GUAM WATERWORKS AUTHORITY
"Better Water. Better Lives."
Suite 200, Gloria B. Nelson Public Service Building, 688 Route 15, Mangilao, Guam 96913
Tel. No. (671) 300-6846/48 Fax No. (671) 648-3290

January 8, 2020

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:
Northern Guam Lens Aquifer Monitoring System Expansion/Rehabilitation Project

Buenas yan Saluda Mr. Reyes,

Enclosed, please find the Federal Consistency Application for Guam Waterworks Authority's (GWA) Northern Guam Lens Aquifer (NGLA) Monitoring System Expansion/Rehabilitation Project. 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 *NGLA Monitoring System Expansion/Rehabilitation Project* comply with the enforceable policies of Guam Costal Management Program 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,

Miguel C. Bordallo, P.E.
General Manager

MCB/jat
CC: Mauryn McDonald, GWA Interim Chief Engineer
Prudencio Aguon, GWA Grants Administrator
Evangeline Lujan, GWA Senior Regulatory Analyst
Thomas Konner, USEPA Environmental Engineer
Enclosures:
Project Description, Assessment Forms, Summary of Findings
Appendix A - One Guam Water MOU
Appendix B – Archaeological Inventory Survey
Appendix C - Biological Assessment

Project Description

In 2016, Guam Waterworks Authority, (GWA), the applicant, secured federal grant funding from the Department of Defense's (DoD) Office of Economic Adjustment (OEA) under Grant OCON676-16-03 for the Northern Guam Lens Aquifer Monitoring System Expansion and Rehabilitation Project. The intent of the project is to rehabilitate twelve existing groundwater monitoring wells and construct seven new monitoring wells, also known as deep observation wells (DOW). Nine of the new and rehab well sites are located on military property. GWA will coordinate with Joint Region Marianas, Naval Base Guam, and Andersen Air Force Base to resolve any issues related to obtaining easements for utility access during the period of construction for this project. GWA and the Department of Defense have agreed, as part of the "One-Guam Water" Memorandum of Understanding (See Appendix A), to cooperate to improve the NGLA Observation Well System including expansion of the current system and rehabilitation of existing wells. This project will enhance monitoring and management of the NGLA in order to mitigate impacts to NGLA. Project funding covers the design, rehabilitation, construction, and project/construction management for both GWA wells and DOD wells. Under this MOU, GWA and DOD agree to share access and responsibilities for the maintenance of those wells located on their respective properties.

Project Background and Intent

Both GWA and Joint Region Marianas, Naval Base Guam (NBG) and Andersen Air Force Base (AAFB), provide water and wastewater services to the residents of Guam, with a population of approximately 178,000 people. Ninety percent of GWA's drinking water supply is sourced from the Northern Guam Lens Aquifer (NGLA), the island's main freshwater source. The aquifer is characterized primarily by coral/karst geology and water permeates to the aquifer through six groundwater basins. Only three of those basins are currently monitored via groundwater wells. The two existing military bases rely on water supplies developed by DoD. All of AAFB's current water demand is supplied from NGLA groundwater wells, while NBG relies on NGLA groundwater wells, Fena Valley Lake Reservoir, and natural spring water.

In 2010, the DoD prepared an Environmental Impact Statement (EIS) and released a Record of Decision (ROD) summarizing the plan for the military's expansion and the impacts the expansion would have on the island. The military realignment includes the design and construction of a new Marine Cantonment on the northwestern coast of Guam (north of NCTS Finegayan), family housing at AAFB, a live-fire training range complex on the northern coast (AAFB Northwest Field), an Urban Combat training area in central Guam, and upgraded water/wastewater services to support the new development. The DoD altered their 2010 plans, and in July 2015, the DoD completed a Supplemental Environmental Impact Statement (SEIS) for the military realignment; the resulting ROD was issued in August 2015. The DoD plans to relocate approximately 5,000 military and 1,300 dependents to Guam over a 13-year period, increasing the military population on Guam by nearly 50 percent over 2014 levels. The expected population increase will peak by 9,721 people in 2023, including the military and dependent relocation as well as the influx of construction personnel and civilian DoD personnel associated with the realignment.

With the peak population increase of 9,721 people by 2023, Guam will quickly face a 6.1% increase in population over 2010 levels and an increase in potable water demand. Per the 2015 SEIS, the estimated increased potable water demand resulting from the military realignment is 1.7 mgd (620.5 mgals annually). It is anticipated that the DoD will meet this demand via increased groundwater production. To date, the DoD has not developed any additional groundwater wells. However, Marine Corps Activity Guam (MCAG), the entity responsible for leading the construction activities for the realignment, currently has a project in the design phase to drill new production wells. Most of these wells are planned to be located in optimal production zones of the Northern Guam Lens Aquifer (NGLA) in the Northwest Field area of AAFB. The plan is to develop an adequate number of production wells to meet the projected demand. The location and number of wells will be determined based upon field investigations and test wells which began in early 2019.

As a mitigation measure for the military realignment's impact to the island's water supply, GWA initiated the NGLA Monitoring System Expansion and Rehabilitation Project to ensure comprehensive long-term water quality monitoring for five of the six groundwater basins of the NGLA. The primary focus of the monitoring program is salinity, an indicator of aquifer drawdown and seawater intrusion. Because the project was initiated as a response to the military realignment, GWA sought funding from the federal government in the form of OEA grant funds. With the military and civilian populations highly dependent upon this critical aquifer, maintaining its integrity is of the utmost importance. Increased water demand and the emerging threats triggered by environmental conditions put the aquifer at risk of contamination and salt-water intrusion, and the intent of this project is to help mitigate those effects through enhanced monitoring.

Location Description

This project features rehabilitation activities at twelve existing well sites and drilling/ construction activities at seven new well sites. The locations, coordinates, and current land ownership are listed in Table 1, and Figure 1 presents a map of all nineteen sites across northern Guam.

Scope of Work – Expansion

The objective of the work is to construct seven new monitoring wells. The work at each site includes the following:

1. Clearing and vegetation removal, as necessary, and not to exceed the designated 100-ft x 100-ft area of potential effect.
2. Borehole drilling (between approximately 510 to 780 feet below ground surface, depending on well location) using the air rotary drilling method.
    a. 18-inch borehole to a depth of 40-feet
    b. 10 ¾ -inch borehole from 40-feet to depth
3. Installation of 12-inch-diameter stainless steel surface casing.
4. Installation of 6-inch-diameter Schedule 80 polyvinyl chloride (PVC) blank casing.

5. Installation of well screen, gravel filter material and bentonite pellets, and cement grout surface seal.
6. Monitoring well development.
7. Wellhead improvements including the construction of a 16-ft x 16-ft x 8-inch concrete wellhead pad and the installation of a wellhead enclosure.
8. 12-ft x 12-ft security chain-link site fencing (except at DOW-NCSB1).
9. Provide locks for wellhead cap, enclosure, and fence.

Scope of Work – Rehabilitation

The objective of the work is to rehabilitate twelve existing monitoring wells to enhance each well's life-time. The work common to each site includes:

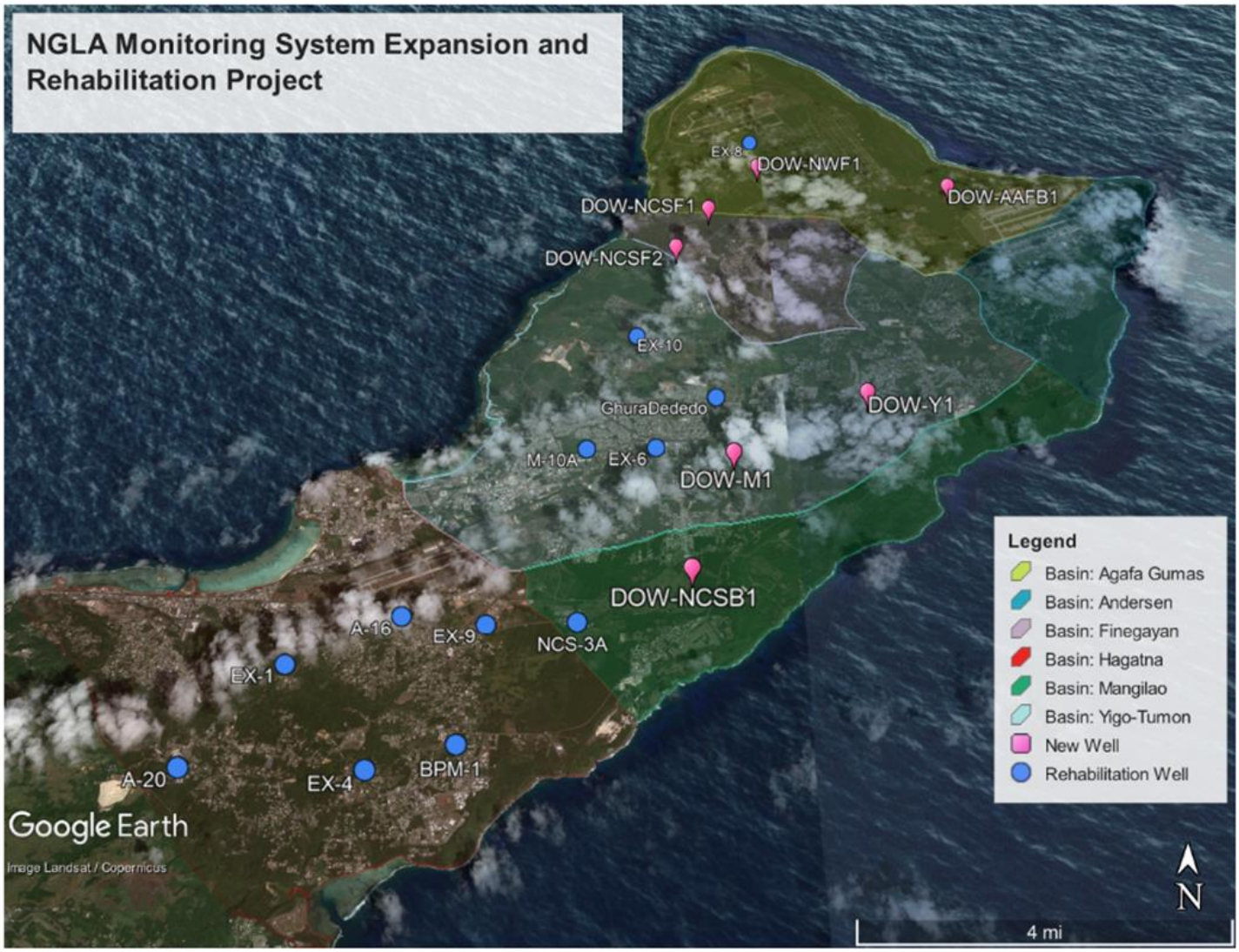
1. Demolish and remove existing wellhead enclosures, concrete pad, concrete pedestal and fencing, where applicable.
2. Remove any floating debris from water surface, as applicable.
3. Construct new concrete wellhead pad (size varies per site).
4. Provide new wellhead enclosure and chain-link site fencing (size varies per site).
5. Provide locks for wellhead cap, enclosure, and fence.

Work specific to certain sites includes:

1. The removal of well fill from BPM-1.
2. The removal of trees and shallow roots impacting M-10A.
3. Installation of PVC surface casing (size varies), PVC blank casing (size varies), well screen, and gravel filter material and bentonite pellets, and develop the well at five monitoring well sites (A-16, A-20, BPM-1, M-10A, and NCS-3A).

Table 1. Monitoring Well Locations and Property Ownership					
Well Type	Well	Property Ownership	Location Description	Latitude	Longitude
New	DOW-NWF1	U.S. Air Force	Off shoulder of Route 3A outside of AAFB fence line	13.59569	144.8622
New	DOW-AAFB1	U.S. Air Force	On a utility road through AAFB's main gate	13.588623	144.906147
New	DOW-NCSF1	U.S. Navy	On NCTS site in a utility corridor	13.580071	144.850181
New	DOW-NCSF2	U.S. Navy	On NCTS site near gymnasium	13.566813	144.842522
New	DOW-NCSB1	U.S. Navy	On NCS-Radio Barrigada	13.478581	144.843912
New	DOW-M1	U.S. Air Force	Within the Marbo Annex	13.506319	144.852678
New	DOW-Y1	U.S. Air Force	To the east side of Yigo Fire Station	13.52225	144.880164
Rehab	A-16	GovGuam	Carbullido Elementary School	13.471361	144.792528
Rehab	A-20	GovGuam	Chalan Pago Elementary School	13.44175	144.759639
Rehab	BPM-1	Frank T. Pangelinan	Private property	13.446528	144.804333
Rehab	EX-1	GovGuam	San Miguel Elementary School	13.461389	144.773611
Rehab	EX-10	GovGuam	Swamp Road, off of Route 3	13.54183	144.83389
Rehab	EX-4	GovGuam	In the front yard of a private home, near Father Duenas School	13.441583	144.790028
Rehab	EX-6	GovGuam, Lessee: Frederic Lujan Guerrero	To the side of a private driveway to a home	13.51086	144.83767
Rehab	EX-8	U.S. Air Force	On the far north of AAFB, near the old air field	13.60945	144.86116
Rehab	EX-9	GovGuam	To the side of PC Lujan Elementary School	13.46967	144.80753
Rehab	GHURA-Dededo	GovGuam, on GICC golf course	Guam International Country Club golf course near hole S-1	13.524257	144.849912
Rehab	M-10A	GovGuam	Juan Guerrero Elementary School - large old tree and palm tree	13.51061	144.82414
Rehab	NCS-3A	U.S. Navy	Near the Radio Barrigada site on U.S. Navy property, across from the former Nimitz Golf Course	13.470258	144.823545

Figure 1. NGLA Monitoring System Expansion and Rehabilitation Map



GUAM COASTAL MANAGEMENT PROGRAM
ASSESSMENT FORM

DATE OF APPLICATION: January 8, 2020
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 Guam Lens Aquifer Monitoring System Expansion/Rehabilitation Project

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: January 8, 2020

Project/Activity Title or
Description: Northern Guam Lens Aquifer Monitoring System Expansion/Rehabilitation Project

Location: Dededo, Yigo, Mangilao, Barrigada, Ordot, Mongmong-Toto-Maite

Other applicable area(s) affected, if appropriate:
N/A

Est. Start Date: Jun. 2020 Est. Duration: 10 Months

APPLICANT

Name & Title: Miguel C. Bordallo, General Manager

Agency/Organization: Guam Waterworks Authority

Address: 688 Route 15, Gloria B. Nelson Public Service Building, Suite 200

Mangilao, GU Zip Code: 96913

Telephone No. during business hours:

Primary (671) 300-6846

Alternate

Fax (671) 648-3290

E-mail Address: mcbordallo@guamwaterworks.org

AGENT

Name & Title: Thomas Konner, Environmental Engineer

Agency/Organization: United States Environmental Protection Agency

Address: 75 Hawthorne St., EPA, Region IX, Water Division

San Francisco, CA Zip Code: 94105

Telephone No. during business hours:

Primary (415) 972-3408

Alternate (415) 972-3545

Fax

E-mail Address: Konner.Thomas@epa.gov

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 (504) 628-9007

FEDERAL AUTHORITY FOR ACTIVITY

Title of Law _____
Section _____

OTHER GUAM APPROVALS REQUIRED:

Agency	Type of Approval	Date of Application	Status

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 new and existing wells for this project lie outside Guam's Seashore Reserve. This project will not impact the environmental and aesthetic quality of shore area land use. The wells are neither located along the shoreline nor within beach access points.

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 does not include any high-density developments nor will result in any high density or new developments. The project will be a rehabilitation and expansion of the deep observation well system used to monitor and collect data from the Northern Guam Lens Aquifer (NGLA). This is intended as a mitigation measure for the military realignment's impact to the island's water supply.

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 data to observe the effects on the NGLA due to the population increase resulting from the relocation of Marines to Guam.

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:
Several well sites lie near military utility corridors. However, they have been vetted and approved by the military and should not garner national interest.

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.

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.

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:
The project sites are not located on areas 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 which 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/rehabilitation of the observation wells.

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 observation wells for the project will not affect Guam's drinking, recreational, and ecologically sensitive waters. The project sites are 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 above indicated fragile areas.

The Archaeological Inventory Survey for Northern Guam Lens Aquifer (NGLA) Monitoring System Expansion/Rehabilitation Project was completed on December 2019. Through communication with the State Historic Preservation Officer, it was determined that four of the new and rehab observation well sites required survey and determination of effect. The results of the study indicated that there were no National Register of Historic Places-eligible properties present in the areas of potential effect, no archaeological or cultural resources were encountered, and subsurface testing produced no evidence of subsurface cultural deposition. The completed study is attached. See Appendix B.

The Biological Assessment for Northern Guam Lens Aquifer (NGLA) Monitoring System Expansion was also completed on December 2019. Federally protected plant species were identified in close proximity to proposed well sites DOW-AAFB1 and DOW-NCSF1, but no significant species were observed within forty feet of the proposed wellhead locations. No federally protected endangered flora or fauna species were observed at the other proposed or rehabilitation well sites. The complete study is attached. See Appendix C.

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.

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.

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, nor should it affect the visual quality of Guam's scenic beauty. Upon completion, areas that were aesthetically disturbed during construction will be restored to its original condition.

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, nor should the constructed wells 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:
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:
Of the nineteen well sites, five are identified to be located on agricultural land based on current available GIS shapefiles. Two are on public school property, two are near private homes, and one is located on a golf course. The project should not affect agricultural use of these sites, nor are they expected to induce urban development.

GUAM WATERWORKS AUTHORITY

Federal Consistency Certification Application
Northern Guam Lens Aquifer Monitoring System Expansion/
Rehabilitation Project

Appendix A

One-Guam Water Memorandum of Understanding

December 7, 2016

Agreement Number: N61128-20161129-1859

APPENDIX A

ONE-GUAM WATER

MEMORANDUM OF UNDERSTANDING

7 December 2016

Agreement Number: N61128-20161129-1859

JOINT REGION MARIANAS
NAVAL FACILITIES ENGINEERING COMMAND MARIANAS
GUAM WATERWORKS AUTHORITY
GUAM CONSOLIDATED COMMISSION ON UTILITIES

NFM
4000
Ser N00/299
6 Dec 16

JTREGMARIANAS
4000
Ser J5/0420
7 Dec 16

MEMORANDUM OF UNDERSTANDING
BETWEEN
GUAM WATERWORKS AUTHORITY
AND
GUAM CONSOLIDATED COMMISSION ON UTILITIES
AND
NAVAL FACILITIES ENGINEERING COMMAND MARIANAS
AND
JOINT REGION MARIANAS

Subj: MEMORANDUM OF UNDERSTANDING TO EXPLORE MUTUALLY BENEFICIAL OPPORTUNITIES

Ref: (a) MOU between the United States Navy and the Guam Waterworks Authority dated 16 July 2010
(b) Framework for Discussion: Strategy for an Integrated Water System for Guam, March 3, 2016 or later
(c) National Institute of Standards and Technology (NIST) Special Publication (SP) 800-82, Revision 2, May 2016

Encl: (1) 2010 MOU Exhibit A: MOU on the Tumon Maui Well Project dated 6 May 2016
(2) One-Guam Water Functional Overview Charts

1. Purpose. The purpose of this Memorandum of Understanding (MOU) is to define the relationship between Joint Region Marianas (JRM), Naval Facilities Engineering Command Marianas (NAVFAC Marianas), Guam Consolidated Commission on Utilities (CCU), and Guam Waterworks Authority (GWA) (hereafter referred to as the "Parties") while developing the "One-Guam" vision for water and wastewater needs expected to increase as a result of military and civilian population growth. The Parties desire to facilitate changes to both systems in a manner that is mutually beneficial and maximizes the effectiveness of the overall Department of Defense (DoD) and GWA water utility systems as a whole.

Subj: MEMORANDUM OF UNDERSTANDING TO EXPLORE MUTUALLY BENEFICIAL OPPORTUNITIES

2. Background. Reference (a) was developed in response to the pending U.S. Marine Corps relocation from Japan to Guam, and is the precursor to this document. Enclosure (1) is the first exhibit to reference (a) outlining a specific project. It will continue as an exhibit to this MOU for the life of the exhibit. Any future projects under this MOU will also be assigned exhibit identifiers, and will continue on future versions of this MOU for their life. Reference (b) was also developed as a result of reference (a), but as a living document which can be revised at any time. The current version as of the development of this MOU is dated 3 March 2016. The goal of all documents is sustainable, reliable, compliant and secure water delivery, followed with reliable and compliant wastewater removal.

3. Cancellation. MOU between the United States Navy and GWA dated 16 July 2010 (reference (a)).

4. Applicability. This MOU and the objectives, goals, and processes agreed upon are subject to applicable laws and regulations of the United States, the Government of Guam (GovGuam), and the Department of the Navy (DON). The Parties agree that legal requirements applicable to either Party take precedence over any understanding reflected in this MOU.

5. Objectives. To explore opportunities for partnering and integration of the water and wastewater utilities, and to address projected additional requirements and/or re-capitalization efforts needed, objectives related to the implementation of utility service solutions were established as follows:

a. Water

(1) Protect the Northern Guam Lens Aquifer (NGLA) and other drinking water sources from contamination and/or salt water intrusion.

(2) Share information relevant to water-related requirements and proposed solutions. This information may consist of facility technical descriptions, planning studies, requirements, designs, rates, schedules and forecasts.

(3) Support all efforts to improve the well-head protection and enforcement.

(4) Cooperate to improve the NGLA Observation Well System used to study the changes in the NGLA via expansion of the current system, rehabilitation of existing wells, and proper abandonment of wells no longer intended for production to enhance monitoring and management of the NGLA in order to mitigate impacts to potable water resources. Share access to, and responsibilities for the maintenance of those wells.

b. Water and Wastewater

(1) Cooperate and partner on the following initiatives:

(a) Interoperability

(b) Geographic Information Systems (GIS)

(c) Hydraulic Modeling

(d) Cybersecurity

(2) Maintain cooperative and coordinated efforts to facilitate development of water resources and proper maintenance of water and wastewater infrastructures on Guam. Accomplish this in accordance with sound business practices and principles that respect the resource limitations, missions, authorities and responsibilities of the Parties to the MOU.

(3) Evaluate opportunities to integrate military and civilian water utility systems on Guam to meet the needs of the island's population including all population growth from the military buildup. Such integration may involve joint use of production and distribution assets, or future transfer of production, distribution, collection and treatment systems from DoD to GWA. The Parties understand that any transfer would require an agreement of terms and conditions acceptable to both DoD and GWA, subject to GWA meeting reasonable minimum reliability, security, and quality standards and possible legislative authorizations.

(4) Develop and utilize common standards to improve overall quality, security, reliability, interoperability, construction, and performance.

(5) Cooperate with federal and local agencies to resolve challenges and emerging concerns, including funding, for

facility and infrastructure planning decisions to support capability improvements for the potable water and wastewater treatment and collection systems.

c. Wastewater

(1) Jointly work to locate and resolve inflow and infiltration issues for all wastewater collection systems, but particularly related to the Northern District and Hagatna systems that handle both local and military wastewater collections.

(2) Share information reports related to discharge certification or pretreatment permits for all Guam wastewater systems (Northern, Southern, and Hagatna).

(3) Cooperate to implement improvements to the Northern District Wastewater Treatment Plant (NDWWTP) which are expected to reduce negative impacts to near shore marine resources and protect the NGLA.

(4) Cooperate to complete the GWA Interceptor Sewer Refurbishment project for the existing sewer lines from Andersen Air Force Base (AAFB) to the NDWWTP to include manhole rehabilitation as necessary. This is to mitigate impacts to wastewater utilities and groundwater resources and ensure the relocation of military assets to Guam do not adversely affect the civilian infrastructure systems or resources.

d. Other

(1) Work closely with the Guam Water and Wastewater Intergovernmental Support Team (GWWIST) to ensure the timely and effective execution of water and wastewater projects designed to meet the demands associated with the proposed military buildup on Guam which are paid for by the Office of Economic Adjustment (OEA).

(2) Work to resolve issues related to easements for utility access following all required real estate procedures and protocols.

(3) Develop cybersecurity procedures to ensure that cybersecurity programs for Industrial Control Systems (ICS) exist which include the major security objectives. Develop

defense-in-depth strategy and evaluate ICS security posture using reference (c).

(4) Cooperate on other issues related to water and wastewater such as development of a coordinated drought response and water conservation plan, and ensuring emergency procedures are appropriately followed when disasters are declared or emergency events occur.

6. Organizational Components. The following defines the various organizations whose interactions are a result of this MOU. Enclosure (2) aids in following that interaction.

a. Guam CCU is the governing board for GWA. The members are elected by public vote and are responsible to the people of Guam.

b. GWA is the water and wastewater utility purveyor for the civilian community on Guam.

c. JRM provides executive level installation management support to all DoD components on Guam. JRM is also the official interface between DoD and the civilian community for the matter of coordinating utilities. For the purpose of the DoD water utilities, JRM is also known as the landowner. JRM oversees installation support for all military installations, structures and infrastructure in the Marianas to include, but not limited to:

(1) Naval Base Guam (NBG)

(2) AAFB

(3) Marine Corps Base Guam (when established)

d. NAVFAC Marianas is the Engineering Command responsible for planning, designing, constructing, altering, repairing, maintaining, and operating DoD utilities systems on Guam. NAVFAC Marianas delivers environmental, utilities, and other base operations support services in support of DoD commands.

e. NAVFAC Marianas Utilities and Energy Management (UEM) Product Line Coordinator (PLC) is JRM's parallel position to GWA's General Manager position.

f. Public Utilities Commission (PUC). An independent regulatory commission consisting of seven members appointed by the Governor of Guam with confirmation by the Guam Legislature. The commission has oversight on rates for the water utility as well as any contracts it enters that may affect those rates.

g. Senior Advisory Group (SAG). Leaders who provide vision and guidance to the Parties for the development of Guam's water resources and infrastructure. SAG will likely consist of:

(1) JRM Region Commander

(2) JRM Deputy Region Commander

(3) Speaker of the Guam Legislature

(4) Guam Legislative Chair for Utilities and Infrastructure

(5) Consolidated Commission on Utilities Chair

h. One-Guam Water and Wastewater Working Group hereafter referred to as the Working Group (WG). The WG will identify problems, make minor adjustments as needed to water resource sharing, develop a prioritized list of recommendations for SAG on proposed water resource infrastructure projects, and track and facilitate approved projects to meet water production, quality, security, and conservation standards and goals. This group will meet at least quarterly and will be co-chaired by GWA and NAVFAC Marianas. At least one WG member from each Party must be empowered to make decisions on behalf of that Party. If any member is unavailable to attend a meeting, a designated representative should be sent in their stead. WG will consist at a minimum of:

(1) NAVFAC Marianas Commanding Officer

(2) GWA General Manager

(3) 36th Civil Engineering Squadron Commander

(4) Marine Corps Activities Group Planning and Design

(5) NBG Public Works Department

(6) NAVFAC Marianas UEM PLC

(7) GWA Chief Engineer

(8) NAVFAC Marianas Water Utility One-Guam Liaison

(9) Operations, engineering, cybersecurity, and compliance personnel from either/both Parties, as needed.

i. Technical Experts (TE). A group of experts in the field of water and wastewater who will maintain regular communication to share water resource data and raise concerns and issues to the WG. TE will develop and maintain all databases and technical tools to monitor and assess the health of the NGLA, and other fresh water resources of Guam. TE will identify problems and propose solutions to the WG. TE members may attend meetings of the WG by invitation, or by approved request. TE will consist, at a minimum, of:

(1) GWA Engineering/Operational Staff

(2) NAVFAC Marianas UEM/Environmental Staff

(3) Guam Environmental Protection Agency (GEPA)

(4) Water and Environmental Research Institute (WERI)

(5) United States Geological Survey (USGS)

j. GWWIST. This group works to meet the demands associated with the proposed military build-up by ensuring timely and effective execution of water and wastewater projects referred to in paragraph 5d(1). Note: The charts in enclosure (2) do not include this organization. Although this MOU addresses some of the One-Guam related work they bring, GWWIST has a separate agreement, and are not directly covered by this MOU. GWWIST members include:

(1) DoD OEA

(2) GWA/Guam CCU

(3) U.S. Environmental Protection Agency

(4) DON

(5) Office of the Governor of Guam

k. WERI, located at the University of Guam (UOG), is the designated repository of the water-related data the Parties wish to share. GWA and NAVFAC Marianas will maintain separate MOUs with WERI to define accepted protocols for the handling of the data to be shared. Additionally, as experts in the field of water, WERI performs technical studies related to our water resources.

