus viridis</i>	slender amaranth
Basidiomycota spp.	shelf fungus
<i>Bidens alba</i>	beggartick
<i>Bothrichloa pertusa</i>	pitted beardgrass
<i>Calyptocarpus vialis</i>	straggler daisy
<i>Cenchrus echinatus</i>	southern sandbur
<i>Chamaesyce hirta</i>	pillpod sandmat
<i>Chloris barbata</i>	swollen fingergrass
<i>Chromolaena odorata</i>	jack in the bush
<i>Cyanthillium cinereum</i>	little ironweed
<i>Desmodium triflorum</i>	black clover
<i>Eleusine indica</i>	Indian goosegrass
<i>Fimbristylis dichotoma</i>	forked fimbry
Fungi spp.	fungus
<i>Heliotropium procumbens</i>	fourspike heliotrope
<i>Ipomoea triloba</i>	littlebell
<i>Kyllinga nemoralis</i>	whitehead spikesedge
Lichen	lichen
<i>Lucaena leucocephala</i>	tangan tangan
<i>Mikania micrantha</i>	mile-a-minute
<i>Mimosa pudica</i>	sensitive plant
<i>Paspalum paniculatum</i>	angel grass
<i>Pennisetum polystachion</i>	mission grass
<i>Phyla nodiflora</i>	tangle frogfruit
Plantae sp 22	unidentified plant species 22
Poacea sp 6	unidentified plant species 6
<i>Spermacoce assurgens</i>	woodland false buttonweed
<i>Stylosanthes</i> sp.	pencilflower
<i>Tridax procumbens</i>	coat buttons

Reference sources: McConnell and Gutierrez 2006; Miller 1968; Moore and McMakin 1979; Raulerson and Rinehart 1991, 1992; Reddy 2011; Reichel and Glass 1991; Schreiner and Nafus 1997; Whistler 1995

Appendix C: NDWWTP Upgrade Area Species List

FLORA		FAUNA	
Scientific Name	Common Name	Scientific Name	Common Name
<i>Acalypha indica</i>	Indian nettle	Arachnidae spp.	spiders
<i>Achyranthes aspera</i>	chaff-flower	<i>Argiope appensa</i>	Hawaiian garden spider
<i>Aidia cochinchensis</i>	no common name	<i>Boiga irregularis</i>	brown tree snake
<i>Alysicarpus vaginalis</i>	white moneywort	Buprestidae sp.	jewel beetle
<i>Annona reticulata</i>	custard apple	<i>Carlia fusca</i>	curious brown skink
<i>Antigonon leptopus</i>	coral vine	<i>Coenobita cavipes</i>	land hermit crab
<i>Asplenium nidus</i>	bird's nest fern	<i>Coniglobus</i> spp.	snails
Basidiomycota spp.	shelf mushroom	Diplopoda spp.	millipedes
<i>Bidens alba</i>	beggarstick	<i>Emoia caeruleocauda</i>	Pacific blue-tail skink
<i>Brachiaria subquadrifera</i>	signal grass	<i>Francolinus francolinus</i>	black francolin
Bryophyta spp.	moss	<i>Gallus gallus</i>	feral chicken
<i>Caesalpinia major</i>	Hawaiian pearls	Gekkonidae spp.	geckos
<i>Carica papaya</i>	papaya	<i>Hypolimnas bolina</i>	great eggfly
<i>Chamaechrista nictitans</i>	sensitive partridge pea	Isoptera spp.	termites
<i>Chamaesyce hirta</i>	pillpod sandmat	<i>Ixobrychus sinensus</i>	yellow bittern
<i>Chamaesyce hypericifolia</i>	graceful sandmat	<i>Melantis leda</i>	common evening brown
<i>Chromolaena odorata</i>	jack in the bush	Odonata spp.	dragon/damselflies
<i>Chrysopogon aciculatus</i>	golden false beardgrass	Orthoptera spp.	grasshoppers/crickets/katydid
<i>Cocos nucifera</i>	coconut	<i>Papilio polytes</i>	common Mormon
<i>Columbrina asiatica</i>	leatherleaf	Papilionoidea spp.	butterflies
<i>Conyza canadensis</i>	Canadian horseweed	<i>Rhinella marina</i>	cane toad
<i>Cyperus polystachios</i>	many spike flatsedge	<i>Ropalidia</i> sp.	paper wasps
<i>Davallia solida</i>	hare's foot fern	<i>Streptopelia</i> sp.	doves
<i>Desmodium</i> sp.	ticktrefoil	<i>Sus scrofa</i>	feral hog
<i>Dracaena</i> sp.	dracaena	<i>Veronicella cubensis</i>	Cuban slug
<i>Eleusine indica</i>	Indian goosegrass	Vespididae spp.	wasps
<i>Euphorbia cyanthophora</i>	wild poinsettia		
<i>Euphorbia heterophylla</i>	Mexican fireplant		
<i>Eustachys petrea</i>	pinewoods fingergrass		
<i>Flagellaria indica</i>	false rattan		

