

Draft Environmental Impact Statement Infrastructure Improvements at the Yap International Airport and the Yap Seaport Yap State, Federated States of Micronesia

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Appendix I
Terrestrial Resources Baseline Survey Reports
(Draft 2024 DAF and 2023 Navy)
and Terrestrial Consultation package (forthcoming)





Natural Resources Survey Report

Environmental Impact Statement for
Yap International Airport Improvement
Project, State of Yap, Federated States
of Micronesia



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Abbreviations and Acronyms

°F	degrees Fahrenheit
CoFA	Compact of Free Association
DAF	Department of the Air Force
DoAF	Division of Agriculture and Forestry
ERW	explosive remnants of war
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FSM	Federated States of Micronesia
IUCN	International Union for the Conservation of Nature
JRM	Joint Region Marianas
spp.	species
U.S.	United States
YSC	Yap State Code

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1. Introduction

1.1 Natural Resources Survey Purpose

The Department of the Air Force (DAF) proposes to construct and operate facilities and infrastructure at the Yap International Airport to conduct military readiness activities which include training exercises and operations.

The purpose of the natural resources survey conducted at the Yap International Airport was to record the natural resources the DAF identified within the environmental survey area that encompasses the proposed project to improve the capabilities of Yap International Airport and support any applicable environmental planning processes.

This *Natural Resources Survey Report* provides a brief overview of the project location and proposed action, desktop review results, survey area and methodology, and survey findings. This report provides information about current conditions to support environmental planning analysis and anticipated natural resources coordination with the Yap State Division of Agriculture and Forestry (DoAF). Natural resources coordination between the DAF and DoAF will comply with Title One, Article VI (Environmental Protection) of the CoFA (DOS 2003), which identifies U.S. government obligations for actions within the FSM. Additionally, the DAF incorporated Yap State Code (YSC) Title 18, *Conservation and Resources*; Chapter 10, Sections 1001 through 1011, *Wildlife Conservation*; and Chapter 11, Section 1101, *Fruit Bat Sanctuary Act 2013* (revised 2015), referred to as Yap regulated in tables and text, when designing the survey methodology.

In accordance with Title One, Article VI of the CoFA, the DAF is required to comply with U.S. federal protections. The Endangered Species Act (ESA) of 1973 prohibits take of any listed species without prior approval of the U.S. Secretary of the Interior. Take is defined as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct.” Other laws identified such as the Ocean Dumping Act and the Clean Water Act have substantive standards that indirectly affect natural or biological resources and would be addressed in environmental planning.

1.2 Project Description

1.2.1 Project Location

The Proposed Action would occur at the Yap International Airport, which is on Yap Island within the State of Yap, FSM (see **Figure 1-1**). The FSM is a sovereign island nation in the western Pacific Ocean. The State of Yap is the westernmost state of the FSM and spans over 100,000 square miles, approximately 520 miles southwest of Guam. The State of Yap consists of four main islands (Yap, Tamil-Gagil, Maap, and Rumung) and 134 smaller islands, 22 of which are populated (BSAP 2004). According to the 2021 census projection, approximately 11,600 residents are on Yap (HRSA 2023).

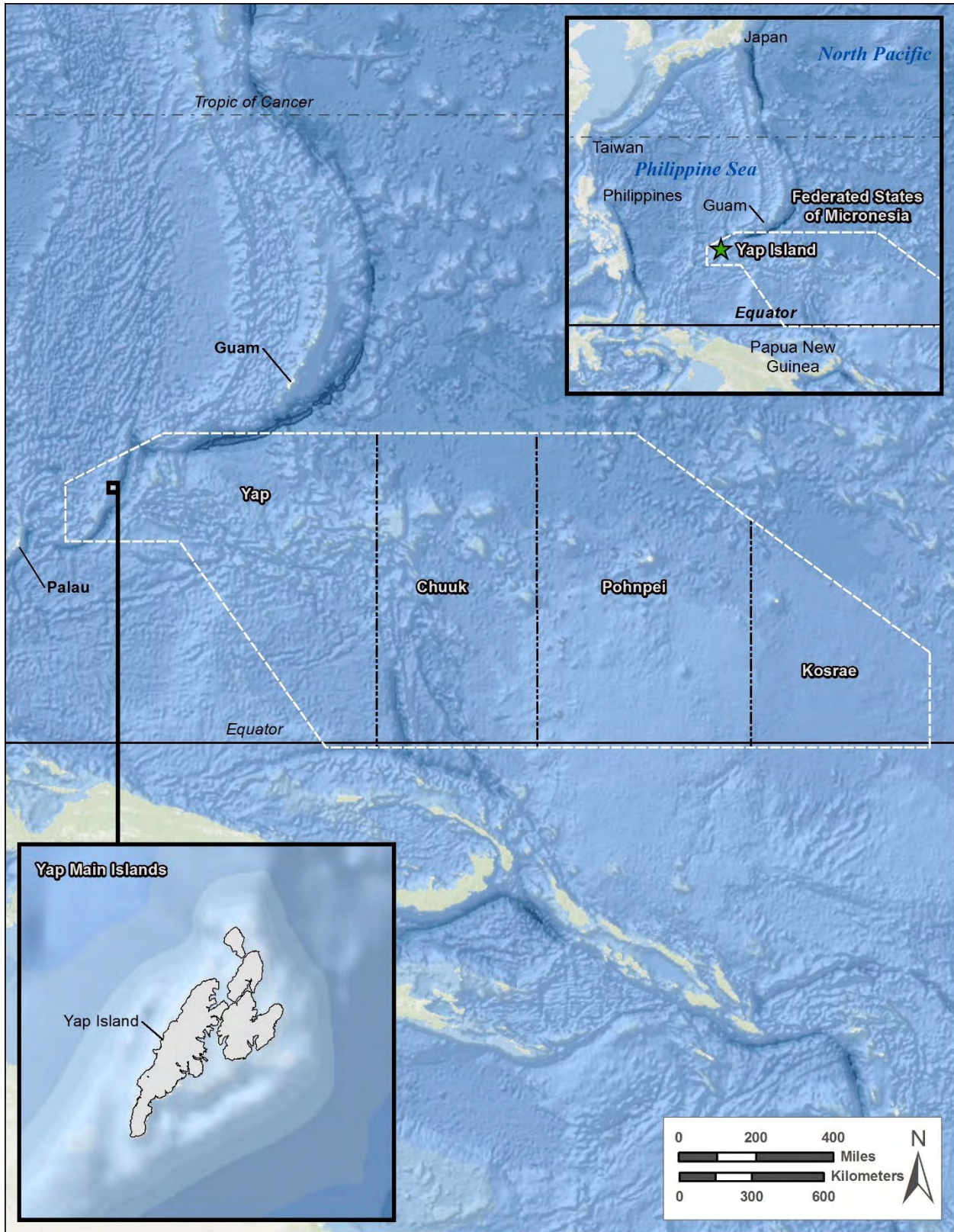
The Yap International Airport is on the southwestern portion of Yap Island, approximately 3 miles southwest of Colonia (see **Figure 1-2**). The airport has a terminal complex and one runway (07/25) that is approximately 6,000 feet long and 150 feet wide, has 25-foot-wide

shoulders (total of 200 feet wide), and has turnarounds at both ends. It is a U.S. Federal Aviation Administration (FAA) certified airport and is governed by FAA criteria for clear zones, imaginary surfaces, and other airfield restrictions (DAF 2020). The land surrounding the airport is primarily vegetated and undeveloped.

1.2.2 Proposed Action

DAF is proposing airport improvements at the Yap International Airport to augment and adapt the DAF's and the Department of the Navy's military readiness capabilities within the FSM to conduct military readiness activities to support evolving mission requirements to meet U.S. national security objectives and fulfill U.S. obligations to provide for the defense of the FSM per Title Three of the CoFA between the U.S. and the FSM. The Proposed Action is limited to construction and military readiness activities.

Natural resources surveys, completed in March 2024, were conducted on the environmental survey area covering approximately 919 acres on and around the airport, including the seaport-to-airport road. Only approximately 265 acres (i.e., project area) of the 919-acre environmental survey area (see **Figure 1-3**) would be disturbed during construction and would either be developed, resurfaced with ground cover (e.g., gravel), or revegetated once construction is complete.

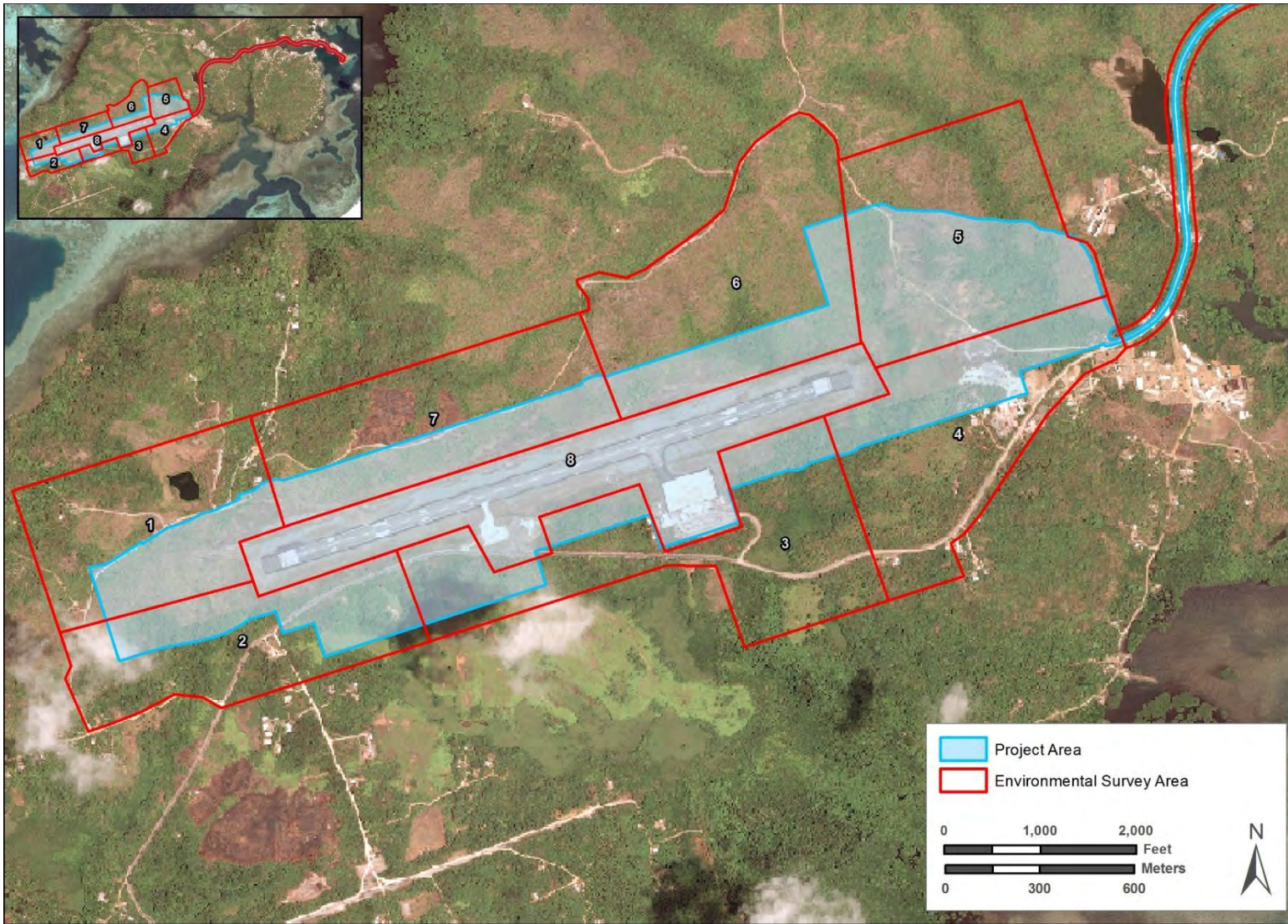


Basemap: World Ocean Base

Figure 1-1. Yap Island, State of Yap, and Federated States of Micronesia



Figure 1-2. Yap International Airport



Basemap: Digital Atlas of Micronesia 2018 Imagery

Figure 1-3. Environmental Survey Area and Project Area

2. Desktop Research

2.1 Background

Throughout the text of this report, the first introduction of a plant or wildlife species includes the scientific name, followed by the common and local names, if applicable, in parenthesis. Subsequent references to species use the common name whenever possible. In the absence of common names, the shortened scientific name is used.

Previous Surveys: Biological monitoring surveys were conducted in support of geotechnical site investigations between March 2 and 28, 2023. These surveys were focused around the perimeter of, and extending east and west of, the airport. The survey team documented seven sensitive plant species: *Calophyllum inophyllum* (beach mahogany/biyuuch), *Cyrtosperma merkusii* (Giant swamp taro/lak), *Pandanus tectorius* (Tahitian screwpine/choi), *Pandanus yapensis* (tha), *Robiquetia* spp. (pouched orchid), *Timonius albus* (gathemach), and *Trichosperma ikutai* (wapof). Additionally, eight sensitive wildlife species were documented: *Anous minutus* (black noddy), *Arenaria interpres* (ruddy turnstone), *Bubulcus coromandus* (Eastern cattle egret), *Gygis alba* (white tern), *Ixobrychus sinensis* (yellow bittern), *Monarcha godfreyi* (Yap monarch), *Pluvialis fulva* (Pacific golden plover), and *Zosterops hypolais* (Yap plain white-eye) (NAVFACPAC 2024).

Climate and Vegetation. Yap consists of four metamorphic, old volcanic high islands and a group of approximately 15 coralline atolls. Yap's climate is characterized by heavy rainfall, and high temperatures and humidity. The mean annual rainfall is approximately 122 inches, with the driest months occurring between February and April (FSM 2024). The mean annual temperature is 81 degrees Fahrenheit (°F), with generally less than 3°F difference between the warmest and coolest months (USDA 1987, FSM 2024).

A U.S. Department of Agriculture vegetation study was completed in 2019 to update and standardize the vegetation community classification for Yap Island (USDA 2019). The study assigned vegetation community and land use categories from aerial imagery, previous vegetation mapping, and field visits where appropriate. In total, ten vegetation community categories were developed and applied across the island, with all but one class (mangroves) represented within the project area. Since 2003, a net increase of 57 percent agroforest and net decreases of 27 percent mangroves and more than 160 percent fern savannas have occurred (USDA 2019). General decline in natural vegetation is likely a combined pressure on natural resources to produce food for growing populations combined with Japanese agricultural practices, droughts, and burning practices (USDA 1987). **Table 2-1** provides a breakdown of vegetation classes across Yap Island; descriptions of land classes is provided in **Appendix A, Table A-1**.

Table 2-1. Yap Island Vegetation Classes

Class	Acres	Percentage
Agroforest	6,766.6	28.4
Barren	184.1	0.8
Mangrove forest	2,637.5	11.0
Marsh	310.2	1.3
Savanna	4,097.4	17.2
Secondary vegetation	985.2	4.1
Swamp forest	61.9	0.3
Upland forest	7,737.3	32.4
Urban built-up/ cultivated	1,021.1	4.3
Open water	22.2	0.1
Total	23,823.5	99.9^a

Source: USDA 2019

Key:^a Numbers do not add up to 100 percent due to rounding issues

Mammals. There is one native mammal known to inhabit Yap Island, *Pteropus pelewensis yapensis* (Yap flying fox/maagul'aew). The Global Invasive Species Database notes an additional five mammals that are considered invasive and have been documented on Yap (GISD 2024). *Rusa marianna* (Philippine brown deer) may also be present on Yap, but that has not been confirmed (iNaturalist 2024d). The Yap flying fox is listed on the IUCN Red List as vulnerable and this species is provided State of Yap protections against “the taking, hunting, exporting, purchasing or selling” under YSC Title 18, Chapter 11, Section 1101 (Wiles et al. 2008, YSC 1987a). Additional protections are provided under the Ninth Legislature of the State of Yap Bill 9-18, which amends Chapter 11 and establishes a flying fox sanctuary defined as “all mangroves, known roosting sites and forests of Yap” (LSY 2015). See **Appendix A, Table A-3** for a list of invasive mammal species.

Birds. Approximately 106 birds, including 9 endemic and 6 introduced species, have been recorded on Yap. Endemic species include the *Acrocephalus astrolabii* (Mangareva reed warbler [presumed extinct]), *Acrocephalus syrinx* (Carolinian reed warbler), *Aplonis opaca* (Micronesian starling), *Edolisoma nesiotis* (Yap cicadabird), *Myzomela rubratra* (Micronesian myzomela), Yap monarch, *Pampusana xanthonura* (white-throated ground dove), Yap plain white-eye, and *Zosterops oleagineus* (Yap olive white-eye) (Avibase 2023). See **Appendix A, Table A-2** for the full species list.

Reptiles and Amphibians. Yap herpetological surveys have been sporadic and predominantly focused on Yap atolls. No published surveys have occurred for Yap Island; however, between 2010 and 2013, up to 15 species of reptiles and amphibians were recorded between Fais Island, Sorol Atoll, and Ngulu Atoll. Reptile species included two sea turtles, six geckos, six skinks, and one monitor lizard (Buden, 2010, 2011, 2013). Incidental observations on Yap Island have documented eight reptiles and one amphibian (iNaturalist 2024a, 2024b). Additionally, *Perochirus ateles* (Micronesia saw-tailed gecko/qadburrug) is considered a widespread resident of Yap Island and is listed as vulnerable by the International Union for the Conservation of Nature (IUCN; Buden 2011). Two reptiles, *Emoia boettgeri* (Boettger’s Emo skink) and *Hemidactylus frenatus* (common house gecko), are suspected, not confirmed, to inhabit Yap Island. The monitor lizard is an invasive species (GISD 2024), and the green

anole and cane toad are introduced; it is not clear if the remaining species are considered native or endemic. See **Appendix A, Table A-2** for a complete species list.

Invertebrates. No comprehensive surveys of invertebrates have been published for Yap Island or the surrounding islands or atolls. Eleven incidental sightings of invertebrates have occurred (iNaturalist 2024c). Additionally, *Birgus latro* (coconut crab) is known to occur on the island. This species is listed on the IUCN Red List as vulnerable and is protected under YSC Title 18, Chapter 10, Section 1004, which designates hunting limitations and selling of coconut crab (Cumberlidge 2020, YSC 1987b). One species, *Wasmannia auropunctata* (little fire ant), is an invasive species (GISD 2024). No threatened invertebrate species listed on the IUCN Red List are known to occur on Yap Island. See **Appendix A, Table A-2** for a complete species list.

Special Status Species. Nineteen special status species identified by DAF, listed in **Table 2-2**, could occur on or around the environmental survey area, including 6 plant and 13 animal species. Field team members documented all birds observed to ensure any migratory species were included in this report (see **Table 4-4** in **Section 4.2**).

Invasive Species. According to the Global Invasive Species Database, 41 invasive terrestrial species have been documented on Yap Island, including 35 plant and 6 wildlife species (GISD 2024). See **Appendix A, Table A-3** for a complete invasive species list.

2.2 Special Status Species Review

DAF conducted a desktop search for species that have U.S. federal, FSM, and Yap State protections. Additionally, IUCN at risk species (<https://www.iucnredlist.org/>) were considered to identify special status species that have not been formally recognized by the State of Yap as sensitive and vulnerable to extinction.

2.2.1 Plants

The potential exists for one U.S. federally listed and five IUCN-listed plants to occur within the environmental survey area (ARW 1998, Bachman and Chadburn 2015, Barstow 2018, Barstow 2020, DOI 2016, Omosowon and Kell 2019).

***Cycas micronesica* (cycad/faltir):** Cycads are typically unbranched trees with a thick trunk that can grow 26 to 39 feet tall. Leaves can be 3 to 8 feet long, are pinnate, and spiral in a round crown at the top. Leaves have a pinnate pattern that are a glossy dark green. Cycads do not flower but produce male and female cones on separate trees. Cycads are threatened by the invasive *Aulacaspis yasumatsui* (aulacaspis scale), which is currently known to occur in Guam, Rota, and Palau. Cycads prefer slightly acidic, well-draining soils and can tolerate full sun to partial shade (Bösenberg 2022). The U.S. Fish and Wildlife Service and IUCN list this species as endangered (DOI 2016); Yap has an estimated total of approximately 288,450 cycads between four populations (DOI 2016).

***Dioscorea nummularia* (Pacific yam/thap):** The Pacific yam is a climbing perennial plant that annually produces twining stems from a tuberous rootstock. The species grows best within lowland areas with well-draining, sandy loam soil, and is cultivated throughout Micronesia as a food source (UTPD 2014). Yap population estimates for the Pacific yam are not available;

however, the IUCN identifies a trending decreasing population. The IUCN 2019 assessment considers the Pacific yam to be near threatened due to deforestation, expanding human settlements, and associated agriculture (Omosowon and Kell 2019).

***Intsia bijuga* (Borneo teak/throrrot):** Borneo teak is a tall tree that can grow up to 150 feet tall, with a smooth-barked trunk. Leaves are compound, with four wavy leaflets that are 3 to 6 inches long with medium to dark green coloration. This species prefers forest edges, and grows best within lowland areas with well-drained soils and full sun (USDA 2015, Orwa et al. 2009). Yap population estimates for the Borneo teak are not available; however, the IUCN identifies a trending decreasing population. The IUCN 2020 assessment considers the Borneo teak to be near threatened due to fire, flooding, deforestation, expanding human settlements, and associated agriculture (Barstow 2020).

***Metroxylon amicarum* (Caroline ivory nut palm):** The Caroline ivory nut palm is a tall palm tree that can grow up to 60 feet tall, with a massive trunk and short root spines. This palm is endemic to Pohnpei and Chuuk, and only occasionally planted on Yap. Leaves are pinnate fronds that grow up to 15 feet long; fronds have a woolly appearance. This species prefers moist forest edges above 1,500 feet elevation, wetlands, and coastal rainforests (USDA 2015, PFAF 2024). Yap population estimates for the Caroline ivory nut palm are not available, and the trending population status is unknown. The IUCN 2011 assessment considers the Caroline ivory nut palm to be near threatened due to flooding, deforestation, expanding human settlements, and associated agriculture (Bachman and Chadburn 2015).

***Pericopsis mooniana* (nedun tree):** The nedun tree can grow up to 120 feet tall and has thin, flaking bark. Leaves are pinnate with a sharp tip, with five to nine leaflets that are 1 to 3 inches long. This species is typically found along rivers and coasts, and is considered uncommon on Yap (USDA 2015). Yap population estimates for the nedun tree are not available, and the trending population status is unknown. The IUCN 1998 assessment considers the nedun tree to be vulnerable due to logging and wood harvesting (ARW 1998).

***Pterocarpus indicus* (rosewood/lach):** Rosewood is a tall tree that can grow up to 120 feet tall with a stout, buttressed trunk. Leaves are compound pinnate leaves up to 12 inches long, with 6 to 12 leaflets that are pointed at the tip. This species is most commonly found along rocky shores, tidal creeks, and coasts but can be found in savannas and uplands (USDA 2015). Yap population estimates for rosewood are not available; however, the IUCN identifies a trending decreasing population. The IUCN 2018 assessment considers rosewood to be endangered due to logging and wood harvesting (Barstow 2018).

2.2.2 Wildlife

The potential exists for 10 IUCN-listed birds, 1 IUCN-listed reptile, 1 IUCN-listed and State of Yap-protected mammal, and 1 State of Yap-protected crustacean to occur within the environmental survey area (BLI 2017a, BLI 2017b, BLI 2017c, BLI 2018a, BLI 2018b, BLI 2019, BLI 2020, BLI 2022a, BLI 2022b, BLI 2022c, BLI 2022d, BLI 2023).

Birds

***Calidris tenuirostris* (Great knot):** The great knot is a stocky, medium sized shorebird. It has a black bill, a blackish back and mottled chest with an orange upper wing patch (eBird 2024a). This species prefers mudflats, coastal marine, wetlands, and intertidal habitats. Great knots nest and breed in Russia. Yap and worldwide population estimates are not available; however, records indicate that this species is declining (BLI 2019). The IUCN 2016 assessment considers the great knot to be an endangered species due to habitat impacts, development, pollution, climate change, and agriculture (BLI 2019).

***Ducula oceanica* (Micronesian imperial-pigeon/buleogol):** The Micronesian imperial-pigeon is a large forest pigeon with green wings, a predominantly gray body, and a diagnostic black fleshy knob above the bill. This species is found across most habitats, but it prefers undisturbed forest (BLI 2020). No information is available about foraging and nesting preferences; however, other imperial-pigeon species are known to forage fruits within the dense tree canopy in pairs or groups and nest in pairs or colonies in mangroves or forests (Backyard 2024a). Yap population estimates are not available; however, the IUCN estimates 2,500 to 12,200 mature individuals across the pigeon's range, with a trending decreasing population. The IUCN 2020 assessment considers the Micronesian imperial-pigeon to be a vulnerable species due to habitat impacts, hunting, logging and wood harvesting, and agriculture (BLI 2020).

***Edolisoma nesiotis* (Yap cicadabird [formerly common cicadabird]):** The Yap cicadabird is a long-bodied and long-billed species. Males are dark slate gray, with a predominantly gray body. This species is found across most habitats, but it prefers undisturbed forest habitats (BLI 2022a). No information is available about foraging and nesting preferences; however, other cicadabird species are known to forage for insects, fruits, and seeds in tree crowns and build shallow nests made of bark, twigs, grass, and spiderwebs on horizontal branches (Backyard 2024b). Yap population estimates for cicadabird are 180 mature individuals across the species' range, with a trending stable population. The IUCN 2022 assessment considers the Yap cicadabird to be an endangered species due to habitat impacts, invasive species, and fire concerns (BLI 2022a).

***Limosa lapponica* (bar-tailed godwit):** The bar-tailed godwit has a barred tail with a white underwing, and lacks a white wing-bar; females are larger and paler with a longer bill. This species is generally found on sandy beaches and intertidal habitats. Bar-tailed godwits nest and breed on the Arctic tundra. Yap population estimates are not available; however, the IUCN estimates are 1,099,000 to 1,149,000 mature individuals across the species' range, with a trending decreasing population. The IUCN 2016 assessment considers the bar-tailed godwit to be a near threatened species due to habitat impacts, invasive species, pollution, and agriculture (BLI 2017a).

***Limosa limosa* (black-tailed godwit):** The black-tailed godwit has a long bill with a small head and long neck and legs; it has a striking wing-bar and rump. This species is generally found on grasslands, wetlands, and intertidal habitats. Black-tailed godwits nest and breed in cooler northern climes. Yap and worldwide population estimates are not available; however, records indicate that this species is rapidly declining (BLI 2017b). The IUCN 2016 assessment considers

this godwit to be a near threatened species due to habitat impacts, invasive species, pollution, and agriculture (BLI 2017b).

***Monarcha godeffroyi* (Yap monarch):** The Yap monarch is black and white; the male has a white body with a black head, tail, and wings; females are black overall with a white collar. Juveniles are dull brown with a grayish head. This species is found across most habitats, including mangroves and savannahs (BLI 2022b). No information is available about foraging and nesting preferences for the Yap monarch; however, other monarch species are known to forage insects in the forest understory and build a small cup nest made of bark, moss, fibers, and spiderwebs in hanging vines or tree forks 3 to 18 feet above the ground, typically near water (Backyard 2024c). The IUCN 2022 assessment for the Yap monarch population estimates are 10,000 to 30,000 mature individuals, with a trending stable population. The IUCN considers the Yap monarch to be a near threatened species due to habitat impacts, invasive species, and fire concerns (BLI 2022b).

***Numenius madagascariensis* (Far-Eastern curlew):** The far-Eastern curlew has a long and decurved bill, a light brown rump, and underwings that are heavily marked (eBird 2024b) This species is generally found in coastal marine areas, estuaries, intertidal flats and mangrove swamps. Far-Eastern curlews nest and breed in Mongolia and Russia. Yap population estimates are not available; however, the IUCN estimates approximately 32,000 mature individuals occur across the species' range, with a trending decreasing population. The IUCN 2017 assessment considers the far-Eastern curlew to be an endangered species due to habitat impacts, pollution, development, and agriculture (BLI 2017c).

***Numenius tahitiensis* (bristle-thighed curlew):** The bristle-thighed curlew has a long and decurved bill with bristled feathers on the legs and light, spotted brown belly plumage. This species is generally found on coral reefs, intertidal flats, palm forests, rocky shores, and beaches. Bristle-thighed curlews nest and breed on the Arctic tundra. Yap population estimates are not available; however, the IUCN estimates approximately 10,000 mature individuals occur across the species' range, with a trending decreasing population. The IUCN 2020 assessment considers the bristle-thighed curlew to be a near threatened species due to habitat impacts, invasive species, pollution, and agriculture (BLI 2022c).

***Pampusana xanthonura* (white-throated ground dove):** The white-throated ground dove is a medium-sized bird; males are brown with a white head and chest, while females are a shade of brown. This species inhabits a variety of areas, including native and secondary forest, fields, and developed areas such as plantations. White-throated ground doves forage for fruits, flowers, and seeds within the canopy but have been known to forage on the ground on Yap. This species builds twig nests placed highly in trees and generally mate for life (Animalia 2024). Yap population estimates are not available; however, the IUCN estimates 10,000 to 19,999 mature individuals occur across the species' range, with a trending population that is unknown. The IUCN 2023 assessment considers the white-throated ground dove to be a near threatened species due to hunting and invasive species impacts (BLI 2023).

***Pseudobulweria becki* (Beck's petrel):** Beck's petrel is dark brown on the back, head, and throat with a distinct wing-bar; the belly and breast are white. This species is likely to nest in burrows of high mountains but may breed on small islets. No documented observations have

occurred on Yap, but it is within the range. The IUCN estimates 50 to 249 mature individuals exist across the species' range, with a trending decreasing population. The IUCN 2018 assessment considers the Beck's petrel to be a critically endangered species due to habitat impacts, invasive species, and agriculture (BLI 2018a).

***Zosterops hypolais* (Yap plain white-eye):** The Yap plain white-eye is a small warbler endemic to Yap, with a grayish body and pale-yellow throat with a narrow white eye-ring. This species prefers shrublands, grasslands, forests, and savannahs (eBird 2024c). Not much has been published about this warbler species, but similar warblers eat insects and berries, and tend to forage in flocks and nest up to 50 feet high on horizontal branches (BA 2024). The IUCN estimates 40,000 to 80,000 mature individuals occur across the species' range, with a trending population that is stable. The IUCN 2022 assessment considers the Yap plain white-eye to be a near threatened species due to habitat changes and invasive species impacts (BLI 2022d).

***Zosterops oleagineus* (Yap olive white-eye):** The Yap olive white-eye is a small warbler endemic to Yap, with dark-brown-olive coloration, a bright white eye-ring, and yellow legs. This species prefers forest habitats, including forest edges and mangroves (eBird 2024d). Not much has been published about this warbler species, but similar warblers eat insects and berries, and tend to forage in flocks and nest up to 50 feet high on horizontal branches (BA 2024). The IUCN estimates 13,000 mature individuals occur across the species' range, with a trending population that is stable. The IUCN 2018 assessment considers the Yap olive white-eye to be a near threatened species due to habitat changes, fire, and invasive species impacts (BLI 2018b).

Reptiles

***Perochirus ateles* (Micronesia saw-tailed gecko/qadburruq):** Micronesia saw-tailed gecko is a relatively large gecko weighing 4 to 5 grams; it is endemic to Micronesia and, with the exception of Fais Island, is considered widespread and common on all Yap islands (Buden 2011). This species inhabits forests and introduced vegetation, and has been observed in bushes and shrubs, and under bark. No IUCN population estimate exists; however, the trending population is decreasing. The IUCN 2018 assessment considers the Micronesia saw-tailed gecko to be a vulnerable species due to habitat changes and invasive species impacts (Allison et al. 2017).

Mammal

***Pteropus pelewensis yapensis* (Yap flying fox/maagul'aew):** The Yap flying fox is endemic to Yap and is a subspecies of the Pelew flying fox (*Pteropus pelewensis*). This small to medium-sized frugivorous bat in the Pteropidae family weighs under a pound with forearm lengths between 115 and 138 millimeters. The mantle coloration varies with shades of yellow to buff, the backside is mostly black-brown, and there are silver hairs in the belly area. This species of flying fox produces pups throughout the year and forms colonies and roosts, primarily in mangrove swamps (Falanruw and Manmaw 1992). In 1986, the population estimate was between 2,500 and 5,000 individuals; there is no current population estimate. Threats to the Yap flying fox include habitat loss, typhoons, and illegal hunting (Wiles et al. 2008). No IUCN population estimate exists and the trending population is unknown. The 2008 IUCN assessment considers the Yap flying fox to be a vulnerable species due to hunting, habitat changes, and agricultural impacts (Wiles et al. 2008).