7. Terms of Understanding

a. GWA will:

(1) Develop and/or upgrade water and wastewater distribution, collection, and treatment systems not located on DoD property, but necessary to support the increased DoD load. This will be contingent on appropriate and available funding sources, and must be in compliance with GWA's approved Capital Improvement Program.

(2) Follow all appropriate DoD requirements to obtain identification badges to ensure access to DoD facilities.

(3) Comply with all DoD requirements, policies, and procedures when performing work on DoD property, whether operational or construction in nature. (An example of such a requirement is munitions and explosives procedures.)

b. NAVFAC Marianas will evaluate costs associated with meeting DoD requirements and address them on a case-by-case basis.

c. JRM will provide GWA personnel access to facilities wherein GWA has operational oversight. GWA will follow all appropriate DoD requirements to obtain identification badges (and escort as required) to ensure access to those facilities. DoD reserves the right to restrict access due to operational requirements.

d. All Parties will:

(1) Cooperate in determining the most cost effective and timely source(s) of funding to facilitate solutions proposed by the working group.

(2) Cooperate in completing studies related to meeting the drinking water needs of Guam including NGLA sustainability studies. Future studies will be coordinated between GWA, DoD and other Federal and GovGuam agencies (such as GEPA, USGS and UOG/WERI) that may have a stake or required expertise in these matters. The Parties will coordinate the development of the objectives and methodology to accomplish such studies.

(3) Coordinate the selection of future water well sites with GEPA, USGS, and UOG/WERI.

(4) Cooperate in developing appropriate plans for the integration of new water production and distribution infrastructure with existing water systems.

(5) Share water resources as needed to address urgent needs.

(6) Cooperate to assess potential impacts to other wastewater infrastructure and identify options for mitigating the impacts.

(7) Cooperate in all aspects of drinking water resource development, protection, and management on Guam to ensure the long-term sustainability. In order to accomplish this objective, the Parties will designate representatives to convene an advisory team known as the WG to make recommendations on priorities and issues.

(8) Cooperate to facilitate resolution of mutually agreeable appropriate standards for water quality and water production targets based on current assessment of the aquifer and other water resources; and undertake such other roles and responsibilities deemed appropriate for fostering interagency cooperation.

(9) Evaluate current and proposed laws, service rules, and contracts for DoD contributions to system development and determine if such provisions are adequate and fair to both Parties.

(10) Evaluate and monitor timelines required to implement proposed solutions relative to timelines required to meet demand increases resulting from military and civilian population growth.

(11) Continue to develop agreements to formalize the concepts provided herein.

(12) Communicate concerns, issues and problems in a timely manner to provide Parties the time to pursue reasonable and executable courses of action (COAs) to mitigate adverse impacts.

8. Other Provisions

a. Enforceability

(1) Performance. Performance under this MOU by all Parties is dependent upon lawful appropriation, availability, and allocation of funds by proper authorities. Nothing herein shall constitute nor be considered to constitute an obligation or expenditure of funds in advance of or in excess of proper appropriations for either Party (for DoD: Congress of the United States or otherwise be in violation of the Anti-Deficiency Act, 31 U.S.C. § 1341 et seq.; for GWA: Their management and/or the CCU or the PUC).

(2) Benefits. This MOU is not intended to, and does not create any right or benefit, substantive or procedural, enforceable at law or in equity, by any Party against the United States or GWA, or agencies, instrumentalities, officers, employees, or agents of either.

(3) Contingency Clause. In the event of an emerging national security requirement, DoD can unilaterally exit the MOU for the duration of the situation, as required. Such situation will be validated by military orders and DoD will inform the other Parties to the MOU as soon as practical.

b. Resolution of Disagreements

(1) The Parties shall consult with one another to resolve issues at the WG level and elevate disputes through the respective chains-of-command only if necessary.

(2) Notification of areas of disagreement by any Party will be submitted, in writing, by and between the GWA General Manager and the NAVFAC Marianas UEM PLC.

Subj: MEMORANDUM OF UNDERSTANDING TO EXPLORE MUTUALLY BENEFICIAL OPPORTUNITIES

(3) If there is no resolution at the WG level, the Parties may elevate the issue to their respective leadership for resolution at the SAG level.

9. Modification. Modifications to this agreement may be made with the concurrence of all Parties. Modifications desired by any Party are to be requested, in writing, at least 60 days in advance of the proposed effective date and will become effective only if agreed upon, in writing, by all Parties.

10. Review. This MOU will be reviewed triennially and/or when there is a change in principals to evaluate its effectiveness and determine if any modifications are required.

11. Effective Date. This MOU is effective upon the date of final signature and shall remain in effect for a period of nine years. This MOU may be terminated by any of the Parties upon providing 30 days written notification to all Parties.

APPROVED:

JOSEPH T. DUENAS
Chairman
Guam Consolidated Commission on Utilities

Date: 12/6/16

B. BOLIVAR
Rear Admiral, U.S. Navy
Commander
Joint Region Marianas

Date: 7 Dec 16

MIGUEL C. BORDALLO, P.E.
General Manager
Guam Waterworks Authority

Date: 12.6.16

S. M. JONES
Captain, U.S. Navy
Commanding Officer
Naval Facilities Engineering Command Marianas

Date: 6 DEC 2016

2010 MEMORANDUM OF UNDERSTANDING
Exhibit A

May 2016

Enclosure (1)

MEMORANDUM OF UNDERSTANDING
BETWEEN
GUAM WATERWORKS AUTHORITY
AND
THE UNITED STATES NAVY

Subj: MEMORANDUM OF UNDERSTANDING ON THE TUMON MAUI WELL PROJECT

This document details the Tumon Maui Well (TMW) and related interties project developed as part of the "Strategy for an Integrated Water System for Guam" framework and the Memorandum of Understanding (MOU) between the United States Navy and the Guam Waterworks Authority (GWA) dated 16 July 2010.

1. INTRODUCTION

a. The 2010 MOU between the Department of the Navy (DoN, or the Navy) and GWA addresses expected water and wastewater needs for the proposed military buildup. Section V, Future Objectives, of the MOU states that DoN and GWA "...will agree to evaluate opportunities to integrate military and civilian water on Guam. Such integration may involve the future transfer of production, distribution, collection and treatment systems from DoN to GWA. The parties understand that such transfer would require agreement of terms and conditions acceptable to both DoN and GWA, subject to GWA meeting reasonable minimum reliability and quality standards and possible legislative authorizations."

b. Section VII of the 2010 MOU states that the parties agree to have further discussions. Item 5 of that section lists the development of agreements to formalize the concepts of the MOU. Since March 2015, Naval Facilities Engineering Command (NAVFAC) Marianas and GWA have been partnering to evaluate opportunities towards integrating military and civilian water systems on Guam. The joint water working group holds bi-weekly meetings that include the NAVFAC Marianas Commanding Officer, General Manager of GWA, and key members of their utilities, operational, environmental and business staffs.

c. The working group developed a draft "Strategy for an Integrated Water System for Guam" that was coordinated with the Guam Consolidated Commission on Utilities (CCU) in August 2015 and October 2015. The CCU approved the working group's framework document which is a living document that will be periodically updated to address the current objectives. The framework is a plan to lead the organizations through actions working toward a potential future integration of Navy and GWA water systems. This integration effort will require close coordination with Guam EPA and U.S. EPA (Region IX).

Subj: MEMORANDUM OF UNDERSTANDING ON THE TUMON MAUI WELL PROJECT

2. PURPOSE

a. Exhibit A is the detailed agreement between the Navy and GWA related to the Tumon Maui Well license. It specifies the responsibilities and expectations for both parties in the operation and maintenance of the Tumon Maui Well.

b. Exhibit A ensures that all agreed upon services are documented and that all maintenance and operational responsibilities are clearly defined.

c. Navy and GWA will enter into a License Agreement authorizing GWA to operate the Tumon Maui Well to include the extraction of up to 800 gallons per minute (GPM) of water. Requirements for the operation and maintanence of the Tumon Maui Well are contained in the License Agreement.

d. Additionally, the intertie at Route 3 and Potts Junction is a critical component in this water integration pilot in that a trade agreement will be employed to provide an additional water supply to the USMC cantonment facilities (to be located at NCTC Finegayan) via GWA lines from Tumon Maui Well. This exhibit documents GWA's commitment to construct the required infrastucture for a new waterline intertie along Route 3 at Potts Junctions and their commitment to provide a maximum of 210 GPM to Navy via the intertie during the initial license term. The amount may be revisited and subject to change in the future as needs change.

3. BACKGROUND

a. The Tumon Maui Well is a significant component of the water system on Guam. Constructed in 1947, it accounted for a large portion of the water supply until its initial closure in 1995 because of chemical pollution. The Tumon Maui Well has the capacity to provide up to 900 GPM. When the well was in operation, it was one of the highest capacity wells of the Northern Guam Lens Aquifer (NGLA) system. NGLA is the primary source of Guam's fresh water. The well is also significant as an example of a Maui-type water well that operates to skim underground fresh water from the thin basal layer. It is the only Maui-type well on Guam that is capable of producing reliable fresh water. After 1995, it was placed back into service for a short time and then closed again in 1999. As part of the 2010 Military Build Up preparation, the well was rehabilitated. The well is connected to a 24 inch water line (GWA water main) along Marine Corps Drive. Activating the well and putting it into service will require minimal resources for GWA due to the close proximity of their existing infrastructure. Operating the Tumon Maui Well will enable the Navy and GWA to work together in protecting the NGLA, potentially reduce the levels of chlorides in the overall water well systems, mitigate adverse impacts to the NGLA, provide additional water supply for GWA's customers, and support growth and responsible development for the island. This additional capacity will enable GWA to shut down four of its smaller wells where chloride readings have been high.

b. Navy and GWA agree that this effort will improve the island's water system capability by taking advantage of existing infrastructure which will provide interoperability opportunities leading to improved water security for both parties. This project improves Guam's capability to provide an uninterrupted supply of potable water to civilian and military customers by the most cost effective means possible.

c. As part of this agreement, GWA will provide to the Navy a water connection from Route 3 and Potts Junction in support of the USMC cantonement located at NCTS Finegayan. This connection will allow for water to be supplied from an existing GWA waterline to a Navy connection in support of USMC facilities.

d. The issuance of a real estate license without collection of "fair market value" is allowed because the following four conditions are met:

(1) The license is for one year or less.

(2) The license results in minimal costs to the installation.

(3) The license is issued to a not-for-profit organization / charity / service entity / state or local government to support a public interest activity.

(4) The license is advantageous to DoN.

e. Because water resources are considered a public asset on Guam, GWA may withdraw the water from the aquifer at will. GWA will be licensed to operate the existing Navy facilities, but must provide the power to withdraw the water and the means to treat and distribute it. Any water GWA then distributes to the military will be taken in trade for water the Navy distributes to GWA customers located elsewhere on the island.

4. PILOT PROJECT

a. The Tumon Maui Well project provides GWA with an opportunity to demonstrate their ability to operate and maintain DoD owned water treatment facilities and provide sustainable, reliable, compliant and secure potable water generation. Success in the operation of this project will afford Joint Region Marianas several potential benefits which can reinforce the concept of an integrated system to better serve all parties. One benefit is the opportunity for GWA to operate Navy utility assets to produce potable water and deliver it via GWA transmission systems to DoD facilities, specifically the USMC cantonment being constructed at NCTS Finegayan. Another benefit is that with the additional capacity to support GWA customers, GWA will be able to place in standby, four of its existing wells.

(1) Plan of Action and Milestones (POAM). A plan of action and milestones has developed for the transition of operation of the Tumon Maui Well to GWA.

(2) Bi-lateral Use Agreement Documentation. A License Agreement and MOU are required to authorize GWA to operate, maintain and consume water from the Tumon Maui Well. A draft copy of the license with the conditions of agreement was provided by NAVFAC Marianas to GWA on 23 October 2015. The final agreement package will be reviewed and signed by GWA General Manager and NAVFAC Marianas Commanding Officer.

(3) Re-commissioning of the Plant. Because the Tumon Maui Well water treatment plant has not been in operation for over a year, NAVFAC Marianas will make the repairs necessary to get the well operationally compliant to permit standards. GWA operators and maintenance personnel will be engaged during the repair and re-commissioning process to receive hands-on training and gain knowledge and experience with the system equipment.

(4) GWA Staffing Plan. In January 2016, GWA reached an agreement with Guam Environmental Protection Agency (GEPA) to use Level II Certified Water Operators.

(5) Startup and Operational Testing. Prior to official turn-over of the Tumon Maui Well, Navy and GWA will complete a joint inspection and document the condition of the premises as well as compile an inventory of the major items on site.

(6) Connections Between GWA and Navy Water Systems. GWA committed to making the necessary modifications to their delivery system to provide the USMC cantonment site on NCTS Finegayan with an initial supply of a maximum of 210 GPM when required. The water system connection design was developed by GWA, and submitted to the Navy for review and approval.

(7) Water Delivery. The delivery of water to the USMC cantonment will be a water for water trade. The amount GWA delivers to the USMC cantonment will be counted as a credit toward purchases made by GWA from the Navy to provide water service to customers at other locations.

Based On The Representation And Agreement Contained Herein, The Agreed Upon Consideration, The Parties Agreed As Follows:

5. ROLES AND RESPONSIBILITIES.

a. Tumon Maui Well:

(1) GWA:

(a) Pay the initial administrative fee of $4,800 required for the development of the license to NAVFAC Marianas and subsequent annual license fees. The license will be for the period of one year and may be renewed annually for the first five years. The license fee is recurring and must be paid with each renewal.

(b) Provide routine operational preventive maintenance of equipment and replacement of major equipment as required not covered under the manufacturer's warranty as part of the lifecycle of the component.

(c) Provide the Operation and Maintenance Agreement and staffing plan to the Navy for their review and comment. Address issues the Navy may bring up.

(d) Ensure all regulatory permits are kept up to date and current.

(e) Ensure operators working at the site are appropriately certified.

(f) Provide GWA's updated Chlorine Spill Response Plan and Spill Prevention, Control and Countermeasure Plan, to include the chlorine cylinders stored at the site, to the Navy for approval.

(g) Develop and submit to the Navy regular monthly production reports with daily logs, and annual monitoring and performance standards reports.

(h) GWA will record all operational costs and share this data with the Navy for use in possible future rate setting.

(i) Maintain the security of the Tumon Maui Well compound which includes the well, the tunnel, the vent house, and all the property and facilities along Marine Corps Drive and in the area below by the entrance to the tunnel contained within the perimeter of the existing fencing. The property will not be left unsecure for any length of time. GWA will bear any liability for issues relating to security breaches.

(j) Maintain the grass according to Navy requirement between 2 to 12 inches, or less if the GEPA operating permit requires at GWA expense. Any violation of the permit requirement will be the responsibility of GWA.

(k) GWA will not allow the use of any portion of the property in any manner not approved by the Navy.

(l) GWA will not make any modification to the system without prior Navy approval.

(m) Provide up to 210 GPM of potable water, for use at the Marine Corps Cantonment via Potts Junction intertie whenever needed.

(n) Provide open access to the Navy to conduct inspections of the facility.

(2) **Navy:**

(a) Provide GWA a baseline survey of the existing Environmental Condition of the Property (ECP).

(b) Provide GWA with copies of all available as-built drawings, design documents, maintenance records, and so forth related to the facility.

(c) Provide GWA full right of entry to the Tumon Maui Well facility for the duration of the license.

(d) Provide a fully functional and permitted well facility.

(e) Issue a license for the use of the property, to include the facilities and equipment within the specified boundaries.

(f) Allow GWA to operate the Tumon Maui Well system to withdraw water at up to a rate of 800 GPM at GWA expense and for the benefit of GWA customers.

(g) Require the reservation of 210 GPM, potable water, for use at the Marine Corps Cantonment via Potts Junction intertie whenever needed.

(h) Maintain the right to conduct inspections of the facility, and will provide 24-hour courtesy notice to GWA, except in emergencies.

(i) Provide technical support and assistance when requested.

(j) Allow GWA to connect to the existing SCADA system at the facility when GWA's SCADA is operational, provided the existing SCADA units at Tumon Maui Well are compatible with GWA's system.

(k) Assess GWA's operation and maintenance of the system monthly for use in future decision making regarding the Tumon Maui Well.

(3) **Navy and GWA Jointly:**

(a) Perform startup operating and testing of the Tumon Maui Well with NAVFAC Marianas' Base Operating Support (BOS) Contractor, and conduct preliminary dual operation for a period of 60-90 days which includes the 45 days for startup/testing to ensure functionality and understanding of the facility and the equipment in place.

(b) Conduct a joint inspection and inventory assessment to document the condition of the premises after the start up and testing plan is completed; the subsequent Joint Inspection and Inventory Report (JIIR) will be signed by both parties.

(c) Meet quarterly to review and discuss the status of operations and issues related to the operation of the Tumon Maui Well. Within 2 months of the signing of this agreement, the

parties will develop and agree upon the format and the materials to be reviewed during quarterly reviews prior to coming together.

b. Route 3 and Potts Junction Connection:

(1) GWA:

(a) Design, construct, and maintain a water intertie along the federally owned property adjacent to Route 3 and Potts Junction. Provide all material and services to install an appropriate connection valve and lateral line terminating into a fire hydrant, at GWA expense, for future direct connection to Navy's water distribution system. Construction is to be completed during the first year's license.

(b) Install and maintain a meter on the Government of Guam easement adjacent to the federally owned property.

(2) Navy:

(a) Provide and maintain the connection line from the meter to the Navy water system.

(b) Provide and maintain a back flow preventer which meets GWA standards to be placed on DoD property.

The Parties hereby affix signatures of offices duly appointed and authorized to make the commitments contained in this Agreement.

FOR GUAM WATERWORKS AUTHORITY:

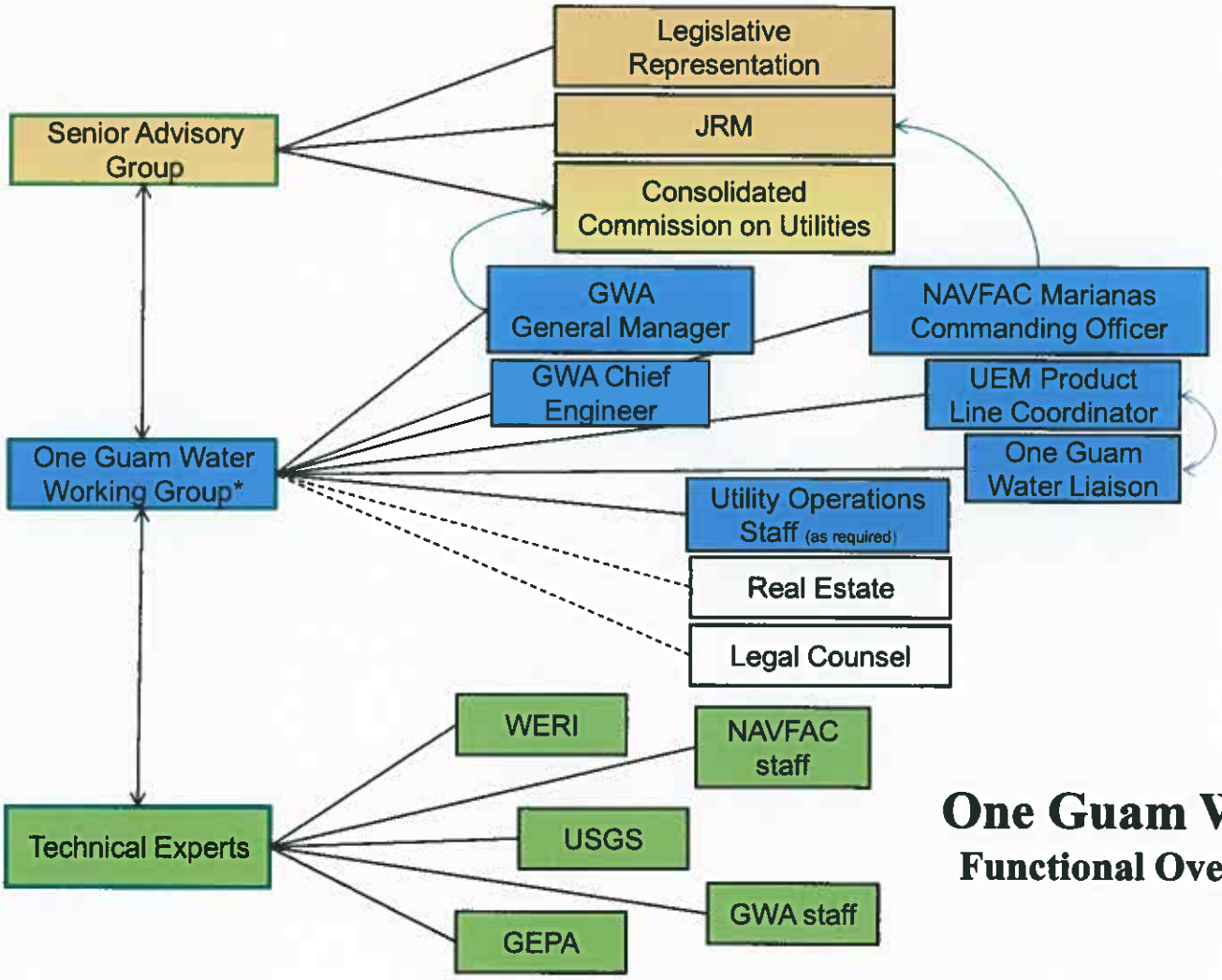
By: _____
Miguel C. Bordallo, P.E.
General Manager

Date: 5.6.16

FOR NAVAL FACILITIES ENGINEERING COMMAND MARIANAS

By: _____
Stephanie M. Jones
Captain, Civil Engineer Corps, U.S. Navy
Commanding Officer

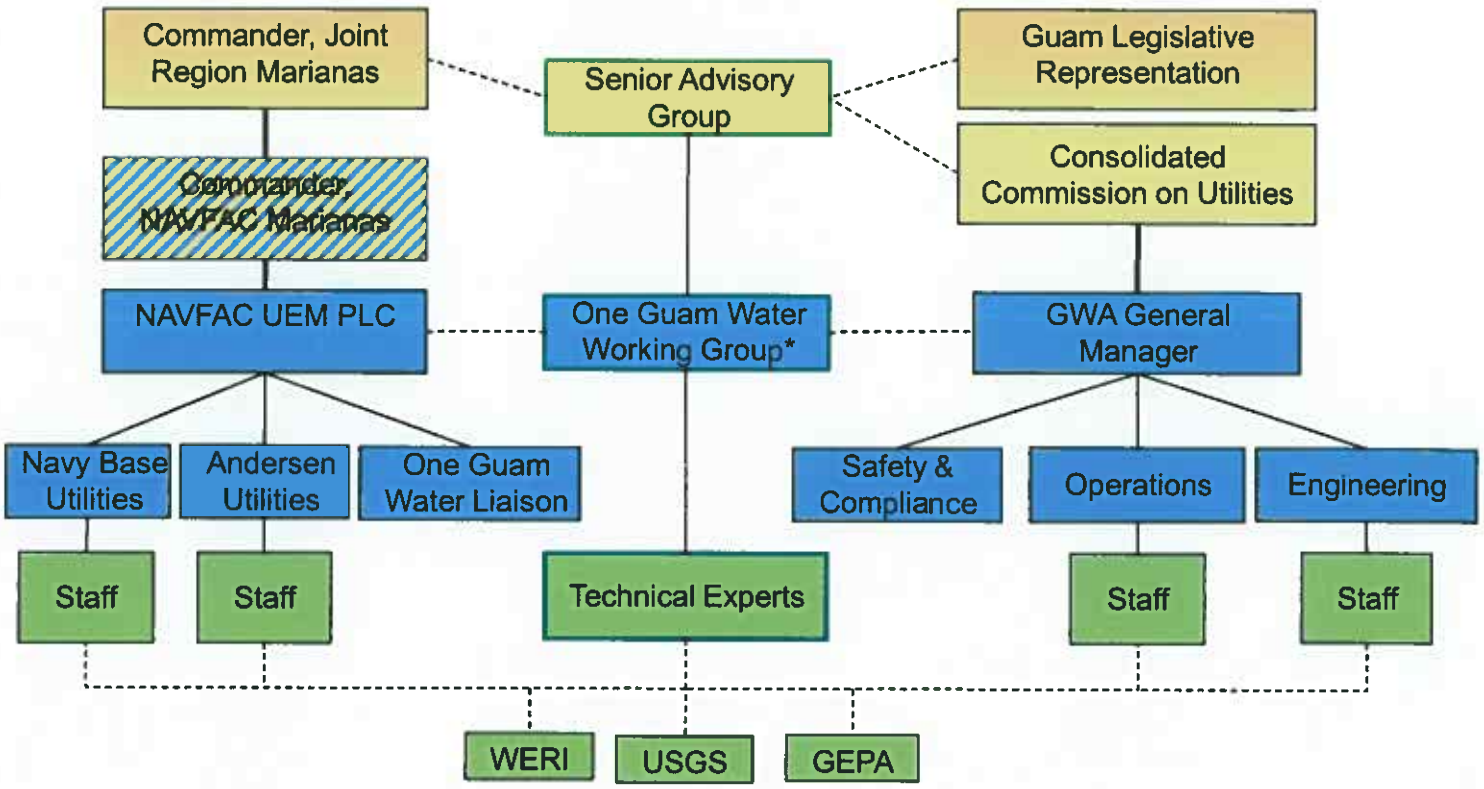
Date: 6 MAY 2016



One Guam Water
Functional Overview

Enclosure (2)

One-Guam Water
Functional Overview



* Note that other subject matter experts not specified above (e.g., Counsel, Real Estate, etc.) from Navy and/or GWA may be called to participate at the working group level as needed.

GUAM WATERWORKS AUTHORITY

Federal Consistency Certification Application
Northern Guam Lens Aquifer Monitoring System Expansion/
Rehabilitation Project

Appendix B

Archaeological Inventory Survey for the Northern Guam Lens Aquifer (NGLA) Monitoring System Expansion/Rehabilitation Project

December 3, 2019

APPENDIX B

FINAL—Archaeological Inventory Survey for the Northern Guam Lens Aquifer (NGLA) Monitoring System Expansion/ Rehabilitation Project, Dededo, Mangilao, and Yigo Municipalities, Guam

Prepared For:

Brown and Caldwell
414 West Soledad Avenue, Suite 602
Hagåtña, Guam 96910

Prepared By:

Cacilie E. Craft, MA, RPA
David Byerly, BA
and
Amanda Sims, BA

Garcia and Associates
146 Hekili Street, Suite 101
Kailua, Hawai‘i 96734

GANDA Report No. 2415-2-2

3 December 2019

ABSTRACT

At the request of Brown and Caldwell and on behalf of the Guam Waterworks Authority and the U.S. Environmental Protection Agency, Garcia and Associates conducted a Phase I Archaeological Inventory Survey for the Northern Guam Lens Aquifer Monitoring System Expansion/ Rehabilitation Project (GWA Project No. S17-001-OEA; RC2019-0035). The archaeological investigation is in support of Section 106 compliance under the National Historic Preservation Act for this federally-funded undertaking. The objective of the archaeological inventory survey was to determine the presence of historic properties within the study area and to evaluate any extant properties for National Register of Historic Places eligibility.

Investigations resulted in a finding of no NRHP-eligible historic properties being present in the Area of Potential Effect. The transect survey and excavation of 12 shovel test pits encountered no cultural or archaeological resources or subsurface cultural deposition. No further archaeological work is recommended for the undertaking based on the extent of prior disturbance evidenced in the APE, shallow limestone soils, and lack of cultural deposition.

