Final
Preliminary Assessment Report
Camp Santiago Joint Maneuver Training Center,
Salinas, Puerto Rico

Perfluorooctane-Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA) Impacted Sites
ARNG Installations, Nationwide

March 2020

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Acronyms and Abbreviations

°F	degrees Fahrenheit
AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film forming foam
amsl	above mean sea level
AOI	Area of Interest
ARNG	Army National Guard
bgs	below ground surface
Camp Santiago	Camp Santiago Joint Maneuver Training Center
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CSM	conceptual site model
DoD	Department of Defense
DPW	Department of Public Works
EDR	Environmental Data Resources, Inc.
EQB	Environmental Quality Board
FTA	fire training area
IED	Installations & Environment Division
HAZMAT	Hazardous material
in/yr	inches per year
lb	pound
MATES	Maneuver Area Training Equipment Site
No.	Number
OWS	oil-water separator
PA	Preliminary Assessment
PFAS	per- and poly-fluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
ppt	parts per trillion
PRARNG	Puerto Rico Army National Guard
PX	Post Exchange
SI	Site Inspection
US	United States
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United State Fish and Wildlife Service
USGS	United States Geological Survey
WWTP	Wastewater Treatment Plant

Executive Summary

The United States (US) Army Corps of Engineers (USACE) Baltimore District on behalf of the Army National Guard (ARNG)-Installations & Environment Division (IED), Cleanup Branch contracted AECOM Technical Services, Inc. (AECOM) to perform *Preliminary Assessments (PAs) and Site Inspections (SIs) for Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) Impacted Sites at ARNG Facilities Nationwide*. The ARNG is assessing potential effects on human health related to processes at facilities that used per- and poly-fluoroalkyl substances (PFAS), primarily in the form of aqueous film forming foam released as part of firefighting activities, although other PFAS sources are possible.

AECOM completed a PA for PFAS at Camp Santiago Joint Maneuver Training Center (Camp Santiago; also referred to as the "facility"), in Salinas, Puerto Rico, to assess potential PFAS release areas and exposure pathways to receptors. Camp Santiago is constructed on a parcel of land owned by the USACE and leased to the Puerto Rico ARNG (PRARNG). The performance of this PA included the following tasks:

- Reviewed data resources to obtain information relevant to suspected PFAS releases
- Conducted a site visit on 24 May 2019
- Interviewed current PRARNG Camp Santiago personnel during the site visit including the Camp Santiago Fire Chief, the Director of the Department of Public Works, a safety officer, and the Maneuver Area Training Equipment Site Shop Chief.
- Completed visual site inspections at known or suspected PFAS release locations and documented with photographs
- Developed a preliminary conceptual site model (CSM) to outline the potential release and pathway of PFAS for the Area(s) of Interest (AOIs) and the facility (**Figure ES-1**)

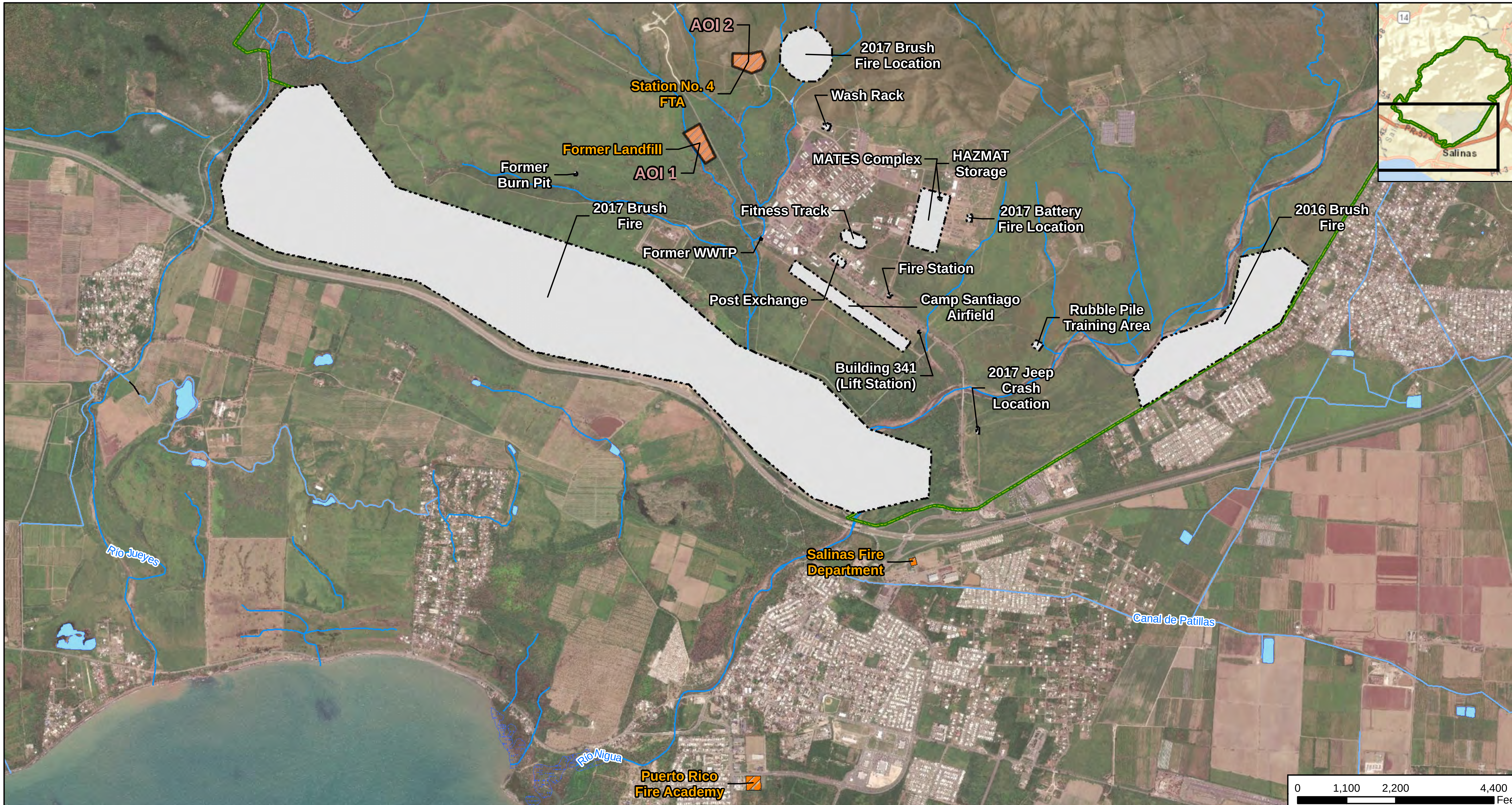
Two AOIs related to a potential PFAS release were identified at Camp Santiago during the PA. The AOIs are shown on **Figure ES-1** and described in **Table ES-1** below:

Table ES-1: AOIs at Camp Santiago

Area of Interest	Name	Used by	Potential Release Date
AOI 1	Former Landfill	PRARNG	Unknown - 1993
AOI 2	Station No. 4 FTA	PRARNG, Other DoD and non-DoD Units	Unknown (2012-present)

Based on the possible PFAS releases at the AOIs, there is potential for exposure to PFAS contamination in media at or near the facility. The preliminary CSM for Camp Santiago is shown on **Figure ES-2**, which presents the potential receptors and media impacted.

Based on the US Environmental Protection Agency (USEPA) Unregulated Contaminant Monitoring Rule 3 data, it was indicated that no PFAS were detected in a public water system above the USEPA Health Advisory level within 20 miles of Camp Santiago.



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PROJECT	Preliminary Assessment for PFAS at Camp Santiago, PR				
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SCALE	1:26,400	CHK BY	JW	1/9/2020	
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c)		PM	RG	1/9/2020	

Area of Interest
Potential PFAS Release
No Suspected Release
Facility Location
Water Body
Wetland
River/Stream
Canal/Ditch

N

Summary of Findings

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Figure ES-1

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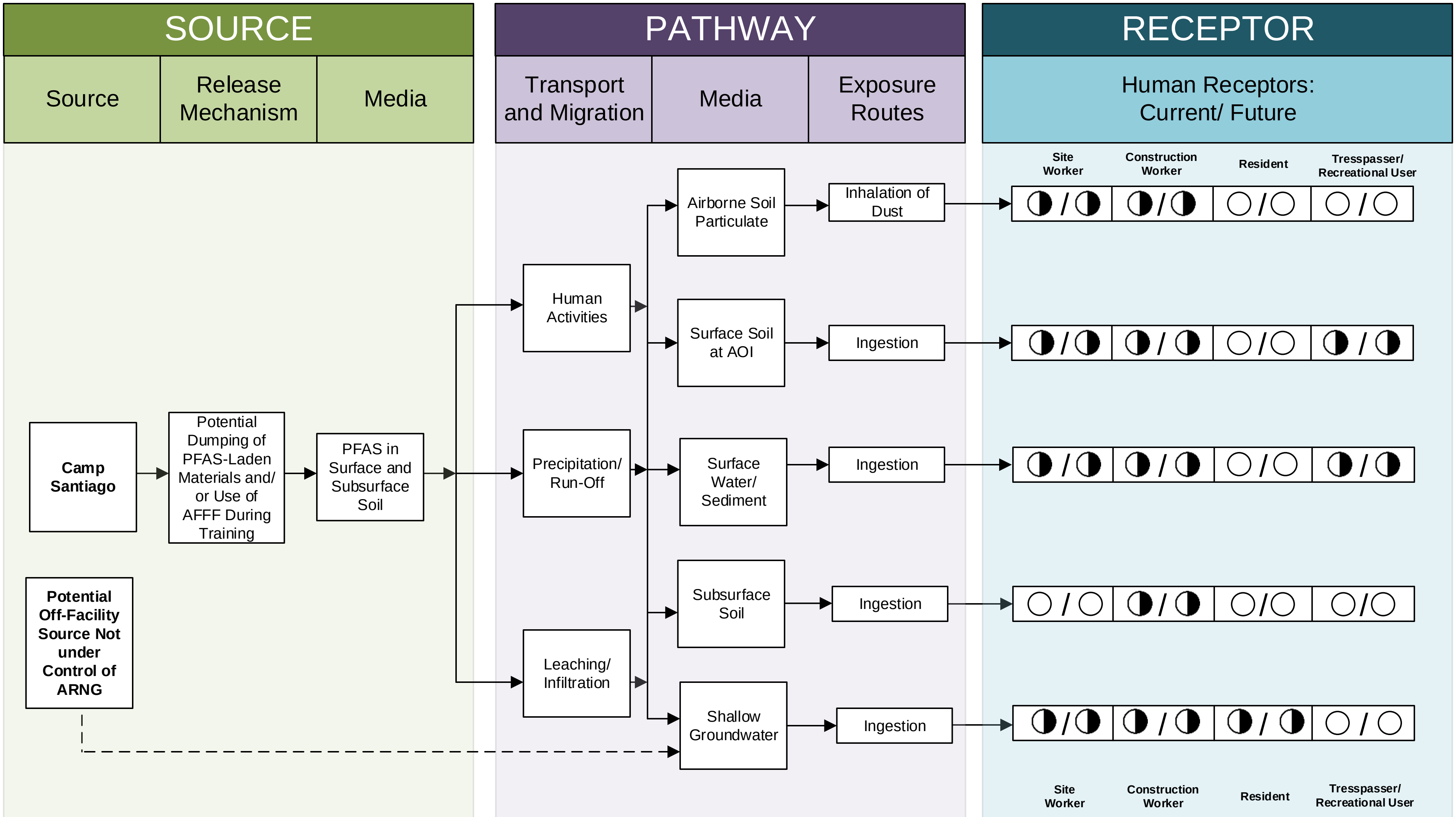

LEGEND

Flow-Chart Stops

Flow-Chart Continues

Partial / Possible Flow

Incomplete Pathway

Potentially Complete Pathway

Complete Pathway

Notes:

1. The resident and recreational user receptors refer to an off-site resident and recreational user.
2. Dermal contact exposure pathway is incomplete for PFAS.

Figure ES-2
Preliminary Conceptual Site Model
Camp Santiago

1. Introduction

1.1 Authority and Purpose

The United States (US) Army Corps of Engineers (USACE) Baltimore District on behalf of the Army National Guard (ARNG)-Installations & Environment Division, Cleanup Branch contracted AECOM Technical Services, Inc. (AECOM) to perform *Preliminary Assessments (PAs) and Site Inspections (SIs) for Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) Impacted Sites at ARNG Facilities Nationwide* under Contract Number W912DR-12-D-0014, Task Order W912DR17F0192, issued 11 August 2017. The ARNG is assessing potential effects on human health related to processes at facilities that used per- and poly-fluoroalkyl substances (PFAS), primarily in the form of aqueous film forming foam (AFFF) released as part of firefighting activities, although other PFAS sources are possible. In addition, the ARNG is assessing businesses or operations adjacent to the ARNG facility (not under the control of ARNG) that could potentially be responsible for a PFAS release.

PFAS are classified as emerging environmental contaminants that are garnering increasing regulatory interest due to their potential risks to human health and the environment. PFAS formulations contain highly diverse mixtures of compounds. Thus, the fate of PFAS compounds in the environment varies. The regulatory framework at both federal and state levels continues to evolve. The US Environmental Protection Agency (USEPA) issued Drinking Water Health Advisories for PFOA and PFOS in May 2016, but there are currently no promulgated national standards regulating PFAS in drinking water. In the absence of federal maximum contaminant levels, some states have adopted their own drinking water standards for PFAS. Puerto Rico does not currently have drinking water standards for PFAS.

This report presents the findings of a PA for PFAS at Camp Santiago Joint Maneuver Training Center (Camp Santiago; also referred to as the “facility”), in Salinas, Puerto Rico, in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, the National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Federal Regulations [CFR] Part 300), and USACE requirements and guidance.

This PA documents the known fire training areas (FTAs) as well as other locations where PFAS may have been released into the environment at Camp Santiago. The term PFAS will be used throughout this report to encompass all PFAS chemicals being evaluated, including PFOS and PFOA, which are key components of AFFF.

1.2 Preliminary Assessment Methods

The performance of this PA included the following tasks:

- Reviewed data resources to obtain information relevant to suspected PFAS releases
- Conducted a site visit on 24 May 2019
- Interviewed current and former Puerto Rico ARNG (PRARNG) Camp Santiago personnel during the site visit, including the Camp Santiago Fire Chief, the Director of the Department of Public Works (DPW), a safety officer, and the Maneuver Area Training Equipment Site (MATES) Shop Chief
- Completed visual site inspections at known or suspected PFAS release locations and documented with photographs
- Developed a preliminary conceptual site model (CSM) to outline the potential release and pathway of PFAS for the Area(s) of Interest (AOIs) and the facility

1.3 Report Organization

This report has been prepared in accordance with the USEPA *Guidance for Performing Preliminary Assessments under CERCLA* (USEPA 1991). The report sections and descriptions of each are:

- **Section 1 – Introduction:** identifies the project purpose and authority and describes the facility location, environmental setting, and methods used to complete the PA
- **Section 2 – Fire Training Areas:** describes the FTAs at the facility identified during the site visit
- **Section 3 – Non-Fire Training Areas:** describes other locations of potential PFAS releases at the facility identified during the site visit
- **Section 4 – Emergency Response Areas:** describes areas of potential PFAS release at the facility, specifically in response to emergency situations
- **Section 5 – Adjacent Sources:** describes sources of potential PFAS release adjacent to the facility that are not under the control of ARNG
- **Section 6 – Preliminary Conceptual Site Model:** describes the pathways of PFAS transport and receptors for the AOIs and the facility
- **Section 7 – Conclusions:** summarizes the data findings and presents the conclusions of the PA
- **Section 8 – References:** provides the references used to develop this document
- **Appendix A** – Data Resources
- **Appendix B** – Preliminary Assessment Documentation
- **Appendix C** – Photographic Log

1.4 Facility Location and Description

Camp Santiago is located on the south-central coast of Puerto Rico, north of the municipality of Salinas, Puerto Rico. The main gate is located on Highway PR-52 (**Figure 1-1**). Camp Santiago is the largest training site licensed for ARNG training activities in the Caribbean and occupies 12,590 acres. The Caribbean Sea is approximately 2 miles south from Camp Santiago (PRARNG, 2005).

In 1940, Camp Santiago was acquired from the Commonwealth of Puerto Rico by the US Army for training and was established as the Salinas Training Area. During World War II and through the end of the Korean War, the Salinas Training Area was used for military training (PRARNG, 2005). The facility was licensed for use by the PRARNG in 1967. In 1975, it was renamed Camp Santiago (PEER, 1992). Camp Santiago provides support and services to PRARNG as well as other Department of Defense (DoD) and non-DoD users, such as state and federal law enforcement agencies. Camp Santiago does not house permanent residents, although the barracks can temporarily house a large number of troops.

Camp Santiago's cantonment area is approximately 405 acres and includes 180 buildings. The camp is a self-supporting facility with finance, quartermaster, medical, and other support and services normally available at military installations. Within the camp, there are approximately 12 miles of improved roads and 150 miles of unimproved roads. The improved roads (asphalt paved) are primarily comprised of Highway PR-154, streets and avenues in the cantonment area, and a stretch of road to range areas at the camp (PRARNG, 2005).

Real property documents for the facility provided by the PRARNG are include in **Appendix A**.

1.5 Facility Environmental Setting

This section presents information taken from several sources, including the 2005 PRARNG Integrated Natural Resources Management Plan (PRARNG, 2005), the 1985 PRARNG Camp Santiago Environmental Management Analysis and Plan (PRARNG, 1985), a 1992 Screening Site Inspection Report (PEER, 1992), a 1981 Solid Waste Disposal/Landfill Study (USAEHA, 1981), and several geological and hydrogeological studies.

Camp Santiago lies on the southern slope of the Cordillera Central mountain range, which forms the east-west drainage divide in Puerto Rico (USAEHA, 1993). Topography across the facility ranges from mountains located along the northern portion of the facility to a gently sloping outwash plain occupying the southernmost end of the facility (PEER, 1992). Camp Santiago lies just to the east of the Salinas fan delta in an interfan or alluvial plain area (USGS, 2002). Elevations across the facility range from 40 feet above mean sea level (amsl) along the outwash plain to approximately 2,000 feet amsl in the mountains (USAEHA, 1993).

1.5.1 Soils

The soils in the southern portion of Puerto Rico are high in clay, medium-low in silt, and low in sand. The soils associated with Camp Santiago are primarily transported, but there are some residual soils present. In general, the soils can be grouped as the shallow soils associated with the volcanic heights and deep soils that are clayey and expansive on the semiarid terraces (USAEHA, 1981).

Based on the soil survey for Camp Santiago, the five most extensive soil units found within the site boundaries are the following: Aguilita stony clay loam, Callabo silty clay loam, Llanos clay, Jacana Clay, and Cobbly alluvial land. All soil units are well drained except the Cobbly alluvial land, which is found on floodplains. The pH values for the five soil types range from 5.6 to 8.4 in the upper most 60 inches, and organic matter content is five percent or less. The erodibility of these soil units is based on the susceptibility of a soil to sheer and rill erosion by water. These soils units have a slight to moderate erodibility when exposed or un-vegetated (U S Department of Agriculture, 2007).

1.5.2 Geology

Camp Santiago is located on the southern slope of the Cordillera Central mountain range, also called the Puerto Rican anticlinorium (USAEHA, 1993). Geology beneath the facility is shown on **Figure 1-2**. The mountains that occupy the northern portion of the facility are composed of highly faulted and folded sedimentary and volcanic formations. The volcaniclastic and sedimentary rocks consist of massive- to thick-bedded andesitic tuff, welded tuff, porphyritic basalt, volcanic breccia, sandstone, and siltstone (USGS, 1999). A principal structural feature of the strata is a dominant southwesterly dip (PEER, 1992).

The southernmost end of the facility is located on a gentle sloping outwash plain (PEER, 1992). This area is characterized by a low-lying, narrow fan-delta consisting of gravel, sand, and silt of Quaternary age (USGS, 2002). The alluvial and colluvial deposits that are present at the facility have been washed down from the surrounding hills and mountains (PEER, 1992).

The Río Jueyes fault is present within the main post area and passes through the cantonment area at an angle of approximately north 60 degrees west (PEER, 1992). The Esmeralda Fault, an ancient inactive fault, may also be present in the bedrock beneath the colluvium at the southern boundary of the site (PEER, 1992).

Much of the central portion of Camp Santiago is directly underlain by the conglomerates, sandstones, siltstones, and limestones of the Cariblanco formation, which is also exposed in the mountains to the north and south as far as the Río Jueyes fault (PEER, 1992). The Río Nigua river valley drains the impact area. Relatively young alluvium has collected in the valley bottom and extends to the southeast where it coalesces with the north-northeast to south-southwest trending alluvial valley from the Río Majada. Alluvium transported from the mountains to the north of Camp Santiago has formed an alluvial fan and plain which underlies the southeast corner of the camp and most of the region to the southeast. This feature is called the Río Nigua de Salinas alluvial fan (USGS, 2006) and is part of the larger South Coastal Plain Alluvial Aquifer.

1.5.3 Hydrogeology

Camp Santiago straddles two very different hydrogeologic regions. Groundwater within the portions of the facility directly overlying volcanic and sedimentary bedrock units primarily moves through structural features such as joints, fractures, and bedding planes. This groundwater is not generally used for drinking water purposes in the area surrounding Camp Santiago. Hydrothermal springs have been identified to the northwest of the facility, outside of the city of Coamo. The influence of hydrothermal groundwater can be seen seasonally through its impact on temperatures in wells in various parts of the facility (USGS, 2006).

Part of the central portion and most of the southeastern third of the facility lies within the second hydrogeologic region, overlying an interfan on the edge of an alluvial plain within the eastern section of the South Coast groundwater province. This province extends along the western half of the south coast of Puerto Rico. This portion of the facility is located on the western border of the Río Nigua de Salinas alluvial fan aquifer. The Río Nigua de Salinas alluvial fan aquifer is one of a series of alluvial fans and coastal sediments deposited during the Quaternary period that form the larger South Coastal Plain alluvial aquifer. The Río Nigua de Salinas alluvial fan aquifer is the principal source of drinking water for the residents of Salinas and the surrounding area. Based on topography, infiltration from the facility represents a very small proportion of total recharge that reaches the aquifer. The aquifer in Salinas includes three principal hydrogeologic units: (1) an upper zone typically composed of varying proportions of sand, gravel, and clay, with finer sediments increasing coastward; (2) the fan deltas and alluvial deposits, which are the principal groundwater flow zone; and (3) weathered bedrock that consists of limestones, diorite, sandstone, conglomerates, and siltstone. Groundwater within the sand and gravel beds of the upper zone is mostly unconfined; however, as the amount of fine-grained material increases coastward, this upper zone becomes a semi-confining unit to the principal groundwater flow zone within the fan delta and alluvial deposits. The upper zone varies in thickness from 75 feet along the coast to 10 to 40 feet along the northern boundary and supplies water to domestic wells. The thickness of the fan delta is reported to be up to 350 feet, and the fan delta supplies water for municipalities and industrial water wells (USGS, 2006).

Static groundwater level measurements in wells at Camp Santiago ranged from 10 to 13 feet below ground surface (bgs) during a 1993 study. Borehole depths ranged from 48 to 62 feet bgs (USAEHA, 1993). Groundwater elevations in the Río Nigua de Salinas alluvial fan aquifer located down gradient from Camp Santiago within the 4-mile groundwater receptor zone ranged from 26 to 66 feet bgs during a 2002 investigation. Well depths ranged from 42 to 346 feet bgs. The hydraulic conductivity of the fan deposits in the Salinas area ranges from 26 to 100 feet per day (USGS, 2006). Two additional groundwater monitoring wells were installed at Camp Santiago in 2012 and are located in the northeastern portion of the facility near the eastern boundary (URS Group, Inc. & Arcadis U.S, Inc., 2008).

Regional groundwater flow near Camp Santiago is to the south, toward the Caribbean Sea (**Figure 1-2**) (USAEHA, 1993). Localized flow may be complex due to the preferential flow paths located within the colluvium, influences of underlying bedrock that are exposed at Cerro Modesto south of the cantonment area, and the presence of the Esmeralda fault, which may be located in bedrock beneath the colluvium at the southern boundary of the facility (PEER, 1992). Pumping from wells in the Río Nigua de Salinas alluvial fan aquifer has lowered the water table sufficiently to create a cone of depression that has changed the natural north to south direction of groundwater flow (USGS, 2006).

Groundwater is the only source of drinking water for Camp Santiago. There are two water supply wells located near the Main Gate that supply water to the facility that are screened in the Río Nigua de Salinas alluvial fan aquifer deposits (**Figure 1-2**). Camp Santiago also includes a water treatment plant, a water distribution system, and a sewer line system connected to the Salinas municipal sewage system. Based on 2010 Census data, approximately 30,000 people live in Salinas and the surrounding areas near Camp Santiago and rely on groundwater as their sole water supply source (US Census Bureau, 2012). There are more than 70 groundwater wells registered between the Puerto Rico Department of Health and the Puerto Rico Aqueduct and Sewer Authority located primarily south of Camp Santiago within the 4-mile down gradient groundwater receptor zone (Commonwealth of Puerto Rico, 2006). The water supply wells located south of Camp Santiago are screened at various depths in the Río Nigua de Salinas alluvial fan aquifer (USGS, 2006). According to Camp Santiago personnel, municipal water infrastructure was recently established for the city of Salinas; however, it is unclear whether municipal water is primary source of drinking water.

Additionally, sampling of two domestic water sources at Camp Santiago for PFAS were conducted by the ARNG in June 2017. Estimated concentrations of various PFAS compounds were detected, including a concentrations of PFOS ranging from 1.67 parts per trillion (ppt) to 2.90 ppt in samples collected from a waterspout inside Building 002 and a waterspout inside Building 003. Both buildings are located in the facility cantonment area. PFOA was not detected in samples. All PFAS detections reported are orders of magnitude below the USEPA Health Advisory of 70 ppt. The tabulated sampling results are included in **Appendix A**, and potable well locations are shown on **Figure 1-2**.

Based on the USEPA Unregulated Contaminant Monitoring Rule 3 data, it was indicated that no PFAS were detected in a public water system above the USEPA Health Advisory level within 20 miles of Camp Santiago.

1.5.4 Hydrology

Camp Santiago is situated on the southern slope of the Cordillera Central mountain range, which forms the main drainage divide of Puerto Rico. The steep topography of the southern slope of the Cordillera Central results in rapid runoff and occasional flash flooding along the intermittent streams that traverse Camp Santiago (PEER, 1992). All surface water in Camp Santiago flows south to the Caribbean Sea, roughly 2 miles from the facility boundary (**Figure 1-3**).

There are approximately 144 miles of perennial or intermittent streams within the boundaries of Camp Santiago. Where munitions use and fires have disrupted native plants, only grass, herbaceous plants, and shrubs grow along the stream courses. The only surface waters that flow off-facility are the Río Jueyes, Río Nigua, and Quebrada Honda. Of these waters, the Río Nigua is the principal drainage for Camp Santiago, with a watershed basin size of 112 square miles (Puerto Rico Environmental Quality Board, 2003).

The Río Nigua watershed drains the eastern half of the facility. The Río Majada, which flows along the northeastern portion of the facility boundary, is also part of the watershed and confluences with the Río Nigua downstream. The Río Jueyes watershed is much smaller, with a basin size of roughly 12 square miles, and drains the western portion of the facility. The Quebrada Honda watershed drains the south-central part of the facility and consists of a relatively small, intermittent creek that mainly dries out and/or infiltrates to groundwater downstream of Camp Santiago's southern boundary (PRARNG, 2005).

Most of the drainage features flowing through the northern and central areas of Camp Santiago are intermittent or ephemeral streams, with low gradients, sizable deposits of loose gravels and sand, and losing over significant reaches. The unconsolidated material is easily entrained and transported during high stream flow periods (PRARNG, 2005).

Generally, flow in streams within the Camp Santiago area is less than 35 cubic feet per second, with some sections often drying out (USGS, 2002). Intense runoff events, mostly in the mountainous area to the north and east of Camp Santiago, create flash flood conditions in the lower elevations. All low elevation areas, including the firing ranges and neighboring areas, can be flooded within hours of the onset of a storm. The local geology and drainage patterns indicate that portions of the facility and the adjacent communities of El Coco and Salinas occupy historical floodplains (PEER, 1992; PRARNG, 2005).

1.5.5 Climate

Puerto Rico has a mildly tropical Caribbean climate, and seasonal variation in temperatures is very low. The average temperature in the summer in the nearby city of Ponce is 82.3 degrees Fahrenheit (°F), while the average temperature in the winter is 77.2 °F (NOAA, 2019).

Puerto Rico has a complex rainfall pattern that is controlled mainly by the orographic effects of the Cordillera Central mountain range. The Cordillera Central forms a barrier to the prevailing northeast trade winds and affects the distribution of rainfall throughout Puerto Rico. The trade winds persist throughout the year, producing a wind pattern varying from northeast to southeast according to the season. Much of the south coast, including Camp Santiago, lies in a rain shadow. The average annual rainfall in Ponce is about 35.48 inches (NOAA, 2019).

1.5.6 Current and Future Land Use

The Camp Santiago Training Center is the largest training site licensed for ARNG training activities in the Caribbean, and future land use is not anticipated to change.

CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at Camp Santiago, PR			
REVISED	11/4/2019	GIS BY	MS	11/4/2019
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Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	RG	11/4/2019

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Facility Location

AECOM
12420 Milestone Center Drive
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Figure 1-1

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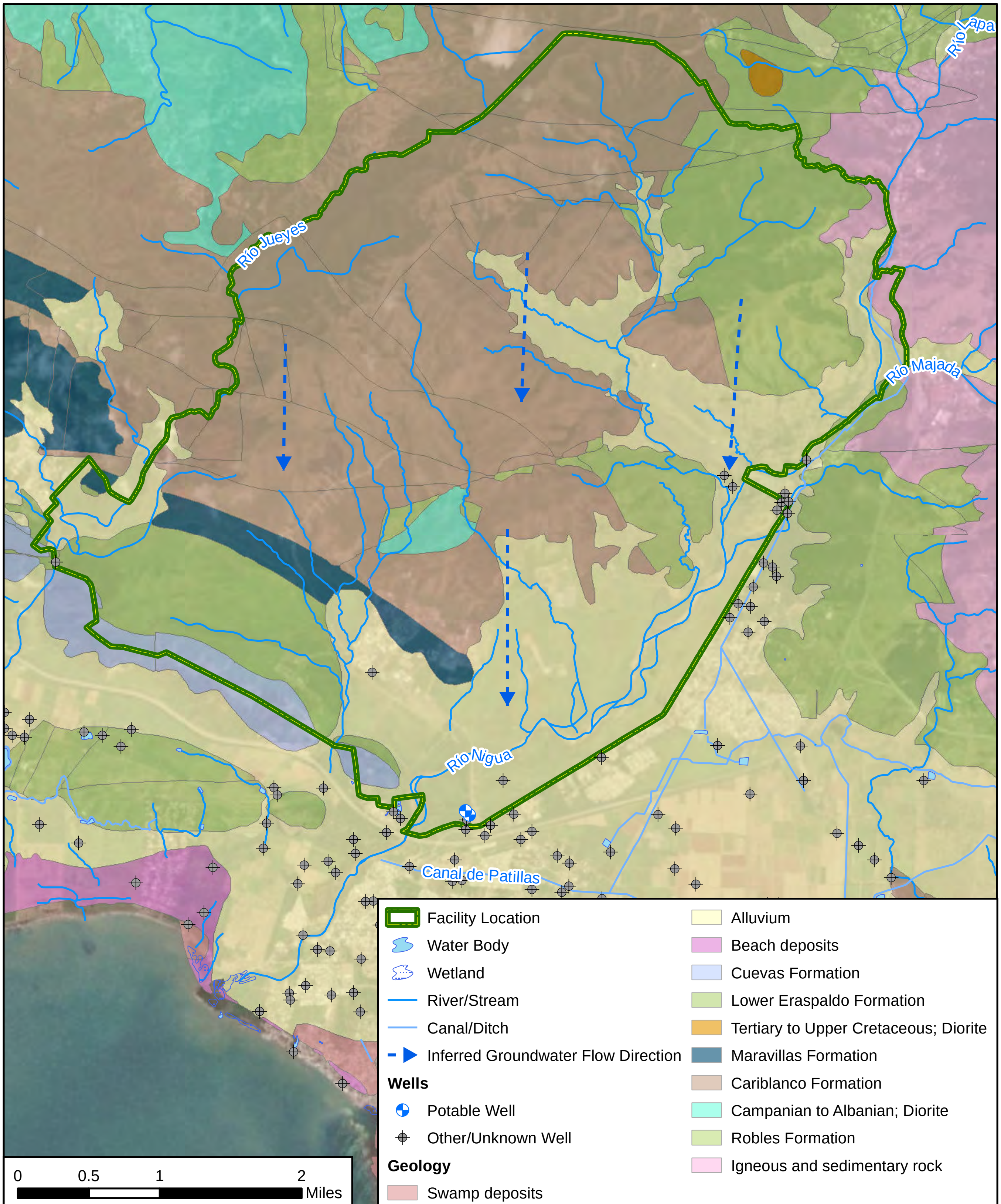

CLIENT	ARNG				Groundwater Features
NOTES	Preliminary Assessment for PFAS at Camp Santiago, PR				
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SCALE	1:63,360	CHK BY	JW	1/9/2020	
Base Map: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	1/9/2020	

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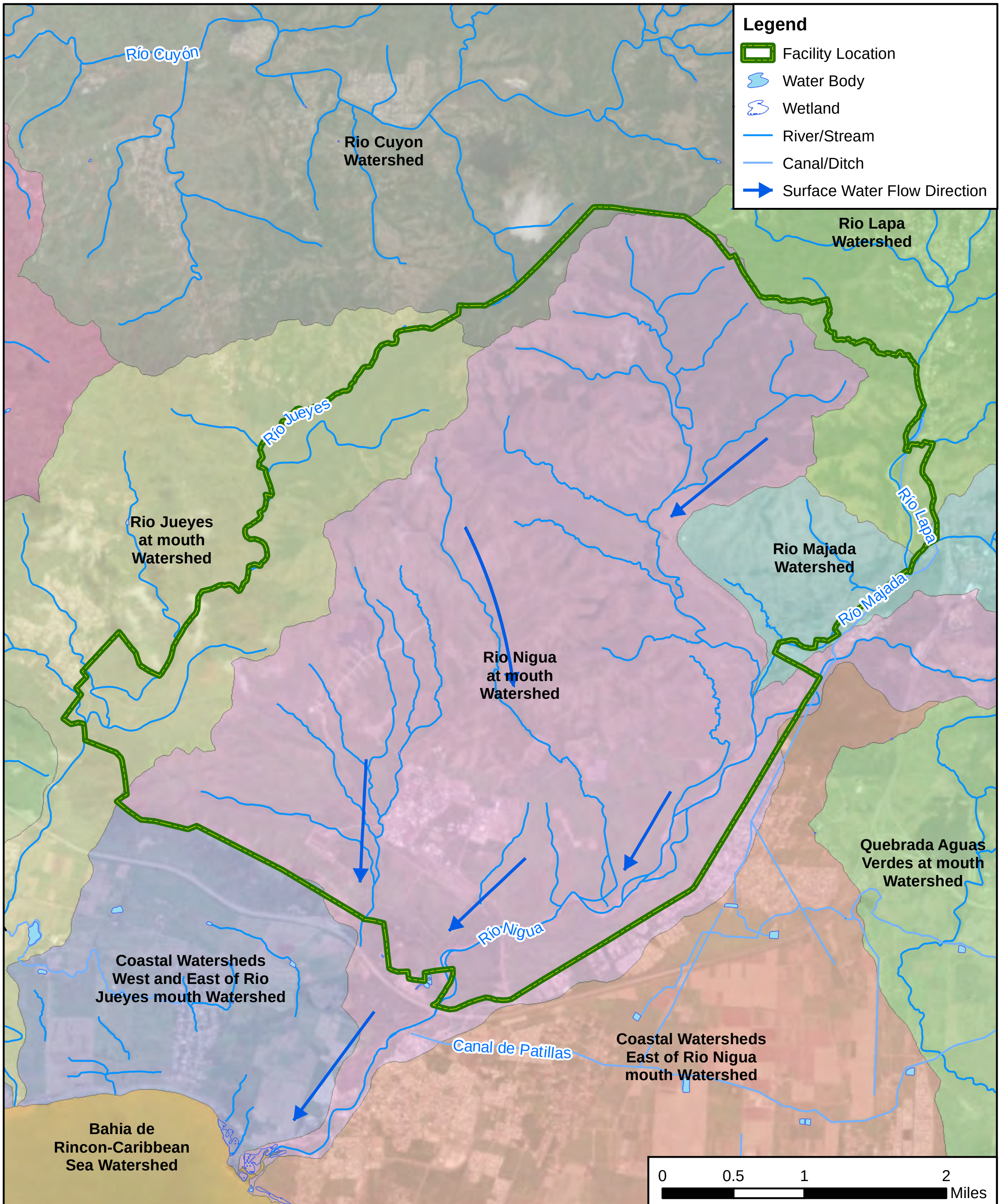

CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at Camp Santiago, PR			
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Base Map: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,		PM	RG	11/5/2019

Surface Water Features

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Figure 1-3

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2. Fire Training Areas

FTAs are considered areas where deliberate discharge of AFFF or other firefighting materials is performed for purposes of training personnel. One FTA was identified at Camp Santiago (**Figure 2-1**) during the PA through interviews, review of the Environmental Data Resources, Inc. (EDR) report for a 1-mile radius surrounding the facility (**Appendix A**), and historical document review.

2.1 Station No. 4 FTA

The Station Number (No.) 4 FTA is located northwest of the cantonment area at Camp Santiago, (18°0'56.18"N; 66°18'1.53"W). The FTA is used for fire training by the Camp Santiago Fire Department, as well as the 215th Firefighter Engineer Department stationed at Vega Baja Readiness Center, the Fort Allen Fire Department, and other DoD and non-DoD units. The FTA compound includes several structures used for storage and training.

Although AFFF is stored by the Camp Santiago Fire Department at the facility fire station, AFFF is not used in training at Camp Santiago. According to the Camp Santiago Fire Chief, whose tenure with PRARNG firefighting companies at Camp Santiago and Vega Baja spans from 2003 to present, AFFF has never been used for training purposes at the Station No. 4 FTA, or any other location on Camp Santiago. According to PRARNG staff, the first AFFF-capable firefighting vehicle was received at Camp Santiago in 2006, and AFFF was procured in 2007. Since its arrival at Camp Santiago, AFFF has never been used at the facility or disposed of.

The Camp Santiago Fire Department, and other units that train at the Station No. 4 FTA, only use water during training. Records of the routine fire training exercises are not kept by the PRARNG. Although there have been no known uses of AFFF at this FTA by the PRARNG, the undocumented use of the FTA by other agencies may have included AFFF. Because of this uncertainty, and the known detections of PFAS in groundwater concentrations at the facility, the Station No. 4 FTA is considered a potential PFAS release area.

The exact timeframe and frequency of training at the Station No. 4 FTA are unknown and undocumented; however, the earliest aerial imagery showing the presence of the FTA is 2012. Two small streams exist within 0.2 miles to the east and west of the FTA and flow south towards the Caribbean Sea (US Fish and Wildlife Service [USFWS], 2019).

2.2 Former Burn Pit

The Former Burn Pit is located west of the cantonment area at Camp Santiago; its exact location is unknown. The pit is approximately 30 to 40 ft long and lined with concrete. The ends of the pit are open to allow water to flow outwards onto the surrounding land surface. According to a 2008 Operational Range Assessment Program Phase II Report, the Former Burn Pit was used to train personnel in the safe management and expedient destruction of unused propellant by open burn (URS Group, Inc. & Arcadis U.S, Inc., 2008). Because PRARNG personnel stated that AFFF has never been used for training purposes, and the explicit use of this burn pit was to destroy unused propellant, the Former Burn Pit is not considered a potential PFAS release area. The exact timeframe of use for training at the Former Burn Pit is unknown.

CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at Camp Santiago, PR			
REVISED	1/9/2020	GIS BY	MS	1/9/2020
SCALE	1:12,000	CHK BY	JW	1/9/2020
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	RG	1/9/2020

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Fire Training Area

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 2-1

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3. Non-Fire Training Areas

Several non-FTAs where AFFF was potentially stored and/or released were identified during the PA. A description of each non-FTA is presented below, and the non-FTAs are shown on **Figure 3-1**.

3.1 Fire Station

The Camp Santiago Fire Station is located in the southeastern corner of the facility cantonment area (18°0'5.08"N; 66°17'28.21"W). The fire station is currently operating and is used for the storage of equipment and materials associated with firefighting. As previously stated, the first AFFF-capable firefighting vehicle was received at Camp Santiago in 2006, and AFFF was procured in 2007. The fire station currently stores two High Mobility Multipurpose Wheeled Vehicle (Humvee) Skid Units (one capable of carrying 10 gallons of AFFF, the other only capable of carrying water), one E-One Pumper Truck (carrying 50 gallons of 3% AFFF), and one additional firefighting vehicle with unknown contents and capabilities as it pertains to AFFF. The AFFF tank on one of the Humvee skid units at the fire station was empty during the PA site visit. Camp Santiago fire department staff stated during interviews that none of the vehicles have a history of leaking or other maintenance issues that may result in the release of AFFF. Fire department vehicles are maintained at the MATES facility. Chemguard 3% AFFF C303 and C306 products are also stored in 5-gallon buckets at the fire station; the safety data sheets for those products are included in **Appendix A**. Fewer than ten 5-gallon buckets containing AFFF products were present during the PA site visit.

The only known use of the AFFF stored at Camp Santiago was in response to a 2009 fuel fire at the Caribbean Petroleum Refinery, located on the north side of the island, in Bayamon. AFFF used by the Camp Santiago Fire Department was mixed at the scene of the emergency, not at the fire station. No other AFFF has been used or disposed of by the Camp Santiago Fire Department since it received AFFF in 2007. No fire training occurs at the Camp Santiago Fire Station. The fire department trains only with water at the Station No. 4 FTA. The fire department performs non-fire training at the Rubble Pile Training as well; however, no fire fires are lit during this training. The fire department also occasionally trains off-post at the US Army Garrison Fort Buchanan on the northern side of the island. There are no storage records for the AFFF kept at the fire station.

The exact timeframe of use of the fire station at Camp Santiago is unknown; however, the earliest aerial imagery showing the presence of the fire station is 2004. One small stream exists within 0.2 miles to the east of the fire station (USFWS, 2019). The stream discharges to the Río Nigua, and ultimately to the Caribbean Sea.

3.2 Rubble Pile Training Area

The Rubble Pile Training Area is located southeast of the facility cantonment area (17°59'54.60"N; 66°16'53.63"W). The training area is currently used by the Camp Santiago Fire Department, as well as other DoD and non-DoD units, for emergency rescue training. According to Camp Santiago Fire Department staff, no fire training occurs at the Rubble Pile Training Area, and no AFFF is stored in the area. No fire suppression system exists in the training area. No evidence indicates that AFFF has ever been released at the Rubble Pile Training Area.