Crustacean

***Birgus latro* (coconut crab):** The coconut crab is a large terrestrial crab that inhabits forests and marine tidal areas. This species can have a carapace that exceeds 8 inches, a leg span of 30 inches, and a weight of up to 9 pounds (SDZ 2024). Coconut crabs are a slow-growing species, with males being larger than females. No IUCN population estimate exists. The trending population is decreasing (Cumberlidge 2020). The 2018 IUCN assessment considers the coconut crab to be a vulnerable species due to hunting, habitat changes, invasive species, and agricultural impacts (Cumberlidge 2020).

Table 2-2 summarizes the special status species that could potentially occur within the project area.

Table 2-2. Special Status Species with the Potential to Occur within the Environmental Survey Area

Scientific Name	Common/Yapese Name	Status	Required Habitat	Potential to Occur within Project Area
Plants				
<i>Cycas micronesica</i>	Cycad/faltir	FE/ IUCN E	Occurs most often on coastal limestone and cliffsides, and occasionally on back strands	Possible
<i>Dioscorea nummularia</i>	Pacific yam/thap	IUCN NT	Occurs mostly in lowland areas with well-draining sandy loam soil	Likely
<i>Intsia bijuga</i>	Borneo teak/throrrot	IUCN NT	Found along forest edges, grows best within lowland areas with well-drained soils and full sun	Possible
<i>Metroxylon amicarum</i>	Caroline ivory nut palm	IUCN NT	Prefers moist forest edges above 1,500 feet, wetlands, and coastal rainforests	Not likely
<i>Pericopsis mooniana</i>	Nedun tree	IUCN V	Occurs along rivers and coasts	Not likely
<i>Pterocarpus indicus</i>	Rosewood/lach	IUCN E	Occurs along rocky shores, tidal creeks, and coasts; occasionally in savannas and uplands	Possible
Birds				
<i>Calidris tenuirostris</i>	Great knot	IUCN E	Prefers mudflats, coastal marine, wetlands, and intertidal habitats	Not likely
<i>Ducula oceanica</i>	Micronesian imperial-pigeon/buleogol	IUCN V	Found across most habitats, but prefers undisturbed forest	Possible
<i>Edolisoma nesiotis</i>	Yap cicadabird	IUCN E	Found across most habitats, but prefers undisturbed forest	Possible
<i>Limosa lapponica</i>	Bar-tailed godwit	IUCN NT	Occurs on sandy beaches and intertidal habitats	Not likely
<i>Limosa limosa</i>	Black-tailed godwit	IUCN NT	Occurs on grasslands, wetlands, and intertidal habitats	Possible
<i>Monarcha godeffroyi</i>	Yap monarch	IUCN NT	Occurs across most habitats including mangroves and savannahs	Likely
<i>Numenius madagascariensis</i>	Far Eastern curlew	IUCN E	Found along coastal marine areas, estuaries, intertidal flats and mangrove swamps	Not likely
<i>Numenius tahitiensis</i>	Bristle-thighed curlew	IUCN NT	Found along coral reefs, intertidal flats, palm forests, rocky shores, and beaches	Not likely
<i>Pampusana xanthonura</i>	White-throated ground-dove	IUCN NT	Found in native and secondary forest, fields, and developed areas	Likely
<i>Pseudobulweria becki</i>	Beck's petrel	IUCN CR	Nests in burrows of high mountains but may breed on small islets	Not likely

Scientific Name	Common/Yapese Name	Status	Required Habitat	Potential to Occur within Project Area
<i>Zosterops hypolais</i>	Yap plain white-eye	IUCN NT	Found in shrublands, grasslands, forests, and savannahs	Possible
<i>Zosterops oleagineus</i>	Yap olive white-eye	IUCN NT	Found in forest habitats, including forest edges and mangroves	Possible
Reptiles				
<i>Perochirus ateles</i>	Micronesia saw-tailed gecko/qadburrug	IUCN V	Inhabits forests and introduced vegetation	Likely
Mammals				
<i>Pteropus pelewensis yapensis</i>	Yap flying fox/maagul'aew	IUCN V/ Yap Regulated	Inhabits forests and mangroves	Likely
Crustaceans				
<i>Birgus latro</i>	Coconut crab	IUCN V/ Yap Regulated	Inhabits forests and marine tidal areas	Possible

Key: CR = Critically Endangered; E = Endangered; F = Federal; NT = Near Threatened; V = Vulnerable

3. Methods

DAF conducted a natural resources survey of 919 acres, hereafter the environmental survey area, surrounding the project area between January 8 to March 1, 2024 (Chuuk Time Zone). Surveys were conducted during appropriate weather conditions, sunny to light precipitation. The environmental survey area was divided into eight survey zones (see **Figure 1-3**). The purpose of these zones was to allow the natural resources survey to occur concurrently with cultural and environmental baselines surveys without overlap of field surveyors who might startle fauna, potentially introducing observational error. Species observations were recorded using a Trimble Geo7X Global Positioning System. A data dictionary, also referred to as attribute data, was developed prior to field surveys for species known or with potential to be present within the environmental survey area.

No marine, marsh, swamp, mangrove, or wetland assessments were conducted as a part of the natural resources survey.

Species names for plants were established using the Integrated Taxonomic Information System to verify the most current accepted taxonomy (<https://www.itis.gov>). Common names include Yapese names where available.

The environmental survey included a generalized habitat survey, special status species, invasive species, and incidental observations of interest encountered during transect surveys to include water features, taro patches, World War II artifacts, potential burials, and non-special status species wildlife.

3.1 Vegetation/Habitat Survey

A generalized vegetation survey was conducted in conjunction with the special status species surveys to confirm the vegetation communities within the environmental survey area. Previously collected information regarding the vegetation communities and habitat types was downloaded from the 2019 U.S. Geological Survey and other publicly available land cover data (<https://www.usgs.gov/programs/gap-analysis-project/science/land-cover>). Prior to the field survey, a project map was created and uploaded to the Trimble. This data was used in the field to aid in navigation, and confirm coverage of various land cover and habitat types.

3.2 Special Status Species Surveys

The field team members performed meandering pedestrian and windshield surveys of the environmental survey area (see **Figure 1-3**) to determine the presence or absence of special status species, as discussed in **Section 2.2** and **Table 2-2**. Meandering surveys were done along pre-determined transects (as permitted by topography and terrain) to ensure the most accurate and adequate coverage that allowed for actual field conditions. The field team documented incidental observations of all species observed. Special status surveys did not include any hands-on survey techniques (e.g., trap and release) or avian call-backs. The field team took representative photographs when possible (see **Appendix B**).

3.3 Survey Methodologies

3.3.1 Transect Methodology

To document special status species, field team members walked meandering surveys in systematic, parallel transects (as vegetation and terrain permitted) of approximately 826 acres of the main environmental survey area. The spacing between each field team member was approximately 15 meters (see **Appendix B, Photo 1**). Transect spacing was adjusted based on visibility of special status species, suitable habitat conditions, and safety considerations. Additionally, incidental observations of invasive species, taro patches, water features (e.g., surface water, streams), and potential World War II artifacts were documented on the Trimble and the size was estimated, if appropriate.

3.3.2 Windshield Survey Methodology

Approximately 3.8 miles of road with a 200-meter buffer (approximately 93 acres) connecting the main project area to the port was surveyed for special status species using a “windshield” method. This method consisted of field team members driving the road and stopping every 250 meters, or the approximate distance that could safely be stopped and parked; getting out of the vehicle; visually inspecting the area for special status species and general habitat; and listening for 5 minutes. This methodology was used on both sides of the seaport-to-airport road.

3.3.3 Bird and Bat Observation Station Methodology

Surveys for the Yap flying fox and birds within the environmental survey area were conducted using protocols outlined in the “Landscape counts for solitary bats” in the *Joint Region Marianas Mariana Fruit Bat Monitoring Protocol*, dated September 2010 (JRM 2010). See **Appendix D**.

Bird and bat monitoring stations were identified based on field observations and vantage points. A total of 14 observation locations that provided line of sight to different aspects of the environmental survey area were selected to conduct surveys. Bird and bat surveys included 2 hours of dawn or 2 hours of dusk surveys, depending on the monitoring station. For dawn surveys, the field team members were in place as soon as it was light enough to see, and the survey continued for a full 2 hours after full light. For dusk surveys, surveys were conducted in the same location, approximately 2 hours prior to sunset until it was too dark to distinguish shapes and movement.

4. Results

Environmental surveys of the 919 acres documented nine special status species within the larger environmental survey area (see **Table 4-5**, **Table 4-6**, and **Table 4-7**). Eight special status species individuals were documented in either the main project area or during the windshield survey of the seaport-to-airport road; one special status species was documented outside both the main project area and seaport-to-airport road.

The results of these surveys are considered valid for the duration of project planning, biological coordination, and construction. Survey methods provided coverage of the project area. Special status species that were not observed were presumed absent from the area. Numbers of individuals for special status species may change between now and the implementation of the Proposed Action due to natural changes, such as decline in plant health, wildlife movement, or storm events.

4.1 Vegetation

The vegetation community categories and mapping from 2019 Yap vegetation surveys conducted by the U.S. Department of Agriculture and the 2005 Digital Atlas of Micronesia that mapped Yap Island from satellite imagery, computer modeling, and visual interpretation (USDA 2019) were reviewed. Of the 10 vegetation types or land uses present on Yap, all 10 were mapped within the environmental survey area, and 9 were mapped within the project area (i.e., main project area and the seaport-to-airport road) (see **Figure 4-1** and **Figure 4-2**). Field team members reviewed the vegetation communities while completing transects. The field team did not observe substantial deviations from the vegetation community mapping. **Table 4-1** and **Table 4-2** summarize acreages for each description of vegetation communities identified within the environmental survey area and project area, respectively. Descriptions for the vegetation communities present within the project area were derived from the U.S. Department of Agriculture 1987 mapping (USDA 1987) and provided in **Appendix A, Table A-1**. See **Appendix B, Photos 2 - 15** for representative photographs.

Table 4-1. Vegetation Communities within the Environmental Survey Area

Vegetation Type/ Land Cover	Survey Area (acres)	% of Survey Area	% of Yap Island Area
Agroforest	64.00	6.95	0.27
Barren	37.55	4.08	0.16
Mangrove forest	9.40	1.02	0.04
Marsh	1.85	0.20	0.01
Savanna	414.01	44.94	1.74
Secondary vegetation	95.46	10.36	0.40
Swamp forest	1.60	0.17	0.01
Upland forest	96.47	10.47	0.40
Urban build-up/cultivated	194.50	21.11	0.82
Water	6.25	0.68	0.03
Total	921.09	99.98 ^a	3.87

Source: USDA 2019

Key: ^a Numbers do not add up to 100 percent due to rounding issues

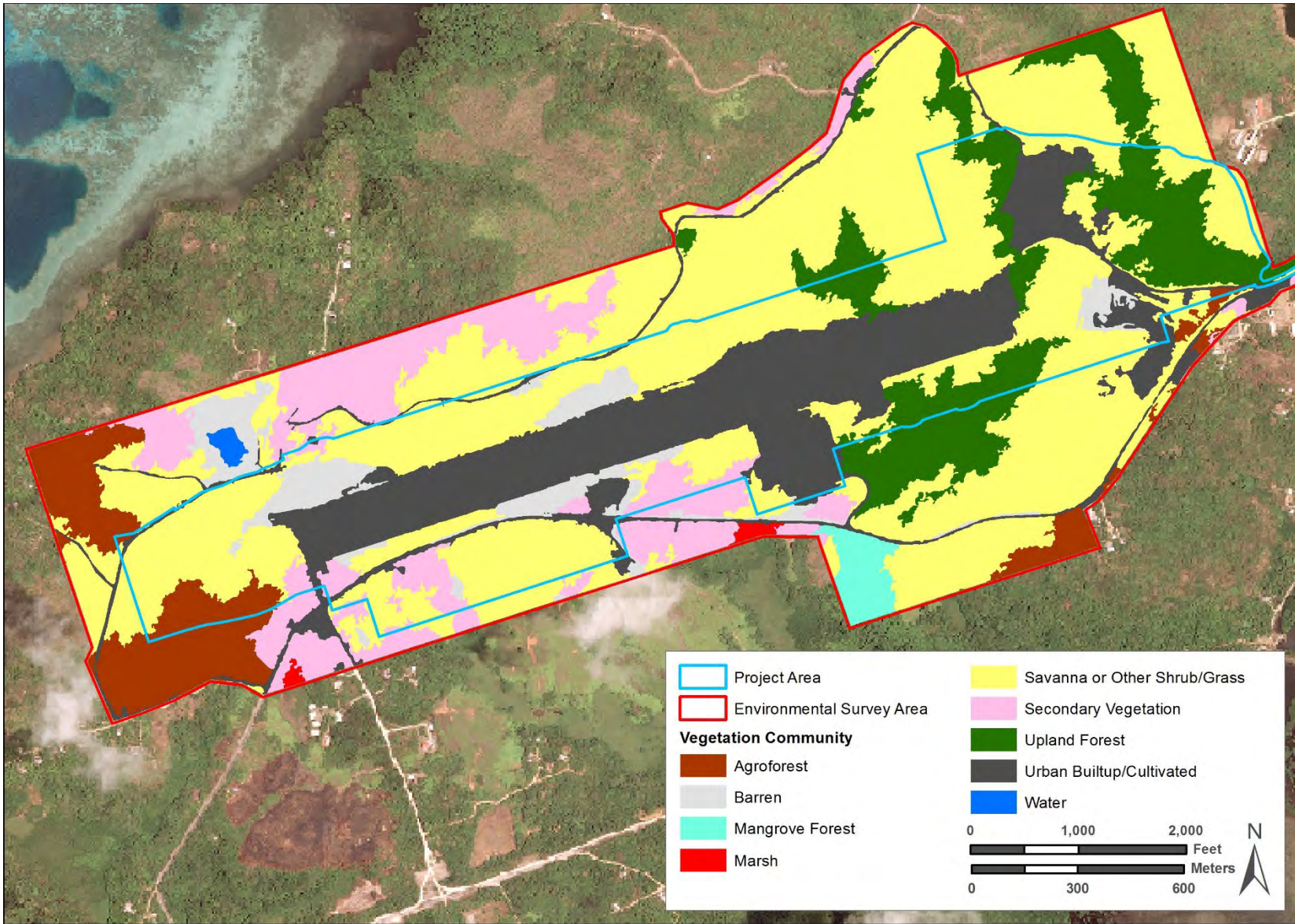


Figure 4-1. Vegetation Communities in the Environmental Survey Area and Project Area

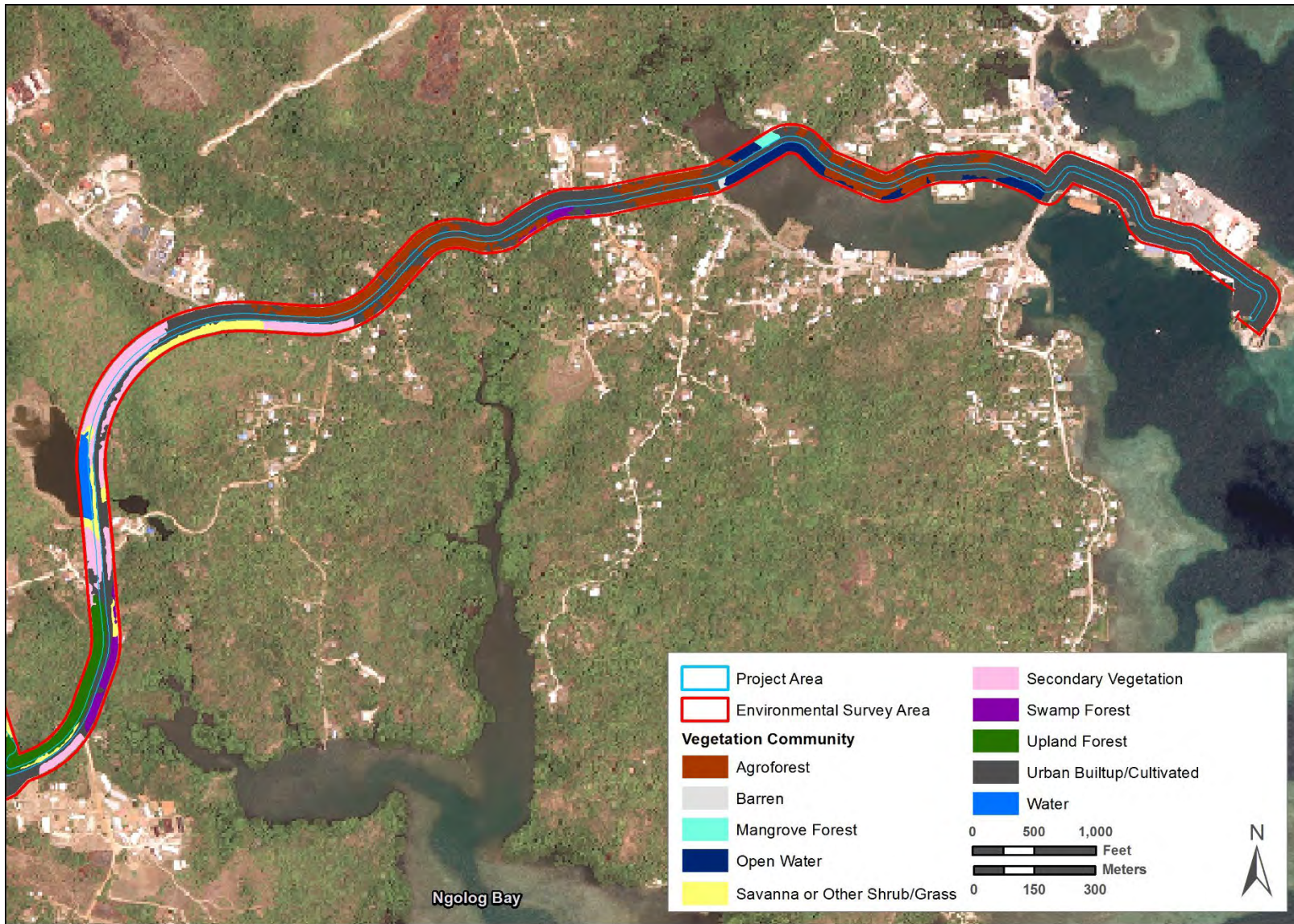


Figure 4-2. Vegetation Communities in the Environmental Survey Area and Seaport-to-Airport Road

Table 4-2. Vegetation Communities within the Project Area

Vegetation Type/ Land Cover	Main Project Area (acres)	Seaport-to- Airport Road (acres)	% of Project Area	% of Yap Island Area
Agroforest	8.81	1.00	2.27	0.01
Barren	25.63	0.00	5.92	0.02
Mangrove forest	0.00	0.01	<0.01	<0.01
Savanna	178.57	0.77	41.43	0.17
Secondary vegetation	15.52	1.41	3.91	0.02
Swamp forest	0.00	0.01	<0.01	<0.01
Upland forest	51.49	0.73	12.07	<0.01
Urban build-up/cultivated	137.61	11.02	34.35	0.14
Water	0.00	0.13	0.03	<0.01
Total	417.64	15.09	99.98^a	0.42

Source: USDA 2019

Key: ^a Numbers do not add up to 100 percent due to rounding issues

Common Plant Species

The vegetation types within the survey zones contain mixtures of native and non-native vegetation. **Table 4-3** presents the most common plant species observed throughout all zones. A list of plants documented within each zone is included in **Appendix A, Table A-3**. A summary of all plants documented within the environmental survey area is included in **Appendix A, Table A-4**.

Table 4-3. Most Common Plant Species Observed Within the Environmental Survey Area

Scientific Name	Common/Yapese Name
<i>Alysicarpus vaginalis</i>	White moneywort
<i>Euphorbia hypericifolia</i>	Graceful sandmat
<i>Chromolaena odorata</i> ^a	Jack in the bush
<i>Cocos nucifera</i>	Coconut palm/ntew
<i>Desmodium triflorum</i>	Threeflower ticktrefoil
<i>Leucaena leucocephala</i>	Tangantangan
<i>Mikania scandens</i>	Climbing hempvine
<i>Morinda citrifolia</i>	Indian mulberry/magarwek
<i>Pandanus tectorius</i>	Tahitian screwpine/choi
<i>Passiflora suberosa</i>	Corksystem passionflower
<i>Phyla nodiflora</i>	Turkey tangle fogfruit
<i>Microsorium scolopendria</i>	Monarch fern
<i>Pilea microphylla</i>	Rockweed
<i>Portulaca oleracea</i>	Common purslane
<i>Premna serratifolia</i>	Malbau
<i>Pyrrhosia lanceolata</i>	Lanceleaf tongue fern
<i>Tridax procumbens</i>	Coat buttons

Key: ^a Invasive

4.1.1 Main Project Area Vegetation

The main project area is approximately 418 acres. Urban build-up/cultivated and savanna make up approximately 75 percent of the main project area. There is approximately 68 acres of upland forest and secondary forest that likely provide habitat for native and special status wildlife species (see **Figure 4-1** and **Table 4-2**).

4.1.2 Vegetation Along the Seaport-to-Airport Road to the Port

The seaport-to-airport road (40 feet wide including the road and shoulders) and adjacent area (20-feet on either side) of the seaport-to-airport road is predominantly urban build-up/cultivated and secondary vegetation (see **Figure 4-2** and **Table 4-2**). There is 0.01 acres of mangrove forest, 0.01 acres of swamp forest, and 0.13 acres of water that overlap the area. These three class types are important for species protections and foraging (e.g., the Yap flying fox) as well as ecosystem health (e.g., fish larvae).

4.2 Wildlife

Transect surveys were conducted to locate and record target special status species (see **Table 2-2**). Survey methods to detect other wildlife species, such as avian point counts, game cameras, or live traps, were not used. Incidental observations of wildlife were recorded during the transect surveys as discussed in the following sections. **Table 4-4** provides wildlife species without special status protections that were observed within the environmental survey area during the transect surveys.

Table 4-4. Non-Special Status Wildlife Species Observed within the Environmental Survey Area

Common Name	Scientific Name	Status
<i>Mammals</i>		
<i>Canis familiaris</i>	Domestic dog, feral	Invasive
<i>Felis catus</i>	Domestic cat, feral	Invasive
<i>Birds</i>		
<i>Anous stolidus</i>	Brown noddy	Migratory
<i>Aplonis opaca</i>	Micronesian starling	Migratory
<i>Egretta garzetta</i>	Little egret	Migratory
<i>Gallus gallus</i>	Red junglefowl	Introduced
<i>Gygis alba</i>	White tern	Migratory
<i>Ixobrychus sinensis</i>	Yellow bittern	Migratory
<i>Myzomela rubratra</i>	Micronesian myzomela	Native
<i>Passer montanus</i>	Eurasian tree sparrow	Introduced
<i>Pluvialis fulva</i>	Pacific golden plover	Migratory
<i>Reptiles and Amphibians</i>		
<i>Carlia ailanpalai</i>	Curious skink	Introduced
<i>Lamprolepis smaragdina</i>	Emerald tree skink	Native

<i>Rhinella marina</i>	Cane toad	Invasive
<i>Varanus indicus</i>	Monitor lizard	Invasive
Mollusks		
<i>Tuerkayana hirtipes</i>	Pacific land crab	Native
Insects and Arachnids		
<i>Agrionoptera insignis</i>	Grenadier	Native
<i>Hypolimnas bolina</i>	Great eggfly	Introduced
<i>Neurothemis terminata</i>	Indonesian red-winged dragonfly	Introduced
<i>Orthetrum serapia</i>	Green skimmer	Introduced
<i>Papilio polyte</i>	Common mormon	Introduced

4.3 Special Status Species

4.3.1 Transect and Windshield Surveys

Transect surveys were conducted to document special status species within the main project area between January 8 and February 26, 2024; the windshield survey of the seaport-to-airport road was conducted on January 10, 2024. **Table 2-2** lists species for which field team members were surveying. Three plant, one mammal, one reptile, and four bird species were documented within the environmental survey area; three plant, one mammal, and four bird species were documented within the project area. **Table 4-5** summarizes the special status species recorded within the environmental survey area. The transects walked during the special status species surveys are included in mapbooks in **Appendix C**. See **Appendix B, Photos 16-24** for representative photographs.

Table 4-5. Special Status Species Observed within the Environmental Survey Area

Scientific Name	Common/Yapese Name	Individuals within the Environmental Survey Area	Individuals within the Main Project Area	Individuals within the Seaport-to-Airport Road
<i>Cycas micronesica</i>	Cycad/faltir	2	1	1
<i>Ducula oceanica</i>	Micronesian imperial-pigeon/ buleogol	1	0	1
<i>Dioscorea nummularia</i>	Pacific yam/thap	8	3	0
<i>Monarcha godeffroyi</i>	Yap monarch	46	11	0
<i>Pampusana xanthonura</i>	White-throated ground-dove	9	2	0
<i>Perochirus ateles</i>	Micronesia saw-tailed gecko/ qadburruq	1	0	0
<i>Pterocarpus indicus</i>	Rosewood/lach	1	0	1
<i>Pteropus pelewensis yapensis</i>	Yap flying fox/ maagul'aew	1	1	0
<i>Zosterops hypolais</i>	Yap plain white-eye	2	1	0

4.3.2 Yap Fuit Bat and Bird Station Surveys

Yap flying fox and bird surveys were conducted at 14 monitoring stations between February 27 and March 1, 2024. Inclement weather precluded evening surveys on March 1, 2024.

Figure 4-3 shows the locations of Yap flying fox and bird monitoring stations. Survey results are discussed in the sections below. Field team members observed possible foraging marks from Yap flying foxes on *Pandanus* fruits (either Tahitian screwpine or *Pandanus yapensis*) throughout the environmental survey area.

Yap Flying Foxes

The survey team recorded a total of 18 observations of the Yap flying fox at Stations 1, 8, 11, and 12 within the environmental survey area during monitoring station surveys. Field team members detected bat ejecta, droppings, and scent at Station 8. The survey team found no obvious droppings on or throughout the rest of the stations. **Table 4-6** summarizes observations of Yap flying foxes observed during monitoring station surveys.

Table 4-6. Yap Flying Fox Monitoring Station Survey Results

Station Identifier	Bat Detections	Observations
<i>February 27, 2024</i>		
1	13	Bats were observed flying east of Zone 5, over Zone 4, and to the south outside the main project area
2	0	No observations
3	0	No observations
4	0	No observations
<i>February 28, 2024</i>		
5	0	No observations
6	0	No observations
7	0	No observations
8	2	Bats came in from Zones 4 or 5, and roosted in an unknown tree; field team members detected bat ejecta, droppings, and scent around the station
<i>February 29, 2024</i>		
9	0	No observations
10	0	No observations
11	2	Bats observed flying north over the main project area
12	1	Bats observed flying north over the main project area
<i>March 1, 2024</i>		
13	0	No observations
14	0	No observations

Special Status Species Birds

The survey team observed a total of 16 special status birds between February 27 and March 1, 2024. **Table 4-7** summarizes observations of special status birds during the bird station surveys. During both dusk and dawn survey events, field team members heard general bird sounds throughout monitoring stations. The Yap monarch was observed approximately 12 times between Stations 1, 3, 6, and 13; white-throated ground doves were observed four times between Stations 3 and 11.

Table 4-7. Bird Monitoring Station Survey Results

Station Identifier	Bird Detections	Observations
<i>February 27, 2024</i>		
1	2	2 Yap monarchs observed in flight
2	0	No observations
3	9	3 white-ground doves observed foraging on the ground underneath a mango tree 6 Yap monarchs observed in flight
4	0	No observations
<i>February 28, 2024</i>		
5	0	No observations
6	3	3 Yap monarchs observed in flight
7	0	No observations
8	0	No observations
<i>February 29, 2024</i>		
9	0	No observations
10	0	No observations
11	1	1 white-ground dove observed foraging on the ground
12	0	No observations
<i>March 1, 2024</i>		
13	1	1 Yap monarch observed in flight
14	0	No observations

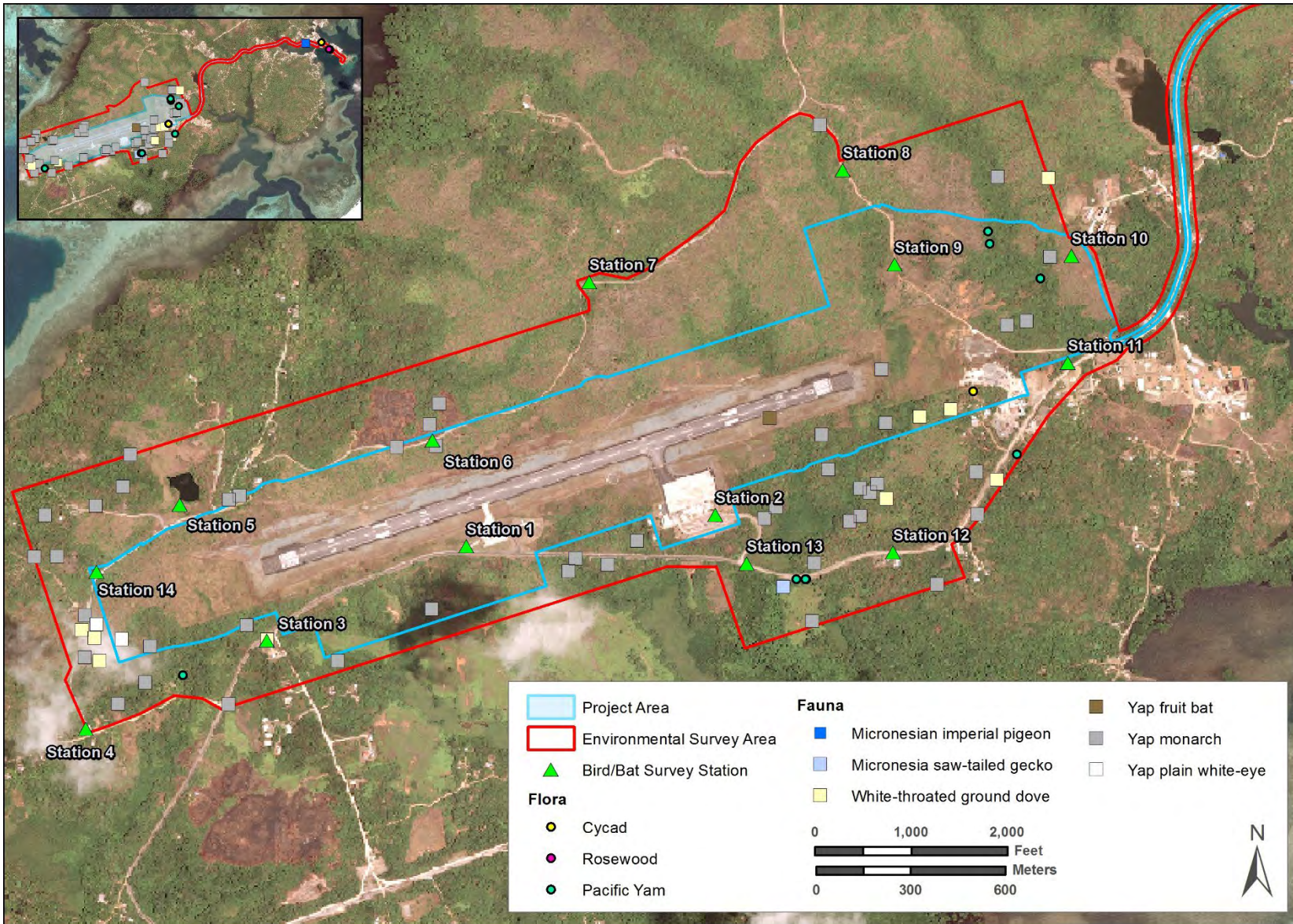


Figure 4-3. Special Status Species Documented within the Environmental Survey Area

4.3.3 Main Project Area Special Status Species

***Dioscorea nummularia* (Pacific yam/thap):** There were eight documented occurrences of Pacific yams within the environmental survey area, three individuals were documented within the eastern portion of the main project area (see **Figure 4-3**). See **Appendix B, Photo 16** for a representative photograph.

***Monarcha godeffroyi* (Yap monarch):** A total of 46 Yap monarchs were documented during transect surveys, and 12 were documented during bird monitoring station surveys within the environmental survey area. See **Appendix B, Photo 17** for a representative photograph. Of the 58 Yap monarchs documented, up to 20 individuals (some observations were in flight), could be within the main project area (see **Figure 4-3** and **Table 4-7**).