TABLE OF CONTENTS

FIGURES

Figures

TABLES

1.0 INTRODUCTION

At the request of Brown and Caldwell and on behalf of the Guam Waterworks Authority (GWA) and the U.S. Environmental Protection Agency (USEPA), Garcia and Associates conducted a Phase I Archaeological Inventory Survey (AIS) for the Northern Guam Lens Aquifer (NGLA) Monitoring System Expansion/ Rehabilitation Project (GWA Project No. S17-001-OEA; RC2019-0035) (Figure 1). The archaeological investigation is in support of Section 106 compliance under the National Historic Preservation Act for this federally-funded undertaking. The objective of the AIS was to determine the presence of historic properties within the study area and to evaluate any extant properties for National Register of Historic Places (NRHP) eligibility.

This document presents the results of the archaeological investigation as well as the theoretical, methodological, and procedural framework that guided its implementation. This includes a review of the survey area's environmental, cultural-historical, and archaeological background, which provides a useful context for interpreting the results of the study as well as its intended research objectives.

1.1 Description of the Undertaking

This project is federally-funded by the Department of Defense, Office of Economic Adjustment (OEA). It is therefore an undertaking as defined in 36 Code of Federal Regulation 800.16(y) and requires compliance with Section 106 of the National Historic Preservation Act of 1966 (as amended). This AIS was conducted to support Section 106 consultation efforts for the undertaking which will be led by the USEPA, who has been designated as the federal action agency representative for the OEA.

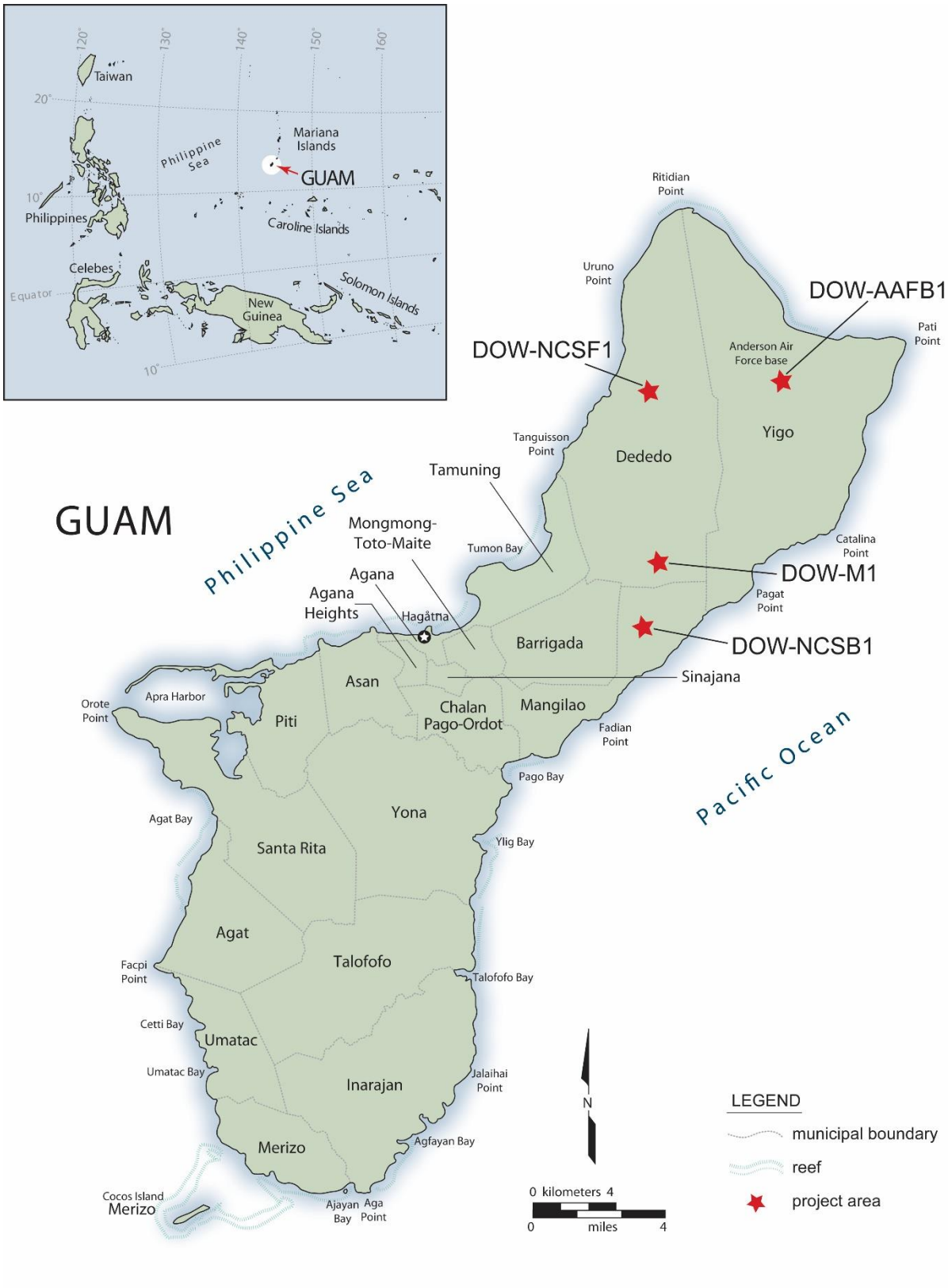


Figure 1. APE within the Western Pacific and the island of Guam.

The proposed undertaking is intended to improve Guam's water-resource management program in response to projected population growth over the next decade and concerns over fresh water level decline and potential for increased salinity in the island's NGLA. The NGLA Monitoring System Expansion/Rehabilitation Project proposes to expand and rehabilitate the NGLA monitoring system by drilling seven new deep monitoring wells and rehabilitating 12 existing monitoring wells on Guam's northern limestone plateau. Per Section 106 consultation between the USEPA and the Guam Historic Resources Division (GHRD) in January 2019 (RC2019-0035, letter dated January 18, 2019, Appendix B), GHRD has "no concerns" with the existing 12 wells to be rehabilitated and two of the seven new wells to be drilled. On June 19, 2019, GHRD issued a statement to the USEPA that investigations were also not required for the DOW-NWF1 well site. Thus, the remaining 4 new wells to be drilled (DOW-AAFB1, DOW-NCSF1, DOW-NCSB1, and DOW-M1) required identification efforts and determination of effect, resulting in this report presenting results of a Phase I AIS of four of these well sites.

1.2 Area of Potential Effect

The Area of Potential Effect (APE) consists of four noncontiguous construction footprints totaling 3,600 square meters (0.36 hectares) distributed across Dededo, Mangilao, and Yigo Municipalities (Figure 2). Each footprint is designated for construction for drilling one of four new water wells. These include new wells DOW-AAFB1, DOW-NCSF1, DOW-NCSB1, and DOW-M1. Each footprint encompasses a 30 by 30-meter area centered on the new well location to allow

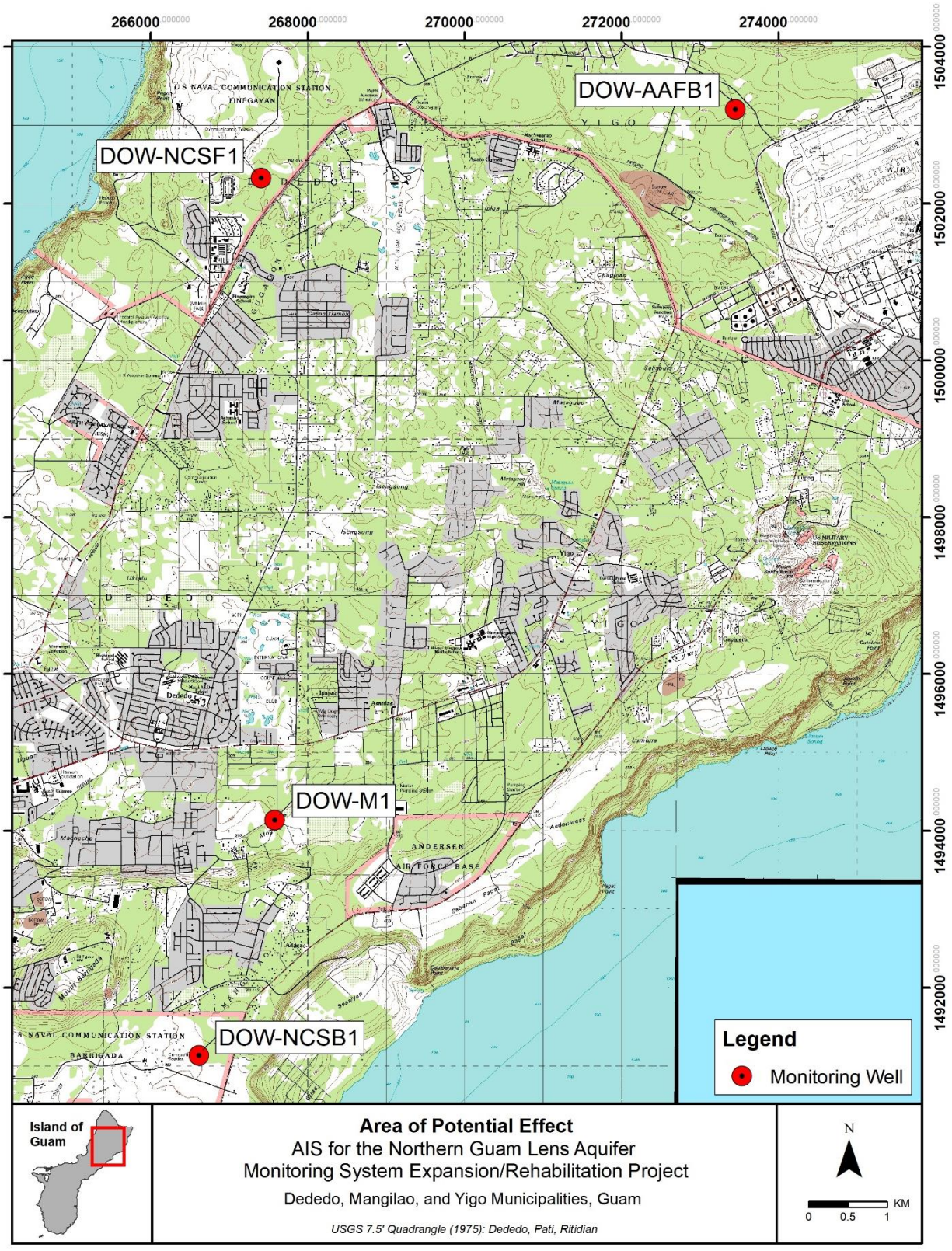


Figure 2. Noncontiguous APE in Dededo, Mangilao, and Yigo Municipalities.

room for construction equipment and laydown areas. DOW-AAFB1 is approximately 700 meters northwest of Perimeter Road along an unnamed utility road on Andersen Air Force Base (AAFB) in Yigo Municipality. DOW-M1 is approximately 500 meters northeast of the southern terminus of Liguan Avenue along an unnamed road on the U.S. Air Force Marianas-Bonin (MARBO) Annex in Dededo Municipality. DOW-NCSB1 is approximately 400 meters west of Route 15 on U.S. Naval Communications Center Radio-Barrigada in Mangilao Municipality. DOW-NCSF1 is approximately 300 meters northwest of Route 3 on U.S. Naval Computer and Telecommunications Station (NCTS) in a utility corridor in Dededo Municipality.

2.0 BACKGROUND

The background information presented below establishes the environmental, historical, and archaeological setting of the study area. This information provides a contextual framework within which cultural resources identified during the archaeological survey can be interpreted and evaluated for significance.

2.1 Environmental Context

Guam is the largest and southernmost island in the Mariana Islands archipelago. Situated at 13 degrees north latitude and 144 degrees east longitude, the island experiences a tropical marine climate that is typically hot and humid throughout the year. Precipitation averages from 216 to 292 centimeters per year with the wet season beginning in July and the dry season beginning from the end of November to the beginning of December (Gingerich 2003:1).

Geologically, Guam is divided into two distinct regions separated by the Pago-Adelup Fault line. The northern half of Guam is a broad undulating uplifted limestone plateau bounded by sea

cliffs, while the southern portion of Guam features rugged volcanic highlands with ravines and protected embayments. The APE is situated on the northern limestone plateau where fresh water resources are limited due to the permeability of the porous limestone.

Soils on the northern plateau of Guam are generally entisols, consisting of poorly-developed soils without B-horizons (Young 1988). These typically very shallow soils developed from the erosion of the limestone plateau and the decomposition of organic matter. Soils classified within the APE consist exclusively of the Guam cobbly clay loam series with 3 to 7 percent slopes (Young 1988) (Figure 3 and Figure 4). This soil series consists of very shallow, well-drained soils that developed from the underlying parent material consisting of porous coralline limestone. Depth to limestone ranges from 5 to 40 centimeters. Permeability of these shallow soils is moderately rapid, runoff is slow, and the hazard of water erosion is slight. This soil series is primarily suited for urban development and grazing. Without extensive landscape alterations, the shallow soil depth and cobbles limit agricultural production.

Vegetation in the APE primarily consists of secondary growth thicket with simple structure and canopy height no more than 4.6 meters (15 feet), consistent with a history of recent disturbance. Dominant trees/shrubs include *tangantangan* (*Leuceana lecocephala*), *lada* (*Morinda citrifolia*), and custard apple (*Annona reticulata*). Native trees/shrubs, such as *pago* (*Hibiscus tiliaceus*), *ahgao* (*Premna serratifolia*), and *chosga* (*Phyllanthus mariannensis*) were observed occasionally. False ratan (*Flagellaria indica*) and the invasive mile-a-minute (*Mikania micrantha*) as well as native and introduced herbs and subshrubs are also encountered.

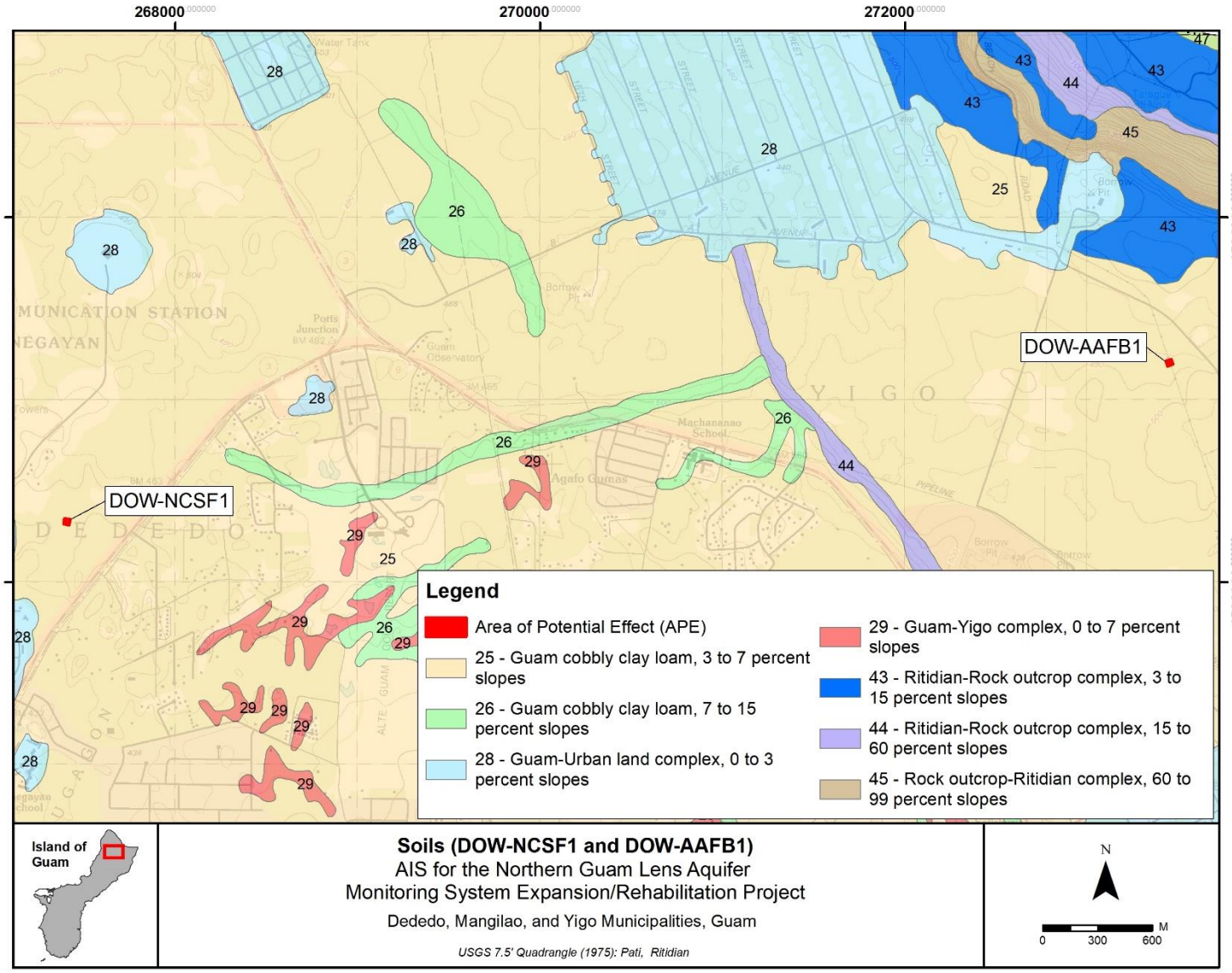


Figure 3. Soils in and around the northern wells.

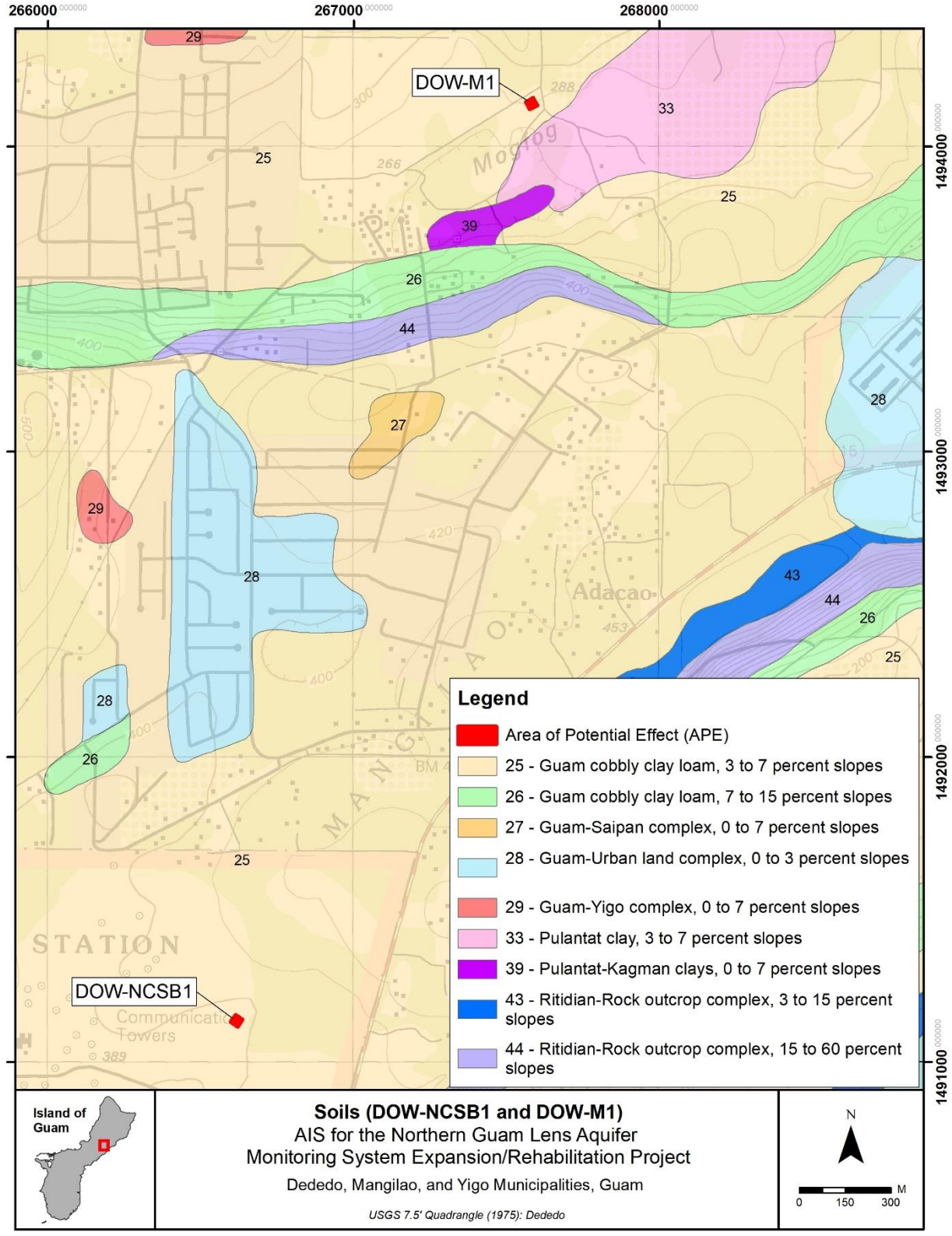


Figure 4. Soils in and around the southern wells.

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, Transitional, and Latte periods. Guam's Historic Era is characterized by increasing influence by colonial powers during the Pre-Colonial European Trade, Spanish Missionization/ CHamoru Spanish Wars, Spanish Colonial, First American Territorial, World War II/ Japanese Military Occupation, Post-World War II/ Second American Territorial, and Organic Act/ Home Rule/Economic Development periods (GHRD 2014). These chronological divisions are used to structure the following overview of Guam's cultural history as it relates to the current APE.

2.2.1 Pre-Latte Period (1500 BCE–500CE) and Transitional Period (500–800 CE)

The Pre-Latte Period, extending from 1500 BCE to 500 CE, can be divided into the Early (1500–1000 BCE), Middle (1000–500 BCE), and Late (500 BCE–500 CE) Pre-Latte periods (GHRD 2014). 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. Habitation sites during the Pre-Latte Period probably consisted of small, nucleated groups of stilt houses near the shoreline as well as caves and rockshelters useful for storm protection (Russell 1998:90–91). The Transitional Period (500–800 CE) is marked by an expansion from coastal sites to the island's interior (potentially including the project region), likely for exploitation of natural resources and fresh water.

The Tarague embayment on the north coast of Guam (Kurashina et al. 1981; Liston 1996) and Huchunao on the east coast of Guam (Dilli et al. 1998) represent the closest known Pre-Latte

habitation centers to the APE at DOW-AAFB1. Transitional Period use and habitation of Guam's north coast has been recorded at Tarague (Guam Historic Properties Inventory [GHPI] Site 66-07-1614) and Pati Point (GHPI Site 66-07-0016) (Tomonari-Tuggle et al. 2003:32). On the island's northwest coast, leeward embayments and smaller coves were occupied or utilized during this period, including Ague Cove and Pugua Point west of the DOW-NCSF1 APE (Hunter-Anderson et al. 2001; Olmo et al. 2000). Tumon Bay, southwest of the DOW-NCSF1 APE, supported extensive coastal habitation during this long period (Graves and Moore 1985). Abutting these coastal environments, the limestone interior (where the APE is situated) presumably did not support Pre-Latte habitation, and yet nearby populations may have exploited its native forest communities for food and other resources.

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. 2011a: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. 2011a; 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. 2011a; Dixon et al. 2012; Liston 1996).

While large populations were residing in and around Tarague and Ritidian on the north coast by this time, archaeological evidence suggests that only small, short-term habitation centers or temporary use sites associated with resource exploitation and agricultural encampments would have been present in the APE or its vicinity. Larger archaeological sites, some with *latte* sets, have been documented in such northern interior areas as Finegayan and Mataguac (southwest of the DOW-AAFB1 APE), which are situated near fresh water sources. However, shallow subsurface cultural deposits recorded at these sites indicate that they were occupied intermittently or for a relatively short duration (Reinman 1977). The DOW-NCSF1 APE'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.

Despite the lack of archaeological evidence for permanent habitation near the DOW-M1 and DOW-NCSB1 APE, the adjacent landmark, Mount Barrigada, is culturally significant for its association with the traditional oral account of Puntan and Fu'una's creation of the island of Guam from Puntan's body. Mount Barrigada is thought to have been created from Puntan's stomach or flank (Griffin et al. 2010:25).

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

The Magellan expedition landed in Guam in 1521, ushering in the Pre-Colonial European Trade Period (1521–1668 CE). Soon thereafter, foreign seafarers anchored in Guam and bartered

with the local population for fresh provisions in exchange for foreign materials, iron being the local favorite. Spain did not formally acknowledge colonial possession of the Mariana Island chain until 1565, the same year the Manila-Acapulco galleon trade made its first stop in the Marianas. The Marianas became a regular stop—weather permitting—for the galleons during their annual trade route, where they would offload provisions, soldiers, and eventually missionaries.

2.2.4 Spanish Missionization Period/ CHamoru Spanish Wars (1668–1700 CE)

Indigenous settlement patterns 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 5). The main village of Agadña (later Agaña, now Hagåtña) and its church are shown, along with several subsidiary and mostly coastal villages. The project APE appears to be situated near Hanum on the east coast and in the general area of an inland trail and the village of Upi in the north.

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 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.

Figure 5. Seventeenth-century Spanish map of Guam designating village names and locations (Le Gobien 1700).

2.2.5 Spanish Colonial Period (1700–1898 CE)

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, CHamoru maintained *lånchos* (ranches) in the island interior. The Spanish government encouraged cattle ranching in the northern interior by offering land grants to CHamoru-Spanish families to establish small ranches on the limestone plateau.

2.2.6 First American Territorial Period (1898–1941)

In 1898, the United States won the Spanish-American War and secured Guam from Spain. The island was put under the jurisdiction of the U.S. Department of the Navy and commanded like a battleship, with over two dozen naval officers acting as governors from 1903 until the Japanese occupation in December 1941 (Rogers 1995:119–120).

The Spanish-CHamoru way of life persisted for the first several years of the early 20th century as naval officers took varying levels of interest in governing the island and bettering the lives of its inhabitants (Rogers 1995:120). The northern region of the island received telephone service during this period through the extension of a line from Agaña. Such improvements likely contributed to intensified utilization of the area. Otherwise, the northern interior, including the APE, remained largely uninhabited during this period, albeit with scattered *lånchos* and copra production plantations. Maps from this period note the traditional place names of Magua, Astobias, Adacao, and Mogfog in the APE vicinity and show road and trail networks traversing the area,

including a trail passing directly east of the DOW-NCSF1 APE, but no farms or ranches are recorded in the APE vicinity (Figure 6 and Figure 7).

2.2.7 World War II/ Japanese Military Occupation Period (1941–1944)

Guam was unfortified in 1941 in compliance with the 1922 Washington Naval Treaty, enabling Japan to easily take possession of the island. Japanese forces, numbering almost 6,000, overtook the capital and other major villages, occupying public buildings and many residences (Rogers 1995:158). Throughout the occupation, the CHamoru population was forced to toil in agricultural fields to feed the influx of troops and administrators and to construct airfields and defensive positions, often with inadequate tools over long, grueling hours.

The APE does not appear to have been occupied or utilized by the Japanese during this period. Military fortification during the Japanese occupation was not extensive in the project region, since Japanese efforts focused on airfields and defenses along the island's southern coasts and Orote Peninsula. In addition to limited military activity in the project area, CHamorus may have accessed the general region during the occupation, as many families permanently relocated to pre-war *lånchos* in an attempt to avoid the Japanese (Blaz 2008). The 1944 U.S. Army map prepared for the subsequent invasion of the island continues to show a trail directly east of the DOW-NCSF1 APE, similar to earlier maps. No *lånchos* are marked within the boundaries of any part of the APE (Figure 8 and Figure 9).