The exact timeframe of use of the Rubble Pile Training Area at Camp Santiago is unknown; however, the earliest aerial imagery showing the presence of the training area is 2004. The Río Nigua exists within 0.1 miles to the east of the Rubble Pile Training Area (USFWS, 2019) and discharges into the Caribbean Sea.

3.3 Camp Santiago Airfield

The Camp Santiago Airfield is located south of the cantonment area at the facility(18°0'5.08"N; 66°17'28.21"W). The former tactical airfield hasn’t been used for fixed-winged aircraft since 1983. The airfield requires redesign and expansion to become operational. Because the airfield is inoperable, no fire suppression systems exist at its location, nor are any mobile or handheld fire extinguishers staged at the flightline.

Airfields are investigated as potential PFAS release areas based on the potential for incidents requiring AFFF response, such as fuel spills and crashes. According to PRARNG staff, whose tenure span the complete history of the presence of AFFF at Camp Santiago, no incidents requiring AFFF use at the airfield have ever occurred. Records or incidents at the airfield were unavailable during this PA. Three small streams exist adjacent to the airfield to the east, south, and west (USFWS, 2019). Each stream drains to the Río Nigua.

3.4 MATES Complex

The Camp Santiago MATES Complex comprises approximately 20 acres (excluding supplemental vehicle parking areas) and is located on the eastern edge of the facility cantonment area (18°0'22.22"N; 66°17'18.86"W). The complex was constructed in 1985 and is currently operational; however, it was heavily damaged during Hurricane Maria in 2017 and is scheduled for replacement. The MATES Complex is used for the maintenance and service of vehicles from Fort Allen and Camp Santiago, including firefighting vehicles. According to the MATES Shop Chief, no AFFF is stored or used at the MATES Complex, and no emergencies have occurred at the MATES Complex requiring AFFF in response.

The MATES Complex uses a water sprinkler system for fire suppression. Handheld dry chemical fire extinguishers are also staged throughout the complex, as well as larger mobile fire extinguishers, including the Buckeye A-150-SP ABC Dry Chemical Wheeled Stored Pressure Fire Extinguisher and Kidde 125 pound (lb) ABC Class Wheeled Fire Extinguisher. The larger fire extinguishers use an ammonium phosphate-based extinguishant that does not include PFAS. An information sheet for the large Buckeye wheeled fire extinguisher is included in **Appendix A**. The MATES Complex Shop Chief stated during interviews that MATES staff train with the large wheeled fire extinguishers twice a year and are prepared to support the fire department in response to an emergency if necessary. Fuel spills within the complex are responded to with collapsible berms, never AFFF.

No evidence indicates that AFFF has ever been released within the MATES Complex. Floor drains at the MATES Complex connect to an oil-water separator (OWS) and discharge to municipal sanitary sewers. A freshwater wetland and small stream exist adjacent to the MATES parking area on the east side of the complex (USFWS, 2019). The wetland and stream discharge to the Río Nigua, and ultimately to the Caribbean Sea.

3.5 HAZMAT Storage Area

The Hazardous Material (HAZMAT) Storage Area is located in the northeast corner of the MATES Complex within the facility cantonment area (18°0'26.73"N; 66°17'16.86"W). The storage area was constructed in 2011 and includes three bays and petroleum, oils, and lubricant storage. The MATES Complex utilizes a Purple K fire suppression system and also typically stores a Buckeye A-150-SP ABC Dry Chemical Wheeled Stored Pressure Fire Extinguisher or Kidde 125 lb ABC Class Wheeled Fire Extinguisher.

According to the MATES Shop Chief and Camp Santiago Fire Chief, no AFFF is stored or used at the HAZMAT Storage Area, and no emergencies have occurred requiring AFFF in response. No evidence indicates that AFFF has ever been released at the HAZMAT Storage Area. Floor drains at the storage area connect to an OWS and discharge to municipal sanitary sewers. A small stream exists within 0.3 miles east side of the HAZMAT Storage Area that discharges to the Río Nigua (USFWS, 2019).

3.6 Wash Rack

The Wash Rack is located in the northwest corner of the facility cantonment area (18°0'42.33"N; 66°17'43.49"W). The Wash Rack is used to wash vehicles, heavy equipment, tools, and parts. The exact timeframe of use of the Wash Rack at Camp Santiago is unknown; however, the earliest aerial imagery showing the presence of the Wash Rack is from 2004. Large wheeled fire extinguishers may be stored at the Wash Rack occasionally, but no AFFF is stored or charged in a fire suppression system at the Wash Rack. Due to the absence of vehicles with a history of leaks, or emergencies requiring AFFF use at the facility, it is not expected that AFFF has ever been rinsed from vehicles or equipment at the Wash Rack.

No evidence indicates that AFFF has ever been released at the Wash Rack. Floor drains at the Wash Rack connect to an OWS and discharge to municipal sanitary sewers. One small stream exists within 0.2 miles to the west of the Wash Rack that flows south and discharges to the Caribbean Sea (USFWS, 2019).

3.7 Fitness Track

The Fitness Track is located in the south-central portion of the facility cantonment area (18°0'17.33"N; 66°17'36.74"W). The location is predominantly used for physical training, but is also occasionally used for the landing of helicopters. As such, two Buckeye and Kidde dry chemical wheeled fire extinguishers are staged at the Fitness Track. According to all PRARNG staff interviewed, no emergencies have occurred at the Fitness Track that required AFFF response, nor have any AFFF products or equipment ever been stored in the area.

No evidence indicates that AFFF has ever been released at the Fitness Track. There are no floor drains in the area. The nearest surface water bodies are located within 0.4 miles to the east and west of the Fitness Track (USFWS, 2019). No surface water bodies exist in the immediate vicinity of the Fitness Track.

3.8 Post Exchange

The Camp Santiago Post Exchange (PX) is located in the south-central portion of the facility cantonment area, on Highway PR-154 (18°0'12.73"N; 66°17'40.20"W). The PX was considered a potential AFFF storage and use location based on its storage of fuels; however, staff at the PX confirmed that no AFFF has ever been stored or used at the location.

The Director of the DPW at Camp Santiago stated during interviews that a tanker spilled fuel at the PX at an unknown date, but no AFFF was used in response to the fuel spill. Camp Santiago Fire Department staff also confirmed during interviews that no emergencies have occurred at the PX that required AFFF in response. A water sprinkler fire suppression system exists within the PX building, and dry chemical fire extinguishers are also stored at the facility. No evidence indicates that AFFF has ever been released at the PX. The nearest surface water bodies are located within 0.4 miles to the east and west (USFWS, 2019).

3.9 Former WWTP

The former wastewater treatment plant (WWTP) at Camp Santiago is located in the southwestern corner of the facility cantonment area (18°0'17.16"N; 66°17'58.16"W). The former WWTP formerly handled sewage generated at the facility, but the WWTP no longer operates. The date of closure for the WWTP is unknown. Following closure of the WWTP, Camp Santiago was connected to the Salinas municipal sewage treatment system. Wastewater from the facility is connected to the Salinas municipal sewage treatment system via the lift station at Building 341. The former WWTP site has not been totally reclaimed; plastic pipes still protrude from an eroded bank along one of the facility improved roads.

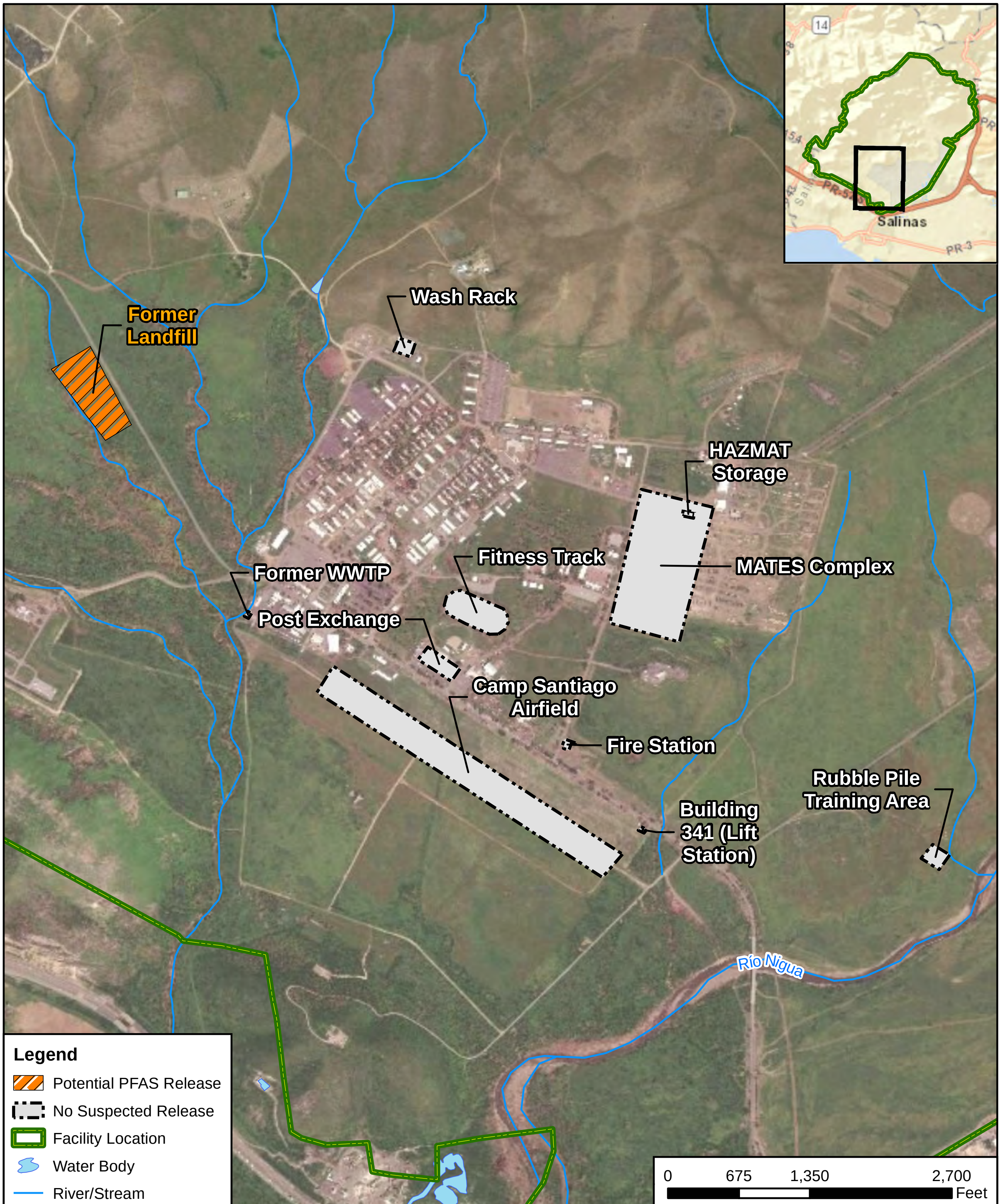
WWTPs are not usually a primary potential release area of PFAS, but sludges and liquids from areas of potential release that are treated at WWTPs may create a secondary source of contamination. Because there are no known AFFF release areas at Camp Santiago, the former WWTP is not considered a potential PFAS release area. The former WWTP is located adjacent to a small stream that discharges to the Río Nigua, south of Camp Santiago.

3.10 Former Landfill

The former landfill at Camp Santiago is located west of the facility cantonment area (18°0'37.61"N; 66°18'12.05"W). The landfill formerly operated as an approved solid waste disposal facility under a Puerto Rico Environmental Quality Board (EQB) Sanitary Landfill Permit; however, infrequent open burning of refuse occurred at the landfill without approval from the EQB. No other burn pits existed at Camp Santiago. The landfill was used primarily for the dumping of medical, household, and construction waste. According to PRARNG environmental staff, the landfill closure process began in 1993. Because AFFF products did not arrive to Camp Santiago until 2007, it is not expected that any AFFF-impacted materials have been disposed of in the landfill.

Landfills are not usually a primary potential release area of PFAS, but materials disposed of in landfills may create a secondary source of contamination. Such materials, to name a few, may include sludge from a WWTP that processes PFAS-laden water or products associated with waterproofing uniforms or boots. Although AFFF was not present at Camp Santiago during the landfills operational years, other PFAS-laden materials may have been disposed of in the landfill. Because PFAS compounds have been detected in drinking water collected from wells at the facility, and no other PFAS release areas are known to have occurred at Camp Santiago, the former landfill is considered a potential PFAS release area. The former landfill is located generally upgradient from the two water supply wells located near the main facility entrance. It is also possible that a background plumbing source may be the cause for detections of PFAS in the groundwater.

The former landfill was located in an area of shallow, fractured rock with a minimal amount of soil development, which would be conducive to the generation of a groundwater pollution problem with excessive rainfall. The semiarid condition in southern Puerto Rico is believed to mitigate leachate generation (PRARNG, 1985). The former landfill is also located adjacent to a small stream that discharges to the Río Nigua, south of the facility.



CLIENT	ARNG				Non-Fire Training Areas
NOTES	Preliminary Assessment for PFAS at Camp Santiago, PR			N	
REVISED	11/26/2019	GIS BY	MS	11/26/2019	AECOM 12420 Milestone Center Drive Germantown, MD 20876 — Figure 3-1
SCALE	1:16,200	CHK BY	JW	11/26/2019	
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	RG	11/26/2019	

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4. Emergency Response Areas

Several emergency response areas were identified at Camp Santiago. A description of the emergency response areas are presented below and shown on **Figure 4-1**. Interview records are included in **Appendix B**.

4.1 2016 Brush Fire

Camp Santiago and the surrounding communities are frequently affected by wildland fires due to the semiarid climate of southeastern Puerto Rico and natural fuel buildup on the drier facility grasslands. In 2016, a wildland brush fire took place in the eastern portion of Camp Santiago, between the Río Nigua and the eastern facility boundary. The approximate center of the fire area was 17°59'56.12"N; 66°16'11.69"W. The total acreage of the fire is unknown.

According to Camp Santiago Fire Department staff, only water was used in response to the brush fire. It is not routine practice for the Camp Santiago Fire Department to use AFFF in response to wildland fires. Records of the fire were not available during PA efforts. The 2016 Brush Fire area is not considered a potential PFAS release area.

4.2 2017 Brush Fire

On 5 March 2017, a large wildland brush fire occurred along the southern boundary of Camp Santiago, adjacent to Highway PR-52. The total acreage of the fire is unknown. According to Camp Santiago Fire Department staff, the fire departments from Salinas, Ponce, and Guayana supported the Camp Santiago Fire Department in response to the fire. Interviewees stated that only water was used in response to the brush fire. Records of the fire were not available from PRARNG during PA efforts. The 2017 Brush Fire area is not considered a potential PFAS release area.

4.3 2017 Brush Fire #2

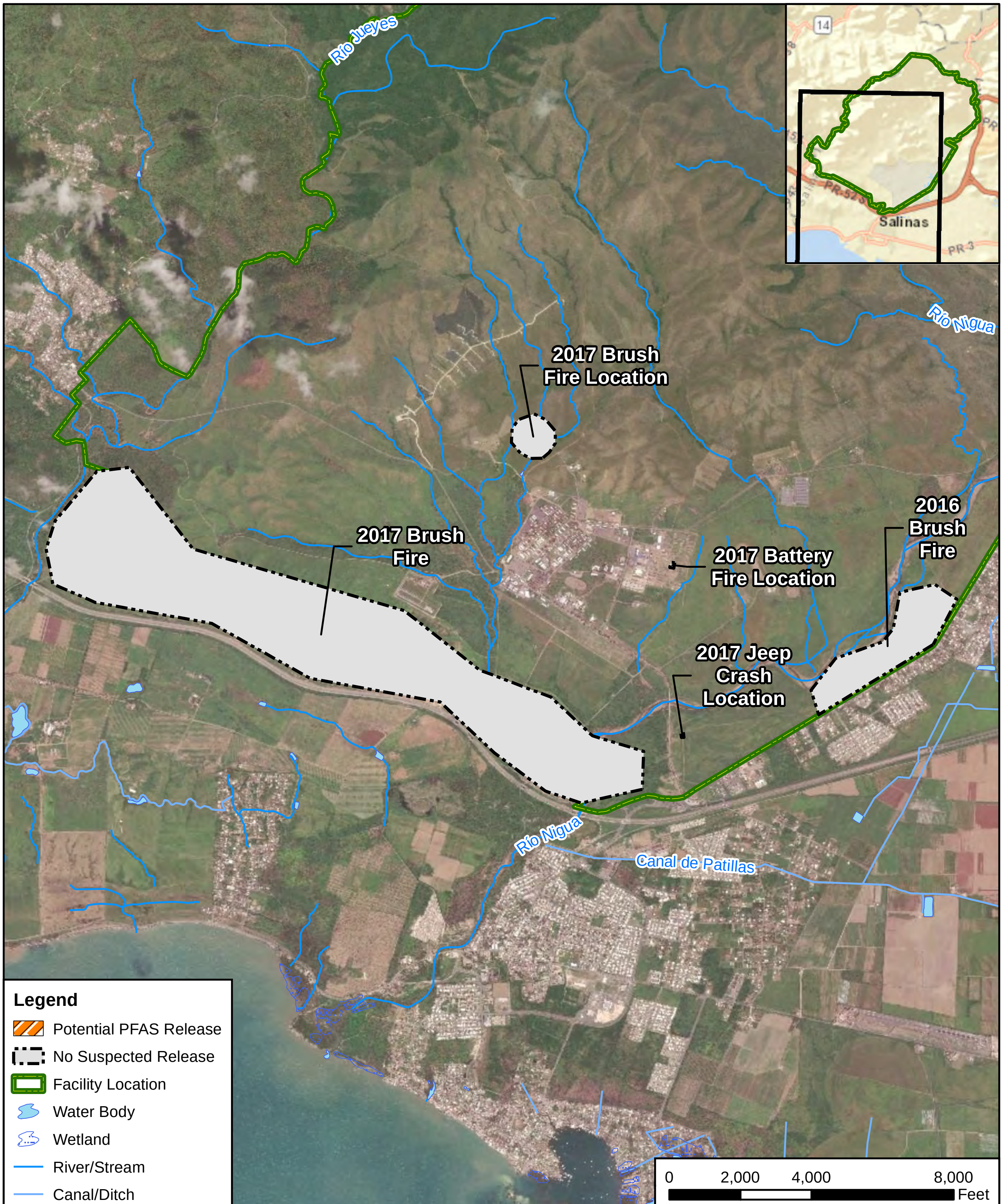
A second wildland brush fire occurred in 2017 at Camp Santiago, near the Station No. 4 FTA northwest of the cantonment area. The approximate coordinates for the fire are 18°0'58.02"N; 66°17'48.84"W. The total acreage of the fire is unknown. According to Camp Santiago Fire Department staff, only water was used in response to the brush fire. Records of the fire were not available during PA efforts. The 2017 Brush Fire #2 area is not considered a potential PFAS release area.

4.4 2017 Jeep Crash Location

In 2017, a PRARNG vehicle crashed on Highway PR-154, near the entrance to Camp Santiago. The approximate coordinates for the crash location are 17°59'35.43"N; 66°17'7.18"W. As a result of the crash, fuel spilled onto the dirt road adjacent to Highway PR-154. According to PRARNG staff, no fire occurred as a result, and no AFFF was used in response to prevent ignition. Records of the incident were not available during PA efforts. The 2017 Jeep Crash Location is not considered a potential PFAS release area.

4.5 2017 Battery Fire Location

In 2017, a car battery started a fire in the parking area east of the MATES Complex within the facility cantonment area. The approximate coordinates for the fire location are 18°0'22.42"N; 66°17'9.92"W. According to the MATES Shop Chief, the fire was extinguished using dry chemical fire extinguishers. Records of the fire were not available during PA efforts. The 2017 Battery Fire area is not considered a potential PFAS release area.



CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at Camp Santiago, PR			
REVISED	11/4/2019	GIS BY	MS	11/4/2019
SCALE	1:48,000	CHK BY	JW	11/4/2019
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	RG	11/4/2019

Emergency Response Areas

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 4-1

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5. Adjacent Sources

Two potential off-facility source of PFAS adjacent to Camp Santiago, not under the control of the PRARNG, were identified during the PA through interviews, review of the EDR report for a 1-mile radius surrounding Camp Santiago (**Appendix A**), and historical document review. A description of each potential adjacent source is presented below, and the sources are shown on **Figure 5-1**

5.1 Salinas Fire Department

The Salinas Fire Department is located south of Camp Santiago, on the southern side of PR Highway-52, approximately 0.4 miles southwest of the Camp Santiago entrance (17°59'6.10"N; 66°17'21.56"W). According to Camp Santiago personnel, the Salinas Fire Department occasionally trains at Camp Santiago alongside the Camp Santiago Fire Department; however, AFFF has never been used in training at the facility. It is unknown whether the Salinas Fire Department stores AFFF at the fire station, trains with AFFF, or maintains firefighting vehicles capable of using AFFF. The Salinas Fire Department is located downgradient of the facility.

5.2 Puerto Rico Academy of Firefighters

The Puerto Rico Fire Academy of Firefighters is located south of Camp Santiago, approximately 1.5 miles southwest of the Camp Santiago entrance (17°58'16.20"N; 66°17'57.91"W). According to Camp Santiago personnel, the local fire departments from the surrounding municipalities occasionally train at Camp Santiago; however, AFFF has never been used in training at the facility. It is unknown whether the Puerto Rico Fire Academy stores AFFF at the fire station, trains with AFFF, or maintains firefighting vehicles capable of using AFFF. The Puerto Rico Fire Academy is also located downgradient of the facility.

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CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at Camp Santiago, PR			
REVISED	11/4/2019	GIS BY	MS	11/4/2019
SCALE	1:18,000	CHK BY	JW	11/4/2019
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,		PM	RG	11/4/2019

N

Adjacent Sources

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 5-1

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6. Preliminary Conceptual Site Model

Based on the PA findings, one AOI was identified at Camp Santiago: the Former Landfill. The AOI location is shown on **Figure 6-1**. The following sections describe the CSM components and the specific preliminary CSM developed for the AOI. The CSM identifies the three components necessary for a potentially complete exposure pathway: (1) source, (2) pathway, (3) receptor. If any of these elements are missing, the pathway is considered incomplete.

In general, the potential PFAS exposure pathways are ingestion and inhalation. Human exposure via the dermal contact pathway may occur, and current risk practice suggests it is an insignificant pathway compared to ingestion; however, exposure data for dermal pathways are sparse and continue to be the subject of PFAS toxicological study (National Ground Water Association, 2018). Receptors at Camp Santiago include site workers, construction workers, trespassers, and off-facility residents. The preliminary CSM diagram (**Figure 6-2**) for Camp Santiago indicates which specific receptors could potentially be exposed to PFAS.

6.1 AOI 1 Former Landfill

AOI 1 is the former landfill at Camp Santiago and is located west of the facility cantonment area (18°0'37.61"N; 66°18'12.05"W). The landfill was used primarily for the dumping of medical, household, and construction waste; however, infrequent open burning also occurred. Although no AFFF is suspected to have been disposed of at the former landfill, other PFAS-laden materials may have been. Detections of various PFAS compounds in groundwater used for drinking purposes at Camp Santiago indicate that a PFAS source is contributing to PFAS in groundwater. The landfill is located generally upgradient of the sampling locations, and is a potential PFAS source area.

Potential PFAS releases at the former landfill would have occurred within the landfill, not to surface soil. As such, surface soil at the AOI is not considered a complete pathway for PFAS contamination to site workers, construction workers, and trespassers. PFAS contamination exposure to construction workers via ingestion and inhalation of subsurface soil, however, is considered a potentially complete pathway.

The former landfill was located in an area of shallow, fractured rock with minimal soil, which can be conducive to leachate generation with excessive rainfall. The semiarid condition and frequent droughts in the region mitigate leaching from the former landfill; however, it is possible that PFAS in landfill materials have leached to groundwater at the AOI. As such, groundwater is considered a potentially complete pathway for PFAS contamination exposure to site and construction workers via ingestion. Additionally, numerous domestic-use wells exist within the cross- and down-gradient portions of Salinas. If AFFF releases at the AOI infiltrated the subsurface, the pathway for off-facility resident exposure to PFAS in groundwater is also considered potentially complete.

AOI 1 is also located adjacent to a small stream that discharges to the Río Nigua, south of the facility. As a result, it is possible that PFAS in groundwater discharging to surface water have migrated into the small stream, the Río Nigua, and the Caribbean Sea south of the facility. As such, the pathway for PFAS exposure to site workers, construction workers, and trespassers via ingestion of surface water and sediment is considered potentially complete.

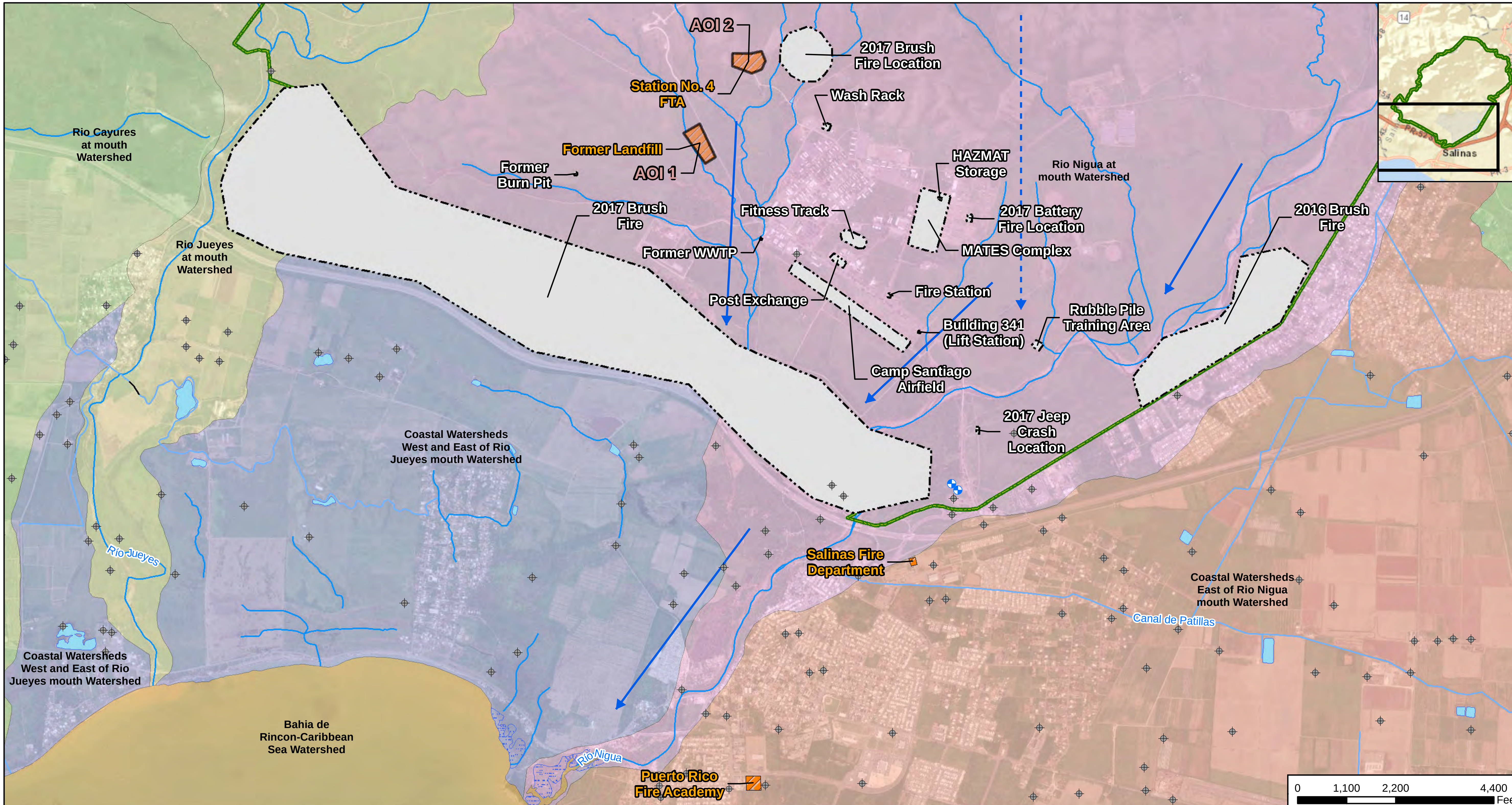
6.2 AOI 2 Station No. 4 FTA

AOI 2 is the Station No. 4 FTA and is located northwest of the cantonment area at Camp Santiago, (18°0'56.18"N; 66°18'1.53"W). The FTA is used for fire training by the Camp Santiago Fire Department, as well as other DoD and non-DoD units. The FTA compound includes several structures used for storage and training. Although there is no known or recorded use of AFFF at the FTA, it is possible that AFFF has been used at the FTA by non-DoD units without the knowledge of the PRARNG personnel interviewed for this PA.

If AFFF was sprayed during fire training, remnant AFFF is possibly present in surface soil at the AOI. PFAS contamination exposure to site workers and construction workers via ingestion of surface soil and inhalation of dust is considered a potentially complete pathway. Ingestion of surface soil is also considered a potentially complete pathway for trespassers to the area. Additionally, PFAS exposure to construction workers via ingestion of subsurface soil is considered a potentially complete pathway.

As previously stated, PFAS has been detected in groundwater at Camp Santiago. If AFFF was used at AOI 2, it may have leached from subsurface soil to groundwater. Groundwater is considered a potentially complete pathway for PFAS exposure to site and construction workers, and off-facility residents via ingestion.

Two small streams exist within 0.2 miles of AOI 2. It is possible that remnant AFFF has migrated to the small streams. As such, the pathway for PFAS exposure to site workers, construction workers, and trespassers via ingestion of surface water and sediment is considered potentially complete.



CLIENT	ARNG				
PROJECT	Preliminary Assessment for PFAS at Camp Santiago, PR				
REVISED	1/9/2020	GIS BY	MS	1/9/2020	
SCALE	1:26,400	CHK BY	JW	1/9/2020	
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c)		PM	RG	1/9/2020	

Area of Interest
Potential PFAS Release
No Suspected Release
Facility Location
Water Body
Wetland
River/Stream
Canal/Ditch
Surface Water Flow Direction
Inferred Groundwater Flow Direction
Potable Well
Other/Unknown Well

N

Areas of Interest

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-1

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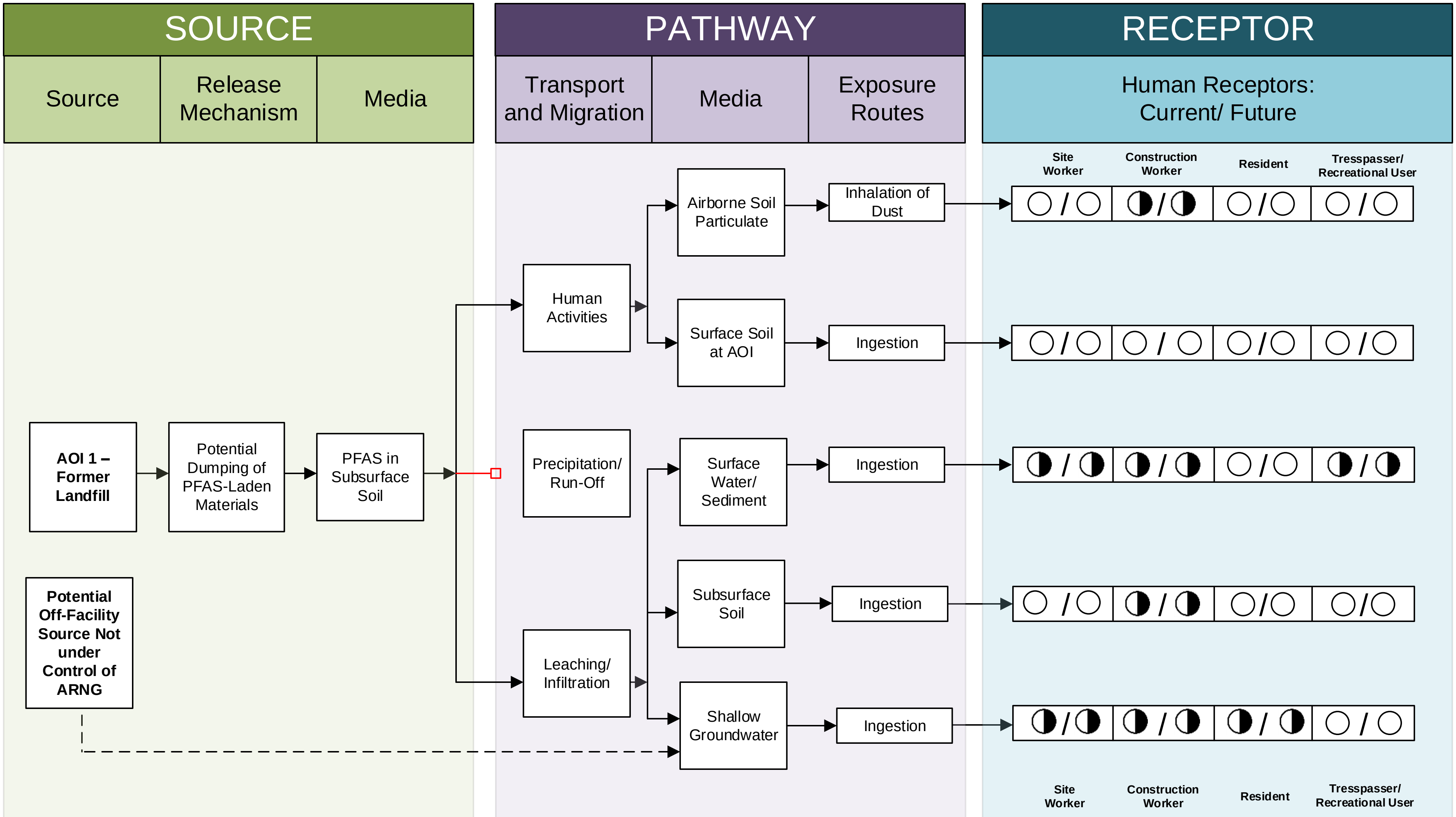


LEGEND

Flow-Chart Stops

Flow-Chart Continues

Partial / Possible Flow

Incomplete Pathway

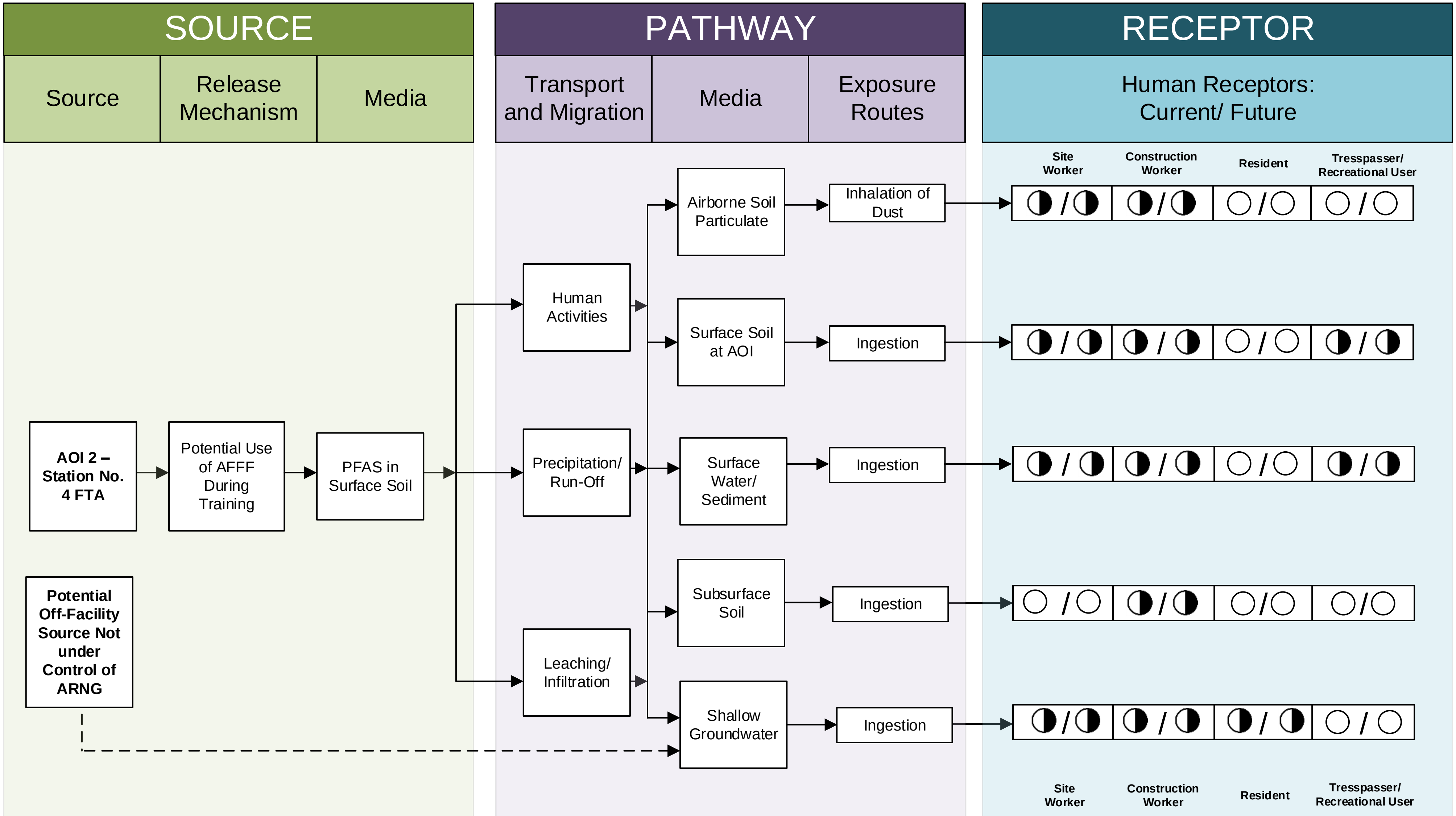
Potentially Complete Pathway

Complete Pathway

Notes:

1. The resident and recreational user receptors refer to an off-site resident and recreational user.
2. Dermal contact exposure pathway is incomplete for PFAS.

Figure 6-2
Preliminary Conceptual Site Model
AOI 1 – Former Landfill



LEGEND

- Flow-Chart Stops
- Flow-Chart Continues
- Partial / Possible Flow
- Incomplete Pathway
- Potentially Complete Pathway
- Complete Pathway

Notes:

1. The resident and recreational user receptors refer to an off-site resident and recreational user.
2. Dermal contact exposure pathway is incomplete for PFAS.

Figure 6-3
Preliminary Conceptual Site Model
AOI 2 – Station No. 4 FTA

7. Conclusions

This report presents a summary of available information gathered during the PA on the use and storage of AFFF and other PFAS-related activities at Camp Santiago. The PA findings are based on personnel interviews, environmental investigations and reports, historical documents, and the visual site inspection (**Appendix A** and **Appendix B**).

7.1 Findings

Two AOIs related to potential PFAS releases were identified at Camp Santiago based on PA data (**Figure 7-1**) and are summarized in **Table 7-1** below:

Table 7-1: AOIs at Camp Santiago

Area of Interest	Name	Used by	Potential Release Dates
AOI 1	Former Landfill	PRARNG	Unknown - 1993
AOI 2	Station No. 4 FTA	PRARNG, Other DoD and non-DoD Units	Unknown (2012-present)

Based on the possible PFAS releases at these AOIs, there is potential for exposure to PFAS contamination in media at or near the facility. The preliminary CSM for Camp Santiago is shown on **Figure 6-2**.

The following areas discussed in **Section 2** through **Section 5** were determined to have no suspected release and are described in **Table 7-2** below:

Table 7-2: No Suspected Release Areas

No Suspected Release Area	Used by	Rationale for No Suspected Release Determination
Fire Station	PRARNG	According to interviewees, no AFFF has been used at the fire station, and no trucks have a history of leaking. Maintenance is performed at the MATES Complex.
Rubble Pile Training Area	PRARNG/ Other DoD and non-DoD Units	According to interviewees, no AFFF has been used at the Rubble Pile Training Area.
Camp Santiago Airfield	PRARNG	Usage of the airfield ceased prior to the presence of AFFF at Camp Santiago.
MATES Complex	PRARNG	According to interviewees, no AFFF has ever been used or stored at the MATES Complex, and no firefighting vehicles have had releases of AFFF.
HAZMAT Storage Area	PRARNG	According to interviewees, no AFFF has ever been used or stored at the HAZMAT Storage Area.
Wash Rack	PRARNG	According to interviewees, no AFFF is stored or used at the Wash Rack, and no vehicles carrying AFFF have a history of leaking.
Fitness Track	PRARNG	According to interviewees, No AFFF has ever been stored or used at the Fitness Track.

No Suspected Release Area	Used by	Rationale for No Suspected Release Determination
Post Exchange	PRARNG	No AFFF has ever been stored or used at the PX.
Former WWTP	PRARNG	No known releases of AFFF or other PFAS-laden materials have occurred in areas that would result in migration to the former WWTP.
Emergency Response Areas	PRARNG	According to interviewees, no emergency areas at Camp Santiago have been responded to with AFFF.

7.2 Uncertainties

A number of information sources were investigated during this PA to determine the potential for PFAS-containing materials to have been present, used, or released at the facility. Historically, documentation of PFAS use was not required because PFAS were considered benign. Therefore, records were not typically kept by the PRARNG on the storage of AFFF or on its disposition. There is no known history on the use of AFFF at Camp Santiago, but it is also unlikely that records would have been kept in the event of use.

The conclusions of this PA are predominantly based on the information provided during interviews with personnel who had direct knowledge of PFAS use at the facility. Sometimes, the provided information was vague or conflicted with other sources. Gathered information has a degree of uncertainty due to the absence of written documentation, the limited number of personnel with direct knowledge, the time passed since PFAS were first used by the ARNG (1969 to present), the time passed since AFFF arrived at Camp Santiago (2007 to present), and a reliance on personal recollection. Inaccuracies may arise in potential PFAS storage locations. There is also a possibility the PA has missed a source of PFAS, as the science of how PFAS may enter the environment continually evolves.

In order to minimize the level of uncertainty, readily available data regarding storage of PFAS were reviewed, tenured personnel were interviewed, multiple persons were interviewed for the same potential source area, and potential source areas were visually inspected.

Table 7-3 summarizes the uncertainties associated with the PA:

Table 7-3: Sources of Uncertainty

Location	Source of Uncertainty
Station No. 4 FTA	The use of the FTA by non-PRARNG units is undocumented, and may be unsupervised by PRARNG personnel at times. It is unknown whether any non-PRARNG unit has ever used AFFF at the FTA.
Fire Station	The capabilities and contents of one of the Fire Department vehicles is unknown.
Former Burn Pit	The exact timeframe of use and location of the Former Burn Pit is unknown.
MATES Complex	Records of maintenance to Fire Department vehicles are not available. The frequency and nature of maintenance to the vehicles is unknown.
Former Landfill	The dates of use for the Former Landfill are unknown. The potential PFAS-laden waste materials disposed of at the landfill are unknown.