***Pampusana xanthonura* (white-throated ground dove):** Ten white-throated ground doves were documented during transect surveys and four were documented during bird monitoring station surveys within the environmental survey area. See **Appendix B, Photos 18** and **19** for representative photographs. Of the 14 white-throated ground doves documented, 3 individuals were within the main project area (see **Figure 4-3** and **Table 4-7**).

***Pteropus pelewensis yapensis* (Yap flying fox/maagal'aew):** Six tree species that the Yap flying fox is known to use to forage were documented within the environmental survey area: *Artocarpus altilis* (breadfruit), *Glochidion ramiflorum*, beach mahogany, *Camptosperma brevipetiolata*, coconut palm, and Tahitian screwpine. Beach mahogany, *Camptosperma brevipetiolata*, coconut palm, and Tahitian screwpine were common throughout the environmental survey area. See **Appendix A, Table A-6** for a full list of trees the Yap flying fox is known to forage (Wiles and Fujita 1992).

There were no Yap flying fox colonies documented during transect surveys or observed during monitoring station surveys. Field team members observed three flying foxes during transect surveys. Two flying foxes were observed in early morning while driving to the survey transects within the main project area. Both times, flying foxes were flying from north to south across the seaport-to-airport road; one on January 12, 2024 and the other on January 16, 2024. Field team members observed a third flying fox during surveys within Zone 8, flying from north to south over the runway. Eighteen Yap flying foxes were documented during monitoring station surveys (see **Figure 4-3** and **Table 4-6**).

***Zosterops hypolais* (Yap plain white-eye):** Field team members documented two Yap plain white-eyes during transect surveys within the environmental survey area, one of those individuals was documented within the main project area (see **Figure 4-3**).

4.3.4 Special Status Species Along the Seaport-to-Airport Road

***Cycas micronesica* (Cycad/faltir):** Cycads are protected by the U.S. Fish and Wildlife Service as federally endangered and are considered endangered by the IUCN. Yap has an estimated total of approximately 288,450 cycads between 4 populations (DOI 2016). Two cycads were documented within the environmental survey area. One was outside the main project area at a residence to the south and the other was along the seaport-to-airport road at a business/residence (see **Figure 4-3**). See **Appendix B, Photo 20** for a representative photograph. Both cycads appeared healthy. No cycads were documented within the main project area.

***Pterocarpus indicus* (Rosewood/lach):** Three rosewood trees were documented within 15 feet of the western portion of the seaport-to-airport road and no rosewood trees were documented within the main project area (see **Figure 4-3**). See **Appendix B, Photos 21 and 22** for representative photographs. They appeared to be in good health and were being maintained by a business/residence.

***Ducula oceanica* (Micronesian imperial-pigeon/buleogol):** One Micronesian imperial-pigeon was documented during windshield surveys of the seaport-to-airport road (see **Figure 4-3**). The bird was in a cage at The Pines restaurant. No Micronesian imperial-pigeons were documented within the main project area.

4.3.5 Special Status Species Surveyed but Not Recorded

Special status species that have the potential to occur within the environmental survey area but were not observed during the field surveys are discussed below. These species are not expected to move into the environmental survey area during the planning and construction period due to various factors, including:

- Lack of suitable habitat or host plants;
- Distance from the closest known potential source;
- Limited numbers of individuals on Yap;
- Limited extent on Yap; and/or
- No known occurrences in the wild.

Plants: The survey team did not document Borneo teak, Caroline ivory nut palm, or the nedun tree during the environmental surveys.

Wildlife: The survey team did not document the Yap cicadabird, bar-tailed godwit, black-tailed godwit, far-eastern curlew, bristle-thighed curlew, great knot, Beck's petrel, Yap olive-white-eye, or the coconut crab during the environmental surveys.

4.4 Additional Observations

Incidental observations of water features (e.g., surface water, streams), taro patches, and potential World War II artifacts were documented and are discussed in sections below.

4.4.1 Water Features

Surface Water

The field team members observed 43 water features (totaling approximately 3.72 acres) within the environmental survey area with 21 water features (approximately 1.42 acres) within the main project area. One water feature was historically a quarry; the rest of the water features appear to be moist depressions of water that are isolated from the known streams. Field team members observed two streams with slow moving water within the environmental survey area. One stream ran from the southern edge of the main project area, through the environmental survey area south of it, and outside the survey boundaries. This stream was approximately 1,040 feet long; with 180 feet of the stream within the project area (see **Figure 4-4**). The second stream originated in the northeastern corner of the environmental survey area, curved through the main project area, and out the southeastern boundary of the environmental survey area. This stream was approximately 3,220 feet long; with 2,020 feet of the stream within the project area (see **Figure 4-4**). See **Appendix B, Photos 25 - 33** for representative photographs.

Additionally, Yap Protected Areas and Areas of Biodiversity Significance were reviewed. No Yap Protected Area overlaps with the environmental survey area. Approximately 9.8 acres of the environmental survey area overlaps with the Area of Biodiversity Significance; there is no overlap of the project area (see **Figure 4-4**).

4.4.2 Taro

Taro Patches

Taro belongs to the Araceae family, which includes 110 genera and more than 2,500 species worldwide. Three main species of taro grow on Yap. The most common taro grown is Giant swamp taro/lak, the second is *Colocasia esculenta* (wild taro/mal), and the least common is *Xanthosoma sagittifolium* (arrowleaf elephant's ear/ Honolulu). On Yap, taro is grown using almost a dozen different methods, including around the house; in intermittent mixed garden within natural skylight openings of forest trees; and in dry depressions surrounded by raised dikes (Falanfuw n.d.).

Field team members observed 195 (approximately 7.39 acres) taro patches within the environmental survey area; 43 (approximately 0.70 acres) taro patches were within the main project area (see **Figure 4-4**). No taro patches were observed along the seaport-to-airport road. The majority of the taro patches observed were in moist depressions with raised dikes. See **Appendix B, Photos 34 - 38** for representative photographs.

4.4.3 Observations of Interest

In addition to the special status species surveys, bird and bat surveys, and documentation of water features and taro patches, field team members documented World War II evidence. Team members documented suspected impact craters, depressions of unknown origin, World War II artifacts, and suspected explosive remnants of war (ERW).

Impact Craters

The field team encountered numerous deep, uniform depressions approximately 20 feet in diameter and 10 feet deep that were assumed to be potential impact craters from World War II

bombing. The survey team observed 18 impact craters within the environmental survey area; with 11 of the impact craters within the main project area (see **Figure 4-5**). Except for four occurrences, all impact craters were located along the westernmost portion of the environmental survey area and project area. See **Appendix B, Photo 39** for a representative photograph.

Depressions

In addition to the uniform crater depressions, field team members also encountered numerous non-uniform depressions that varied in size and depth. It was unclear whether these depressions were human-made or natural and they did not contain water at the time of observation. The survey team observed 33 depressions of unknown origin within the environmental survey area, 17 of these depressions were within the main project area (see **Figure 4-5**). See **Appendix B, Photo 40** for a representative photograph.

World War II Artifacts and Other Observations of Note

Several World War II artifacts were observed during surveys (see **Figure 4-5**):

- Two crashed airplanes were documented: one in the western portion of the project area and one along the southwestern edge of the environmental survey area outside the project area. See **Appendix B, Photos 41 - 42** for representative photographs.
- Three World War II weapons were documented within the project area along the northern edge. See **Appendix B, Photos 43 - 44** for representative photographs.
- An assumed World War II generator was documented along the southwestern edge of the environmental survey area outside the project area. See **Appendix B, Photo 45** for a representative photograph.

Additionally, an aircraft engine was observed south of the runway immediately inside the project area and a cave was documented in the northeastern corner of the environmental survey area outside the project area.

Explosive Remnants of War

The survey team documented one suspected ERW during surveys within the project area north of the airport. The field team member stopped as soon as the suspected ERW was observed, took pictures, flagged at a safe location, and submitted the location and photographs to the DAF Yap liaison via email the same day (see **Figure 4-5**). See **Appendix B, Photo 46** for a representative photograph.

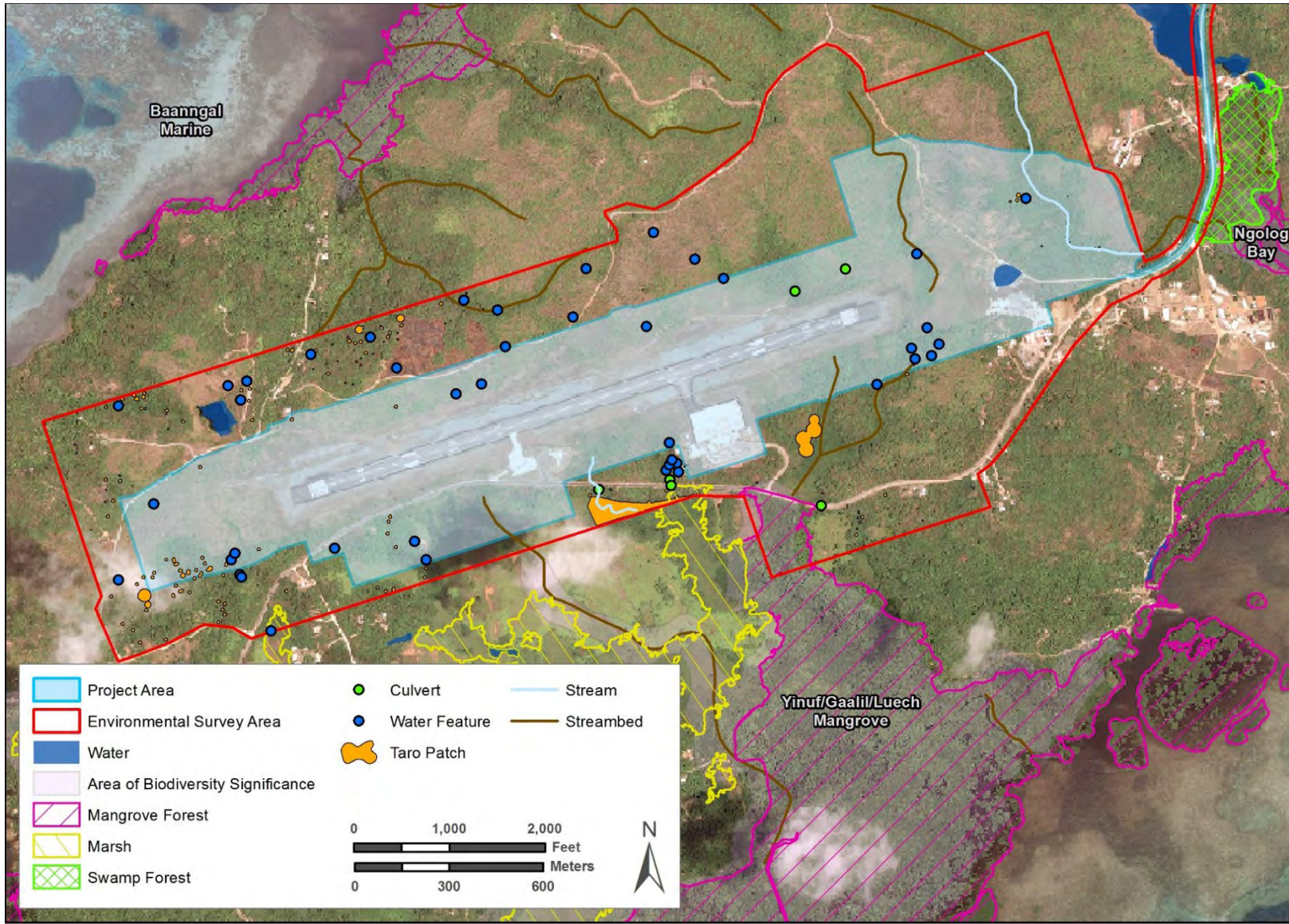
4.4.4 Notes and Observations

Burial Sites: There were numerous potential burial sites the natural resources survey team members encountered throughout the environmental survey area. When a potential burial site was observed during the natural resources survey, field team members flagged it, took a Trimble position and a photograph, and sent the information to the cultural resources survey team as soon as possible, but not later than the end of the day. As soon as identified, field team members were respectful of any potential burial area and carefully moved around the area to resume transect surveys on the other side. See **Appendix B, Photos 51 - 53** for representative photographs.

Cleared Areas: During the natural resource surveys, field team members observed several areas that appeared to have been cleared of vegetation prior to surveys based on terrestrial churn and recently downed trees. Most of these disturbances were north of the airport. Field team members did their best to survey these areas; however, there were many areas that needed to be widely surveyed to maintain safety with unstable vegetation debris. There was one area (east of the airport) that was actively being cleared with heavy equipment during the natural resource surveys. For safety reasons, field team members were unable to survey the approximately 13.9 acres of Zone 5 (see **Figure 4-5**). See **Appendix B, Photos 54 - 62** for representative photographs

4.4.5 Invasive Species

There were ten invasive species documented during the natural resources surveys: two monitor lizards were observed in the southwestern portion of the environmental survey area; domestic dogs, domestic cats, cane toads, common bamboo, hairy beggarticks, Jack in the bush, Bermuda grass, nutgrass, and the shameplant were observed throughout the environmental survey area and project area. See **Appendix B, Photos 47 - 50** for representative photographs.



Basemap: Digital Atlas of Micronesia 2018 Imagery

Figure 4-4. Water Features and Taro of Interest Documented within the Environmental Survey Area

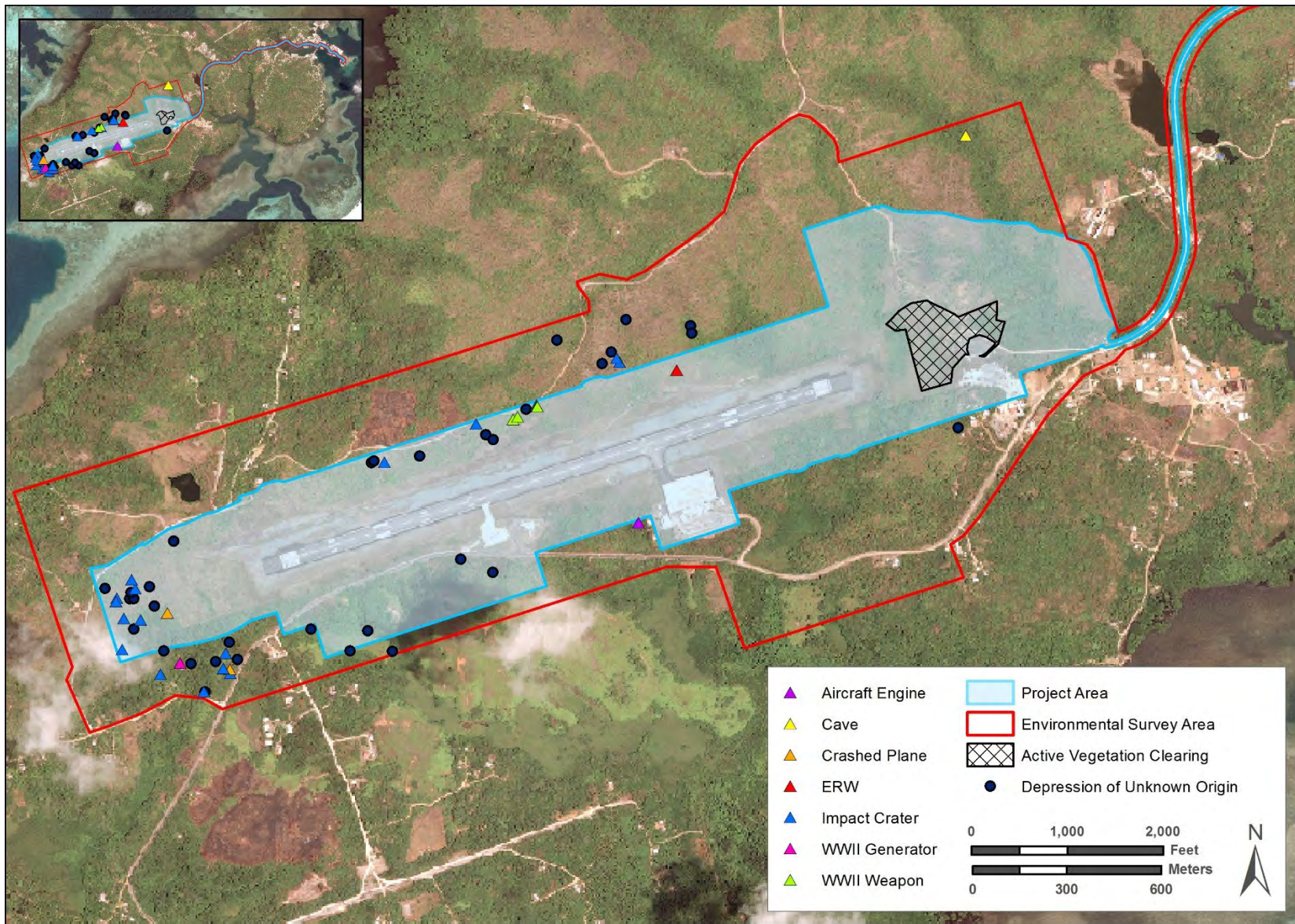


Figure 4-5. Observations of Interest Documented within the Environmental Survey Area

Draft Report- To be Updated with Additional Survey Information

5. Conclusion

The natural resources surveys conducted at the Yap International Airport confirmed the presence of 2 cycads, 8 Pacific yams, 3 rosewood trees, 1 Micronesian imperial-pigeon, 58 Yap monarchs, 14 white-throated ground doves, 21 flying foxes, and 2 Yap plain white-eyes within the environmental survey area. There were no Yap flying fox colonies or roosts documented within the environmental survey area. Within the main project area there were 3 Pacific yams, 20 Yap monarchs, 3 white-throated ground doves, 3 Yap flying foxes (in flight), and 2 Yap plain white-eyes documented. There were 2 cycads, 3 rosewood trees, and 1 Micronesian imperial-pigeon documented along the seaport-to-airport road. Survey findings were consistent with expectations for the species potentially present in the environmental survey area.

Sensitive status species that were not recorded during the natural resource surveys are presumed absent from the project area.

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Appendix A.

Species Lists

Table A-1. Yap Island Forest Classes

Scientific Name	Common/Yapese Name
Agroforest	<p>Found growing around villages and consisting of a mixture of food and useful trees. The canopy is often uneven and may be interspersed with open areas of croplands, taro patches, and secondary vegetation. Tree gardens, taro patches, and open gardens work together for food. Some examples of tree species include: <i>Artocarpus altilis</i> (breadfruit/thow), <i>Cocos nucifera</i> (coconut palm/ntew), <i>Pangium edule</i> (football fruit/rowal), <i>Areca catechu</i> (betel palm/buw), <i>Calophyllum inophyllum</i> (beach mahogany), <i>Citrus aurantifolia</i> (lime), <i>Crateva religiosa</i> (garlic pear/abtuuch), and <i>Psidium guajava</i> (guava/abas). The understory may consist of shrubs, herbs, epiphytes, vines, and ground cover plants. Additionally, taro patches may be developed in low areas and connected via water channels; varieties of <i>Colocasia esculenta</i> (wild taro/mal) and <i>Cyrtosperma merkusii</i> (swamp taro/lak) are typical. Many gardens will include <i>Dioscorea</i> spp. (yams) and other crops.</p>
Barren	Bare ground, unvegetated areas, and disturbed areas that lack natural vegetation.
Mangrove	<p>Mangrove forests have specialized roots periodically inundated by sea water and are found around coastal areas, specifically mud flats at the mouths of drainage systems. This habitat serves as a nutrient buffering and natural filtering system between the lagoon and island, fish nurseries, and habitat for flying foxes and birds. Some examples of species include <i>Rhizophora</i> spp. (true mangroves), <i>Bruguiera gymnorhiza</i> (Burmese mangrove/rok), <i>Nypa fruticans</i> (nipa palm/eang), <i>Sonneratia alba</i> (mangrove apple/abrur), <i>Ceriops tagal</i>, <i>Xylocarpus granatum</i> (cannonball mangrove/yamgur), <i>Lumnitzera littorea</i> (yiy), <i>Scyphiphora hydrophyllacea</i> (guad), and <i>Excoecaria agallocha</i> (blinding mangrove/bat').</p>
Marsh	<p>Areas of herbs, grasses, and sedges that grow in standing water. There are two types of marshes:</p> <ul style="list-style-type: none"> • Saline marshes are generally along the coast and adjacent mangroves, and are only periodically inundated by salt water. Some examples of common species include <i>Derris trifoliata</i> (threeleaf derris/gabati), <i>Cyperus javanicus</i> (Javanese flatsedge), <i>Vigna marina</i> (notched cowpea), <i>Paspalum distichum</i> (knotgrass), and <i>Melanthera biflora</i> (Honolulu nehe). • Freshwater marshes are generally located just above sea level, landward of mangroves, or in upland depressions. Some examples of common species include <i>Phragmites karka</i> (tall weed), <i>Carex</i> spp. (sedges), <i>Ludwigia hyssopifolia</i> (seedbox), <i>Hanguana malayana</i>, and <i>Acrostichum aureum</i> (golden leatherfern/welbrob). Freshwater marshes are often cultivated for taro.
Savanna	<p>Areas thought to be the result of some form of destruction, like fire or soil exposure to rain and sun. Some examples of common species include <i>Dicranopteris linearis</i> (old world forked fern), Tahitian screwpine, <i>T. albus</i>, <i>Decaspermum fruticosum</i>, <i>Melastoma malabathricum</i>, <i>Myrtella bennigsiana</i>, <i>Nepenthes mirabilis</i> (aad), <i>Morinda citrifolia</i> (Indian mulberry/magarwek), <i>Scaevola taccada</i> (beach naupaka), and <i>Tacca leontopetaloides</i> (batflower).</p>
Secondary vegetation	<p>This includes landcover that is not forest and savanna, and is generally covered with weedy species. Some examples of common species include <i>Talipariti tiliaceum</i> (sea hibiscus), <i>Macaranga carolinensis</i> (bith), <i>Rhus taitensis</i> (sumac/glad), <i>Commersonia bartramia</i> (brown kurrajong/guguw), <i>Mimosa diplotricha</i> (giant false sensitive plant), <i>Lantana camara</i> (largeleaf lantana), <i>Premna serratifolia</i> (arr), <i>Hyptis capitata</i> (false ironwart), and <i>Casuarina equisetifolia</i> (ironwood tree/natch).</p>
Swamp forest	<p>Swamp forests occur when soils are inundated with fresh or slightly saline water and are generally found in low, wet areas inland of mangroves. They are lower in elevation than the surrounding terrain but above tidal influences. Swamp forests on Yap are limited, and are heavily disturbed and poorly developed. Some examples</p>

Scientific Name	Common/Yapese Name
	of common species include <i>Dolichandrone spathacea</i> (mangrove trumpet/riyou), <i>Millettia pinnata</i> (ngelak), <i>Barringtonia racemose</i> (wathol), <i>Dalbergia candenatensis</i> (prain), <i>Cynometra ramiflora</i> (manbul), <i>Inocarpus fagifer</i> (buoy), <i>Ficus tinctoria</i> (dye fig/wacheguy), and <i>Pandanus polycephalus</i> .
Upland forest	<p>This forest type may be a mixture of native, secondary, agroforest, and introduced plant species. Some representative plant species that may be found in better native forests include <i>Camposperma brevipetiolata</i> (ramlieu), <i>S. venenosus</i>, <i>Inocarpus fagifer</i> (buoy), <i>Buchanania engleriana</i>, <i>Pterocarpus indicus</i> (rosewood/lach), <i>Garcinia rumiyo</i> (titol), <i>Serianthes kanehirae</i> var. <i>yapensis</i> (gumor), <i>Ficus prolixa</i> (banyan tre/aw), sumac, beach mahogany, <i>T. albus</i>, <i>Meryta senjftiana</i>, and <i>Ixora casei</i> (gachiow).</p> <ul style="list-style-type: none"> • Higher elevation: Higher elevation forests have better drainage. These forests may include species such as <i>Diospyros ferrea</i> (achingal), <i>Ixora triantha</i>, <i>Aidia cochinchinensis</i>, <i>T. albus</i>, and cycad. • Lower elevation: Lower elevation forests are commonly located in ravines or coastal areas and retain more water. These forests may include species such as <i>Trichospermum ikutai</i>, <i>C. brevipetiolata</i>, brown kurrajong, sumac, beach mahogany, <i>Pouteria obovata</i>, <i>Guettarda speciosa</i> (blaw), <i>Hernandia sonora</i> (mago/gachal), <i>Vitex negundo</i> (negundo chastetree), and <i>Pemphis acidula</i> (gangiy).
Urban built-up/ cultivated	This type includes paved, compacted, impervious, unvegetated, and cultivated areas that are generally associated with villages and towns.
Water	Inland water includes freshwater, brackish water, and enclosed saltwater bays.

Table A-2. Wildlife Species Documented on Yap

Scientific Name	Common/Yapese Name	Status
<i>Mammals</i>		
<i>Mus musculus</i>	House mouse	Invasive
<i>Pteropus pelewensis yapensis</i>	(Yap flying fox/maagul'aew)	Endemic
<i>Rattus exulans</i>	Polynesian rat	Invasive
<i>Rattus norvegicus</i>	Brown rat	Invasive
<i>Rattus rattus</i>	Black rat	Invasive
<i>Birds</i>		
<i>Sus scrofa</i>	Wild boar	Invasive
<i>Accipiter soloensis</i>	Chinese sparrowhawk	Migratory
<i>Actitis hypoleucos</i>	Common sandpiper	Migratory
<i>Acrocephalus astrolabii</i>	Mangareva reed warbler	Endemic
<i>Acrocephalus syrinx</i>	Caroline reed warbler	Endemic
<i>Aerodramus inquietus</i>	Caroline Islands swiftlet	None
<i>Anas acuta</i>	Northern pintail	Migratory
<i>Anas crecca</i>	Green-winged teal	Migratory
<i>Anous minutus</i>	Black noddy	Migratory
<i>Anous stolidus</i>	Brown noddy	Migratory
<i>Anthus cervinus</i>	Red-throated pipit	Migratory
<i>Aplonis opaca</i>	Micronesian starling	Endemic
<i>Ardea alba</i>	Great egret	Migratory
<i>Ardea cinerea</i>	Gray heron	Migratory
<i>Ardea intermedia</i>	Medium egret	Migratory
<i>Arenaria interpres</i>	Ruddy turnstone	Migratory
<i>Aythya fuligula</i>	Tufted duck	Migratory
<i>Aythya marila</i>	Greater scaup	Migratory
<i>Bubulcus coromandus</i>	Eastern cattle egret	Unknown
<i>Bulweria bulwerii</i>	Bulwer's Petrel	Migratory
<i>Butastur indicus</i>	Gray-faced buzzard	Migratory
<i>Butorides striata</i>	Striated heron	Unknown
<i>Calidris acuminata</i>	Sharp-tailed sandpiper	Migratory
<i>Calidris alba</i>	Sanderling	Migratory
<i>Calidris ferruginea</i>	Curlew sandpiper	Migratory
<i>Calidris pugnax</i>	Ruff	Migratory
<i>Calidris ruficollis</i>	Red-necked stint	Migratory
<i>Calidris subminuta</i>	Long-toed stint	Migratory
<i>Calonectris leucomelas</i>	Streaked shearwater	Migratory
<i>Charadrius alexandrinus</i>	Kentish plover	Unknown
<i>Charadrius dubius</i>	Little ringed plover	Migratory
<i>Charadrius leschenaultii</i>	Greater sand-plover	Unknown
<i>Charadrius mongolus</i>	Siberian sand-plover	Unknown
<i>Chlidonias hybrida</i>	Whiskered tern	Migratory
<i>Chlidonias leucopterus</i>	White-winged tern	Migratory
<i>Chroicocephalus ridibundus</i>	Black-headed gull	Migratory
<i>Columba livia</i>	Rock pigeon	Introduced
<i>Cuculus optatus</i>	Oriental cuckoo	Migratory
<i>Ducula oceanica</i>	Micronesian imperial-pigeon	IUCN-V/Introduced
<i>Edolisoma nesiotis</i>	Yap cicadabird	IUCN-E/Endemic
<i>Egretta garzetta</i>	Little egret	Migratory
<i>Egretta sacra</i>	Pacific reef-heron	Migratory
<i>Eurystomus orientalis</i>	Dollarbird	Unknown
<i>Falco peregrinus</i>	Peregrine falcon	Migratory

Scientific Name	Common/Yapese Name	Status
<i>Fregata ariel</i>	Lesser frigatebird	Migratory
<i>Fregata minor</i>	Great frigatebird	Unknown
<i>Gallinula chloropus</i>	Eurasian moorhen	Migratory
<i>Gallinago megala</i>	Swinhoe's snipe	Migratory
<i>Gallus gallus</i>	Red junglefowl	Introduced
<i>Glareola maldivarum</i>	Oriental pratincole	Unknown
<i>Gygis alba</i>	White tern	Migratory
<i>Himantopus himantopus</i>	Black-winged stilt	Migratory
<i>Himantopus leucocephalus</i>	Pied stilt	Unknown
<i>Himantopus mexicanus</i>	Black-necked stilt	Migratory
<i>Hirundo rustica</i>	Barn swallow	Migratory
<i>Oceanodroma matsudairae</i>	Matsudaira's storm petrel	Migratory
<i>Ixobrychus cinnamomeus</i>	Sinnamon bittern	Unknown
<i>Ixobrychus sinensis</i>	Yellow bittern	Migratory
<i>Limosa lapponica</i>	Bar-tailed godwit	IUCN-NT
<i>Limosa limosa</i>	Black-tailed godwit	IUCN-NT
<i>Lonchura punctulate</i>	Scaly-breasted munia	Introduced
<i>Mareca penelope</i>	Eurasian wigeon	Migratory
<i>Microcarbo melanoleucos</i>	Little pied cormorant	Migratory
<i>Monarcha godeffroyi</i>	Yap monarch	IUCN-NT/Endemic
<i>Motacilla cinerea</i>	Ray wagtail	Migratory
<i>Motacilla tschutschensis</i>	Eastern yellow wagtail	Migratory
<i>Muscicapa griseisticta</i>	Gray-streaked flycatcher	Migratory
<i>Myzomela rubrata</i>	Micronesian myzomela	Endemic
<i>Numenius madagascariensis</i>	Far Eastern curlew	IUCN-E
<i>Numenius phaeopus</i>	Whimbrel	Migratory
<i>Numenius tahitiensis</i>	Bristle-thighed curlew	IUCN-NT
<i>Nycticorax nycticorax</i>	Black-crowned night heron	Migratory
<i>Onychoprion fuscatus</i>	Sooty tern	Migratory
<i>Onychoprion lunatus</i>	Gray-backed tern	Migratory
<i>Pampusana xanthonura</i>	White-throated ground dove	IUCN-NT/Endemic
<i>Pandion haliaetus</i>	Osprey	Migratory
<i>Passer montanus</i>	Eurasian tree sparrow	Introduced
<i>Phaethon lepturus</i>	White-tailed tropicbird	Migratory
<i>Phalacrocorax carbo</i>	Great cormorant	Migratory
<i>Pluvialis fulva</i>	Pacific golden-plover	Migratory
<i>Pluvialis squatarola</i>	Black-bellied plover	Migratory
<i>Poliolimnas cinereus</i>	White-browed crane	Unknown
<i>Pseudobulweria rostrata</i>	Tahiti petrel	Migratory
<i>Puffinus bailloni</i>	Tropical shearwater	Unknown
<i>Puffinus carneipes</i>	Flesh-footed shearwater	Migratory
<i>Puffinus pacifica</i>	Wedge-tailed shearwater	Migratory
<i>Puffinus tenuirostris</i>	Short-tailed shearwater	Migratory
<i>Rhipidura versicolor</i>	Micronesian rufous fantail	Unknown
<i>Spatula clypeata</i>	Northern shoveler	Migratory
<i>Sternula albifrons</i>	Little tern	Migratory
<i>Sterna hirundo</i>	Common tern	Migratory
<i>Sterna sumatrana</i>	Black-naped tern	Migratory
<i>Streptopelia dusumieri</i>	Philippine collared-dove	Introduced
<i>Sula dactylatra</i>	Masked booby	Migratory
<i>Sula leucogaster</i>	Brown booby	Migratory
<i>Sula sula</i>	Red-footed booby	Migratory

Scientific Name	Common/Yapese Name	Status
<i>Thalasseus bergii</i>	Great crested tern	Migratory
<i>Tringa brevipes</i>	Gray-tailed tattler	Migratory
<i>Tringa glareola</i>	Wood sandpiper	Migratory
<i>Tringa incana</i>	Wandering tattler	Migratory
<i>Tringa nebularia</i>	Common greenshank	Migratory
<i>Tringa stagnatilis</i>	Marsh sandpiper	Migratory
<i>Tringa totanus</i>	Common redshank	Migratory
<i>Urodynamis taitensis</i>	Long-tailed koel	Migratory
<i>Xenus cinereus</i>	Terek sandpiper	Migratory
<i>Zosterops hypolais</i>	Plain white-eye	ICUN-NT/Endemic
<i>Zosterops oleaginosa</i>	Yap white-eye	ICUN-NT/Endemic
Reptiles and Amphibians		
<i>Anolis carolinensis</i>	Green anole	Unknown
<i>Carlia ailanpalai</i>	Curious skink	Introduced
<i>Emoia atrocostata</i>	Littoral whiptail skink	Unknown
<i>Emoia impa</i>	Azure-tailed skink	Unknown
<i>Emoia jakati</i>	Kopstein's emo skink	Unknown
<i>Eretmochelys imbricata</i>	Hawksbill sea turtle	Endemic
<i>Lamprolepis smaragdina</i>	Emerald tree skink	Unknown
<i>Perochirus ateles</i>	Micronesia saw-tailed Gecko/qadburruq	Endemic
<i>Ramphotyphlops hatmaliyeb</i>	Blind snake/hatmaliyeb	Unknown
<i>Rhinella marina</i>	Cane toad	Introduced
<i>Varanus indicus</i>	Monitor lizard	Invasive
Invertebrates		
<i>Agrionoptera insignis</i>	Grenadier	Unknown
<i>Birgus latro</i>	Coconut crab	Endemic
<i>Camponotus erythrocephalus</i>	No common name	Unknown
<i>Coenobita rugosus</i>	Tawney hermit crab	Unknown
<i>Cryptophyllum yapicum</i>	Hidden leaf insect	Unknown
<i>Hypolimnas bolina</i>	Great eggfly	Unknown
<i>Neurothemis terminata</i>	Indonesian red-winged dragonfly	Unknown
<i>Olethrius carolinensis</i>	No common name	Unknown
<i>Orthetrum serapia</i>	Green skimmer	Unknown
<i>Papilio polytes</i>	Common Mormon swallowtail	Unknown
<i>Tuerkayana hirtipes</i>	Pacific land crab	Unknown
<i>Wasmannia auropunctata</i>	Little fire ant	Invasive

Source: Avibase 2023; Buden 2011; iNaturalist 2024a, 2024b, 2024c; USFWS 2023

Key: E = Endangered; F = Federal; IUCN = International Union for Conservation of Nature and Natural Resources; NT = Near Threatened; V = Vulnerable.