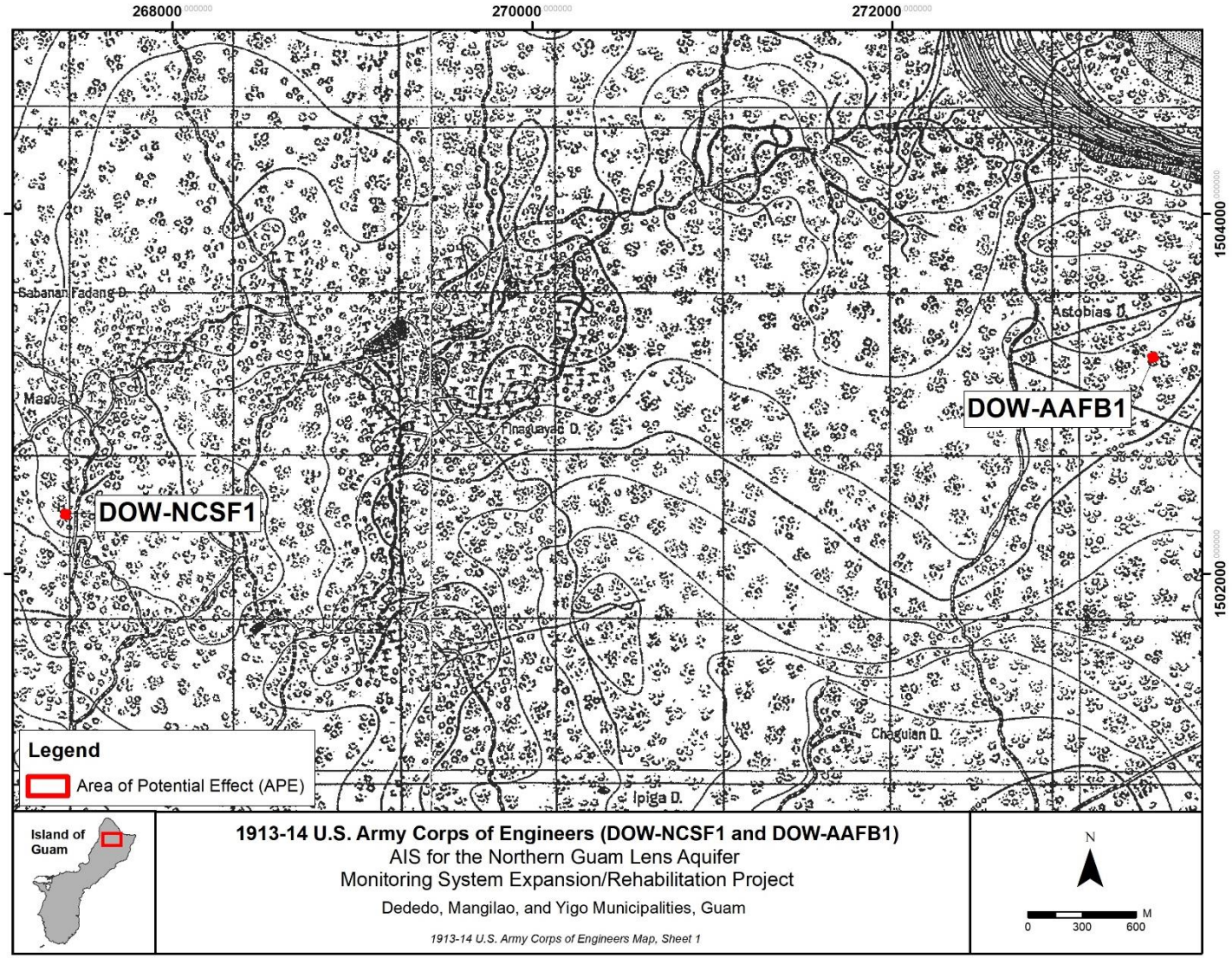


Figure 6. Portion of Army Corps of Engineers 1913–1914 cartographic survey of Guam (on file at MARC) showing northern wells.

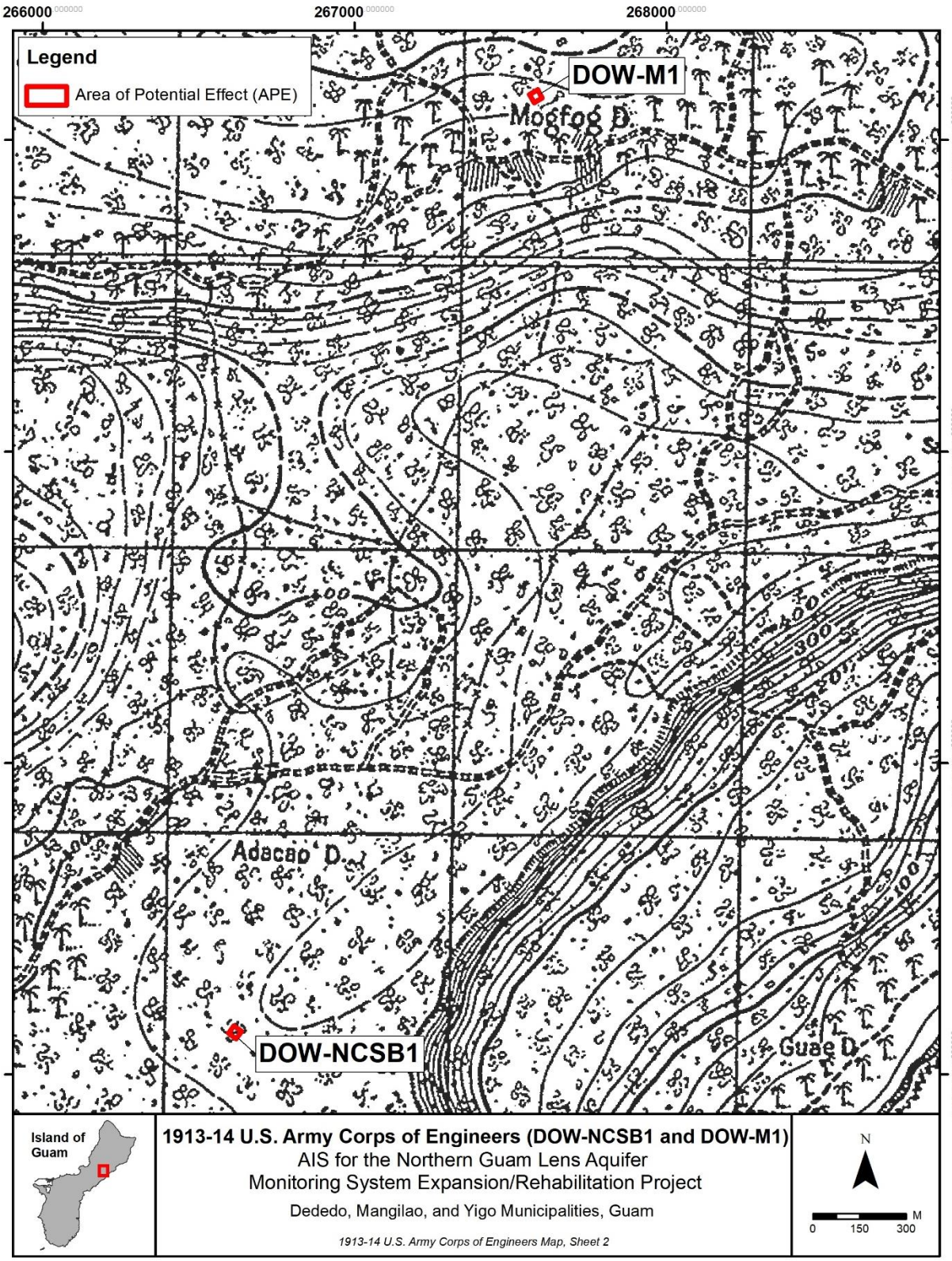


Figure 7. Portion of Army Corps of Engineers 1913–1914 cartographic survey of Guam (on file at MARC) showing southern wells.

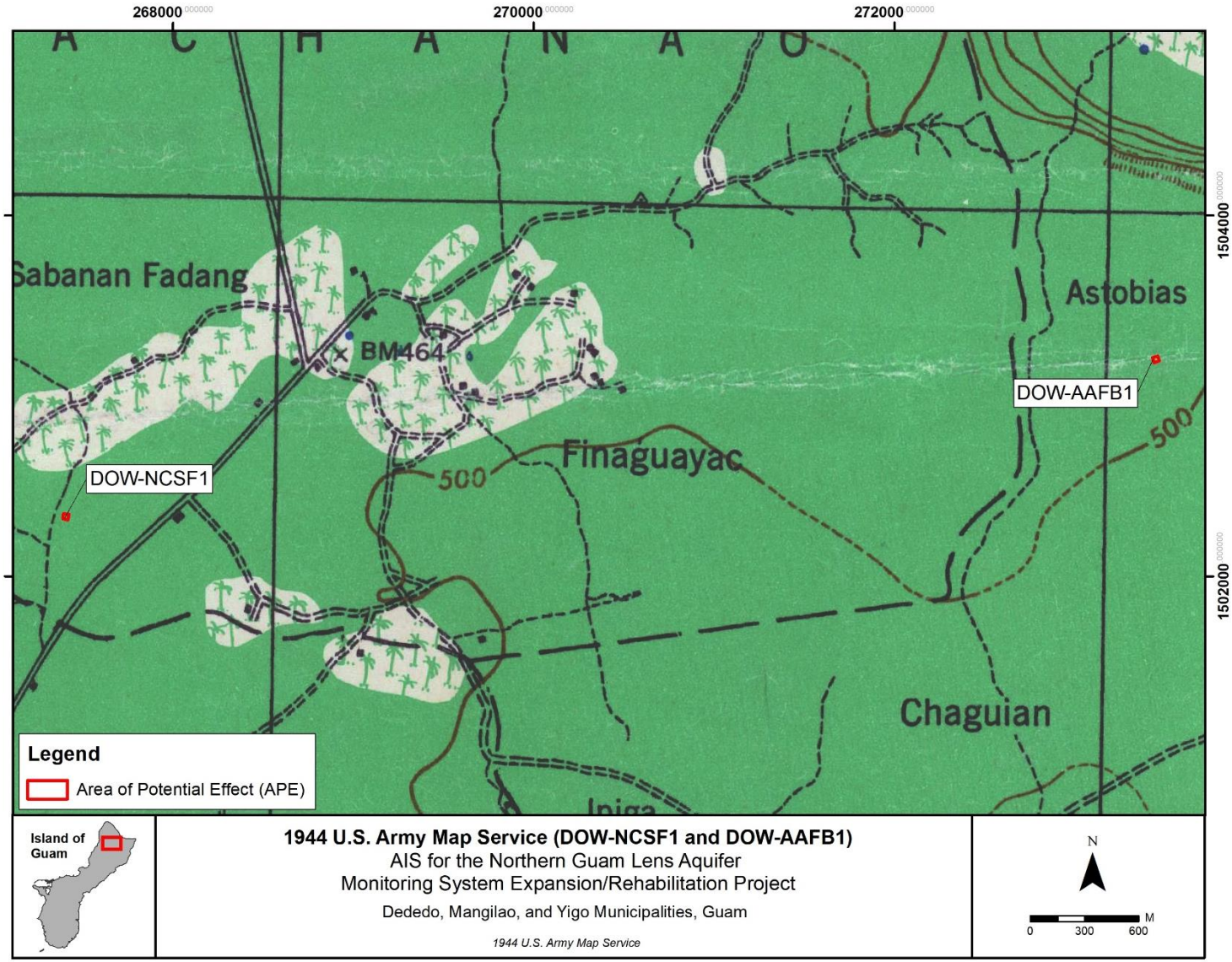


Figure 8. Portion of 1944 Army Map of Island of Guam showing northern wells.

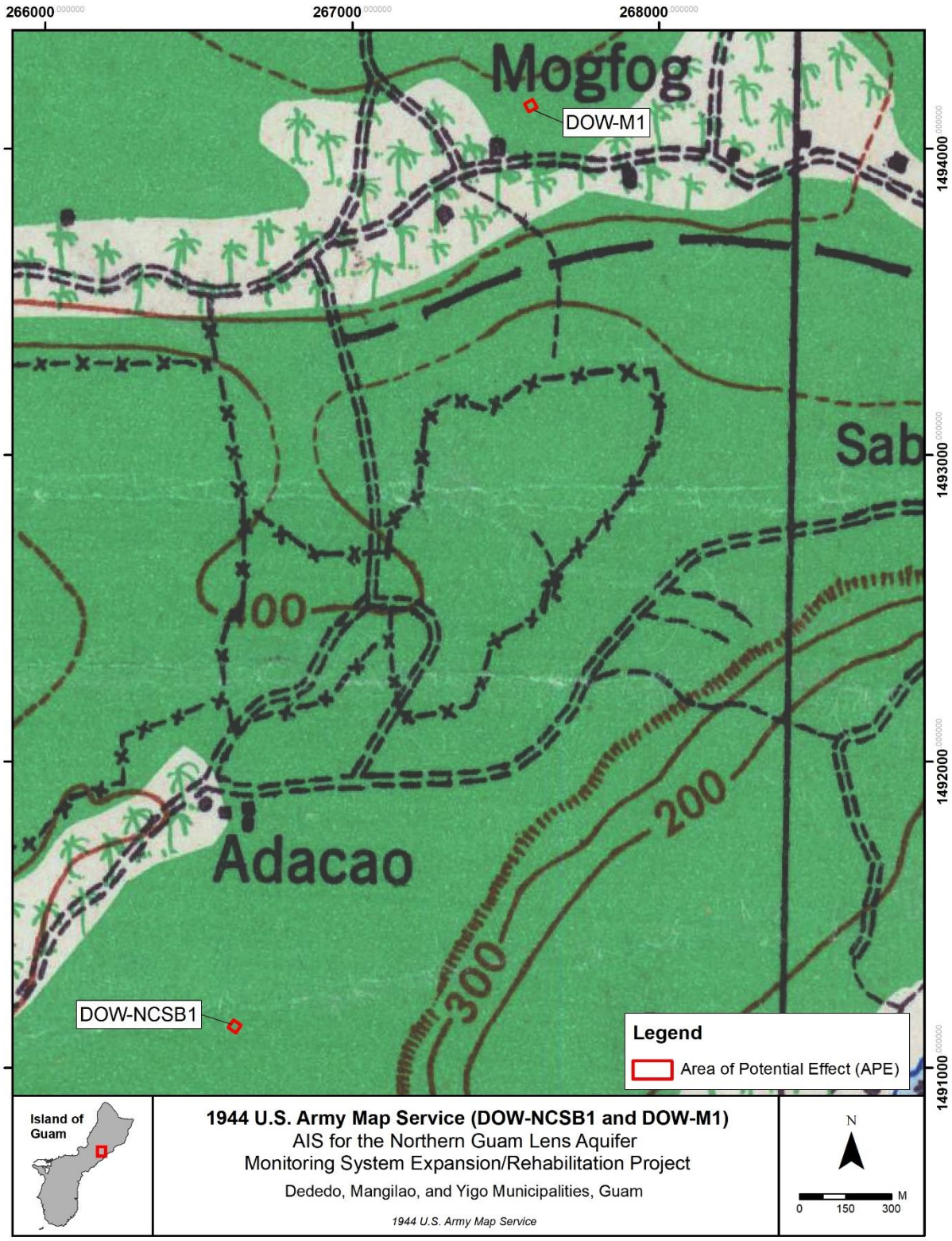


Figure 9. Portion of 1944 Army Map of Island of Guam showing southern wells.

2.2.7.1 Battle of Guam

U.S. troops invaded Asan and Agat beaches on Guam's southwest coast on July 21, 1944. On July 28, after heavy fighting on both sides, U.S. forces joined the northern and southern beachheads. On July 30, General Roy S. Geiger (USMC) ordered his troops to pursue the retreating Japanese Army north. By the first of August 1944, units of the U.S. Army's 77th Infantry Division had pushed Japanese forces as far north as Yigo where they faced Japanese resistance just north of Barrigada village in the approximate area of DOW-M1 and DOW-NCSB1 (Crowl 1993:386). The units fought difficult terrain, dense vegetation, and scattered Japanese resistance through this area from the 3rd to the 6th of August (Crowl 1993:398–417). By the 7th of August, U.S. troops were sweeping through the region near DOW-AAFB1 on their way north to secure the island. Japanese forces had set up their final defensive line in this area from Mount Mataguac to Mount Santa Rosa. U.S. forces engaged and succeeded against the last Japanese strongholds on the island at Mount Santa Rosa on August 8th and at Lt. General Obata's Mataguac Hill command post on August 11th (Crowl 1993:436).

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 10th. The remaining Japanese forces, numbering more than 9,000, were dispersed and unorganized within the jungles of Guam, necessitating extensive reconnaissance operations long after the island was declared secure.

2.2.8 Post-World War II/ 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. The United States' goal of securing the Mariana Islands was fully realized with the construction of specialized airfields to support long-range, high-altitude bombers, known as the B-29 Superfortress, which were commanded by the XXI Bomber Command. The unique capability of the Superfortress allowed for air strikes on the Japanese home islands. Two of these new airfields were constructed in northern Guam: North Field (now known as AAFB) and Northwest Field. Naval aerial imagery from 1949 shows the edge of North Field to the southeast of DOW-AAFB1 and the buildings of the 1864th Army Engineer Aviation Battalion to the west (Figure 10). The location of DOW-AAFB1 is situated directly adjacent to a military access road.

Other facilities constructed during this time include the MARBO Annex near Barrigada and the NCTS in northwest Guam. The MARBO Annex, which included the 204th Army hospital, roads, and other infrastructure, is visible in 1949 naval aerial imagery just north of DOW-M1 (Figure 11). The location of DOW-M1 is located directly adjacent to a road and appears to have been cleared of vegetation around this time. The NCTS can be seen on 1949 naval aerial imagery northwest of DOW-NCSF1 (Figure 12). This location appears to be adjacent to a jeep trail or unimproved road. Minimal vegetation clearance is evident, possibly related to a copra plantation.

A large swathe of Barrigada village, where CHamoru families from Hagåtña had established ranches before the war, was taken over by the Navy for the establishment of a radio transmission station, initially known as Radio Barrigada and now the Naval Communications Center Radio-Barrigada. The radio base was comprised of temporary facilities in Quonset huts surrounded by

Figure 10. Portion of 1949 U.S. Navy aerial photograph showing DOW-AAFB1 APE.

Figure 11. Portion of 1949 U.S. Navy aerial photograph showing DOW-M1 APE.

Figure 12. Portion of 1949 U.S. Navy aerial photograph showing DOW-NCSF1 APE.

bracketed antenna equipment. The edge of the radio station can be seen to the west of DOW-NCSB1 in a 1949 naval aerial image (Figure 13). This area witnessed extensive land clearance during development of the radio station and its extensive antenna array.

2.2.9 Organic Act/ Home Rule/ Economic Development Period (1950–Present)

Since 1950, the APE has been left largely abandoned albeit with several nearby access points and roads. DOW-AAFB1 has the same roads today as in the previous period but the infrastructure to the west has been removed. DOW-M1 has the most dramatic change with the removal of the MARBO Annex north of the APE. DOW-NCSB1 and DOW-NCSF1 are similar with the remains of naval telecommunications infrastructure still visible in the area.

2.3 Archaeological Context

Eight archaeological studies have been conducted within a 0.25-mile/0.4-kilometer radius of the four well locations: Kurashina et al. (1988), Amesbury and Moore (1989), Olmo et al. (2000), Grant et al. (2007), Athens (2009), Welch (2010), and Dixon et al. (2011b, 2015) (Figure 14–Figure 17; Table 1). Five of these studies yielded an absence of historic properties, while the other three studies documented potential cultural or historical resources. The studies and their findings are discussed below.

Grant et al. (2007) conducted archaeological and architectural cultural resource inventories and shovel testing of the approximately 85-hectare (210-acre) Intelligence, Surveillance, Reconnaissance and Strike Capability study area northwest of AAFB. A portion of this survey is located northeast of the DOW-AAFB1 APE (Figure 14). Overall, the study recorded 20 prehistoric

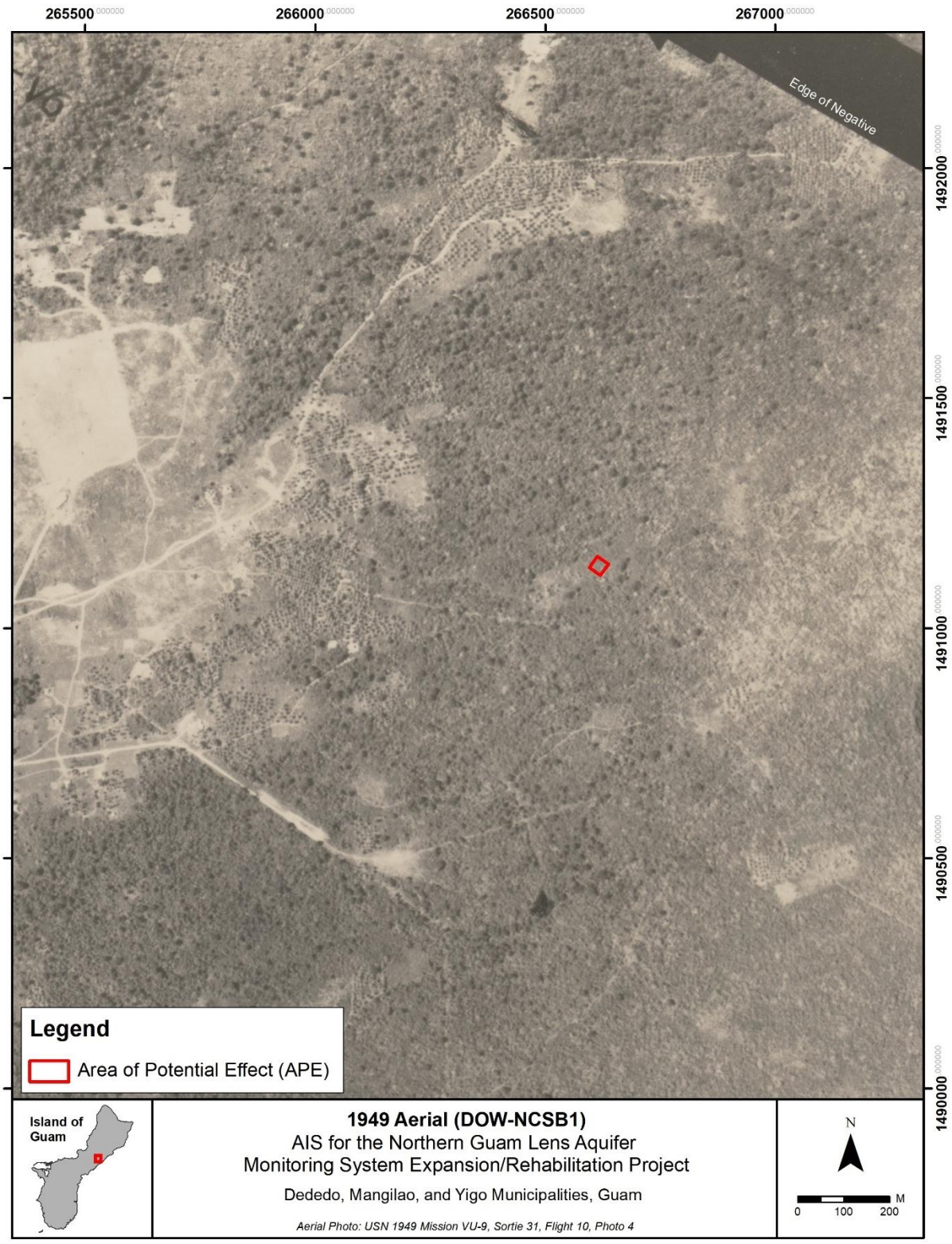


Figure 13. Portion of 1949 U.S. Navy aerial photograph showing DOW-NCSB1 APE.

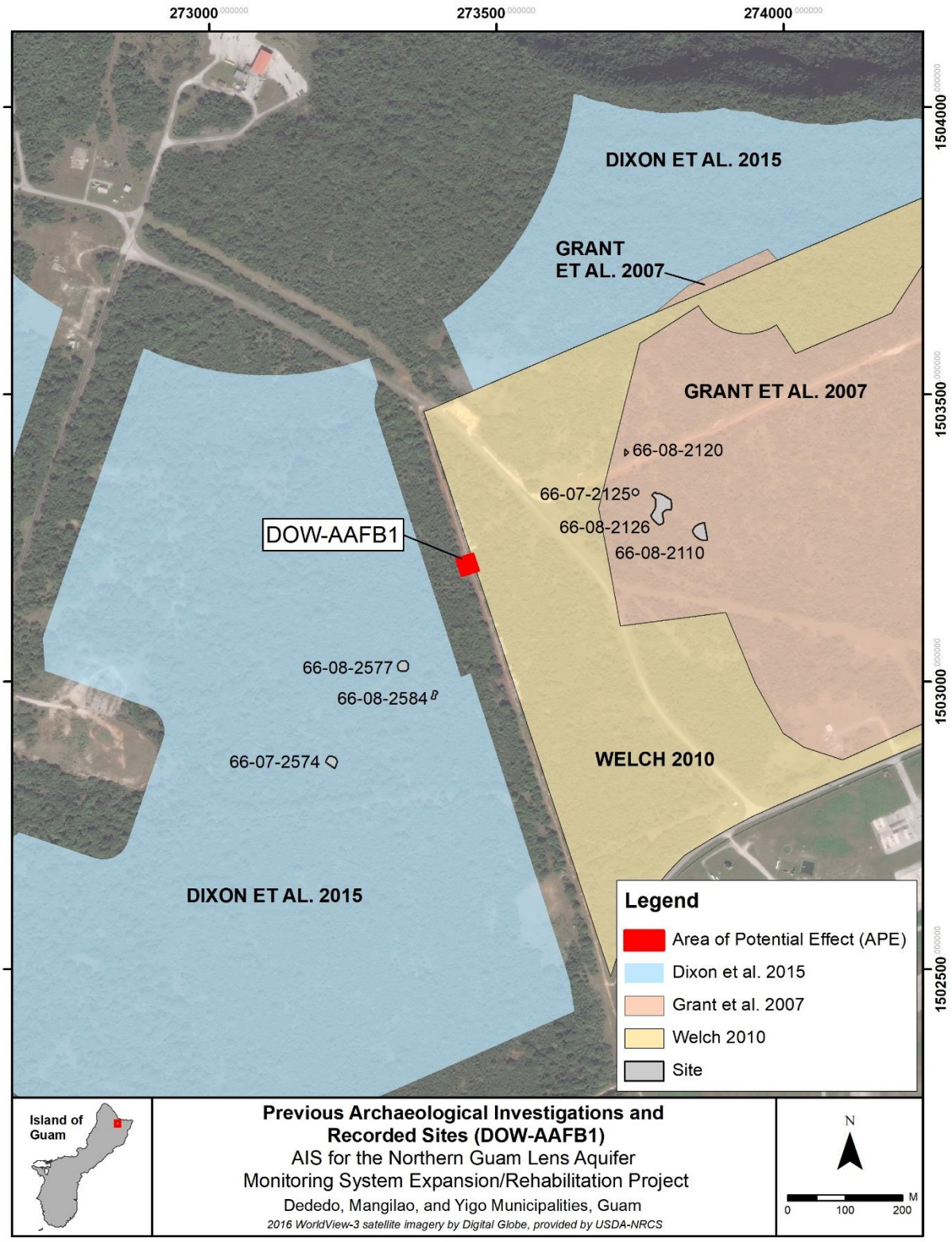


Figure 14. Previous archaeological investigations and recorded sites in DOW-AAFB1 APE vicinity.