Groundwater (general)	Because no known PFAS releases have occurred at Camp Santiago, the source of PFAS in groundwater is unknown. It is possible that an adjacent area, or PFAS-laden materials in the plumbing system may be the source of PFAS detections.

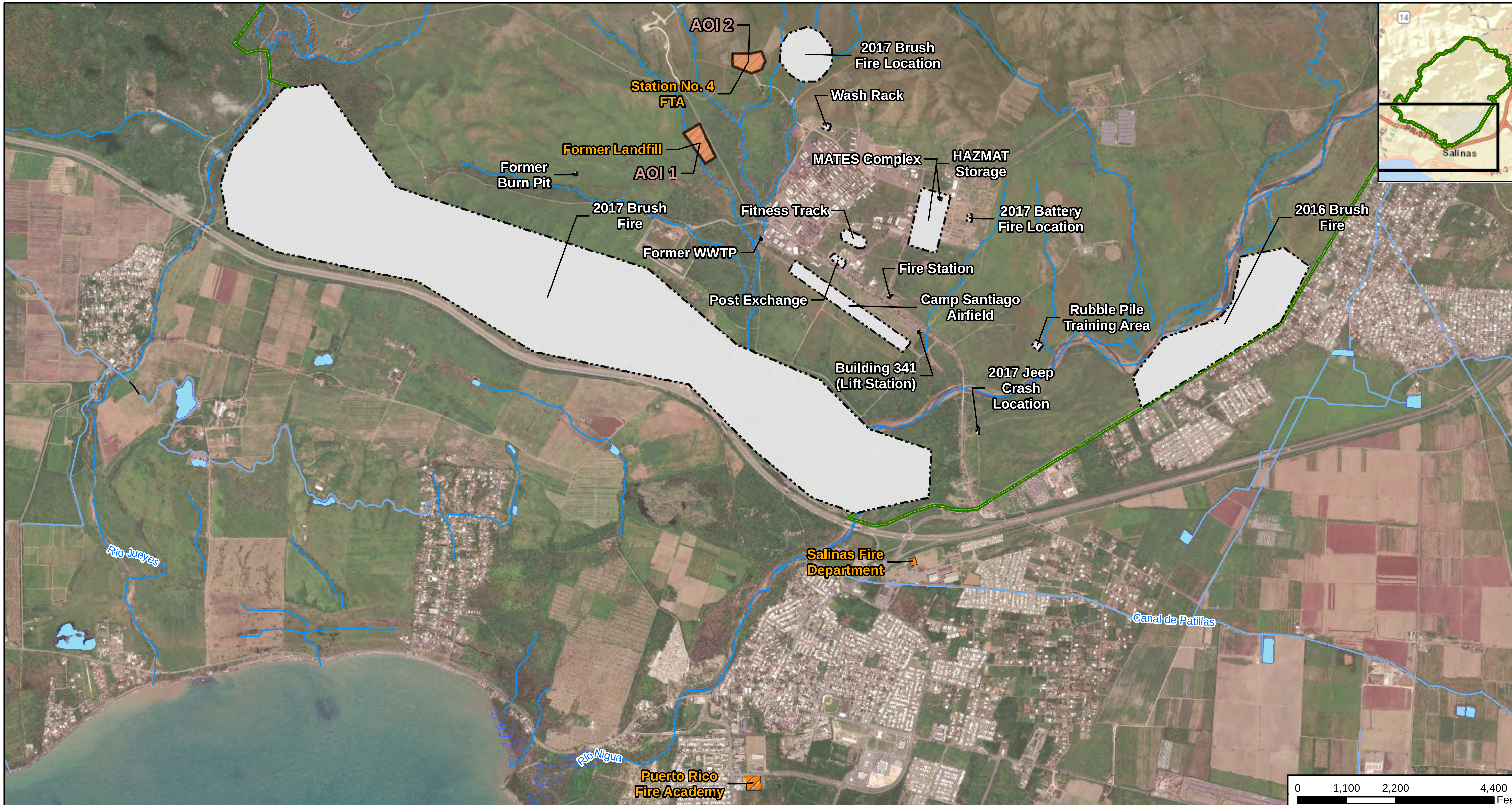
7.3 Potential Future Actions

Interviews with Camp Santiago staff whose first-hand knowledge span the entire history of the presence of AFFF on the facility (2007 to present), and date back to 1994 with the PRARNG, indicate that ARNG activities have not resulted in the release of AFFF at Camp Santiago; however, disposal of other PFAS-laden materials at the Former Landfill may have resulted in a potential PFAS release at one AOI identified during the PA. Based on the preliminary CSM developed for the AOI, there is potential for PFAS to be exposed to human receptors as a result of releases at Camp Santiago (see **Section 7.1**). **Table 7-4** summarizes the rationale used to determine if the AOI should be considered for further investigation under the CERCLA process and undergo an SI.

Table 7-4: PA Findings Summary

Area of Interest	AOI Location	Rationale	Potential Future Action
AOI 1 Former Landfill	18°0'37.61"N; 66°18'12.05"W	Waste deposited has the potential to contain PFAS, and PFAS has been detected in groundwater at the facility	Proceed to an SI, focus on soil, sediment, surface water, and groundwater
AOI 2 Station No. 4 FTA	18°0'56.18"N; 66°18'1.53"W	PRARNG and other DoD and non-DoD units use the AOI as an FTA. Undocumented AFFF use may have occurred.	Proceed to an SI, focus on soil, sediment, surface water, and groundwater

ARNG will evaluate the need for an SI at Camp Santiago based on the potential receptors, the potential migration of PFAS contamination off the facility, and the availability of resources.



CLIENT	ARNG			
PROJECT	Preliminary Assessment for PFAS at Camp Santiago, PR			
REVISED	1/9/2020	GIS BY	MS	1/9/2020
SCALE	1:26,400	CHK BY	JW	1/9/2020
Base Map: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c)		PM	RG	1/9/2020

Area of Interest
Potential PFAS Release
No Suspected Release
Facility Location
Water Body
Wetland
River/Stream
Canal/Ditch

N

Summary of Findings

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 7-1

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Appendix A
Data Resources

Data Resources will be provided separately on CD. Data Resources for Camp Santiago includes:

Camp Santiago Information Sources

- 1985 Camp Santiago, Puerto Rico Environmental Management and Analysis Plan, Phase II Environmental Assessment
- 2005 Integrated Natural Resources Management Plan for the Camp Santiago Training Center

Camp Santiago EDR Report

- 2019 Camp Santiago EDR Report 5714997

Camp Santiago Firefighting Material Information

- 2019 Chemguard C303 3% AFFF (C303P) Safety Data Sheet
- 2019 Chemguard 3% AFFF C306-MS-C Safety Data Sheet
- Buckeye A-150-SP ABC Dry Chemical Wheeled Stored Pressure Fire Extinguisher Information Sheet

Camp Santiago Previous PFAS Investigations

- 2017 ARNG Drinking Water PFAS Analytical Data

Camp Santiago Real Property Documents

- 2004 Amendment No. 11 to License No. DACA17-3-67-3002 for Camp Santiago Military Reservation, Salinas, Puerto Rico

COMMONWEALTH OF PUERTO RICO
NATIONAL GUARD
THE ADJUTANT GENERAL'S OFFICE
P. O. BOX 3786 — SAN JUAN, PUERTO RICO 00904

ADDRESS ALL OFFICIAL COMMUNICATIONS TO THE ADJUTANT GENERAL

TELEPHONE ______________

NOTICE OF FINDING OF NO SIGNIFICANT IMPACT

An Environmental Assessment (EA) entitled "Camp Santiago, Puerto Rico, Environmental Management Analysis and Plan (EMAP), Phase II" has been prepared for the analysis of the environmental impacts of ongoing and proposed activities at Camp Santiago, Salinas, Puerto Rico.

Based on this EA, a Finding of No Significant Impact has been prepared which summarizes the ongoing and proposed activities and sets forth the reasons why an Environmental Impact Statement will not be prepared.

The public is invited to review and comment on both the EA and the FNSI.

These documents may be reviewed at:

Puerto Rico National Guard
Engineering Division
Stop 3 1/2, Puerta de Tierra
San Juan, Puerto Rico

between the hours of 8:00 A.M. to 3:30 P.M., Monday to Friday.

Also, a limited number of the documents are available for mailing to interested persons by writing the above address or by calling (809) 724-3321. The point of contact is CPT José A. Fernández.

Written, substantive comments received at the above address within 14 days of the published notice will be made a part of the EA.

Approved for Release:

ALFREDO J. MORA
MAJOR GENERAL (PR) PRARNG
The Adjutant General

file

200-AVISOS

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ALFREDO J. MORA, MG
The Adjuntant General

CAMP SANTIAGO, PUERTO RICO

ENVIRONMENTAL MANAGEMENT ANALYSIS AND PLAN (EMAP)

PHASE II

ENVIRONMENTAL ASSESSMENT

APRIL 1985

1. Executive Summary .

The focus of this Phase II, Environmental Management Analysis and Plan (EMAP), Environmental Assessment for Camp Santiago is to provide, in a single format, as much base line information as possible, as well as an Environmental Assessment of environmental impacts and recommendations for their mitigation. This Environmental Assessment will be submitted to the Puerto Rico Army National Guard for their use as a management tool. Information presented here was gathered during site visits in June-July of 1981 and supplemented during the fall 1981 and spring 1982. The EMAP concept and phasing is fully described in a subsequent section.

Baseline data, impacts, and mitigation measures discussed in this Environmental Assessment pertain to the following areas: air quality, noise pollution, soils, natural resources, land use, pesticides, waste disposal, water resources, cultural and economic resources, and energy. Below follows a summary of major environmental impacts identified.

Ongoing activities are not significantly affecting regional air quality. Dust made airborne through training activities occasionally causes localized dust problems. Noise generated by aircraft and training activities is not currently affecting the aesthetic environment of nearby communities. The primary impact on soils pertains to increased erosion from training activities. Impacts to ecological resources include disturbances of vegetation (wildlife habitat), and distrubances of wildlife within the boundaries of Camp Santiago. training activities contribute to both of these, while wildfires started either spontaneously or indirectly from training contribute to vegetation disturbance. The existence of Camp Santiago has not affected local land use.

Impacts to hydrological resources result in a potential for groundwater depletion and point source discharges to surface waters. These impacts result mainly from operation and maintenance activities on Camp Santiago. Impacts of ongoing activites on cultural, archeological and historical resources is not known at this time. Literature and field studies are currently underway. Ongoing procurement activities, including wages and salaries, are having a very positive effect on the economy of the Salinas municipality. Energy consumption at Camp Santiago is small compared to other military installations.

<u>Major Conclusion</u> . Ongong training activities, and operation and maintenance of Camp Santiago are not adversely affecting the environment. No significant areas of controversy have been identified. However, mitigative policies have been recommended and should be established in response to those environmental impacts which have been identified.

2.

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3. EMAP Concept and Need .

The Army National Guard's mission is to train and maintain ARNG units at a high level of mobilization/combat readiness to support the National Defense policy and the constitutional role of the States. An important factor in reaching a high level of readiness is the training objectives established by DA and maintained by the ARNG.

In order to obtain and maintain ARTEP level 1/Readiness Condition 1 viable training sites must be properly managed to ensure an effective and realistic training environment, not only for ongoing training but for further utilization.

If existing training sites are severely damaged by training which is not sensitive to environment and natural resource concerns, the training sites could be damaged to such an extent that they no longer provide a needed training environment.

A dynamic environmental management program is needed to analyze potential environmental impacts of ongoing training activities to ensure effective training sites in the future. The ARNG Environmental Resources Branch has developed the Environmental Management Analysis and Plan (EMAP) for selected major training sites. The EMAP will provide environmental baseline data which can be used as a management tool for: (a) identifying potential existing environmental pollution sources, (b) identifying and describing the existing environment, (c) determining the compliance status of ongoing activities, (d) indicating facilities and routine activities which impact on environmental attributes, (e) analyzing the significance of impact relationships between existing facilities, routine activities, and environmental attributes, and (f) proposing a plan to mitigate identified adverse environmental impacts and to provide a clear understanding of environmentally sensitive issues (potential problems).

EMAP is not a single document resulting from a proposed scope of work. Instead it is a four phased approach towards data collection, synthesis, manipuation, and analyses resulting in various products which can stand alone or be used in concert with each other creating a more indepth environmental management tool (Figure 1). Decision points are provided at the end of each EMAP phase prior to the initiation of the next phase. The purpose of these decision points is to evaluate the conclusions and recommendations generated by the previous phase(s) and to coordinate with the State/Territory ARNG on appropriate and desired follow-up actions. In addition, this process will allow the Environmental Resources Branch to evaluate the effectiveness of the EMAP Program at a specific ARNG training site.

EMAP CONCEPT

PROCESS WITH VARIABLE PRODUCTS

4 PHASES:

- PHASE I (SITE VISIT) TRIP REPORT (FOLLOW-UP)

  "DECISION POINT" *

- PHASE II (ENVIRONMENTAL ASSESSMENT)

  FORMAL DOCUMENT

  "DECISION POINT"

- PHASE III (COMPUTER MGT SYSTEM)

  DATA FILE (GRAPHICS)

  "DECISION POINT"

- PHASE IV (INTEGRATE WITH MOB & EEWS, DATABASE EXPANSION/UPDATE)

* DECISION POINTS = NGB/STATE ARNG COORDINATION & AGREEMENT

FIGURE 1

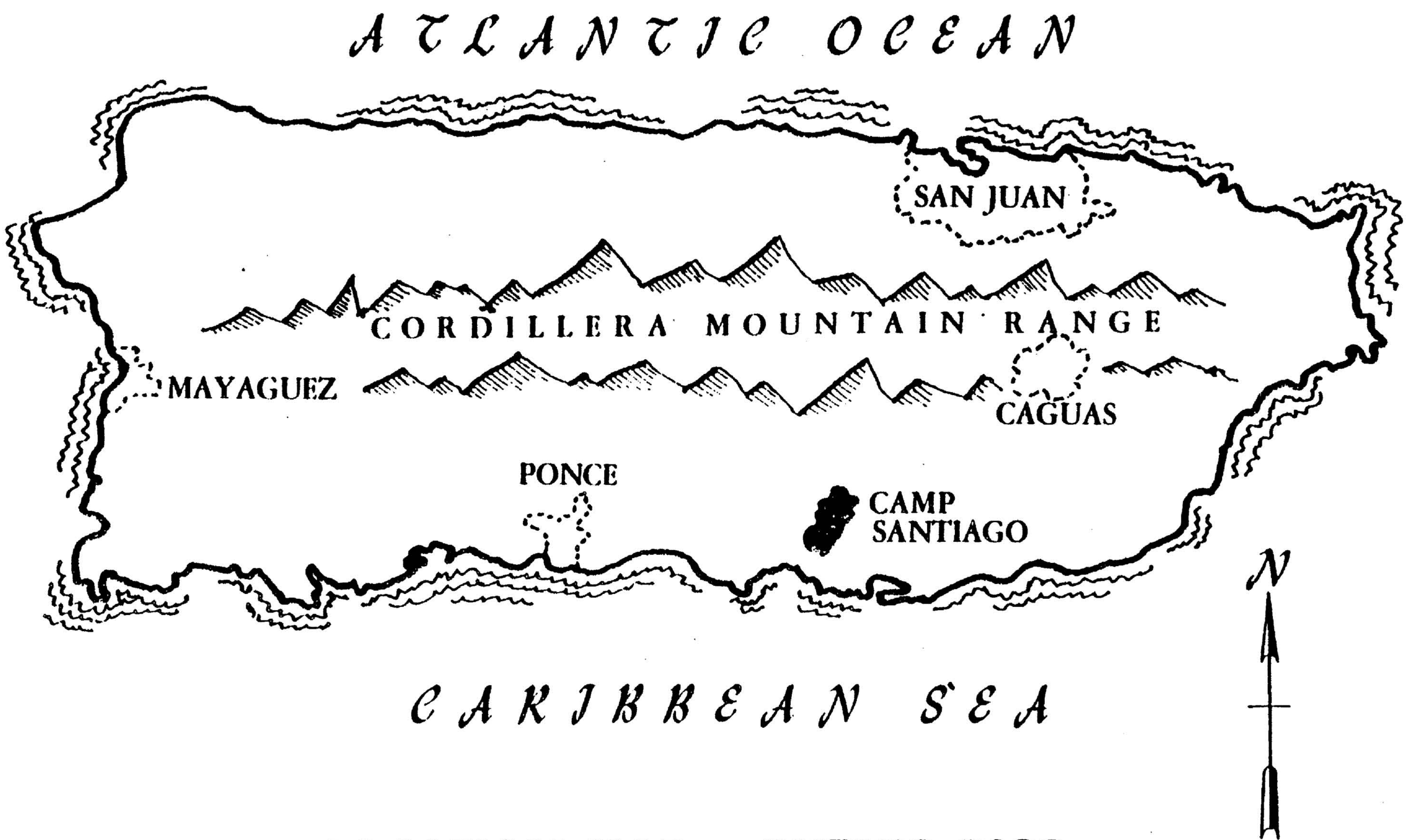
The EMAP also contains several computer generated maps which were developed by the US Army Corps of Engineers, Construction Engineering Research Laboratory. These graphics are a integral part of the installation data base, allowing planners to plot training scenarios and other activities against specific environmental attributes such as soils or vegetation in order to predict impacts. The computerized data base will also serve as a locational tool to help find the least sensitive areas for sitting construction and training activities or other land uses.

The Phase II EMAP Environmental Assessment is designed for extended use as an updateable source of environmental data for Camp Santiago. It is intended to provide ready access to and easy update of the various information sections. The notebook binding allows for the replacement of outdated pages, inclusion of new or updated data and the removal of individual sections for distribution or special actions.

Each media section can stand alone as an environmental evaluation of Camp Santiago, and can quickly be referred to for identifying existing conditions and impacts, as well as evaluating the compliance status utilizing conclusions and recommendations.

The Summary of Environmental Status section is a synopsis of Camp Santiago's environmental status. This section contains a summary of mitigative measures which should be initiated not only to ensure compliance with applicable environmental laws and regulations, but also to provide guidance for the proper management of the Camp's environmental resources towards continued maximum utilization. Recommendations are restated to provide a quick referral against the mitigative measures. This section is intended to serve as a culmination of all environmental non-compliances, including recommended corrective measures.

Appended to the text of the EMAP Environmental Assessment, and an integral part of the Phase II EMAP, are the various media studies which, in themselves, provide additional environmental data. As future studies are completed, media sections should be rewritten and the actual study itself appended to the EMAP Environmental Assessment. In this manner the entire Phase II EMAP Environmental Assessment is continuously updated and current.



LOCATION MAP — PUERTO RICO

FIGURE 2

Scale:
0 miles 13

4. Description of the Action.

4.1 Installation of Description.

4.2 Location.

Camp Santiago is located in the Salinas municipality of southern Puerto Rico approximately 16 kilometers west of Guayama and 4.8 kilometers northeast of the city of Salinas. The cities of San Juan and Ponce are located approximately 72 kilometers to the north and 35 kilometers to the west, respectively. The Commonwealth of Puerto Rico is the easternmost and smallest of the greater Antilles and is situated between Hispaniola to the west and the Virgin Islands on the east. The Atlantic Ocean borders the island on the north and east and the Caribbean Sea surrounds the south and west portions. Figure 2 shows the location of the Camp.

4.3 History.

Camp Santiago is the primary training site for the National Guard forces of Puerto Rico. The commonwealth has a rich tradition of a recognized citizen militia which dates back as far as 1510 when Don Juan Ponce de Leon organized the "Las Milicias Disciplinarias de Puerto Rico". The Salinas Training Area was purchased by the Federal government in 1940 from the Commonwealth. The Salinas Training area has been used actively for military training since 1967 and, on 1 July 1975, was renamed Camp Santiago in honor of Specialist 4 Hector Santiago Colon who was awarded the congressional medal of Honor posthumously for distinguishing himself by conspicuous gallantry in Vietnam. Camp Santiago is presently comprised of 12,739 acres of fee-owned lands that are licensed for use by the Puerto Rico National Guard. The United States has exclusive jurisdiction over 6,743 acres and concurrent jurdisdiction over 5,995 acres. Exclusive jurisdiction was vested with the United States in the present concurrent jurisdiction areas.

The Camp's training area was closed after World War II, but was reopened 1 July 1967 when it was licensed to Puerto Rico for National Guard training. In 1963, 1,360 acres were fee-transferred from the Department of the Army to the Department of the Navy which operates a communication center on the site.

4.4 Mission.

Camp Santiago is the only Commonwealth property available for the field training of various units of the Puerto Rico Army and Air National Guard. Additionally, units of the US Army Reserve located in Puerto Rico and National Guard units of the Virgin Islands utilize the Camp's facilities throughout the year along with ROTC and regular Army units, the US Marine Corps, the Boy Scouts, and the FBI and Federal Marshalls. The primary mission of the installation and its training site headquarters is to provide the most suitable training area possible where various military training activities can be performed and weapons systems utilized to ensure the readiness and military capability of the reserve components of the armed forces of the United States and Puerto Rico. Training facilities at Camp Santiago have been tailored to the training requirements of units assigned to the Puerto Rico National Guard and other military and non-military units. The installation also has the mission of being the operations center/mobilization station when National Guard troops are activated for national and Commonwealth emergencies. A complete Mission statement of Camp Santiago is found at Appendix I.

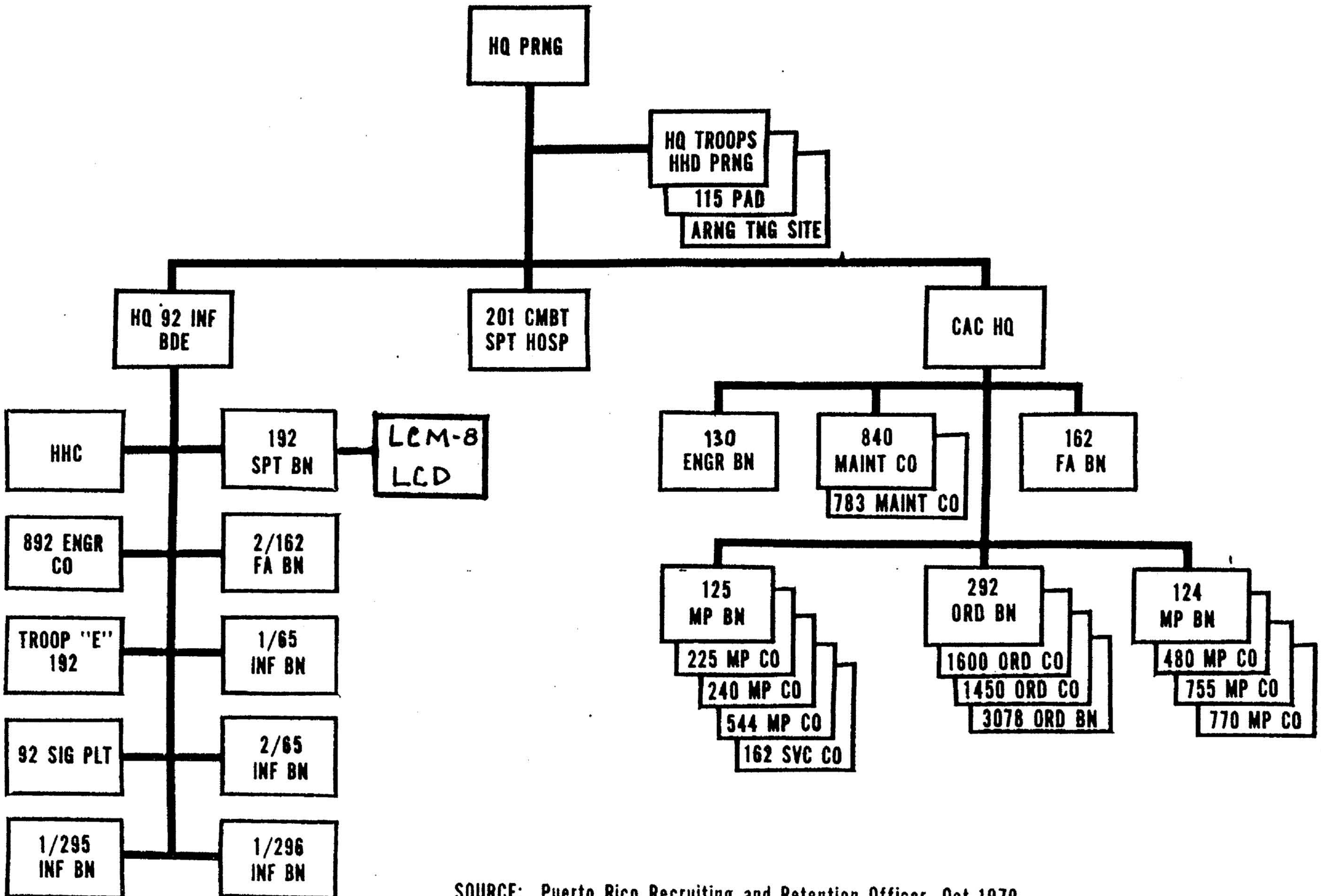
4.4.1 Staff Elements.

4.4.1.1 Puerto Rico Army National Guard (PRARNG).

The PRARNG is composed primarily of a light infantry brigade, a combat support hospital and supporting units. Figure 3 illustrates the organizational structure of the PRARNG.

ORGANIZATION STRUCTURE

PUERTO RICO NATIONAL GUARD



SOURCE: Puerto Rico Recruiting and Retention Officer, Oct 1979

FIGURE 3

Appendix II identifies the strength and location of each PRARNG unit. There are over 9,000 personnel assigned to the various units located at armories throughout the Commonwealth. Specific to Camp Santiago is the 92d Infantry Brigade with its supporting units which are structured to function independently of other tactical units, and consequently has a larger force structure than a typical Infantry Brigade. Major Brigade units include four Infantry Battalions (3 organic, 1 inorganic), the 892d Engineer Company, the 192d Support Battalion and the 2/162d Field Artillery Battalion. Other units which train at Camp Santiago include the 130th Enigneer Battalion, Military Police Battalions, a Command and Control Unit (maintenance/supply units), the Combat Support Hospital and a Field Artillery Battalion. A list of the weapons used by the Infantry Brigade is Table 1. Vehicles assigned to the maneuver, combat support, and service support battalion include various 1/4, 1/2, 2 1/2 and 5 ton trucks suited for off-road use. These vehicles are utilized to tow equipment, and to transport personnel and supplies, including food, water, ammunition and petroleum. The cavalry troop is assigned 9 tanks, 13 armored personnel carriers and 1 recovery vehicle. All of these vehicles are tracked as opposed to wheeled. There are 20 helicopters assigned to the brigade: 11-UHI, and 9-OH6. Two fixed wing aircrafts also utilize Camp Santiago: a C7A (Caribou) and a U8. Construction equipment is characteristic of the Engineer Battalion and its subordinate engineering companies, i.e., dump trucks, motor graders and bulldozers.

TABLE 1

WEAPONS USED BY LIGHT INFANTRY BRIGADE (-)

Camp Santiago, Puerto Rico

Unit NO. TOE	HHC CO 1 77-102-H	Armored Cav TROOP 1 17-117-H	Engr Co 1 5-207-H	Spt Bn 1 29-245-H	FA Bn 1 6-115-H	Inf Bn 1 7-175-H	Bde 1 77-100-H
Armd Recon Airborne Asslt Veh		6					6
TOW, Launcher						36	36
Howitzer, 105mm					18		18
Launcher, grenade 40mm	12	20	20	5	18	146	221
Launcher, rocket, multiple, 115mm					3		3
Launcher, rocket, 66mm, 4 Tube		3				18	21
Machine gun, cal .50		7		1			8
Machine gun, 7.62mm	2	19	7	8	29	40	105
Mortar, 81mm		3				26	29
Pistol, cal .45	34	33	2	35	19	264	387
Revolver, cal .38	22						22
Rifle, 5.56mm	191	111	168	414	458	1,366	2,708
Submachine gun, cal .45		14		2			16

SOURCE: FM 101-10-1, Staff Officers Field Manual organizational, Technical and Logistic Data, July 1976 with C-1.

4.4.1.2 Puerto Rico Air National Guard (PRARNG).

The PRARNG is composed of the 156th Tactical Figher Group, the 198th Tactical Fighter Squadron and supporting units. Aircrafts are parked and maintained at the Muniz Air National Guard Base which is located near San Juan, Puerto Rico.

There are 18 A7 Corsair II aircraft in the figher squadron which utilizes the bombing range located within the impact area at Camp Santiago. The Air Guard's usage of the range averages about 17 days a month throughout the year with 2,012 sorties being flown during 1980. A sortie is a mission of a single aircraft over the training areas which usually requires about 20 minutes for the pilot to complete his training tasks. Four events are included in each sortie, each event being carried out twice.

Each sortie includes the following:

1. Low Angle Bombing (91m minimum)
2. Low Angle Low Drag Bombing (305m minimum)
3. Dive Bombing at 30^{o} (457m minimum)
4. Stafing Passes (30m minimum)

During daytime operations, a 25 pound inert bomb is dropped on each of 6 separate passes over the range. These dummy bombs have a small spotter charge which releases white smoke upon impact with the ground. In addition to the bombing passes, pilots make 2 strafing passes where a total of 125 rounds of 20mm inert ball ammunition is fired from the Vulcan cannon of the aircraft.

Aircraft personnel conduct their training activities at Camp Santiago in the FAA approved restricted area R-7103A and fly to and from the Camp in the Salinas Military Operation Area (MOA). Controlled airspace in the MOA limits aircraft to fly between 760 and 4,572 meters daily from 0800 to 2000 hours. Most of the sorties conducted at Camp Santiago occur during the daytime and require from 20-30 minutes. Night-time operations normally require about 10 minutes, as fewer bombing passes and no strafing passes are made. Figures 4 and 5 show the authorized flight pattern of aircraft within the 7103A restricted air space over Camp Santiago for the normal bombing and strafing passes and for the pop-up bombing/strafing passes respectively.

4.4.1.3 US Army Reserves (USAR).

The USAR units of Puerto Rico are organized under the command and control of the 758th Army Garrison. The USAR with an approximate strength of 5,000 troops, includes the 35th Signal Battalion, the 346th Transportation Battalion, the 448th Engineer Battalion and the 369th Station Hospital. Each USAR battalion contains more than the usual number of organic company size units, i.e., the Engineer Battalion has 8 companies instead of 4. These additional units are assigned for administrative and training purposes. All of the USAR units have either combat support or combat service support missions. Camp Santiago is the primary training site for all USAR units in Puerto Rico. The USAR School teaches military occupational Specialty (MOS) courses at Camp Santiago during the Annual Training (AT) cycle. The training requirements for USAR units are the same as those descirbed for the PRARNG with similar missions, however, the direct USAR training impacts on the Camp's environment are somewhat different since there are no maneuver battalions associated with the USAR forces.

AIRCRAFT FLIGHT PATTERN — NORMAL BOMBING AND STRAFING PASS

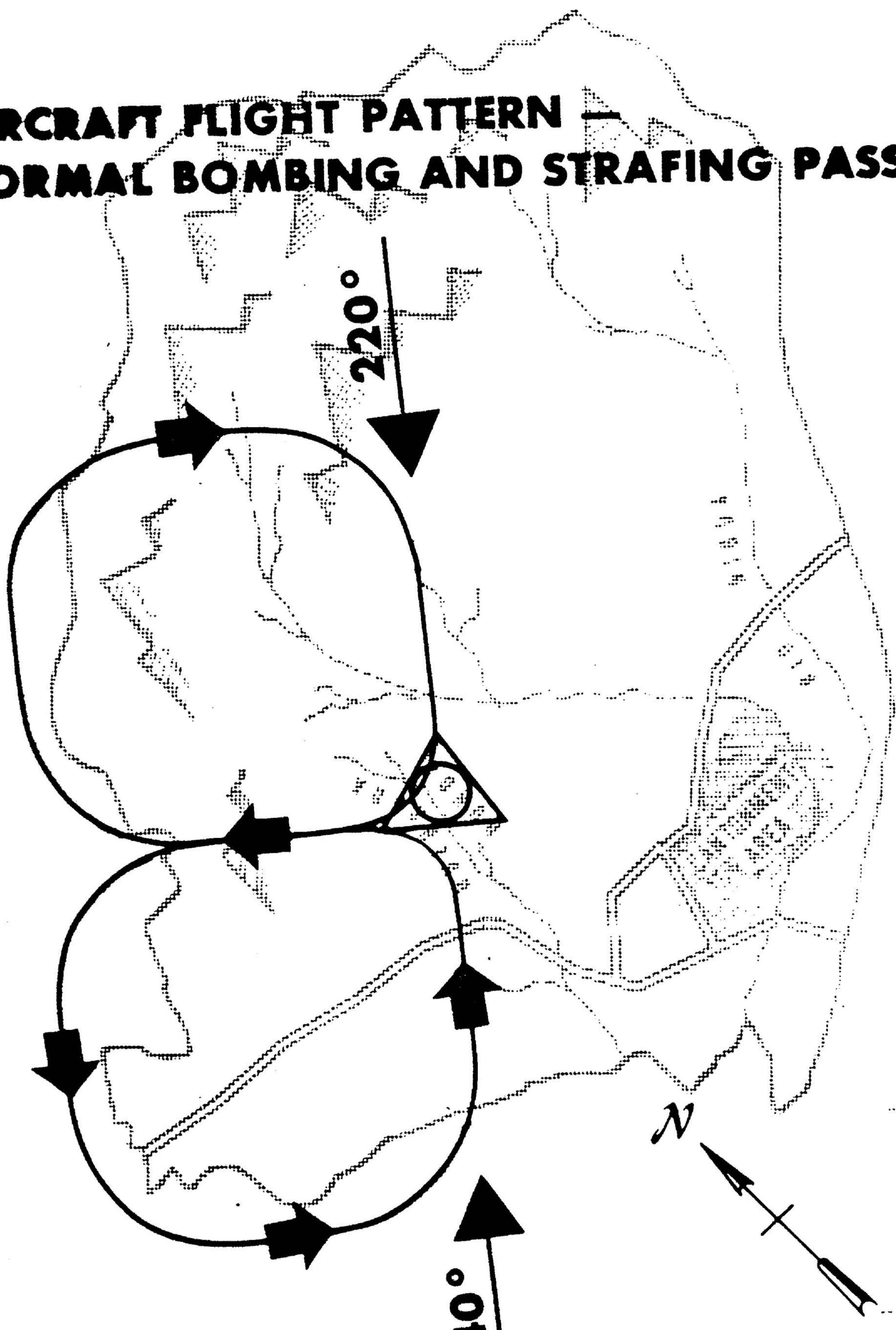


FIGURE 4

AIRCRAFT FLIGHT PATTERN — POP-UP BOMBING AND STRAFING PASSES

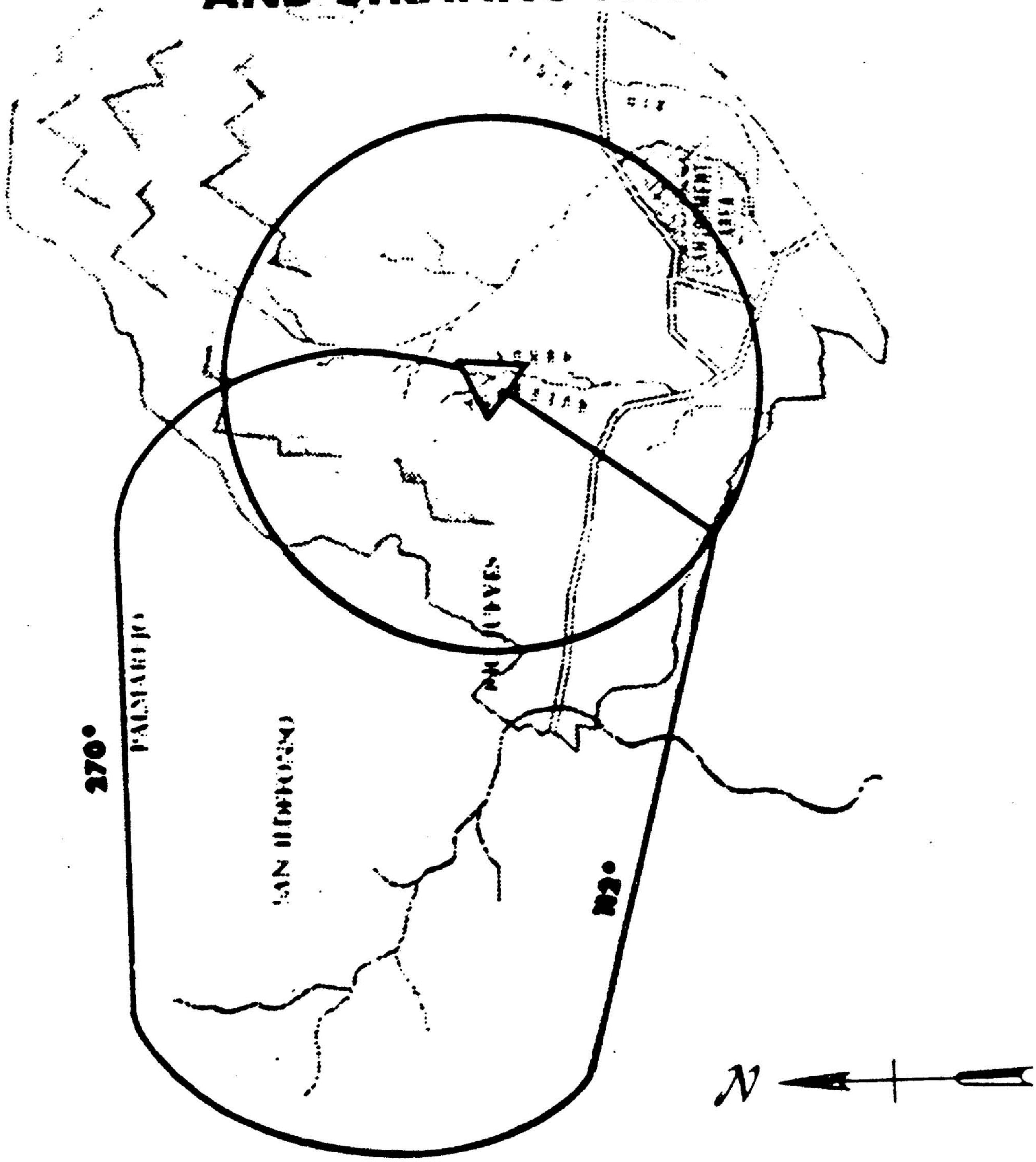


FIGURE 5

4.4.2 Training Areas and Activities.

4.4.2.1 Utilization of Post Lands.

Camp Santiago is divided into 16 training areas, a cantonment area, ammunition area, and airfield. Also located within the installation borders are a cattle holding area, the Navy's DCA antenna farm, and the impact area. Sixteen existing ranges utilizing various training areas direct fire into the impact area. Figure 6 identifies the various training areas as well as the 16 existing and 3 proposed ranges. The DCA antenna farm of the US Navy is off-limits to training.

The total area of the Camp available for training is apparently 11,577 acres; apportioned as follows:

AREAS	ACRES
Training	10,157
Cantonment	700
Ammunition (ASP)	120
Airfield	600
Impact	1,345

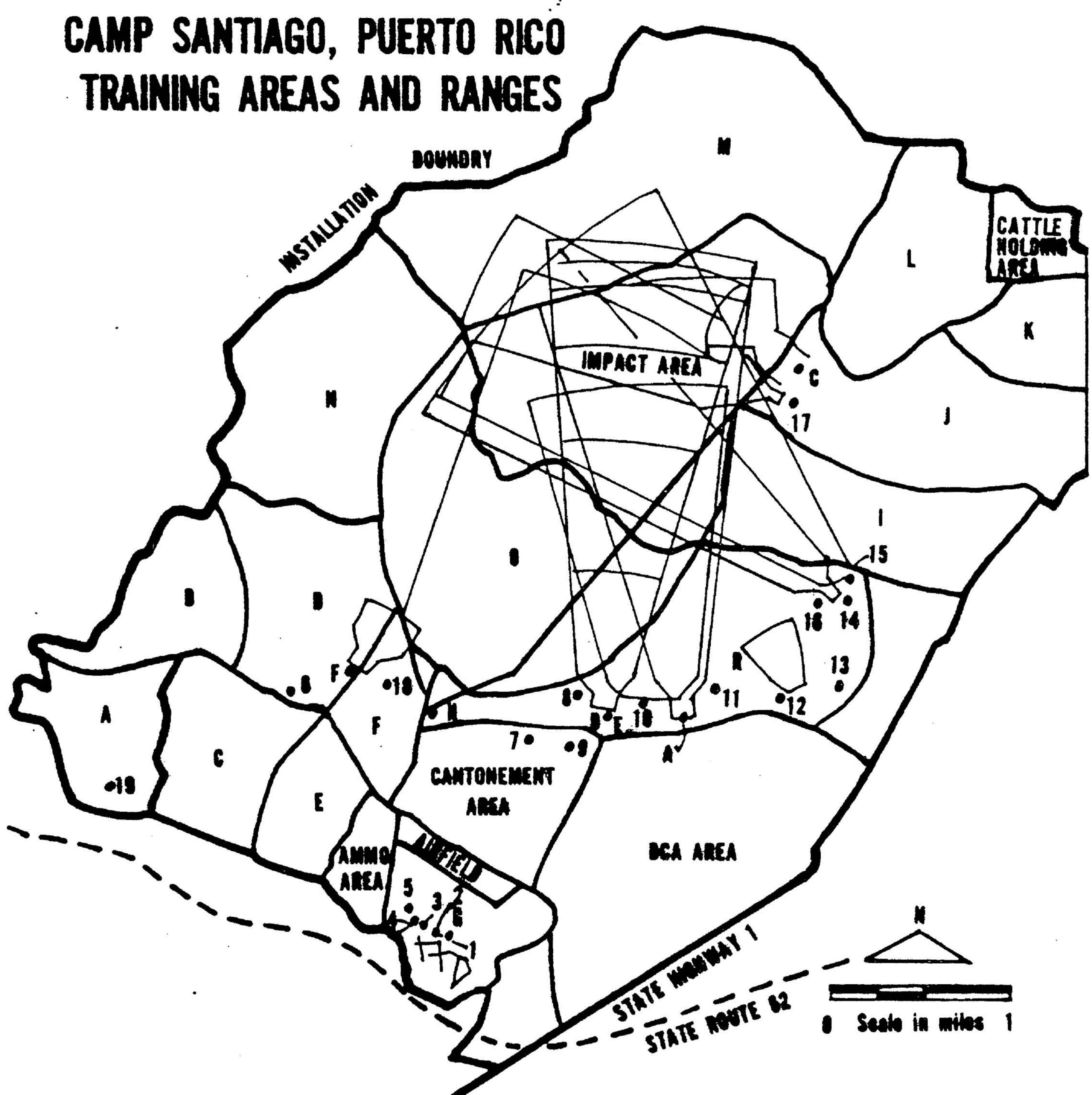
The actual acreage used for infantry training of the maneuver battalions is 7,406 acres due to safety restrictions associated with facilities and weapons systems, and the rugged nature of some of the mountainous terrain. Figure 6 also shows the safety fans associated with the Camp's 16 ranges. No other training is allowed within a range safety fan when that range is in use. Therefore, many designated training areas cannot be used when artillery and mortars are being fired. Table 2 describes the range complex.