Appendix C: NDWWTP Upgrade Area Species List

FLORA (cont.)	
Scientific Name	Common Name
Fungi spp.	fungus
<i>Hibiscus tiliaceus</i>	Pago
<i>Ipomoea triloba</i>	littlebell
<i>Jasminium</i> sp.	jasmine
<i>Lantana camara</i>	wild sage
<i>Leucaena leucocephala</i>	tangan tangan
Lichen	lichen
Liverwort	liverwort
<i>Macroptilium lathyroides</i>	wild bushbean
<i>Malvastrum coromandelianum</i>	threelobe false mallow
<i>Mikania micrantha</i>	mile-a-minute
<i>Mimosa pudica</i>	sensitive plant
<i>Momordica charantia</i>	bittermelon
<i>Morinda citrifolia</i>	Noni
<i>Nephrolepis hirsutula</i>	scaly swordfern
<i>Nervilia aragoana</i>	tall shield orchid
<i>Oxalis corniculata</i>	creeping woodsorrel
<i>Pandanus tectorius</i>	thatch screwpine
Parmaelacea sp.	moss
<i>Paspalum conjugatum</i>	hilograss
<i>Passiflora foetida</i>	bush passion fruit
<i>Passiflora suberosa</i>	corkstem passionflower
<i>Pennisetum polystachion</i>	mission grass
<i>Phyllanthus amarus</i>	stonebreaker
<i>Phymatosaurus scolopendria</i>	monarch fern
Plantae sp 7	unidentified plant species 7
Plantae sp 8	unidentified plant species 8
Plantae sp. 9	unidentified plant species 9
Plantae sp. 10	unidentified plant species 10
Plantae sp. 11	unidentified plant species 11
Plantae sp. 12	unidentified plant species 12
Poacea sp 4	unidentified grass species 4
<i>Polygala paniculata</i>	orosne
<i>Premna serratifolia</i>	headache tree
<i>Psidium guajava</i>	common guava
<i>Pyrossia lanceolata</i>	lanceleaf tongue fern
<i>Ramalina</i> sp.	Spanish moss

Appendix C: NDWWTP Upgrade Area Species List

FLORA (cont.)	
Scientific Name	Common Name
<i>Sacchrum spontaneum</i>	wild sugarcane
<i>Sanseveria</i> sp.	snake plant
<i>Scaevola taccada</i>	beach naupaka
<i>Senna occidentalis</i>	septicweed
<i>Sida rhombifolia</i>	Cuban jute
<i>Spathodea campanulata</i>	African tuliptree
<i>Stachytarpheta jamaicensis</i>	blue porterweed
<i>Stylosanthes</i> sp.	pencilflower
<i>Tabebuia pallida</i>	pink trumpet tree
<i>Taeniophyllum mariannense</i>	worm orchid
<i>Triphasia trifolia</i>	limeberry
<i>Vitex parviflora</i>	smallflower chastetree

Reference sources: McConnell and Gutierrez 2006; Miller 1968; Moore and McMakin 1979; Raulerson and Rinehart 1991, 1992; Reddy 2011; Reichel and Glass 1991; Schreiner and Nafus 1997; Whistler 1995