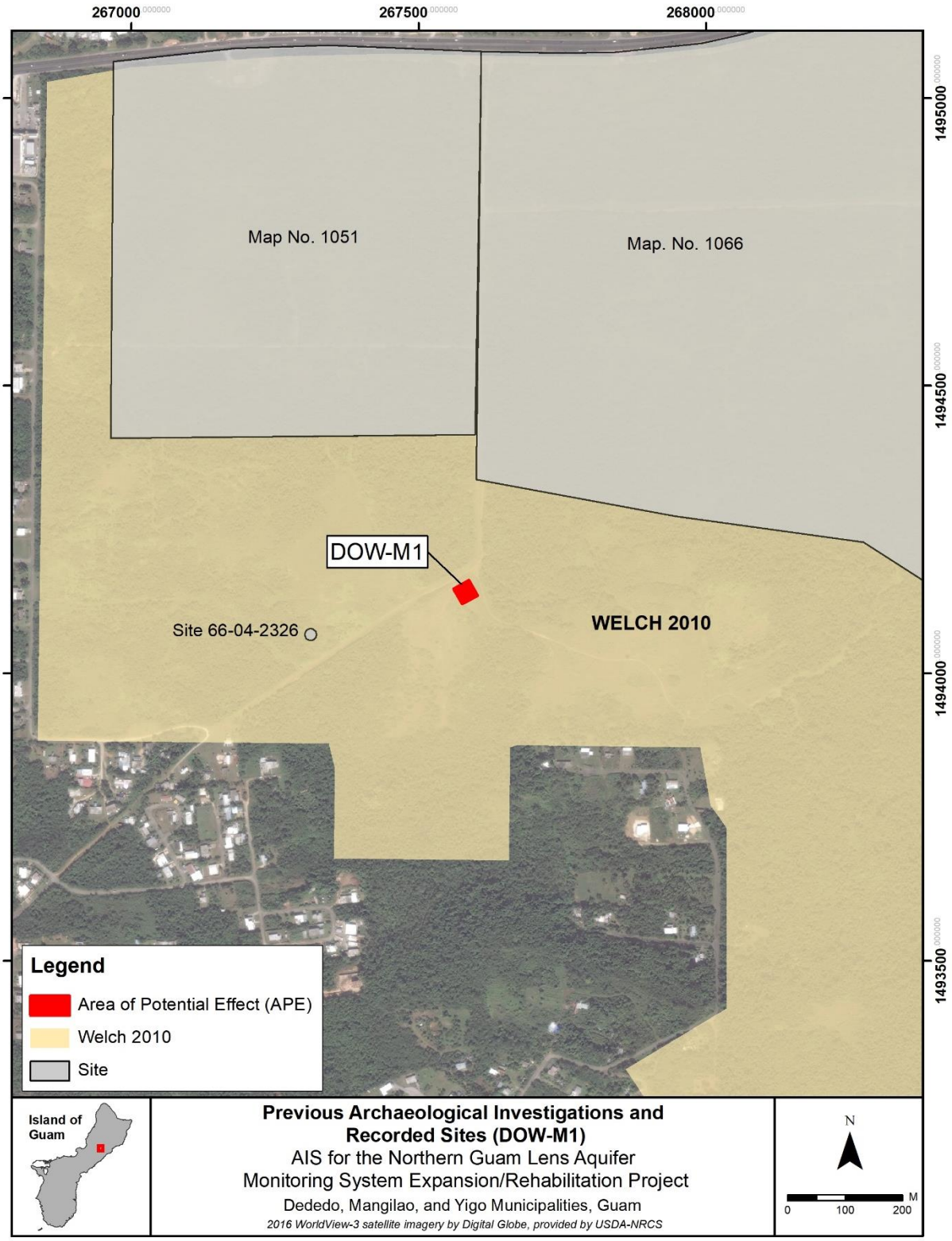


Figure 15. Previous archaeological investigations and recorded sites in DOW-M1 APE vicinity.

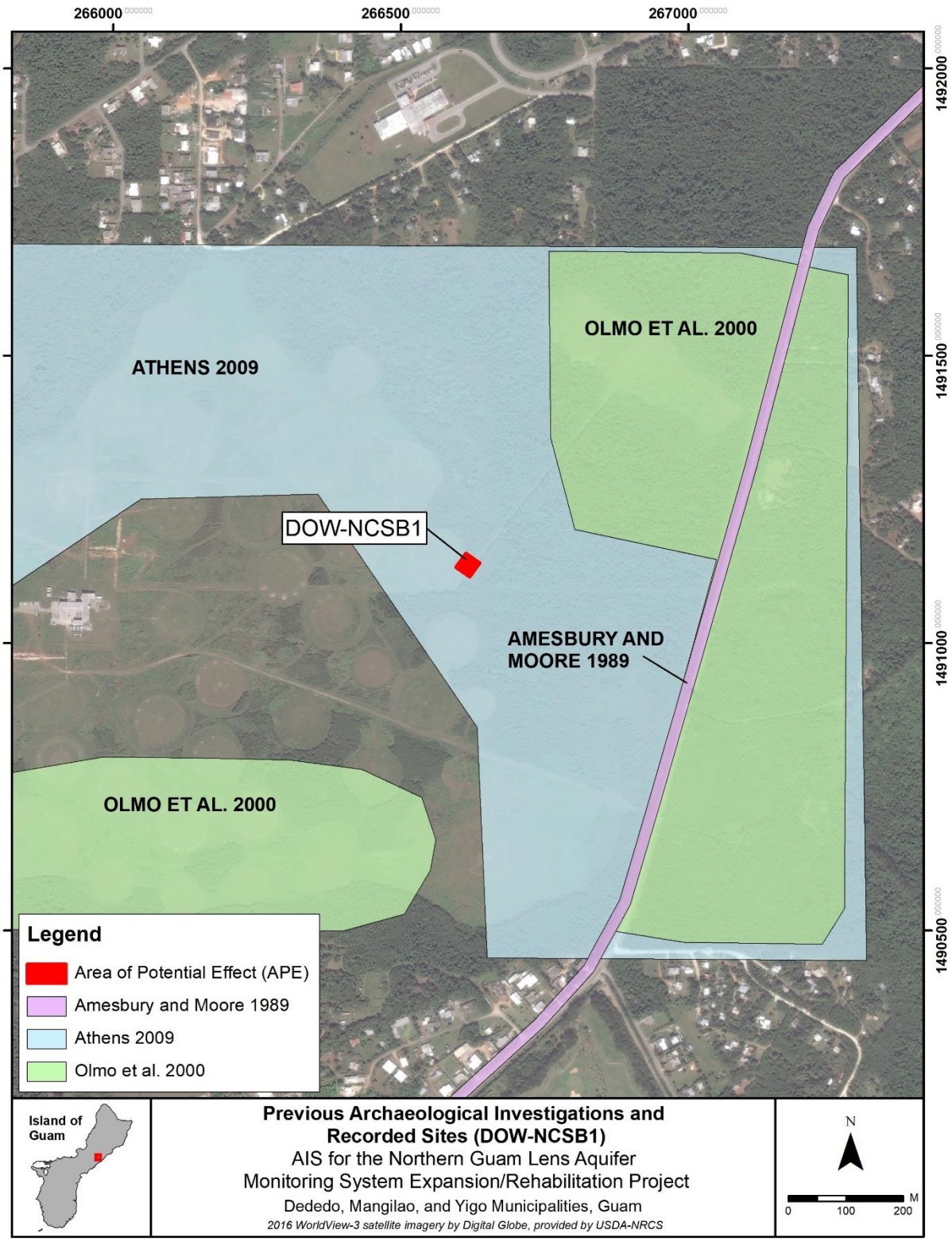


Figure 16. Previous archaeological investigations and recorded sites in DOW-NCSB1 APE vicinity.

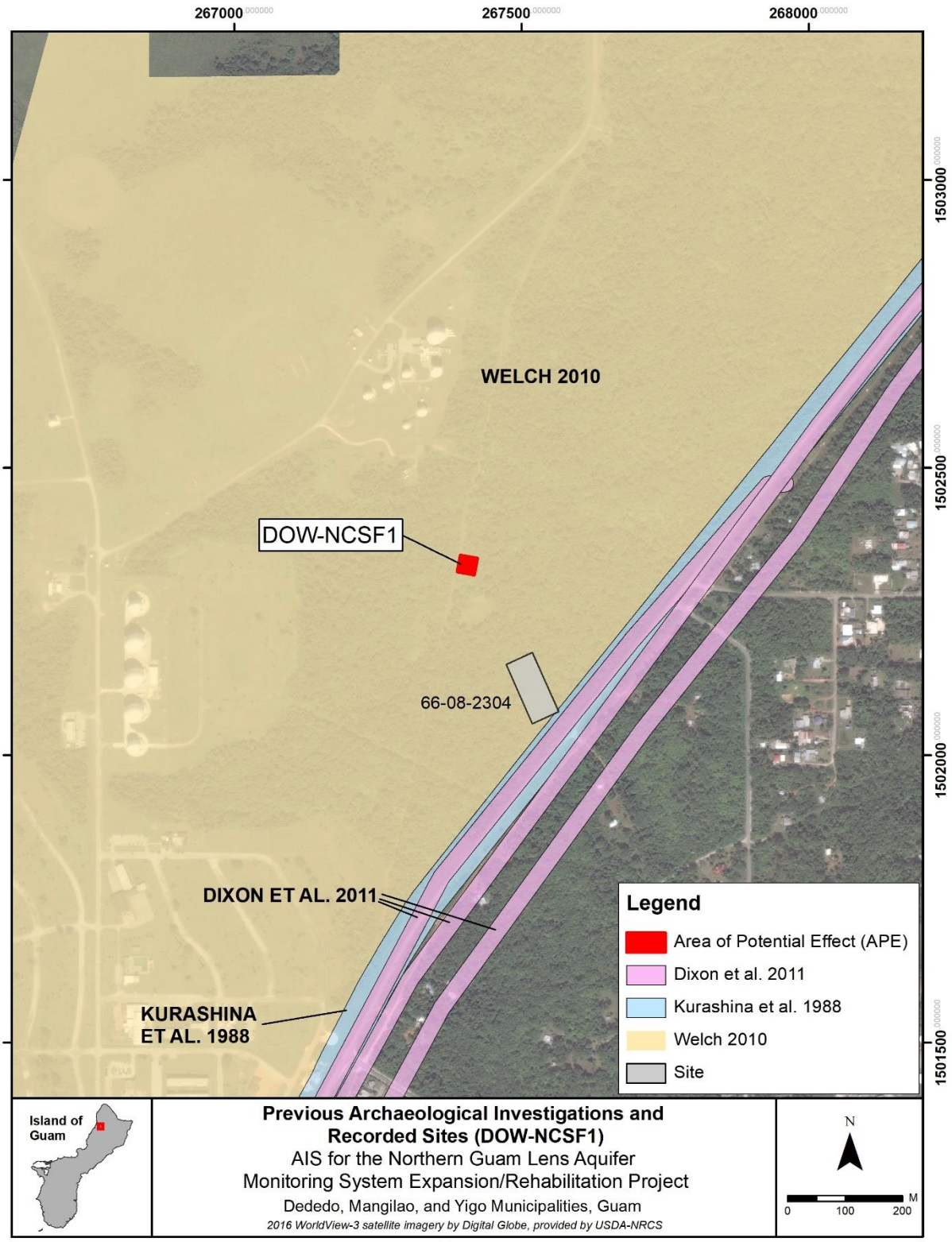


Figure 17. Previous archaeological investigations and recorded sites in DOW-NCSF1 APE vicinity.

Table 1. Previous Archaeological Investigations Conducted within 0.25 mile of APE

Well No. (DOW-)	*Reference*	*Study Type*	*Findings*
AAFB1	Grant et al. 2007	Inventory survey	One Latte Period artifact scatter (GHPI 66-08-2110) and three Latte Period ceramic scatters (GHPI 66-08-2120, 66-07-2125, and 66-08-2126).
	Welch 2010	Inventory survey	No Findings within 0.25 mile/0.4 kilometer of the APE.
	Dixon et al. 2015	Inventory survey	Two Latte Period artifact scatters (GHPI 66-07-2574 and 66-08-2584) and three Post-World War II concrete foundations (GHPI 66-08-2577).
M1	Welch 2010	Inventory survey	One World War II concrete building (GHPI 66-04-2326), World War II/ Post-World War II Army hospital concrete foundation complex (Map. No. 1051), and World War II/ Post-World War II MARBO installation infrastructure (Map No. 1066).
NCSB1	Amesbury and Moore 1989	Archaeological assessment	No Findings within 0.25 mile/0.4 kilometer of the APE.
	Olmo et al. 2000	Inventory survey	No Findings within 0.25 mile/0.4 kilometer of the APE.
	Athens 2009	Inventory survey	No Findings within 0.25 mile/0.4 kilometer of the APE.
NCSF1	Kurashina et al. 1988	Inventory survey	No Findings within 0.25 mile/0.4 kilometer of the APE.
	Welch 2010	Inventory survey	One World War II encampment (GHPI 66-08-2304).
	Dixon et al. 2011b	Inventory survey	No Findings within 0.25 mile/0.4 kilometer of the APE.

sites, four historic sites, and one multi-component site. Four of these sites were recorded within 0.25 mile of DOW-AAFB1 APE: one Latte Period artifact scatter (GHPI 66-08-2110) and three Latte Period ceramic scatters (GHPI 66-08-2120, 66-07-2125, and 66-08-2126). These sites were considered ineligible for NRHP as they lacked integrity of association (Grant et al. 2007:210).

As part of the 2007 fieldwork for the proposed Joint Guam Build-up, Welch (2010) conducted archaeological survey of previously unsurveyed areas at NCTS Finegayan, the GLUP 77 parcel, the new magazines area at Ordnance Annex, AAFB Main Base, Potts Junction Fuel Tank Farm, and Andersen South. Thirty-four new sites were recorded during this fieldwork: 22 prehistoric and 12 historic. In addition to this survey, Welch (2010) conducted field verification of 46 known archaeological sites as well as archaeological testing, and archival research. DOW-M1 and DOW-NCSF1 are within the Welch (2010) survey area and DOW-AAFB1 is located on the western edge of this survey (Figure 14, Figure 15, and Figure 17). Three sites were recorded within 0.25 mile of DOW-M1 APE: one World War II concrete building (GHPI 66-04-2326), a World War II/ Post-World War II Army hospital concrete foundation complex (Map. No. 1051), and World War II/ Post-World War II MARBO installation infrastructure (Map No. 1066). One site was recorded within 0.25 mile of the DOW-NCSF1 APE: a World War II encampment consisting of four artifact scatters (GHPI 66-08-2304). GHPI 66-04-2326 lacked enough information to recommend it as NRHP-eligible, and further archival and oral history research by an architectural historian was recommended to determine the function and importance of the building (Welch 2010: 324). GHPI 66-08-2304 and Map. Nos. 1051 and 1066 were recommended ineligible for nomination to the NRHP (Welch 2010: 351, 357).

Dixon et al. (2015) conducted archaeological surveys and architectural inventories of previously unsurveyed areas for the Guam and Commonwealth of the Northern Mariana Islands Military Relocation 2012 Roadmap Adjustments Supplemental Environmental Impact Statement, including those areas associated with the Live-Fire Training Range Complex, access routes, utility corridors, and Main Cantonment/Housing alternatives. DOW-AAFB1 is located between two Dixon et al. (2015) survey areas, one to the west and one to the northeast (Figure 14). A total of 107 new sites were recorded: 51 prehistoric and 56 historic. Three of these sites were recorded within 0.25 miles of DOW-AAFB1 APE: two Latte Period artifact scatters (GHPI 66-07-2574 and 66-08-2584) and three Post-World War II concrete foundations (GHPI 66-08-2577). All three sites were recommended ineligible for nomination to the NRHP (Dixon et al. 2015: 4-142, 4-143).

The remaining five surveys yielded an absence of historic properties within 0.25 miles of the four well locations. These include Kurashina et al. (1988), Amesbury and Moore (1989), Olmo et al. (2000), Athens (2009), and Dixon et al. (2011b). Kurashina et al. (1988) conducted an archaeological survey along a 5.8-mile stretch of Route 3 in Dededo Municipality; a portion of this survey is located southeast of the DOW-NCSF1 APE (Figure 17). The investigation yielded widespread evidence of Post-World War II and recent disturbance, including rubble piles, newly installed concrete power poles, and monuments indicating the presence of buried utility lines. No previously documented or newly recorded sites were encountered within this survey area.

Amesbury and Moore (1989) conducted an archaeological assessment along an 8.6-mile length of a proposed waterline corridor along Routes 4 and 15 and Dairy Road; a portion of this survey is located southeast of the DOW-NCSB1 APE (Figure 16). The entire project area appeared

to have been graded. Two previously unrecorded sites were documented outside of the project corridor: a *latte* set and a Latte Period pottery scatter (Amesbury and Moore 1989: 38).

Olmo et al. (2000) conducted an archaeological survey and detailed recording of three separate properties totaling 2,205 hectares (5,446.6 acres) of the Commander, U.S. Naval Forces Marianas Communications Annex; a portion of this survey is located on either side of the DOW-NCSB1 APE (Figure 16). Twenty-six sites identified during the project were evaluated for listing on the NRHP: thirteen rock shelters, three *latte* sites, two artifact scatters, two sinkholes, a wall, a roughly constructed enclosure, and four World War II sites. Of these, one was recommended as eligible for listing for the NRHP under Criterion C, two were recommended as eligible under Criteria C and D, eighteen were recommended as eligible under Criterion D, and five were recommended not eligible (Olmo et al. 2000: 214). None of these sites are in the APE vicinity.

Athens (2009) conducted archaeological inventory survey and subsurface test excavations on various parcels on Guam administered by the U.S. Navy and Air Force for the Joint Guam Build-Up; DOW-NCSB1 APE is located within a portion of this survey (Figure 16). Most of the survey areas were found to be heavily disturbed. Numerous prehistoric and historic sites were identified and evaluated for listing on the NRHP (Athens 2009). None of these sites are in the APE vicinity.

Dixon et al. (2011b) conducted archaeological surveys of various parcels in AAFB and along non-Department of Defense highways in northern Guam for the Joint Guam Build-Up; a portion of this survey is located southeast of the DOW-NCSF1 APE (Figure 17). A total of 50 archaeological sites were recorded within AAFB: 30 Latte Period sites, one multicomponent site, and 19 World War II or Cold War facilities. All Latte Period sites and the multicomponent site are recommended as eligible for listing on the NRHP and the historic sites are recommended as not

eligible for listing on the NRHP (Dixon et al. 2011b: 4-65). None of these sites are in the APE vicinity.

2.3.1 Archaeological Expectations

Although Pre-Contact artifact and pottery scatters are recorded in the vicinity of the APE (GHPI 66-082584, 66-072125, 66-08-2126, and 66-08-2110), there is a low to medium potential for encountering such deposits within the current APE. Historical aerial imagery indicates that all but one of the well footprints (DOW-AAFB1) has undergone some level of prior land clearance since the World War II Period, with the DOW-NCSB1 APE having undergone the most extensive land modification associated with development of the adjacent telecommunications station. Due to the extent of previous disturbance in this area particularly, it likely that only re-deposited resources void of their original context would be encountered, which would have limited research potential. The DOW-AAFB1 APE appears to have witnessed the least amount of direct disturbance since the World War II Period and thus may have a higher potential of yielding cultural or historic resources.

There are no recorded pre-war *lånchos* in the APE or its direct vicinity, although even if present at one time, prior land clearance has likely also impacted evidence associated with pre-war ranching and other activities. However, minimal vegetation clearance visible on historic aerial imagery for the NCSF1 APE may indicate the presence of a small, isolated copra plantation.

World War II to Post-World War II infrastructure has also been encountered in the APE vicinity. There may be a higher potential for encountering historic military infrastructure or isolated material associated with military activity within the proposed well footprints. Resource

types may include remnant concrete foundations, military paraphernalia, and historic glass beverage bottles.

3.0 PROJECT DESIGN

Archaeological investigations for the APE involved three primary work tasks:

- Preparation of research objectives based on historical research, previous archaeological investigations, and the environmental context of the project area.
- Determination of presence or absence of historic properties in the APE.
- Preparation of archaeological recommendations for the APE and production of a technical report.

Research objectives and methods and protocols followed during archaeological investigations are detailed in the following sections.

3.1 Research Objectives

The primary research goal for the current investigation was to identify whether NRHP-eligible historic properties exist within the APE, per Section 106 of the National Historic Preservation Act. Beyond this, research objectives were developed to investigate specific topics during the archaeological investigation. Questions were formulated based on traditional settlement patterns, previous land use history, and a review of historical documents and previous archaeological reports. The following research questions were intended to provide insight into how extensively

the project area may have been utilized in the Pre-Contact to late Historic eras as well as how late historic to modern land use may have impacted this utilization.

1. Is there evidence of Pre-Contact activity in the APE, and if so, what is the nature or extent of this activity and what can it tell us about Pre-Contact land use in general within the interior northern plateau?

The APE's proximity to Pre-Contact coastal habitation centers below the limestone plateau indicates that brief or intermittent use sites represented by pottery and artifact scatters may have once been present within the APE. Dryland agricultural features, as encountered in other upland areas in the Marianas (Dixon et al. 2011a; Dixon et al. 2012; Moore 2005), may also have once been present within the APE. Such features have the potential 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.

2. To what extent have historic land use practices and modern activity removed evidence of Pre-Contact land use within the project area?

U.S. Navy aerial photography indicates that late historic land clearing activities encroached into the APE and its immediate vicinity in the Pre-World War II to Post-World War II periods. This type of activity would have greatly impacted if not obliterated historic properties that may have been present before that period. The current investigation searched for evidence of prior disturbance to ascertain whether this activity may have affected the potential for encountering pre-war cultural or historic resources and its effect on the answer to Research Question No. 1 above.

3.2 Field Methods

Archaeological fieldwork included a pedestrian survey and subsurface testing to determine the presence or absence of historic properties in the APE. The survey included pedestrian transects spaced at approximately 5 meters (depending on vegetation and terrain) to inspect the ground surface for the presence of cultural resources in the form of artifacts, surface structures, and cultural material. Any cultural resources encountered during the survey were to be 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) and a digital camera (5-megapixels or higher). All photographs were taken with a photograph board, scale, and north arrow, as appropriate (e.g., landscape photos may not include a photograph board but will include a scale or scale references).

Subsurface testing included the excavation of three 50- by 50-centimeter shovel test pits within each of the four new well footprints, for a total of twelve test pits. Shovel tests were systematically distributed throughout the APE to determine the presence or absence 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.

4.0 RESULTS

Results of the AIS indicate there are no National Register of Historic Places-eligible historic properties present in the APE. No archaeological or cultural resources were encountered during archaeological investigations at each of the four proposed water well locations (DOW-AAFB1, DOW-M1, DOW-NCSB1, and DOW-NCSF1). Subsurface testing produced no evidence of subsurface cultural deposition. Although results for each well location are slightly redundant, they are presented individually, per each well location, below.

4.1 DOW-AAFB1 Survey Results

No archaeological or cultural resources were encountered during archaeological investigations at DOW-AAFB1 (Figure 18). DOW-AAFB1 is situated on a utility corridor and access road which extend through an otherwise undeveloped portion of Andersen AFB (Figure 19). This utility corridor extends southeast off an unnamed perimeter road—this is the first left after passing through the Andersen AFB access gate for contractors and commercial services. The transect survey covered 100 percent of the 30 by 30-meter APE. Survey transects were oriented 70 degrees east-northeast by 250 degrees west-southwest. Roughly 30 percent of the survey area consists of a minimally vegetated (e.g., grass and other ground cover), cut and graded surface associated with utility corridor construction. The remaining 70 percent is fairly level and vegetated in a *tangantangan* thicket with a relatively open understory. This understory provided a reasonable level of visibility throughout the survey area. A thick layer of leaf litter, however, minimized ground visibility such that smaller cultural material, such as pottery sherds, may be obscured.

Figure 18. Results of archaeological investigations at DOW-AAFB1.

Figure 19. DOW-AAFB1, view to northwest showing utility corridor and access road.

4.1.1 DOW-AAFB1 Subsurface Testing

No evidence of subsurface cultural deposition was encountered during test excavations at the DOW-AAFB1 location. Three (n=3) STPs were excavated, which yielded a weakly developed A-horizon (dark brown silty clay) overlying a B-horizon (dark reddish-brown silty clay) formed over eroding limestone bedrock (Figure 20 through Figure 22). Stratigraphic descriptions for these STPs are presented in Table 2, and stratigraphic profiles are shown in Figure 23.

Figure 20. DOW-AFFB1, STP 1.

Figure 21. DOW-AFFB1, STP 2.

Figure 22. DOW-AFFB1, STP 3.

Table 2. DOW-AAFB1 Stratigraphic Descriptions

STP No.	*Layer*	*Depth (cmbs)*	*Description*	*Interpretation*
1	I	0–2	7.5YR 3/4 dark brown silty clay; moist, loose, fine to very fine granular structure, few roots; clear abrupt lower boundary.	Weakly developed A-horizon
	II	2–41	2.5YR 2.5/4 dark reddish-brown silty clay; moist, loose, fine to very fine granular structure, root common, large limestone inclusions. [STP terminated at limestone bedrock.]	B-horizon
2	I	0–5	7.5YR 3/4 dark brown silty clay; moist, loose, fine to very fine granular structure, few roots; clear abrupt lower boundary.	Weakly developed A-horizon
	II	5–30	2.5YR 2.5/4 dark reddish-brown silty clay; moist, loose, fine to very fine granular structure, root common. [STP terminated at limestone bedrock.]	B-horizon
3	I	0–18	2.5YR 2.5/4 dark reddish-brown silty clay; moist, loose, fine to very fine granular structure, roots common; clear abrupt lower boundary.	Disturbed B-horizon
	II	18–22	7.5YR 8/1 white eroding limestone bedrock; cemented structure.	C-horizon

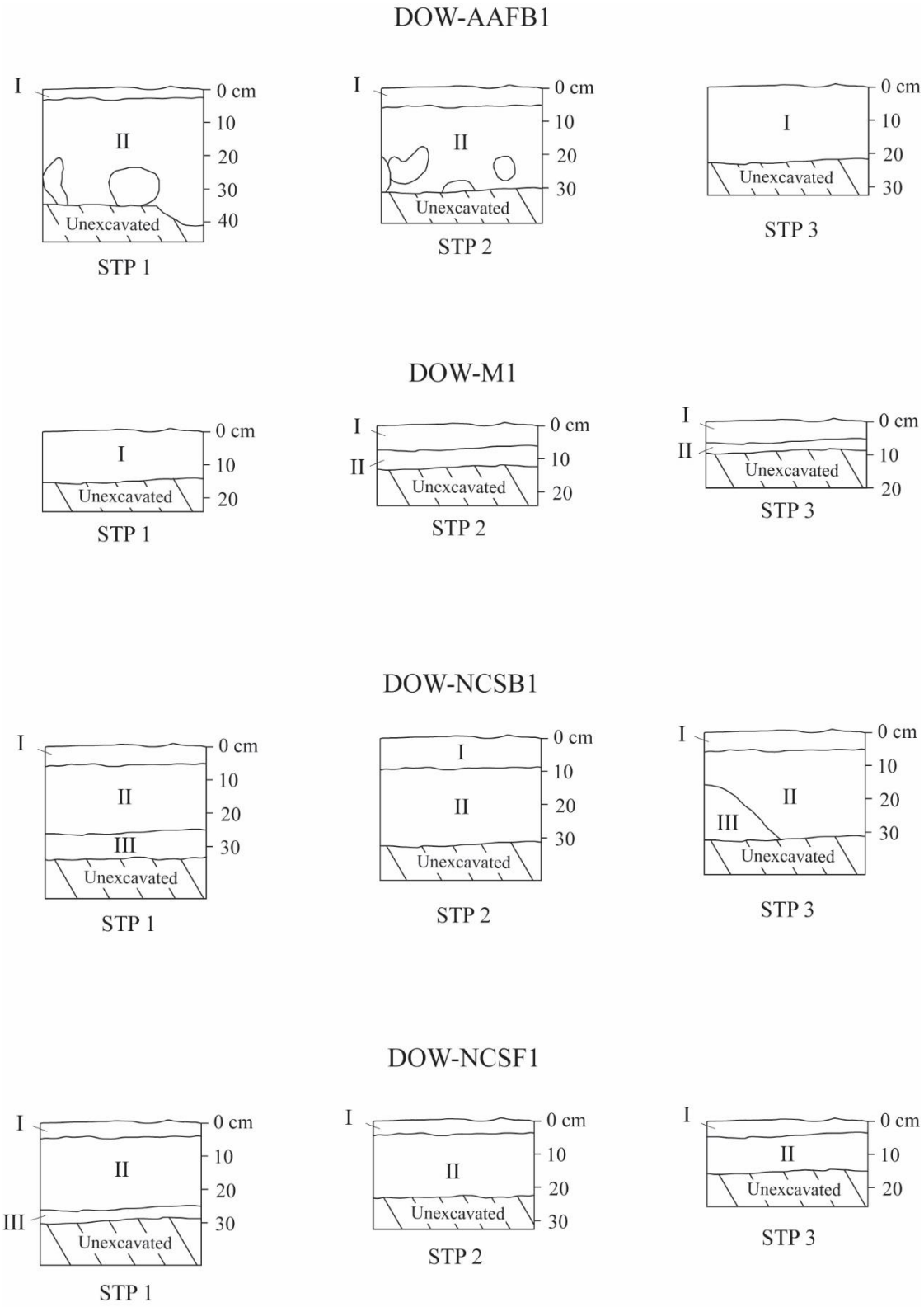


Figure 23. Stratigraphic profiles for STPs excavated at each well location.