TABLE 2

* EXISTING RANGES

Range #	Facility Type	Range Capacity (firing Point)
1	Tank Gunnery, 106mm R.C.L.R. Mgv & Sta 25m	2 FP
2	M60 7 Cal .50 Machine Gun (M6), 10M	10 FP
3	Pistol Range, .38 & .45 Cal	25 FP
4	Combat Pistol Range	Proposed
5	Skeet Range-Recreational	2 lanes
6	Transition & Moving Target, M60, Cal .50 MG	Proposed
7	Mini-Tank Range	-
8	Target Detection Range	25 FP
9	Known Distance Range	25 FP
10	25M M16 Range	100 FP
11	Modified Record Fire Range (MRF)	Proposed
12	Platoon Assault Course	1 Lane
13	M203 Grenade Launcher Range	4 FP
14	Direct Fire (105mm)/Field Firing	Proposed
15	Hand Greade Range	4 FP
16	M31 Artillery Trainer	12 FP
17	Anti-Tank Range	Proposed
18	Helicopter Gunnery Range	-
19	Demolition Range	4 lb.

* NOTE: Detailed descriptions of these ranges can be found in TC 25-2.



● **EXISTING or PROPOSED RANGES:**

A through R – Designated Training Areas

1	25M Subcal Range	8	Target Detection Range	15	Hand Grenade
2	10M Range	9	KD Range	16	M31 Arty Trainer
3	Pistol Range	10	25M Range	17	Anti-tank Range
4	Pistol Range	11	MRF	18	Helicopter Gunnery Range
5	Skeet Range	12	Platoon Assault Course	19	Demolition Range
6	Transition & Moving Target	13	M203 GL Range		
7	Minitank Range	14	Direct Fire, Field Firing		

FIGURE 6

Because of the limited maneuver area available, training areas can only support the training requirements of 2-3 battalions at a time (depending upon its size). Unit training is generally at the company and platoon level which maximizes the usage of a relatively small training area. Each type of military unit has a prescribed mission that requires certain Army Training and Evaluation Program (ATEP) mission tasks to be accomplished within a certain time interval in order to obtain or maintain a specified unit proficiency level. Missions for a light infantry brigade associated with the units of the PRARNG are listed in Appendix III. Almost all of these ARTEPs require foot soldiers to either attach or defend an objective, withdraw or delay, or provide direct or general support as a unit. Army training techniques are used to develop individual or team/unit proficiency. Examples of these techniques include battle tactical exercises without troops (TEWT), map maneuvers, field training exercises (FTX), and command post exercises (CPX). During most FTXs, battlefield conditions are simulated using blank ammunition, various types of simulator devices, i.e. booby trap simulators and artillery simulators. All of these result in minimum ground disturbance since training is dismounted except for the ARTEPs associated with the mechanized Cavalry Troop. Troops are prohibited from digging foxholes and from cutting trees or shrubs for camouflage. Troops bivouac in the training areas where mess facilities are established and field expedient latrines are constructed in accordance with FM 21-10, Field Hygiene and Sanitation.

Camp Santiago's 16 various training areas are utilized for directing fire into the impact area from the 19 desiginated ranges and the 18 surveyed firing points located throughout the Camp. Special training exercises are conducted at specific firing areas. Riot control (chemical tear agents) are used periodically in the training areas to evaluate the proficiency of units for fighting in a chemical environment. The Camp's gas chamber is used most frequently for protective mask confidence training.

Military communication systems are periodically jammed within various training areas using electromagnetic interference techniques. Other training areas may serve multiple training purposes. Close-in training include bivouac areas, road march areas, a compass course, an orienteering course, and a dirt air assault strip. A drop zone is used about once every other month by airborne units C130 and C141 aircraft. Use of these areas, as well as outside training areas, is scheduled with the Range Officer 30 days in advance of the training.

Soldiers are required to maintain proficiency with their individual assigned weapons by annual familiarization and record firing. Consequently, the small arms ranges are very active. The .45 caliber pistol range is the most active range since it is used almost every weekend by the National Guard Pistol Team.

Less frequently utilized ranges include a special mini-tank gunnery range which is used 4-6 weekends each year by the Cavalry Troop to simulate the firing of the main tank gun by using a .22 caliber weapon attached to the gun tube. Tank Tables I-III are fired on this range. The main gun of the tanks is fired 3 times each year at Camp Santiago (Table VI only). The helicopter gunnery range is used only twice a year during daylight hours. A demolition range is used by engineer battalions for the detonation of 2 pound charges.

In addition to the various ranges, there are 18 surveyed firing points located within various training areas throughout the Camp containing a circular safety fan 250m in diameter around each firing point. Mortars are fired from 6 of these locations. Twelve other firing points used for artillery firing are located primarily in the southwestern quadrant of the training area. The familiarization and record fire of artillery pieces and mortars requires the utilization of the 18 various firing ponts 6 weekends a year and 10 days during AT.

A Nap-Of-the Earth (NOE) helicopter course has been developed at Camp Santiago. This course is no closer than 200-500m from the reservation boundary. Figure 7 illustrates the NOE route. Except for NOE flying, and take-off and landing approaches, helicopter low-level flying is limited to an altitude of 152mm above the highest obstacle in the immediate area. The NOE course has had very little use during the past two years; increased use in projected in the future.

Table 3 is a summary of the various types and quantities of ordance used at Camp Santiago each year. Fire from all training areas, ranges and firing points is directed towards the impact area comprising approximately 1,300 acres and located in the center of the Camp. Aproximately 6,000 rounds from mortars and artillery pieces were exploded in the impact area in 1980, 20% of them at night. Most of the artillery rounds fired in 1980 were 105mm. In 1981, one of the artillery battalions had its 105mm towed howitzers replaced with 155mm towed howitzers. The utilization of the helicopter gunnery range results in 50 rockets being fired into the impact area. An Explosive Ordnance Disposal Team (EOD) comes to Camp Santiago monthly to explode in place any unexploded rounds which were fired into the impact area. There are two target areas registered and used by the engineer battalions within the impact area for the detonation of 15 pound shape charges and 40-pound cratering charges.

The cattle holding area in the northeast corner of the Camp is used by local livestock owners to pasture a small number of animals. This area was used for grazing before the military reservation was established. Current use has continued informally without grazing easements or other agreements governing its use.

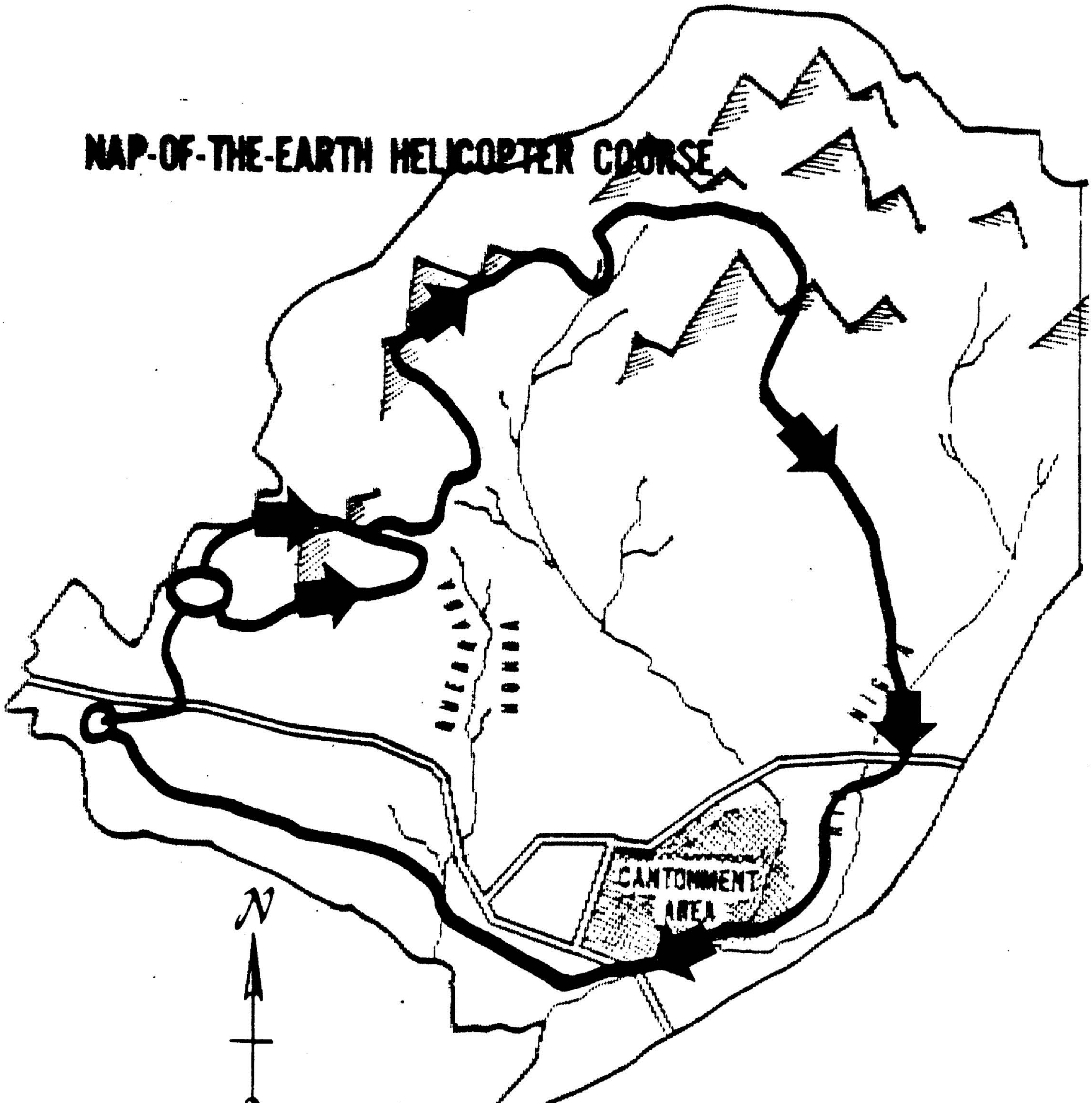


FIGURE 7

TABLE 3

APPROXIMATE NUMBER OF ROUNDS OF MAJOR AMMUNITION

TYPES EXPENDED AT CAMP SANTIAGO IN 1980

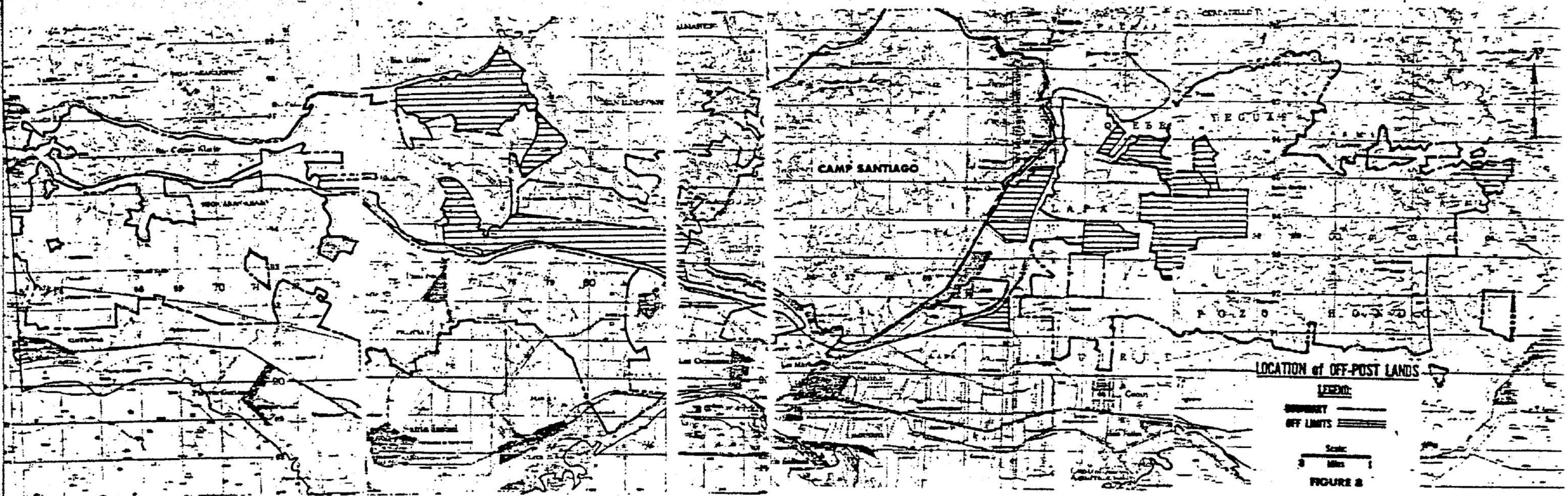
TYPE	NO. OF ROUNDS
Small Arms Ammunition:	
12 ga. (shotgun)	650
5.56mm (rifle)	810,000
.22 caliber (rifle)	100,000
7.62mm (rifle)	295,000
.38 caliber (pistol)	3,000
.45 caliber (pistol)	53,000
.50 caliber (machine gun)	250
Indirect Fire Ammunition:	
40mm (grenade launches)	2,900
60mm (mortar)	325
81mm (mortar)	2,500
105mm (Howitzer)	500*
4 inches (mortar)	330
Rifle Grenades (7.62mm)	2,200
Smoke Grenades	600
Simulators	2,300
Chemical (CS/CN tear agents)	200
Illumination	150

*Beginning in 1981 approximately one-half of these rounds will be 155mm.

4.4.2.2 Utilization of Off-Post Lands.

In addition to Camp Santiago property, the PRARNG trains on other private and Commonwealth owned properties. Approximately 5,000 - 7,000 acres of adjacent land to the east and west of Camp Santiago are licensed annually by the PRARNG. The license allows the PRARNG to conduct field training exercises, command post exerecises, and other training activities during the summer at AT camps with the proviso that tanks and live ammunition will not be used. The government agrees either to pay for any damages resulting from training activities or to restore the property in lieu of payment. The San Juan area Office of the US Corps of Engineers secures permission from local landowners to use their properties for this military training. Over the past several years the amount of land licensed has decreased as landowners are converting more of their properties from woodland to agriculture. The licensed lands are very similar to the terrain of Camp Santiago since these are also located in the semi-arid southern foothills of the Cordillers mountain range and include alluvial plains of the coast. The location of these licensed lands is shown in Figure 8.

Three parcels of Commonwealth lands are intermittently utilized by the PRARNG for limited military training. These include the Carite, Toro Negro and Maricao Forests which are thickly forested areas located in the mountains, and, as such, differ greatly from the terrain of Camp Santiago. The type of military training performed in these areas is limited to patrolling, survival training, map reading and orienteering at the Company/Detachment level.



LOCATION of OFF-POST LANDS

FIGURE 8

4.4.3 Support Activities.

The primary responsibility of the Training Site Headquarters of Camp Santiago is to provide logistical support and to coordinate the utilization of the Camp's training by PRARNG, PRUSAR and other organizations. Site support includes billeting and subsistence, ammunition, Petroleum Oil Lubricants (POL), the repair and maintenance of facilities and equipment, and the provision of janitorial, medical, and other miscellaneous supplies.

Site support to units visiting Camp Santiago is provided through an organizational structure consisting of administrative, logistical and maintenance divisions. The Administrative Division provides security and fire protection and operates/coordinates the use of communication facilities, training areas and ranges; while the Logistics division provides supplies ammunition, POL, subsistence, warehousing and recordkeeping required to maintain property accountability. The Maintenance Division provides carpentry, electrical, plumbing and refrigeration repair to the Camp's facilities and maintains wheeled vehicles and heavy equipment at an Organizational Maintenance Shop (OMS) located at the Camp. The PRARNG has programmed in FY85 the construction of a Mobilization and Training Equipment Site (MATES) at Camp Santiago. The proposed MATES will be located within the cantonment area and will provide for 33 work days, administrative work area, and equipment maintenance and storage. The Maintenance Division is also responsible for the water supply, sewage collection and treatment, solid and hazardous waste management and pest control.

Facilities at Camp Santiago are used almost every weekend of the year with an average of 2,000 troops performing military training. During the summer, 3 or 4 separate two-week AT cycles are conducted. An average of 2,000-5,000 troops attend Camp Santiago during each AT cycle. According to the Expansion Capability Plan (May, 1981), a total of 297 buildings are located at Camp

5. Environmental Impact.

5.1 Climate.

The climate of Puerto Rico and Camp Santiago is determined primarily by two factors; the Bermuda High and the insular topography. These factors provide a climate that is characterized by warm, even temperatures with little seasonal variation, steady breezes which vary in direction between daytime and nighttime, and generally abundant rainfall unless modified by local factors.

The weather of Puerto Rico and Camp Santiago is principally influenced by the Bermuda High which is relatively permanent high system centered most of the year over the Azores.

The high pressure system generates the Tradewinds which in the vicinity of Puerto Rico are from the east and are referred to as the tropical easterly Tradewinds. These easterly winds continually furnish the island with relatively constant warm air flow and a tropical marine climate which is characterized by small diurnal and seasonal temperature fluctuations, high humidity, persistant easterly winds, high solar radiation and convective cloud types.

The climate also exhibits a wind shift phenomenon; during the day, an on-shore direction, and during the night, an off-shore direction. This land-sea breeze effect is associated with thermal circulation patterns. The diurnal variation in wind patterns is the result of land surfaces heating up during the day faster than the surrounding ocean; the land-heated air rises causing cooler off-shore winds to flow landward. At night the land cools faster than the ocean, resulting in a reversal of the pattern as the cooled air from the mountains descends the slopes and crosses the plains to the sea. Depending upon the location in Puerto Rico the land-sea breeze magnetic directions will vary, In the south, the on-shore breeze is typically from the southeast while the off-shore breeze is from the northeast. Figure 9 is the wind rose for the City of Ponce which approximates conditions at Camp Santiago.

Topography greatly influences temperature and rainfall levels in Puerto Rico. The Cordillera Central Mountain Range which runs the length of the island on a central east-west axis provides a physical barrier resulting in temperature and rainfall discontinuities between north and south Puerto Rico. The Cordillera Mountain Range averages more than 3,500 feet in elevation with its highest peak at 4,389 feet.

Generally, south Puerto Rico is warmer than north Puerto Rico. Mean annual temperature in the Camp Santiago area range between 76-90°F. It has been determined that the mean annual temperature at Camp Santiago is 84.5°F with winter lows around 60°F and summer highs around 100°F in August-September. Figure 10 shows temperature levels in southern Puerto Rico.

Although horizontal temperature gradients remain fairly constant, vertical temperature gradients vary diurnally in semitropical and tropical areas like Camp Santiago. This results in temperature inversions which typically occur in the late evening and early morning hours. During the day as the air mass warms near the ground, it rises, becoming cooler with increased altitude. This results in vertical air turbulence and an unstable, well-mixed air mass. However, when the sun sets, the air close to the ground gets colder than the air above. When this occurs, typically in the late evening and early morning, a stable stratum develops, resulting in little or no vertical air movement as the colder surface air mass does not rise. Once solar radiation returns in the morning, the surface air mass is heated again, rises, and causes the temperature inversion to become unstable.

Rainfall distribution, Figure 11, in Puerto Rico is greatly influenced by the Cordillera Mountain Range. As the warm, moist Easterlies approach the mountain range, they are deflected upward where they cool rapidly resulting in rainfall. This phenomenon results in an orographic distribution of precipitation whereby rainfall levels are high on the northside of the mountains and low on the southside.

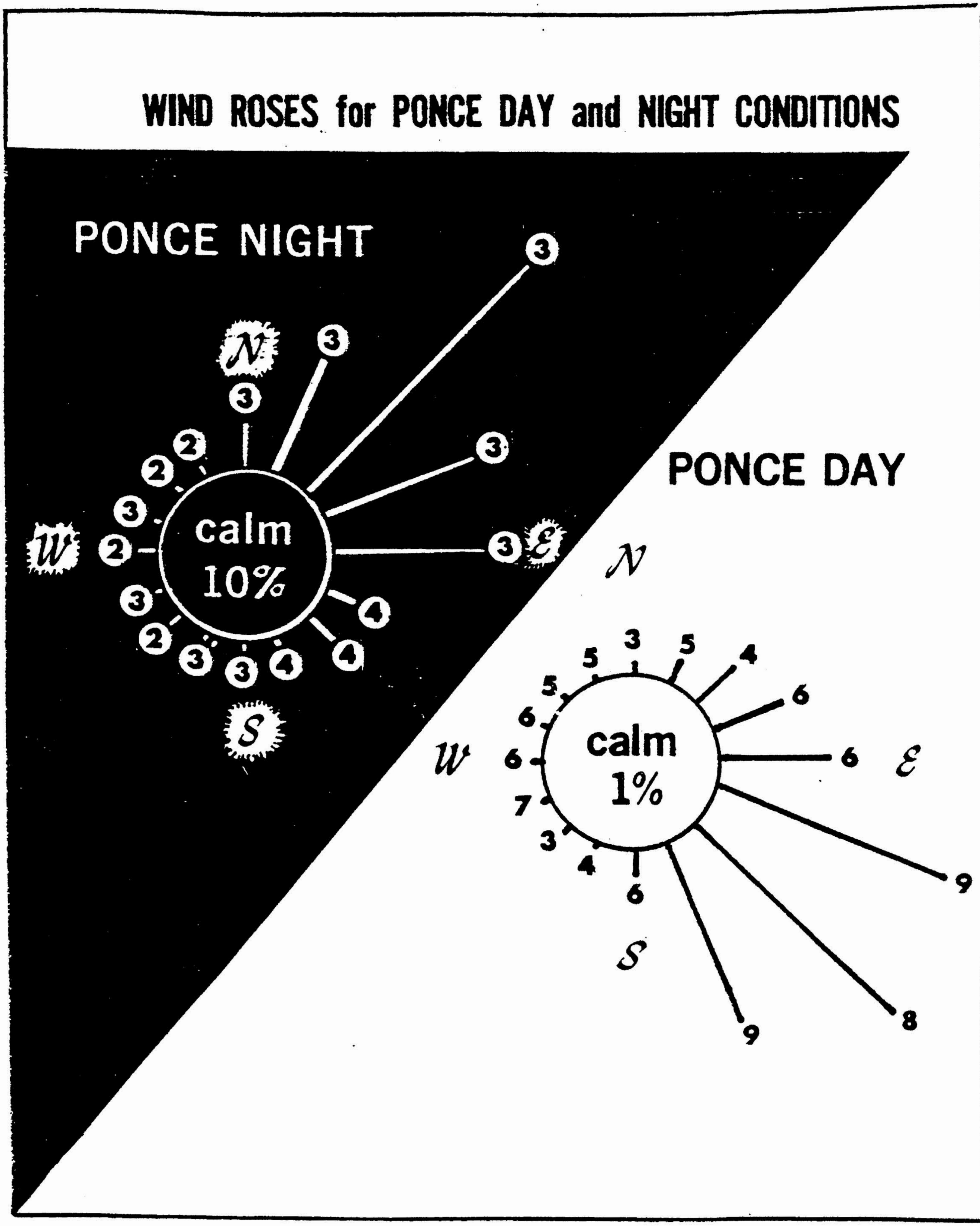


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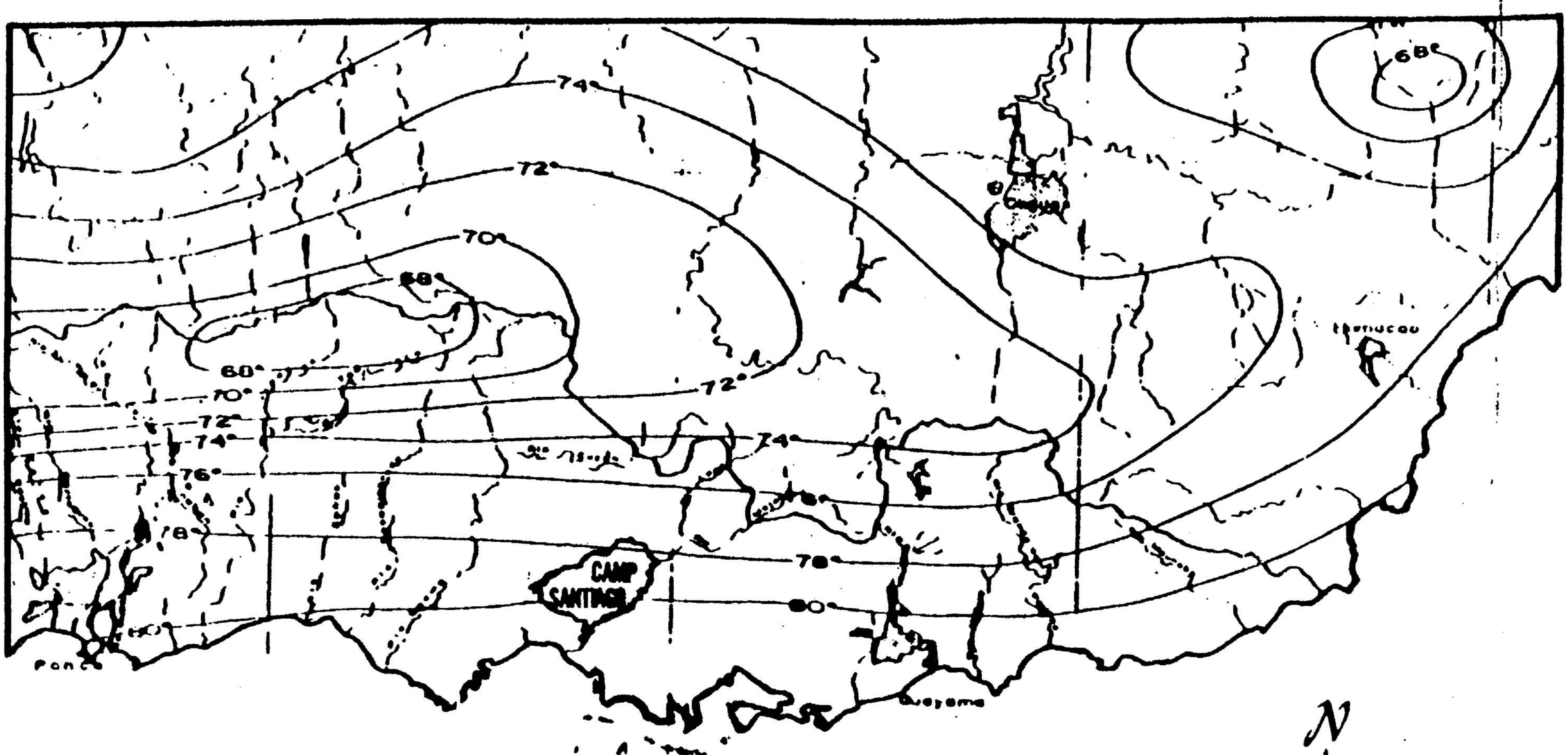
Figure 9



MEAN ANNUAL TEMPERATURE (F°)

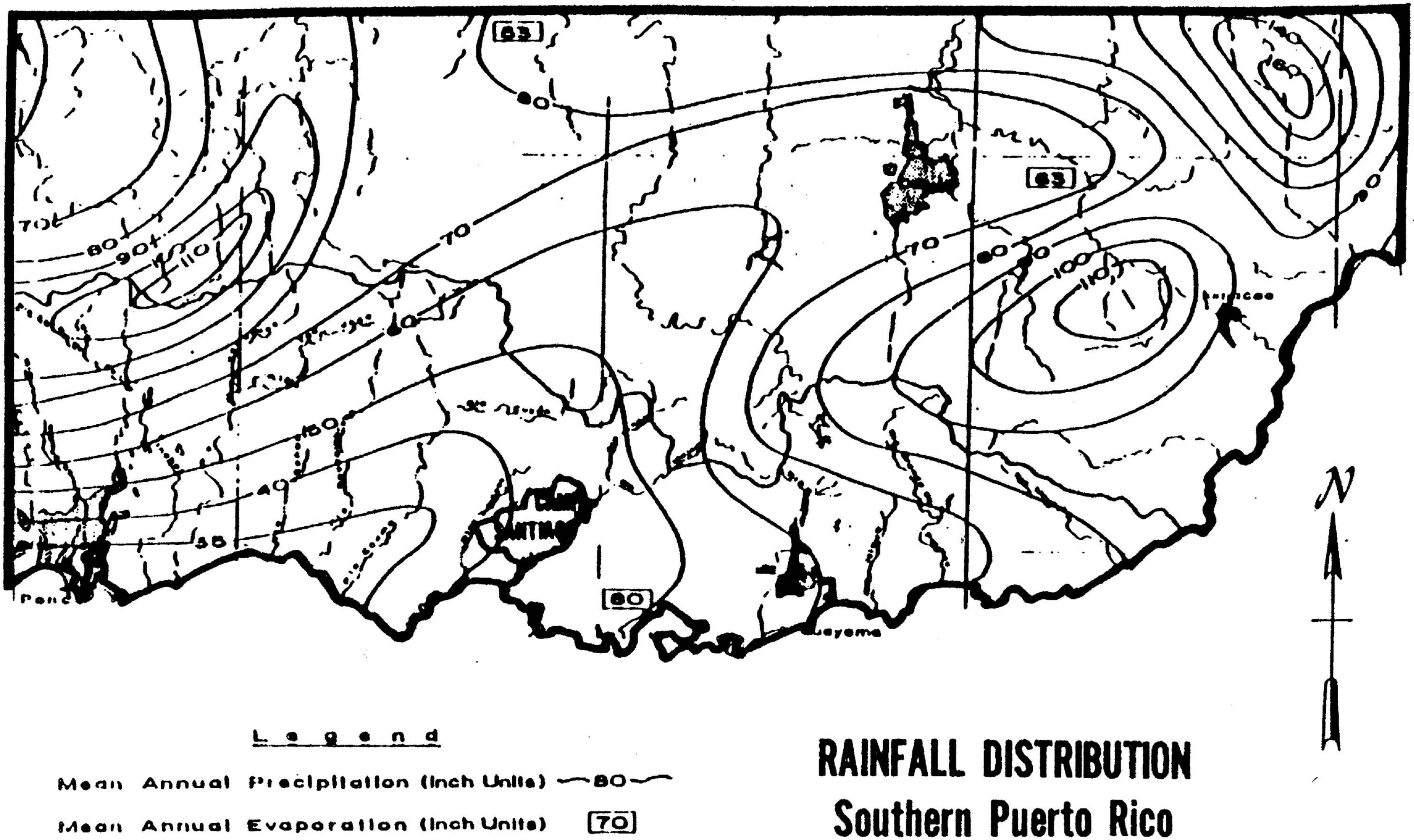
Southern Puerto Rico

Scale:

0 10 20 30 40 Kilometers

0 10 20 30 Miles

FIGURE 10



RAINFALL DISTRIBUTION
Southern Puerto Rico

FIGURE 11

A "rain shadow" is characteristic of the southern portion of Puerto Rico. It is reported that the mountainous areas to the north may receive rain as much as 300 days per year, while in the south as little as 100 days per year. The "rain shadow" effect is evident in the Camp Santiago area where the climate could be described as semi-arid; the rainfall average in the Camp Santiago vicinity is estimated to be between 35-40 inches per year, while the average rainfall for Pueto Rico is 75 inches per year.

Puerto Rico and Camp Santiago have wet and dry seasons. The wet season in the vicinity of Camp Santiago is from May through mid-December. Additionally, the wet season is bimodal with peaks in May and August-September. More detailed local climatology data is available from the National Oceanic and Atmospheric Administration (NOAA).

5.2 Air Quality.

Existing Condition. A review of the Commonwealth's Implementation Plan (40 CFR 81) indicates that the Puerto Rico Air Quality Control Region (AQCR) has generally reached attainment for criteria pollutants. Most of the island is designated as attainment for the majority of the criteria pollutants. Camp Santiago is located in the Guyanilla Air Basin which has been designated an attainment area. Table 4 identifies the Environmental Protection Agency (EPA) classification of the Guaynilla Air Basin's air quality for total suspended particles (TSP), nitrous oxides (NOX), sulfur oxide (SO2) hydrocarbons (HC) and oxidants (OX).

In developing the air emissions inventory for Puerto Rico, sources were categorized as either point or area emission sources.

Area emission sources include: open burning, gasoline fuel off-highway, diesel fuel off-highway, aircraft and airport operations, dirt roads traveled, dirt air strips and brush fires. Area sources generate the majority of TSP emissions. Fugitive dust represents 60% of the total area source pollution (based on a island-wide emissions inventory); fugitive dust in the southern part of the island constitutes 77% of the total area source contribution. Of the estimated 26,468 tons TSP/yr generated in the southern area, the following quantities are generated by each source:

Unpaved road	13,505 Tons/Year
Unpaved airstrips	64
Wild forest fire	236
Military aircraft	6
Diesel (Off-highway)	81
Gasoline (Off-highway)	39
Government Open Buring	0

Table 4

GUAYANILLA AIR BASIN - AIR QUALITY*

POLLUTANT	CLASSIFICATION
Particulates	Does not meet secondary National Ambient Air Quality Standards (NAAQS)
Sulfur Oxides	Cannot be classified or better than NAAQS
Oxidants	Cannot be classified or better than NAAQS
Nitrous Oxides	Cannot be classified or better than NAAQS
Hydrocarbons	Cannot be classified or better than NAAQS

*Source: Environmental Reporter 40 CFR 81.355

Existing Camp Santiago mission activities contribute little to the estimated TSP generation rate. Point source emissions in the south contribute 26,573 tons TSP/yr. There are no point sources at Camp Santiago, however, there are three point sources located within 20 miles of the Camp; a hydroelectric plant and oil refinery at Guayama, and a sugar mill at Aguirre. Generally, the Camp Santiago air quality is considered very good, except for occasional dust problems. In 1968, the Environmental Quality Board (EQB) monitored the air quality for a short period and found the concentrations of criteria pollutants below the national standards. Table 5 includes a listing existing air emission sources at Camp Santiago.

Impacts. Construction activities such as those associated with combat engineer training, building and training facility site development occur at Camp Santiago. During the construction phase of such facilities as the proposed MATES and Battalion Billeting, fugitive dust and vehicle exhaust emissions from workers' vehicles, earth moving equipment, vehicular traffic on unpaved roads, and construction of paved areas may cause short-term degradation of the existing air quality (particulates and carbon monoxide). Dust generated by local traffic on unpaved roads would be the primary source of increased particulates at these proposed sites. It is expected that construction vehicle engines would be equipped with emission control devices required by EPA for the year of manufacture and that these engines would be maintained in accordance with the manufacturer's specification and applicable Federal, Commonwealth and local standards. It is anticipated that known meterorological conditions in the area would disperse particulates and other air pollutants throughout the construction areas, minimizing any potential for adverse impact on the existing air quality.

Civilian and military motor vehicle operations at the Camp during unit training assemblies (drill weekends) and during the 5-day work week are expected to make slight emission contributions to air pollution in the area.

TABLE 5

EXISTING AIR EMISSION SOURCES AT CAMP SANTIAGO

Quantity	Source Type
2,000	Weekend Training
5,000	Annual Training
147	Full-Time Camp Staff (POV)
44	PRARNG Tracked Vehicles
1,338	PRARNG Wheeled Vehicles
4	POL Storage Tanks:
1	25,000 GAL MOGAS
1	10,000 GAL Diesel (DF 2)
1	7,000 MOGAS (Proposed)
1	7,000 Diesel (Proposed)
20	Helicopter (Refueling)
2	Fixed Wing Aircraft (Refueling)
18	Artillery Pieces (105mm Howitzers) (See additional weapons inventory list at paragraph 4.3 Mission)
31	Engineer Construction Equipment (Dump trucks, graders, bulldozers, other earth moving equipment)
1	Quarry Operations (Demolition and Blasting)
16	Weapons Firing Ranges
1	Bombing and Strafing Range
2	Open Burning/Detonation Areas

ARNG motor vehicle engines are equipped with emission control devices required by EPA during the year of manufacturer. ARNG vehicle engines are maintained in accordance with the manufacturer's specification and applicable Federal, Commonwealth and local standards. Upon completion of the proposed MATES vehicle traffic at Camp Santiago will increase 10% due to the maintenance activities associated with the MATES.

Existing underground petroleum product storage tanks (25,000 gallon MOGAS and 10,000 gallon diesel) and ancillary distribution systems at the Camp are not subject to Federal, Commonwealth and local air pollution control regulations governing evaporative loss (vapor emmission) because they do not contain more than 40,000 gallons. Significant quantities of volatile organic fumes are released into the atmosphere with no adverse effects on air quality at the Camp. Two additional 7,000 gallon underground tanks are proposed for the MATES facility; MOGAS, and diesel.

Although fugitive dust is a significant air quality problem in southern Puerto Rico, it is unlikely that military activities conducted at Camp Santiago are making a significant contribution to this problem. It is likely that the largest portion of the fugitive dust generated at Camp Santiago settles within the Camp. Due to low rainfall, fugitive dust is produced during dry periods when military vehicles travel unpaved roads and trails. Winds rapidly disperse suspended particles which settle mainly within the reservation boundaries, although some settling occurs outside the Camp when roads extend near the perimeter. Fugitive dust is also produced in small quantities when artillery and mortar rounds and aircraft strafing rounds hit the impact area, and during quarry and borrow pit operations.

Air emissions also result from the firing of munitions in the Camp's ranges nitroglycerine, HC and WP smoke mixes, thermite mixes, and CS and CN. Air quality should not be significantly degraded as a result of these activities and the air emissions should be rapidly dispersed. There have been no public complaints or reports that these pollutants are going beyond the reservation boundaries. Adverse public reaction could result if munitions, exploding near the reservation boundaries, were to encounter certain meterological conditions and be transported into nearby communities.

The EQB is concerned about the frequency that open burning is occurring in southern Puerto Rico, primarily the open burning of agricultural wastes and plant life which is prohibited by Rule 402 of the Commonwealth's Air Control Regulations. Camp Santiago has a high frequency of wild grassland fires as large portions of the training area burn annually during the dry season. These fires are not started intentionally, but can result from the use of simulator devises and firing small and large caliber ammunition such as blanks, tracers, low and high explosive, smoke, incendiaries and illumination rounds. Fires at the Camp have also been reported to have started spontaneously. Due to the lack of a comprehensive fire break system, the fires frequently burn large areas with the existing road network serving as the only containment source. However, the containment and control of any grassfire on the lowlands is very difficult.since wind speeds are characteristically high and grasses are from 1 to 8 feet tall providing excessive fuel. An extensive firebreak system would not guarantee containment of most grassfires which occur in the training areas since they usually jump the road-type firebreaks.

A practical approach to controlling wild fires would be to prescribe burn those areas where fires are frequently started due to military activities, i.e. impact area and some small arms ranges. Construction of firebreaks around

these smaller areas would be less costly to prepare and maintain since the number of miles of firebreaks would be less. Areas could be prescribed burned at night when wind speeds are relatively low so that the fires could be contained and controlled.
A variance to the air pollution regulation would have to be authorized by the EQB for the open burning of the grasses since this technique would be used to help reduce the potential and extent of open burning of the larger portions of the training area. It is most likely that the EQB would approve the variance.

Wild grass fires on Camp Santiago produce significant quantities of suspended particles and contribute to the over-all particulate level of southern Puerto Rico. It is unlikely, however, that the contribution is significant considering the other areas in southern Puerto Rico that are also suseptible to open burning. These grass fires have been occurring in the Salinas area for decades, and in 1968 the EQB conducted short-term monitoring of the air quality in the Camp's training areas. The EQB concluded that existing levels of air pollution were within acceptable levels. Additionally, the EQB declared the southern portion of Puerto Rico an attainment region for criteria pollutants.

Open burning has also occurred at the Camp's sanitary landfill. These fires are probably intentionally started by individuals unaware of the Commonwealth's air pollution regulation that prohibits open burning of refuse. These fires emit various pollutants into the atmosphere in small concentrations since the typical quantity of uncovered refuse is small.

In summary, the frequent open burning occurring in the southern part of the island is contributing to the particulate concentration of the southern region's air quality. However, open burning resulting from the Camp's operational activities is locally minor and regionally insignficant.

Conclusions.

1. Fugitive dust is generated from construction activities, vehicle traffic on unpaved roads, and quarry and borrow pit operations at the Camp.

2. Existing air emission sources at the Camp have not been formally studied to identify all pollution sources, to classify the pollutants generated, to determine the amount of pollution emitted into the atmosphere, or to identify their environmental impacts and to recommend corrective action.

3. PRARNG internal combustion engines are equipped with emission control devices required by EPA during the year of manufacture and should be maintained in accordance with the manufacturer's specifications and applicable Federal and Commonwealth regulatory standards. Upon completion of the proposed MATES vehicle traffic will increase at Camp Santiago by 10%.

4. Weapons firing on the ranges produce various air pollutants which appear to be readily and rapidly dispersed throughout the range areas and do not appear to mitigate beyond the Camp's boundaries.

5. Spontaneous grassland fires occur frequently on the Camp and occasionally munitions functioning on the small and large caliber firing ranges initiate additional grassland fires.

6. Road net and/or firebreaks appear to have been inadequate for controlling grassland fires on the Camp. Extensive dry seasons, excessive fuel, and high winds tend to compound this problem.

Recommendations.

1. Common dust suppressant techniques should be employed during the Camp's construction activities and on heavily traveled unpaved roads. Fugitive dust generated from vehicular traffic should not migrate beyond the Camp's boundaries, therefore traffic management controls should be developed to ensure that vehicular traffic to and from the training and cantonment areas should be routed on roads nearest the most upwind Camp boundary.

2. The quarry and borrow pit operation should be individually studied to determine if the operations are in compliance with Federal and local air pollution control regulations. The quarry operation may require an operating permit.

3. A Camp-wide air emissions inventory study should be conducted to identify all air pollution sources on the Camp, to classify the pollutants, quantify pollutant concentrations and their impact on existing air quality at the Camp, and to identify corrective action as appropriate.

4. The Camp's and PRARNG internal combustion engines should continue to be maintained in accordance with the manufactuer's specification and applicable Federal and Commonwealth regulatory standard. The construction of the proposed MATES will assist in maintenance of emission control devices.