Table A-3. Invasive Species Documented on Yap

Scientific Name	Common/Yapese Name
Plants	
<i>Abelmoschus moschatus</i>	Muskmallow
<i>Acacia confusa</i>	Ayangile
<i>Ageratum conyzoides</i>	Billygoat weed
<i>Alternanthera sessilis</i>	Sessile joyweed
<i>Angiopteris evecta</i>	Elephant fern
<i>Antigonon leptopus</i>	Mexican creeper
<i>Bambusa vulgaris</i>	Common bamboo
<i>Bidens pilosa</i>	Hairy beggarticks
<i>Canna indica</i>	Indian shot
<i>Cedrela odorata</i>	No common name
<i>Cenchrus polystachios</i>	No common name
<i>Cestrum nocturnum</i>	Night blooming jasmine
<i>Chromolaena odorata</i>	Jack in the bush
<i>Cynodon dactylon</i>	Bermuda grass
<i>Cyperus rotundus</i>	Nutgrass
<i>Dioscorea bulbifera</i>	No common name
<i>Eichhornia crassipes</i>	Common water hyacinth
<i>Falcataria moluccana</i>	Moluccan Albizia
<i>Imperata cylindrica</i>	Cogon grass
<i>Ischaemum polystachyum</i>	Paddle grass
<i>Lantana camara</i>	West Indian lantana
<i>Melaleuca quinquenervia</i>	Punktree
<i>Melia azedarach</i>	Chinaberry
<i>Merremia peltata</i>	No common name
<i>Mikania micrantha</i>	No common name
<i>Mimosa diplotricha</i>	No common name
<i>Mimosa pudica</i>	Shameplant
<i>Opuntia monacantha</i>	Drooping prickly pear
<i>Paspalum scrobiculatum</i>	Kodo millet
<i>Passiflora foetida</i>	Stinking passionflower
<i>Psidium guajava</i>	Common guava
<i>Pueraria montana var. lobata</i>	No common name
<i>Ricinus communis</i>	Caster bean
<i>Sphagneticola trilobata</i>	Singapore daisy
<i>Thevetia peruviana</i>	Yellow oleander
Animals	
<i>Mus musculus</i>	House mouse
<i>Rattus exulans</i>	Polynesian rat
<i>Rattus norvegicus</i>	Brown rat
<i>Rattus rattus</i>	Black rat
<i>Sus scrofa</i>	Wild boar
<i>Varanus indicus</i>	Monitor lizard

Source: GISD 2024

Table A-4. Plant Species Observed by Zone in the Environmental Survey Area

Scientific Name	Common/Yapese Name
Zone 1	
<i>Acacia auriculifolia</i>	akasia
<i>Acacia mangium</i>	akasia
<i>Buchanania engleriana</i>	omail
<i>Calophyllum inophyllum</i>	Beach mahogany/biyuuch
<i>Camptosperma brevipetiolata</i>	ramlieu
<i>Cocos nucifera</i>	Coconut palm/ntew
<i>Commersonia bartramia</i>	Brown kurrajong/guguw
<i>Talipariti tiliaceum</i>	Sea hibiscus/gal'
<i>Melaleuca quinquenervia</i>	Bottle brush tree
<i>Melanolepis trees</i>	No common name
<i>Morinda citrifolia</i>	Indian mulberry/magarwek
<i>Ochrosia oppositifolia</i>	mow
<i>Pandanus tectorius</i>	Tahitian screwpine/cho
<i>Pandanus yapanensis</i>	No common name
<i>Premna serratifolia</i>	arr
<i>Tacca leontopetaloides</i>	Batflower
<i>Xanthosoma sagittifolium</i>	tannia
Zone 2	
<i>Acacia auriculifolia</i>	akasia
<i>Acacia mangium</i>	akasia
<i>Areca catechu</i>	betel palm/buw
<i>Artocarpus altilis</i>	Breadfruit/thow
<i>Artocarpus mariannensis</i>	meiyas
<i>Bambusa vulgaris</i>	Common bamboo
<i>Buchanania engleriana</i>	omail
<i>Calophyllum inophyllum</i>	Beach mahogany/biyuuch
<i>Camptosperma brevipetiolata</i>	ramlieu
<i>Cocos nucifera</i>	Coconut palm/ntew
<i>Talipariti tiliaceum</i>	Sea hibiscus/gal'
<i>Lycopodium cernuum</i>	Staghorn clubmoss
<i>Melaleuca quinquenervia</i>	Bottle brush tree
<i>Melanolepis multiglandulosa</i>	No common name
<i>Morinda citrifolia</i>	Indian mulberry/magarwek
<i>Pandanus tectorius</i>	Tahitian screwpine/cho
<i>Pandanus yapanensis</i>	No common name
<i>Premna serratifolia</i>	arr
<i>Serianthes kanehirae</i>	gumor
<i>Tacca leontopetaloides</i>	Batflower
<i>Tuberolabium sp.</i>	No common name
<i>Xanthosoma sagittifolium</i>	tannia
Zone 3	
<i>Acacia auriculifolia</i>	akasia
<i>Acacia mangium</i>	akasia
<i>Areca catechu</i>	buw/ betel palm
<i>Avicennia alba</i>	dadit
<i>Bambusa vulgaris</i>	Common bamboo
<i>Bruguiera gymnorrhiza</i>	Oriental mangrove/yangach
<i>Buchanania engleriana</i>	omail
<i>Calophyllum inophyllum</i>	Beach mahogany/biyuuch

Scientific Name	Common/Yapese Name
<i>Camptosperma brevipetiolata</i>	ramlieu
<i>Cocos nucifera</i>	Coconut palm/ntew
<i>Eleocharis ochrostachys</i>	Spikerush
<i>Garcinia rumiyo</i>	tilol
<i>Talipariti tiliaceum</i>	Sea hibiscus/gal'
<i>Lycopodium cernuum</i>	Staghorn clubmoss
<i>Melaleuca quinquenervia</i> ,	Bottle brush tree
<i>Melanolepis multiglandulosa</i>	No common name
<i>Mimosa pudica</i>	Shameplant
<i>Morinda citrifolia</i>	Indian mulberry/magarwek
<i>Pandanus tectorius</i>	Tahitian screwpine/cho
<i>Pandanus yapanensis</i>	No common name
<i>Premna serratifolia</i>	arr
<i>Rhizophora spp.</i>	No common name
<i>Tacca leontopetaloides</i>	Batflower
<i>Xanthosoma sagittifolium</i>	tannia
<i>Xylocarpus granatum</i>	yamgur
Zone 4	
<i>Acacia auriculifolia</i>	akasia
<i>Acacia mangium</i>	akasia
<i>Bambusa vulgaris</i>	Common bamboo
<i>Buchanania engleriana</i>	omail
<i>Camptosperma brevipetiolata</i>	ramlieu
<i>Calophyllum inophyllum</i>	Beach mahogany/ biyuuch
<i>Cocos nucifera</i>	Coconut palm/ntew
<i>Commersonia bartramia</i>	Brown kurrajong/guguw
<i>Talipariti tiliaceum</i>	Sea hibiscus/gal'
<i>Ixora triantha</i>	No common name
<i>Melaleuca quinquenervia</i>	Bottle brush tree
<i>Melanolepis multiglandulosa</i>	No common name
<i>Morinda citrifolia</i>	Indian mulberry/magarwek
<i>Pandanus tectorius</i>	Tahitian screwpine/cho
<i>Pandanus yapanensis</i>	No common name
<i>Premna serratifolia</i>	arr
<i>Tuberolabium spp.</i>	No common name
<i>Xanthosoma sagittifolium</i>	tannia
Zone 5	
<i>Acacia auriculifolia</i>	akasia
<i>Acacia mangium</i>	akasia
<i>Buchanania engleriana</i>	omail
<i>Calophyllum inophyllum</i>	Beach mahogany/biyuuch
<i>Camptosperma brevipetiolata</i>	ramlieu
<i>Cocos nucifera</i>	Coconut palm/ntew
<i>Commersonia bartramia</i>	Brown kurrajong/guguw
<i>Garcinia rumiyo</i>	tilol
<i>Talipariti tiliaceum</i>	Sea hibiscus/gal'
<i>Lycopodium cernuum</i>	Staghorn clubmoss
<i>Mammea odorata</i>	lubodol
<i>Melaleuca quinquenervia</i>	Bottle brush tree
<i>Melanolepis multiglandulosa</i>	No common name
<i>Morinda citrifolia</i>	Indian mulberry/magarwek
<i>Pandanus tectorius</i>	Tahitian screwpine/cho

Scientific Name	Common/Yapese Name
<i>Pandanus yapanensis</i>	No common name
<i>Premna serratifolia</i>	arr
<i>Tacca leontopetaloides</i>	Batflower
Zone 6	
<i>Acacia auriculifolia</i>	akasia
<i>Acacia mangium</i>	akasia
<i>Alphitonia carolinensis</i>	Root beer tree/k'ing
<i>Anacardium occidentale</i>	Cashew
<i>Buchanania engleriana</i>	omail
<i>Calophyllum inophyllum</i>	Beach mahogany/biyuuch
<i>Camptosperma brevipetiolata</i>	ramlieu
<i>Cocos nucifera</i>	Coconut palm/ntew
<i>Commersonia bartramia</i>	Brown kurrajong/guguw
<i>Glochidion ramiflorum</i>	ngumol
<i>Talipariti tiliaceum</i>	Sea hibiscus/gal'
<i>Ixora triantha</i>	No common name
<i>Leucaena leucocephala</i>	White lead tree/ganinityuwan
<i>Lycopodium cernuum</i>	Staghorn clubmoss
<i>Macaranga carolinensis</i>	bith
<i>Mallotus papillaris</i>	burr
<i>Melaleuca quinquenervia</i>	Bottle brush tree
<i>Mimosa pudica</i>	Shameplant
<i>Morinda citrifolia</i>	Indian mulberry/magarwek
<i>Ochrosia oppositifolia</i>	mow
<i>Pandanus tectorius</i>	Tahitian screwpine/cho
<i>Pandanus yapensis</i>	tha
<i>Plumeria rubra</i>	Plumeria/sawur
<i>Premna serratifolia</i>	arr
<i>Rhus taitensis</i>	Sumac/ glad
<i>Scaevola taccada</i>	Beach naupaka
<i>Tacca leontopetaloides</i>	Batflower
<i>Tuberolabium sp.</i>	No common name
Zone 7	
<i>Acacia auriculifolia</i>	akasia
<i>Acacia mangium</i>	akasia
<i>Alphitonia carolinensis</i>	Root beer tree/k'ing
<i>Anacardium occidentale</i>	Cashew
<i>Buchanania engleriana</i>	omail
<i>Calophyllum inophyllum</i>	Beach mahogany/ biyuuch
<i>Camptosperma brevipetiolata</i>	ramlieu
<i>Cocos nucifera</i>	Coconut palm/ntew
<i>Commersonia bartramia</i>	Brown kurrajong/guguw
<i>Glochidion ramiflorum</i>	ngumol
<i>Talipariti tiliaceum</i>	Sea hibiscus/gal'
<i>Ixora triantha</i>	No common name
<i>Leucaena leucocephala</i>	White lead tree/ ganinityuwan
<i>Lycopodium cernuum</i>	Staghorn clubmoss
<i>Macaranga carolinensis</i>	bith
<i>Mallotus papillaris</i>	burr
<i>Melaleuca quinquenervia</i>	Bottle brush tree
<i>Morinda citrifolia</i>	Indian mulberry/magarwek
<i>Ochrosia oppositifolia</i>	mow

Scientific Name	Common/Yapese Name
<i>Pandanus tectorius</i>	Tahitian screwpine/choi
<i>Pandanus yapensis</i>	choi
<i>Plumeria rubra</i>	Plumeria/ sawur
<i>Premna serratifolia</i>	arr
<i>Rhus taitensis,</i>	Sumac/ glad
<i>Scaevola taccada</i>	Beach naupaka
<i>Tacca leontopetaloides</i>	Batflower
<i>Tuberolabium sp.</i>	No common name
Zone 8	
<i>Calophyllum inophyllum</i>	Beach mahogany/biyuuch
<i>Cocos nucifera</i>	Coconut palm/ntew
<i>Talipariti tiliaceum</i>	Sea hibiscus/gal'
<i>Melanolepis multiglandulosa</i>	No common name
<i>Mimosa pudica</i>	Shameplant
<i>Miscanthus floridulus</i>	Japanese silvergrass
<i>Pandanus tectorius</i>	Tahitian screwpine/cho

Table A-5. Plant Species Documented within the Environmental Survey Area

Scientific	Common	Origin	Growth Form
<i>Asplenium nidus</i>	NCN	N	Epiphytic fern
<i>Alysicarpus vaginalis</i>	White moneywort	NN	Forb
<i>Bambusa vulgaris</i>	Common bamboo	I	Grass
<i>Bidens pilosa</i>	Hairy beggarticks	I	Forb
<i>Bothriochloa bladhii</i>	Caucasian bluestem	NN	Grass
<i>Cassytha filiformis</i>	NCN	N	Vine
<i>Cenchrus echinatus</i>	Southern sandbur	NN	Grass
<i>Chamaesyce hirta</i>	Pillpod sandmat	NN	Forb
<i>Euphorbia hypericifolia</i>	Graceful sandmat	NN	Forb
<i>Chloris radiata</i>	Radiate fingergrass	NN	Grass
<i>Chromolaena odorata</i>	Jack in the bush	I	Forb
<i>Cochlidium punctatum</i>	NCN	N	Epiphytic fern
<i>Cocos nucifera</i>	Coconut palm	NN	Tree
<i>Cycas micronesica</i>	Cycad	N	Tree
<i>Cynodon dactylon</i>	Bermuda grass	I	Grass
<i>Cyperus compressus</i>	Poorland flatsedge	NN	Sedge
<i>Cyperus cyperoides</i>	Pacific island flatsedge	N	Sedge
<i>Cyperus rotundus</i>	Nutgrass	I	Sedge
<i>Dactyloctenium aegyptium</i>	Egyptian grass	NN	Grass
<i>Dendrocnide latifolia</i>	NCN	N	Tree
<i>Desmodium triflorum</i>	Threeflower ticktrefoil	NN	Forb
<i>Eleusine indica</i>	Indian goosegrass	NN	Grass
<i>Eragrostis brownii</i>	Brown's lovegrass	NN	Grass
<i>Eragrostis ciliaris</i>	Gophertail lovegrass	NN	Grass
<i>Euphorbia heterophylla</i>	Mexican fireplant	NN	Forb
<i>Fimbristylis cymosa</i>	Hurricanegrass	N	Sedge
<i>Geuttarda speciosa</i>	Beach gardenia	N	Tree
<i>Kyllinga nemoralis</i>	Whitehead spikesedge	N	Sedge
<i>Leucaena leucocephala</i>	tangantangan	NN	Tree
<i>Mangifera indica</i>	Mango/manga	NN	Tree
<i>Melanolepis multiglandulosa</i>	NCN	N	Tree
<i>Melochia villosissima</i>	NCN	N	Shrub
<i>Mikania scandens</i>	Climbing hempvine	NN	Vine
<i>Mimosa pudica</i>	Shameplant	I	Forb
<i>Morinda citrifolia</i>	Indian mulberry	N	Tree
<i>Nephrolepis acutifolia</i>	NCN	N	Epiphytic fern
<i>Nephrolepis biserrate</i>	Giant swordfern	N	Terrestrial fern
<i>Ochrosia oppositifolia</i>	NCN	N	Tree
<i>Oldenlandia corymbose</i>	Flat-top mille grains	NN	Forb
<i>Pandanus tectorius</i>	Tahitian screwpine	N	Tree
<i>Paspalum paniculatum</i>	arrocillo	NN	Grass
<i>Paspalum setaceum</i>	Thin paspalum	NN	Grass
<i>Passiflora suberosa</i>	Corksystem passionflower	NN	Vine
<i>Pennisetum polystachion</i>	Mission grass	NN	Grass
<i>Phyla nodiflora</i>	Turkey tangle fogfruit	NN	Forb
<i>Microsorium scolopendria</i>	Monarch fern	N	Epiphytic fern
<i>Pilea microphylla</i>	Rockweed	NN	Forb
<i>Pisonia grandis</i>	NCN	N	Tree
<i>Portulaca oleracea</i>	Common purslane	N	Forb
<i>Premna serratifolia</i>	malbau	N	Tree
<i>Chamaesyce prostrata</i>	Prostrate sandmat	NN	Forb

Scientific	Common	Origin	Growth Form
<i>Pyrrosia lanceolata</i>	Lanceleaf tongue fern	N	Epiphytic fern
<i>Saccharum spontaneum</i>	Wild sugar cane	N	Grass
<i>Sporobolus fertilis</i>	Smut grass	N	Grass
<i>Tridax procumbens</i>	Coat buttons	NN	Forb
<i>Tuberolabium</i> spp.	NCN	N	Epiphytic forb
<i>Urochloa maxima</i>	Guineagrass	NN	Grass
<i>Waltheria indica</i>	uhaloa	NN	Forb

Source: GISD 2024

Key: I = Invasive; N = Native; NCN = No Common Name; NN = Non-native

Table A-6. Yap Flying Fox Foraging Trees

Scientific Name	Common/Yapese name
<i>Annona muricata</i>	Soursop/sausau
<i>Artocarpus altilis</i>	Breadfruit/thow
<i>Artocarpus heterophyllus</i>	Jackfruit
<i>Calophyllum inophyllum</i>	Beach mahogany/biyuuch
<i>Camptosperma brevipetiolata</i>	ramlieu
<i>Carica papaya</i>	Papaya
<i>Ceiba pentandra</i>	Kapok tree/batey
<i>Citrus spp.</i>	No common name
<i>Cocos nucifera</i>	Coconut palm/ntew
<i>Freycinetia spp.</i>	No common name
<i>Ficus prolixa</i>	Fig/aw
<i>Glochidion ramiflorum</i>	ngumol
<i>Inocarpus fagifer</i>	buoy
<i>Lumnitzera littorea</i>	yy
<i>Mangifera indica</i>	Mango/manga
<i>Melaleuca viridiflora</i>	nialui
<i>Musa spp.</i>	Banana
<i>Parinari spp.</i>	No common name
<i>Pandanus tectorius</i>	Tahitian screwpine/choi
<i>Terminalia catappa</i>	India almond
<i>Semecarpus venenosus</i>	changath

Sources: Wiles and Fujita 1992; USDA 2015



Appendix B.



Survey Photos





Photo 1. Field team members lining up on respective transects.



Photo 2. General vegetation communities south of the airport.



Photo 3. Steep grade south of the airport.



Photo 4. General vegetation communities south of the airport.



Photo 5. General vegetation communities south of the airport.



Photo 6. Mangrove forest south of the airport.



Photo 7. General vegetation communities south of the airport.



Photo 8. General vegetation communities south of the airport.



Photo 9. Agroforest south of the airport.



Photo 10. General vegetation communities north of the airport



Photo 11. General vegetation communities north of the airport.



Photo 12. General vegetation communities north of the airport



Photo 13. Fern savanna north of the airport.



Photo 14. Vegetation composition from inside the airport fence.



Photo 15. Vegetation composition from inside the airport fence.



Photo 16. Pacific yam.



Photo 17. Female Yap monarch.



Photo 18. Female white-throated ground dove.



Photo 19. Male white-throated ground dove.



Photo 20. Cycad documented in Colonia during windshield surveys.



Photo 21. Rosewood documented in Colonia during windshield surveys.



Photo 22. Rosewood closeup with flowers.



Photo 23. Micronesia saw-tailed gecko.



Photo 24. Bird nest (unknown species); not likely to be from any special status species based on composition and height.



Photo 25. Surface water south of the airport.



Photo 26. Surface water south of the airport.



Photo 27. Marsh area directly south of environmental survey area.



Photo 28. Stream south of airport.



Photo 29. Eastern edge of the mangrove forest south of the airport.



Photo 30. Culvert located south of airport near main road on the edge of the Galil mangrove.



Photo 31. Surface water north of the airport.



Photo 32. Surface water north of the airport.



Photo 33. Surface water north of the airport (previously quarry).



Photo 34. Taro patch south of the airport.



Photo 35. Taro patch south of the airport.



Photo 36. Taro patch south of the airport.



Photo 37. Taro patch south of the airport.



Photo 38. Taro patch north of the airport.



Photo 39. Suspected impact crater north of the airport.



Photo 40. Depression of unknown origin north of the airport.



Photo 41. Downed aircraft south of the airport.



Photo 42. Downed aircraft west of the airport.



Photo 43. World War II weapon north of the airport.



Photo 44. World War II weapon north of the airport.



Photo 45. Presumed World War II generator west of the airport.



Photo 46. Potential explosive remnant of war north of the airport.



Figure 47. Invasive bamboo forest observed west of the airport



Figure 48. Invasive giant mimosa observed north of the airport fence.



Figure 49. Cane toad observed north of the airport.



Figure 50. Monitor lizard basking south of the airport.



Figure 51. Potential burial observed north of the airport.



Figure 52. Cemetery/burial ground west of the airport.



Figure 53. Burial hut surrounded by taro and betel nut south of the airport.



Photo 54. Cleared vegetation east of airport.



Photo 55. Cleared vegetation east of airport.



Photo 56. Cleared vegetation east of airport.



Photo 57. Active vegetation clearing east of airport.



Photo 58. Cleared vegetation east of airport.



Photo 59. Cleared vegetation east of airport.




Photo 60. Cleared road east of airport.



Photo 61. Construction area east of airport.



Photo 62. Construction staging area east of airport.



Appendix C.

Survey Mapbooks

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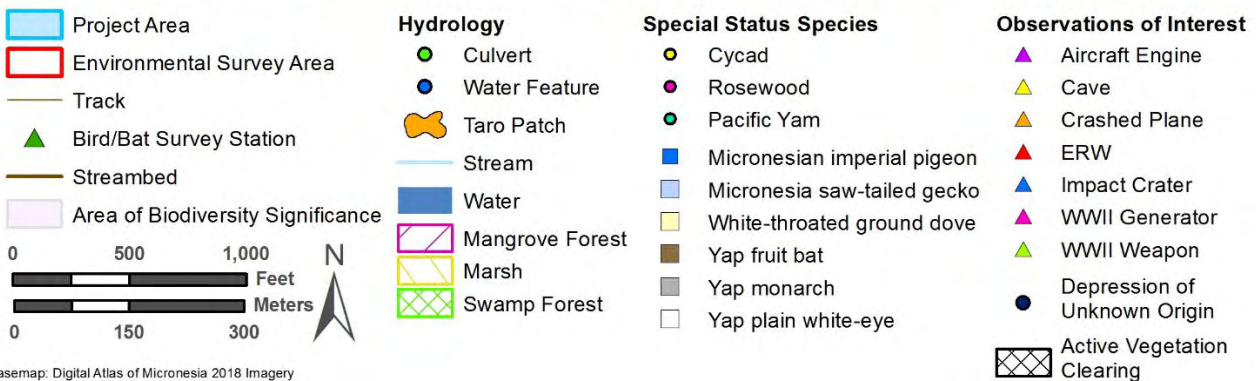
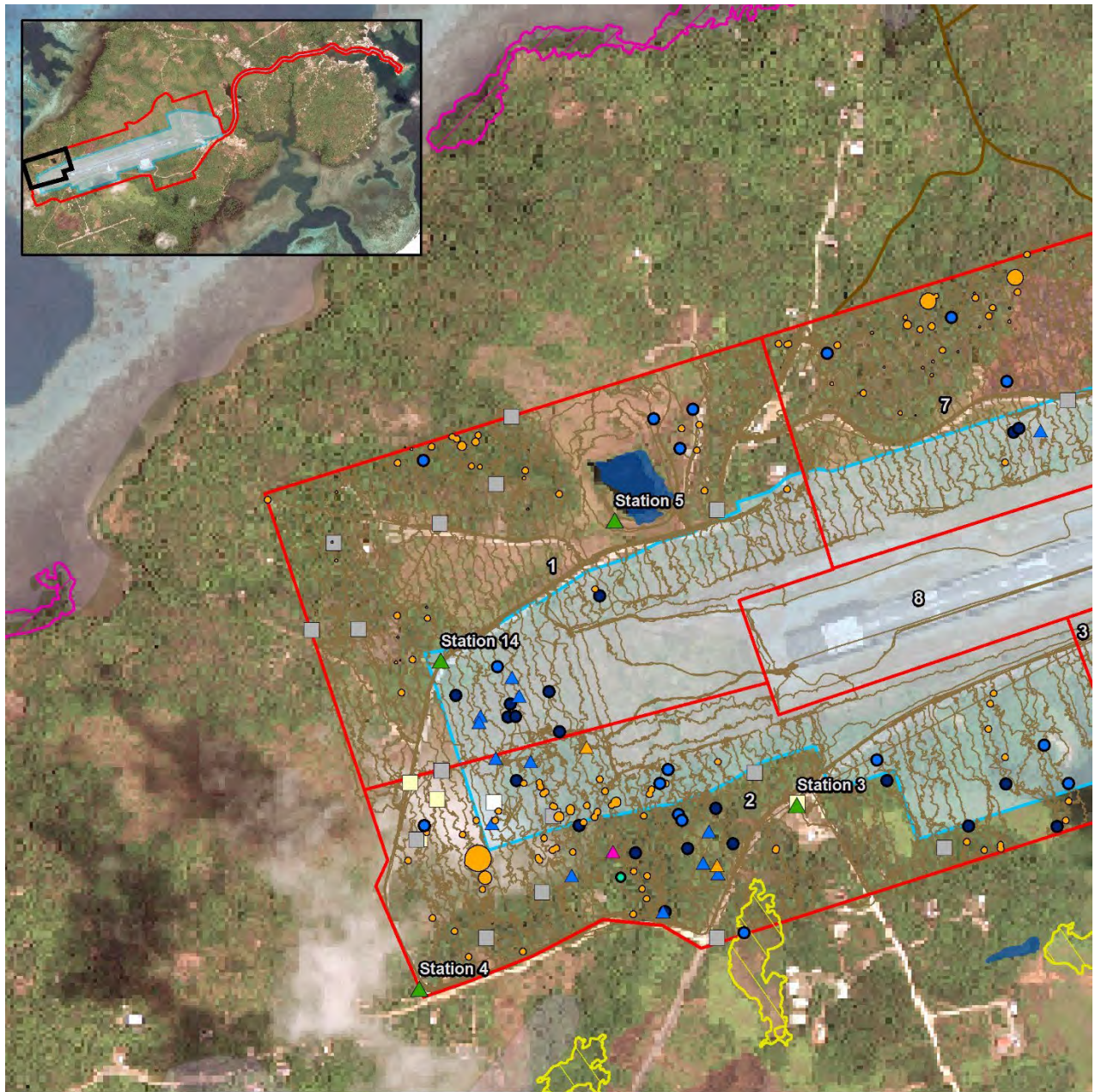


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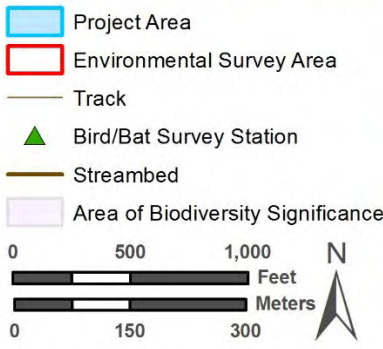
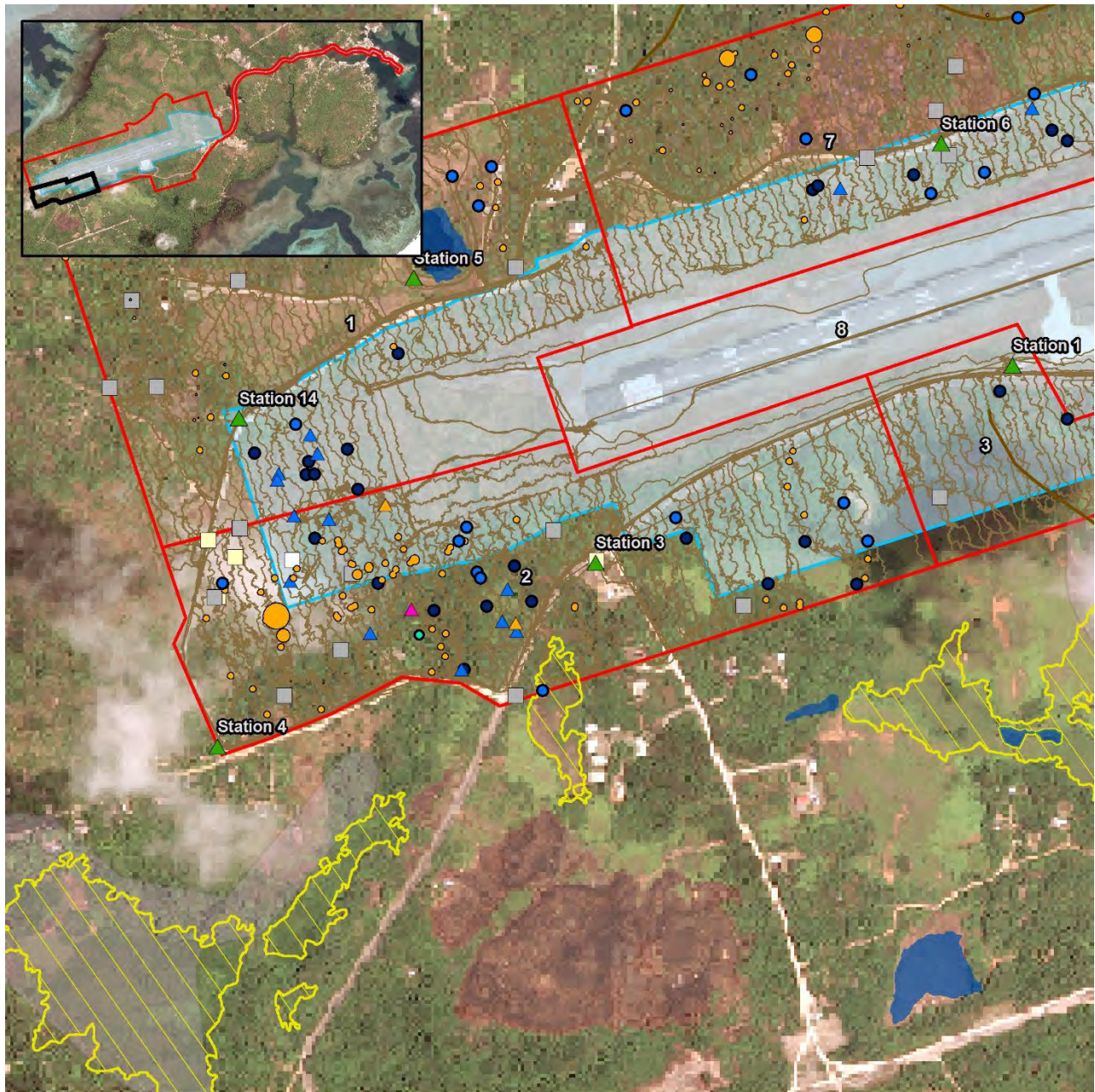
Environmental Survey Area Mapbook Overview