4.2 DOW-M1 Survey Results

No archaeological or cultural resources were encountered during archaeological investigations at DOW-M1 (Figure 25). DOW-M1 is located adjacent to a utility line corridor which extends from Liguan Avenue into largely undeveloped land (Figure 24). DOW-M1 is situated on the south side of the utility corridor's concrete utility poles. The transect survey covered 100 percent of the 30 by 30-meter APE. Survey transects were oriented 45 degrees northeast by 225 degrees southwest. The survey area has been cut and graded in the past and currently consists of various grasses and exposed limestone bedrock, which afforded nearly 100 percent ground visibility (Figure 26). Recent dumping episodes are evident across the survey area and include tires, automobile parts, and aluminum cans (Figure 27).

Figure 24. DOW-M1, view to northeast.

Figure 25. Results of archaeological investigations at DOW-M1.

Figure 26. DOW-M1, view to southwest of exposed limestone bedrock.

Figure 27. DOW-M1, view to southeast of modern refuse found in the area.

4.2.1 DOW-M1 Subsurface Testing

No evidence of subsurface cultural deposition was encountered during test excavations at DOW-M1. Three (n=3) STPs were excavated across the APE footprint, which yielded a very shallow layer of disturbed sediment (dark brown silty clay) overlying limestone bedrock, indicative of prior land clearing (Figure 28 through Figure 30). Only one small pocket (ca. 20 by 25-centimeter area) of an intact B-horizon (strong brown silty clay) was encountered during subsurface testing at this location (see STP 3 in Table 3). Stratigraphic descriptions for these STPs are presented in Table 3, and stratigraphic profiles are shown in Figure 23.

Figure 28. DOW-M1, STP 1.

Figure 29. DOW-M1, STP 2.

Figure 30. DOW-M1, STP 3.

Table 3. DOW-M1 Stratigraphic Descriptions

STP No.	*Layer*	*Depth (cmbs)*	*Description*	*Interpretation*
1	I	0–14	7.5YR 3/3 dark brown silty clay; dry, loose, fine to very fine granular structure, root common. [STP terminated at limestone bedrock.]	Disturbed sediment
2	I	0–6	7.5YR 4/3 brown silty clay; dry, loose, fine to very fine granular structure, few roots; clear abrupt lower boundary.	Disturbed sediment
	II	6–12	7.5YR 8/1 white eroding limestone bedrock; cemented structure.	C-horizon.
3	I	0–5	7.5YR 4/3 brown silty clay; dry, loose, fine to very fine granular structure, few roots; clear abrupt lower boundary.	Disturbed sediment
	II	5–8	7.5YR 8/1 white eroding limestone bedrock; cemented structure.	C-horizon

4.3 DOW-NCSB1 Survey Results

No archaeological cultural resources were encountered during archaeological investigations at DOW-NCSB1 (Figure 31). DOW-NCSB1, located on Radio-Barrigada, is situated along a utility corridor next to a large radio antenna. The transect survey covered 100 percent of the 30 by 30-meter APE. Survey transects were oriented 45 degrees northeast by 225 degrees southwest. Roughly 30 percent of the survey area consisted of a cut and graded surface associated with utility corridor and adjacent antenna pad construction. The vegetated portion of the survey area was fairly level and consisted of a very thick understory of grasses and *tangantangan* that limited ground visibility (Figure 32).

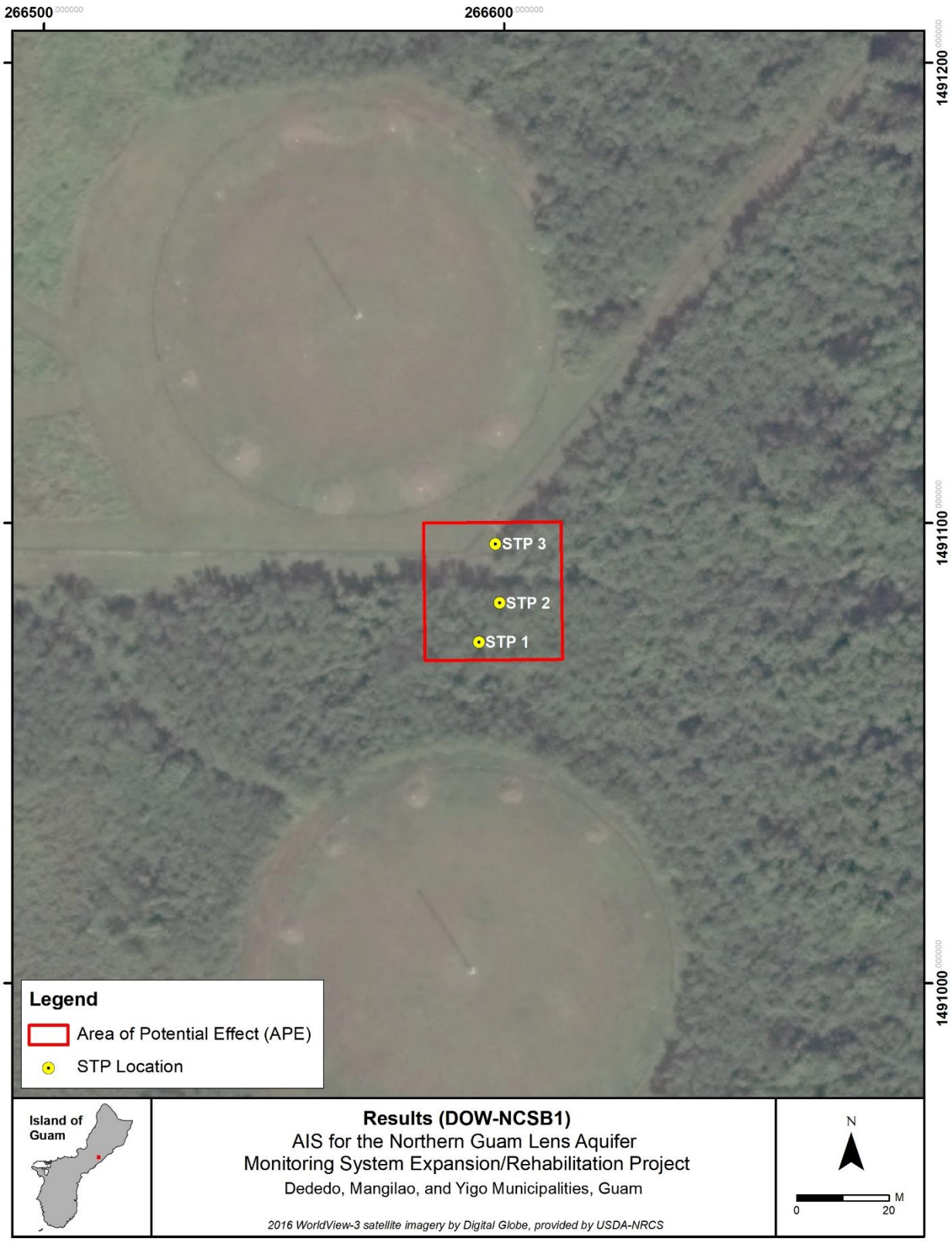


Figure 31. Results of archaeological investigations at DOW-NCSB1.

Figure 32. DOW-NCSB1, view to southeast.

4.3.1 DOW-NCSB1 Subsurface Testing

No evidence of subsurface cultural deposition was encountered during test excavations at DOW- NCSB1. Three (n=3) STPs were excavated, which yielded a weakly developed A-horizon (2.5YR 3/4 or 5YR 3/4 dark reddish-brown silty clay) overlying a B-horizon (dark red silty clay or dark reddish-brown silty clay) on top of eroding limestone bedrock (Figure 33 through Figure 35). Stratigraphic descriptions for these STPs are presented in Table 4, and stratigraphic profiles are shown in Figure 23.

Figure 33. DOW-NCSB1, STP 1.

Figure 34. DOW-NCSB1, STP 2.

Figure 35. DOW-NCSB1, STP 3.

Table 4. DOW-NCSB1 Stratigraphic Descriptions

STP No.	*Layer*	*Depth (cmbs)*	*Description*	*Interpretation*
1	I	0–6	2.5YR 3/4 dark reddish-brown silty clay; moist, loose, fine to very fine granular structure, few roots; smooth lower boundary	Weakly developed A-horizon
	II	6–25	2.5YR 3/6 dark red silty clay; moist, loose, fine to very fine granular structure, few roots; smooth lower boundary	B-horizon
	III	25–33	7.5YR 8/1 white eroding limestone bedrock; cemented structure.	C-horizon
2	I	0–9	2.5YR 2.5/4 dark reddish-brown silty clay; moist, loose, fine to very fine granular structure, few roots; smooth lower boundary.	Weakly developed A-horizon
	II	9–31	2.5YR 3/6 dark red silty clay; moist, loose, fine to very fine granular structure, few roots. [STP terminated at limestone bedrock.]	B-horizon

Table 4. (cont.)

STP No.	*Layer*	*Depth (cmbs)*	*Description*	*Interpretation*
3	I	0–5	5YR 3/4 dark reddish-brown silty clay; dry, loose; fine to very fine granular structure, few roots, clear abrupt lower boundary.	Weakly developed A-horizon
	II	5–31	2.5YR 3/4 dark reddish-brown silty clay; moist, loose, fine to very fine granular structure, few roots; clear abrupt lower boundary.	B-horizon
	III	15–31	7.5YR 8/1 white eroding limestone bedrock; cemented structure.	C-horizon

4.4 DOW-NCSF1 Survey Results

No archaeological or cultural resources were encountered during archaeological investigations at DOW-NCSF1 (Figure 36). DOW-NCSF1 is situated along a utility corridor located within the NCTS. The utility corridor parallels Route 3 before veering to the north. The transect survey covered 100 percent of the 30 by 30-meter APE. Survey transects were oriented 90 degrees east by 270 degrees west. Roughly 30 percent of the survey area consisted of a cut and graded surface associated with utility corridor construction (Figure 37). The vegetated portion of the survey area was fairly level and consisted of a very open understory providing good visibility of the ground surface (Figure 38).

Figure 36. Results of archaeological investigations at DOW-NCSF1.

Figure 37. DOW-NCSF1, view to northwest.

Figure 38. DOW-NCSF1, view to west.

4.4.1 DOW-NCSF1 Subsurface Testing

No evidence of subsurface cultural deposition was encountered during test excavations at DOW- NCSF1. Three (n=3) STPs were excavated, which yielded a weakly developed A-horizon (2.5YR 3/4 or 5YR 3/3 dark reddish-brown silty clay) overlying a B-horizon (dark reddish brown silty clay or dark red silty clay) formed over eroding limestone bedrock (Figure 39 through Figure 41). Stratigraphic descriptions for these STPs are presented in Table 5, and stratigraphic profiles are shown in Figure 23.

Figure 39. DOW-NCSF1, STP 1.

Figure 40. DOW-NCSF1, STP 2.

Figure 41. DOW-NCSF1, STP 3.

Table 5. DOW-NCSF1 Stratigraphic Descriptions

STP No.	*Layer*	*Depth (cmbs)*	*Description*	*Interpretation*
1	I	0–4	2.5YR 3/4 dark reddish-brown silty clay; moist, loose, fine to very fine granular structure, few roots; clear abrupt lower boundary.	Weakly developed A-horizon
	II	4–25	2.5YR 2.5/4 dark reddish-brown silty clay; moist, loose, fine to very fine granular structure, few roots; clear abrupt lower boundary.	B-horizon
	III	25–28	7.5YR 8/1 white eroding limestone bedrock; cemented structure.	C-horizon
2	I	0–3	5YR 3/3 dark reddish-brown silty clay; moist, loose, fine to very fine granular structure, few roots; clear abrupt lower boundary.	Weakly developed A-horizon
	II	3–24	5YR 3/2 dark red silty clay; moist, loose, fine to very fine granular structure, few roots. [STP terminated at limestone bedrock.]	B-horizon
3	I	0–4	2.5YR 3/4 dark reddish-brown silty clay; moist, loose, fine to very fine granular structure, few roots; clear abrupt lower boundary.	Weakly developed A-horizon
	II	4–15	2.5YR 2.5/4 dark reddish-brown silty clay; moist, loose, fine to very fine granular structure, few roots. [STP terminated at limestone bedrock.]	B-horizon

5.0 DISCUSSION AND CONCLUSION

The primary objective of this AIS for the NGLA Monitoring System Expansion/ Rehabilitation Project was to assess the presence and nature of NRHP-eligible historic properties in the undertaking APE. Investigations at each of the four proposed water well locations encountered no significant archaeological or cultural resources eligible for NRHP listing. This report concludes, therefore, that there are no historic properties present in the APE.

It appears that extensive prior land clearing associated with utility line installation and construction of antenna pads and access roads has altered much of the original land surface at each water well location. This is evidenced by nearly flat and level terrain with exposed limestone bedrock in some areas (e.g., DOW-M1), disturbed and truncated native sediment, and secondary growth vegetation (e.g., *tangantangan* thicket). This prior land alteration has likely removed evidence of former land use (e.g., Latte Period occupation and resource procurement, Spanish to First American Period farming and ranching), if it was once present in the APE.

5.1 Recommendations

The results of this study indicate there are no NRHP-eligible historic properties or significant cultural or archaeological resources in the undertaking APE. Further, the disturbed nature of the APE in general, shallow limestone soils, and lack of any pre-Contact deposits indicate a low probability for inadvertent discovery of intact cultural or archaeological resources within the area of impact. Therefore, no further archaeological work is recommended for the APE.

6.0 REFERENCES

Amesbury, J.R. and D.R. Moore

1989 *Archaeological Survey of Portions of Routes 4 and 15 and Dairy Road, Guam*. Prepared for Juan Tenorio and Associates, Agana, Guam. On file at Guam Historic Preservation Office, Agana Heights, Guam.

Athens, J.S.

2009 *Archaeological Surveys and Cultural Resources Studies on Guam and the Commonwealth of the Northern Mariana Islands in Support of the Joint Guam Build-Up Environmental Impact Statement. Volume I: Guam*. Prepared for Department of the Navy, Naval Facilities Engineering Command Pacific, Pearl Harbor, Hawai‘i. International Archaeological Research Institute, Inc., Honolulu, and TEC Inc. Joint Venture, Charlottesville, Virginia.

Blaz, V.

2008 *Bisita Guam: Let Us Remember Nihi Ta Hasso: Remembrances of the Occupation Years in World War II*. MARC Publication Series 30. University of Hawai‘i Press, Honolulu.

Crowl, P.A.

1993 *Campaign in the Marianas*. Center of Military History, United States Army, Washington, D.C.

Dilli, B.J., A. Haun, and S.T. Goodfellow

1998 *Volume I: Introduction, Research Design, and Data Recovery Results, Archaeological Mitigation Program, Mangilao Golf Course Project Area, Mangilao Municipality, Territory of Guam*. Prepared for Mr. Jetan Sahni, GMF, Guam. Paul H. Rosendahl, Ph.D., Inc., Hilo, Hawai‘i.

Dixon, B., H. Barton, J. Coil, W. Dickinson, G. Murakami, and J. Ward

2011a Recognizing inland expansion of Latte Period agricultural from multi-disciplinary data on Tinian, Commonwealth of the Northern Mariana Islands. *The Journal of Island and Coastal Archaeology* 6:375–397.

Dixon, B., S. Walker, and R. Schaefer

2011b *Cultural Resources Investigations Conducted in the Territory of Guam Supporting the Joint Guam Build-Up Environmental Impact Statement: Archaeological Surveys on Guam 2010 on Andersen AFB and Highway Utilities*. Prepared for the Department of the Navy Naval Facilities Engineering Command, Pacific. Pearl Harbor, Hawai‘i. TEC, Inc.

Dixon, B., S. Walker, M. Golabi, and H. Manner

2012 Two probably Latte Period agricultural sites in Northern Guam: Their plants, soils, and interpretations. *Micronesica* 42(1/2):209–257.

Dixon, B., T. Rudolph, A. Jalandoni, I. Nelson, M. Hroncich-Conner, S. Leary, R. Schaefer, E. Lash, M. Todd

2015 *Final Proposed Guam and CNMI Military Relocation 2012 Roadmap Adjustments SEIS Live-Fire Training Range Complex Footprint and Main Cantonment Alternatives and*

Access Route Options In-Fill Cultural Resource Studies. Prepared for the Naval Facilities Engineering Command, Pacific Division. Cardno TEC, Inc., Honolulu.

Garcia, F.

2006 *The Mariana Islands, 1884–1887: Random Notes*. Translated by M.G. Driver. Micronesian Area Research Center, University of Guam, Mangilao, Guam.

Gingerich, S.B.

2003 *Hydrologic Resources of Guam*. Water-Resources Investigation Report 03-4126. U.S. Geological Survey, Honolulu.

Grant, M., M. Travisano, S. Wenzlau, and M. Durst

2007 *Results of Cultural Resource Inventories for Establishment and Operation of an Intelligence, Surveillance, Reconnaissance, and Strike Capability and the Deployment of the Red Horse Squadron, Andersen Air Force Base, Guam*. Prepared for Department of the Air Force, Headquarters Pacific Air Forces/A7P, and Air Force Center for Environmental Excellence. Submitted to Parsons. Geo-Marine Inc., Plano, Texas.

Graves, M. and D. Moore

1985 *Tumon Bay Area Overview: Cultural and Historical Resources*. Prepared for Guam Department of Parks and Recreation, Hagåtña, Guam. Micronesian Area Research Center, University of Guam, Mangilao, Guam.

Griffin, A. E., M. Carson, and J. Peterson

2010 *A Study of Potential Traditional Cultural Properties in Guam*. Prepared for Department of the Navy, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, Hawai‘i.

Guam Historic Resources Division (GHRD)

2014 *Guam Historic Properties Inventory Data Form*. Guam Department of Parks and Recreation, Hagåtña, Guam.

Hunter-Anderson, R., D. Dixon, and T. Mangieri

2001 *Cultural Resources Survey of Five Navy Surplus Guam Land Use Plan Parcels, Territory of Guam*. Prepared for the Department of the Navy, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, Hawai‘i. Micronesian Archaeological Research Services, Inc., Mangilao, Guam, and International Archaeological Research Institute, Inc., Honolulu.

Kurashina, H., D. Moore, O. Kataoka, R. Clayshulte, and E. Ray

1981 Prehistoric and protohistoric cultural occurrences at Tarague, Guam. *Asian Perspectives* 24 (1):57–68.

Kurashina, H., D. Wooster, T. McGrath, and J. Toenjes

1988 *Archaeological Investigations of the Route 3 Road Corridor, Territory of Guam, Mariana Islands*. Prepared for Juan C. Tenorio and Associates, Inc., Agana, Guam. On file at Guam Historic Preservation Office, Agana Heights, Guam.

Le Gobien, C.

1700 *History of the Mariana Islands Newly Converted to the Christian Religion and of the Glorious Death of the First Martyrs who Preached the Faith There*. Translated by Father P.V. Daly, C.P.S. (1949). Ms. on file, Micronesian Area Research Center, University of Guam, Mangilao, Guam.

Liston, J.

1996 *The Legacy of* Tarague *Embayment and Its Inhabitants, Andersen AFB, Guam*. Prepared for Andersen Air Force Base, Guam. International Archaeological Research Institute, Inc., Honolulu.

Moore, D.

2005 Archaeological evidence of a prehistoric farming technique on Guam. *Micronesica* 38: 93–120.

Olmo, R., T. Mangieri, D. Welch, and T. Dye

2000 *Phase II Archaeological Survey and Detailed Recording at Commander, U.S. Naval Forces Marianas, Communications Annex (Formerly Naval Computer and Telecommunications Area Master Station, Western Pacific), Territory of Guam, Mariana Islands*. Prepared for the Department of the Navy, Honolulu. International Archaeological Research Institute, Inc., Honolulu.

Reinman, F.R.

1977 *An Archaeological Survey and Preliminary Test Excavations on the Island of Guam, Mariana Islands, 1965–66*. Micronesian Area Research Center, University of Guam, Mangilao, Guam.

Rogers, R.F.

1995 *Destiny's Landfall: A History of Guam*. University of Hawai‘i Press, Honolulu.

Russell, S.

1998 *Tiempon I Manomofo'ona: Ancient Chamorro Culture and History of the Northern Marianas Islands*. Micronesian Archaeological Survey Report, 32. Division of Historic Preservation, Saipan, CNMI.

Tomonari-Tuggle, M.J., H.D. Tuggle, and D.J. Welch

2003 *Integrated Cultural Resource Management Plan for Andersen Air Force Base, Guam, 2003 Update*. Prepared for Earth Tech, Inc. Global and Environmental Services. International Archaeological Research Institute, Inc., Honolulu.

Welch, D.J.

2010 *Archaeological Surveys and Cultural Resources Studies Conducted in 2007 on the Island of Guam in Support of the Joint Guam Build-up Environmental Impact Statement. Volume I: Narrative; Volume II: Site Descriptions*. Prepared for Department of the Navy, Naval Facilities Engineering Command Pacific, Pearl Harbor, Hawai‘i. International Archaeological Research Institute, Inc., Honolulu, and TEC Inc. Joint Venture, Charlottesville, Virginia.

Young, F.J.

1988 *Soil Survey of the Territory of Guam*. United States Department of Agriculture, Soil Conservation Service in cooperation with the Guam Department of Commerce and the University of Guam. Washington, D.C.

APPENDIX A: ARCHAEOLOGICAL REPORT SUMMARY FORM

Guam Historic Resource Division
(State Historic Preservation Office)
Department of Parks and Recreation

Archaeological Report Summary Form (ARSF)

GHRD USE ONLY
RC #:_____
Date: _____
Reviewer: _____
GIS Logger: _____
Date: _____
GHRD #_____
MS__ AB __ Draft __ Final __

Please print clearly when completing this form. Include completed forms in all reports to be submitted to the Department, such as management summaries, abbreviated reports, draft and final reports, etc. This form may be downloaded or expanded as needed, but do not eliminate any fields.

1. Report Title: Final-Archaeological Inventory Survey for the Northern Guam Lens Aquifer (NGLA) Monitoring System Expansion/Rehabilitation Project, Dededo, Mangilao, and Yigo Municipalities, Guam
2. PI Cacilie Craft, MA, RPA MA X PhD / Firm or Institution GANDA
3. Report Date: (01-06-2002) 12-3-2019 Number of Pages 68 Draft Report_____
   Revised Report___ Letter of Acceptance of Final Report ___ Two (2) Final Reports (spiraled) and one CD X
   Research Design: Yes___ No___ Scope of Work: Yes___ No___ RC # RC2019-0035
4. Type of Report: Terrestrial X Marine ____ Architecture:___ Historic _____ Prehistoric _____
   Type of Work: Identification X Evaluation____ Data Recovery____ Monitoring____ Shapefiles Provided: Y / N
   Further work recommended Yes____ No X What? _____ Preservation Y / N
5. Agency/Lessees Name: _____ Federal Guam Private
   Company / Land Owner: US Air Force and US Navy Lot No. (s): Multiple
6. Project Area: Quad, Municipality, Village, (list all) Place Name/s: _____

Quad	Municipality	Village	Place Name
Dededo, Pati, Ritidian	Dededo, Mangilao, Yigo	Dededo, Mangilao, Yigo	Magua, Astobias, Mogfog, Adacao

7. Nearest Project Area Drainage (s): None Distance from site: n/a
8. Basic Field Information: Series of Soil: Guam cobbly clay loam series with 3 to 7 percent slopes
   a. Area of Potential Effect (APE) / Project Area in Hectares: 0.36 Acres: 0.89 Square Miles: 0.001
   b. Type of Proposed Project/ Impacts: Well drilling, construction Dates of Field Investigation(s): TBD
   c. Closest Recorded Historic Property to APE (Site Name, Site #, Reference): Multiple, see report
   d. Description of Field Conditions and Disturbance (wooded, previously cleared, recently bulldozed, untouched, etc.): Most of the noncontiguous APE has been previously cleared in the past. Now mostly wooded.
9. GHPI Site Numbers, for unrecorded sites, if any: NA
   a. Guam Historic Properties Inventory (GHPI) Data Form/s submitted : Yes ___ No ___
10. Number of sites "Meeting" National Register Criteria: NA Guam Register Criteria NA
11. Number of sites "Not Meeting" National Register Criteria: NA Guam Register Criteria: NA
12. Number of Sites with No Effect Determination NA No Adverse Effect NA Adverse Effect NA
13. Other agreements or requirements: Certificate of Approval # NA Notice of Violation # NA
    Memorandum of Agreement NA Programmatic Agreement NA Artifact Catalog # NA
14. Disposition of Artifacts / Stored With / At / Date: NA

APPENDIX B: GHRD SECTION 106 REVIEW LETTERS

Lourdes Leon Guerrero
Governor
Joshua Tenorio
Lt. Governor

Department of Parks and Recreation
Government of Guam
490 Chalan Palasyo, Agana Heights, Guam 96910
Director's Office: (671) 475-6288
Parks Division: (671) 475-6291
Guam Historic Resources Division: (671) 475-6294/5
Facsimile: (671) 477-2822

Richard Ybanez
Acting Director
Victor Villagomez
Acting Deputy Director

In reply refer to:
RC2019-0035

January 18, 2019

Thomas Konner, Ph.D.
Environmental Engineer
U.S. EPA Region 9 WTR
75 Hawthorne St.
San Francisco, CA 94105

Subject: Section 106 Review
Northern Guam Lens Aquifer (NGLA) Monitoring System Expansion/Rehabilitation Project

Dear Mr. Konner,

We have reviewed all the documents you submitted, listed on Page 2 of your letter dated, November 13, 2018, which we received on November 28, 2018. The subject project is separated into two categories, one being a Rehabilitation Project consisting of twelve (12) existing monitoring wells, and the other, an Expansion Project for the construction of seven (7) new monitoring wells.

We noted that in the project category, the subject Section 106 Consultation letter did not provide an assessment of a determination or findings on the projects' effects on any of the wells and the areas of potential effect (APEs. Nevertheless, based on our reviews, and our assessment of the projects' APEs, overall, we are providing our comments on each project category, as follow:

a. NGLA Monitoring System Rehabilitation Project: *

1.	Monitoring Well A-20	7.	Monitoring Well M-10A
2.	Monitoring Well EX-1	8.	Monitoring Well BPM-1
3.	Monitoring Well A-16	9.	Monitoring Well EX-9
4.	Monitoring Well EX-4	10.	Monitoring Well EX-10
5.	Monitoring Well GHURA-Dededo	11.	Monitoring Well EX-8
6.	Monitoring Well EX-6	12.	Monitoring Well NCS-3

*We have no concerns with all the wells listed.

b. NGLA Monitoring System Expansion Project:

1. Northwest Field- (DOW-NWF-1) *
2. Andersen AFB- (DOW- AAFB1) *
3. NCS Finegayan #2-(DOW- NCSF2) **
4. NCS Finegayan #1-(DOW-NCSF1) *
5. NCS Barrigada – (DOW- NCSB1) *
6. MARBO – (DOW- M1) *
7. Yigo – (DOW-Y1) **

* We have concerns with these proposed DOWs, including the existing and proposed access road for monitoring Well DOW-NWF1.

** We have no concerns with proposed DOW- NCSF2 and DOW- Y1.

As indicated above, we have no concerns with the existing twelve (12) wells listed in the Rehabilitation Project, and two (2) of the seven (7) proposed wells under the Expansion Project. Your archaeologist, Garcia and Associates, has submitted a Request for Assistance (RFA) to our office for records search and various other information on the twelve wells listed, under Rehabilitation Project, which we have no concerns. However, once you received this letter please inform the archaeologist of what areas need to be surveyed, as there is no need to survey areas where we have no concerns on.