5. The Camp should discuss the possibility of entering into an agreement with the Salinas fire department to establish a research and development fire training program, and should plan to develop a fire break design and other methods that would be effective in controlling grassland fires on the island. The Camp's training areas could be used for this research and development effort by the local fire departments. This fire training plan would have to be submitted to the EQB for approval in accordance with the Puerto Rico air pollution control regulation. If approved, the Camp's training areas could be programmed/scheduled for controlled burning prior to unit training by the local fire department as part of the fire training research and development effort. This type of fire activity is exempt by the EQB and would not require a permit or variance for open burning.

6. Open burning of refuse at the Camp's landfill should be stopped with appropriate management of effective control measures taken during the peak training cycle (May-August) and implemented in accordance with the U.S. Army Environmental Hygiene Agency's (AEHA) solid waste landfill study recommendations at Appendix IV.

5.3 Noise.

Existing Conditions. The four local communities around Camp Santiago are El Coco and El Bosque to the east, Rio Jueyes to the west, and Salinas to the south. The major local noise sources are the heavily trafficed highways and Camp Santiago. Camp Santiago is used by the Army National Guard, Air National Guard, Army Reserves, and for special exercises by the active-duty military forces. No one lives on post full-time. The most noise-sensitive activity on post is the English Technical Language School, which prepares its 200+ full-time students for basic training over on the mainland. The greatest activity at Camp Santiago is during the four 2-week AT periods.

a. Aircraft Noise Activity. Collazo Airfield, Camp Santiago's airfield, has no assigned aircraft. Camp Santiago's aircraft noise comes from these sources: the Air Force, the Army Aviation Support Group, and the PRARNG.

(1) The Air Force typically flies from the mainland, participates in an airdrop over Camp Santiago, then departs. The Air Force does not land at Collazo Airfield. In a normal year the Air Force will support a maximum of four airborne operations with three C-130's or C-141's per operation.

(2) The Army Aviation Support Group, stationed at San Juan, operates one U-8 Seminole, one C-7A Caribou, nine OH-6A LOH's and eleven UH-1H Hueys. The two fixed-wind aircraft, the U-8 and C-7A, do not normally fly to Collazo Airfield. During any particular weekend, a maximum of 12 helicopters, UH-1H's or OH-6A's may fly from San Juan to Collazo Airfield. The support Group's greatest activity is 25 hours of air time per day during its 2 weeks AT. Most of the flights are off post. The helicopter landing pattern comes between two foothills west of Camp Santiago at 600 ft above ground level and

descends onto Collazo Airfield, thus avoiding over-flight of inhabited areas. The helicopter gunnery range and NOE flight paths are used about twice a year.

(3) The 198th Tactical Fighter Squadron, PRARNG, stationed in San Juan, operates 18 A-7 Corsair II jets. The Air National Guard uses the bombing range within Camp Satiago's impact area. Missions are normally scheduled for four days a week, including one Sunday and two to three Saturdays a month. Each of the 2,012 sorties the Air National Guard flew in 1980 consisted of a maximum of two low-angle bombings; two low-angle, low-drag bombings; two dive bombings; and two strafing passes. Day sorties required 20-30 minutes but night sorties only required 10 minutes as no strafing passes and fewer bombing passes were flown Two or three jets fly for each operation.

b. Impulsive Noise Activity. The four major sources of impulsive noise at Camp Santiago are demolition, artillery, tank gunnery, and small arms ranges.

(1) Demolitions are detonated by the combat engineers of the 192d Infantry Brigade. The engineers have two demolition sites: one in a gully on the southwestern edge of the post and the other inside the impact area. All charges greater than 2-pounds are set off inside the impact area. In 1980 the engineers exploded 281 2-pound blocks of C-4, 138 1-pound sticks of TNT, 71 1/2-pound stick of TNT, 7 Bangalore torpedoes, 47 15-pound shaping charges, and 11 40-pound cratering charges.

(2) The 162d Field Artillery fires artillery six weekends a year, mortar six weekends a year, and both artillery and mortar for 2 weeks a year during its AT. A maximum of 100 rounds are fired per weekend. In 1980 the 162d Field Artillery fired 325 rounds of 60-mm mortar, 2,500 rounds of 81-mm mortar, 500 rounds of 105-mm artillery, and 350 rounds of 155-mm artillery.

(3) The M-48A5 tanks of the cavalry unit fire their main guns three times a year. They fire from areas C and D, on the western area of Camp Santiago, into the impact area. In 1980, using tank table VI, 136 105-mm rounds were fired.

(4) Camp Santiago has small-arms ranges for machine guns, shotguns, rifles, pistols, grenades, and LAWs. The shotgun and pistol ranges are the most frequently used. The other ranges are largely used only during the weekends and during the four 2-week ATs. The ranges are mainly grouped in two areas: south of the airfield, and west of El Bosque. In 1980, approximately 1,300,000 rounds were fired or thrown.

c. Noise Complaints. No written noise complaint log is kept because of the infrequency of such complaints. Four live mortar firing points have been coverted into exclusively dry firing points as a result of complaints received from residents on the eastern boundary of Camp Santiago.

The A-7 jet flight patterns were altered after an Air Force Official visited complainants. Neither written nor oral complaints have been received since the previously mentioned changes went into effect.

Impacts. During the period 20-31 July 81, an environmental noise assessment of military operations at Camp Santiago was conducted by the AEHA which included predictive models and on-site noise measurements of aircraft, blast and small arms noise sources.

The AEHA noise study concluded that no unacceptable noise zone extends offpost, even with the aircraft, small-arms ranges, and blast noise contours integrated together. Camp Santiago presently does not adversely impact any local community. However, the regions north of Camp Santiago, which are in the normally unacceptable zone should be kept free from residential development.

Although the aircraft average noise level is acceptable for classroom work, the English Technical Language School's classes are occasionally interrupted by the jets. Though soundproofing the classrooms is possible, it may not be economically feasible or even desirable, for no formal complaints about these interruptions were found.

Though the noise contours and other criteria agree with Camp Santiago's actual experience, that few noise complaints have been received, the potential for noise complaints does exist. Past problems, normally resolved by a personal visit from appropriate personnel, have resulted in the conversion of live mortar firing points to dry fire practice points and in the alternation of the A-7 jet flight patterns.

A potential problem still exists with the normally unacceptable zone extending north of Camp Santiago. Land use planning should be used to help prevent potential problems. South of Camp Santiago, 134 single family dwellings are being built without regard to the noise environment. Fortunately, Camp Santiago does not adversely impact this particular development. National Guard officials need to ensure that future developments will consider Camp Santiago's noise environment, especially any development to the north.

<u>Conclusion</u>. Camp Santiago does not adversely impact the noise environment outside its boundaries but needs to become involved in local master planning.

Recommendation. Continue excellent responses to noise complaints. Establish and maintain a liaison with local planning and zoning authorities in all matters pertaining to new development around Camp Santiago, especially the northern regions.

5.4 Physical Setting.

5.4.1 Physiography and Geology.

Puerto Rico is the easternmost and smallest of the four islands in the Greater Antilles chain. The most prominent physical feature of the island is the east-west running central mountain range, the Cordillera Central, which extends almost the entire length of the island.

Camp Santiago spans two physiographic regions within the island; the southern foothills of the Cordillera Central on the northwest, and the southern coastal low lands. Coalescing alluvial formations are found on the boundary of the foothills and southern lowlands.

The Cordillera Mountain Range is composed of volcanic lavas with intrusive rocks, i.e. granodiorite and diorite. The central core of Puerto Rico is composed principally of volcanic and intrusive rocks of late Cretaceous and Early Tertiary Age. The volcanic rocks are predominately ashy shale embedded with thick, dense lava flows and relatively thin beds of limestones which have been complexly faulted, folded, and intruded by dioritic rocks. Serpentine and silicified rocks underlie large areas in the southwest. The core is flanked on the north and south by clastic sediments and limestones of Oligocene and Miocene Age. The clastic sediments are composed of poorly sorted gravel, sands and finer materials.

The north-northwestern part of Camp Santiago located within the southern foothills zone is characterized by rock types that are mostly volcanic in origin, although limestone and intrusive rocks are common. The southern part of the Camp (southern coastal lowlands zone) is covered by sand silt and clay deposited by erosion. The general geology of Puerto Rico is illustrated in Figure 12.

5.4.2 Topography.

The southern foothills of the Cordillera Central average about 8 kilometers wide and range in elevation from 76m above mean sea level near the coast to 548m near the mountains.

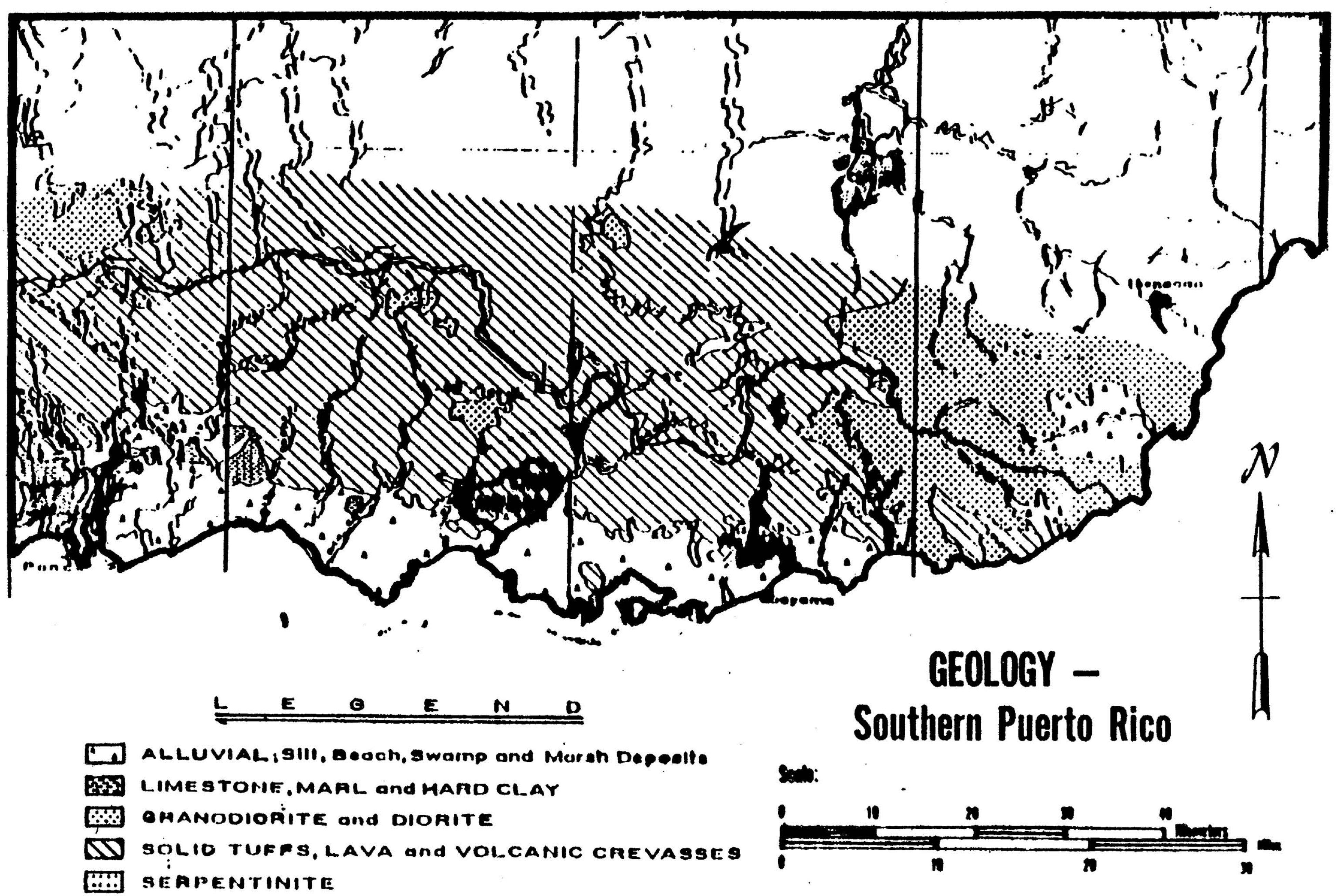

GEOLOGY —
Southern Puerto Rico
N
L E G E N D
ALLUVIAL, Silt, Beach, Swamp and Marsh Deposits
LIMESTONE, MARL and HARD CLAY
GRANODIORITE and DIORITE
SOLID TUFFS, LAVA and VOLCANIC CREVASSES
SERPENTINITE
Scale:
0 10 20 30 40
Kilometers
0 10 20 30
Miles

FIGURE 12

The foothills are characterized by numerous rock types which are volcanic in nature although limestone and intrusive rocks are common.

Bordering the foothills in the south is a relatively wide coastal plain or lowland which is composed primarily of alluvial deposits. The plain averages 5.5km in width and is covered by sands, silts and clays which ave been deposited by erosion and may be 48-72km thick. The Camp Santiago area is comprised of the foothill zone to the north and the coastal lowlands to the south. Four relatively high foothills are located on the military reservation: Cerro Modesto (126m). Cerro Raspaldo (225m) Cerro Pio Juan (450m) and Cerro Cariblanco (550m). Figure 13 is a topographic map of Camp Santiago.

5.4.3 Soils.

Existing Conditions. Because of their volcanic and intrusive origins, typical soils of the southern portion of Puerto Rico are high in clay, medium low in silt and low in sand. The 197 different soil series and 426 soil types of Puerto Rico are classified into one of two groups based upon Geological history: residual (formed in place) and transported (deposited as sediments some distance away from their point of origin). Soils associated with Camp Santiago are primarily transported soils, since this type is characteristic of the alluvial lowlands but is also found in part of the foothill regions. The foothills also contain residual type soils, characterized by coarse sands and gravels. Transported soils are generaly porous and of limited utility. Soils of the coastal lowlands are composed of fine-grained clays and silts deposited by erosion.

The soils of Camp Santiago were mapped as a part of the Humacao Survey Area.

The soils map of Camp Santiago is in Figure 14. A review of this soils map reveals that 8 basic soil types comprise three main associations which are characteristic of the area; the Descalabado-Guayama, the Coamo-Guamani-Vives, and the Jacana-Ameleia-Frternidad associations. These soil types are described in Table 6 and range from rock land to a silt clay loam. The largest percentage of the soils have capability classes which limit their potential uses to grassing, woodlands and wildlife habitat, require special consideration if the soils are signficantly disturbed to preclude erosion, and are limited by excessive slope, shallowness or dryness. The soils of Camp Santiago can be grouped as shallow soils of the dry volcanic heights and deep silts that are clayey and expansive on the semi-arid terraces.

Impacts. Soils associated with Camp Santiago have a relatively high erosion potential. However, the amount of erosion occurring at the Camp resulting from military activities is limited. This is due not only to the fact that most activities result in only minor ground disturbance but is also due to the extensive amount of ground cover and low rainfall levels characteristic of the area. The soils in the coastal plain are alluvial and have a better role of permeability than the clayey shallow soils of the mountainous area. However, because of the semiarid conditions, the rate of permeability of both soils is reduced and runoff is a problem during storms. Proper erosion control techniques will be employed during the proposed construction of the MATES and Battalion billeting facilities.

TOPOGRAPHICAL MAP

Camp Santiago, Puerto Rico

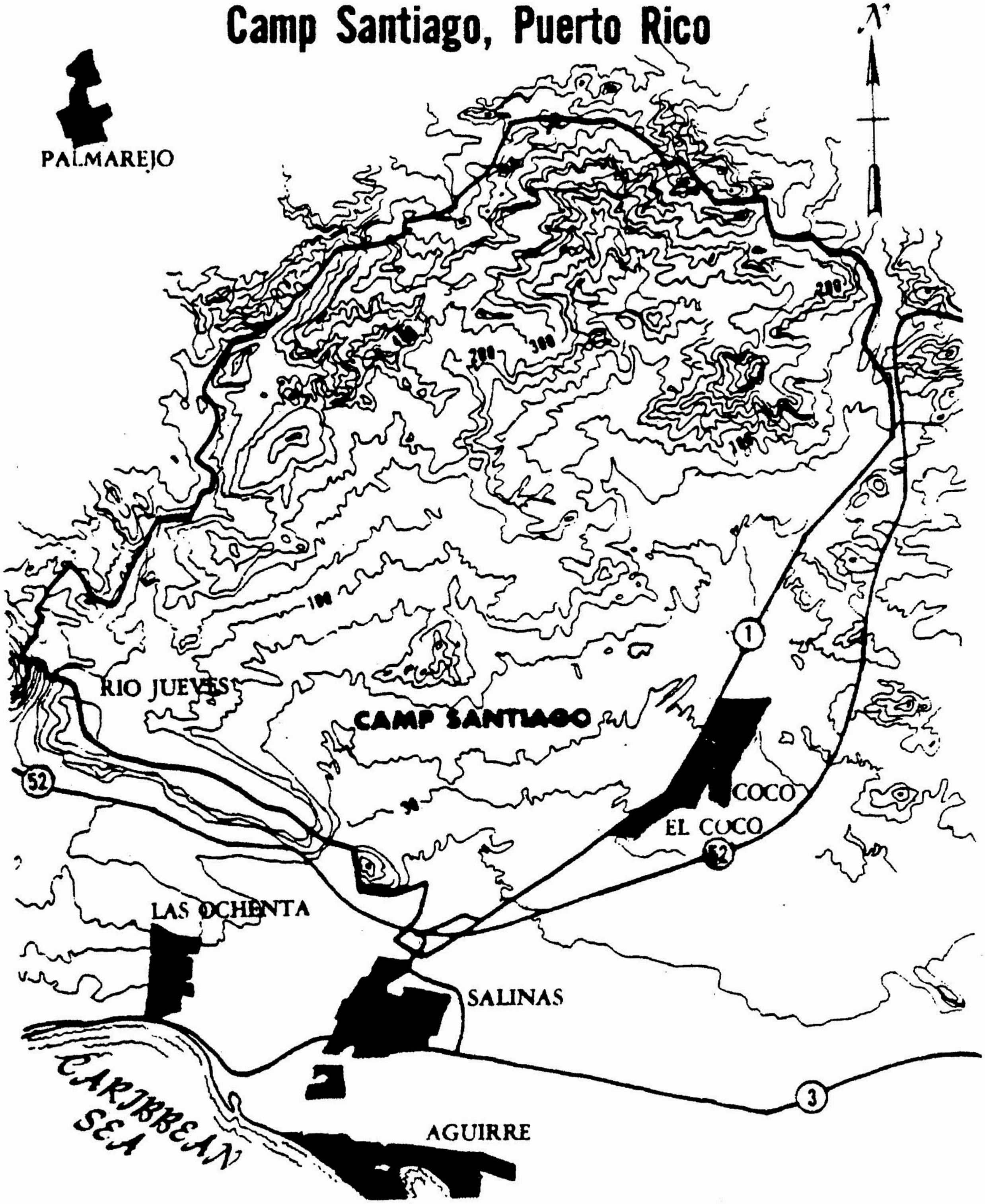


FIGURE 13

SOILS MAP OF CAMP SANTIAGO

LEGEND FOUND ON FOLLOWING TWO PAGES

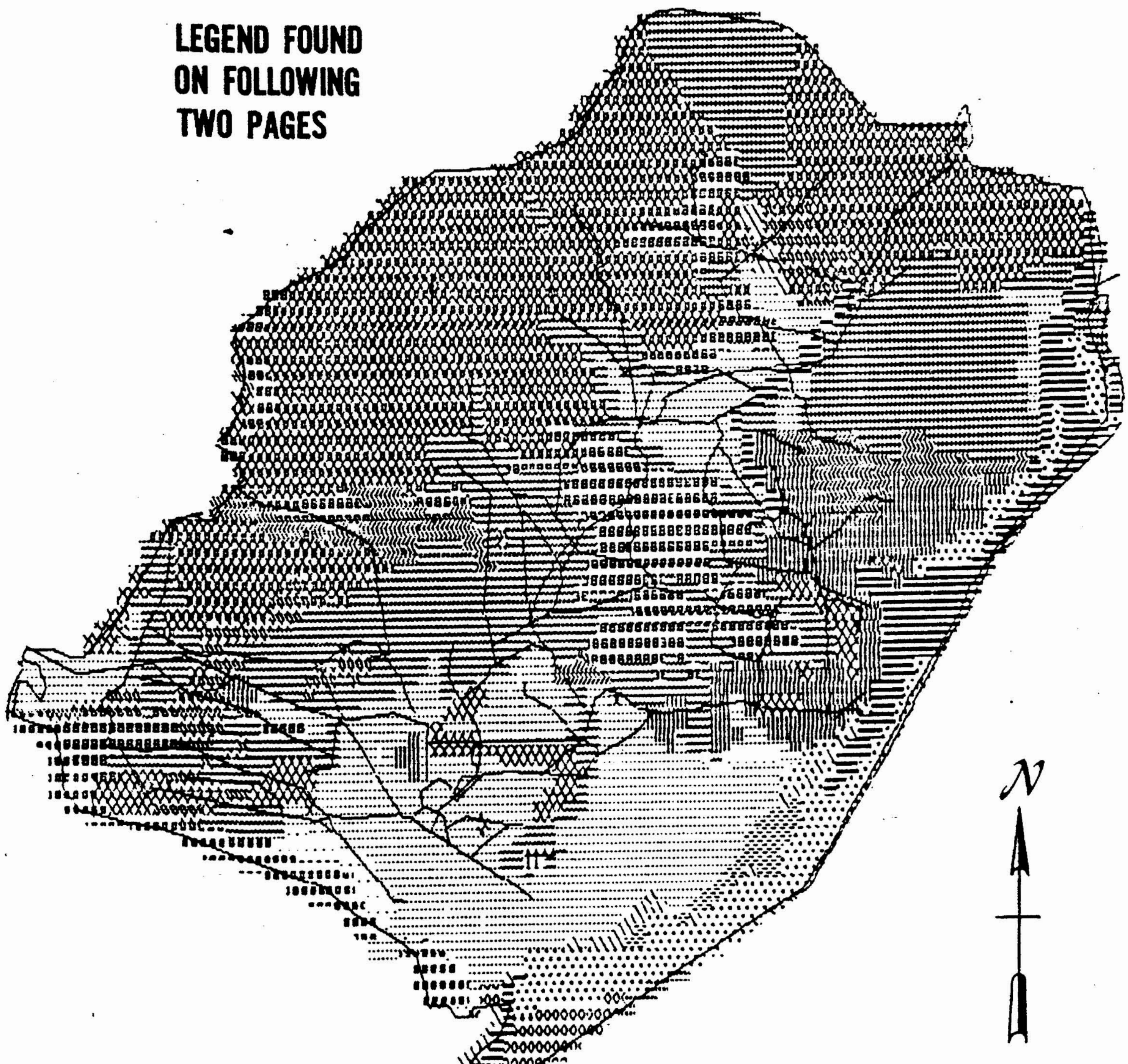


FIGURE 14

SOILS MAP OF CAMP SANTIAGO

LEGEND

SOILS	APPROVED NAME
1: 121/C-2 ------	POZO BLANCO (clay loam)
2: 166/B-1 ------	COAMO (clay loam)
3: 226 --------	COBBLY ALLUVIAL LAND (riverwash)
4: 265 --------	GUAMANI (silty clay loam)
5: 267 --------	VIVES (silty clay loam)
6: 4226 -------	COBBLY ALLUVIAL LAND (riverwash stabilized)
7: 508 --------	ROCKLAND (volcanic)
8: 514 --------	VIVES (silty clay loam)
9: 705/D-2 ------	*
10: 768/C-2 -----	*
11: 81/E -------	ROCKLAND (limestone)

*Information not available from SCS or NGB

FIGURE 14

SOILS MAP OF CAMP SANTIAGO

LEGEND CONTINUED

SOILS	APPROVED NAME
12: 826	*
13: 84/C2	DESCALABRADO (clay loam)
14: 84/D-2	DESCALABRADO (clay loam)
15: 84/E-2	DESCALABRADO (clay loam)
16: 84/F-2	DESCALABRADO (rockland complex)
17: 8514	GUAMANI (silty clay loam)
18: 89/B1	JACANA (clay)
19: 89/C-2	JACANA (clay)
20: 89/C-2 Gr	GR-AMELIA (gravelly clay loam)
21: 95/?-2	SAN GERMAN (cobbly loam)

*Information not available from SCS or NGB

FIGURE 14

TABLE 6

SOILS OF CAMP SANTIAGO

SYMBOL	APPROVED NAME	CAPABILITY CLASS*	SUBCLASS
89 gr B-1	Amelia gravelly clay loam, 2-5% slope	IV	c-3
89 gr C-2	Ameilia gravelly clay loam, 5-12% slope	IV	c-8
166 B-1	Coamo clay loan, 2-5% slope	III	c-2
84 C-2	Descalabrado clay loam, 5-12% slope	IV	s-2
84 D-2, E-2	Descalabrado clay loam, 20-40% slope	VII	s-4
84 F-2	Descalabrado-Rockland complex, 40-60% slope	VII	s-4
265	Guamani silty clay loam	IV	c-1
89 C-2	Jacana clay, 5-12%	IV	e-4
121 B-2	Pozo Blanco clay loam, 5-12%, slope, eroded	IV	e-3
508	Rockland (Volcanic)	VIII	s
81 E	Rockland (limestone)	VIII	s
4226	Cobbly alluvial land (Riverwash stabilized)	VIII	s
226	Cobbly alluvial land (Riverwash)	VIII	s

*CAPABILITY CLASSES

II: Soils have moderate limitation that reduce the choice of plants or that require moderate conservation practices.

III: Soils have severe limitation which reduce the choice of plants or that require special conservation practices, or both.

IV: Soils have very severe limitations that reduce choice of plants or that require very careful management, or both.

VI: Soils have severe limitation that make them generally unsuitable for cultivation and limited for other uses by the low available water capacity or shallowness to gravel or hard rock.

VII: Soils have very severe limitation that make them unsuitable for cultivation and restrict their use primarily to grazing, woodlands and wildlife habitat.

VIII: Soils and land forms have limitation that preclude their use for commerical crop production and restrict their use to recreation, wildlife habitat, water supply or aesthetic purposes.

xx SUBCLASS

e: Erosion Potential

s: Shallow Soils

c: Too cold on too dry

Page Not Used

Areas used by the cavalry troop receive more ground distrubance than those used by the infantry and combat and service support battalion, but there is little evidence of any significant erosion in any of the training areas. Although the training areas burn over almost annually, root systems underlying those grassy areas susceptible to fires prevent significant sheet erosion. Gully erosion is evident along most of the unpaved roads, but is not considered significant (see the water quality section for a discussion of sediment loading to waterway).

Borrow pit operations result in some erosion, but an inspection of the pits indicated that there was not a significant problem. This is also true of stream fording sites since the streams are almost always dry and rainfall is realtively low.

Conclusions. The gully erosion which is occurring along most unpaved roads of Camp Santiago happens during the rainy season when high intensity rains wash roads located on sloped terrain. Erosion is not a significant problem at the borrow pits. Burned over training areas used by tracked vehicles are vulnerable to sheet erosion.

Recommendations. Control of gully erosion could be enhanced if drainage ditches were routinely maintained and provided with drain-outs at appropriate distances along the road. This would prevent runoff from generating enough velocity to start sheet erosion and to cut deep erosional gulleys. Work could possibly be performed by engineering units that train at Camp Santiago during a period prior to the rainy season each year; beneficial traning would be realized by military personnel performing the horizontal construction/maintenance work.

Proper construction erosion control and Best Management Practices (BMPs) should be employed during construction of facilities at Camp Santiago.

Sediment basins could be provided to collect sediments suspended in runoff from the borrow pit areas. To reduce the potential for sheet erosion in the training areas, the cavalry troop vehicles should conduct maneuvers with tracked vehicles in training areas characterized by lower slope angles and avoid steeper slopes where erosion potential is higher. Ideally, they should only use tracked vehicles during the drier seasons of the year.

5.5 Natural Resources.

5.5.1 Vegetation.

Puerto Rico is characterized by six life zones which are defined in terms of latitude belt and humidity province. These zones can be further defined by soils, rainfall distribution, and drainage patterns. Camp Santiago is included within the Subtropical Dry Forest Zone. This life zone is the driest with rainfall averaging between 64-102cm per year, most of which occurs between the months of August and January. The vegetation of this life zone is composed primarily of decidous types on most soils and there is a tendency toward complete ground cover. Tree species present are characterized by small and succulent or coriaceous leaves and by broad, spreading and flattened crowns with sparce foliage. Trees usually do not exceed 15m in height. Vegetation patterns vary at Camp Santiago as a function of altitudes, soil type, and rainfall. Although no botanical surveys are known to have been conducted, a xerophytic species composition faunal at Camp Santiago appears very similar to that described by Dansereau and Buell (1966) and by Glecson and Cook (1962) for the semi-deciduous and xerophytic forests of Puerto Rico. These references between forested areas and pastured area; the pastured areas contain prairies but are also covered extensively by savannah.

The north-northwest portion of Camp Santiago is covered by a medium height dense woody growth with a small crown interspersed with small tress, brush, and grasses. The south-southeast part of the Camp is primarily grassy cover with scattered clumps of less dense woody growth. Small areas of the heavier growth are also present here.

VEGETATION MAP
CAMP SANTIAGO

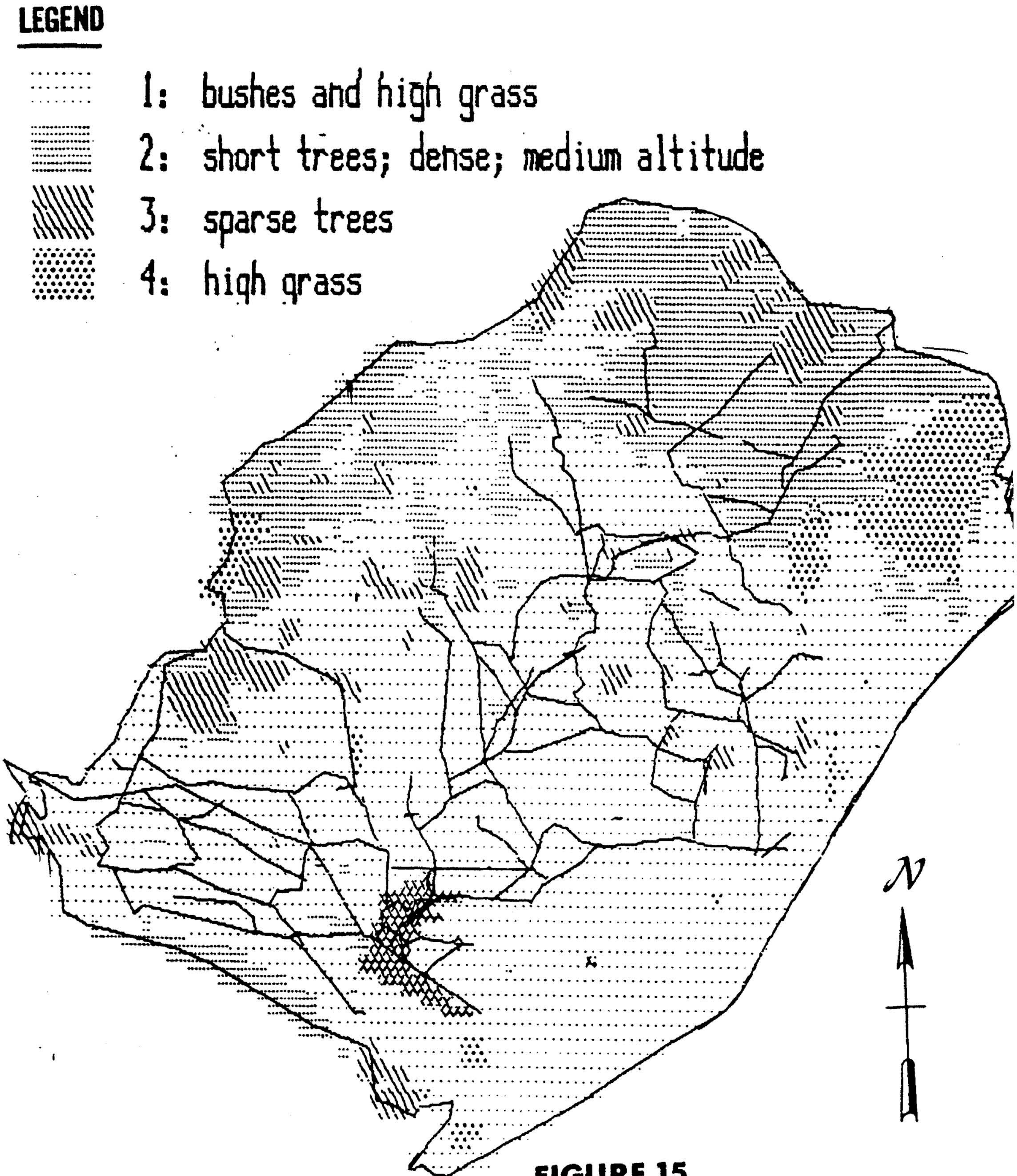


FIGURE 15

The species composition of these clumps of forested and brushy growth is unknown. According to Dansereau and Buell, some of the plant communities that may be representative to varying extents on Camp Santiago would include:

1. Bucaro woodland and forest
2. Gumbolimbo savanna
3. Sebucan-tachuelo thornscrub
4. Grama grass steppe
5. Guinea grass prairie
6. Mesquite savanna
7. Bucaro-mesquite savanna
8. Angelton-grass sward

Succession in the more southern pastured areas of the Camp is controlled primarily by fire since this part burns over annually. There is an indication that some forested areas are being converted to grasslands as a result of fire disturbance. Although the climax species for this are is Bucida buceras (oxhorn bucida) the frequency of fire appears to be maintaining the vegetation in a sub-climax stage of grasses.

Communication with the DNR has indicated that several rare and endangered plant species listed by the Commonwealth of Puerto Rico are reported from the Camp Santiago area. None of these plants is federally listed. Endangered endemic plants reported from the area are listed in Table 7. Additionally, there are 12 nonendemic endangered plant species and 6 nonendemic rare species reported from the area. The area where the plants were reported is a mountain ridge called Las Piedras Chiquitas along the northern most edge of the reservation.

TABLE 7

ENDANGERED ENDEMIC PLANTS LISTED BY COMMONWEALTH OF PUERTO RICO

FROM THE CAMP SANTIAGO AREA

	Name	Family	Habit
1.	*Diapedium krugii*	Acanthaceae	Herb
2.	*Cassia exunguis*	Cactaceae	Shrub
3.	*Anguria cookiana*	Cucurbitaceae	slender vine
4.	*Cyperus urbani*	Cyperaceae	Sedge
5.	*Schrankia portaoricensis*	Mimosaceae	Shrub
6.	*Polygala cowellii*	Polygalaceae	Tree
7.	*Cococoloba sintenisuii*	Polygalaceae	Tree
8.	*Reynosia krugii*	Rhamnaceae	Tree
9.	*Zanthoxylum thomasianum*	Rutaceae	Tree
10.	*Solanum mucronatum*	Solanaceae	Shrub

Impacts. Military activities are having a minor impact upon the vegetation communities of Camp Santiago. The Camp is considered one of the few well vegetated areas in the deforested southern coastal plain. Trees and shrubs are basically protected and cutting for camouflage is prohibited. Trees are needed for cover and concealment and for protection from solar radiation so it is important that they be preserved. The largest forest stands are located on the mountain slopes where military training is very limited due to the terrain so that these stands are not disturbed directly by military training. There is no funded forestry management program for Camp Santiago. The cantonment area is in the southern deforested lowland portion of the installation. A planting program would improve the appearance of the Camp if funds are allocated for this purpose.

The training areas burn over almost every year and because limited efforts are made to control the fires, a minor shift in the ratio of forest lands to grasslands may be occurring in some areas. Grasses appear to be encroaching up the mountans in some areas as wild fires kill woody species along the edge between the forest and grasslands. This is especially evident in woods associated with lowlands having large stands of Panicum maximum. In the mountainous areas in the northwestern portion of the reservation, the effect of wild fires is not evident. These are also the areas where the largest timber stands exist and thus appear to be protected from encroachment of grass communities induced by fires related to military training. Although it appears that the woodlands of the southern portions of the Camp may be reduced in size over a long period of time as a result of fire, the bulk of the woodlands of Camp Santiago should not be affected.

There are no federally listed endangered plants found on Camp Santiago at the present time. Of the plants designated by the Commonwealth as rare or endangered, most are located on a portion of the reservation that is generally protected from fire and the impacts of military training.

Construction of the proposed MATES and Battalion billeting should not affect vegetation since the proposed sites are within the cantonment area.

Conclusions. Camp Santiago has no forest or land management program. The training areas burn over annually as grass fires are started spontaneously, directly or indirectly by military training activities. These wild fires burn uncontrolled as no firebreak system exists other that the unpaved road system found in the training area. This road system is inadequate as a fire break system because the roads are generally narrow and high winds and excessive fuel provided by the grasses allow fires to easily jump the fire breaks. The development and maintenance of an extensive fire break system would be costly and would probably not provide for total containment of a wild fire unless fire breaks are excessively wide.

Recommendations. The DNR has recommended that Camp Santiago prepare and implement a forest management plan which emphasizes the planting of trees suited to the semi-arid environment associated with the Camp. The success of a reforestation program would be contingent upon the ability of management personnel to exclude fire from planted areas and to provide irrigation, at least until the seedlings become established during the first year. The DNR has previously agreed to assist Camp Santiago in establishing a reforestation program. The DNR has already recommended species which would have the best success in the area and has agreed to provide the seedlings. Military training benefits could be derived from a successful reforestation program since cover and concealment would improve. If areas were reforested successfully, the size of those areas where wild grass fires burn would be reduced as the forest would affect wind patterns and the extent of fuel available for burning. New forested lands would also provide additional habitat for faunal species. The establishment of a pilot reforestation program should be considered for a selected area to evaluate whether such a program could be economically implemented considering the availability of personnel and water and the requirements for controlling fire characteristic of this area.

5.5.2 Wildlife.

Existing Conditions. The native wildlife species of Puerto Rico are limited. There are approximately 200 bird species found on the island of which 13 are endemic. Other animal species include turtles (5), snakes (7), toads (2), frogs (15), lizards (31), and bats (15). There have been 5 predatory species introduced to Puerto Rico: the dog, cat, mongoose, and two species of rat. The subtropical dry forest zone in which Camp Santiago is located is inhabited by a richer bird population than wetter life zones. Birds known to occur on Camp Santiago include the bare legged owl, Caribbean sparrow hawk, redtailed hawk, turkey vulture, and gray kingbird. Specific information on mammals and reptiles resident to Camp Santiago is unavilable.

A comprehensive wildlife survey has not been done on the Camp Santiago area. However, the DNR has identified Camp Santiago as a critical wildlife area of secondary importance. The DNR indicated that uncommon land birds on the coast depend upon forested areas such as those on the reservation. The peregrine falcon occurs as a transient throughout the islands. Although unconfirmed, the endangered Puerto Rican Plain Pigeon and the rare Puerto Rican short eared owl have been reported from the Camp Santiago locality. Table 8 is a list of federally endangered and threatened animal species for the Camp Santiago

Region, Puerto Rico.

Impacts. Coordination with the US Fish and Wildlife Service (USFWS) indicated that it was unlikely that military training would adversely affect federally listed endangered wildlife species reported from the area. The habitats for species associated with the forested uplands and valleys are located in the northwestern portions of the reservation where only limited military training occurs. The DNR recommends that forested valleys be maintained in their present state. USFWS personnel indicated that informal consulation would probably satisfy Camp Santiago's responsibilities under Section 7 of the Endangered Species Act. No hunting is allowed on the Camp so that wildlife occurring on the installtion area should be considered protected. Fires resulting from military training would temporarily reduce available cover and food for wildlife. The significance of this effect is unknown since information on animal populations and their use of particular habitats within the installation is not available.

Construction of the proposed MATES and Battalion billeting should not affect wildlife since the proposed sites are within the cantonment area.

TABLE 8

PARTIAL LIST OF

FEDERALLY LISTED SPECIES BY STATE (COMMONWEALTH)

PUERTO RICO

(E= Endangered; T= Threatened; CH= Critical Habitat determined)

Birds	
Falcon Arctic peregrine (*Falco peregrinus tundrius*) - E	Entire island
Parrot, Puerto Rican (*Amazona vittata*) - E	Luquillo Forest
Pelican, brown (*Pelecanus occidentalis*) - E	Coastal
Pifeon, Puerto Rican plain (*Camprimulcas noctitherus*) - E	Cidra
Whip-poor-will, Puerto Rican (*Camprimulcas noctitherus*) - E	Southwest
Blackbird, yellow-shouldered (*Acelaius xanthomus*) - E, CH	East and Southwest Coast; Mona Island
Reptiles	
Boa, Puerto Rican (*Epicrates*) *inornatus*) - E	Entire island
Turtle, green (*Chelnia mydas*) - T	Coastal waters
Turtle, hawksbill (*Eretmochelys imbricata*) - E	
Turtle, leatherback (*Dermochelys coriacea*) - E	Coastal waters
Turtle, loggerhead (*Caretta carettaa*) - T	Coastal waters
Amphibians	
Golden coqui (*Eleutherodactylus jasperi*) - T, CH	Southeast

5.6 Regional Land Use and Development.

The region surrounding Camp Santiago is rural, as is most of southern Puerto Rico, with extensive agricultural development in the Coastal plain and smaller farms and forests in the foothills. Approximately 53% of the land use of the island is agricultural. The primary land use in the municipality of Salinas is agricultural. Sugar cane is the primary crop grown on the adjacent lands licensed by the PRARNG.

In addition to the city of Salinas, which is located a few miles south of the Camp, there are three small communities adjacent to the Camp; El Coco and El Bosque to the southeast, and Rio Jueyes to the southwest. Five other rural communities are located in the southeastern part of the municipality closer to the urban center of Guayama. El Coc and Rio Jueyes are rural communities which have been expanded under a government program called "Comunidades Rurales" where additions to the communities were made at very little cost to the families. In 1975, over 2,800 households were established in 7 of these "rural communities" in the municipality of Salinas. The persistence of small towns in southern Puerto Rico is due primarily to medium and small sized commerical and industrial enterprises in the communities. These enterprises are geared to satisfying local needs and services and to produce exportable goods.

There are no prime or unique farmlands associated with Camp Santiago although the lowlands with alluvial soils are well suited for agriculture. Similar soils occur on most of the land surrounding the training area. These lands have been converted to agriculture when water is available for irrigation. Camp Santiago has been in existence for over 40 years with little or no impact on local land use. Although not documented, Camp Santiago could have stimulated some small development in the neighboring municipalities but this has not resulted in a significant change in land use which is still primarily agricultural. Impacts on the lands used by the PRARNG under license are expected to be minimal since tanks and live ammunition are not allowed.

5.7 Pesticides.

Existing Condition. The maintenance division is responsible for pest control at Camp Santiago. Pesticides are currently stored in a secured concrete building, however, it is not known if the necessary warning signs are posted on the exterior of the building or if there is adequate ventilation in the building.

The pest control personnel are certified by the Commonwealth. The Army requires certification if there is more than 0.25 man years expended in pest control operations. There is no record of any pest applicator personnel being certified by either the Commonwealth or the Army.