Basemap: Digital Atlas of Micronesia 2018 Imagery

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Zone 1 Mapbook



- Hydrology**
- Culvert
 - Water Feature
 - 🍷 Taro Patch
 - Stream
 - Water
 - Mangrove Forest
 - Marsh
 - Swamp Forest

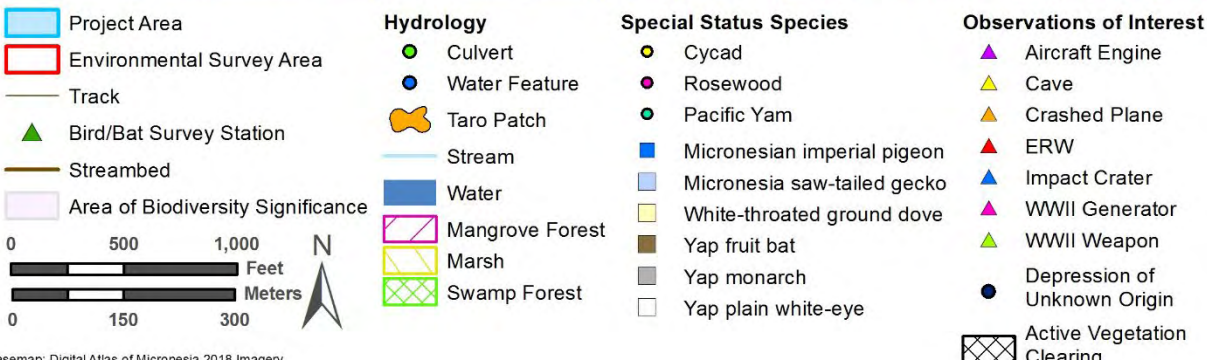
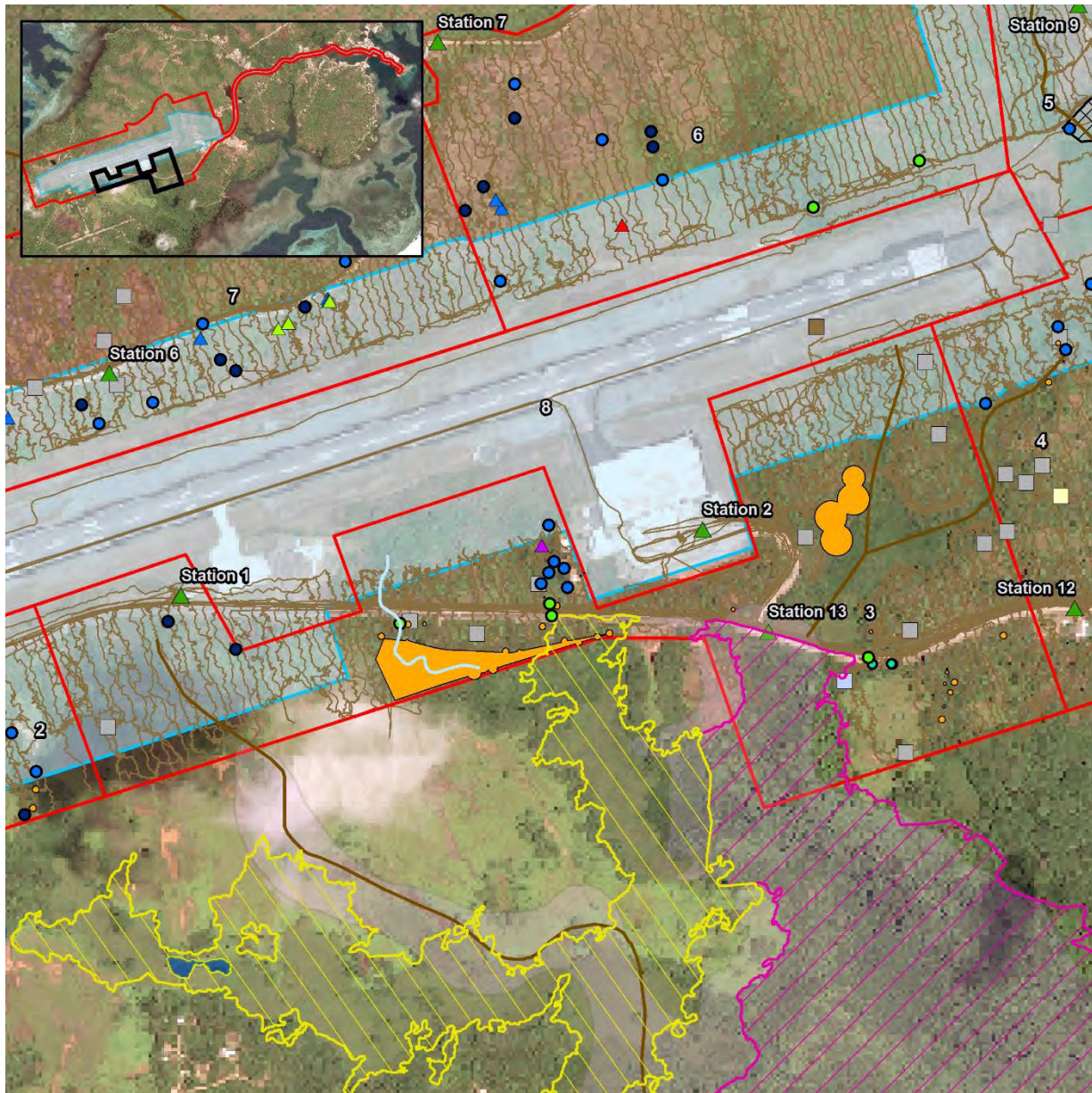
- Special Status Species**
- Cycad
 - Rosewood
 - Pacific Yam
 - Micronesia imperial pigeon
 - Micronesia saw-tailed gecko
 - White-throated ground dove
 - Yap fruit bat
 - Yap monarch
 - Yap plain white-eye

- Observations of Interest**
- ▲ Aircraft Engine
 - ▲ Cave
 - ▲ Crashed Plane
 - ▲ ERW
 - ▲ Impact Crater
 - ▲ WWII Generator
 - ▲ WWII Weapon
 - Depression of Unknown Origin
 - Active Vegetation Clearing

1 Basemap: Digital Atlas of Micronesia 2018 Imagery

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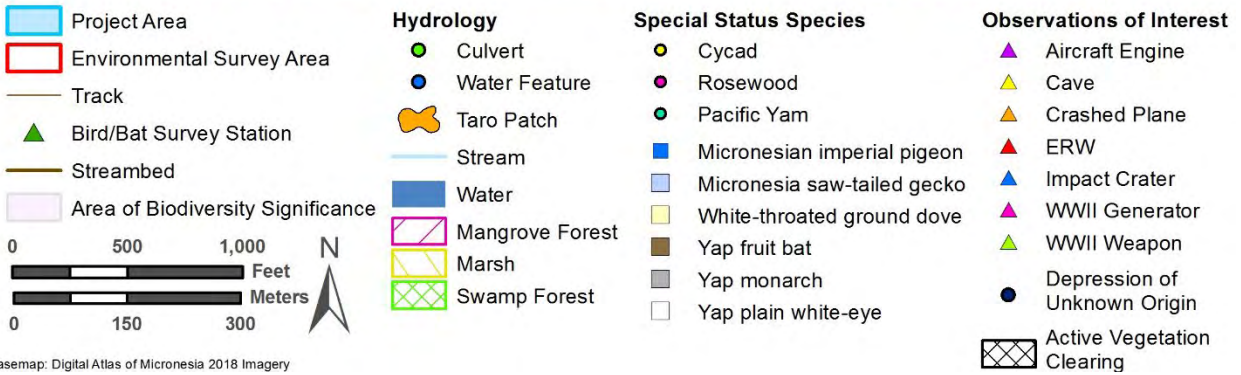
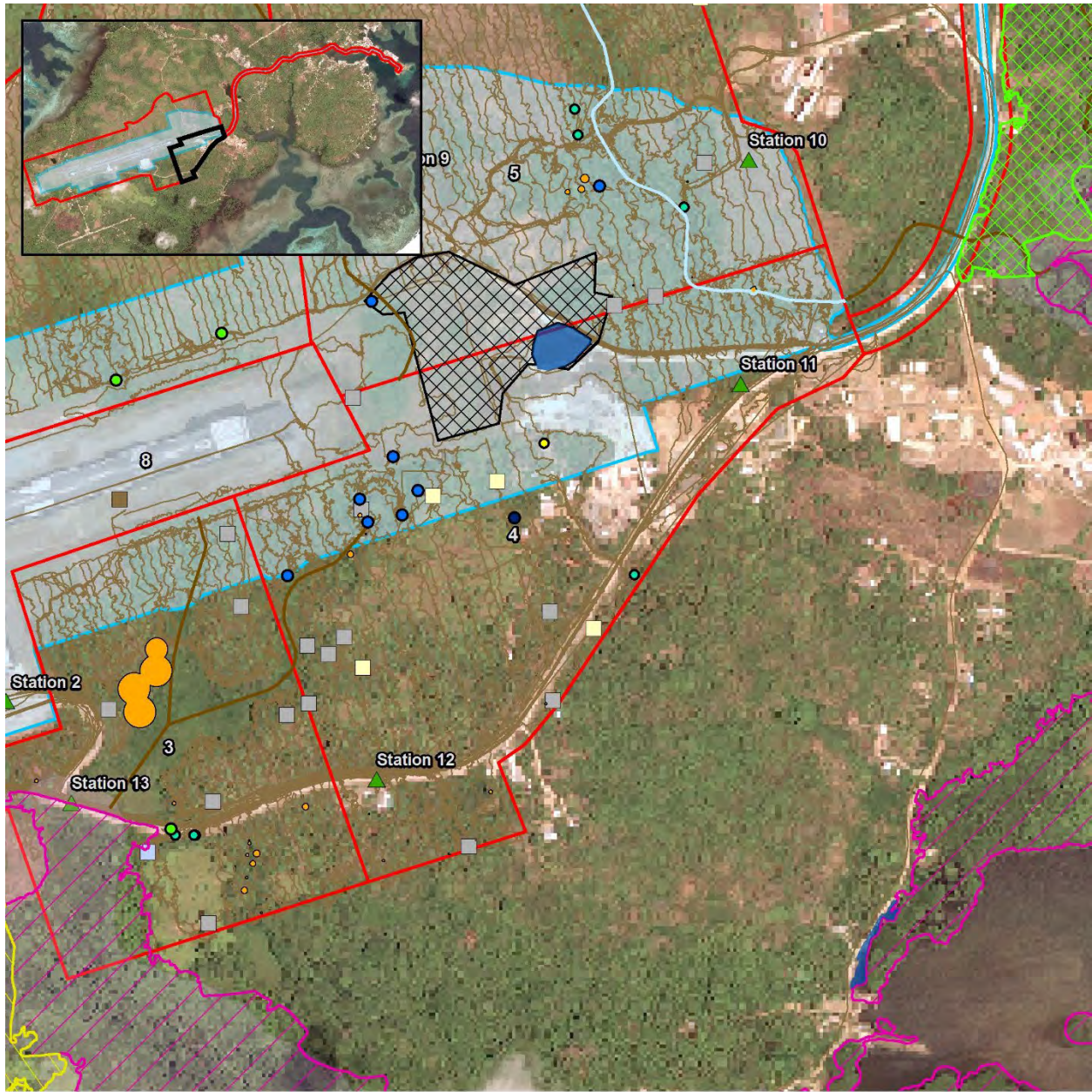
Zone 2 Mapbook



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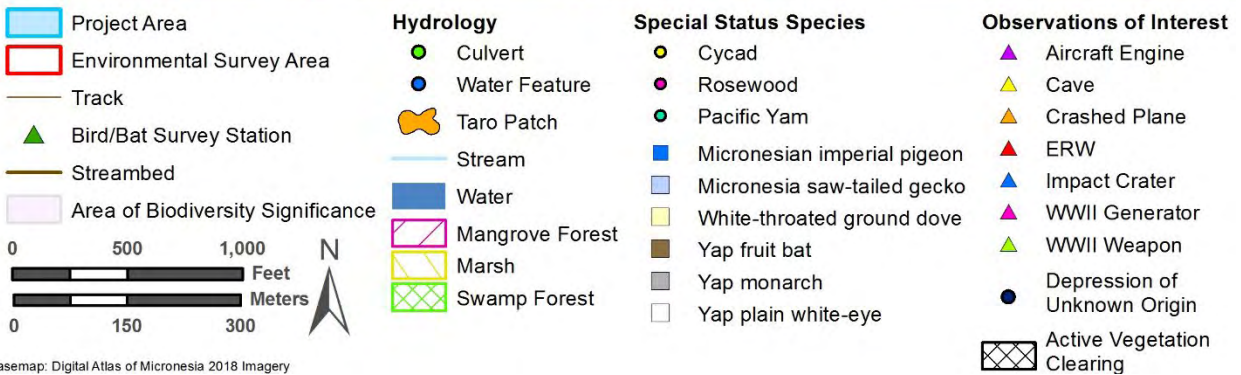
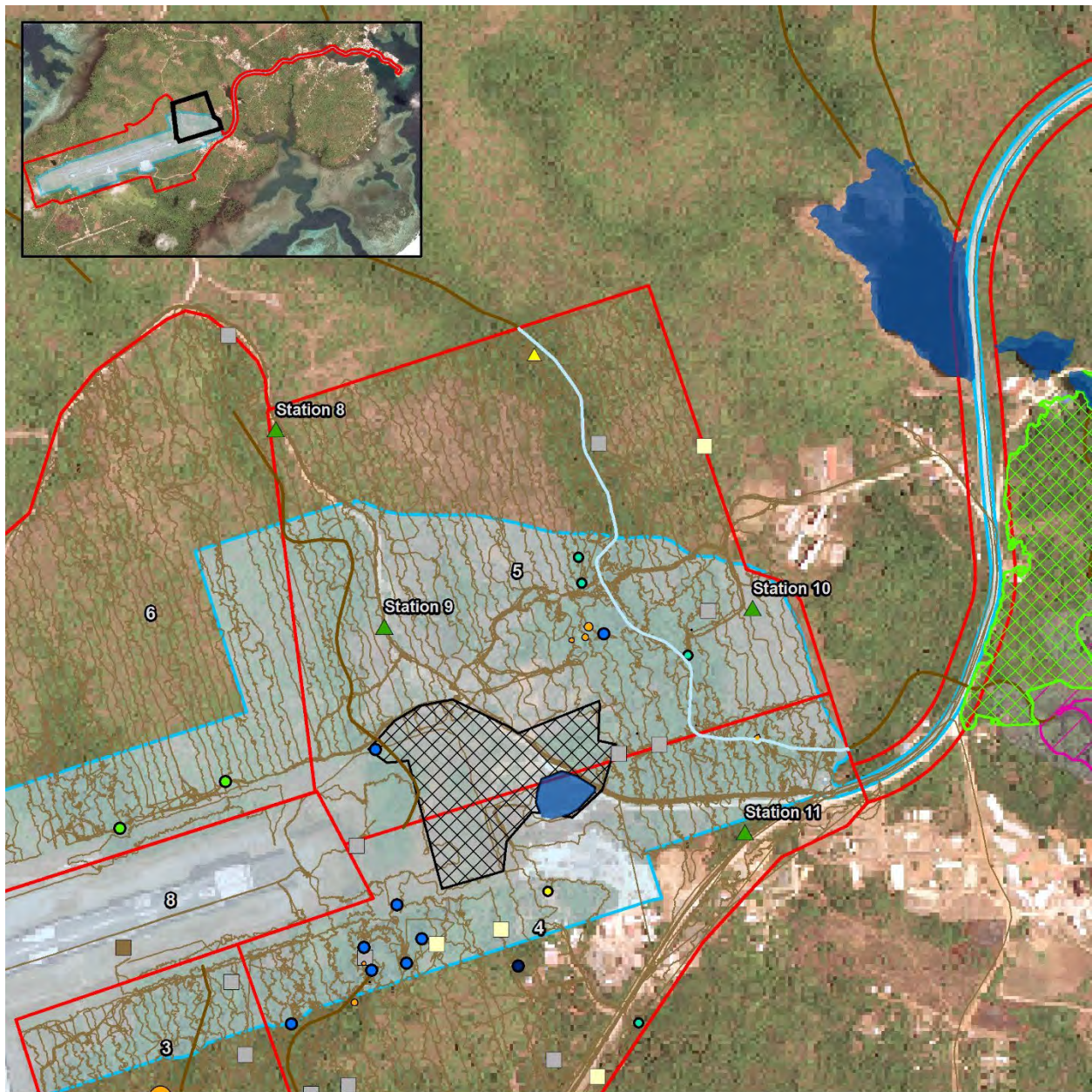
Zone 3 Mapbook



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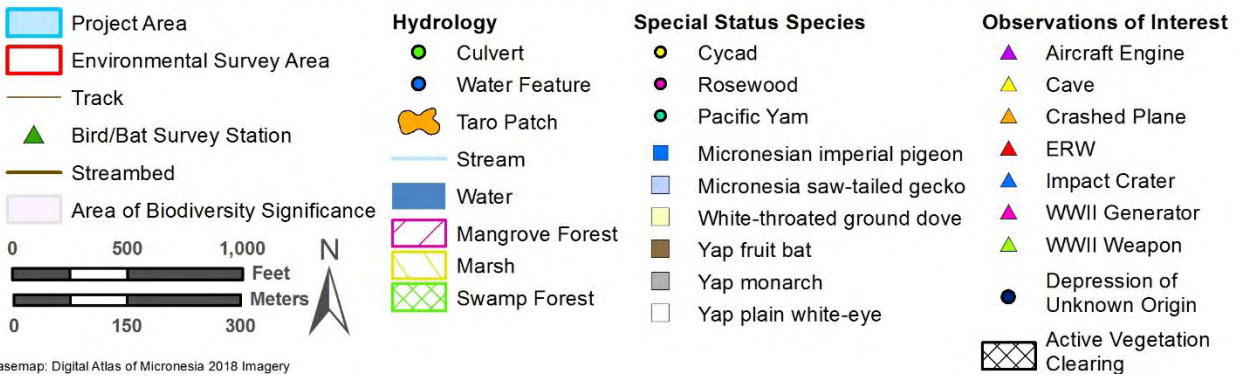
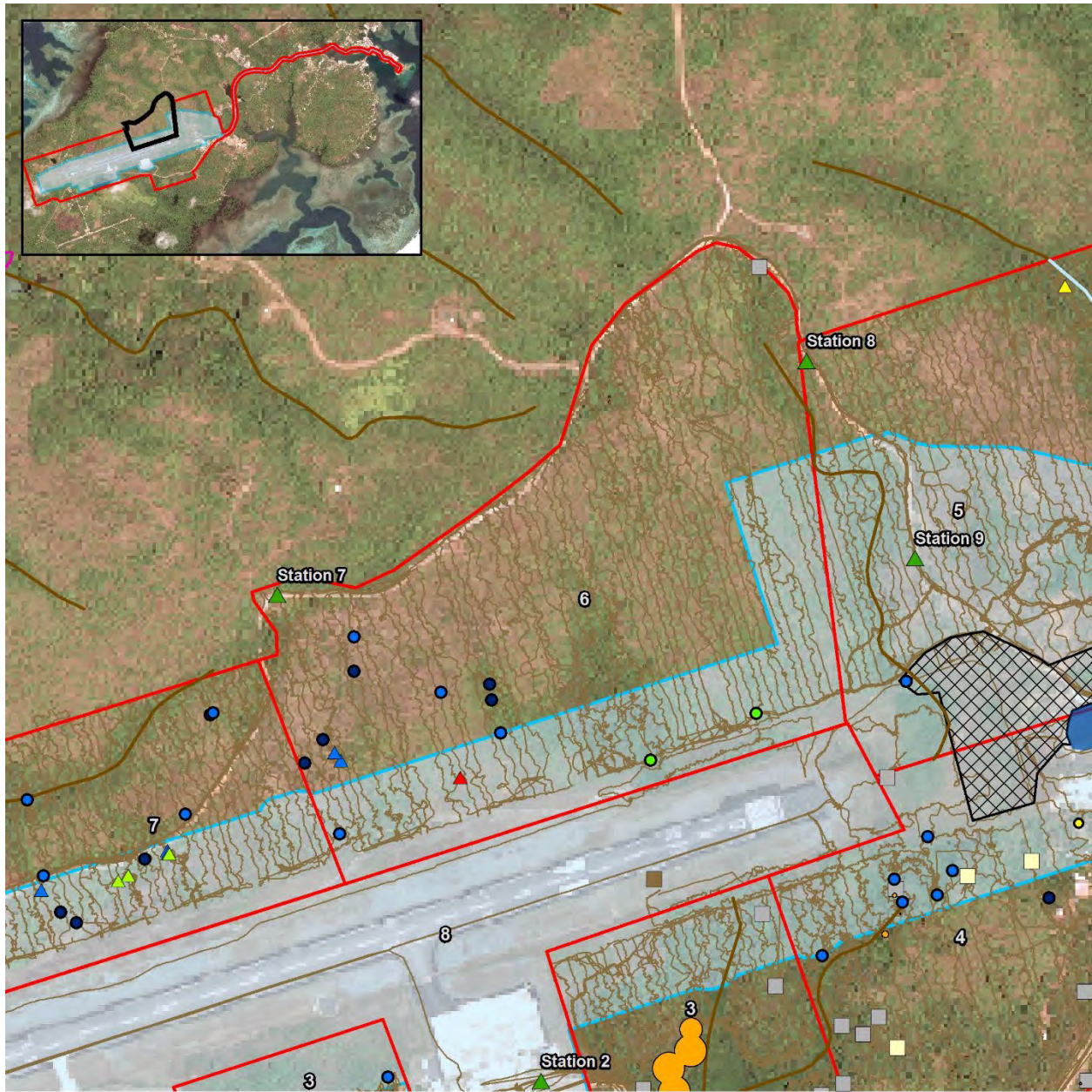
Zone 4 Mapbook



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Zone 5 Mapbook

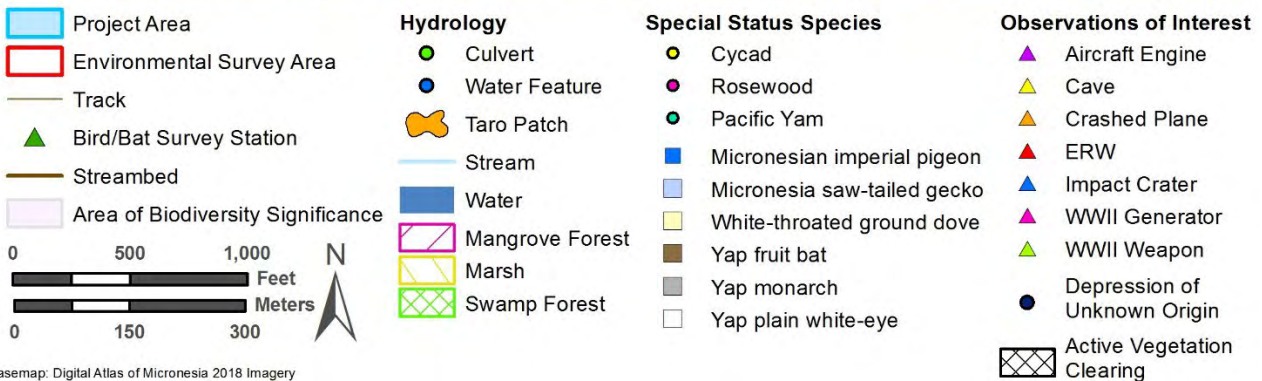
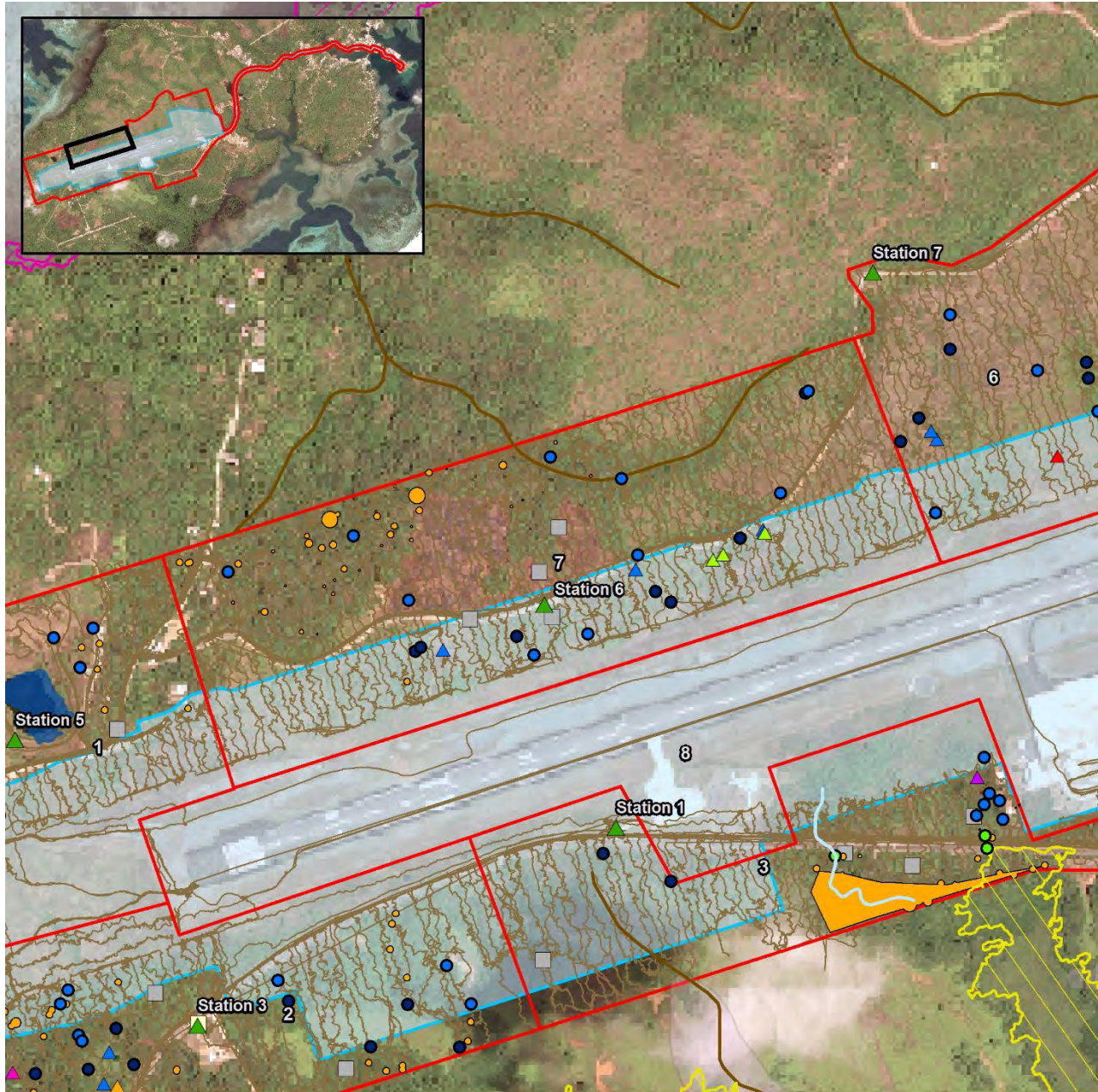


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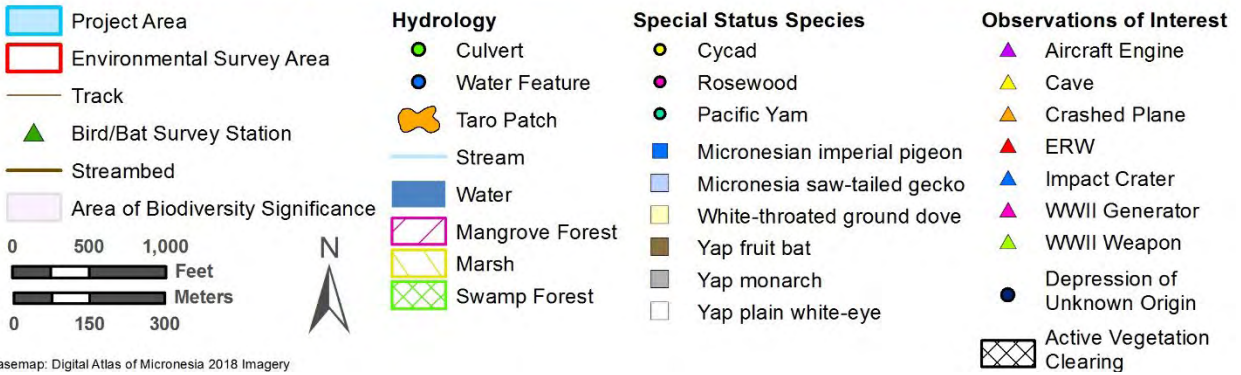
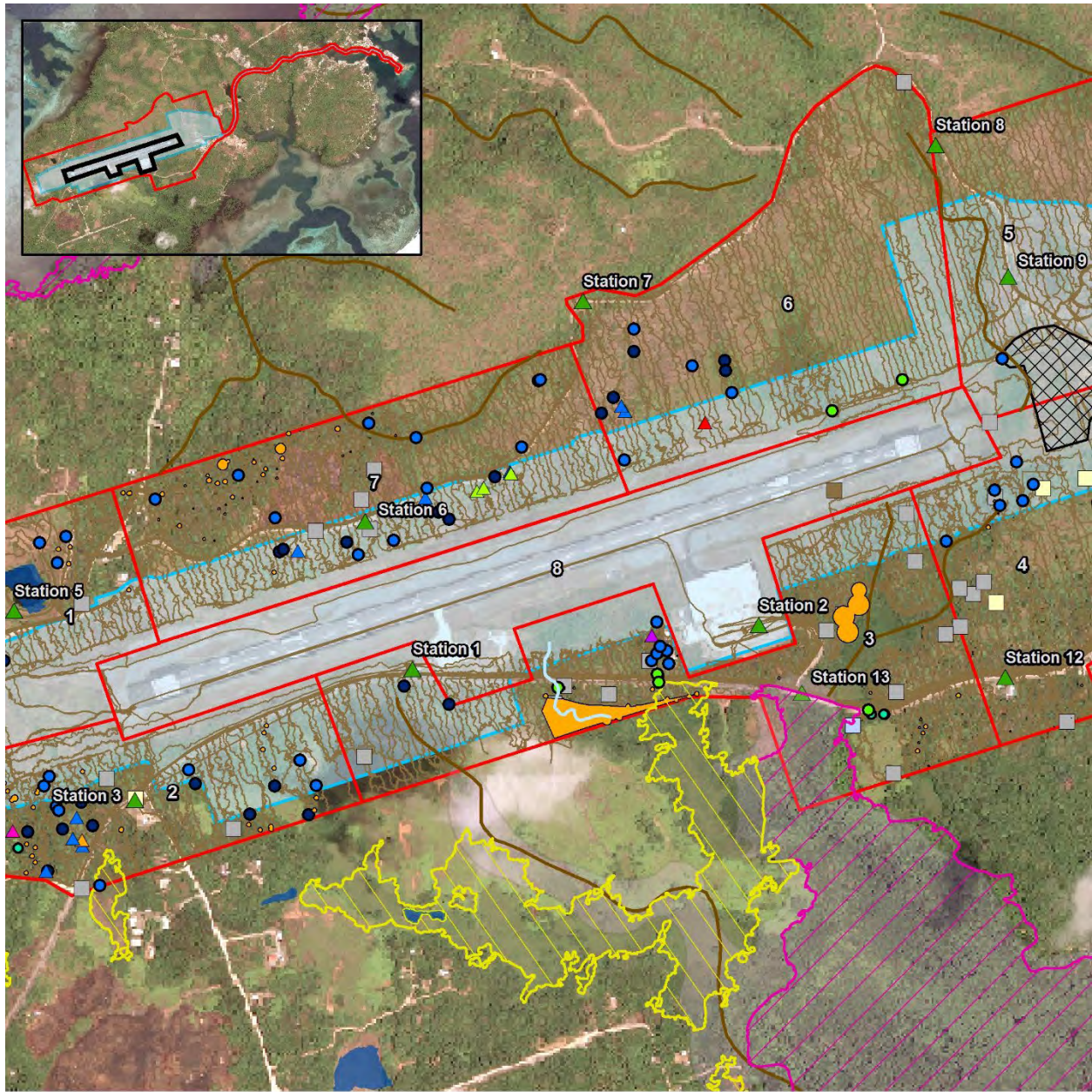
Zone 6 Mapbook