Our letter should provide you with the information to make an informed determination on the Rehabilitation and Expansion Projects, aforementioned. Our suggestion would be to separate the projects that we have no concerns on and submit your letter of determination for those as soon as possible so work can get underway on those wells. These projects will be subject to *36 CFR Sec. 800.13 Post-review discoveries*. For those listed under the Expansion Project that we have concerns with, we look forward to your letter of determination for those as well.

We look forward to hearing from you once you get back at work. Please do not hesitate to contact our office should you have any questions.

Sincerely,

Richard Ybanez
Acting

Lynda Bordallo Aguon
State Historic Preservation Officer

Cc: Cacilie Craft, MA, RPA, Pacific Regional, Senior Archaeologist
ccraft@garciaandassociates.com

Lourdes A. Leon Guerrero
Governor
Joshua F. Tenorio
Lt. Governor

Department of Parks and Recreation
Dipattamenton Plaset yan Dibuetsion
Government of Guam
Director's Office, Parks and Recreation Divisions:
#1 Paseo de Susana, Hagåtña, Guam 96910
P.O. Box 2950, Hagåtña, Guam 96932
(671) 475-6288; Facsimile (671) 477-0997
Guam Historic Resources Division:
490 Chalan Palasyo, Agana Heights, Guam 96910
(671) 475-6294/6355; Facsimile (671) 477-2822

Richard Y. Ybanez
Acting Director
Victor R. Villagomez
Deputy Director

In reply refer to:
RC2019-0035

November 29, 2019

Thomas Konner, Ph.D.
Environmental Engineer
U.S. EPA Region 9 WTR
75 Hawthorne St.
San Francisco, CA 94105

Subject: Draft Archaeological Inventory Survey for the Northern Guam Lens Aquifer (NGLA) Monitoring System Expansion/Rehabilitation Project, Dededo, Mangilao, and Yigo Municipalities, Guam

Dear Mr. Konner,

We have reviewed the draft report and concur with the findings on the subject undertakings. The draft report is the results of the archaeological investigation at each of the four (4) proposed well locations of DOW-AAFB1, DOW-M1, DOW-NCSB1, and DOW-NCSF1.

DOW-NWF1 was originally included along with the four wells, however, it was relocated within an existing utility corridor outside of the Andersen Air Force Base (AAFB) fence-line along Route 3A. This utility corridor was previously consulted on with AAFB and was determined to have no historic properties for this area of potential effect. Therefore, no survey was required for this well (re: RCS17-0003/RC2017-0123).

Before submitting the Final Report, please ensure that it complies with our Basic Reporting Requirements, i.e., two spiral-bound hard copies with front and back hard-stock cover, including the attachment of the Archaeological Report Summary Form (ARSF) as Appendix A, and a digital copy of the report and shapefiles.

Please feel free to start your undertaking, however, in the event of inadvertent discoveries the undertaking is subject to 36 CFR 800.13 post review discoveries.

Should you have any questions, please don't hesitate to contact Mr. Jose Garrido at 475-6292, or Mr. John Mark Joseph, Guam State Archaeologist, at 475-6339.

Sincerely,

Patrick Lujan,
State Historic Preservation Officer

Cc: Cacilie E. Craft, MA, RPA,
Cheryl Dilkes

GUAM WATERWORKS AUTHORITY

Federal Consistency Certification Application
Northern Guam Lens Aquifer Monitoring System Expansion/
Rehabilitation Project

Appendix C

Biological Assessment for Northern Guam Lens Aquifer (NGLA) Monitoring System Expansion

December 4, 2019

APPENDIX C

Biological Assessment
for
Northern Guam Lens Aquifer (NGLA)
Monitoring System Expansion

Prepared For

GUAM WATERWORKS AUTHORITY
578 North Marine Corps Drive
Tamuning, Guam 96913

Prepared By

EA Engineering, Science, and Technology, Inc., PBC
1001 Army Drive, Suite 103
Barrigada, Guam 96913

4 December 2019

This page intentionally left blank

Table of Contents

List of Tables

List of Figures

List of Appendices

Acronyms and Abbreviations

CFR	Code of Federal Regulations
DOI	Department of Interior
DOW	Deep Observation Wells
EA	EA Engineering, Science, and Technology, Inc., PBC
ESA	Endangered Species Act
ft.	feet
GWA	Guam Waterworks Authority
HVT	High Value Tree
in.	inch
N.C.N.	no common name
NGLA	Northern Guam Lens Aquifer
WERI	University of Guam Water and Environmental Research Institute
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

This page intentionally left blank

1. Introduction

1.1. Purpose and Objectives

The purpose of this Biological Assessment is to review the natural resources affected by actions associated with the installation of seven new deep-monitoring wells and rehabilitation of 12 existing wells within the Northern Guam Lens Aquifer (NGLA) Monitoring System. This review includes sufficient detail to determine the extent to which the project might affect any threatened, endangered, proposed, or otherwise protected or sensitive species.

This Biological Assessment was developed in accordance with the legal requirements set forth under the federal Endangered Species Act (ESA) (16 United States Code [U.S.C.] 1531 et seq.).

1.2. Proposed Action

The proposed action is the installation of new deep-monitoring wells and rehabilitation of existing wells within the NGLA.

This page intentionally left blank

2. Project Description

Guam Waterworks Authority (GWA), United States Geological Survey (USGS) and the University of Guam Water and Environmental Research Institute (WERI) of the Western Pacific propose to install seven new deep-monitoring wells and rehabilitate 12 existing wells within the Northern Guam Lens Aquifer (NGLA) Monitoring System. Expansion of the groundwater monitoring system will provide long-term hydrologic data and information needed for effective management of Guam's drinking-water resources.

The seven new deep observations wells (DOW) are located across Northern Guam (Figure 1) and are designated with the identifiers DOW-AAFB1, DOW-M1, DOW-NCSB1, DOW-NCSF1, DOW-NCSF2, DOW-NWF1 and DOW-Y1. The 12 existing wells selected for rehabilitation are designated with identifiers A-16, A-20, BPM-1, EX-1, EX-4, EX-6, EX-8, EX-9, EX-10, GHURA-Dededo, M-10A and NCS-3A. The locations, coordinates, and current land ownership are listed in Table 2 below. Rehabilitation and construction activities (i.e. drilling for new wells) will have limited surface impact. The new wells are anticipated to disturb less than 10,000 ft^2 of surrounding area, while rehabilitation activities will only impact the previously disturbed well locations.

Table 2. Monitoring Well Locations and Property Ownership

Well Type	Well	Property Ownership	Location Description	Latitude	Longitude
New	DOW-NWF1	U.S. Air Force	Off shoulder of Route 3A outside of AAFB fence line	13.59569	144.8622
New	DOW-AAFB1	U.S. Air Force	On a utility road through AAFB's main gate	13.588625	144.906150
New	DOW-NCSF1	U.S. Navy	On NCTS site in a utility corridor	13.580095	144.850202
New	DOW-NCSF2	U.S. Navy	On NCTS site near gymnasium	13.566813	144.842522
New	DOW-NCSB1	U.S. Navy	On NCS-Radio Barrigada	13.478581	144.843912
New	DOW-M1	U.S. Air Force	Within the Marbo Annex	13.506293	144.852779
New	DOW-Y1	U.S. Air Force	To the east side of Yigo Fire Station	13.52225	144.880164
Rehab	A-16	GovGuam	Carbullido Elementary School	13.471361	144.792528
Rehab	A-20	GovGuam	Chalan Pago Elementary School	13.44175	144.759639
Rehab	BPM-1	Frank T. Pangelinan	Private property	13.446528	144.804333
Rehab	EX-1	GovGuam	San Miguel Elementary School	13.461389	144.773611
Rehab	EX-10	GovGuam	Swamp Road, off of Route 3	13.54183	144.83389
Rehab	EX-4	GovGuam	In the front yard of a private home, near Father Duenas School	13.441583	144.790028

Well Type	Well	Property Ownership	Location Description	Latitude	Longitude
Rehab	EX-6	GovGuam, Lessee: Frederic Lujan Guerrero	To the side of a private driveway to a home	13.51086	144.83767
Rehab	EX-8	U.S. Air Force	On the far north of AAFB, near the old air field	13.60945	144.86116
Rehab	EX-9	GovGuam	To the side of PC Lujan Elementary School	13.46967	144.80753
Rehab	GHURA- Dededo	GovGuam, but on GICC golf course	Guam International Country Club golf course near hole S-1	13.5242569	144.8499119
Rehab	M-10A	GovGuam	Juan Guerrero Elementary School - large old tree and palm tree	13.51061	144.82414
Rehab	NCS-3A	U.S. Navy	Near the Radio Barrigada site on U.S. Navy property, across from the former Nimitz Golf Course	13.47025816	144.8235445

Construction equipment expected on the new well sites is assumed to include the following:

- Air Rotary Drill Rig (37 feet long x 8 feet wide x 12 feet high),
- two flatbed support trucks (20 feet long x 8 feet wide x 8 feet high),
- Non-potable water tanker (16 feet long x 8 feet wide x 8 feet high),
- two 40-yard trash containers (22 feet long x 7.5 feet wide x 8 feet high).

Photo 1. Typical Drill Site Layout with Air Rotary Drill Completing Deep Well

Photo 2. Typical Drill Site Layout Showing Drill Cuttings and Liquid Containment

All equipment will be on site for approximately four weeks during drilling and construction. After drilling is completed, the monitoring well will be constructed on a 20-foot by 20-foot concrete slab. A chain-link fence with a locking gate will be constructed around the well pad. No construction equipment will remain on site after construction is complete.

Due to the location of the wells within the NGLA Monitoring System, GWA, USGS and WERI require that a biological survey of the area be completed to determine potential effects on federally protected species within the project footprint. A biological survey was conducted at each rehabilitation well and proposed new well site to identify natural resources that are located within the project area. This Biological Assessment Report presents the results of the biological survey.

EA Engineering, Science, and Technology, Inc., PBC (EA) was contracted by Brown and Caldwell, GWA's Program Manager, to conduct field surveys related to the occurrence and potential for impacts to threatened or endangered species for Guam as listed by the United States Fish and Wildlife Service (USFWS) in 50 Code of Federal Regulation (CFR) Part 17.

2.1. Project Area

Rehabilitation and new wells are located at various locations around Northern Guam (Figure 1). The action area for this proposed action is the same as the project area, as impacts from the proposed action are not anticipated to extend beyond the project area.

2.2. Protected Species with the Potential to Occur within the Action Area

The purpose of the biological field survey was to determine if federally protected species occur within the footprint of the project and to document and locate their occurrence, if observed. The objective of this project is to ensure that actions associated with the NGLA Monitoring System Expansion project are consistent with the requirements of ESA, Section 7 and to identify and avoid the potential impacts on listed species identified within or immediately adjacent to the project area.

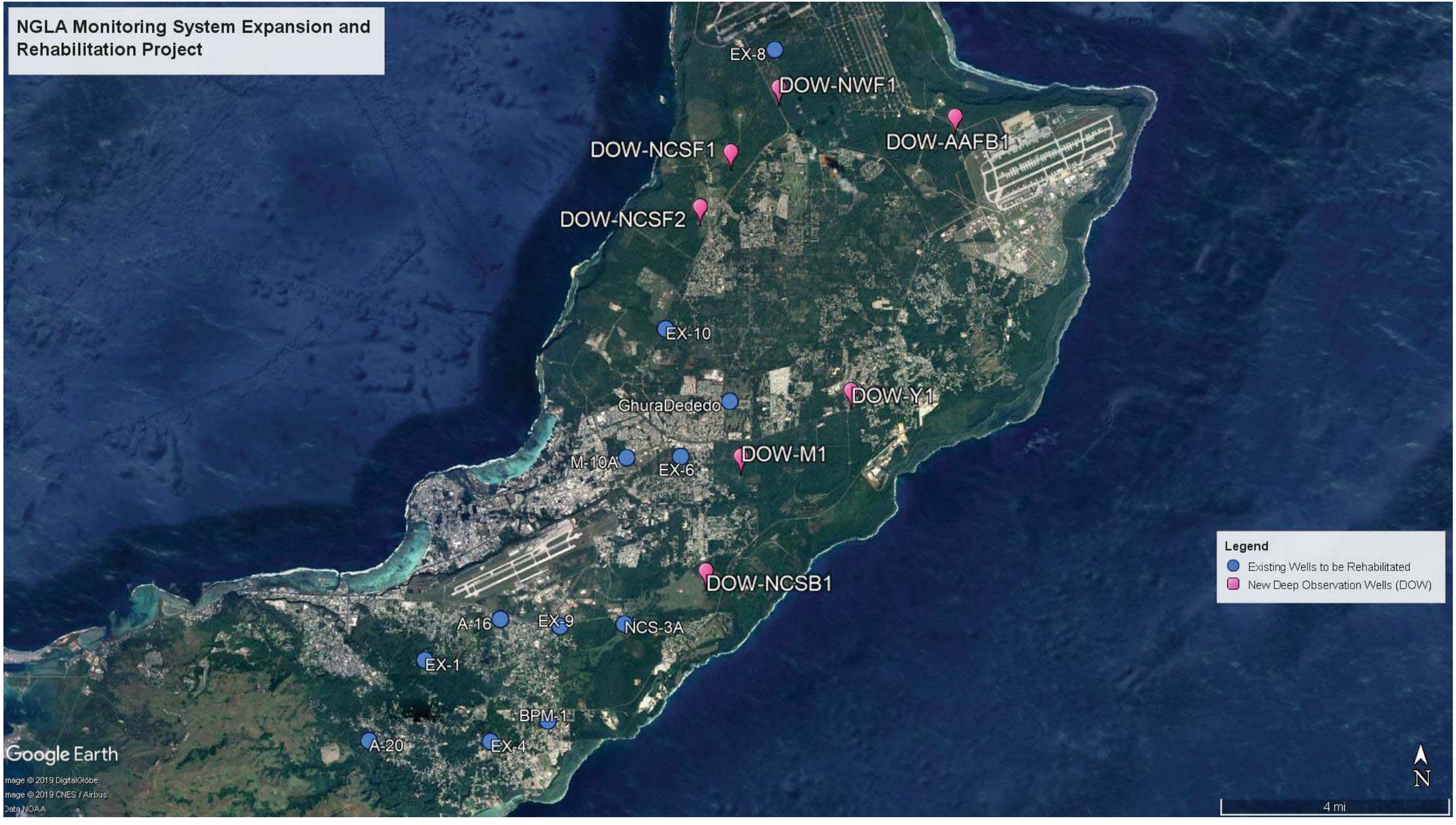


Figure 1.
Vicinity Map of Rehabilitation and New Wells

This page intentionally left blank

3. Species/Critical Habitat Considered

3.1. Species and Critical Habitat

Section 7 of the ESA (16 United States Code 1536) requires federal agencies to ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any federally protected endangered or threatened species or result in the destruction or adverse modification of critical habitat. The current list of federally protected species for Guam is presented by the USFWS in 50 CFR Part 17. The list of federally protected species for Guam was reviewed and species habitat requirements were compared to conditions occurring on the project survey sites.

Table 2 provides the list of species for Guam along with their potential to occur on the site, based on habitat requirements. Based on the review of habitat requirements and habitat conditions in the project area, it was determined that 13 federally protected flora species and 5 fauna species have the potential to occur on or in proximity to the existing NGLA Monitoring System well locations and new well locations.

Table 2. Guam Federally Protected Flora and Fauna and Their Potential to Occur on NGLA Well Sites

Scientific Name	Common Name	Chamorro Name	Status	Potential to occur onsite	Reason
Flora					
Bulbophyllum guamense	wild onion	cebello halumtano	threatened	possible	epiphyte occurring most commonly in humid, moist areas on tree trunks and branches in forested habitats
Cycas micronesica	Micronesian cycad	fadang	threatened	possible	occurs in closed forest on coral limestone or coral sand
Dendrobium guamense	N.C.N.	-	endangered	possible	epiphyte occurring in forested habitats in moist areas with filtered or direct sunlight
Eugenia bryanii	N.C.N.	-	endangered	possible	most often occurs on cliffsides, also on coastal limestone and occasionally back strand
Hedyotis megalantha	N.C.N.	pau dedu	endangered	possible	occurs in open savanna, in clearings, and under forest canopy
Heritiera longipetiolata	N.C.N.	ufa halomtanu	endangered	possible	restricted to limestone cliffs and plateaus

Scientific Name	Common Name	Chamorro Name	Status	Potential to occur onsite	Reason
Maesa walkeri	N.C.N.	-	threatened	possible	limestone ridges with no overstory and exposure to wind
Nervilia jacksoniae	N.C.N.	-	threatened	possible	typically occurs in shady places in rocky areas with leaf litter
Phyllanthus saffordii	N.C.N.	-	endangered	no	lack of suitable habitat - occurs in savannah badlands in areas with red clay soil
Psychotria malaspinae	N.C.N.	aplokating palaoan	endangered	possible	occurs on limestone forest
Serianthes nelsonii	fire tree	hayun lagu	endangered	possible	this species is known to occur at Andersen Air Force Base
Solanum guamense	N.C.N.	Biringenas halumtanu	endangered	possible	occurs on limestone cliffs, terraces near the sea, and edge plants along roads
Tabernaemont-ana rotensis	N.C.N.	-	threatened	possible	occurs on limestone plateaus, usually areas with soil
Tinospora homosepala	N.C.N.	-	endangered	possible	occurs on limestone; back strand - hangs from tall canopies
Tuberolabium guamense	N.C.N.	-	threatened	possible	occurs in moist shady (~60% light) areas, common in higher elevations in southern Guam and older limestone forests in northern Guam
Fauna					
Aerodramus vanikorensis bartschi	Mariana gray swiftlet	yayaguak	endangered	no	closest active roosting/nesting caves over 15 miles away
Chelonia mydas	green sea turtle	hagan betde	endangered	no	lack of suitable habitat
Corvus kubaryi	Mariana crow	aga	endangered	no	two Mariana crows were translocated to Andersen Air Force Base from Rota, but they have not been documented for several years
Emballonura semicaudata rotensis	Pacific sheath tailed bat	payeyi	endangered	no	species only has possible historical occurrence on Guam

Scientific Name	Common Name	Chamorro Name	Status	Potential to occur onsite	Reason
Emoia slevini	Slevin's skink	gualiik halumyanu	endangered	no	this species is found on the forest floor, in old fields and low on tree trunks, but it has not been documented on Guam for over 20 years (DOI USFWS 2015)
Eretmochelys imbricata	hawksbill sea turtle	hagan karai	endangered	no	lack of suitable habitat
Gallinula chloropus guami	Mariana common moorhen	pulattat	endangered	no	lack of suitable habitat
Hypolimnas octocula marianensis	Mariana eight-spot butterfly	ababbang	endangered	possible	host plant is known to occur on limestone karst
Partula gibba	humped tree snail	akaleha'	endangered	possible	occurs in cool shaded forest
Partula radiolata	Guam tree snail	akaleha'	endangered	possible	occurs in cool shaded forest
Pteropus mariannus	Mariana fruit bat	fanihi	threatened	possible	sightings have been recorded in northern Guam during annual surveys for Mariana fruit bat
Rallus owstonii	Guam rail	ko'ko'	endangered	no	extirpated on mainland Guam
Samoana fragilis	fragile tree snail	akaleha' dogas	endangered	possible	occurs in cool, shaded forest
Todiramphus cinnamominus	Guam kingfisher	sihek	endangered	no	extirpated on Guam
Vagrans egistina	Mariana wandering butterfly	ababbang	endangered	no	the butterfly has not been documented on Guam since 1979 (USFWS 2014)

N.C.N. - no common name

3.2. Identification of Listed Resources

Once species with the potential to occur were identified based on habitat available within the action area, field surveys were completed to determine the potential presence of the species. Field surveys for federally threatened and endangered species were conducted on 18 September 2018, 3 January 2019, and 6 June 2019 at new well sites and on 18 September 2018 at rehabilitation well sites. Biologists that conducted the field surveys have previous species-specific flora and fauna

experience, habitat-specific knowledge, and experience with the survey methods also used on other threatened and endangered species field surveys.

3.2.1. Field Survey Methods

Two biologists simultaneously searched for all threatened and endangered species by conducting meandering surveys throughout the entire interior of each site. One GPS unit was used by the survey team and location data was collected by only one person during the survey. Biologists closely surveyed the project areas for flora and fauna species with the potential to occur within habitats in the project area as shown in Table 1. The biologist team walked in tandem within eyesight of each other, 10 to 20 feet apart during the survey. Meandering survey tracks varied due to the habitat type encountered. Certain well locations (DOW-M1, DOW-NWF1, DOW-NCSF2) were in areas of developed land, characterized by pavement, human disturbance and maintained/mowed grasses. These locations required fewer meanders as the lack of trees and tall vegetation allowed for higher levels of visibility across the Areas of Potential Effects (APE). For well sites located in primary and secondary mixed limestone forest or scrub forest (DOW-NCSF1, DOW-NCSB1, DOW-AAFB1, DOW-Y1), surveys required a higher number of meanders because of lower visibility throughout the APE. During surveys in these more complex habitats, biologists worked simultaneously, keeping a maximum distance 20 feet from each other to ensure maximum coverage and assessment of all sides of trees and vegetation.

The surveys consisted of surveys for threatened and endangered species searching primarily for protected flora species, snails, Mariana fruit bat, and migratory birds. Federally protected species observed 5 ft. outside the project area were also recorded to bring awareness of their presence. Protected fauna species other than the bats and snails are very unlikely to occur on the site, but were searched for because habitat conditions might, but are very unlikely to, support their occurrence.

Intensive visual surveys were conducted of trees with the potential to support *Bulbophyllum guamense*, *Dendrobium guamense* and *Tuberolabium guamense*. In addition, special attention was paid to areas with the potential for the occurrence of smaller understory species such as *Nervilia jacksoniae*. All suitable habitats within project footprint were surveyed for the occurrence of listed species with the potential to occur in the project areas. Along with federally protected species, culturally significant high value trees (HVT), previously determined by natural resource personnel of the Government of Guam and Department of Chamorro Affairs were marked with flagging tape.

Intensive visual surveys for humped tree snail (*Partula gibba*), Guam tree snail (*Partula radiolata*), and fragile tree snail (*Samoana fragilis*) were conducted following variations to methods used by Hopper and Smith (1992) and Fiedler (2019). During surveys, biologists slowly walked throughout the area searching for protected snails. Using the methods outlined by Fiedler (2019) surveys were conducted by sampling the plants listed as category 1 plants/trees for a longer period and category 4 plants/trees for a shorter period for snails. Several broadleaved canopy trees and host trees are commonly associated with partulid snails on Guam (e.g. *Artocarpus* sp., *Barringtonia asiatica, Cocos nucifera, Merilliodendron megacarpum, Ochrosia oppositifolia*).

Biologists searched the undersides of all leaves, stems, branches, and trunks (if tree), and identified tall, broadleaved canopy trees and examined them and the plants in their understory. Biologists prioritized broadleaved plants, examined groundcover plants, and ground and leaf litter for snails. The ground and leaf litter under the broadleaved trees were examined for vacant shells. As biologists continued vegetation surveys at the site, visual examinations of trunks and foliage of all types of vegetation, as well as the ground layer (for empty shells) were performed. On Guam, partulid snails have previously been observed on approximately 50 species with varying levels of association. The project area for each well location was limited and the vegetation was searched by biologists to ensure that no presence of protected partulid species was found within the affected areas. During surveys, biologists searched for migratory birds and nests in the vegetation or birds flying overhead.

EA compiled all data collected during the survey including all observed federally protected species, the general condition of species observed, photographs, locations and track logs recorded with a Trimble GPS unit with sub-meter accuracy.

3.3. Species Observed in the Area of Effect

Biological field survey results for each well site are listed below (Table 3). A total of six *Tuberolabium guamense* and two *Cycas micronesica* were observed in close proximity to the proposed new wellhead locations. Survey foot tracks as well as the listed species and high-value trees (HVT) observed at each new well location are located in Figures 2 through 8. The footprint and footpath at DOW-NWF1 represent the same line, as the DOW-NWF1 footprint consisted entirely of maintained grass (Figure 7). No federally protected species were observed at any of the rehabilitation well sites. All rehabilitation wells are located on previously disturbed sites and will only impact the area previously disturbed. Pictures of both rehabilitation sites and new well locations are included in Appendix A.