An Integrated Pest Management Program includes cultural methods, physical barriers, sanitation and natural controls with less dependece on pesticides for pest control. There is no indication that Integrated Pest Managment is employed in the Camp's pest management program, nor it is not known if contractural pest management is used.

A complete pest management plan needs to be prepared for Camp Santiago, since monthly inspections of pesticides are not conducted to determine how excess pesticides, pesticide residues, or pesticide containers are disposed. Neither the RCS DD-M(A&AR) 1080 nor the monthly DD Form 1532 (Pest Control Report) have been submitted; therefore the quantity of pesticide used again what pest is not known.

While an annual onsite review of the installation pest management and surveillance activities has not been conducted, the following pesticides were on hand during July 1981 when an inventory was conducted:

July 1981 Pesticide Inventory

PESTICIDE	USE	AMOUNT ON HAND
Malathion (57%)	Mosquito/fly control	130 gal
AEP Week Killer (93.1%)	Herbicide	330 gal
Weed-Go (79.9%)	Herbicide	210 gal
Rat Pucks (0,5%)	Rodenticide	200 lbs
Diazanon (99.9%)	Housefiles	72 gal
Household spray (84.7%)	Crawling Insects	72 gal
Baygon (2%)	House Flies	150 lbs
Insecticide, Air Borne	Flying Insects	144 1/2 oz. cans
Insecticide, Ni-Late	Flying Insects	144 15 oz. cans
Insecticide, Bomb, Unico	Ant/Roach Control	144 15 oz. cans

Impacts. If there is a pesticide spill in the present storage facility and if there are floor drains in the storage area, it is possible that the spilled pesticide could get into the sewer system and ultimately contaminate the groundwater. If there is not adequate ventilation in the storage area, it is possible that toxic fumes may accumulate and could cause serious health problems to personnel who enter the area. Without proper training and certification for applicator personnel, it is possible that pesticides may be improperly used with resultant environmental pollution.

A pest management plan should be initiated to give guidance to pest control personnel as to what pest are to be controlled and with what methods. A monthly inventory of pesticides is necessary for the proper management of pesticide stocks. Proper procedures should be followed in disposing of excess pesticides, residues or containers in order to prevent possible environmental contamination. Proper reports should be forwarded to higher headquarters for review by professional pest management personnelso that appropriate technical advice can be provided if needed.

Conclusion. Although there is limited information available about the Camp Santiago Pest Management Program, it appears that the Camp does not have certified operators nor does it have a pest management plan.

Recommendations.

1. Prepare a pest management plan (AR 420-76, paragraph 3-3) for Camp Santiago utilizing the Integrated Pest Management concept (R 420-76, paragraph 2-2). Included in this plan should be procedures for:

(a) Conducting monthly pesticide inspections (AR 420-76, paragraph 4-1);

(b) Disposing of excess pesticides, residue and containers in accordance with AR 420-76, paragraph 4-2;

(c) Preparing the necessary pest reports (AR 420-76, paragraph 4-4); and

(d) Submitting the annual onsite installation pest management review (AR 420-76, paragraph 3-1).

2. Ensure that the storage building is in compliance with Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) design standards.

3. If more than 0.25 man years is to be expended in pest control operations, the appropriate number of personnel should be certified (letter, DAEN-MPO-B, 18 March 1981, subject: Army Pest Managment Program (AR 420-76)).

4. If contractual pest control is used, the procedures in AR 420-76, paragraph 2-12 should be followed.

5. Conduct a Pesticide Management Survey at Camp Santiago and implement the recommendations.

5.8 Waste Disposal.

5.8.1 Solid Waste.

Existing Conditions. Camp Santiago operates an approved solid waste disposal facility under an EQB Sanitary Landfill Permit, however infrequent open burning of refuse has occurred at the landfill site without approval from the EQB. The AEHA conducted a solid waste disposal/landfill study at Camp Santiago during 21-25 September 1981. This study contains more detailed information on the Camp's solid waste practices.

Infectious waste generated at the Camp's hospital is incinerated at the VA hospital in San Juan.

Defective and unexploded ordnance is disposed of by trained Explosive Ordnance Disposal (EOD) teams on the Camp's weapons firing ranges. In addition, small quantities of unused artillery propellant bag charges are open burned on the artillery firing ranges.

Impacts. The Camp's solid waste disposal practices were evaluated by the AEHA in September 1981 resulting in recommendations for daily operations to include; daily cover, elimination of open burning, and the use of surface water diversions at the landfill.

Infectious wastes generated at the Camp's hospital should be disposed of in accordance with the applicable solid waste and air pollution control regulations.

The residue from open burning/detonation of waste explosives may be regulated by Federal, Commonwealth and Army regulations governing solid waste disposal, hazardous waste disposal and air pollution control. If the residue remains on the ground at the open burning/detonation site, then this site may require a solid waste disposal permit as another Camp landfill. Otherwise, the residue could be removed after each burn/detonation operation and deposited into the Camp's existing landfill. In addition, if explosive material waste is reactive, corrosive, flammable, or toxic then the residue generated by the thermal process (open burning/detonation) may be classified as a hazardous waste and would require hazardous waste treatment and/or disposal in accordance with the Resource Conservation and Recoving Act (RCRA) or Rule 815 of the Commonwealth's Hazardous Waste Regulations.

Additional wastes generated as a result of the proposed construction of the

MATES and Battlaion billeting will be handled by the existing landfill under the conditions of the proposed permits.

Conclusions. During those times of the year that no training is being conducted at the installation, there does not appear to be any major solid waste handling problems. Collection and disposal (covering and compaction) operations function in an acceptable manner. There is, however, a problem when training is actively being conducted and the volume of solid waste to be handled increases.

The problem is having someone at the sanitary landfill to direct the deposition, compaction, and covering of the waste on a daily basis. According to EQB regulations, wastes must be covered daily with at least 6 inches of soil material. Daily cover at the landfill has not been applied in the past and the resulting problems have been disease vectors (flies) and periodic fires.

The landfill is a trench-type operation which is located in an area of shallow, fractured rock with a minimal amount of soil development. This condition would be conducive to the generation of a groundwater pollution problem if the climate were such that there was an excess of rainfall over evaporation. The climatic conditions, however, in the southern section of Puerto Rico are semiarid; therefore, leachate generation will be minimal. The landfill, if operated correctly, should not impact on the groundwater quality of the area and should meet the requirements of the Commonwealth of Puerto Rico's Sanitary landfill Permit.

Since residue generated from open burning/detonation remains on the ground, open burning pits and demotion pits may require permitting as solid waste disposal facilities.

Recommendations.

1. Upgrade the current solid waste disposal practices of the installation to met the requirements of the Commonwealth of Puerto Rico Sanitary Landfill Permit. The major practices which should be upgraded are;

(a) Place cover material (6 inches) on refuse which is deposited in the trench by the end of the day,

(b) Do not allow open burning of refuse in the trench, and

(c) Place surface-water diversions (ditches) around the trench to preclude any surface-water run-on from entering the trench.

2. Do not exceed 10 feet in depth when constructing future trenches because of the shallow depth of soil.

3. Consider increasing the staffing of the landfill operation during the time when active training is being conducted at the installation.

4. Sample and analyze the open burning and open detonation pits residue for potential hazardous waste characteristics (reactive, corrosive, ignitable or toxic) and take appropriate action under RCRA to achieve compliance, if required. If residue is determined non-hazardous, it may be removed following the burn/detonation operation and deposited into the Camp's landfill.

5.8.2 Hazardous Wastes.

Existing Conditions. Camp Santiago is not listed as a hazardous waste generator, transporter, treater, storer, or disposer by either the EQB or the Federal Environmental Protection Agency (EPA). Therefore, no approved hazardous waste facilities exist on the Camp.

Impacts. Although a hazardous waste inventory has not been accomplished at Camp Santiago, it is unlikely that sufficient quantities (1,000 kg/month) are produced for the Camp to be classified as a generator under RCRA.

Hazardous substances, such as electrolyte batteries, battery acid, used oil, lubricants, solvents, pesticides, etc., should be stored and disposed of in accordance with Federal, Commonwealth, and local regulations. Treatment, storage, and disposal of any hazardous waste generated as a result of construction or operation of the Camp's facilities, will be regulated by RCRA. Specificantly, pursuant to RCRA Regulations 40 CFR 260-267, the following rules apply:

a. For all Camp facilities and activities generating hazardous waste, EPA will be notified and an identification number obtained.

b. If hazardous waste would be stored for longer than 90 days or disposed of onsite, a permit application for a hazardous waste storage or disposal facility would have to be submitted. Such a facility would be required to comply with applicable hazardous waste facility design and standards in order to obtan a permit. This would be required to be completed prior to commencing storage or disposal operations.

Conclusion. No formal hazardous waste study has been conducted at the Camp to identify, classify or quantify any hazardous waste activities that may be on-going at the Camp and to determine the Camp's compliance with RCRA.

Recommendations. That a hazardous waste management study be conducted at the Camp and implement study recommendations.

5.9 Water Resources.

5.9.1 Surface Hydrology.

Existing Conditions. As stated in the Islandwide Project Management Plan, rain is virtually the Island's only source of fresh water. There are seventeen river basins which drain the island; however, only seven have drainage areas in excess of 160 square kilometers. The basins in the southern portion of Puerto Rico are generally small. The largest basin is the Rio Salinas Basin with a drainage area of approximately 82 square kilometers. The Rio Nigua is the largest river in the Rio Salinas Basin. It flows along the eastern boundary of Camp Santiago exiting the southern boundary of the reservation draining the eastern and northern portions of the reservation. This river receives additional flow from the Querbrada Honda tributary which flows along the western boundary of the cantonment area and drains the central portion of the training area. The western portion of the reservation is drained by the Rio Jueyes which establishes the western boundary of the training area. The three rivers associated with Camp Santiago are included within the Rio Majada Region of the Puerto Rico Aquaduct and Sewer Authority Planning Area.

Impacts. Although both the Rio Nigua and Rio Jueyes exhibit flooding states during portions of the rainy season, they generally exist as alluvial flood plains and dry river beds as the aquifers become subterranean. A portion of land located along the Rio Nigua bordering the eastern boundary of the Camp and south of the confluence with the Rio Majado, has been categorized as susceptible to inundation due to rising water, although the 100-year floodplain has not been identified.

Conclusion. While the three rivers associated with Camp Santiago are dry during the majority of the year, flooding occurs during the rainy season. A determination of the 100 year flood-plain located within Camp Santiago would provide valuable information for determining the location of future facilities as well as evaluating training area utilization.

Recommendation. Recommend that a study be undertaken by the Corps of Engineers to determine the 100 year flood-plain within the boundaries of Camp Santiago.

5.9.2 Water Quality.

Existing Conditions. The Puerto Rico Water Quality Standards Regulation (June 1973) identified water quality standards for most receiving streams as follows:

1.	Dissolved oxygen (DO)mg/1	5.0 (24 hrs avg)
2.	Fecal coliform, #110m1	2000
3.	pH (range)	6.0-9.0
4.	Phosphorus, ppb	50/25 (streams/lakes)
5.	Dissolved solids, mg/1	500
6.	Chlorides, mg/1	50

The majority of surface waters in Puerto Rico have been found to be in violation of existing water quality standards. Although data is not available, it is unlikely that the water quality of the Rio Nigua meets the standards, as it is dry most of the year, and the communities located along its bank just

outside the training area lack adquate facilities for handling sewage. Streams of the south slope generally violate DO and Biological Oxygen Demand (BOD) standards to a lesser degree than on the northern slopes, but characteristically have a worse problem with fecal coliform.
In addition to receiving raw sewage, the Rio Nigua is probably infested with Schistosoma mansoni, a parasitic fluke which lodges in various organs of the human abdomen.

Erosion, accompanying sedimentation loads, and non-point sources of pollution vary within the Rio Salinas Basin as a function of the intensity and duration of rainfall, the extent of agricultural development, and nature of the soils.

Impacts. Camp Santiago operates a sewage treatment facility which discharges treated effluent limitations required to comply with applicable water quality standards.

The use of military vehicles at Camp Santiago results in minor ground distubance so that the potential for erosion and signficant sediment loading to the dry rivers of Camp Santiago and downstream of the Camp is relatively low. This is especially true if one considers the extent of vegetative cover which is almost complete in the training area and the semi-arid nature of the climate characteristic of the Camp. Most of the sediment loading which does result from military training is from sheet and gully erosion of the unpaved roads.

The Camp's roads are only intermittently maintained, and depending upon the soil type and slope, the erosion potential can be high. The high intensity rainfall periods and the topographic characteristic of Camp Santiago cause the erosion to be the highest during the rainy season which is of relatively short duration. Consequently, sediment loading to typically dry streams and rivers associated with the Camp can be relatively high; such erosion is not continuous and is no considered to be significant.

The use of the tracked vehicles associated with training of the cavalry troops result in more ground dsturbance than training conducted using wheeled vehicles. The tracked vehicles use training areas which are relatively flat compared with the mountainous terrain in the northern part of Camp Santiago, making the erosion potential in the flat areas lower than in the more mountainous areas which have greater slopes. Recognizing this, the length of the growing season, and the extent of vegetative cover associated with the training areas, the use of tracked equipment does not result in a significant increase in the sediment load contributed by Camp Santiago's activities to the waterways. Artillery and mortar rounds dishcarged in the impact area may result in some pollutants which could become waterborn. However, the decomposition products of the explosives used result mainly in gasses being emitted upon rapid oxidation of the explosive. It is not expected that surface waters would be degraded as a result of the small number of rounds which are exploded in the impact area annually.

Conclusion. While some general statements may be made relative to the water quality standards of rivers sampled in the soutern portion of Puerto Rico, there are no actual water quality data available for the rivers associated with Camp Santiago.

Training activities associated with Camp Santiago result in erosion problems which not only affect the usefulness of the training area but produce an unacceptable sedimentation loading on the streams and rivers located on and downstream of Camp Santiago.

Recommendations. Recommend the initiation of a stream monitoring program at Camp Santiago to determine existing water quality conditions and the applicability of the existing conditions to the existing water quality standards. Also recommend an evaluation of training practices as they relate to the destruction of roads and hillside susceptible to surface water runoff. Such options as the initiation of a more intense road maintenance program, the construction of siltation catchment basins, or the redirection of troop movement away from susceptible erosion areas.

5.9.3 Ground Water Hydrology. Ground water is a resource closely monitored by the Commonwealth of Puerto Rico, especially in the south as this is the primary source of water. precipitation and evapotranspiration are generally equal in southern Puerto Rico so that the water balance demonstrates a deficiency most of the year; another reason why ground water resources are closely monitored. This is especially important since agricultural development in the south is particularly dependent upon irrigation which can affect public water supplies. Ground water levels in the Camp Santiago area range from 3-12m above Mean Sea Level (MSL). Data from wells south of Salinas indicate that from 1971-1978 groundwater was pumped at a greater rate than was recharged resulting in a ground water deficit which could result in salt water intrusion. Consulation with the Puerto Rico Aqueduct and Sewer Authority indicates that the aquifer is overdrawn and that little reserve capacity is available; to date the aquifer has never dried up in the immediate vicinity of Salinas and Camp Santiago.

The water quality of the ground water aquifer used by Camp Santiago is good as the only treatment required is chlorination. Typically, water from alluvial aquifers along the coast locally will have high concentrations of iron and maganese; the sources of these minerals is unknown. Ground water throughout Puerto Rico is a calcium bicarbonate type differing primarily in the concentration of dissolved solids. In the south, alluvium aquifers are characterized by dissolved solids concentrations of 300-500 mg/1 while limestone aquifers are characterized by concentrations ranging from 500-800 mg/1.

In summary, the ground water used by Camp Santiago is of good quality; however, drawdown of the aquifer for agricultural purposes without sufficient recharge could ultimately result in a deficient water balance.

Impacts. Camp Santiago does not keep records on water usage, but it is not anticipated that the use of its water wells will significantly affect the availability of ground water tothe public sector using the same aquifer. The water pumping system can only support an effective population capacity of around 2,000-2,500 which is the average number of troops training at Camp Santiago. Peak water demands on the aquifer generally occur only on weekends and during the AT periods in the summer. Compared to the quantities of water used for irrigation in the area, Camp Santiago's consumption is lower.

A potential for the contamination of ground water exists at the sanitary landfill operated by the Camp. Inspection of the landfill following high intensity, short duration rains indicated that within several hours most of the rainwater which had accumulated in the trench had disappeared into the ground. This intermittently produced leachate is probably relatively clean as the existing construction of the landfill prevents the pooled rainwater from mixing with cover refuse. However, since the refuse is not covered daily, a potential exists for the contamination of the rainwater as it accumulates with the unburied refuse and for the contamination of ground water from the leachate. The landfill site has not been studied to determine its geohydrological characteristics. Although the potential exists for leachate contamination of ground water, controlled operation of the landfill using approved techniques will greatly minimize this potential, if not totally eliminate it.

Conclusion. While ground water is considered a critical natural resource in Puerto Rico, the actual amount of data available for evaluating current conditions for future management is very minimal. There is no ground water withdrawal data for Camp Santiago with only minimal graduation quality data. With the continued increase in demand for ground water utilization and possible contamination, a comprehensive ground water study should be undertaken at Camp Santiago to ensure an adequate supply of water in the future.

Recommendations. Recommend the initiation of an extensive ground water study at Camp Santiago to include influences of the Salinas Municipality. The study should include as a minimum data on well withdrawal notes, ground water sampling, and a determination of the current state of the ground water aquifer. Based on the recommendations of the groundwater study, initiate appropriate action.

5.9.4 Drinking Water.

Existing Conditions. The water supply at Camp Santiago is provided by two deep wells located near the main gate.

One well is equipped with a 25 horsepower motor and pump rated at 970 liters/per minute and the other well has a 25 horsepower motor pump rated at

870 liters per minute. Both are powered by electric motors with no emergency standby power sources. Well pump operation is controlled by a float located inthe 1.1 million gallon water storage tank. When the water level drops 0.3 meters below the top of the tank, one pump starts; if the water level continues to fall, the second pump starts. The pumps stop when the tank is full. Good quality ground water eliminates the need for treatment beyond chlorination. However, routine water samples should be analyzed to ensure compliance with the Safe Drinking Water Act. Two gas chlorinators (one for each well) are located on the single 0.2m transmission line which supplies the distribution system. The water distribution system is 21km in length and consists of asbestos cement and cast iron mains ranging from 0.1m to 0.2m in diameter.

Impacts. Camp Santiago does not keep any records of pump operating cycles nor does it meter water usage, therefore, no water usage data is available. Specific data on the water bearing aquifer's safe yield is also unavailable because of the lack of pumping test data. Since there is no treatment of the ground water beyond chlorination prior to distribution, there is no waste water generated by the water system and therefore no waste water treatment required.

Utilizing a theoretical value of 580 liters of water consumption per day, per person, the existing water supply system is capable of supporting the 2,000 troops who utilize Camp Santiago at peak training periods. The proposed construction of the proposed MATES and Battalion billeting should have no significant impact on water demands at Camp Santiago.

Conclusion. While there is currently no treatment of the ground water at Camp Santiago beyond chlorination, indicating high quality ground water, data does not exist to establish Camp Santiago's compliance with the Safe Drinking Water Acts requirements for meeting maximum containment levels.

Recommendation. Recommend the initiation of a sampling program to determine compliance with the Safe Drinking Water Act. Based on the recommendations of the sampling program, initiate proper actions.

5.9.5 Waste Water.

Existing Conditions. Waste water is collected and treated at Camp Santiago by an activated sludge sewage treatment plant which discharges treated effluent into the Quebrada Honda, a tributary of the Rio Nigua.

The sewage collection system consists of .2m and .3m diameter mains. The collection system is a gravity system constructed in the late 1960's. Raw sewage from throughout the cantonment area enters the sewage treatment plant through a .3m diameter gravity sewer and passes through a bar screen comminutor and parshall flume. Sewage then flows through primary contact basins, stabilization basins, final clarifiers, and a chlorine contact chamber. Two sludge recirculation pumps recirculate the activiated sludge from the final clarifiers to the primary contact basins. Excess sludge is drawn off to an aerobic sludge digestor where digested sludge is deposited on drying beds. Dried sludge is disposed of at the land fill on post. The sewage treatment plant has a design flow of 0.25 million gallons per day. Based on log sheets maintained at the treatment plant the average daily flow of 0.05 million gallons per day. However, during AT flows can reach as high as 0.70 million gallons per day.

The quality of the sewage treatment plant's effluent has been historically good, averaging 15-20 mg/l for both BOD and TSS. The plant is manned 8 hours a day, 5 days a week by a certified operator who performs some chemical analyses on the effluent; however, BOD, TSS, and other more complicated analyses are performed off post.

Presently, several facilities dispose of waste water into drainage fields. Because of the semi-arid nature of the climate and the porosity of the soils, these drainage fields work well. Their use should not significantly degrade any ground waters. It is planned to eventually connect all field lines to the waste water treatment system. There are presently no treatment facilities associated with the washracks, therefore oils and greases washed from vehicles are probably exceeding water quality standards, however, no data were available. A consolidated wash rack is currently under construction which will be provided for pretreatment of the wash water prior to dischange to the sanitary sewer.

When military units utilize the licensed lands, they infrequently use equipment for treating surface waters to be used for drinking water. This equipment is usually located near Lago Coama and Lago Melania andis used primarily during the AT cycles. The treatment process results in the generation of a flocculation which is discharged downstream of the influent line and back into the surface water.

Impacts. The EQB of Puerto Rico establishes regulations for the discharge of sewage treatment plant effluents. These standards apply at all times, except when surface water flow is less than the average minimum seven day, ten year low flow condition. Both Quebrada Honda and Rio Nigua are reportedly dry from January through June during most years.

At the present time Camp Santiago does not have an NPDES Permit for its washracks or potable water purification systems. However, Camp Santiago has obtained an NPDES permit for its wastewater treatment plant No. PR 0023906. The EQB indicated that they intended to certify that the discharge will comply with applicable water quality standards if the NPDES permit effluent limitations are met. The EQB recognized the fact that the receiving stream is dry most of the year. Therefore, the permit specifies a comprehensive monitoring program related to water quality parameters and the absence of a mixing zone. A compliance schedule is not proposed by the Commonwealth. It is not believed that the construction of the Battalion billeting will result in adverse impact on the existing sewage treatment plant.

The EQB has also indicated that the NPDES Permit is required for the point source discharges associated with the portable water purification systems. The discharge from these systems is basically a slurry composed primarily of ferric chloride. However, it is not anticipated that the small volumes of waste that are discharged intermittently and only 3-4 times a year will result in a significant impact on the water quality of the receiving system.

In order to bring Camp Santiago's washracks into compliance, construction of a new consolidated washrack is proposed which will provide pretreatment prior to discharge to the Camp's sanitary sewer. The proposed consolidated washrack will result in the elimination of the existing washracks and the need for NPDES permits. The 14 washracks proposed for the MATES will also be provided with pretreatment and will be connected to the sanitary sewer.

Conclusions. Camp Santiago is currently operating six washracks and portable water purification systems which have point source discharges and operate without either waste water treatment facilities or NPDES permits.

Recommendations. Recommend that an industrial waste survey be undertaken at Camp Santiago to identify all point source discharges, and that waste water treatment facilities be installed and NPDES permits be obtained for all point source dishcarges at Camp Santiago.

5.9.6 Spill Plans.

Existing Conditions: Army regulations implementing the Clean Water Act require installations having certain non-transportation related onshore and offshore oil storage facilities to prepare and maintain a Spill Prevention Control and Countermeasure (SPCC) Plan to prevent and control the discharge of oil hazardous substances before they occur. Further, an Installation Spill Contingency Plan (ISCP) is required to identify responsibilities, procedures, and resources to be employed in the event that a spill does occur. Two underground storage tanks for MOGAS (25,000 gal) and diesel (10,000 gal) are located in the northwest part of the cantonment area.

Even though Camp Santiago does not meet the criteria for a SPCC Plan, an SPCC Plan and an ISCP were prepared in August 1979.

Conclusion. While an SPCC/ISCP Plan has been developed for Camp Santiago, new Federal and Commonwealth Regulations require the existing Spill Plans be updated.

Recommendations. Recommend the initiation of a study to identify all potential sources of oil and hazardous substances at Camp Santiago. Based on the results of that study implement the development of an updated SPCC Plan and an ISCP as appropriate.

5.10 Cultural Resources.

5.10.1 Archeological/ Historical.

Existing Conditions. There are no known historic properties or archeological sites at Camp Santiago. However, a cultural resource survey has not been coducted at the Camp. A review of the distribution of known sites which are located around Camp Santiago indicates that it is very probable that signficant sites could be located. Table 9 describes the known archeological resources from the Salinas area. Coordination with the Puerto Rico State Historic Preservation Office indicated that South Puerto Rico is much richer in pre-Columbian sites than in North Puerto Rico.

Impacts. Until a survey is completed, it is possible that an unknown its site could be disturbed. Intensified use of maneuver areas and ranges could result in damage or loss of an unidentified archeological/historical site on the installation. Some sites may have been disturbed in the past during construction of buildings, roads, airfields, and ranges, and during the operation of borrow pits. A cultural resource survey is being developed by the National Park Service and should be conducted during the late winter 1983.

Conclusion. The impact of current military activities on cultural resources cannot be fully analyzed until the completion of the programmed archeological/historical survey.

Recommendation. Initiate the recommendations resulting from the archeological/historical survey currently programmed.

TABLE 9

LIST OF ARCHEOLOGICAL SITES IN THE VICINITY OF

CAMP SANTIAGO, SALINAS

QUAD SHEET	SITE NAME	SITE NUMBER	DESCRIPTION
A. Coamo	1. Las Flores	CO-1	shell midden & plaza
	2. Cuyon	CO-2	shell midden & plaza
	3. Buenos Aires	CO-2	archaeological site
	4. Cantera	CO-4	archaeological site
	*5. Banos de Coamo	CO-5	rock carvings (petroglyph)
B. Guayama	1. Jajome	GA-1	archeological site
	2. El palo	GA-2	rock carvings (petroglph)
	3. Phillips	GA-3	archeological site
	4. Guamani	GA-4	reguse deposit
	5. Jobos	CA-5	
C. Salinas	1. Cayo Cofrsi	S-1	shell midden
	2. Las Mareas	S-2	archeological site
	3. Turabo	S-3	plaza
	4. La Plena I	S-4	archeological site & plaza
	5. La Plena II	S-5	archeological site & plaza
	6. Aguirre	S-6	archeological site
	7. El Caro	S-7	archeological site
	8. Abeyno	S-8	archeological site
	9. Abeyno	S-9	reguse deposit
	10. Margarita	S-10	archeological site
	11. El Llano	S-11	archeological site & plaza
D. Santa Isabel	1. Penuelas	SI-8	archeological site
	2. La Jungla	SI-8	archeological site
	3. El Cayito	SI-7	archeological site
	4. Las Ollas	SI-6	archeological site
	5. Aeropueto	SI-5	archeological site
	6. Los Indios	SI-4	archeological site
	7. Jauca III	SI-3	archeological site

*This is also a very significant historical site.

5.10.2 Demography.

Existing Conditions. Camp Santiago is located in the municipality of Salinas which has an area of 69 square miles (179 sp. km.) and in 1980 had a populalation of 26,494. From 1950 to 1970 there was a steady decrease in the population. A significant increase occured from 1970 to 1980. According to projections by the Puerto Rico Planning Board, the Salinas population is expected to increase by only 500 persons by the year 1990. Population migration affecting the Salinas municipality has been characterized by emigration rather than immigration. From 1950 to 1970 approximately 1500 persons emigrated out of Salinas. From 1970 to 1980 persons emigrating out of Salinas numbered only 782, a proportionately great reduction. Information on sex and age of the population was unavailable.

Impacts. Summer AT camps result in dramatic but temporary population increases at Camp Santiago. The effect of these increases in terms of interaction with the resident population, primarily that in the city of Salinas, is unknown.

5.10.3 Social/ Institutional Resources.

Existing Conditions.

1. Education. The Salinas municipality is part of the Ponce School District. In the 1980-81 school year there were 16 schools in the Salinas municipality (preschool to grade 12), with 7,087 students registered in grades 1 through 12 and 329 teachers. In 1980, drop out students numbered 302 or 4.3 percent of the total student body.

2. Health. The Department of Health includes the municipality of Salinas in the Guayama area of the Southern Health Region. In 1978-1980 time period only 9 medical personnel were available to serve the Salinas population of

26,494. This accounts for 2,944 persons per doctor. Information on health facilities outside Camp Santiago was not available.

3. Housing. Information on housing in the Salinas municipality was provided by the Puerto Rico Planning board. In 1979, the housing stock numbered 7,388 urban and rural units. In 1978-79 only 60 construction permits were granted in the Salinas municipality. By 1985 it is projected that an additional 1,718 units (mostly urban) will be needed. Housing density is expected to be at 3.5 persons per unit in the 1985 to 1990 time period.

4. Crime and Law Enforcement. Limited information on crime in the Salinas municipality was obtained from State agencies for the 1978-79 time period. The majority of crimes reported during this time period were for aggravated assault, breaking and entering, and embezzlement. Robbery, rape and murder constituted a small proportion of reported crimes. No information is available for the 1980-81 time period. Information on the enforcement capability of the region is unavilable.

Impacts. The temporary influx of personnel for AT at Camp Santiago does not cause any impact on education, health, or housing services in the region, since all personnel are accommodated on post. The effect of this influx on the regional crime rate is unknown.

5.11 Economic Resources.

5.11.1 Employment.

Existing Conditions. Camp Santiago is located in a poor part of Puerto Rico where unemployment is relatively high and where over 50% of the families live at or below poverty level.

In 1974-75 construction and mining, finance, real estate and insurance accounted for the lowest employment in the Salinas municipality. During this time approximately 17% of the workforce was involved in agriculture, while over 40% was involved in manufacturing and 21% was associated with government. In 1977, the unemployment rate on the island of Puerto Rico was over 20%. The construction employment sector had the highest rate with 47.5% unemployed. These levels of unemployment are characteristic of the Salinas municipality. Table 10 describes the distribution of the workforce in the Salinas municipality for 1974-75 and offers a projection of the workforce into 1999-2000 (Information provided by the Puerto Rico Planning Board). The Planning Board has predicted that workforce distribution levels will remain comparable in the year 2000, with a slight increase in manufacturing jobs and decrease in agricultural jobs. Table 11, Industrial Sectors shows income generated from various industrial sectors for the 1975 fiscal year in the Salinas municipality.

TABLE 10

Employment in the Salinas Municipality by Industrial Sector, 1974 - 1975 and 1999 - 2000 (persons)

SECTOR	1974 - 75	1999 - 2000
Agriculture	532	373
Manufacturing	1318	1728
Construction and Mining	28	18
Transportation and other Public Utilities	119	119
Trade	268	247
Finance, Insurance and Real Estate	48	49
Services	144	140
Government	650	631
TOTAL	3107	3305

TABLE 11

Adjusted Domestic Income from Industry in Salinas Muncipality

1975 Fiscal Year (Thousands of Dollars)

SECTOR	ADJUSTED DOMESTIC INCOME
Agriculture	4226
Manufacturing	10413
Contract Construction and Mining	138
Transportation and other Public utilities	1839
Finance, Insurance and Real Estate	2323
Service	994
Government	7618

Impacts. Camp Santiago provides much needed jobs in an area of Puerto Rico where jobs are scarce. As of the summer 1982, a total of 147 employees were working at Camp Santiago; 35 civilian Federal technicians, 77 State contract employees, and 35 active duty Guard (Federal) employees. This is not an insignificant number considering the rural nature of the surrounding region.

5.11.2 Income.

Existing Conditions. Information on income and family size was provided by the Puerto Rico Planning Board for the Salinas municipality. Estimates are based on the 1960 and 1970 population census on the "Euentas Nacionales". The average income in 1975 was $5,043 with a median income of $4,530; in 1980 the average was $6,034 and the median was $5,345. Domestic per capita income was $1,326 for 1975; dosmestic income for the entire municipality was $29,902,000. Comparable figures for 1980 are unknown. In 1975 and 1980 the level of poverty for a family of four in the Salinas area was $5,850, indicating that the population is relatively poor. In 1975, 70% of the families were in the $6,000 and below income brackets, with the majority of families in this grouping consisting of 2-4 members. In 1980, over 55% of the families were below the poverty level. The Department of Social Services provided food stamps worth $706,886 to 5237 families living in the municipality of Salinas in 1980.

Impacts. Camp Santiago operations result in the expenditure of over $2,573,300 annually. Most of these funds are paid as salaries or are disbursed for supplies and services which are purchased locally (refer to Table 12). Part of the salaries are paid to teachers and students at the English Technical Language School operated on Camp Santiago.

Monies spent in the local area for supplies, services, and salaries exert a beneifical impact upon the local economy, although this amount may not be significantly high. During the summer when AT is held, the installation exerts a minor influence on the local economy from the influx of personnel. Construction of the proposed MATES and Battalion billeting would provide a short-term economic benefit during construction.

Conclusion. Camp Santiago exerts a positive economic effect on the Salinas municipality by providing jobs, utilizing local goods and services, and directly supporting the local communities.

TABLE 12

FY-81 CONTRIBUTION OF FEDERAL FUNDS TO CAMP SANTIAGO TO SUPPORT THE LOCAL ECONOMY

1.	Payment of Salaries and Fringe Benefits of Federal Employees (Technicians)	$423,731.00
2.	Payment of Salaries and Fringe Benefits of Training Site Contract Funds Employees	265,900.00
3.	Payment of Professional Services and Contract of Employees of the English Technical Language School (ETLS)	335,181.00
4.	Payment of services to students of the English Technical Language School (ETLS) to include materials and supply	1,060,853.00
5.	Camp Santiago Training Site Contract Funds Authorization for FY-81 to support the following areas: Payment of Utilities, Materials and Supply, Supplies for Operation, Travel Expenses and IDS maintenance and repairs	345,600.00
	TOTAL	2,440,265.00

5.12 Energy Resources.

Existing Conditions. Energy available to and consumed by Camp Santiago is in the form of electricity and liquid petroleum fuels. Electricity is utilized primarily in supporting cantonment or general population activities while liquid petroleum produces are used in training or equipment oriented activities. The following is a discussion of each energy type with an approximate description of demand and consumption levels.

a. Electrical System. According to the Expansion Capability Plan, the source of electrical power for Camp Santiago is the Puerto Rico Water Resources Authority, Salinas Substation #4501. The distribution system on the Camp is owned and maintained by the National Guard.

A recent study of the power system indicated a present voltage of 117.9 volts (120 volt reference) at the post where regulators are included. A power factor was measured at the substation at 0.79 with a load of 948.6KVA. Because present demands have approached the limit of the single distribution feeder, improvements are planned for the installations's electrical system. Corrections to improve the power factor and raise the voltage level that have been recommended include installation of capacitors and changing conductors to achieve a planned load of 1086 KW (1148 KVA) with a physical limit at 1500 KVA.

b. Liquid Fuels. The use of equipment at Camp Santiago (both PRARNG and USAR) results in an average annual consumption of petroleum product (POL) as follows:

MOGAS	.37M Liters (995,000 gal)
DF2	.26M Liters (67,000 gal)
JP5	.58M Liters (150,000 gal helicopter and fixed wing)

TABLE 13

MONTHLY FUEL CUNSUMPTION

Camp Santiago, Puerto Rico

	1980										1981	
	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
Mogas	11,851	3,590	3,141	4,307	4,591	3,917	4,620	5,328	5,624	3,665	10,126	13,791	74,551
Diesel	6,108	3,348	1,657	2,935	2,186	1,865	1,680	1,961	2,952	1,994	3,467	14,313	44,466
Total	17,959	6,938	4,798	7,242	6,777	5,782	6,300	7,289	8,576	5,659	13,593	28,104	119,017

In addition, the PRARNG flies A7 Corsair II aircraft which consume JP4 fuel. Using an average of 2,000 sorties per year, 20 minutes per sortie and fuel consumed at a rate of 6,000 lbs per hour, the fuel consumption by these aircraft would be approximately 4,000,000 lbs (2.385M liters or 615,385 gallons) per year over Camp Santiago. Fuel used by the PRARNG is drawn from Muniz Airport in San Juan. Table 13 give the actual fuel usage during July 1980 through June 1981. These data indicated peak usage during the May-July period with secondary peaks in October-November and February-March. Most of this POL is consumed in transporting personnel and equipment to and from the Camp from the various armories in the Commonwealth.

Construction of the proposed MATES and Battalion billeting will result in a increase in POL consumption through the servicing and maintenance of vehicles and the transportation of troops.

Impacts. Energy consumption at Camp Santiago is significantly lower than that at other military installations, according to the Expansion Capability Plan. However, Puerto Rico's subtropical location would make it a likely choice for development of alternative energy sources such as wind or solar, which would reduce consumption even further.

Comparable information on liquid petroleum fuel consumption is unavailable, though it is not expected to be relatively high.

Conclusion: The present electrical system is inadequate. Electrical energy consumption at Camp Santiago is not significantly high. Petroleum fuel consumption is probably not significant, although comparative information is unavailable.

Recommendation. Recommend upgrading the present electrical system and researching the development of alternative energy sources such as wind solar power.

6.0 Summary of Environmental Status.

The Phase II EMAP Environmental Assessment for Camp Santiago has identified various deficiencies in the environmental resources management of the Camp. This section is intended to identify all mitigative measures recommended to gain compliance with environmental laws and regulations and to improve the environmental resouce management deficiencies.

6.1 Summary of Mitigative Measures.

1. Permits Required:

   a. NPDES permits: portable water purification system.

2. Management Plans:

   a. Environmental Assessment of Off-Post Training Activities (annually).

   b. Spill Prevention, Control and Countermeasure Plan (SPCC)(update).

   c. Installation Spill Contingency Plan (ISCP)(update).

   d. Cultural Resource Management Plan.

   e. Forest Managment Plan.

   f. Pest Management Plan.

3. Studies and Inventories that should be performed include:

   a. Reconnaissance level archeological survey (to be initiated winter 1983).

   b. Hazardous waste management survey.

   c. Air emissions inventory/source surveillance.

   d. Chemical analysis of dried sewage sludge.

Summary of Mitigative Measures (Cont'd)

f. Flora and Fauna Inventory.

g. Ground water study.

h. Sampling of portable water for compliance with Safe Drinking Water Act.

i. Industrial waste surve.

4. Other mitigative measures:

a. Erosion Control and Maintenance of Roads.

b. Control of Grassfires through a Research and Development Fire Training Program.

c. Centralized Washracks/Land Treatment.

d. Landfill operations.

e. Maintenance of equipment, roads and erosion control devices.

f. Informal coordination with US Fish and Wildlife Service on endangered species.

g. Operating permit for quarry and borrow pit operation.

h. Stream monitoring program.

i. Investigate alternative energy sources.

j. Identification of the 100 year flood plain within the Camp's boundaries.

k. Comprehensive wildlife survey.

6.2 Recommendations.

AIR QUALITY

1. Common dust suppressant techniques should be employed during the Camp's construction activities and on heavily traveled unpaved roads. Fugitive dust generated from vehicular traffic should not migrate beyond the Camp's boundaries, therefore traffic management controls should be developed to ensure that vehicular traffic to and from the training and cantonment areas should be routed on roads nearest the most upwind camp boundary.

2. The quarry and borrow pit operation should be individually studied to determine if the operations are in compliance with Federal and local air pollution control regulations. The quarry operation may require an operating permit.

3. A Camp-wide air emissions inventory study should be conducted to identify all air pollution sources on the Camp, to classify the pollutants, quantify pollutant concentrations and their impacts on existing air quality at the Camp and to identify corrective action as appropriate.

4. The Camp's and PRARNG internal combustion engines should continue to be maintained in accordance with the manufacturer's specifications and applicable Federal and Commonwealth regulatory standards.

5. The Camp should discuss the possibility of entering into an agreement with the Salinas fire department and of establishing a Research and Development Fire Training Program and should plan to develop a fire break design and other methods that would be effective in controlling grassland fires on the installation. The Camp's training areas could be used for this research and development effort by the local fire departments. This fire training plan would have to be submitted to the Commonwealth's EQB for approval in

accordance with Puerto Rico air pollution control regulation. If approved, the Camp training areas could be programmed/scheduled for controlled burning prior to unit training by the local fire department as part of the fire training research and development effort. This type of fire training activity is exempt by the EQB and would not require a permit or variance for open burning.

6. Open burning of refuse at the Camp's landfill should be stopped and appropriate manage with effective control measures taken during the peak training cycles (May-August) and implemented in accordance with the AEHA solid waste/landfill study recommendations at Appendix V.

NOISE

Continue excellent responses to noise complaints. Establish and maintain a liaison with local planning and zoning authorities in all matters pertaining to new developments around Camp Santiago, especially the northern regions.

SOIL

Control of gully erosion could be enhanced if drainage ditches were routinely maintained and provided with drain-outs at appropriate distances along the road. This would prevent runoff from generating enough velocity to start sheet erosion and to cut deep erosional gulleys. Work could possibly be performed by engineering units that train at Camp Santiago during a period prior to the rainy season each year; beneficial training would be realized by military personnel performing the horizontal construction/maintenance work.

Sediment basins could be provided to collect sediments suspended in runoff from the borrow pit area. To reduce the potential for sheet erosion in the training areas, the cavalry troop vehicles should conduct maneuvers with tracked vehicles in training areas characterized by lower slope angles and avoid steeper slopes where erosion potential is higher. Ideally, tracked vehicles should only be utilized during the drier seasons of the year.

VEGETATION

The DNR has recommended that Camp Santiago prepare and implement a forest management plan which emphasizes the planting of trees suited to the semi-arid environment associated with the Camp. The success of a reforestation program would be contingent upon the ability of management personnel to exclude fire from planted areas and to provide irrigation, at least until the seedlings become established during the first year. The DNR has previously agreed to assist Camp Santiago in establishing a reforestation program. The DNR has already recommended species which would have the best success in the area and has agreed to provide the seedlings. Military training benefits could be derived from a successful reforestation program since cover and concealment would improve. If areas were reforested successfully, the size of areas which wild grass fires burn would be reduced as the forest would affect wind patterns and the extent of fuel available for burning. New forested lands would also provide additional habitat for faunal species. The establishment of a pilot reforestation program should be considered for a selected area to evaluate whether such a program could be economically implemented considering the availability of personnel and water and the requirements for controlling fire characteristic of this area.

WILDLIFE

A comprehensive wildlife survey should be conducted on Camp Santiago as manpower and resources permit. Coordination with the USFWS has indicated that formal consultation as required by Section 7 of the Endangered Species Act will probably not be required at Camp Saniago. Camp Santiago should request informal consultation with the USFWS to identify actual habital used by endangered species on the Camp and to assess the effects of military training upon any Federally listed endangered species reported in the area.