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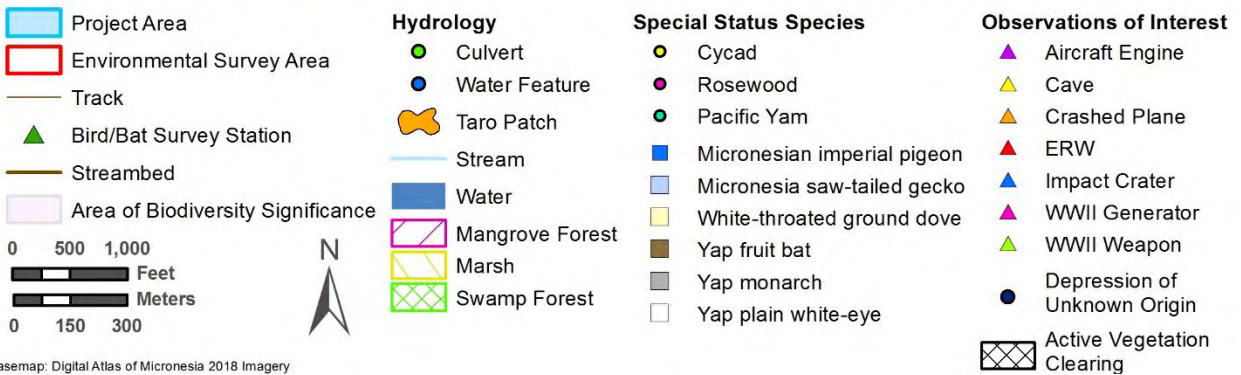
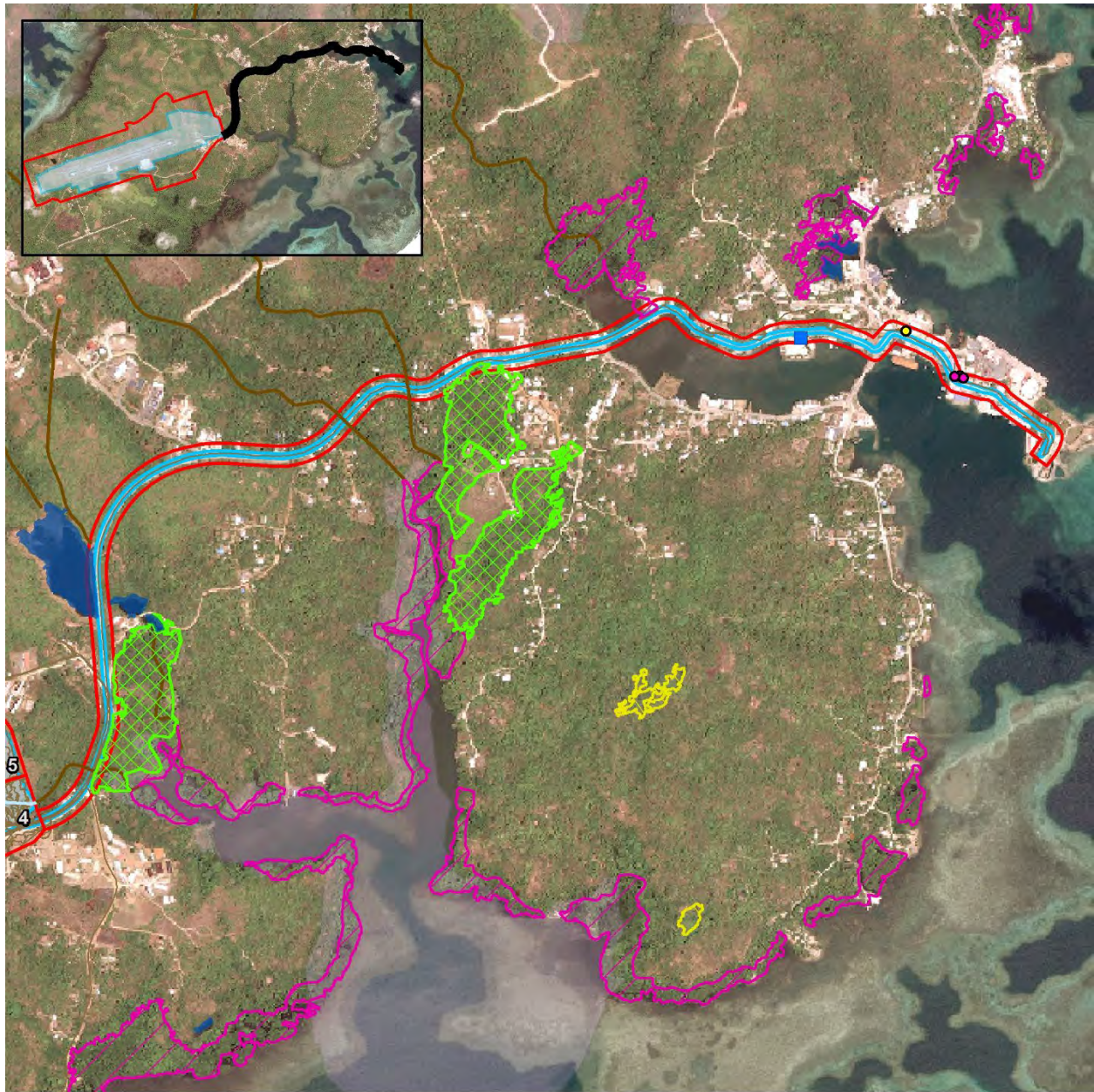
Zone 7 Mapbook



Basemap: Digital Atlas of Micronesia 2018 Imagery

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Zone 8 Mapbook



Basemap: Digital Atlas of Micronesia 2018 Imagery

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Road to the Port Survey Mapbook

Draft Report- To be Updated with Additional Survey Information



Appendix D.



Fruit Bat Monitoring

Joint Region Marianas



**Fruit Bat Monitoring Program
Joint Region Marianas**

Standard Operating Procedure (SOP) # 7:

Fruit Bat Surveys

Version 1.00

September 2010

Previous Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #
#6	Sept 8, 2011	A. Brooke	minor	clarification	#7

Any changes made to SOP # 6 will be recorded in the above table. Version numbers increase incrementally by hundredths (e.g. 1.01, 1.02) for minor revisions (i.e. hours of training). Major revisions (sampling technique) require whole number increments (e.g. 2.0, 3.0). Record the previous version, date of revision, author of revision, paragraphs and pages of revision, reason for change, and the new version number.

Overview

The native mammalian fauna of Guam is limited to three bat species: the Mariana fruit bat (*Pteropus mariannus*), the little Marianas fruit bat (*P. tokudae*) and the Pacific sheath-tailed bat (*Emballonura semicaudata*). Only the Marianna fruit bat is still present on Guam, sheath-tailed bats are present only on Aguiguan in the Marianna archipelago and the little Mariana fruit bat is presumed extinct.

To monitor Fruit Bats on DON lands and assure compliance with appropriate laws, regulations, policies, and executive orders the Fruit Bat Monitoring Program will be implemented. This program and the data collected through it will be used as a tool to assure compliance for activities and projects, facilitate cooperation with existing monitoring plans evaluate effectiveness of the program, and develop strategies for managing natural resources on DON.

Authorities

- COMNAV MARIANAS Final Integrated Natural Resources Management Plan (INRMP) for Navy Lands, Guam (2001)
- U.S. Fish and Wildlife Service. 2010. Draft Revised Recovery Plan for the Mariana Fruit Bat or Fanihi
- 50 FR 49 - [Part 17](#) – Endangered and threatened wildlife and plants: Determination of endangered status for seven birds and two bats on Guam and the Northern Mariana Islands.
- 61755NR09 Species Survey – Long term monitoring of vegetation and wildlife on Navy Lands.
- M5240NR155 Threatened and Endangered Species Monitoring - Long term monitoring of vegetation and wildlife on Andersen Air Force Base.
-

Objectives

- Identify and examine trends in the abundance of Mariana fruit bats

Personnel Requirements and Training

Observers conducting surveys must have the necessary skills to identify Mariana fruit bats and conduct counts at colony sites.

- The field crew of two people must be able to hike through difficult karst limestone terrain, including steep and rugged slopes.
- Observers must have a basic knowledge of the natural history and identification of fruit bats. The team leader must be familiar with and can identify Mariana fruit bats by sight, has prior experience carrying out all three survey techniques, and has extensive knowledge of suitable fruit bat roosting and foraging habitat. The team leader must be knowledgeable of data collection methods, data management, and field reporting.
- Sufficient prior experience is defined as having conducted a minimum of 4 bat surveys of each survey technique (landscape counts for solitary bats, direct colony counts and dispersal colony counts) under the direct supervision of an experienced observer. At each of these counts, bats must have been observed.
- Training will consist of conducting 4 counts of each survey technique under the direct supervision of an experienced observer.
- Experience conducting counts for Mariana swiftlets, seabirds or other aerial foraging birds can substitute for landscape counts.

Study Area

Mariana fruit bats are found throughout the native limestone forests on Guam, and may occasionally be found in other forested areas. Since the 1980s the limestone forest of Andersen Air Force Base (AAFB) has had solitary bats and small groups present in the forest. Solitary bats are also known from the Naval Ordnance Site. Since the 1980s, colonies consisting of five to several hundred bats are known from the northern cliff line area of AAFB and the Janapsan valley. The colony in the cliff line at Pati Point was the most commonly used site from the 1980s until 2010. The colony decreased in size with fewer than 20 bats recorded in 2009-2010. During 2011 only single bats have been seen passing through the previous colony site and roosting temporarily. The Pati Point site is

no longer being used as a colony and extensive surveys on AAFB have not found bats using an alternate site.

Methods

Frequency and timing

- To determine presence or absence of solitary fruit bats, at least five pre-dawn landscape counts are conducted within a one month period.
- Colony counts are conducted monthly at a minimum.

Observers per site

The physical characteristics of each study site (accessibility, size, and location of area) and the number of bats occupying the site determines the number of observers required to conduct a bat survey. The following guidelines are for the minimum number of observers required.

Pati Point colony site is only known remaining colony of fruit bats on Guam. The observation point used for surveys is an overlook of the colony area is located at the cliff edge on the terrace below the flight line.

- Surveys are conducted as early as possible in the morning; hikers should start for the observation point when there is sufficient light to see. The rising sun is directly east of the colony making it impossible to see the colony area and heat later in the morning make observations impossible. Cloudy days are also used for colony counts.
- Two observers are required for the Pati Point site; the observation point is too small to accommodate additional people.

Landscape counts for solitary bats are conducted by one or more observers. The size of the area being surveyed will dictate the number of observers required to adequately monitor.

Field Methods

Three survey techniques are utilized to assess fruit bat activity and abundance: solitary counts, colony exit counts, and colony direct counts (National Park 2009, Utzurrum *et al.* 2003). Solitary fruit bat counts are conducted to determine the presence or absence of fruit bats at a particular location (e.g. the proposed project site), as well as to evaluate flight paths, habitat use, and possibly reveal the location of a colony.

Equipment

- Binoculars
- Spotting scope and tripod
- Fruit bat data sheet
- Pencil
- Clipboard
- Cell phone
- Camera

Weather

Upon arriving at a site and before beginning the survey, observers will estimate and record percent cloud cover, precipitation, and wind speed on the Fruit Bat Count Data Form (Appendix N).

- Cloud cover is the estimated percentage of sky obstructed by clouds and recorded in 25% intervals.
- Precipitation will be recorded on a numeric scale (0 – 4) increasing with level/amount of precipitation (Table 1).
- Wind speed is estimated and recorded using the Beaufort Scale (Table 2).
- Visibility is estimated as the distance (< 50 m, <100 m < 500m, ≥ 500 m) that an object can be viewed unimpeded by weather conditions (i.e. fog).

Table 1. Codes and descriptions of precipitation.

Code	Description
0	No precipitation
1	Mist or fog
2	Light drizzle
3	Light rain
4	Heavy rain

Table 2. Codes and descriptions for wind (Beaufort scale).

Code	Speed (kph)	Description
0	< 2	Calm: smoke rises vertically
1	2 - 5	Light air: smoke drifts
2	6 – 11	Slight breeze: wind felt on face, leaves rustle
3	12 – 20	Gentle breeze: leaves and small twigs in constant motion
4	21 – 32	Moderate breeze: small branches sway, loose paper rises
5	33 – 40	Fresh breeze: small trees sway, thin branches sway
6	41 - 50	Strong breeze: large branches in motion

Data sheets

- Site or colony name
- Date (mm/dd/yyyy): Write in the month (2 digits), day (2 digits) and year (4 digits). Example: 07/21/2008.
- Tree species used for roosting: Record the tree species that is being used as a roost by the fruit bat colony, if trees can be identified (assumes training in species identification is acquired by observers prior to collection of this information)
- Lunar phase: Write in the current moon phase (New Moon, Waxing Crescent, First Quarter, Waxing Gibbous, Full Moon, Waning Gibbous, Third Quarter, and Waning Crescent). If the moon is not visible, check the US Navy website (http://aa.usno.navy.mil/data/docs/RS_OneDay.php) before going into the field. This website also provides information on sun and moon rise and set times.

Landscape counts for solitary bats

- The area should be observed from one or more vantage points with a clear and unobstructed view. Observers should be close enough to clearly see birds and animals without binoculars.
- Surveys are conducted over two-hour periods pre-dawn and dusk. Observers should be in place pre-dawn to take advantage of bat movements in low light. Surveys begin when there is sufficient pre-dawn light to see and continue for approximately 2 hours after full light. Dusk surveys should be conducted from the same location, starting 2 hours before sunset and continue until it is too dark to accurately see. The area should be scanned for movement of flying animals without binoculars
- Where possible, stations should be situated so the observer is looking up (e.g. toward a hill or ridgeline) and the survey area comprises a large amount of sky to facilitate silhouetting and better observation of fruit bats.
- When an animal in flight is seen, use binoculars to identify if bat or bird. If a bat, follow it until it flies from sight or roosts in the forest.
- Note the location of bats observed on a sketch map of the area viewed. Each bat should be noted on the map showing where first seen, flight direction, and where it was lost from sight. Mark the location for each time a bat roosts, flies into or out of the area. If several bats are using the area, it may be difficult to determine the number of bats present. Each bat must be judged whether a new individual or if it has been seen earlier. If a bat flies into a tree to roost and a bat leaves from the same location assume it is the same bat. If a bat flies out from a very different part of a large tree, it may be a different individual. When it is not obvious whether the individuals are different, assume it is the same animal to avoid multiple counts of the same individual.

Colony direct count (Pati Point colony and other sites)

- Direct counts of roosting bats are made from a station that affords a clear view of the roosting bats. The observation point should be enough distance that the presence of people does not disturb the bats.
- Two observers are required for each count, viewing the same area and be positioned next to each other. Observers count simultaneously but independently of each other.
- As you approach a roost site, be aware of the potential disturbance that may be created by loud noises (e.g., snapping branches or rolling rocks) and sudden movements. Remain relatively quiet and well hidden so as not to startle the bat colony into flight or otherwise agitate them.
- The Pati Point colony is known to take flight if the wind shifts from east to west and carries human scent to the colony.
- Once observers arrive at a roosting colony, locate the station or stations using the UTM coordinates that should have been previously downloaded onto the GPS unit.
- Once settled in at a station, the observers spend about five minutes before the count looking to the left and right of the perceived colony to assess if there is bat

movement in other trees (e.g., wing-flapping behavior). Bats in other trees may not be obvious at first. Identify the spatial extent of the colony with other observers prior to counting, and perform counts within these established boundaries.

- Each observer should have a Fruit Bat Colony Count Data Form (Appendix S7.b), and should fill in survey and weather information at the top of the form in the appropriate fields
- The observers should agree in advance to use the same counting method (i.e. from left to right). At least two counts should be conducted at each station by each observer (e.g., left to right, right to left). Observers will not share with the results with each other until all counts have been conducted and recorded. Repeat counts at additional locations if possible. If possible, more than one count station should be used to see the area from different vantage points.
- Results are recorded on the Fruit Bat Colony Count Data Form. Any observations about the count should be written in the “Notes” section corresponding to the station number.
- A spotting scope is used to examine the forest as it gives better accuracy than binoculars. Bats will move back into dense leaves as heat increases. Where the observation site is at a distance from the colony, heat haze can make using a scope or binoculars impossible, early morning count times are best.

Colony dispersal count

Dispersal counts have not been routinely used on Guam because the Pati Point colony can only be monitored from above. Dispersal counts are used when bats can be silhouetted against the sky or the observation point is very close to the colony.

- Dispersal (exit or emergence) counts should be conducted the as same day as a direct count. The site for dispersal counts may be the same as for direct counts or different. Counts generally starts late in the afternoon and continues for about two hours until nightfall, or until observers can no longer see individual bats clearly. Observers station themselves at an observation point in clear view of the colony or flight path. A landscape feature should be used as a marker that delineates a bat leaving the area; bats are counted as they pass the marker. Animals that circle back should be noted so they are not counted twice. Dispersal counts depend on having a good view of the route taken by bats leaving the roost area as bats may leave in one direction or in several directions. A site evaluation is conducted prior to surveys to determine the possible flight paths used and number of observers required for the survey. . Bats may not leave until dusk or after dark where there is active hunting and thermal imaging should be used to supplement dispersal count data.

Data management and Analysis

- All field data will be entered and maintained in a GIS database.
- The Pati Point colony graph will be updated after every field survey. Field data and the colony graph will be available to USFWS and GDAWR after each survey.
- An annual report summarizing the findings will be prepared by 31 October.

Data sheets

- Site or colony name
- Date (mm/dd/yyyy): Write in the month (2 digits), day (2 digits) and year (4 digits).
Example: 07/21/2008.
- Tree species used for roosting: Record the tree species that is being used as a roost by the fruit bat colony, if trees can be identified (assumes training in species identification is acquired by observers prior to collection of this information)
- Lunar phase: Write in the current moon phase (New Moon, Waxing Crescent, First Quarter, Waxing Gibbous, Full Moon, Waning Gibbous, Third Quarter, and Waning Crescent). If the moon is not visible, check the US Navy website (http://aa.usno.navy.mil/data/docs/RS_OneDay.php) before going into the field. This website also provides information on sun and moon rise and set times.

Fruit Bat Count Data Sheet

Page# of

Colony or landscape site _____			
Date _____ Observer(s) _____			
Tree Species Used for Roosting _____			
Lunar Phase _____ Cloud Cover (%) _____ Wind Speed _____ Precipitation Code _____			
Temperature (° F) _____ Start Time _____ End Time _____			Field QA (initials) <input style="width: 40px; height: 20px;" type="text"/>

Station # ¹	Roost Count #1			Roost Count #2		
	Observer #			Observer #		
	1	2	3	1	2	3
1						
2						
3						
4						
5						
6						

Station #	Notes
1	
2	

3	
4	
5	
6	

¹ The station number (1-6) refers to a point near the colony where observers perform counts. Up to three observers may perform counts at a roost station, and each person records their count number in the spaces provided. Up to six roost counts may be performed at any one station.

Dispersal Count

Colony _____	Date _____	Observer(s) _____	
Lunar Phase _____	Cloud Cover (%) _____	Wind Speed _____	Precipitation Code _____
Temperature (° F) _____	Start Time _____	End Time _____	Field QA (initials) <input style="width: 40px; height: 20px;" type="text"/>

Entire Colony Count ¹	Observer #1	Observer #2	Observer #3	Total
Partial Colony Count ²				

Notes

¹ The entire colony dispersing from a roost is counted by each observer. Record separate counts but do not average.

² A portion of the colony is counted by each observer. Two observers divide the sky and ground into equal sections. At the end of the count, the numbers derived by each

Final Field Report for Baseline Terrestrial Resources Surveys for the Sea Port in Yap, Federated States of Micronesia

Submitted to:



Naval Facilities Engineering Systems Command, Pacific

Prepared by:

Cardno GS – AECOM Pacific Joint Venture

Under Contract No.: N62742-18-D-1802

Task Order: N6274223F0128

November 2023

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EXECUTIVE SUMMARY

This field report summarizes the results of baseline terrestrial surveys conducted in and near Yap Port in the Federated States of Micronesia in 2023. Baseline terrestrial surveys were conducted between April 26 and May 1, 2023 (Yap time zone) to assess the occurrence of terrestrial special status species and to map vegetation/land cover types within the identified terrestrial survey area. Completion of a Yap State biodiversity database and an official list of rare species in Yap is a current action goal of the Federated States of Micronesia Yap Biodiversity Strategy and Action Plan (Yap State 2019). Therefore, for the purposes of this survey, the special status species occurring on Yap were considered wildlife and plant species on the International Union for Conservation of Nature Red List and/or bird species protected under the Migratory Bird Treaty Act. Results of the terrestrial surveys included observations of two International Union for Conservation of Nature Red List species, the Yap flying fox (*Pteropus pelewensis yapensis*) and Burmese rosewood (*Pterocarpus indicus*), as well as the following seven species of birds protected under the Migratory Bird Treaty Act: intermediate egret (*Ardea intermedia*), ruddy turnstone (*Arenaria interpres*), cattle egret (*Bubulcus ibis*), greater sand plover (*Charadrius leschenaultia*), white tern (*Gygis alba*), yellow bittern (*Ixobrychus sinensis*), and Pacific golden plover (*Pluvialis fulva*). The Yap Port and adjacent areas are largely developed and/or disturbed habitats; however, habitats for special status and other wildlife and plant species do occur, both within the developed/disturbed areas and the vegetated portions of the terrestrial survey area.

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ACRONYMS AND ABBREVIATIONS

FSM	Federated States of Micronesia	GPS	Global Positioning System
GIS	Geographic Information System	MBTA	Migratory Bird Treaty Act

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1 Introduction

1.1 Background

The Federated States of Micronesia (FSM) is one of the three sub-regions of Pacific Ocean islands, which also include Melanesia and Polynesia (Figure 1-1). The FSM is composed of four states—Yap, Chuuk, Kosrae, and Pohnpei—that collectively include over 607 islands (CIA 2023). Yap consists of four main islands, Yap Island (Maraba'-Numagil), Gagil-Tamil, Maap, and Rumung (Figure 1-2). The outer 134 small, low coralline Yap islands span more than 100,000 square miles (259 square kilometers) and are collectively referred to as the outer or neighboring islands, or "Remathau" (FSM 2018).

Yap State's total land area is 46 square miles (119 square kilometers). The maximum elevation of Yap Island (Maraba'-Numagil) is 571 feet (174 meters), while the outer islands' maximum height is 16.4 feet (5 meters) (FSM 2018). Colonia, located on Yap Island, is the capital of Yap State and contains Colonia (Tamil) Harbor. Tamil Harbor is surrounded by coral reef and mangrove habitat. Yap Port is located on the north side of the largely developed peninsula and provides services for international and domestic cargo, fuel tankers, interisland passenger ships, and occasional longline-fishing vessels (Figure 1-3). Ships travel through a 1.5-mile-long (2.5-kilometer-long) reef passageway, Tamil Channel, to the 230-foot-long (70-meter-long) wharf in Yap Port.

People have lived on Yap for more than 2000 years (Napolitano 2021) and was subject to colonial rule since the 19th century. European traders and missionaries sporadically visited Yap and its outer islands from the 16th to 18th centuries (Hezel 1979). In 1885, Spain purchased Blelaach, a small island off Colonia from a CHamoru woman living on Yap, whose husband received ownership from Nimar village. During the late 19th century, German merchants began transporting goods throughout the region, ushering in a new era of commerce and tension between Spanish and German economic and political interests. Later in 1885, Pope León XIII declared the Caroline Islands to be owned by Spain. In 1899, Germany purchased the Caroline Islands and the Northern Mariana Islands (present day Commonwealth of the Northern Marianas) (Lévesque 2005b, 354–355). Japan began military occupation of Yap in 1914 and officially assumed control of Yap as a protectorate in 1919 (CIA 2022; Yap Visitors Bureau, n.d.). Military installations including concrete foundations, buildings, harbor piers, and other types of infrastructure were built around Yap during a fortification effort from the Japanese administration until the United States' occupation of Yap in 1945 (DON 2022). Following the United States' campaign across the Pacific during World War II, Yap came under United States administration in the Trust Territory of Pacific Islands in 1947 (CIA 2022).

The Cardno GS – AECOM Pacific Joint Venture (CAP JV) prepared a cultural desktop analysis report in 2022 and used this for planning purposes to inform what historic properties and other cultural resources may exist in the terrestrial and marine cultural survey areas. The CAP JV prepared a work plan and dive operations plan in 2023 that outlined proposed methodology, data management, reporting, planning contingencies, schedule, and personnel roles during the prescribed fieldwork (DON 2023; CAP JV 2023). This field report summarizes the cultural surveys that occurred between April and May 2023.

1.1.1 Potentially Occurring Special Status Species

The International Union for Conservation of Nature Red List maintains a running list of special status species known or with the potential to occur in Yap (IUCN Red List 2022). A total of 13 species on the International Union for Conservation of Nature Red List were identified with the potential to occur in Yap and are presented in Table 1-1. Yap Port and adjacent areas are largely developed and/or contain disturbed habitats; therefore, it was not expected that all species in Table 1-1 would or have the potential to occur in the terrestrial survey area.

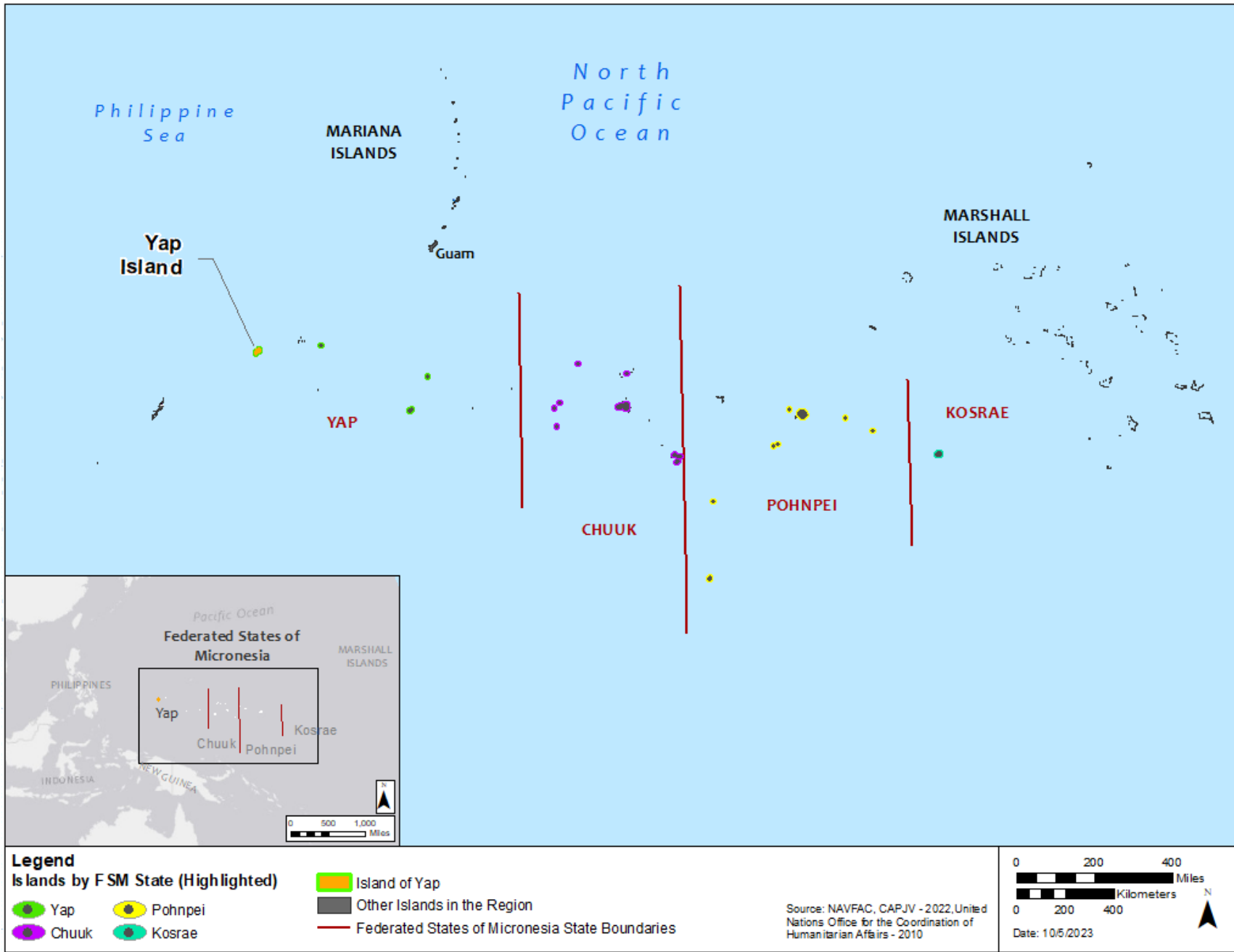


Figure 1-1 Federated States of Micronesia Location Map

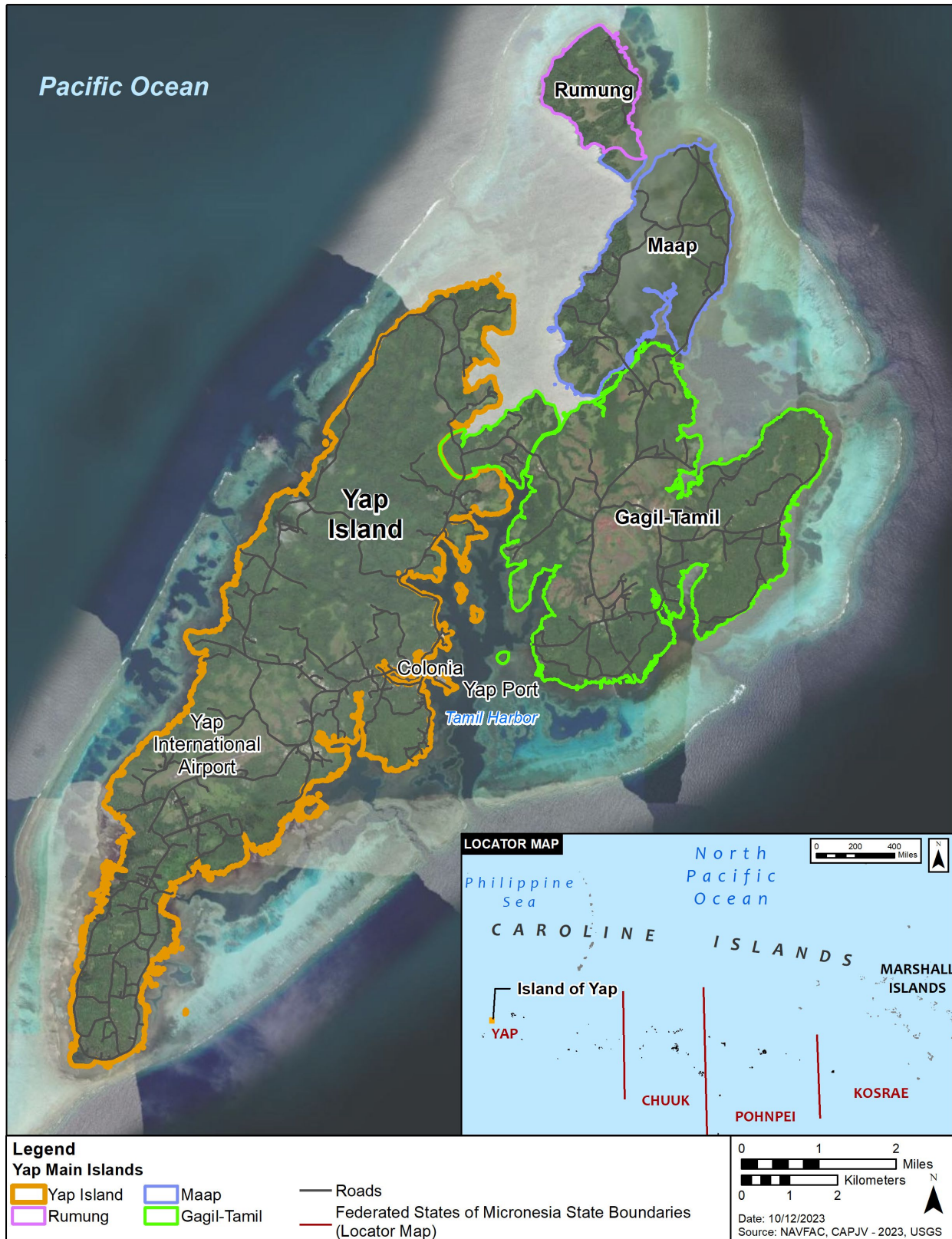


Figure 1-2 Yap Location Map

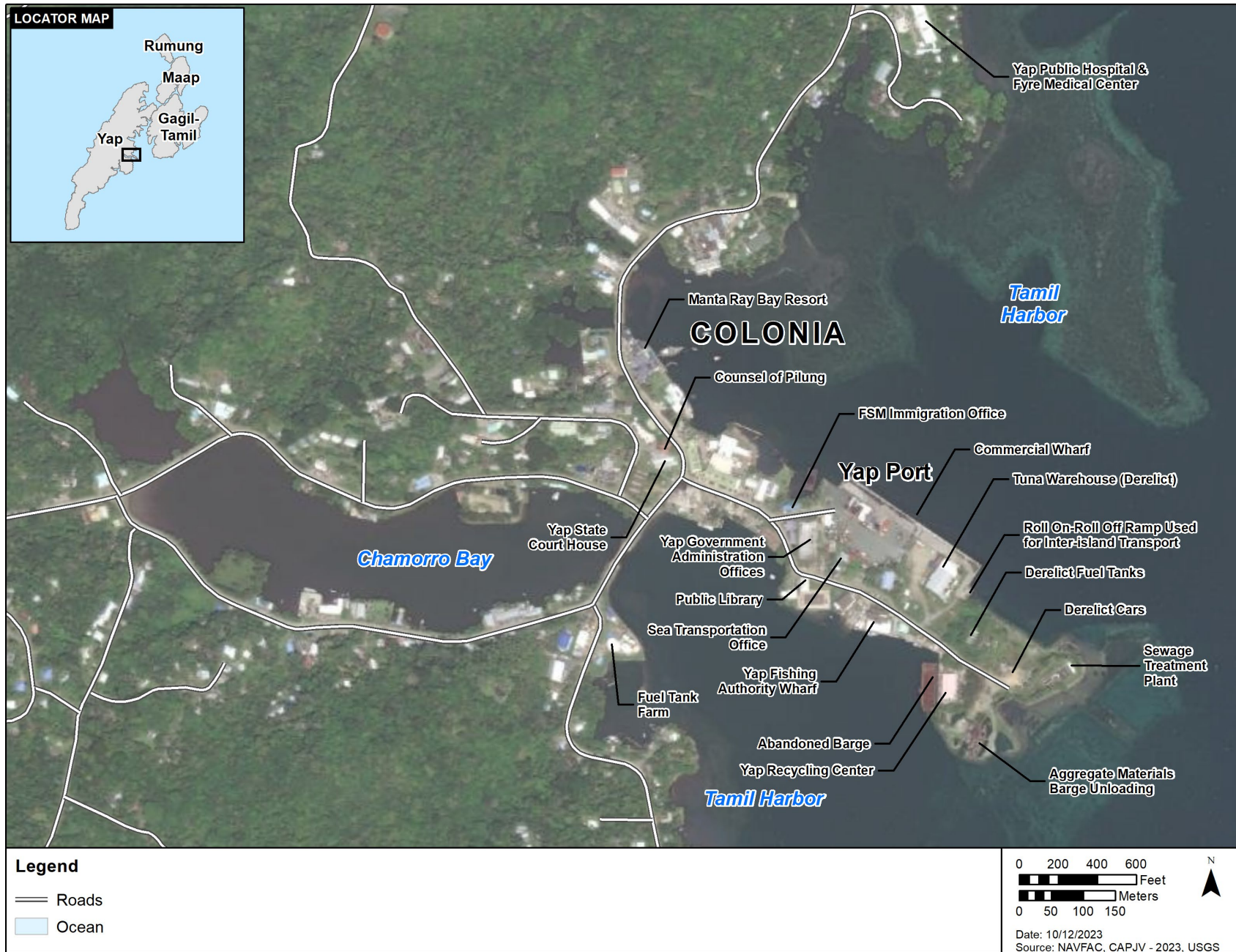


Figure 1-3 Yap Port Location Map

Table 1-1 International Union for Conservation of Nature Red List Species Known or with the Potential to Occur in Yap