Table 3. Threatened and Endangered Species Observed at Each Well Location

Well ID	Date of Survey	Protected Species Observed
New Wells		
DOW-AAFB1	3 Jan, 2019	Two *Cycas micronesica* (cycads) observed in close proximity to the proposed new well sites. The two cycads are located 47 and 89 feet away from the proposed well location.
DOW-M1	3 Jan, 2019	None
DOW-NCSB1	18 Sep, 2018	None
DOW-NCSF1	3 Jan, 2019	Six *Tuberolabium guamense* observed in close proximity to the proposed new well sites. The six orchids were found on three trees, which were located 52, 92 and 120 feet away from the proposed well location. Two *Elaeocarpus joga* (yoga) trees were found in close proximity to the proposed new well sites. *E. joga* is not federally protected but is considered culturally significant and is classified as a high-value tree (HVT). The yoga trees were located 61 and 66 feet away from the proposed well location.
DOW-NCSF2	18 Sep 2018	None
DOW -NWF1	6 June, 2019	None
DOW-Y1	3 Jan, 2019	None
Rehabilitation Wells		
A-20	18 Sep, 2018	None
A-16	18 Sep, 2018	None
BPM-1	18 Sep, 2018	None
EX-1	18 Sep, 2018	None
EX-4	18 Sep, 2018	None
EX-6	18 Sep, 2018	None
EX-8	18 Sep, 2018	None
EX-9	18 Sep, 2018	None
EX-10	18 Sep, 2018	None
GHURA-Dededo	18 Sep, 2018	None
M-10A	18 Sep, 2018	None
NCS-3A	18 Sep, 2018	None

Legend

- Well Head Locations
- EV Points
- Area of Potential Effect
- Survey Line Foot Paths

EA Engineering, Science, and Technology, Inc.
1001 Army Drive, Suite 103,
Barrigada, 96913-1402
Telephone: (671) 646-5231
Facsimile: (671) 646-5230

Task 4 - Biological Assessments for the 7 New Groundwater Monitoring Wells on the Northern Guam Lens Aquifer

Figure 2
Threatened and Endangered Species Survey at DOW-AAFB1

Drawing No. Well DOW-AAFB1	Date: 06/17/19	Drawn By: TCC	EA Project No. 63169.01

100'-0"

100'-0"

DOW-M1
Latitude: 13.506293° N
Longitude: 144.852779° E

Legend

- Proposed_Wellhead_Location
- Area of Potential Effect

0 62.5 125 250 Feet

1993 Guam Geodetic Network Transverse_Mercator

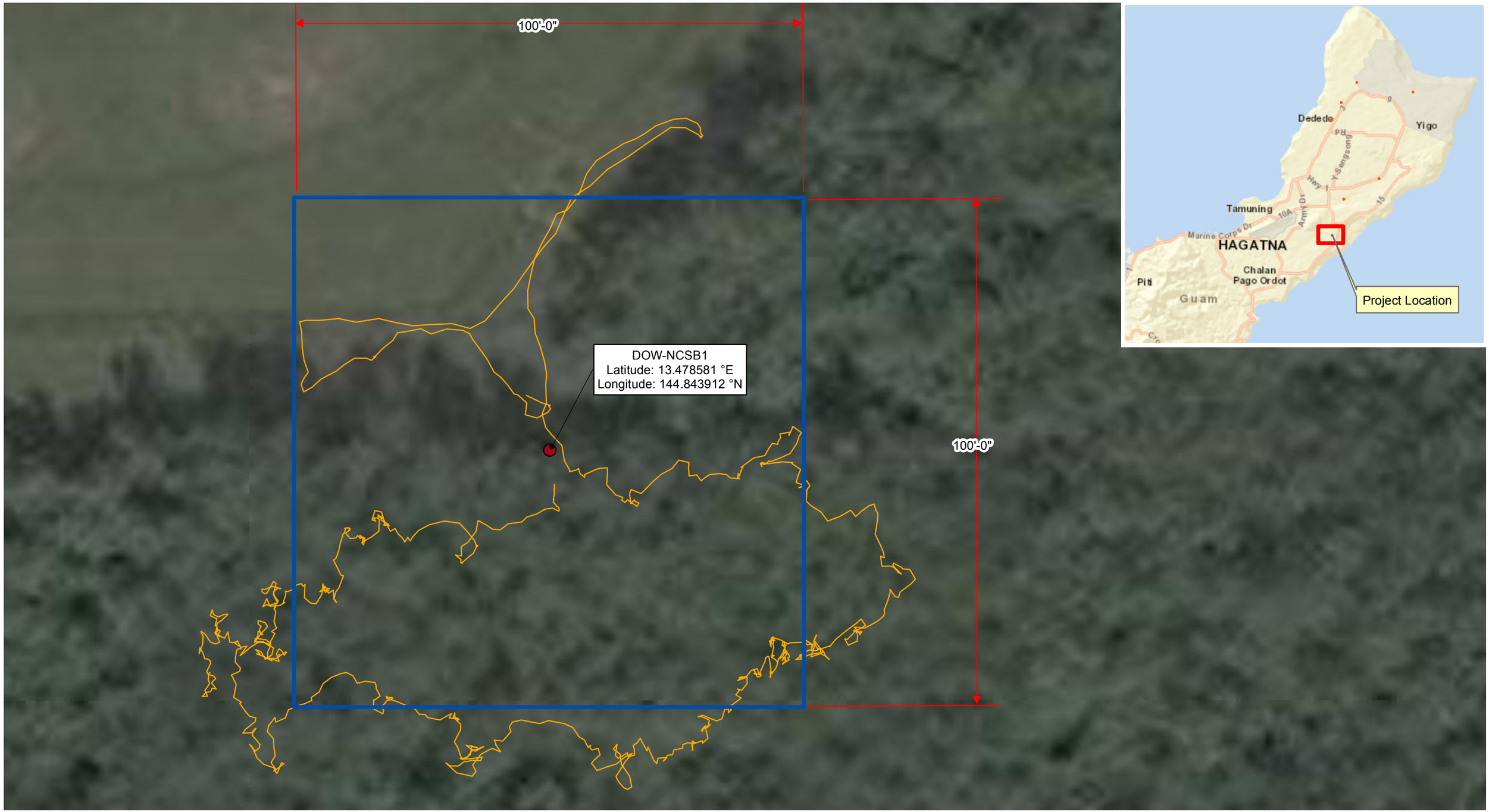
N

EA Engineering, Science, and Technology, Inc.
1001 Army Drive, Suite 103,
Barrigada, 96913-1402
Telephone: (671) 646-5231
Facsimile: (671) 646-5230

Task 4 - Biological Assessments for the 7 New Groundwater Monitoring Wells on the Northern Guam Lens Aquifer

Figure 3
Threatened and Endangered Species Survey at DOW-M1

Drawing No.	Date	Drawn By	EA Project No.
Fig_3_Well DOW-M1	11/15/19	KFisk	63169.01



Legend

- Well Head Locations
- EV Points
- Area of Potential Effect
- Survey Line Foot Paths

0 20 40 80 Feet

1993 Guam Geodetic Network Transverse_Mercator

N

EA Engineering, Science, and Technology, Inc.
1001 Army Drive, Suite 103,
Barrigada, 96913-1402
Telephone: (671) 646-5231
Facsimile: (671) 646-5230

Task 4 - Biological Assessments
for the 7 New Groundwater Monitoring
Wells on the Northern Guam Lens Aquifer

Figure 4
Threatened and Endangered Species Survey at DOW-NCSB1

Drawing No.	Date	Drawn By	EA Project No.
Fig_4_Well DOW-NCSB1	06/24/19	TC	63169.01

EA Engineering, Science, and Technology, Inc.
1001 Army Drive, Suite 103,
Barrigada, 96913-1402
Telephone: (671) 646-5231
Facsimile: (671) 646-5230

Task 4 - Biological Assessments
for the 7 New Groundwater Monitoring
Wells on the Northern Guam Lens Aquifer

Figure 5
Threatened and Endangered Species Survey at DOW-NCSF1

Drawing No.	Date	Drawn By	EA Project No.
Fig_5_Well DOW-NCSF1	06/17/19	TC	63169.01

Legend

- Well Head Locations
- EV Points
- Area of Potential Effect
- Survey Line Foot Paths

0 35 70 140 Feet

1993 Guam Geodetic Network Transverse_Mercator

N

EA Engineering, Science, and Technology, Inc.
1001 Army Drive, Suite 103,
Barrigada, 96913-1402
Telephone: (671) 646-5231
Facsimile: (671) 646-5230

Task 4 - Biological Assessments
for the 7 New Groundwater Monitoring
Wells on the Northern Guam Lens Aquifer

Figure 6
Threatened and Endangered Species Survey at DOW-NCSF2

Drawing No.	Date	Drawn By	EA Project No.
Fig_6_Well DOW-NCSF2	06/17/19	TC	63169.01

Legend

- Well Head Locations
- EV Points
- Area of Potential Effect
- Survey Lines Foot Paths

0 25 50 100 Feet

1993 Guam Geodetic Network Transverse_Mercator

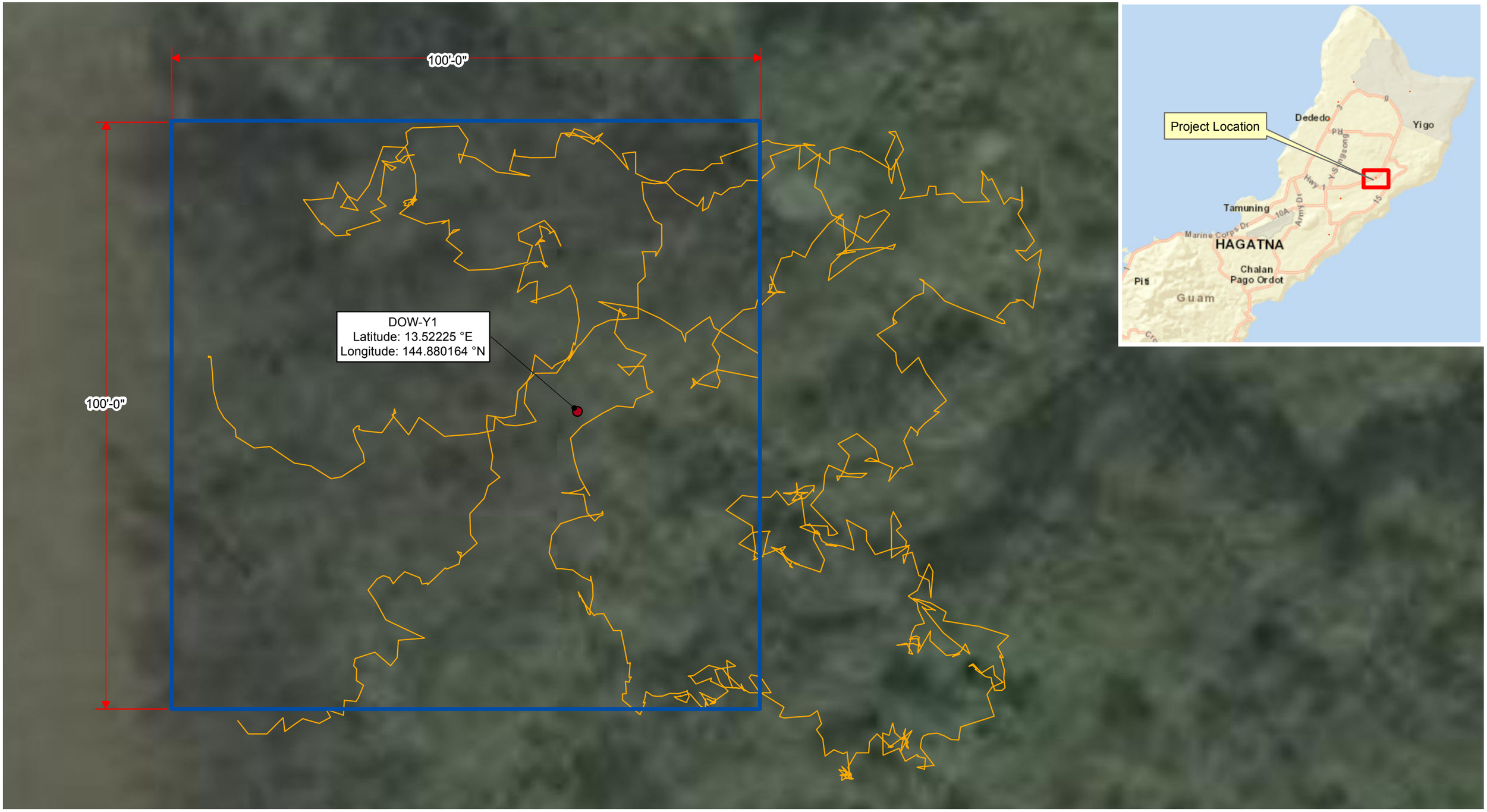
N

EA Engineering, Science, and Technology, Inc.
1001 Army Drive, Suite 103,
Barrigada, 96913-1402
Telephone: (671) 646-5231
Facsimile: (671) 646-5230

Task 4 - Biological Assessments for the 7 New Groundwater Monitoring Wells on the Northern Guam Lens Aquifer

Figure 7
Threatened and Endangered Species Survey at DOW-NWF1

Drawing No.	Date	Drawn By	EA Project No.
Fig_7_Well DOW-NWF1	06/17/19	TC	63169.01



Legend

- Well Head Locations
- EV Points
- Area of Potential Effect
- Survey Line Foot Paths

0 15 30 60 Feet

1993 Guam Geodetic Network Transverse_Mercator

N

EA Engineering, Science, and Technology, Inc.
1001 Army Drive, Suite 103,
Barrigada, 96913-1402
Telephone: (671) 646-5231
Facsimile: (671) 646-5230

Task 4 - Biological Assessments for the 7 New Groundwater Monitoring Wells on the Northern Guam Lens Aquifer

Figure 8
Threatened and Endangered Species Survey at DOW-Y1

Drawing No.	Date	Drawn By	EA Project No.
Fig_8_Well DOW-Y1	06/17/19	TC	63169.01

This page intentionally left blank

4. Effects Analysis

The presence of listed species or their habitat within the proposed project area was assessed during field surveys conducted at the proposed new well sites on 18 September 2018, 3 January 2019, 22 February 2019 and 6 June 2019, as well as on 18 September 2018 at rehabilitation well sites. The biological field surveys were conducted to document the presence and potential impacts to federally protected threatened or endangered species in the project area. The objective of the biological field survey was to ensure that actions associated with the proposed installation and rehabilitation of groundwater monitoring wells is consistent with the requirements of ESA, Section 7 and to identify and avoid potential for impacts if listed species are identified within, or immediately adjacent to, the project area.

The surveys identified two federally protected *Cycas micronesica* (cycads) near proposed well DOW-AAFB1 and a total of six federally protected *Tuberolabium guamense* observed on three separate trees near proposed well DOW-NCSF1. Details about the number and location of each federally protected endangered species are outlined below. No federally protected endangered species were observed at the other proposed well sites or the rehabilitation well sites. Although the species detailed below were identified in close proximity to the proposed wells DOW-AAFB1 and DOW-NCSF1, no significant species were observed within 40 feet of the proposed wellhead locations.

4.1. Micronesian Cycad (*Cycas micronesica*)

Two cycads were identified at DOW-AAFB1 on 3 January 2019. These individuals were located 47 and 89 feet from the well location. AAFB1 is a new well location, which would have the potential to result in disturbance of up to 10,000ft^2 of surrounding area during construction. Cycads are heavily threatened by pests, scale, and predation (DOI USFWS 2015). Due to these factors, many individuals are found in poor health, with low seed production and little growth or recruitment of juveniles. The use of construction equipment in proximity to the individuals of *C. micronesica* has the potential to compact soils, damaging roots. The misuse of equipment could also result in damage or mortality of *C. micronesica* individuals if they were hit or run over during construction activities. Dust may also impact individuals of *C. micronesica* during construction activities. In order to prevent impacts to cycads during the 4-week construction period, a buffer zone with a minimum 30-foot radius has been established around each *C. micronesica* individual observed. Based on the locations of the buffer zones, exclusion zones have been established within the DOW-AAFB1 footprints (Figure 9).

The exclusion zones will be cordoned off using rope or temporary construction fencing by the contractor. Once established, no personnel, equipment or machinery will be allowed to enter or work in the environmental exclusion zones. While active work is going on within the APE, but outside the exclusion zones, dust control will be implemented as necessary using a water spray. By establishing these exclusion zones, listed species found near the well locations will be protected during construction activities. As a result of these conservation measures to protect cycads, it is anticipated that the proposed action may affect, but is not likely to adversely affect *C. micronesica.*

Cycads occur in limestone forest habitats and were once abundant on Guam. Other potential projects on Anderson AFB or in the project vicinity have the potential to impact cycads. There are no known current or future additional projects within the action area that would have the potential to affect protected cycads.

4.2. *Tuberolabium guamense*

Six individuals of *T. guamense* were identified on three trees within the vicinity of DOW-NCSF1 on 3 January 2019. These three trees were located 52, 92, and 120 feet from the well location. This species faces decreasing abundance as a result of habitat loss as well as the introduction of non-native species, herbivory, and typhoons (DOI USFWS 2015). The use of construction equipment in proximity to the host trees for *T. guamense* could result in damage to trees or their root structures. If host trees were damaged or lost it would result in impacts to the orchids. In addition, there could be a direct impact to the individuals of *T. guamense* from construction equipment or dust. In order to prevent impacts to orchids during the four-week construction period, a buffer zone with a minimum 30-foot radius has been established around the *T. guamense* three host trees observed during the field surveys. Based on the locations of the buffer zones, exclusion zones have been established within the DOW-NCSF1 footprints (Figure 10).

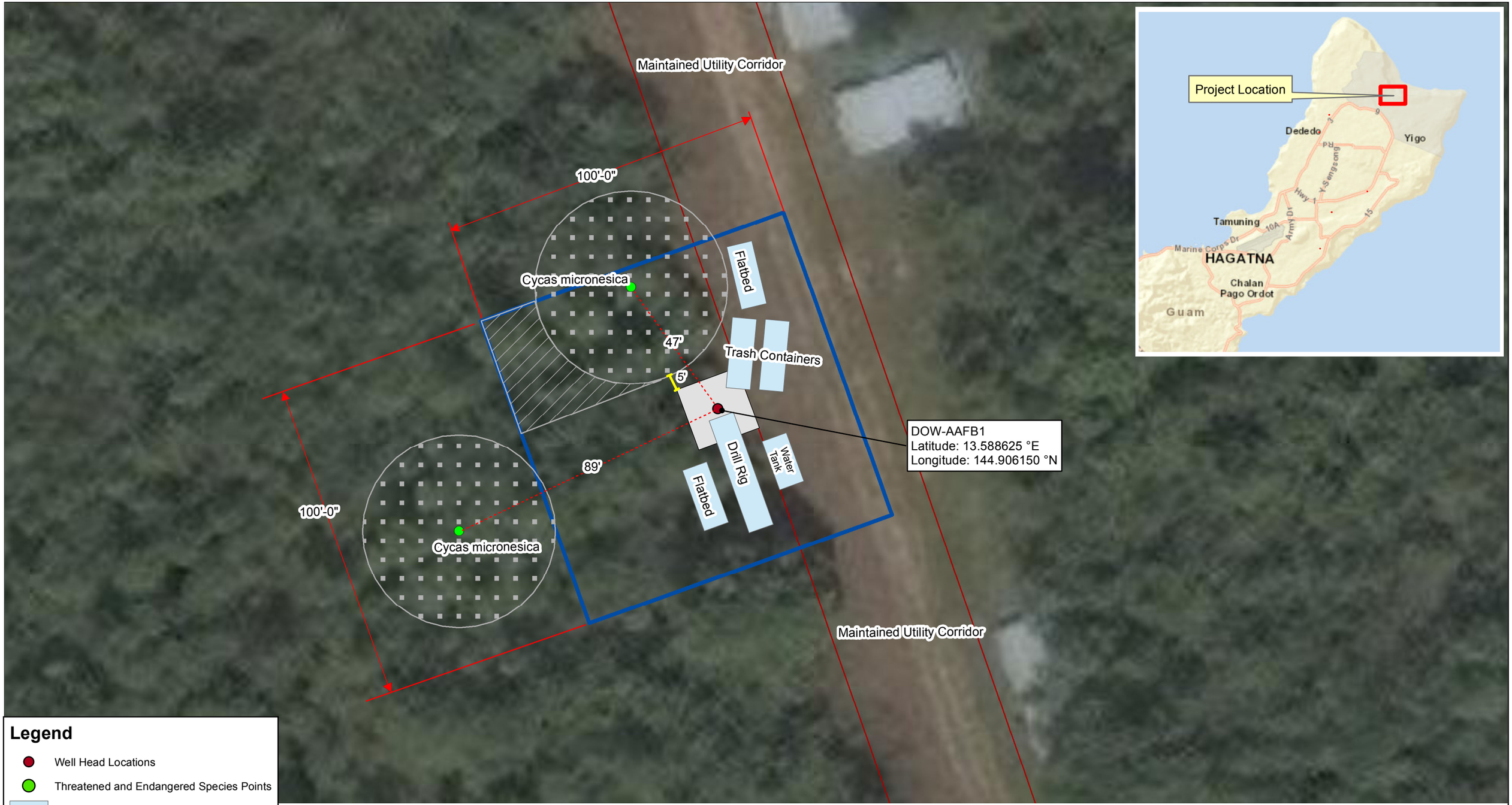
The exclusion zones will be cordoned off using rope or temporary construction fencing by the contractor. Once established, no personnel, equipment or machinery will be allowed to enter or work in the environmental exclusion zones. While active work is going on within the APE, but outside the exclusion zones, dust control will be implemented as necessary using a water spray. By establishing these exclusion zones, listed species found near the well locations will be protected during construction activities. As a result of these measures to protect orchids and their host trees, it is anticipated that the proposed action may affect, but is unlikely to adversely affect *T. guamense*.

Other potential projects on Anderson AFB or in the project vicinity have the potential to impact *T. guamense*. However, there are no known current or future additional projects within the action area that would have the potential to affect listed orchids.

4.3. Mariana Fruit Bat (*Pteropus mariannus*)

No Mariana fruit bats were observed during the surveys, but this project does include suitable Mariana fruit bat habitat. In order to ensure that proposed actions do not result in adverse effects to this species, the bat surveys would be conducted one week prior to the onset of vegetation clearing. A buffer zone at DOW-NCSF1 would also be established around the single *Elaeocarpus joga* tree observed within the APE, which is considered a high value tree (Figure 10). *E. joga* is a known food plant for Mariana fruit bats (Wiles and Fujita 1992)

If a Mariana fruit bat is present within 492 ft (150 m) of the project area during any time of the project, the work will be halted and postponed until the bat has left the area. The measure is intended to prevent, avoid and minimize potential effects to fruit bats, and will be implemented during pre-construction and construction activities. With the implementation of these conservation measures, it is anticipated that the proposed action may affect, but is not likely to adversely affect the Mariana fruit bat.



EA Engineering, Science, and Technology, Inc.
1001 Army Drive, Suite 103,
Barrigada, 96913-1402
Telephone: (671) 646-5231
Facsimile: (671) 646-5230

Task 4 - Biological Assessments for the 7 New Groundwater Monitoring Wells on the Northern Guam Lens Aquifer

Figure 9
Exclusion Zones within Footprint at DOW-AAFB1

Drawing No.	Date	Drawn By	EA Project No.
Fig_9_Well DOW-AAFB1	10/09/19	TC	63169.01

Legend

- Well Head Locations
- Threatened and Endangered Species Points
- Drilling Equipment
- 20' X 20' Concrete Pad
- T&E Species 30 ft Buffer Zone
- Exclusion Zone
- Area of Potential Effect
- Utility Easement

25 12.5 0 25 50 75 100 Feet

N

1993 Guam Geodetic Network Transverse_Mercator

EA Engineering, Science, and Technology, Inc.
1001 Army Drive, Suite 103,
Barrigada, 96913-1402
Telephone: (671) 646-5231
Facsimile: (671) 646-5230

Task 4 - Biological Assessments for the 7 New Groundwater Monitoring Wells on the Northern Guam Lens Aquifer

Figure 10
Exclusion Zones Within Footprint at DOW-NCSF1

Drawing No.	Date	Drawn By	EA Project No.
Fig_10_Well DOW-NCSF1	10/09/19	TC	63169.01

5. Conclusion and Determination of Effects

Field surveys for threatened and endangered species and migratory birds were conducted at the proposed new well sites on 18 September 2018, 3 January 2019, 22 February 2019 and 6 June 2019, as well as on 18 September 2018 at the sites proposed for rehabilitation.

EA recommends a determination that the proposed action would have ***no effect*** on the species presented in Table 4, based on the rationale provided and their absence during the biological surveys.

Table 4. Protected Species with a Section 7 Determination of *No Effect*

Scientific Name	Common Name	Status	Reason
Phyllanthus saffordii	-	E	No suitable habitat for this species occurs in the project area
Aerodramus vanikorensis bartschi	Mariana gray swiftlet	E	The closest active roosting/nesting caves for this species are over 15 miles away
Chelonia mydas	Green sea turtle	E	No suitable habitat for this species occurs in the project area
Corvus kubaryi	Mariana crow	E	Species has not been documented on Guam in several years
Emballonura semicaudata rotensis	Pacific sheath tailed bat	E	Species is only known on Guam from historical occurrences
Emoia slevini	Slevin's skink	E	Species has not been documented on Guam for over 20 years (DOI USFWS 2015)
Eretmochelys imbricata	Hawksbill sea turtle	E	No suitable habitat for this species occurs in the project area
Gallinula chloropus guami	Mariana common moorhen	E	No suitable habitat for this species occurs in the project area
Rallus owstonii	Guam rail	E	Species is extirpated on mainland Guam
Todiramphus cinnamominus	Guam kingfisher	E	Species is extirpated on mainland Guam
Vagrans egistina	Mariana wandering butterfly	E	Species has not been documented on Guam since 1979 (USFWS 2014)
E for Endangered, T for Threatened			

EA recommends a determination that the proposed action ***may affect, but not likely to adversely affect*** the species presented in Table 5, based on the rationale provided in the table. The Federal Action Agency will request concurrence from the USFWS on the determination of may affect, but not likely to adversely affect finding for these species.

Table 5. Protected Species with a Section 7 Determination of *May Affect, but not Likely to Adversely Affect*

Scientific Name	Common Name	Status	Reason
Bulbophyllum guamense	Wild onion	T	Not observed in the project area during the biological survey
Cycas micronesica	Micronesian cycad	T	Two individuals of this species were observed in vicinity to the project area during the biological survey at DOW-AAFB1. While the proposed action has the potential to impact this species, the use of an exclusion zone would minimize the potential for any adverse effect on this species
Dendrobium guamense	-	E	Not observed in the project area during the biological survey
Eugenia bryanii	-	E	Not observed in the project area during the biological survey
Hedyotis megalantha	-	E	Not observed in the project area during the biological survey
Heritiera longipetiolata	-	E	Not observed in the project area during the biological survey
Maesa walkeri	-	T	Not observed in the project area during the biological survey
Nervilia jacksoniae	-	T	Not observed in the project area during the biological survey
Psychotria malaspinae	-	E	Not observed in the project area during the biological survey
Serianthes nelsonii	Fire tree	E	Not observed in the project area during the biological survey
Solanum guamense	-	E	Not observed in the project area during the biological survey
Tabernaemont-ana rotensis	-	T	Not observed in the project area during the biological survey
Tinospora homosepala	-	E	Not observed in the project area during the biological survey
Tuberolabium guamense	-	T	Six individuals on three host trees were observed within the project area at DOW-NCSF1. While the proposed action has the potential to impact this species, the use of an exclusion zone would minimize the potential for any adverse effect on this species
Hypolimnas octocula marianensis	Mariana eight-spot butterfly	E	Not observed in the project area during the biological survey
Partula gibba	Humped tree snail	E	Not observed in the project area during the biological survey
Partula radiolata	Guam tree snail	E	Not observed in the project area during the biological survey

Scientific Name	Common Name	Status	Reason
Pteropus mariannus	Mariana fruit bat	T	Species was not observed in the project area during the biological survey. Surveys would be conducted one week prior to vegetation clearing to ensure that bats were not present. If a bat was found at any point during construction work would be halted until the bat left the project area
Samoana fragilis	Fragile tree snail	E	Not observed in the project area during the biological survey
E for Endangered, T for Threatened			

Conservation measures would be employed to prevent effects to federally protected species with the potential to occur within the project area. These measures include the following:

- A buffer exclusion of approximately 30 feet around each identified cycad, the single observed *E. joga*, and host tree for orchids would be cordoned off using rope or temporary construction fencing by the contractor. Once established, no personnel, equipment or machinery will be allowed to enter or work in the environmental exclusion zones.
- While active work is going on within the APE, but outside the exclusion zones, dust control will be implemented as necessary using a water spray.
- If a Mariana fruit bat is present within 492 ft (150 m) of the project area during any time of the project, the work will be halted and postponed until the bat has left the area.
- If work is completed more than 3 months from the date of the biological field surveys, a snail survey will be conducted in the project area within 3 months of the start of construction to ensure no snails are present in the project area.

This page intentionally left blank

6. Literature Cited

Department of the Interior, Fish and Wildlife Service (DOI USFWS), 2015. *Endangered and Threatened Wildlife and Plants; Endangered Status for 16 Species and Threatened Status for 7 Species in Micronesia*. Federal Register Volume 80, Number 190. Rules and Regulations. Thursday, October 1, 2015.

Fiedler, G.C. 2019. DRAFT Biomonitor Support for Natural Resource Management Surveys at Joint Region Marianas Area of Responsibility (Partulid Snail Survey Methods), Cooperative Agreement N40192-17-2-8005, Prepared for Naval Facilities Engineering Command, Marianas.

University of Guam, 2014. *Federal candidate species surveys on Guam*. Final project report. Prepared for Naval Facilities Engineering Command under Cooperative Agreement N40192-12-2-8001.

USFWS (U.S. Fish and Wildlife Service), 2014. *Mariana Islands Plant and Animal Species Being Considered for Listing as Threatened or Endangered under the Endangered Species Act*. May 2014.

USFWS (U.S. Fish and Wildlife Service), 2014. *Mariana Islands Plant and Animal Species Being Considered for Listing as Threatened or Endangered under the Endangered Species Act*. May 2014.

Wiles, G.J. and Fujita, M. 1992. *Food plants and economic importance of flying foxes on Pacific Islands*. Pp. 24-35 In Proceedings of an international conservation conference Ed by D.E. Wilson and G.L. Graham. USFWS Biological Report 90(23). Washington, DC., USA.

This page intentionally left blank

7. List of Contacts Made and Preparers

Contacts:
Jacqueline Flores – USFWS
Toni Mizerek - USFWS

List of Preparers:
Thomas Konner – Environmental Engineer, U.S. EPA WTR-3-3
Cheryl Dilks – Environmental Engineer, Brown and Caldwell
Daniel M. Savercool, CSE, CERP – Senior Biologist, EA Engineering, Science, and Technology, Inc., PBC
Kathryn Cerny-Chipman – Biologist, EA Engineering, Science, and Technology, Inc., PBC

This page intentionally left blank

APPENDIX A
SITE PHOTOGRAPHS

This page intentionally left blank

Rehabilitation Wells

Site overview of A-16

Site overview of A-20

Site overview of BPM-1

Site overview of EX-1

Site overview of EX-4

Site overview of EX-6

Site overview of EX-8

Site overview of EX-9

Site overview of EX-10

Site overview of M-10A

Site overview of GHURA-Dededo

Site overview of NCS-3A

New Wells

Site overview of DOW-AAFB1

Cycas micronesica at DOW-AAFB1

Site overview of DOW-M1

Site overview of DOW-NCSB1

Site overview of DOW-NCSF1

Tuberolabium guamense observed at DOW-NCSF1

Site overview of DOW-NCSF2

Site overview of DOW-Y1

Site overview of DOW-NWF1