PESTICIDES

1. Prepare a pest management plan (AR 420-76, paragraph 3-3) for Camp Santiago utilizing the Integrated Pest Management concept (AR 420-76, paragraph 2-2). Included in this plan should be procedures for:

   a. Conducting monthly pesticide inspections (AR 420-76, paragraph 4-1);

   b. Disposing of excess pesticides, residue and containers in accordance with AR 420-76, paragraph 4-2;

   c. Preparing the necessary pest reports (AR 420-76, paragraph 4-4) and;

   d. Submitting the annual onsite installation pest management review (AR 420-76, paragraph 3-1).

2. Ensure that the storage building is in compliance with FIFRA design standards.

3. If more than 0.25 man years is to be expected in pest control operations, the appropriate number of personnel should be certified (letter, DARN-MPO-B, 18 Marh 1981, subject: Army Pest Mnagement Program (AR 420-76).

4. If contractual pest control is used, the procedures in AR 420-76, paragraph 2-12 should be followed.

5. Conduct a Pesticide Management Survey at Camp Santiago and implement the recommendations.

SOLID WASTE

1. Upgrade the current solid waste disposal practices of the installation to meet the requirements of the Commonwealth of Puerto Rico's Sanitary Landfill Permit. The major practices which should be upgraded are:

a. Place cover material (6 inches) on refuse which is deposited in the trench by the end of day.

b. Do not allow open burning of refuse in the trench.

c. Place surface-water diversions (ditches) around the trench to preclude any surface water run-off from entering the trench.

2. Do not exceed 10 feet in depth when constructing future trenches because of the shallow depth of the soil.

3. Consider increasing the staffing of the landfill operation during the time when AT is being conducted at the installation.

4. Sample and analyze the open burning and open detonation pits's residue for potential hazardous waste characteristics (reactive, corrosive, ignitable or toxic) and take appropriate action under RCRA to achieve compliance, if required. If residue is determined non-hazardous, it may be removed following the burn/detonation operation and deposited into the Camp's landfill.

HAZARDOUS WASTE

Conduct a hazardous waste management study at the Camp and implement study recommendations.

SURFACE HYDROLOGY

Recommend that a study be undertaken by the Corps of Engineers to determine the 100 year floodplain within the boundaries of Camp Santiago.

WATER QUALTIY

Recommend the initiation of a stream monitoring program at Camp Santiago to determine existing water quality conditions and the applicability of the existing conditions to the existing water quality standards.

Also recommend an evaluation of training practices as they relate to the destruction of road sand hillsides susceptible to surface water runoff. Such options as the initiation of a more intense road maintenance program, the construction of siltation catchment basins and the redirection of troop movement away from susceptible erosion areas.

GROUND WATER HYDROLOGY

Recommend the initiation of an extensive ground water study at Camp Santiago to include influences of the Salinas municipality. The study should include as a minimum data on well withdrawal notes, ground water sampling, and a determination of the current state of the ground water aquifer. Based on the recommendations of the groundwater study initiate appropriate action.

DRINKING WATER

Recommend the initiation of potable water sampling program to determine compliance with the Safe Drinking Water Act. Based on the recommendations of the sampling program, initiate proper actions.

WASTE WATER

Recommend that an industrial water survey be undertake at Camp Santiago to identify all point source discharges, and that waste water treatment facilities be installed and NPDES permits be obtained for all point source discharges at Camp Santiago.

SPILL PLAN

Recommend the initiation of a study to identify all potential sources of oil and hazardous substances at Camp Santiago. Based on the results of that study implement the development of an updated SPCC and an ISCP as appropriate.

ENERGY RESOURCES

Recommend upgrading the present electrical system and researching the development of alternative energy sources such as wind or solar power.

7. List of Persons/Agencies Consulted.

COL Guillermo H. Barbosa, PRARNG.

Hugo C. Biermann, Environmental Protection Specialist, Environmental Resources Branch, National Guard Bureau.

LTC William C. Burns, Deputy District Engineer, U.S. Army Corps of Engineers.

LTC Miguel A. Camacho, PRARNG.

Alejandro Candelario, Director, Division de Inventario, Department of Natural Resources.

Bartolome G. Canellas, Solid Waste Compliance, Puerto Rico Environmental Quality Board.

Luis F. Pieraldi Cappa, Juez de District, Tribuanl General de Justicia, Centro Judicial de Ponce.

Ruth Davial Carreras, Director of Resource Planning, Department of Natural Resources.

Emilio M. Colon, Chief Planning Section, US Army of Corps of Engineers.

Cesar N. Cordera, Attorney.

Julio Diaz, Solid Waste Compliance, Puerto Rico Environmental Quality Board.

Adolfo Moreno Espanol, Reality Specialist, US Army Corps of Engineers.

COL Rafael Fantauzzi, Facilities Management Officer, PRARNG.

Jesus Rigueroa, Archeologist, Puerto Rico Environmental Quality Board.

Sigfrido Garcia, Water Resources, Puerto Rico Planning Board.

Pedro Gelabert, Chairman, Puerto Rico Environmental Quality Board.

Guillermo Gill, Security Representative, American Airlines.

James Hensley, Environmental Protection Specialist, Environmental Resources Branch, National Guard Bureau.

Gerald Hicks, Environmental Protection Specialist, Environmental Resources Branch, National Guard Bureau.

Edward W. Hill, Directorate of Engineering and Housing, US Army Garrison, Ft Buchanon, Puerto Rico.

Dianne L. Huppman, Environmental Protection Specialist, Environmental Resources Branch, National Guard Bureau.

Rene Labaraca, Socioeconomics, Puerto Rico Planning Board.

Ivette Laborde, Scientific Assessment Office, Puerto Rico Environmental Quality Board.

Felix Lopez, US Fish and Wildlife Service.

Robert Lozar, Army Corps of Engineers, Construction Engineering Research Laboratory.

MAJ Arnaldo Malave, 758st, US Army Garrison.

Esteban Mujica, Noise Control, Puerto Rico Environmental Quality Board.

MAJ Rafael Nadal, 2nd MTC, US Army Reserves.

1LT Jeff New, Bioacoustics Division, US Army Envrionmental Hygiene Agency.

John Oberheu, US Fish and Wildlife Service, Jacksonville Area Office.

LTC Jose M. Oliver, Camp Santiago, Air Guard Range Control.

Dr. Agamemnon Gus Pantel, State Historical Preservation Officer, Office of the Governor.

COL Jose A. Parodi, Air Guard Group Commander.

Oho J. Riefkohl, District Counsel, Veteran Administration.

Carmen A. Abrahamson-Rodriquez, Area of Scientific Investigation, Department of Natural Resources.

Luis Ruben Rodriguez, Water Quality Compliance, Puerto Rico Environmental Quality Board.

Santos Rohena, Deputy, Puerto Rico Environmental Quality Board.

Rafael Rosaly, Administrative Assistant, Metropoliton Bus Authority.

William A. Russell, Environmental Protection Specialist, Environmental Resources Branch, National Guard Bureau.

CPT Manuel Sosa, Facilities Engineering, Camp Santiago PRARNG.

Edgardo Soto, Air Compliance, Puerto Rico Environmental Quality Board.

Victor Trinidad, Water Quality, US Environmental Protection Agency.

Angie Valido, San Juan Area Office, US Army Corps of Engineers.

Ivan Velez, Scientific Assessment Office, Puerto Rico Environmental Quality Board.

Dr. Jose Vivaldi, Endangered Species, Puerto Rico Department of Natural Resorces.

Jim Westerveldt, Army Corps of Engineers, Construction Engineering Research Laboratory.

Dr. Ray Woodbury, Endangered Speces, Department of Natural Resources.

FINDING OF NO SIGNIFICANT IMPACT

Camp Santiago, Puerto Rico

A. Description of Action. Camp Santiago is the only Commonwealth property available for the field training of various units of the Puerto Rico Army and Air National Guard. Additionally, units of the US Army Reserves located in Puerto Rico and National Guard units of the Virgin Islands utilize the Camp's facilities throughout the year, along with ROTC and regular Army units, the US Marine Corps, the Boy Scouts, and the FBI and Federal Marshalls. The primary mission of the installation and its training site headquarters is to provide the most suitable training area possible where various military training activities can be performed and weapons systems utilized to ensure the readiness and military capability of the reserve components of the armed forces of the United States and Puerto Rico. Training facilities at Camp Santiago have been tailored to the training requirements of units assigned to the Puerto Rico National Guard and other military and non-military units. The installation also has the mission of being the operations center/mobilization station when National Guard troops are activated for National and Commonwealth emergencies.

B. Environmental Impact. The analysis of the environmental impacts of ongoing and proposed activities at Camp Santiago is documented in an Environmental Assessment entitled "Camp Santiago, Puerto Rico, Environmental Management Analysis and Plan (EMAP), Phase II."

Ongong activities at Camp Santiago are not significantly affecting regional air quality. Dust made airborne through training activities occasionally causes localized dust problems. Noise generated by aircraft and training activities is not currently affecting the aesthetic environment of nearby communities.

The primary impact on soils pertains to increased erosion from training activities. Impacts to ecological resources include disturbances of vegetation (wildlife habitat), and disturbance of wildlife within the boundaries of Camp Santiago. Training activities contribute to vegetation disturbance. The existence of Camp Santiago has not affected local land use. Impact to hydrological resources result from potential for ground water depletion and point source discharges to surface waters. These impacts result mainly from operation and maintenance activities on Camp Santiago. Impacts of ongong activities on cultural, archeological, and historical resources are not known at this time. Literature and field studies are currently underway. Ongoing procurement activities, including wages and salaries, are having a very positive effect on the economy of the Salinas municipality. Energy consumption at Camp Santiago is small compared to other military installations.

C. Finding of No Significant Impact. A careful review of the Environmental Assessment has concluded that ongoing and proposed activities at Camp Santiago do not have a significant impact on the quality of the natural or human environment. The requirements of the National Environmental Policy Act and the Council on Environmental Quality Regulations have been satisfied and an Environmental Impact Statement will not be prepared.

APPENDIX I

MISSION STATEMENT

CAMP SANTAIGO, PUERTO RICO

ORGANIZATION

MISSION.

A. This unit is organized to provide the Adjutant General of the State or Commonwealth concerned with the necessary personnel and equipment to provide training, administrative and logistical site support to training units, and to provide for year-round maintenance and operation of the post. Support will be provided as outlined:

(1) Provide the State Adjutant General with personnel and equipment as required for operation of the Military Reservation.

(2) Maintain the mobilization facilities of installation in accordance with the requirements of AR 210-17, or as otherwise may be required.

(3) Provide maintenance of equipment in support of the post.

(4) Provide communication support fr cantonment area and range operations.

(5) Provide security, fire protection supply, transportation, housing, and construction for assigned and tenant units.

(6) Maintain facilities and provide services necessary for religious, health, education, welfare, and entertainment activities.

(7) Assist the State Adjutant General in the logistical support of units engaged in providing military support to civil authorities.

(8) Within established policies; to plan, to allocate resources, and to support training unit activities conducted on and off the installation by

providing training, administrative, and logistical support as required.

(9) Prepare plans, policies and SOP's for post operation, and to advise and assist the senior commander of the unit conducting training at the site in the execution of approved plans and policies.

(10) Store and maintain installation type equipment and property for temporary use of active Army and Reserve component units, and for mobilization and such other purposes as may be directed.

(11) Perform administration, intelligence, operational, financial managment, and logistical functions necessary to operate the Camp complex and support assigned and tenant units.

(12) Provide facilities for the conduct of technical projects and field exercices for active military forces and reserve forces of the various services, including necessary communications, engineering, and other technical service facilities.

(13) Analyze requirements, design and construct ranges, and other training facilities.

(14) Supervise range operations to ensure compliance with appropriate regulations and safety procedures.

(15) Provide PCS equipment required to support units in performance of training mission when such equipment is not provided by unit TOE/TOA.

(16) Prepare and coordinate mobilization, operational emergency, disaster, and special plans and exercises. Update plans as required and be prepared to execute plans on order for both full or partial mobilization under deliberate or immediate conditions.

(17) Prepare for rapid mobilization of the facility by assuring that personnel, equipment and physical plans are of adequate standards of efficiency for immediate recapture by the active force.

(18) Prepare for integration into a U.S. Army Garrison Unit upon mobilization.

(19) Provide for premobilization orientation and qualification training in the appointed positions for officer, warrant officer, and enlisted personnel of the ready reserve selected as mobilization designees.

(20) Provide those annual training support requirements as set forth by HQDA, FORSCOM, NGB, and other appropriate regulations and documents.

B. Unit equipment is utilized by personnel assigned, attached FTTD, or active component augmentation State personnel and National Guard technicians to maintain, service, and repair buildings and structure, plans and equipment, roads, ranges, airfield utilities and other installation real property assets including service, repair, and maintenance of environmental equipment (air conditioners, heaters, and refrigeration equipment) in support of both pre-and post-mobilization missions. Specialized tools and equipment required to carry out the repair and utility functions described will be provided by this authorization document.

CAPABILITIES:

A. Provides command control and supervision to acomplish the mission of furnishing Garrison, Post Engineer, Administration, Communication, Logistical and Training services as required by units conducting training at the military installtion.

B. Develops plans, policies, regulations, and SOP's for the operation of the post. Advises and assists the senior commander of the units conducting training at the post.

C. Establishes communications with higher, lower, and adjacent headquarters.

D. Provides equipment for use by assigned and attached FTTD personnel, active component augmentation, state personnel and National Guard technicians to maintain, service, and repair buildings and structures, plants and equipment, roads, ranges, airfield, utilities, and other installation real property assets including service, repair, and maintenance of environmental equipment (air conditioners, heaters, and refrigeration equipment) in support of both pre-and post-mobilization missions.

E. Provides the Adjutant General of the State with the necessary post support to conduct annual training for units designated by the Army area site plan.

F. Provides assistance to the State Adjutant General in the logistical support of units engaged in providing military support to civil authorities.

G. Provides logistical support as required for units conducting training off-post.

H. Provides for rapid mobilization of the facility by assuring that personnel, equipment, and physical plans are of adequate standards of efficiency for immediate recapture by the active force.

TENANT UNITS: As allocated by the Chief, National Guard Bureau.

APPENDIX II

PUERTO RICO NATIONAL GUARD

ASSIGNED STRENGTH - SEPTEMBER, 1979

UNIT	LOCATION	OFF	WO	EM	TOTAL
HQ PRNG					
HHD PRARNG	San Juan	72	15	105	192
113th PAD	San Juan	4	0	9	13
248th Army Band	Isla Grande	0	1	36	37
HHD AFTS	Camp Santiago	18	5	70	93
TOTAL		94	21	220	335
92nd Inf Bde					
HHC 92nd Inf Bde	San Juan	38	16	254	308
892nd Engr Co	Humacaco	5	0	248	253
Co E-65th Inf	Isla Grande	9	1	196	206
Troop E-192nd Cav	Camp Santiago	7	0	157	164
92nd Signal Plt	San Juan	1	1	62	64
TOTAL		60	18	917	995
192nd Spt Bn					
HHC 192nd Spt Co	San Juan	12	2	133	147
Co A 192nd Spt	San Juan	19	4	134	157
Co B 192nd Spt	San Juan	9	0	116	125
Co C 192nd Spt	Gurado	4	0	138	142
Co C 192nd Spt	Hato Rey	5	3	155	163
TOTAL		49	9	676	734
1st Bn-65th Inf					
HHC 1st-65th Inf	Cayey	12	2	122	136
Co A 1st-65th Inf	Aibonito	6	0	200	206
Co B 1st-65th Inf	Guyama	5	0	225	230
Co C 1st-65th Inf	Coamo	6	0	191	197
Spt Co 1st 65th Inf	Cayey	5	0	144	149
TOTAL		34	2	882	918
2nd Bn-65th Inf					
HHC 2nd-65th Inf	Aguadilla	10	0	97	107
Co A 2nd-65th Inf	Arecibo	5	0	170	175
Co B 2nd-65th Inf	Utuado	4	0	139	143
Co C 2nd-65th Inf	Vega Baia	4	0	155	159
Spt Co 2nd-65th Inf	Aguadilla	5	0	109	114
TOTAL		28	0	670	698

APPENDIX II (CONTINUED)
PUERTO RICO NATIONAL GUARD
ASSIGNED STRENGTH - SEPTEMBER, 1979

UNIT	LOCATION	OFF	WO	EM	TOTAL
1ST Bn-295th Inf					
HHC 1st-295th Inf	Caguas	14	2	111	127
Co A 1st-295th Inf	Gurado	7	0	181	188
Co B 1st-295th Inf	Ceiba	6	0	162	168
Co C 1st-295th Inf	Juncos	6	0	162	168
Spt Co 1st-295th Inf	Gurado	5	0	138	143
TOTAL		38	2	754	794
1st Bn-296th Inf					
HHC 1st-296th Inf	Mayaquez	11	2	110	123
Co A 1st-296th Inf	San German	5	0	168	173
Co B 1st-296th Inf	Sabana Grande	6	0	157	163
Co C 1st-296th Inf	Cabo Rojo	5	0	168	173
Spt Co 1st-296th Inf	Mayaquez	5	0	129	134
TOTAL		32	2	732	766
2nd Bn-162nd FA					
HHC 2nd-162nd FA	Hato Rey	23	1	241	265
Co A 2nd-162nd FA	Hato Rey	4	0	86	90
Co B 2nd-162nd FA	Hato Rey	3	0	90	93
Co C 2nd-162nd FA	Hato Rey	4	0	84	88
Svc Btry 2nd-162nd FA	Hato Rey	2	1	65	68
TOTAL		36	2	566	604
CAC Sep Units					
CAC HQ		12	13	90	115
840th Maint Co	Juana Diaz	4	5	217	226
84th Maint Co	Bayamon	6	0	153	159
192nd Ord Det	Camp Santiago	1	1	74	76
162nd Fld Svc.	Ponce	4	1	204	209
Larc Det	Fajardo	1	1	70	72
TOTAL		28	21	808	857
130th Engr Bn					
HHC 130th Engr Bn	Vega Baja	11	3	173	187
Co A 130th Engr	Vega Baja	5	0	144	149
Co B 130th Engr	Bayamon	4	0	132	136
Co C 130th Engr	Aguadilla	4	0	153	157
Co D 130th Engr	Carolina	4	0	137	141
TOTAL		28	3	739	770

APPENDIX II (CONTINUED)
PUERTO RICO NATIONAL GUARD
ASSIGNED STRENGTH SEPTEMBER, 1979

UNIT	LOCATION	OFF	WO	EM	TOTAL
124th MP Bn					
HHC 124th MP	San Juan	12	1	161	174
480th MP Co	San Juan	4	0	175	179
755th MP Co	Arecibo	4	0	161	165
770th MP Co	Aguadilla	4	0	180	184
TOTAL		24	1	577	602
125th MP Bn					
HHC 125th MP Bn	Ponce	6	0	33	39
225th MP Co	Ponce	5	0	134	139
240th MP Co	Penuelas	4	0	193	147
544th MP Co	Yauco	5	0	163	168
TOTAL	20	20	0	473	493
1st Bn-162nd FA					
HHC 1st-162nd FA	Hato Rey	13	0	113	126
Co A 1st-162nd FA	Hato Rey	4	0	93	97
Co B 1st-162nd FA	Hato Rey	4	0	94	98
Co C 1st-162nd FA	Hato Rey	4	0	95	99
Svc Btry 1st-162nd FA	Hato Rey	3	2	62	67
TOTAL		28	2	457	487
201st Cbt Hosp	Santurce	55	1	190	246
TOTAL		554	84	8,661	9,299

SOURCES: Authorized and Assigned Strengths for September, 1979, CW4 Vitelio N. Silva Benoy Unit Locations, Readiness Group for Puerto Rico, Fort Buchanan.

APPENDIX III

ARTEP TRAINING REQUIREMENTS BY UNIT

CAMP SANTIAGO PUERTO RICO

UNIT/ TASK	ACRE - REQUIREMENT	RESTRICTED
Infantry Bn Total	698,798	145,294
Daylight Attack	24,710	
Defense	17,791	
Delay	55,504	
Night Withdrawal	35,583	
Night Attack	17,791	
Airmobile Assault	31,629	
Defense of Built-up Area	17,791	
Infantry Rifle Co Total	338,863	
Movement to Contact	118,608	
Deliberate Daylight Attack	29,652	
Defense	13,343	
Delay	88,956	
Night Withdrawal	40,030	
Night Attack	20,756	
Airmobile Assault	23,722	
Defense of Built-up Area	3,796	
Infantry Rifle Plt Total	311,479	
Movement to Contact	88,956	
Defense	8,896	
Airmobile Raid	213,494	
Defense of Built-up Area	133	
Infantry Rifle Squad Total	454,209	
Movement to Contact	26,687	
Reconnaissance Patrol	213,494	
Ambush Patrol	213,494	
Forced March/Live Fire	-	
Defense of Built-up Area	534	
Redeye Section Total	4,942	
Provide Air Defense		
Antitank Plt (TOW) Total	11,860	
Provide AT Spt	5,930	
REALTRAIN	5,930	
Antitank Squad (TOW) Total	53,374	
Provide AT Spt		
REALTRAIN	w/Plt	

APPENDIX III (CONTINUTED)
TRAINING REQUIREMENTS BY UNIT

UNIT/	ACRE - DAY REQUIREMENT	RESTRICTED
Scout plt Total	122,662	48,482
Reconnaissance Patrol	9,884	
Screening Mission	74,130	
Route Reconnaissance	29,652	
Rear Area Security	8,896	
Ground Surveillance Sec	23,722	
Provide GS		
Mortar Plt (81nn) Total	1,976	
Provide Indirect Fire Spt	988	
Provide Indirect Fire Spt (Subcal)	988	
Armored Cav Troop Total	94,147	
Crossing Water Obstacle	12,355	
Area Recom	11,120	
Advance Guard	11,120	
Attach (Night)	17,297	
Defense (Night)	12,355	
Tac Road March (Night)	2,471	
Occupy Assembly Area	1,483	
Breaching a Minefield	6,178	
Passage of Lines	19,768	
Armored Cav Plt Total	78,578	
Route Recon (Live Fire)	8,896	
Area Recon	37;065	
Movement to Attack	7,413	
Hasty Attack	2,965	
Defense (Night)	22,239	
Armored Cav GSR	2,965	
Provide GS		
Armored Cav Lt Armor Sec Total		
Battle Run (Day)	-	
Battle Run (Night)	-	
Armor Cav Mortar Squad Total	742	
Provide Indirect Fire Spt	371	
Provide Indirect Fire Spt (Sub-Cal)	371	

APPENDIX III (CONTINUED)
TRAINING REQUIREMENTS BY UNIT

UNIT/ TASK	ACRE - DAY-REQUIREMENT	RESTRICTED
Radar Plt (FARR)		
Provide Target Info	19,768	
FA Bn, 105mm Towed		
Tactical Op	55,350	
HHC, 105mm Towed		
Tactical Op	1,977	
Svc Btry, 105mm Towed		
Tactical Op	988	
Fa Btry, 105mm Towed		
Tactical Op	2,965	
Support Bn		
Tactical Op	15,814	
Engr Co, Cbt Total	30,640	
Conduct Movement Op	2,965	
Conduct Security Op	1,977	
Provide Info & Intel	988	
Barrier & Defense Op	7,907	
Breaching & Clearing Op	7,907	
Spt of Aslt River Crossing	4,448	
Conduct Inf Op	4,448	
Engr Plt, Cbt Total	81,542	
Conduct Movement Op	17,791	
Conduct Security Op	23,722	
Provide Info & Intel	5,930	
Barrier & Defense Op	11,861	
Breaching & Clearing Op	13,343	
Assault River Crossing	1,483	
Infantry Op	2,965	
Horizontal Const Op	2,965	
Vertical Const Op	741	
Water Supply Op	741	

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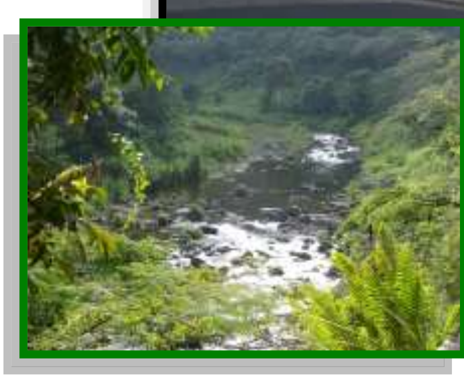
Integrated Natural Resource Management Plan

For the

Camp Santiago Training Center
Puerto Rico Army National Guard

June 2005



For the Time Period
2006 to 2010

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June 2005

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Chapter 1: Goals and Policies

1.1 Introduction

The *Sikes Act* (16 U.S.C. 670a et seq.) requires the Department of Defense (DoD) to prepare and implement an INRMP for each DoD “military installation,” unless the absence of significant natural resources on a particular installation make preparation of such a plan inappropriate or unnecessary.

In accordance with the *Sikes Act* provisions and DoD Instruction 4715.3, the occurrence of natural resources recognized as being significant and the presence of habitat suitable for ecosystem management within the Training Center require Camp Santiago to implement an Integrated Natural Resource Management Plan (INRMP).

Department of Defense Instruction 4715.3, Environmental Conservation Program (3 May 1996), requires that all military installations that have habitat suitable for conserving and managing natural ecosystems prepare INRMPs.

Conservation is an integration or blending of natural resources management and preservation designed to maintain ecosystem integrity. This blending occurs in the INRMP for the Camp Santiago Training Center, a dynamic document that will be maintained and adapted, as necessary, to reflect updated natural resources information. The development and implementation of the INRMP is another sign of Camp Santiago’s commitment to stewardship of natural resources as reflected in DoD Instruction 4715.3, Environmental Conservation Program.

1.2 Background

As part of its mission, the U.S. Army has chosen to be a national leader in environmental and natural resources stewardship both now and in the future. This commitment is documented in the *U.S. Army Environmental Strategy into the 21st Century* (U.S. Department of Army 1992). As a steward of natural and cultural resources, Camp Santiago acknowledges its commitment to be a conservation leader for its area.

Several laws and Army directives regulate the preparation of INRMPs. DoD Instruction 4715.3, Environmental Conservation Program, requires that all military installations that have habitat suitable for conserving and managing natural ecosystems prepare INRMPs.

Development and implementation of the INRMP is guided by Army Regulation (AR) 200-3, Natural Resources – Land, Forest, and Wildlife Management. It provides that policy, procedures, and responsibilities for conservation, management, and restoration of land and the natural resources. Army Regulation 200-3 requires that the INRMP be reviewed annually and revised, as necessary, to incorporate new information or requirements.

The AR requires major revisions of the INRMP at least every 5 years. The INRMP must also be compatible with the Range and Training Land Program Development Plan, Integrated Cultural Resources Management Plan, Installation Master Plan, and Master Training and Operation Schedules.

The *Sikes Act* requires that the Army manage the natural resources of its military installations within the United States to provide for the following:

- No net loss in the capability of military installation lands to support the military mission;
- Integration of land (forest and range) management with the various activities conducted under the plan;
- Management of fish and wildlife and protection and/or enhancement of their habitat;
- Wetland protection, enhancement, and/or restoration necessary for support of fish, wildlife, or vegetation;
- Establishment of specific natural resources management goals and objectives;
- Subject to requirements necessary to ensure safety and military security, provide appropriate and necessary access to the military installation;
- Enforcement of applicable natural resource laws and regulations;
- Other activities as the Secretary of the military department determines appropriate.

The *Sikes Act* also requires coordination between each installation, the U.S. Fish and Wildlife Service (USFWS), and appropriate state agencies on plans that promote the development, maintenance, and conservation of fish and wildlife or the rehabilitation of habitat.

Policy and guidance on INRMPs for Army National Guard Training sites is provided by the All State Memorandum (15 June 2000), Memorandum for the Adjutant General of All States, Puerto Rico, Guam, the Virgin Islands, and the District of Columbia. The All States letter also requires that Army National Guard installations follow state environmental regulations and address these regulations in their INRMPs.

Specific guidance on INRMPs for Army installations, which includes Army National Guard training sites, is provided by the U.S. Army Environmental Center Publication Guidelines to Prepare Integrated Natural Resources Management Plans for Army Installations and Activities (April 1997).

1.3 Goals

Fundamental goals of natural resources management within the CSTC area is to achieve optimum, sustainable use of training lands by protecting natural and cultural resources and providing for multiple uses. The DoD has directed that ecosystem management be the guiding principle for developing and implementing the INRMP. The goal of ecosystem management is to preserve, improve, and enhance natural resources system integrity and bio-diversity conservation.

General goals of this management plan include:

1) Supporting the operational mission of the CSTC;
2) Meeting stewardship requirements, and
3) Enhancing quality of life.

Specific goals of this management plan are summarized in the following table.

Table 1.1
Specific Goals of the Management Plan

Emphasis / Issue	Management Goal
Training	Maximize military training opportunities with no loss of training capabilities and support to the Puerto Rico National Guard
Safety	Increase soldier and public safety.
Cultural Resources	Inventory and protect cultural resources that may be affected by natural resources initiatives.
Scenery	Improve the visual qualities of the Training Center.
Stray Animals	Prevent stray domestic animals and livestock from entering the training area.
Forest Vegetation	Minimize impacts on forest vegetation and implement restoration / reforestation projects.
Riparian Areas	Reduce human, domestic animal, and livestock activity within the riparian areas and implement riparian area restoration projects.
Stream Channels	Restore and protect stream channel and stream bank stability.
Water Quality	Reduce sediment and pollution sources.
Wildlife and Aquatic Species	Minimize wildlife and aquatic species displacement and impacts on their habitat.
Wildfire Management	Improve wildfire prevention and suppression capabilities.

In his visitor's welcome briefing, the Camp's commander articulates his ideal operational environment for the Training Center as follows:

> *:.. to be a clean, well-organized installation that is free of vandalism and is secure, respectful, and available; an installation that fosters and maintains a warm, peaceful environment that is appealing to the senses."*

Implementation of an INRMP at the CSTC would ensure that:

1) Installation operations comply with the *Sikes Act* and other federal and state laws, especially those associated with human uses, watershed health, aquatic species and plant species of concern (rare, sensitive, invasive), and wildlife habitat suitability and security for endangered, threatened, and sensitive species.
2) Natural resources conservation measures and military activities conducted within the CMTC are integrated and consistent with Federal stewardship requirements.

1.4 Policies

To attain the goals described in Section 1.2 above, the following policies are in place:

- All personnel will comply with the environmental quality policies and procedures specified in AR 200-1, AR 200-2, and AR 200-3, and all applicable laws.
- All personnel will be familiar with and comply with the environmental protection measures and environmental awareness as outlined in the Camp Santiago / Fort Allen Training Sites Range Standing Operations Procedures, the CSTS Training Circular 350-1, and the CSTS Weekend Bulletins.
- Prior to conducting training missions within the Training Center area, all unit personnel will attend an environmental awareness briefing provided by Training Center personnel.
- Patrolling of the Training Center by Camp personnel will be a continuing operation to prevent illegal dumping of trash, domestic animal trespass, and unauthorized use of the training area by civilians.
- Monitoring, as specified below and detailed in Appendix A of this document, will be performed to provide a basis for evaluation of the effectiveness of the INRMP.

1.5 Monitoring Program

Monitoring is gathering information and observing management activities in order to provide a basis for periodic evaluation of INRMP effectiveness.

The purpose is to determine how well objectives have been met and how management standards have been applied. Evaluation of the monitoring results would assist in the review and update of the INRMP, as required by Army Regulation 200-3, Environmental Quality natural resources – Lands, Forest, and Wildlife Management.

Chapter 9 (Inventory and Monitoring) of this plan provides additional information on the purpose, methods, and expected results and uses of the proposed monitoring activities.

Chapter 2: Location and Acreage

2.1 Location

Camp Santiago is located in the south-central coast of Puerto Rico, adjacent to the municipality of Salinas. The main gate is located right off Highway 52, approximately 51 miles south of San Juan, the Capital of Puerto Rico.

Figure 2.1 – Vicinity Map (located on page 2-3) shows the general location of the Camp in southern Puerto Rico, while Figure 2.2 (page 2-4) illustrates the CSTC area. Table 2.2 (page 2-5) provides a summary of the designated training areas shown on the Training Camp map.

2.2 Acreage and Acquisition

Camp Santiago has a total of 12,590 acres within its boundaries. Of this total, 1,534 acres is unavailable for training; this subtotal consists of 405 acres for the cantonment area, 989 acres of restricted impact areas, and 140 acres of off-limits for an ammunitions area. For safety reasons, the restricted impact area is not used for any type of maneuver. The approximately net usable maneuver area is 11,056 acres, all of which is classified as light maneuver land. An area of approximately 1,160 acres, which is reserved for a U.S. Navy-run Defense Communications Area (DCA), is available for limited maneuver training and is included in this total.

In 1967, the Secretary of the Army has granted a license (No. DACA17-3-67-3002) to the Commonwealth of Puerto Rico for the use and occupancy of land and certain improvements at the *Salinas Maneuver Site Military Reservation* (which is now referred to as CSTC), Salinas, Puerto Rico, for year-round training and support of the Puerto Rico Army National Guard.

The cantonment area is the only part of Camp Santiago with residential or office structures. The Camp has no permanent residents, schools, hospitals, or other land uses that would be incompatible with the military missions of the Camp.

2.3 Installation History

The first training camp used by the Puerto Rico Army National Guard was nearby the boundaries of Camp Santiago, where more than 1,000 troops of the 1st Infantry Regiment attended from 6 through 20 December, 1920.

Since that date until 1940, other areas were used for training around the island in such municipalities as Hat Rey, Ponce, Vega Baja, Arecibo, Santa Isabel, and Yauco.

During World War II and through the end of the Korean War, Camp Santiago (at that time, Salinas Training Area) was the only official training area used for Advanced Military Training. Also, other training areas such as Camp Tortuguero on the northern coast of the island were heavily used until 1953.

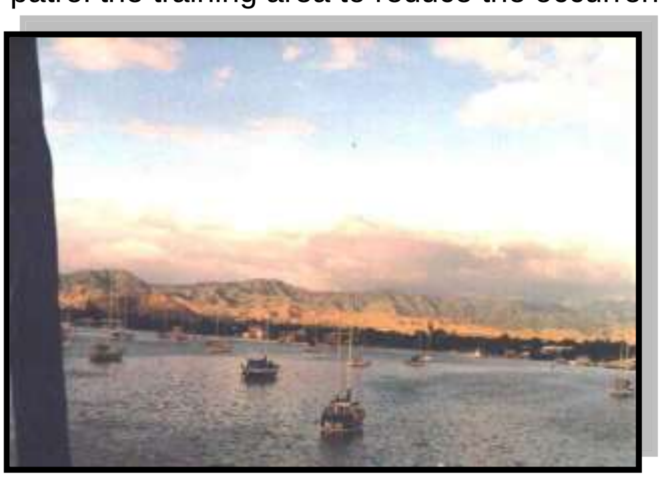
The U.S. Government licensed Camp Santiago to the Puerto Rico Army National Guard in 1967. Since then, it has grown and expanded considerably from a tent city with very few permanent facilities to an installation of more than 300 buildings consisting of approximately 715,680 square feet. On 17 July 1976, it was designated with the name Camp Santiago in honor of Specialist Four Hector Santiago-Colon, who was born in the town of Salinas. He was posthumously decorated with the Congressional Medal of Honor for his extraordinary courage and bravery, sacrificing his life in the Republic of Vietnam.

Camp Santiago is the largest training site licensed for National Guard training activities in the Caribbean. Its mission is to provide support and services by means of training areas, firing ranges, billeting and maintenance facilities, and logistic support to users of the United States DoD, and other non-DoD users, such as state and Federal law enforcement agencies. Additionally, it provides services to the Puerto Rican community supporting numerous social and cultural groups to enhance and promote a better quality of life.

Another important task of the Camp's mission is to serve as a mobilization station during wartime as was done in 1990 for troops of Desert Shield/Desert Storm. The Central American Games of 1993 designated Camp Santiago as the "Olympic Village." In 1994, Camp Santiago was the site for training the multinational force that served in Haiti's "Uphold Democracy Operation." Typically, the site is used 325 days a year.

2.4 Neighbors

The predominant land use around Camp Santiago is farming and residential with several civilian homes and developments located around the borders of the training area. The major training concern for Camp Santiago personnel is the control of noise, dust, and the safety hazard posed by local residents who wander on the property. Some of the installation land along the property borders is not fenced off, allowing free entrance into the training area and, in some cases, the impact area. The lack of permanent fencing poses a challenge; however, Camp Santiago personnel habitually patrol the training area to reduce the occurrence of trespassing civilians.



Salinas

Camp Santiago's relations with the community are good due to several factors. The positive effect created from the income generated by the Camp's activities during the year is significant. The annual (fiscal year 2000) direct employment income generated by the CSTC was $1,345,700 and operational costs associated with the CSTC were $2,266,350.

Figure 2.1 – Vicinity Map

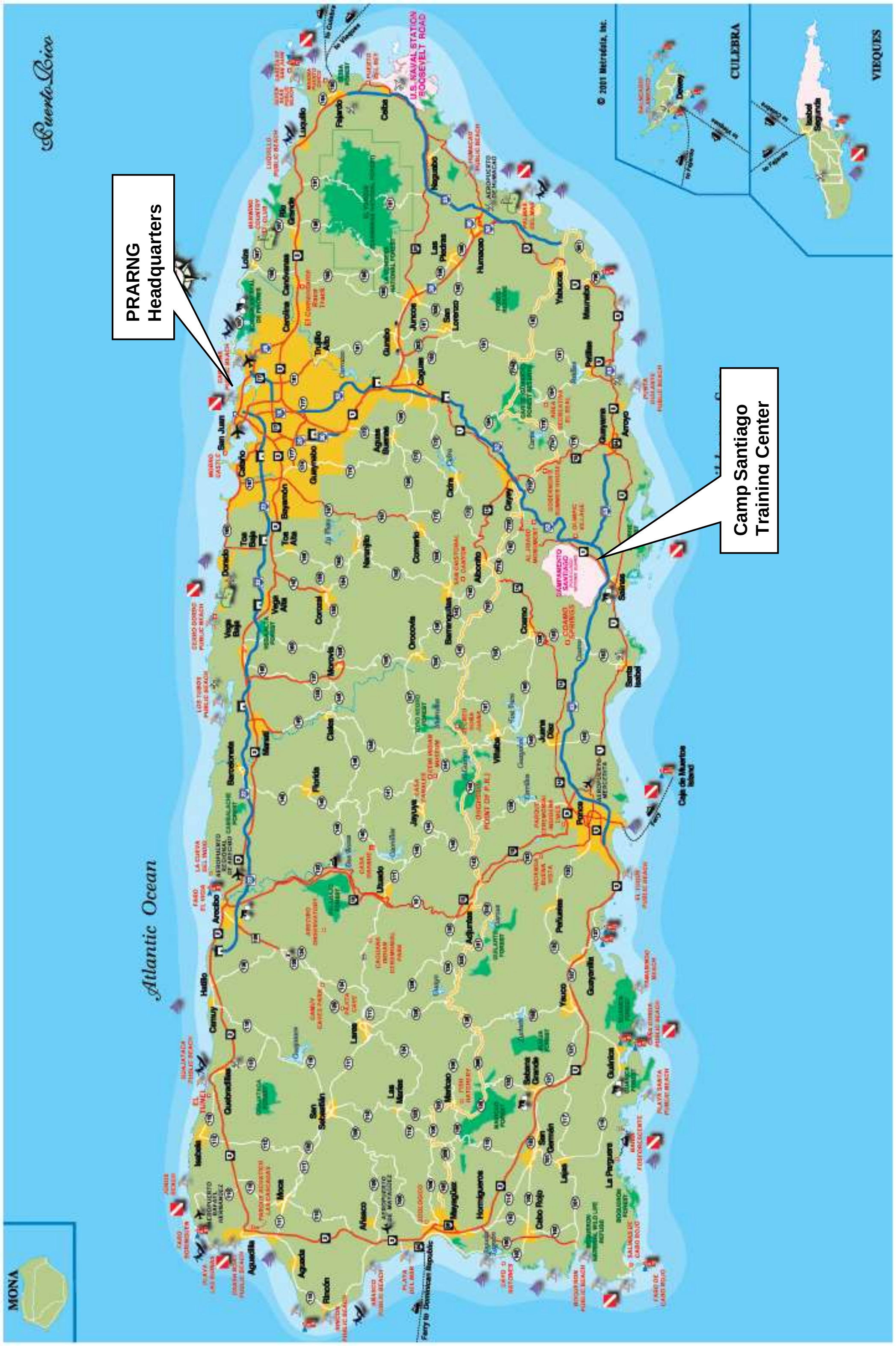
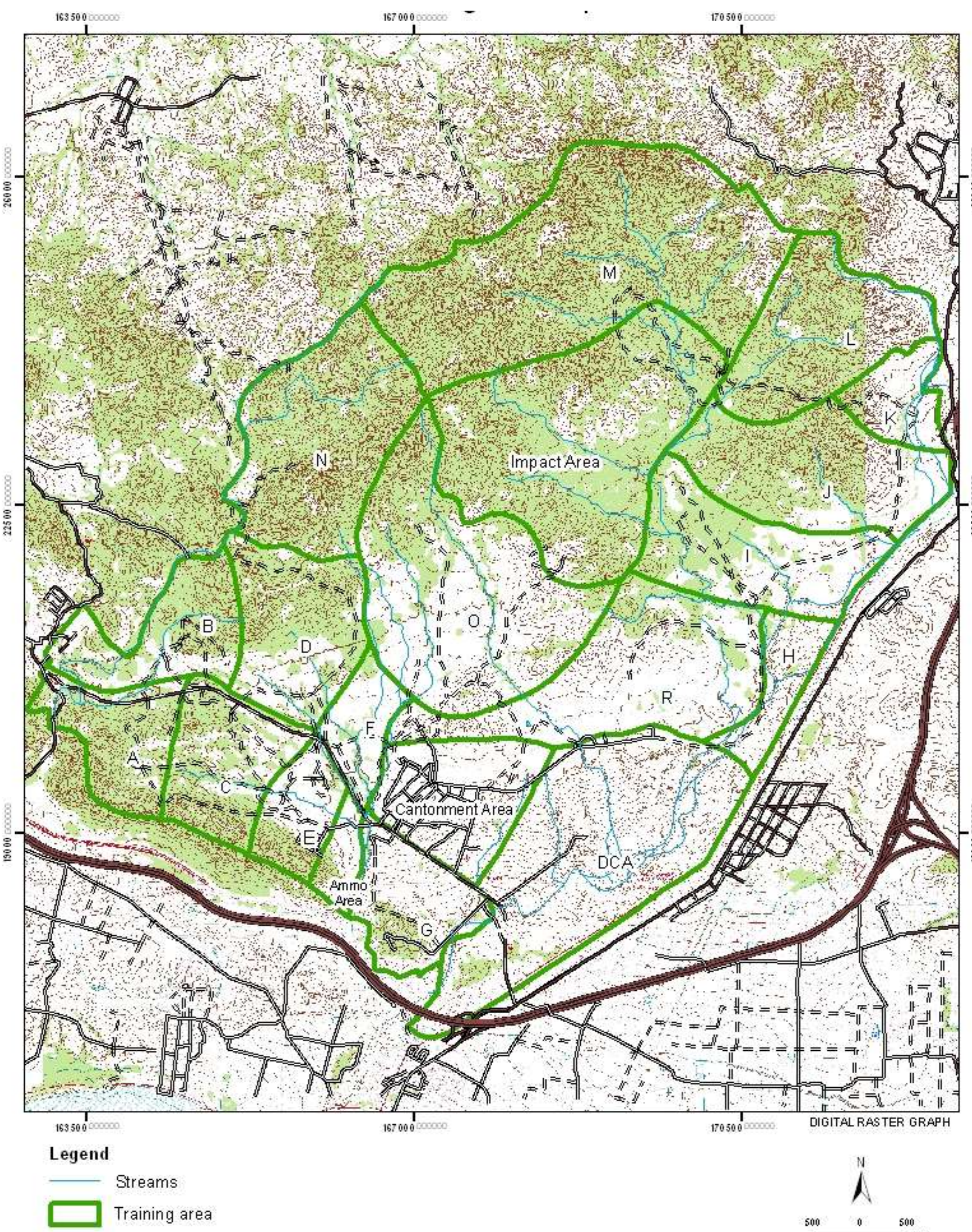


Figure 2.2. Training Site Map



Another factor is the logistical and social support given to institutions and communities close to the Camp. The overall image of the Puerto Rico National Guard as a supportive element during emergencies and natural disasters also exerts a positive attitude towards the Camp.