Scientific Name	Common Name	IUCN Red List Status	Habitat
Birds			
<i>Pseudobulweria becki</i>	Beck's petrel	Critically Endangered	Seabird that is likely to nest in burrows on the slopes of high mountains on larger islands but may also breed on small islets.
<i>Edolisoma nesiotis</i>	Yap cicadabird	Endangered	Recorded in both forest and savanna habitats but at four times the density in forests than savannas.
<i>Pampusana xanthonura</i>	White-throated ground dove	Near Threatened	Inhabits native forests, secondary forests, plantations, introduced <i>Leucaena leucocephala</i> thickets, and habitat mosaics including fields, but appears more frequently in native forests than in disturbed habitats.
<i>Monarcha godeffroyi</i>	Yap monarch	Near Threatened	Inhabits virtually all forest types, including mangroves and secondary forests.
<i>Zosterops hypolais</i>	Yap plain white-eye	Near Threatened	Found in nearly all forest and vegetation types, including brushy thickets in open savannas and meadows.
<i>Zosterops oleagineus</i>	Yap olive white-eye	Near Threatened	Widely distributed in all forest types and woody vegetation, including mangroves, but shows a preference for better-developed forests.
Reptiles			
<i>Perochirus ateles</i>	Micronesian saw-tailed gecko	Vulnerable	Found in palm leaf axils, in shrubs and bushes, and under loose, flaking bark on trees. Highly arboreal and occurs in both disturbed and natural forests.
Mammals			
<i>Pteropus pelewensis yapensis</i>	Yap flying fox	Vulnerable	Roosts and forages mainly in mangroves and secondary forests.
Plants			
<i>Cycas micronesica</i>	Federico nut	Threatened	Shrub to tree (up to 39 feet tall) that occurs in closed forests on coral limestone or coral sand, and occasionally on volcanic soils.
<i>Intsia bijuga</i>	Pacific teak	Near Threatened	Lowland rainforest tree (up to 82 feet tall), often found on sand and coral beaches, but also in periodically inundated localities further inland. It also occurs in dryland mangroves.
<i>Pericopsis mooniana</i>	Nandu wood	Vulnerable	Large tree (up to 131 feet tall), mainly found scattered within coastal forests.
<i>Pterocarpus indicus</i>	Burmese rosewood	Endangered	Large tree (up to 131 feet tall) found in lowland primary and some secondary forests, mainly along tidal creeks, and rocky shores, but can occur up to 4,265 feet above sea level.
<i>Metroxylon amicarum</i>	Ivory nut palm	Near Threatened	Large palm (up to 82 feet tall). Occurs from sea level up to 1,804 feet above sea level.

Legend: IUCN = International Union for Conservation of Nature.

Sources: Falanruw (2002); FSM (2019); IUCN Red List (2022).

1.1.2 Previously Mapped Vegetation and Land Cover Types

Figure 1-4 depicts 11 vegetation and land cover types in the Colonia area previously mapped in 2005 (iREi 2005). Five types were previously mapped within the terrestrial survey area, including agroforest, barren, mangrove forest, urban builtup, and urban cultivated using geospatial information published by the Department of Environment, Climate Change & Emergency Management of FSM (iREi, WERI, and DECEM 2023).

1.2 Purpose and Objectives of the Terrestrial Surveys

The purposes of the terrestrial surveys were to document flora and fauna presence within the terrestrial survey area at Yap Port and the surrounding areas (Figure 1-4) by mapping and describing vegetation and land cover types, as well as to identify the presence of special status wildlife and vegetation species. The primary objective of the terrestrial surveys was to identify what resources exist within the port and associated survey areas in Yap to support any environmental evaluations and consultations potentially required by laws, regulations, or policies.

The survey report will provide the United States Indo-Pacific Command with the necessary information to conduct future analysis regarding harbor development on terrestrial biological resources, and to comply with United States federal, FSM, or Yap State environmental laws, regulations, and policies potentially applicable to federal actions.

1.3 Survey Area

The terrestrial survey area is located on the southeast coast of Yap Island along the north side of a largely developed peninsula (Figure 1-3). For the purpose of this project, the survey area was divided into two distinct survey areas. The Yap Port Survey Area includes approximately 22.9 acres (9.3 hectares) on the publicly accessible developed peninsula where the sea port and numerous buildings are located. The Chamorro Bay Linear Survey Area is a loop along approximately 1.3 miles (2.1 kilometers) of a public road around Chamorro Bay, including a road that connects the Yap Port to the Chamorro Bay Linear Survey Area. These distinct survey areas are depicted in Figure 1-4.

1.4 Survey Schedule and Personnel

Surveys were conducted on six consecutive days from April 26 to May 1, 2023 (Yap time zone). Survey start/end times and weather descriptions for each survey day are included in Table 1-2. As few wildlife individuals were observed during midday periods, surveyors shifted the survey window from midday to the morning and late afternoon/evenings to optimize opportunities to document species presence on separate occasions. Overall, the total field time spent conducting the terrestrial surveys was 34 hours.

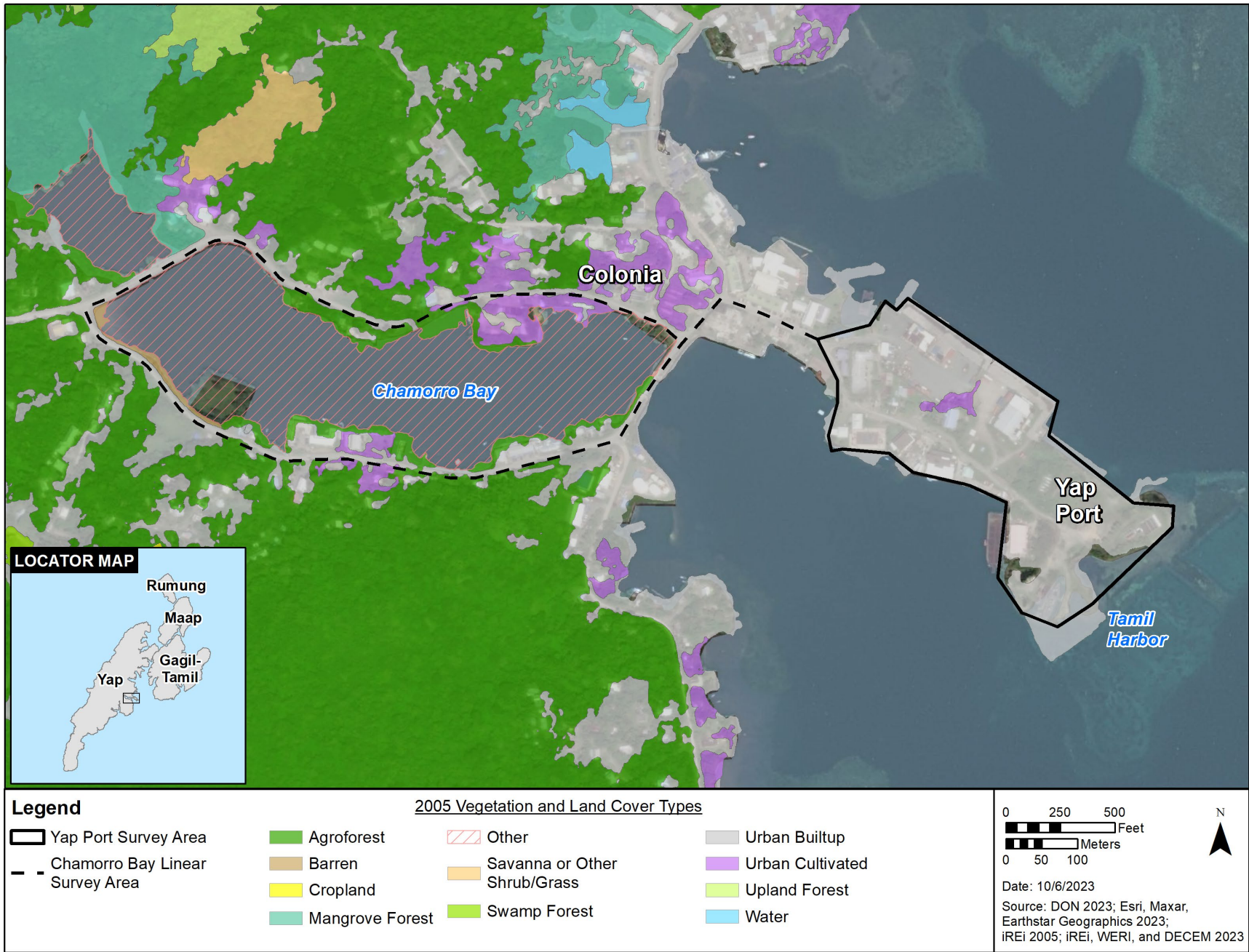


Figure 1-4 Terrestrial Survey Area Location Map

Table 1-2 Survey Dates, Times, and Weather Conditions

Survey Date ^a	Start Time	End Time	Total Time (Hours)	Weather Conditions
April 26, 2023	9:45 a.m.	12:00 p.m.	2.25	Clear, little wind, no rain, mid-80s (°F)
April 27, 2023	5:45 a.m.	7:30 a.m.	1.75	Clear, little wind, no rain, mid-80s (°F)
April 27, 2023	8:30 a.m.	2:45 p.m.	6.25	Clear, little to no wind, no rain, mid-80s (°F)
April 27, 2023	6:30 p.m.	7:30 p.m.	1.00	Clear, little wind, no rain, mid-80s (°F)
April 28, 2023	5:45 a.m.	7:30 a.m.	1.75	Clear, little wind, light rain, mid-80s (°F)
April 28, 2023	1:30 p.m.	5:45 p.m.	4.25	Clear, little wind, light rain, p.m. thunderstorm, mid-80s (°F)
April 29, 2023	6:00 a.m.	8:00 a.m.	2.00	Scattered clouds, slight breeze, light rain, mid-80s (°F)
April 29, 2023	2:45 p.m.	7:30 p.m.	4.75	Scattered clouds, slight breeze, light rain, mid-80s (°F)
April 30, 2023	6:30 a.m.	9:00 a.m.	2.50	Scattered clouds, breezy, scattered heavy rain, mid-80s (°F)
April 30, 2023	12:30 p.m.	2:00 p.m.	1.50	Scattered clouds, breezy, no rain, mid-80s (°F)
April 30, 2023	3:00 p.m.	5:00 p.m.	2.00	Cloudy, breezy, no rain, mid-80s (°F)
May 1, 2023	6:30 a.m.	10:00 a.m.	3.50	Cloudy, breezy, scattered rain, high-80s (°F)
May 1, 2023	11:30 a.m.	12:00 p.m.	0.50	Cloudy, breezy, scattered rain, high-80s (°F)

Legend: °F = degree Fahrenheit.

^a Survey date noted in Yap time zone (YAPT).

The team members involved in performing the project tasks are listed in Table 1-3 along with their project-specific roles. The survey personnel consisted of Hannah Hubanks (field biologist) and Michele Lefebvre (field biologist).

Table 1-3 Project Team and Survey Personnel

Role	Name	Organization
Field Biologist/Health and Safety Coordinator	Hannah Hubanks	Stantec GS Inc.
Field Biologist	Michele Lefebvre	
Terrestrial Biologist/CAP JV/ Stantec Deputy Project Manager	Clint Scheuerman	
Stantec Project Manager	Ben Berridge	
CAP JV Program Manager	William Halperin	
GIS Analyst	Travis Gahm	
Field Coordinator	Christian Warren	
AECOM Deputy Project Manager	Brittany Obando	
CAP JV Project Manager and QA/QC Manager	Kevin Butterbaugh	
TOCOR	Lorraine Shaughnessy	NAVFAC
Alternate TOCOR	Jill Sears	
Alternate TOCOR	Maria Carnevale	
Contracting Specialist	Casey Sugihara	

Legend: AECOM = AECOM Technical Services, Inc.; CAP JV = Cardno GS – AECOM Pacific Joint Venture; GIS = geographic information system; QA = quality assurance; QC = quality control; Stantec = Stantec GS Inc.; TOCOR = Task Order Contracting Officer’s Representative; NAVFAC = Naval Facilities Engineering Systems Command.

2 Survey Methodology

2.1 Terrestrial Survey Methods

Two terrestrial biologists, Hannah Hubanks and Michele Lefebvre, surveyed the entire survey area using the geographic information system (GIS)-provided boundaries in Figure 1-4. One surveyor carried a portable Global Positioning System (GPS) unit with a tracking application to continuously track the movements of the surveyors, as depicted by the survey tracks in Figure 2-1. The Chamorro Bay Linear Survey Area was surveyed by walking along both sides of the public access shoulders of the loop road. Pedestrian surveys were conducted in the Yap Port Survey Area by meandering to ensure full visual inspection. No transects were required as full visual inspections could be completed via the meandering survey method. A large area of debris on the northeastern end of Yap Port was encountered during the surveys that contained herbaceous vegetative growth over derelict vehicles and refuse materials. This area was surveyed visually without entering it due to safety concerns. This method was communicated and confirmed with the Naval Facilities Engineering Systems Command representative on site at the time (April 26, 2023). Vegetation and land cover types were mapped using both line data (along each side of the Chamorro Bay Linear Survey Area) and polygon data (Yap Port Survey Area). Special status wildlife and plant species observations were also recorded during these surveys.

Where special status species were identified, surveyors stopped to map the location(s) of species and collect baseline data (refer to Section 2.3 for the types of data collected). Locations of special status species were mapped using portable GPS units with sub-meter accuracy. For any observed plant species of interest that grew in clumps, groves, or stands, the boundaries of the population were mapped on the GPS in the form of a polygon (or a line, if the plants were observed along a private property). Likewise, for wildlife species of interest that occurred in multiples on the ground, the boundaries of the population were mapped on the GPS in the form of a polygon. When wildlife species of interest in multiples were not on the ground, a data point was taken instead of a polygon.

In some instances, particularly within areas of debris in Yap Port, piles of miscellaneous scrap metal prohibited surveyors from walking through certain areas. In such cases, surveyors walked as close as safely possible to the edge of the refuse materials and visually scanned the area with binoculars. In all cases, the surveyors had complete visual coverage of the survey area. In addition, surveyors walked a very short distance outside of the survey boundaries in certain areas where they thought there might be an opportunity to view wildlife/plant species of interest and/or gain a better view into portions of the survey area (Figure 2-1). However, minimal time was spent doing this (up to 5 minutes) and survey efforts were focused on the survey areas as indicated by the survey tracks in Figure 2-1.

2.2 Survey Equipment and Standards

The surveyor team was equipped with one portable/handheld Trimble Geo7x GPS unit with sub-meter level mapping accuracy. Following surveys, data were downloaded, backed up, and viewed using Pathfinder Office software to ensure data completeness prior to survey completion. Field survey personnel were equipped with proper clothing, personal protective equipment, and binoculars.

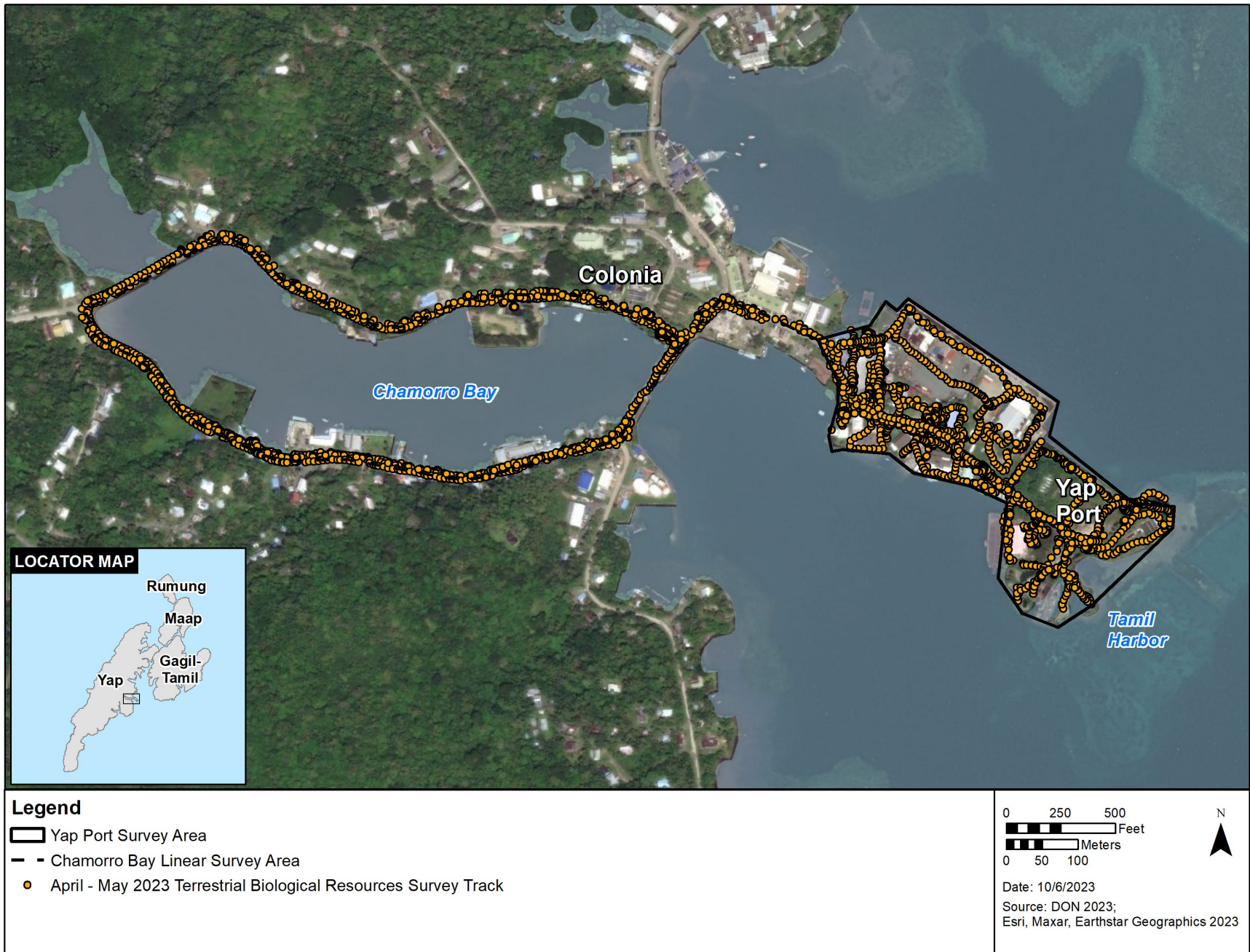


Figure 2-1 Survey Tracks

2.3 Data Collected for Special Status Species

Where special status species were detected; the field survey personnel documented the following on a GPS unit:

1. Species name.
2. GPS location (sub-meter level accuracy).
3. For individual occurrences of an organism, a single data point was collected, and relevant data noted.
4. For any species detected that occurred in multiples (e.g., colony, clumps, groves, or stands) the locations were mapped in the form of a polygon along with the number of individuals within the polygon.
5. Host plant species (if applicable).
6. Life stage (e.g., adult, juvenile, sapling, seedling, egg, larva, chrysalis) (if applicable and discernible in the field).
7. Reproductive stage (e.g., flowering, fruiting) (if applicable and discernible in the field).
8. Condition (if applicable and discernible in the field):
 - a. Excellent (no sign of deterioration; very healthy)
 - b. Good (appears healthy/vigorous)
 - c. Fair (relatively healthy; signs of loss of vigor)
 - d. Poor (poor vigor; signs of dying)

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3 Survey Results

Results of the baseline terrestrial surveys are summarized in Table 3-1 through Table 3-5 and are depicted in Figure 3-1 and Figure 3-2 as 2023 vegetation types. Where more than a single individual was observed, callouts are provided in Figure 3-1 and Figure 3-2 to specify the number of individuals observed, including where groups of individuals occurred in close proximity to each other. Appendix A contains a photo log of the survey area, including wildlife that could be captured on camera, as well as special status plants and vegetation and land cover types. Appendix B contains a complete data matrix for GIS species data collected during the surveys. All GIS survey data collected in the field have been provided to Naval Facilities Engineering Systems Command as a part of this deliverable.

3.1 Special Status Wildlife Species

Table 3-1 details the survey data collected for the special status wildlife species that were observed and mapped. In total, two individual Yap flying foxes (*Pteropus pelewensis yapensis*) were observed and mapped. Table 3-2 summarizes the survey data collected for species protected under the MBTA that were observed and mapped. Seven species of birds protected under the MBTA were documented performing a variety of activities such as flying, foraging, and resting. Discussions of mapped individuals of special status and protected wildlife species are provided in Section 4.

Table 3-1 Special Status Wildlife Species Observed

Scientific Name	Common Name	IUCN Red List Status	Mapped Individuals	Life Stage/Condition/Notes
<i>Pteropus pelewensis yapensis</i>	Yap flying fox	Vulnerable	2	Adults observed in flight, flying separately, and appeared healthy given the limited visibility

Legend: IUCN = International Union for Conservation of Nature.

Table 3-2 Migratory Bird Treaty Act Species Observed

Scientific Name	Common Name	Mapped Individuals	Life Stage/Condition/Notes
<i>Ardea intermedia</i>	Intermediate egret	2	Healthy adult individuals, each observed foraging in grass and vegetation
<i>Arenaria interpres</i>	Ruddy turnstone	8	Healthy adult individuals observed foraging in grass
<i>Bubulcus ibis</i>	Cattle egret	1	Foraging adult, appeared healthy
<i>Charadrius leschenaultii</i>	Greater sand plover	1	Healthy juvenile observed foraging in grass
<i>Gygis alba</i>	White tern	15	Groups of adult individuals observed in flight as well as perched in trees, appeared healthy
<i>Ixobrychus sinensis</i>	Yellow bittern	1	Adult observed flying and then perched in a young mangrove, appeared healthy
<i>Pluvialis fulva</i>	Pacific golden plover	3	Healthy adult individuals, observed foraging and in flight

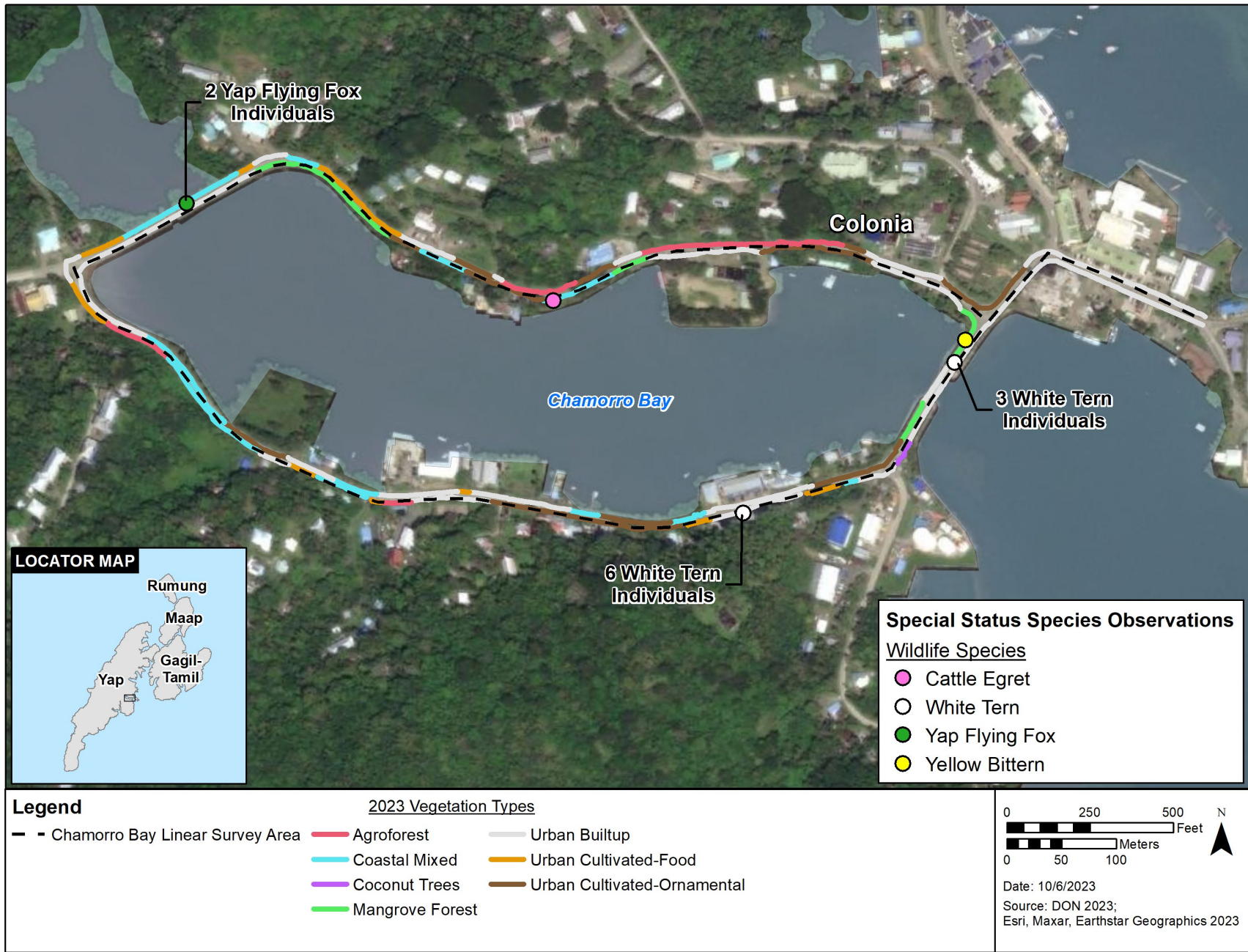


Figure 3-1 Survey Results—Chamorro Bay Linear Survey Area

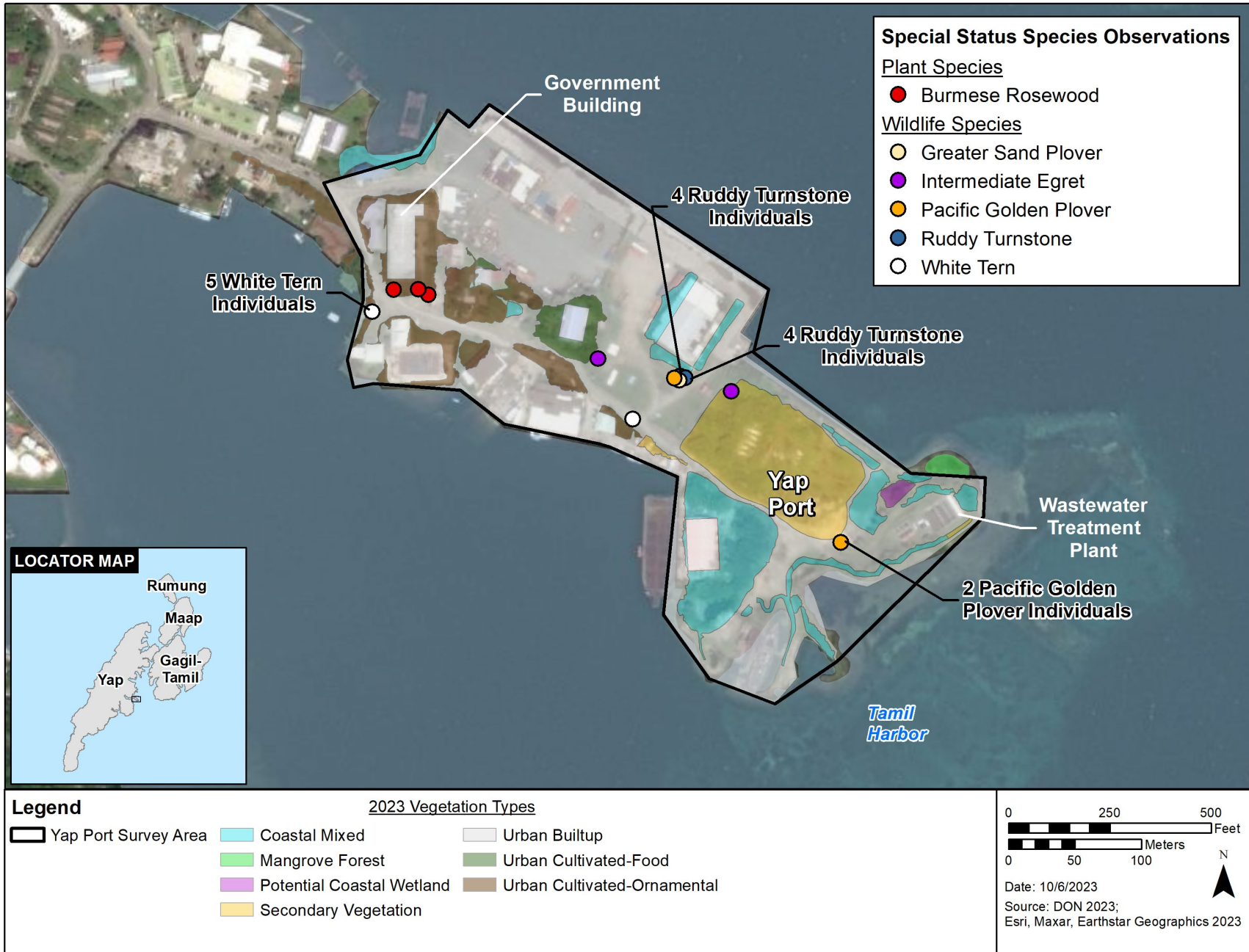


Figure 3-2 Survey Results–Yap Port Survey Area

3.2 Non-Special Status Wildlife Species Observed

Common bird species were observed throughout the survey area performing a variety of activities such as flying, foraging, and resting/perching. Common bird species observed included the Micronesian starling (*Aplonis opaca*), Micronesian myzomela (*Myzomela rubratra*), and Eurasian tree sparrow (*Passer montanus*). One individual rufous fantail (*Rhipidura rufifrons*) was documented. The emerald tree skink (*Lamprolepis smaragdina*) was commonly observed, and one occurrence of the littoral whiptail skink (*Emoia atrocostata*) was documented. Total counts of each species collected during the surveys are documented in Appendix B.

3.3 Special Status Plant Species

Table 3-3 details the survey data collected for the special status plant species that were observed and mapped. In total, three Burmese rosewood (*Pterocarpus indicus*) were mapped in the Yap Port Survey Area. A discussion of mapped individuals of special status and protected plant species is provided in Section 4.

Table 3-3 Special Status Plant Species Observed

Scientific Name	Common Name	IUCN Red List Status	Mapped Individuals	Life Stage/Condition/Notes
<i>Pterocarpus indicus</i>	Burmese rosewood	Endangered	3	Adults, mature, and fruiting; approximately 40 to 50 feet in height

Legend: IUCN = International Union for Conservation of Nature.

3.4 Vegetation and Land Cover Types

Table 3-4 and Table 3-5 provide the total linear distance or acreage of each vegetation and land cover type documented in both survey areas (Figure 3-1 and Figure 3-2). The dominant vegetation/land cover type in both the Chamorro Bay Linear Survey Area and Yap Port Survey Area is urban builtup, followed by coastal mixed and urban cultivated–ornamental. A list of all species observed during the surveys are documented in Appendix C.

Table 3-4 Vegetation and Land Cover in the Chamorro Bay Linear Survey Area

Vegetation and Land Cover Type	Linear Distance (Feet)
Agroforest ^a	1,137.4
Coastal Mixed ^b	2,127.1
Mangrove Forest ^a	923.8
Urban Builtup ^a	5,943.2
Urban Cultivated ^a –Food ^b	985.1
Urban Cultivated ^a –Ornamental ^b	2,642.3
Total	13,758.9

^a iREI, WERI, and DECEM (2023).

^b Identified based on field observations.

Table 3-5 Vegetation and Land Cover in the Yap Port Survey Area

Vegetation and Land Cover Type	Acreage
Coastal Mixed ^a	2.54
Coastal Wetland ^a	0.01
Mangrove Forest ^a	0.07
Urban Builtup ^a	2.36
Secondary Vegetation ^c	15.10
Urban Cultivated ^b –Food ^a	0.47
Urban Cultivated ^b –Ornamental ^a	1.91
Total	22.46

^a Identified based on field observations.

^b iREI, WERI, and DECEM (2023).

^c Falanruw (2002).

Eight vegetation and land cover types were documented in the survey area: urban builtup; mangrove forest; urban cultivated–food; urban cultivated–ornamental; coastal mixed; secondary vegetation; agroforest; and potential coastal wetland (no formal wetland delineation was conducted). Descriptions of the vegetation and land cover types and their characteristic species are included below. A list of plant species encountered is included in Appendix C.

3.4.1 Urban Builtup

Urban builtup are areas where buildings, roads, and bridges are interspersed with manicured grass, herbaceous weeds and grasses growing within cracks in the concrete or gravel, or no vegetation at all. These areas were located along the Chamorro Bay Linear Survey Area on bridges, parking lots, and commercial and residential developments (Figure 3-1). Urban builtup areas were found in the Yap Port Survey Area in areas containing Yap Government facilities, buildings, and roads (Figure 3-2).

3.4.2 Mangrove Forest

Mangrove forests are the most distinctive vegetation type in Yap, with species that have specialized roots inundated at least periodically by sea water. Mangroves surround most of Yap’s coast and serve as a natural filtering and nutrient buffering system between the island and lagoon, settling silt and providing for a slow sustained release of nutrients (Falanruw et al. 1987).

The presence of mangrove forest in the survey area was distinguished by the exclusive presence of the prop-rooted mangrove tree (*Rhizophora apiculata*). This vegetation type in the survey area consisted of narrow bands of mangrove trees growing along the water’s edge near the two bridges in the Chamorro Bay Linear Survey Area (Figure 3-1) and north of the Colonia Wastewater Treatment Plant in the Yap Port Survey Area (Figure 3-2).

3.4.3 Urban Cultivated-Food

The urban cultivated–food vegetation type was found in residential gardens in the Chamorro Bay Linear Survey Area (Figure 3-1) and around Yap Government buildings in the Yap Port Survey Area (Figure 3-2) that were intentionally planted and actively cultivated. Species observed in this vegetation type included the following: banana (*Musa* sp.), betel nut (*Areca catechu*), breadfruit (*Artocarpus altilis*), citrus (*Citrus* spp.), coconut (*Cocos nucifera*), mango (*Manifera indica*), giant swamp taro (*Cytosperma merkusii*), Indian mulberry (*Morinda citrifolia*), papaya (*Carica papaya*), sugar cane (*Saccharum officinarum*), sweet taro (*Colocasia esculenta*), and Jamaican cherry (*Muntingia calabura*).

3.4.4 Urban Cultivated–Ornamental

The urban cultivated–ornamental vegetation type was found in residential gardens in the Chamorro Bay Linear Survey Area (Figure 3-1) and around Yap Government buildings in the Yap Port Survey Area (Figure 3-2) that were planted and actively cultivated with ornamental species predominantly consisting of herbs and shrubs, as well as dispersed trees including the following species: beach spider lily (*Hymenocallis littoralis*), bamboo (*Bambusa* sp.), red ginger (*Alpinia purpurata*), ornamental red ti (*Cordyline* sp.), Chinese hibiscus (*Hibiscus rosa-sinensis*), Arabian jasmine (*Jasminum sambac*), bougainvillea (*Bougainvillea* sp.), plumeria (*Plumeria* sp.), ixora (*Ixora* sp.), and bristly copperleaf (*Acalypha hispida*).

3.4.5 Coastal Mixed

Coastal mixed includes both native and non-native coastal species and were located along the coast in the Chamorro Bay Linear Survey Area (Figure 3-1) and Yap Port Survey Area (Figure 3-2). Dominant species in this vegetation type included mango pine (*Barringtonia asiatica*), ironwood (*Casuarina equisetifolia*), sea hibiscus (*Hibiscus tiliaceus*), screwpine (*Pandanus tectorius*), and morning glory vine (*Ipomea pes-caprae*). Additional species encountered in this vegetation type included the following: beach pea (*Vigna marina*), chastetree (*Vitex trifolia*), climbing vine (*Derris trifoliata*), dodder laurel (*Cassytha filiformis*), fan flower (*Scaevola* sp.), large morning glory (*Merremia* spp.), nephrolepsis (*Nephrolepsis* sp.), pongame oiltree (*Millettia pinnata*), and sea almond (*Terminalia catappa*).

3.4.6 Secondary Vegetation

Secondary vegetation is a forested or shrubby vegetation class that is somewhat intermediate between forest and non-forest. Secondary vegetated areas are generally covered with fast-growing weedy species (Falanruw et al. 1987). The dominant species for this vegetation type included morning glory vine, wedelia (*Sphagneticola trilobata*), and giant sleeping grass (*Mimosa invisa*). Other species encountered in this vegetation type include the following: koa haole (*Leucaena leucocephala*), wedelia (*Wedelia triloba*), sleeping grass (*Mimosa pudica*), threeleaf cayratia (*Cayratia trifolia*), barnyard grass (*Echinochloa crus-galli*), cutleaf groundcherry (*Physalis angulata*), riverhemp (*Sesbania* sp.), and frog fruit (*Phyla nodiflora*).

3.4.7 Agroforest

Agroforest areas in Yap consist of a mixture of food and other useful trees found growing around villages. Scattered coconut trees and breadfruit trees are indicators of agroforest. The canopy is often uneven and may be interspersed with open areas of taro patches, croplands, and areas of secondary vegetation or upland forest too small to be separately mapped (Falanruw et al. 1987).

Agroforest was identified in the Chamorro Bay Linear Survey Area and dominant species present included a mixture of the following food or resource trees: banana, betel nut, breadfruit, coconut, and mango.

3.4.8 Potential Coastal Wetland

A potential coastal wetland (based on the presence of wetland hydrology and the occurrence of known wetland plant species) was located adjacent to the Colonia Wastewater Treatment Plant and was comprised of standing water surrounded by a mud flat near the coast adjacent to the mangrove forest. The following species were encountered in this vegetation type: ficus (*Ficus* sp.), sedges (*Cyperus* sp., *Eleocharis* sp., *Fimbristylis* sp.), rush (*Juncus* sp.), beach mahogany (*Calophyllum inophyllum*), bantigue (*Pemphis acidula*), sea hibiscus (*Hibiscus tiliaceus*), and pongame oiltree (*Millettia pinnata*).

3.5 Other Notable Vegetation

In addition to the special status plant species discussed above, one noteworthy species was identified during the survey, beach mahogany. This species is found in strand vegetation close to shore (above the high tide line) as well as inland habitats. The species is a culturally important plant in Yap, providing timber for use in construction of canoes, tools, house frames and pillars, and handicrafts. It is also used for firewood and a source of medicine (Merlin et al. 2019). Two individuals were documented in the potential coastal wetland area approximately 20 feet (6.1 meters) from the shore northwest of the Colonia Wastewater Treatment Plant in the Yap Port Survey Area (Figure 3-2).

Additionally, a strand of coconut trees was recorded on the east side of the Chamorro Bay Linear Survey Area that measured approximately 74 feet (22.5 meters) in length (Figure 3-1).

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4 Discussion

This section provides details on the special status species observed and mapped during the terrestrial surveys. Specific coordinates of all mapped points and polygons for species locations are provided in Appendix B.

4.1 Yap Flying Fox

The Yap flying fox is found on the four main islands of Yap plus Ulithi Atoll in the FSM. Limited information on abundance and trend are known, as no comprehensive surveys have been conducted since the mid-1980s (Wiles and Waldien 2021). The population was drastically reduced in the late 1970s via commercial hunting; however, qualitative observations indicate that the population is currently viable and healthy (Wiles and Waldien 2021).

Two adult Yap flying foxes were documented flying into Chamorro Bay over the west bridge at dusk and appeared to be in healthy condition. No daytime observations were made, although fruit trees were observed beyond the boundaries of the public roadway that could offer a food source for the Yap flying fox. It appeared to the surveyors that the two individual flying foxes were flying toward an agroforested area south of Chamorro Bay. Pteropodid bats feed by squeezing out the juices of plant parts, which they swallow, and then spit out pellets known as “ejecta” that contain the fibers and often seeds of the plant (Aziz et al. 2021). Ejecta can be an indicator of fruit bat day roost locations (Aziz et al. 2021); however, no ejecta was observed in the survey areas. Some suitable habitat for Yap flying foxes is located along the Chamorro Bay Linear Survey Area where agroforest fruit trees exist, as well as some mature mangrove forests adjacent and to the west of the loop road.

4.2 Migratory Bird Treaty Act Protected Species

Seven species of birds protected under the MBTA were observed performing a variety of activities such as flying, foraging, and resting within the survey area (Table 3-2). All individuals appeared healthy, and all were adults with the exception of one juvenile greater sand plover (*Charadrius leschenaultia*).

Two individuals of an additional unidentified shorebird species were observed drinking from a temporary puddle within the gated sea port; however, the birds were quickly startled and departed before they could be identified by surveyors. Suitable habitat exists for a variety of migratory birds within both survey areas.

4.3 Burmese Rosewood

Burmese rosewood is widely distributed throughout southeast Asia and the Pacific, grows well in tropical habitats up to 1,970 feet (600 meters) in elevation, and is widely cultivated as a timber tree and ornamental (National Tropic Botanical Garden 2023).

Three mature individuals of this species were documented adjacent to the Yap Government building along the road in Yap Port (Appendix A) (Figure 3-2). All three individuals were healthy, over 40 feet (13 meters) in height, and producing fruit at the time of the survey. Burmese rosewood fruit is found in round pods that are thick in the center with thin edges, bearing one to three seeds (Falanruw 2015).

It is anticipated, based on their location, that the trees were planted as ornamentals. The trees are suitable for landscaping and provide abundant shade for employees at the Yap Government building.

4.4 Survey Notes and Recommendations

Incidental observations of wildlife by surveyors outside of the survey period and/or outside of the survey area suggest that a variety of additional bird species may frequent the Yap Port and Tamil Harbor area. The Yap monarch (*Monarcha godeffroyi*), Pacific reef heron (*Egretta sacra*), and white-throated ground dove (*Pampusana xanthonura*) were all seen along roadways near Colonia outside of the survey area. The common greenshank (*Tringa nebularia*) as well as another unidentified species of tattler (*Tringa* sp.) and an unidentified species of plover (*Pluvialis* sp.) were observed within the survey area after the survey period had commenced (species could not be confirmed without binocular use).

Birds and bats were more active and visible during early morning and evening hours than during the daytime. After an initial midday reconnaissance of the survey area, the surveyors used professional judgement to determine that there would be higher likelihood of observing wildlife species at dawn and dusk and conducted multiple surveys at these times (Table 1-2). Since the probability of detection is intrinsically linked to effort, the frequency of visits conducted during the survey reduced false absences and yielded a better reflection of the species richness and species use in the survey areas (Garrard et al. 2015). To improve methodology of surveys in the future, an emphasis on dawn and dusk survey times is encouraged which may improve opportunities for species observations (in addition to the daytime surveys necessary to ensure survey coverage of wildlife such as reptiles). It is recommended that the International Union for Conservation of Nature-listed endangered Burmese rosewood trees be preserved and protected because they are native to Yap, add to the biodiversity of the area, are rare, and provide habitat for species in this primarily urban environment. Following the development of a detailed project description, specific recommendations including environmental protection measures should be developed to avoid and minimize potential impacts to all special status wildlife and plant species and their habitats identified in the survey areas.

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Appendix A

Survey Photographic Record

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Survey Photographic Record



Photo 1. *Pterocarpus indicus* (Burmese rosewood) producing fruits in “healthy” condition

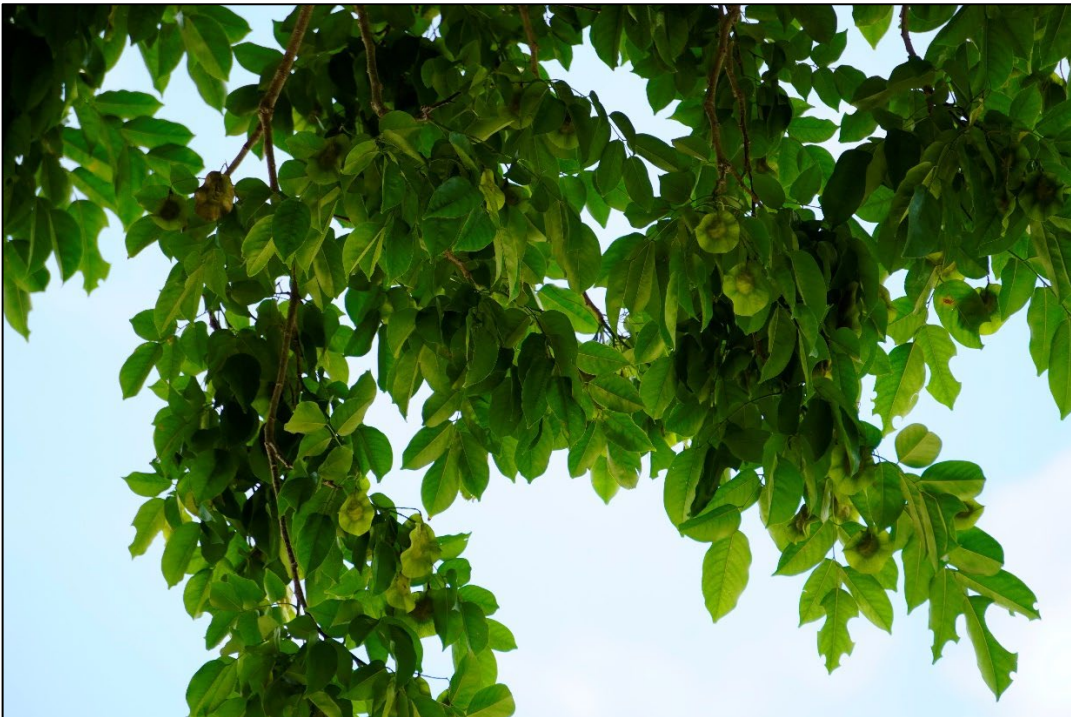


Photo 2. *Pterocarpus indicus* (Burmese rosewood) producing fruits in “healthy” condition

Survey Photographic Record



Photo 3. Area of debris and secondary vegetation in Yap Port Survey Area, facing northeast



Photo 4. Area of debris and secondary vegetation in Yap Port Survey Area, facing northwest

Survey Photographic Record



Photo 5. Area of debris and secondary vegetation in Yap Port Survey Area, facing northwest along middle path



Photo 6. The sewer treatment plant in Yap Port Survey Area, facing east

Survey Photographic Record



Photo 7. Adult *Aplonis opaca* (Micronesian starling) perched in *Casuarina equisetifolia* (common ironwood) on the easternmost end of Yap Port Survey Area south of the sewage treatment plant



Photo 8. Adult *Emoia atrocostata* (littoral whiptail skink) basking on the easternmost end of Yap Port Survey Area south of the sewage treatment plant

Survey Photographic Record



Photo 9. Adult *Lamprolepis smaragdina* (emerald tree skink) basking on a tree at the easternmost end of the Chamorro Bay Linear Survey Area



Photo 10. Adult *Lamprolepis smaragdina* (emerald tree skink) basking on a tree at the easternmost end of the Chamorro Bay Linear Survey Area

Survey Photographic Record



Photo 11. Mangrove forest along far east shoreline of Yap Port Survey Area adjacent to potential coastal wetland, facing northwest



Photo 12. Potential coastal wetland in Yap Port Survey Area

Survey Photographic Record



Photo 13. Coastal mixed vegetation along far east shoreline of Yap Port Survey Area, facing southeast



Photo 14. Refuse facility with scrap metal throughout in Yap Port Survey Area, surrounded by coastal mixed vegetation

Survey Photographic Record



Photo 15. Three mature *Pterocarpus indicus* (Burmese rosewood) individuals identified in Yap Port Survey Area



Photo 16. Mangrove forest in Chamorro Bay Linear Survey Area

Survey Photographic Record



Photo 17. Urban builtup land cover in Chamorro Bay Linear Survey Area



Photo 18. Urban cultivated – food vegetation in Chamorro Bay Linear Survey Area

Survey Photographic Record



Photo 19. Urban cultivated – ornamental vegetation in Chamorro Bay Linear Survey Area



Photo 20. Coastal mixed vegetation in Chamorro Bay Linear Survey Area

Survey Photographic Record



Photo 21. Secondary vegetation in Chamorro Bay Linear Survey Area



Photo 22. Healthy *Calophyllum inophyllum* sapling in Yap Port Survey Area

Survey Photographic Record



Photo 23. Urban cultivated – food vegetation in Yap Port Survey Area



Photo 24. Urban cultivated – ornamental vegetation in Yap Port Survey Area

Survey Photographic Record



Photo 25. Coastal mixed vegetation in Yap Port Survey Area



Photo 26. Potential coastal wetland in Yap Port Survey Area

Survey Photographic Record

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Appendix B

Survey Summary Data Matrix

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GIS Identification Number	Species Name	Organism Type	Quantity	Life Stage	Condition	Reproductive Stage	Activity	Northing (m)	Easting (m)
1	Ixobrychus sinensis	Bird	1	Adult	Good	N/A	Perched	1053172.40750	183950.711329
2	Gygis alba	Bird	3	Adult	Good	N/A	Flying	1053152.06824	183941.348761
3	Lamprolepis smaragdina	Lizard	7	Adult	Good	N/A	Basking	1053201.07134	183942.187035
4	Aplonis opaca	Bird	1	Adult	Good	N/A	Perched	1053192.16235	183955.218378
5	Pteropus pelewensis yapensis	Bat	2	Adult	Good	N/A	Flying	1053283.52591	183243.835518
10	Pterocarpus indicus	Tree	1	Mature	Good	Fruiting	N/A	1053113.66888	184236.546924
11	Pterocarpus indicus	Tree	1	Mature	Good	Fruiting	N/A	1053117.76198	184228.833346
12	Pterocarpus indicus	Tree	1	Mature	Good	Fruiting	N/A	1053117.40193	184210.321602
17	Rhipidura rufifrons	Bird	1	Adult	Good	N/A	Foraging	1053001.83061	183678.157344
24	Terminalia catappa	Tree	1	Mature	Good	Flowering	N/A	1053135.62543	184247.196497
26	Callophylum inophyllum	Tree	1	Sapling	Good	Not flowering or fruiting	N/A	1052969.47898	184590.125949
27	Hibiscus tiliaceus	Tree	1	Mature	Good	Fruiting	N/A	1053233.44907	184053.599635
28	Ardea intermedia	Bird	1	Adult	Good	N/A	Foraging	1053065.70055	184363.961710
29	Arenaria interpres	Bird	4	Adult	Good	N/A	Foraging	1053024.85257	184392.033776
30	Arenaria interpres	Bird	4	Adult	Good	N/A	Foraging	1053006.15629	184422.329340
31	Ardea intermedia	Bird	1	Adult	Good	N/A	Foraging	1053041.12715	184464.038816
32	Myzomela rubratra	Bird	2	Adult	Good	N/A	Foraging	1053029.40500	184459.058683
33	Aplonis opaca	Bird	1	Adult	Good	N/A	Flying	1052986.28656	184426.761001
34	Myzomela rubratra	Bird	1	Adult	Good	N/A	Perched	1053068.60399	184329.638785
35	Lamprolepis smaragdina	Lizard	1	Adult	Good	N/A	Basking	1053123.87102	184228.618927
36	Gygis alba	Bird	5	Adult	Good	N/A	Resting/Flying	1053100.96015	184194.212194
37	Myzomela rubratra	Bird	1	Adult	Good	N/A	Perched	1052932.68832	184523.071515
38	Emoia atrocostata	Lizard	1	Adult	Good	N/A	Basking	1052914.48844	184535.165087
39	Pluvialis fulva	Bird	2	Adult	Good	N/A	Flying	1052927.62162	184546.553365
40	Passer montanus	Bird	Dozens	Adult	Good	N/A	Flying	1052927.34475	184545.933906
41	Myzomela rubratra	Bird	1	Adult	Good	N/A	Perched	1052927.23182	184497.770929
42	Aplonis opaca	Bird	1	Adult	Good	N/A	Perched	1052913.66930	184511.699571
43	Aplonis opaca	Bird	1	Adult	Good	N/A	Perched	1053228.08929	183993.672405
44	Passer montanus	Bird	Dozens	Adult	Good	N/A	Flying	1053181.40925	183966.236856
45	Gygis alba	Bird	6	Adult	Good	N/A	Resting/Flying	1053012.46149	183752.381462
46	Myzomela rubratra	Bird	1	Adult	Good	N/A	Perched	1053243.36763	184017.384304
47	Bubulcus ibis	Bird	1	Adult	Good	N/A	Foraging	1053201.62347	183577.170345
48	Myzomela rubratra	Bird	1	Adult	Good	N/A	Perched	1053195.40141	184232.642475
49	Aplonis opaca	Bird	1	Adult	Good	N/A	Perched	1053141.48661	184243.678095
50	Charadrius leschenaultii	Bird	1	Juvenile	Good	N/A	Foraging	1053024.14468	184390.418995
51	Pluvialis fulva	Bird	1	Adult	Good	N/A	Foraging	1053025.51071	184390.005392
52	Gygis alba	Bird	1	Adult	Good	N/A	Flying	1053020.42474	184389.886325
53	Aplonis opaca	Bird	1	Adult	Good	N/A	Perched	1053108.52685	184469.872880
54	Unidentified Shorebird	Bird	2	Unknown	Unknown	N/A	Flying	1053236.71589	184277.241410

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Appendix C

Complete List of Species Observations

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Table C-1 Species List—Plants

Scientific Name	English Common Name	Family
Trees		
<i>Acacia auriculiformis</i>	Earleaf wattle	Fabaceae
<i>Araucaria heterophylla</i>	Norfolk pink	Araucariaceae
<i>Areca catechu</i>	Betel nut	Arecaceae
<i>Artocarpus altilis</i>	Breadfruit	Moraceae
<i>Bambusa</i> sp.	Bamboo	Gramineae
<i>Barringtonia asiatica</i>	Mango pine	Lecythidaceae
<i>Barringtonia racemosa</i>	Brackwater mangrove	Lecythidaceae
<i>Calophyllum inophyllum</i>	Beach mahogany	Guttiferae
<i>Carica papaya</i>	Papaya	Caricaceae
<i>Casuarina equisetifolia</i>	Ironwood	Casuarinaceae
<i>Citrus</i> spp.	Citrus	Rutaceae
<i>Ficus</i> sp.	Ficus	Moraceae
<i>Hibiscus tiliaceus</i>	Sea hibiscus	Malvaceae
<i>Leucaena leucocephala</i>	Koa haole	Fabaceae
<i>Lumnitzera littorea</i>	Red teruntum	Combretaceae
<i>Macaranga carolinensis</i>	—	Euphorbiaceae
<i>Mangifera indica</i>	Mango	Anacardiaceae
<i>Millettia pinnata</i>	Pongame oiltree	Fabaceae
<i>Morinda citrifolia</i>	Indian mulberry	Rubiaceae
<i>Muntingia calabura</i>	Jamaican cherry	Muntingiaceae
<i>Musa</i> spp.	Banana	Musaceae
<i>Pandanus tectorius</i>	Screwpine	Pandanaceae
<i>Premna serratifolia</i>	—	Lamiaceae
<i>Premna obtusifolia</i>	—	Lamiaceae
<i>Saccharum officinarum</i>	Sugar cane	Poaceae
<i>Pterocarpus indicus</i>	Burmese rosewood	Fabaceae
<i>Plumeria rubra</i>	Plumeria	Apocynaceae
<i>Rhizophora apiculata</i>	Red mangrove	Rhizophoraceae
<i>Spondias pinnata</i>	Sour plum	Anacardiaceae
<i>Terminalia catappa</i>	Sea almond	Combretaceae
<i>Thespesia populnea</i>	Portia tree	Malvaceae
Shrubs		
<i>Acalypha hispida</i>	Bristly copperleaf	Euphorbiaceae
<i>Alpinia purpurata</i>	Red ginger	Zingiberaceae
<i>Asplenium nidus</i>	Bird's nest fern	Aspleniaceae
<i>Colocasia esculenta</i>	Sweet taro	Araceae
<i>Cordyline</i> sp.	Ornamental red ti	Asparagaceae
<i>Crinum asiaticum</i>	Poison bulb	Amaryllidaceae
<i>Cyrtosperma merkusii</i>	Giant swamp taro	Araceae
<i>Hibiscus rosa-sinensis</i>	Chinese hibiscus	Malvaceae
<i>Hymenocallis littoralis</i>	Beach spider lily	Amaryllidaceae
<i>Ixora</i> spp.	Ixora	Rubiaceae
<i>Jasminum sambac</i>	Arabian jasmine	Oleaceae
<i>Pemphis acidula</i>	Bantigue	Lythraceae
<i>Physalis angulata</i>	Cutleaf groundcherry	Solanaceae
<i>Polyscias scutellaria</i>	Shield aralia	Araliaceae
<i>Polyscias fruticosa</i>	Ming aralia	Araliaceae
<i>Scaevola</i> sp.	Fan flower	Goodeniaceae
<i>Sesbania</i> sp.	Riverhemp	Fabaceae
<i>Tradescantia spathacea</i>	Moses in the cradle	Commelinaceae
<i>Tecoma stans</i>	Yellow-bells	Bignoniaceae
<i>Tithonia diversifolia</i>	Tree marigold	Asteraceae

Scientific Name	English Common Name	Family
Vines		
<i>Bougainvillea</i> sp.	Bougainvillea	Nyctaginaceae
<i>Cayratia trifolia</i>	Threeleaf cayratia	Vitaceae
<i>Cassytha filiformis</i>	Dodder laurel	Cayratieae
<i>Derris trifoliata</i>	Climbing vine	Fabaceae
<i>Ipomoea pes-caprae</i>	Morning glory	Convolvulaceae
<i>Merremia</i> spp.	Large morning glory	Convolvulaceae
<i>Passiflora foetida</i> var. <i>hispida</i>	Passionflower	Passifloraceae
<i>Vigna marina</i>	Beach pea	Fabaceae
<i>Vitex trifolia</i>	Chaste tree	Lamiaceae
Herbs		
<i>Bacopa monnieri</i>	Bacopa	Plantaginaceae
<i>Bidens pilosa</i>	Beggarticks	Asteraceae
<i>Hymenocallis littoralis</i>	Beach spider lily	Amaryllidaceae
<i>Melanthera biflora</i>	Sea daisy	Asteraceae
<i>Mimosa invisa</i>	Giant sleeping grass	Fabaceae
<i>Mimosa pudica</i>	Sleeping grass	Fabaceae
<i>Nephrolepis</i> sp.	Nephrolepis	Nephrolepidaceae
<i>Physalis angulata</i>	Groundcherry	Solanaceae
<i>Phyla nodiflora</i>	Frog fruit	Verbenaceae
<i>Polypodium cambricum</i>	Limestone polypody	Polypodiaceae
<i>Stachytarpheta</i> sp.	Snakeweed	Verbenaceae
<i>Wedelia triloba</i>	Wedelia	Asteraceae
Grasses, Rushes, and Sedges		
<i>Cyperus</i> sp.	Sedge	Cyperaceae
<i>Echinochloa crus-galli</i>	Barnyard grass	Poaceae
<i>Eleocharis</i> sp.	Sedge	Cyperaceae
<i>Fimbristylis</i> sp.	Sedge	Cyperaceae
<i>Juncus</i> sp.	Rush	Juncaceae
<i>Paspalum distichum</i>	Knotgrass	Poaceae
<i>Panicum</i> sp.	Panicgrass	Poaceae
<i>Sporobolus</i> sp.	Smutgrass	Poaceae

Legend: — = No standard common name; scientific name is used as its common name.

Table C-2 Species List–Wildlife

Scientific Name	English Common Name	Life Form
<i>Pteropus pelewensis yapensis</i>	Yap flying fox	Mammal
<i>Ixobrychus sinensis</i>	Yellow bittern	Bird
<i>Ardea intermedia</i>	Intermediate egret	Bird
<i>Gygis alba</i>	White tern	Bird
<i>Bubulcus ibis</i>	Cattle egret	Bird
<i>Pluvialis fulva</i>	Pacific golden plover	Bird
<i>Charadrius leschenaultii</i>	Greater sand plover	Bird
<i>Arenaria interpres</i>	Ruddy turnstone	Bird
<i>Aplonis opaca</i>	Micronesian starling	Bird
<i>Myzomela rubrata</i>	Micronesian myzomela	Bird
<i>Passer montanus</i>	Eurasian tree sparrow	Bird
<i>Rhipidura rufifrons</i>	Rufous fantail	Bird
<i>Emoia atrocostata</i>	Littoral whiptail skink	Reptile
<i>Lamprolepis smaragdina</i>	Emerald tree skink	Reptile

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