Another factor is the logistical and social support given to institutions and communities close to the Camp. The overall image of the Puerto Rico National Guard as a supportive element during emergencies and natural disasters also exerts a positive attitude towards the Camp.

There have been instances of complaints due to noise generated during training activities, so a complaint response procedure has been established at the Camp to investigate and follow-up on complaints coming from any impacted sector of the community.

The CSTC is located within the municipality of Salinas and is bordered by two other municipalities: Santa Isabel on the southwest and Coamo on the west (refer to Figure 2.1 – Vicinity Map, page 2-3).

The following table provides 2000 Census Population[1] and Housing information for the municipalities adjacent to the CSTC.

Table 2.1
2000 Census of Population and Housing Information

Municipality	2004 Population	2010 Population (Estimate)	Family Income (Average)
Salinas	31,113	32,613	$11,391
Santa Isabel	21,665	16,604	$11,895
Coamo	37,597	32,613	$12,064
Puerto Rico	3,894,855	4,086,690	$14,412

2.5 Satellite Installations

Fort Allen, located in the southern part of Puerto Rico near the town of Juana Diaz, is a 940-acre satellite installation to the Camp Santiago Training Center. This training area was licensed to the Puerto Rico Army National Guard in 1983. This INRMP does not address natural resource management at the Fort Allen Training Annex. The reason that Fort Allen is not included in this INRMP is that the facility is not considered a major training site; its use is exclusive for administration of the 201st Regional Training Institute and training areas are not available.

[1] Updated with 2004 Revised Census data

Table 2.2
Summary of Camp Santiago Designated Training Areas

Training Area	Acres	Designated Uses	Restrictions
Base Camp	405	Cantonment Area (administrative uses)	
A	256	Demolitions range; gas chamber; maneuver	Demolition up to 2 lbs; no digging
B	348	Artillery firing points; maneuver	No digging
C	283	Artillery firing points; maneuver	No digging
D	585	Mortar & artillery firing points; maneuver; DZ (risky)	No digging
E	186	140-acre Ammo Supply Point; 46 acres w/artillery firing points; maneuver	ASP (**140 acres off limits to training**) Remaining 46 acres no digging
F	210	Helicopter gunnery; maneuver	No digging
G	312	Airfield; shotgun range; combat pistol range, rappel tower; maneuver	No digging
H	231	Maneuver	No digging
I	636	Mortar firing points; small arms range, DZ (nervous) maneuver	No digging
J	689	Mortar firing points; small arms range; DZ (nervous); maneuver	No digging
K	327	Mortar firing points; small arms range, maneuver	No digging
L	755	Maneuver	No digging
M	1,422	Maneuver *Note: Has not been used for several years*	Area is currently not used
N	896	Mortar firing points; maneuver	No digging
O	2,572	Ambush operations; company defensive training machine gun; squad live fire machine gun, DZ (risky); aerial bomb drop zone; maneuver	
R	1,046	M16 machine gun; NBC farm; MG 10-M range; rifle marks-manship machine gun; AT4 subcaliber machine gun; grenade alunc machine gun, DZ (nervous); indirect firing points; maneuver	
IMPACT AREA	988	IMPACT AREA	Off limits to all training activities and the public
DCA	1,160	**Limited maneuver; combat and field trains operations**	**No digging**
Totals	11,056 1,534	**Acres available for maneuver and ranges** **Acres not available for maneuver and ranges**	

Chapter 3: Military Mission

3.1 Overview

The Camp Santiago Training Center is the only Army training installation in the Caribbean area of operations. Training resources provided by the CSTC support the mobilization readiness for one Army National Guard separate infantry brigade (light) and its supporting units. Training resources and support provided by the Training Site include 24-hour operations of maneuver-training areas, ranges for an assortment of individual and light infantry weapon and aviation systems, billeting, mess facilities, medical support, and logistical support. Camp Santiago is the mobilization site for all Puerto Rico and U.S. Virgin Islands Army National Guard and U.S. Army Reserve units.

Camp Santiago Training Center, Puerto Rico

3.1.1 The Commander's Vision Statement for Camp Santiago

Camp Santiago is the National Guard's premier installation for home station training of light infantry forces in the Caribbean area of operation. Camp Santiago is to be capable and ready to deploy a task-organized force during times of crisis. Camp Santiago is to be an effective mobilization site for the Puerto Rico Army National Guard and units of the Virgin Islands. Finally, Camp Santiago is to be an installation that continuously develops its role in contributing to total military readiness by accommodating multiple organizations from across the DoD.

3.1.2 Training Center Mission

The installation's mission is to provide support and services by means of training areas, firing ranges, billeting, maintenance facilities, and logistic support to users of the (DoD) and other non-DoD users such as State and Federal law enforcement agencies. The Training Site is also designated as a wartime mobilization station for National Guard and Reserve forces.

The mission of the installation is not expected to change in the foreseeable future.

3.1.3 Training Center Users

Light infantry combat arms, field artillery, aviation, engineer, and Special Forces units are the primary users of the Training Center.

In addition to Puerto Rico Army National Guard units, units from the U.S. Virgin Islands, U.S. Army Special Operations Command (South), and other reserve units based in the Puerto Rico area are forecasted to conduct most of their inactive and active training on Camp Santiago assets. National Guard units from other states, Forces from the Regional Security System, and nations such as France, Holland, and Great Britain are also forecasted to conduct training at Camp Santiago.

Examples of non-military groups that use the Training Site facilities include: state and federal law enforcement agencies, local fire departments, Puerto Rico Correctional Administration, Youth Conservation Corps, Girl/Boy Scouts of America, and visits to the museum and use of the auditorium by local schools.

3.1.4 Available and Projected Training Support Assets

3.1.4.1 Assets currently available:

- 11 basic weapons marksmanship ranges;
- 6 collective live fire ranges;
- 3 indirect fire facilities (27 mortar points, 24 artillery points, and 1 mortar-scaled range);
- 2 special live fire ranges;
- 16 maneuver areas (light only);
- Shoothouse training facility;
- Engagement skill trainer;
- Rappelling tower;
- Obstacle / confidence course;
- Gas chamber;

- Weaponer station;
- Airborne drop zones;
- Parade ground;
- Missions on urban terrain (MOUT) training area;
- 1 Ammunition Supply Point (ASP), approximately 140 acres within Training Area E;
- Billets and mess facilities to support up to 4,751 troops;
- Tactical airfield (currently is not operational);
- Army / Air Force Exchange (includes gas station);
- Wash rack.

3.1.4.2 Assets projected to be available (within the next 3-years)

- Expansion of Range 22 (Fire Rifle Range – Modified Record Range) by adding 8 firing lanes;
- Expansion of Range 17 (Pistol Range – Military Police Firearm Qualification Course) by changing it to a Combat Pistol Qualification Course (CPQC) and an additional 15 lanes. It will become a 30-lane CPQC;
- Expansion of Range 30 (Close Quarters Battle Maze / Modular Shooting House) by adding more buildings.

3.1.5 Training Center Support Personnel

Personnel providing Training Center operational support and support for the units in training include:

- 82 authorized per the CSTC Table of Distributions and Allowances, which includes 12 officers, 3 warrant officers, and 67 enlisted soldiers (17 of these positions are full time);
- 120 state employees who are currently working at the Training Center.

3.1.6 Training Center Usage

The Training Center ranges and maneuver training areas are essentially used by Puerto Rico National Guard units every weekend of the training year; the majority of these units conduct their 2-week annual training cycle at the Center during the May to August time frame.

New U.S. Army Special Operations Command (South) units are currently planning to train on weekdays throughout the training year.

Training usage records show that, typically, the Training Center is used 325 days a year.

The following table summarizes the CSTC usage of person days by category for training years 1997-2004.

Table 3.1 **Training Site Usage (Person Days for Training Years 1997-2004)**							
Number of Person Days By Category							
Training Year	**PRARNG**	**NG units (from other States)**	**USAR**	**Active Component**	**Other [1] Military**	**Civilians[2]**	**TOTALS**
1997	304,706	3,917	53,694	51,088	60,857	123,921	598,183
1998	312,586	4,930	29,283	35,016	53,212	57,143	492,170
1999[3]	284,494	6,528	37,563	37,133	82,896	73,241	521,855
2000	216,886	3,120	40,523	27,888	95,079	134,839	518,335
2001[4]							
2002	243,879	1,982	28,034	36,060	10,492	203,587	524,034
2003	63,372	410	13,059	1,340	940	9,435	88,556
2004	50,442	334	33,568	10,045	9,234	10,482	114,105

The March 2001 *Range and Training Land Program Development Plan for the Training Site* provides detailed firing range and training area usage for training years 1998, 1999, and 2000 (Appendix K, Annual Utilization Profile by Range, provides the actual utilization profile for each asset; *Appendix L, Annual Utilization Profile by Range*, is a compilation by fiscal year of the training conducted by major range and training land category and number of days used).

[1] Includes ROTC, DoD activities, Small Unit Exchange Program, Puerto Rico State Guard, and permanent employees
[2] Includes State Police Department, local Fire Departments, Puerto Rico Correctional Administration, Youth Conservation Corps, and local civil groups such as the Girl/Boy Scouts of America.
[3] CSTC operations were essentially shut down during the first quarter of training year 1999 because of damage to the Training Center resulting from a September 1998 hurricane (Hurricane Georges).
[4] Usage Data is not available

The draft Range and Training Land Program Development Plan (Administrative Record Exhibit O-4) provides the following conclusions about Training Center usage:

- Usage records for training years 1997 - 2000 show a trend of increasing demand and use of the Training Center;
- Camp Santiago is the only Army training installation in the Caribbean area of operations;
- In addition to continued use of the Training Center by National Guard units, significant usage from other organizations is expected. Units, such as the U.S. Virgin Islands, U.S. Army Special Operations Command (South), 7th Special Forces, and other Reserve units based in the Puerto Rico area, are forecasted to conduct most of their inactive and active training at Camp Santiago; and
- The demands on the firing ranges and training areas will increase as newer and more lethal weapons systems with greater engagement ranges are developed and fielded. These demands will require more effective range and training land management practices. Training facility managers will have to consider redesigning or renovating / relocating existing ranges and training land to meet the increased demand.

3.2 Natural Resources Needed to Support the Military Mission

Camp Santiago has approximately 12,590 acres within its boundaries. This Training Center area is delineated into 19 training areas, each with designated uses and restrictions as illustrated in the following table (refer to Training Center Map on page 2-5).

Natural resources needed to support the military mission include:

3.2.1 Vegetation for concealment and noise abatement

Existing vegetation provides limited concealment and noise abatement. In accordance with the U.S. Army Environmental Center's *Tactical Concealment Area Planning and Design Guidance Document,* August 1999, the Training Center currently has plans to plant approximately 10,000 trees in portions of Training Areas E and DCA. The intent of this planting project is to create additional vegetation to enhance future tactical concealment training.

3.2.2 Diverse terrain and vegetation conditions for dismounted and mounted land navigation

Existing terrain and vegetation conditions support dismounted and limited mounted land navigation.

3.2.3 Open areas for individual and crew served weapons training and drop zones (DZs)

The Training Center has adequate open areas to support firing ranges and DZs requirements.

3.2.4 Stable roadbeds with appropriate stream crossings for conducting convoy operations

Training Center roads are suitable for conducting convoy operations.

3.2.5 Stable soils for cross-country vehicle maneuver and assembly area operations

With the exception of riparian areas, soils conditions are stable and support cross-country vehicle maneuver and assembly area operations.

3.2.6 Areas suitable for the construction and maintenance of cantonment / support facilities

The Training Center offers excellent areas for construction and maintenance of support facilities; the current cantonment area is adequate to support the current level of operations.

3.2.7 Water sources to provide suitable water for drinking and food processing purposes after conventional treatment for removal of naturally present impurities. Water quality must be suitable for bathing and recreation as well as agricultural and industrial uses.

Water sources and treatment facilities are adequate to support the current level of operations.

3.3 Effects of the Military Mission on Natural Resources

Military training and associated activities can have both negative effects and positive benefits to natural resources. Mounted maneuver and mission-related wildfires caused the largest negative effects on the natural resources at Camp Santiago.

Stewardship practices implemented by Camp Santiago's National Guard have benefited natural resources. Examples of these benefits include:

- Protection of historical sites;
- Planting of vegetation in accordance with the U.S. Army Environmental Center's Tactical Concealment Area Planning and Design Guidance Document;
- An aggressive and progressive command climate in which existing and potential environmental stewardship conditions, issues, and constraints are fully integrated into all mission training support and installation planning activities.

The impacts or potential impacts of the current military mission on natural resources identified and addressed in this document are summarized below by ecosystem element.

Table 3.2
Potential Impacts of the Military Mission on Natural Resources

Ecosystem Element	Feature / Process	Impacts
Human Dimension	Recreation Opportunity Feature	Public recreation opportunities are limited and/or restricted by military activities.
	Special Places Feature	Military activities may disturb and/or limit public access to important areas within the Training Site that are locally significant.
	Scenery (Visuals) Feature	Construction of military facilities and training activities may degrade the scenery of the landscape.
	Heritage (Cultural Resources) Feature	Military activities may disturb or degrade historical sites and artifacts.
	Commodities and Other Land Uses Feature	Unauthorized cattle grazing impacts riparian vegetation, stream channel characteristics, and water quality.
Watershed Health	Erosion Process: ▪ Soil Productivity ▪ Erosion ▪ Nutrients	Military activities may contribute to the loss of soil productivity, erosion, and increased nutrient (nitrogen and phosphorus) levels in surface waters.
	Hydrology Process: ▪ Hydrology ▪ Stream Channel	Military activities impact stream discharge and channel characteristics.
	Water Quality	Military activities may degrade surface and ground water quality.
	Aquatic Species: ▪ Biology ▪ Habitat	Military activities may impact aquatic species and their habitat.

Table 3.2 Potential Impacts of the Military Mission on Natural Resources		
Ecosystem Element	**Feature / Process**	**Impacts**
Vegetation	Forest Vegetation: ▪ Cover Type ▪ Patch Size & Pattern ▪ Insects & Disease	Military activities have altered vegetation cover type, patch size and pattern from historical condition, and contributed to increased presence of insects & disease.
	Special Habitats	Military activities may impact special habitats (small isolated plant communities).
	Riparian / Wetlands	Military activities may impact riparian and wetlands.
	Species of Concern: ▪ Rare Plants ▪ Invasive Plant Species	Military activities may impact rare or sensitive plants and contribute to the presence of invasive plant species
Fire & Air	Fire Disturbance and Risk	Range and wildland fires associated with military training activities may impact vegetation, wildlife habitat, contribute to erosion and sediment sources, and degrade air quality.
Wildlife	Habitat Suitability and Security	Military activities may impact wildlife species and their habitat.

3.4 Effects of Natural Resources or Their Management on the Mission

Training activities at Camp Santiago are conducted in accordance with federal and commonwealth environmental laws as well as Department of Defense and Army National Guard policies and regulations.

Regulations that apply to natural resources management for the Training Center are maintained in the Environmental Office library. This library is available to personnel involved in natural resources management at Camp Santiago.

Examples of natural resources that impact or potentially could impact Camp Santiago's mission include:

- Heritage (cultural resources) - travel restrictions have been imposed to protect known historic sites and cultural resources.
- Dense vegetation limits mounted maneuver training; this is especially a factor in Training Areas L, N, and M.
- Management of ground fuels and wildfire suppression - considerable training time is lost while suppressing wildfires caused by

2005 Wildfire at Camp Santiago

firing range operations and extremely hot and dry weather conditions.

- Riparian areas - vehicle travel restrictions have been imposed on training activities for the protection of riparian areas.
- Vegetation - vehicle travel, bivouac, and use of vegetation for camouflage restrictions have been imposed to protect existing vegetation and plantations.
- Soils - travel and bivouac restrictions have been imposed to protect sensitive soils.

Examples of existing restrictions include:

- Restricted area designations (no training activities allowed; no digging) - all restricted areas are recorded at Range Control and delineated on a map that is available to all users. Restricted areas include impact areas, tree plantations, and historic sites.
- All vehicles will use established roads and trails unless otherwise approved.
- Cutting vegetation or evergreens will not be permitted and damage to trees will not be tolerated.

3.5 Future Military Mission Impacts on Natural Resources

The following conclusions on Camp Santiago's future military mission are extracted from the March 2001 *Range and Training Land Program Development Plan* (RTLP):

- The mission of the installation is not expected to change in the foreseeable future.
- The demands on ranges and training areas will increase as newer and more lethal weapon systems with greater engagement ranges are developed and fielded. These demands will require more effective range and training land management practices. Training facility managers will have to consider redesigning, renovating, or relocating existing ranges and training land to meet the increased demands.
- Camp Santiago's light maneuver training land will not increase in size or availability due to increasing environmental stewardship responsibilities.
- As environmental considerations continue to affect plans and training, the growth and future direction of the Integrated Training Area Management (ITAM) program along with current trends in land management planning will help to control the impacts of training on existing assets. Improved land and natural resources management practices that closely support training requirements will provide opportunities to accomplish all required training objectives with minimal impact on current land assets.

The implementation of this INRMP is expected to protect and, in some situations, rehabilitate and restore Camp Santiago's natural resources.

Chapter 4: Facilities

4.1 Overview

Camp Sanitago's cantonment area is approximately 405 acres in size and is located about 1 mile from the center of the town of Salinas. There are 180 buildings in the cantonment area on a daily basis, facilities within the cantonment can support up to 4,000 troops. The Camp is a self-supporting facility with finance, quartermaster, medical, and other support and services normally available at military installations. Sufficient office space is available for several battalions and company headquarters. Troop morale, welfare, and recreational facilities are also available. (Refer to Figure 4.1 – Cantonment Area, page 4-2).

4.2 Transportation System

Camp Santiago is easily accessible by highway from virtually all points on the island.

The San Juan International Airport provides airline service for the island. The largest military-type transports that can utilize the airport are C-17s.

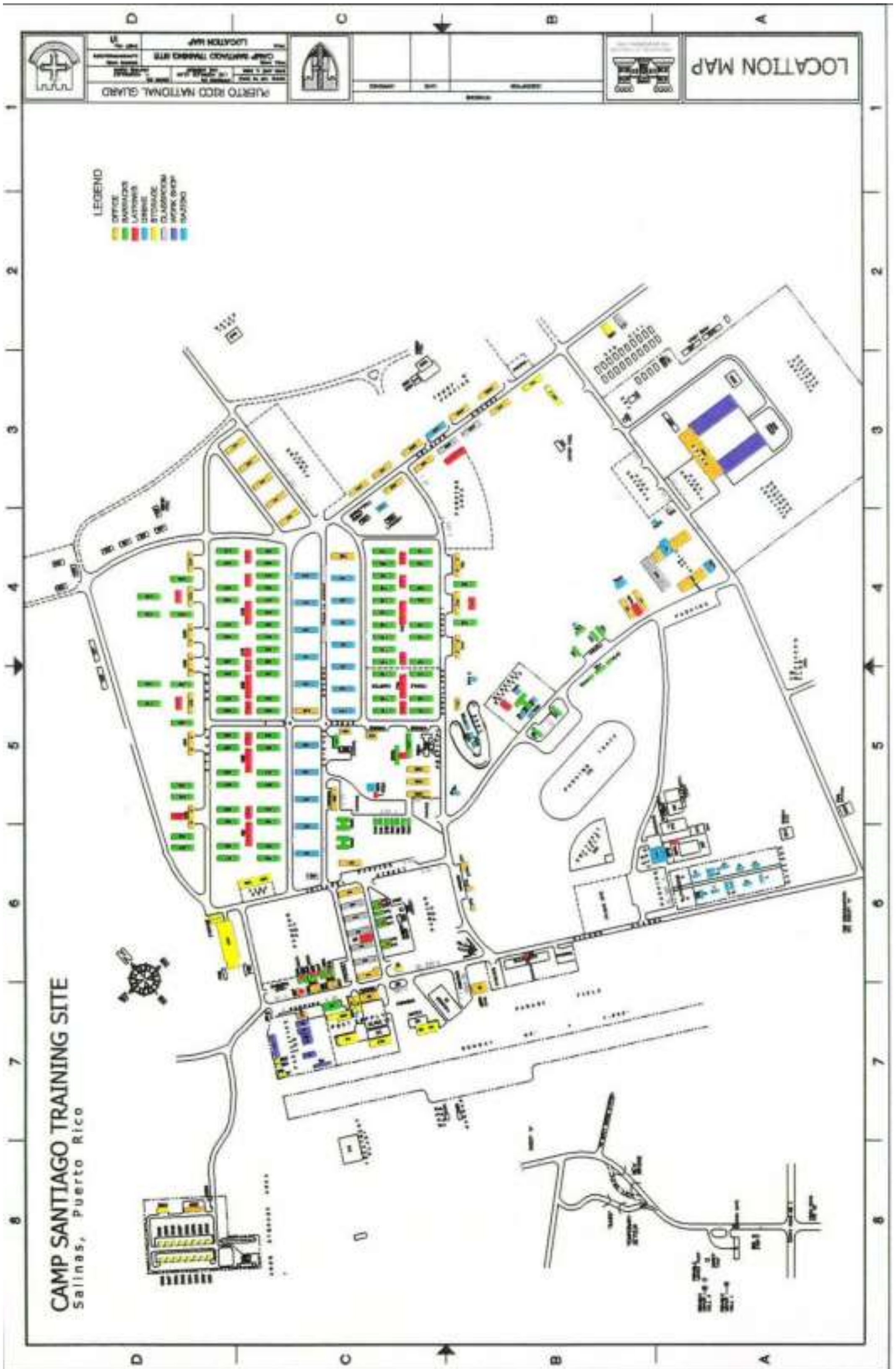
4.2.1 Roads

Within the CSTC, there are approximately 12 miles of improved roads and 150 miles of unimproved roads. The improved roads (asphalt paved) are primarily comprised of Highway 154, streets and avenues in the Cantonment Area, and a stretch of road to Firing Range 22. Six primary convoy routes were identified by CSTC Range Control for training purposes. These routes are designated by color: Blue, Brown, Green, Orange, Red, and Violet convoy routes (Figure 4.2, Convoy Route map). These primary convoy routes comprise approximately 20 miles of improved and unimproved roads. A summary of the six primary convoy routes is provided herein. The remaining unimproved secondary routes (approximately 135 miles) are largely unsurveyed.

Blue Convoy Route

The Blue Convoy Route begins in the southwest corner of the Cantonment Area, follows the western edge for approximately 0.10 mile, and then heads in an easterly direction and out of the Cantonment Area for approximately 2 miles to the Rio Nigua, where the route turns to a northerly direction for approximately 2 miles (see Figure 4.2), The total convoy route is approximately 4 miles.

Figure 4.1 – Cantonment Area



The Blue Convoy Route provides access to the Cantonment Area, Impact Area, and Training Areas DCA, R, H, I, J, K, L, M, and O. Convoy Routes Green and Brown can be accessed from the Blue Convoy Route. Ranges accessed directly from the Blue Convoy Route are 17, 18, 19, 20A, 20B, 22, 23, 25, 26, 27, 28, and 30.

The Blue Convoy Route is paved through the Cantonment Area to Range 22. After this point, the route is native material/gravel. Along the west end of the Cantonment Area, general channel migration of the Quebrada Hondo is eroding into the Blue Convoy Route. There are six culvert stream crossings on this route and a low water bridge over the Rio Nigua. See Chapter 8 for recommendations for this route.

Brown Convoy Route

The Brown Convoy Route begins at the northwest of the Cantonment Area off of the Blue Convoy Route and makes a loop to the north through Training Areas F, O, and R where it again intersects the Blue Convoy Route. The Brown Convoy Route then heads westerly on the Blue Convoy Route and then southerly to its intersection with Highway 154 (see Figure 4.32 The total convoy route, excluding the portion of the Blue Convoy Route, is approximately 2 miles in length.

The Brown Convoy Route provides access to Training Areas F, O, R, and DCA. The Violet Convoy Route is accessed from the Brown Convoy Route. Ranges accessed directly from the Brown Convoy Route include 7, 15, and 18.

The Brown Convoy Route has a native material travel surface through most of the loop portion and is asphalt paved on the portion from the Blue Convoy Route to Highway 154. Unexploded ordnances have been identified along the western portion of the loop. There are no culvert stream crossings on this route.

Green Convoy Route

Initiating at the Blue Convoy Route, the Green Convoy Route heads in a southerly direction for approximately 0.5 mile to its intersection with the paved route to the radio antennas. This route provides access to Training Area DCA.

Orange Convoy Route

The Orange Convoy Route begins off the Red Convoy Route and makes a loop through Training Areas D, N, and O to its intersection with the Brown Convoy Route (see Figure 4.2). The total length of this route is approximately

5 miles and is comprised of native surface material. This route provides access to Firing Range 40.

The Orange Convoy Route has one culvert stream crossing, fords the Rio Jueyes twice, and crosses the Cero Pio Juan twice. It also uses the Rio Jueyes streambed as a portion of the route.

Red Convoy Route

The Red Convoy Route makes two loops, one west of the Cantonment Area to the gas chamber and the other south of the Cantonment Area around the airfield (see Figure 4.2). The total route length is approximately 7.5 miles.

The Red Convoy Route provides access to the Cantonment Area and Training Areas A, B, C, D, E, F, and G. Ranges 3, 4, and 5 are also accessed directly from this route.

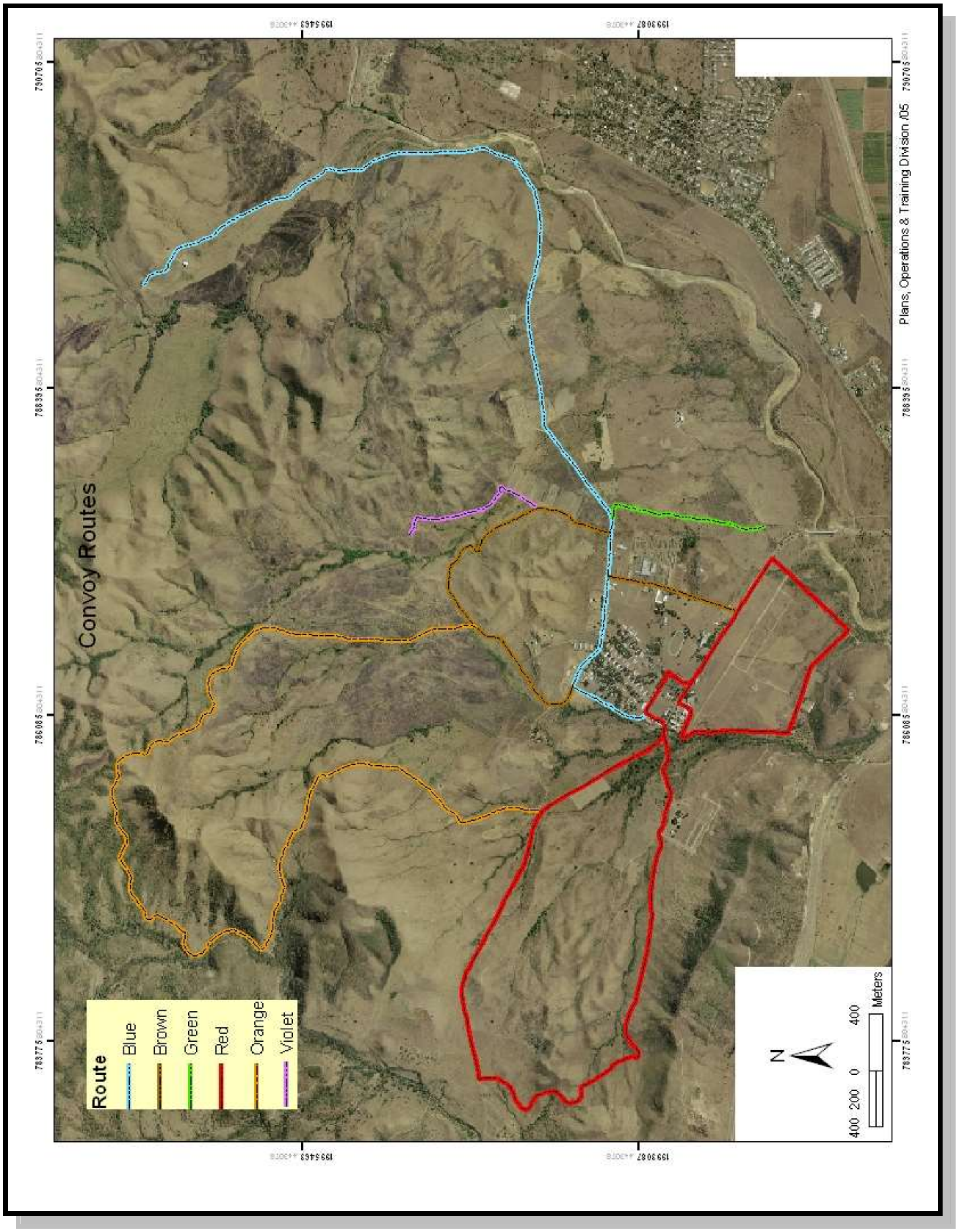
Approximately 2 miles of the western loop of Red Convoy Route is currently paved (the portion coincident with Highway 154). The southern approximate 1.5 miles of the west loop is under contract for paving and placement of road drainage features every 300 feet. A contract to pave and provide surface drainage for the remaining 1 mile of the west loop has been prepared and is waiting funding. When completed, the entire west loop of the Red Convoy Route will be hardened and have surface drainage features in place.

Approximately 1.5 miles of the eastern loop of the Red Convoy Route is currently paved (the portion coincident with Highway 154 and through the Cantonment Area). The remaining approximate 1.5 miles of the west loop is gravel and native surface. The east and west sides of the eastern loop have problems associated with overland flows, channel incision, and channel migration. Flows from the airfield are intercepted by the Red Route, which then follows the route surface until entering drainages at stream crossings. Additionally, it appears that general channel degradation in the Rio Nigua and/or excessive flows in the streams have caused streams to head cut from their confluence with the Rio Nigua up to the stream culverts on the Red Convoy Route. The stream culverts are acting as “grade control”. Additionally, on the west end of the eastern loop, general channel migration of the Quebrada Honda is eroding into the Red Convoy Route.

Violet Convoy Route

This native material route originates off of the Brown Convoy Route along the west side of Range 18 and heads in a northeasterly direction, then a northern direction for a total route length of approximately 0.5 miles. The Violet Convoy Route provides access to the western portion of Training Area R and direct access to Ranges 15A and 18.

Figure 4.2. Convoy Routes



4.2.2 Airports

A tactical airfield is located near the cantonment area. (Refer to Figure 4.1 on page 4-2.) Because of safety concerns, fixed-winged aircraft have not used the airstrip since 1983. For this airfield to become operational, it must be expanded and re-aligned; if this could be accomplished with some funding assistance, it would greatly reduce the substantial time and expense currently required for transporting troops to and from the San Juan Airport. This would also maximize available training time.

4.3 Water Supply

Camp Santiago has a self-sufficient water supply consisting of two wells, a water treatment plant, and a water distribution system.

A sewer line system was recently connected into the Salinas municipal sewage system.

4.4 Projected Changes in Facilities

Projected facility upgrades and expansions are reflected in the following table:

- Expansion of Range 22 (Fire Rifle Range – Modified Record Range) by adding 8 firing lanes;
- Expansion of Range 17 (Pistol Range – Military Police Firearm Qualification Course) by changing it to a Combat Pistol Qualification Course (CPQC) and an additional 15 lanes. It will become a 30-lane CPQC;
- Expansion of Range 30 (close Quarters Battle Maze / Modular Shooting House) by adding more buildings.

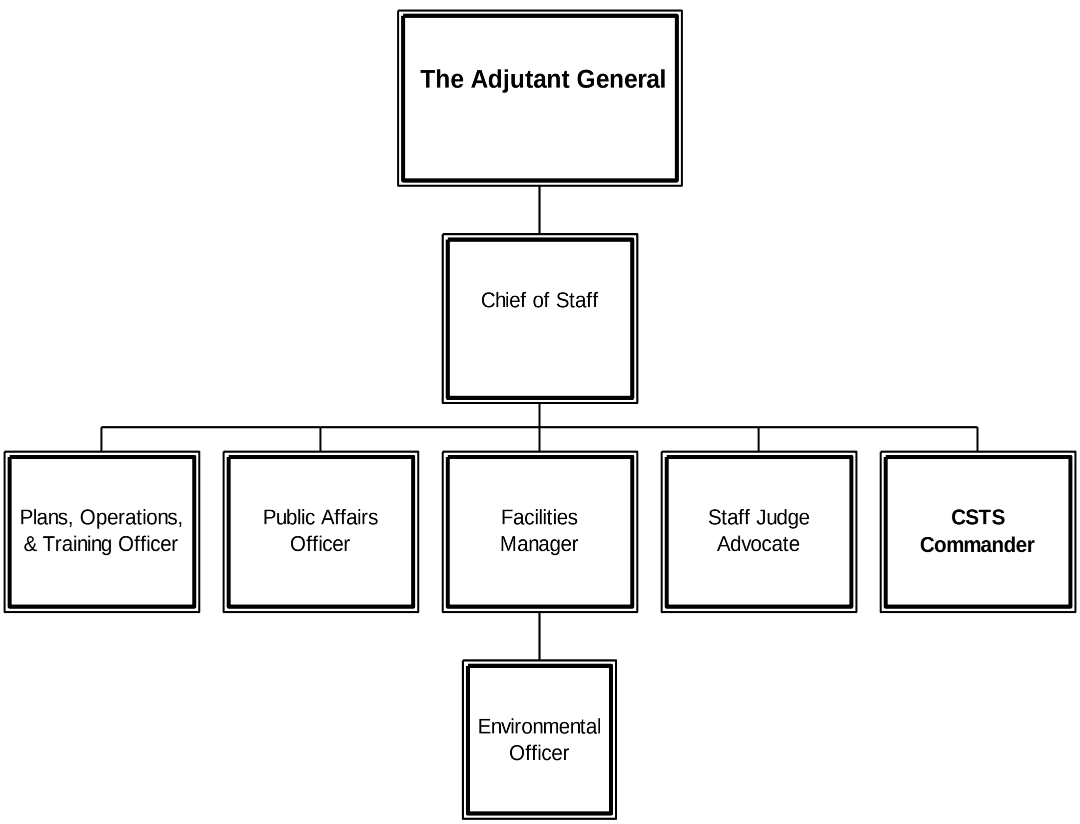
Chapter 5: Responsible Parties

5.1 Puerto Rico Army National Guard

The Adjutant General (TAG) is directly responsible for the operation and maintenance of the CSTC, which includes implementation of the INRMP. Responsibilities of TAG include:

- Ensuring that all installation land users are aware of and comply with procedures, requirements, or applicable laws and regulations that accomplish the objectives of the INRMP.
- Ensuring coordination of the INRMP initiatives between environmental, training, and engineering staffs.

As reflected in the organizational chart below, resources assisting TAG in the implementation of the INRMP include:



The following is a summary of the responsibilities of each position shown on the previous page:

- Chief of Staff – serves as the chairman of TAG's Environmental Quality Control Committee that provides overall guidance and policy direction to the environmental program, including management of the CSTS natural resources.
- Plans, Operation, and Training Officer (POTO) – has the primary responsibility for determining the range, training land, and facilities training and operational requirements, and is responsible for the scheduling of military training and the safety of all personnel while training exercises are being conducted. The POTO is responsible for coordinating the ITAM program, developing a baseline of current and projected training requirements and training lands/facilities for the Training Center, assisting the Facilities Manager Office in determining carrying capacity for the Training Center by providing military usage and training data, planning land use to accomplish training requirements while minimizing negative environmental effects, prioritizing and scheduling Land Rehabilitation and Maintenance (LRAM) projects with the Facilities Managers Office and the Training Center Commander, and allocating funds and resources to accomplish ITAM requirements.
- The Facilities Manager Office (FMO) - provides a full range of financial and engineering disciplines for the CSTC facilities. The FMO is responsible for master planning and ensuring that all construction projects comply with environmental regulations by consulting with the Environmental Office prior to any construction at the CSTC. The Environmental Engineer, ECAS Environmental Manager, and Hazardous Waste Specialist are responsible to the FMO for characterizing flora, fauna, air quality, and water quality of the Training Center, identifying compliance needs, and advising the PRARNG on the best way to comply with federal and state environmental laws and regulations.

Camp Santiago Training Center - Facilities

- The Environmental Officer (ENV) - provides technical assistance to the Training Center Commander including: developing projects, securing permits, conducting field studies, providing environmental awareness materials, locating and mapping natural and cultural resources, preparing the plans such as the INRMP, and subsequent required revisions of the INRMP.
- The Public Affairs Officer (PAO) - provides expertise in the development and production of Environmental Awareness materials for distribution to troop commanders. The PAO prepares news releases, develops and implements public

involvement, and is the liaison with other government agencies and with the public during public meetings and community educational events.

- The Staff Judge Advocate (SJA) – advises TAG, the POTO, the FMO, and the ENV on laws and regulations that affect training land use and environmental compliance.
- The Training Center Commander - is responsible the operation and maintenance of the CSTC, which includes the preparation and implementation of the Camp Santiago Training Center INRMP.

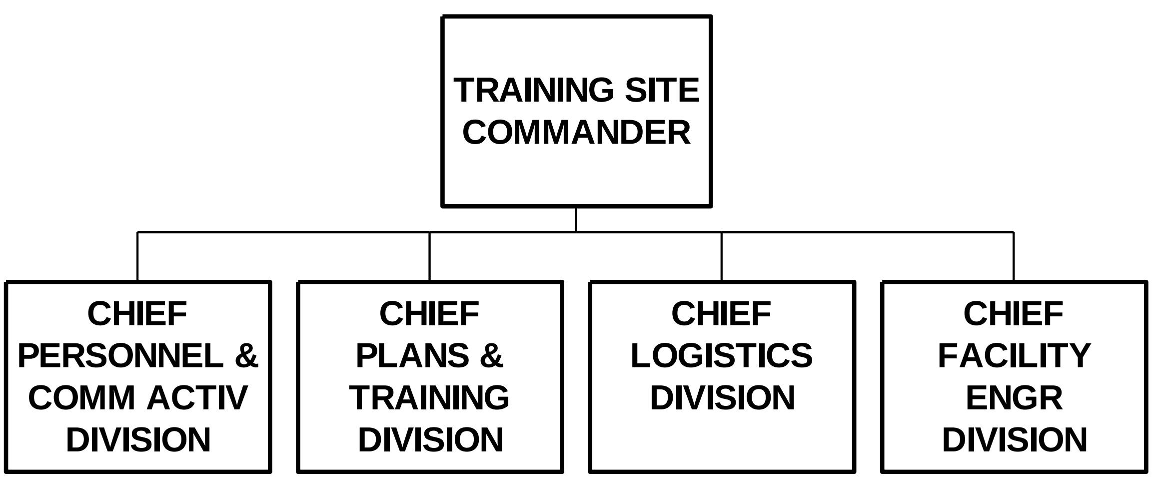
5.2 Camp Santiago Training Site Organization

As reflected in the following organizational chart, Training Center resources assisting the Commander in the implementation of the INRMP include:

- Chief of Facilities,
- Engineer Division,
- Chief of Plans and Training, and
- Chief of Logistics Division.

The CSTC operations staff, which is the Training Center manager, range control personnel and civilian personnel, is the primary stakeholder who ultimately implements the INRMP and assures its success.

CSTS OPERATIONS STAFF



In addition to the divisional functional areas shown above, the Commander also has a Command Sergeant Major, Provost Marshal, and a Detachment Commander to assist in the implementation of the INRMP.

5.3 National Guard Bureau

At the National Guard Bureau Headquarters, the Director of Environmental Programs (NGB-ARE), Director of Engineering (NGB-ARI), and Director of Operations Training and Readiness (NGB-ART) formed a partnership in April 1996 to implement the Integrated Training Area Management (ITAM) Program (National Guard Bureau, 1996a).

The ITAM-related responsibilities of each Directorate are as follows:

- The ITAM program manager at NGB-ART ensures coordination of the ITAM program with other training support requirements.
- The Natural Resources Manager at NGB-ARE is responsible for reviewing the INRMP and advising the Environmental Office before formally submitting the plan to the U.S. Fish and Wildlife Service, the Puerto Rico Department of Natural Resources and Environment, and the State Historic Preservation Office. The Environmental Programs Division ensures operational readiness by sustaining environmental quality and promoting the environmental ethic, and is responsible for tracking projects, providing technical assistance, providing quality assurance, and execution of funds.
- NGB-ARI coordinates proposed construction projects with NGB-ART and NGB-ARE and provides design and construction support.

5.4 Other Defense Organizations

5.4.1 Office of the Director of Environmental Programs (ODEP)

The Office of the Assistant Chief of Staff for Installation Management (ACSIM) is the HQDA proponent for INRMPs and exercises overall responsibility for INRMPs through the ODEP.

5.4.2 Office of the Deputy of Staff for Operations and Plans (ODCSOPS)

The Training Directorate (DAMO-TR) of the ODCSOPS is the Army proponent for the Integrated Training Area Management (ITAM) program, which plays a significant role in INRMP implementation of the Army INRMPs.

5.4.3 U.S. Army Environmental Center (AEC)

The Commander, U.S. Army Environmental Center (AEC), under the direction of the Director of Environmental Programs is responsible for technical support and oversight services for execution of INRMP requirements.

5.5 Other Federal Agencies Contributing to the INRMP

Federal agencies contributing to the development and implementation of the INRMP are summarized in the following table.

Table 5.1
Federal Agencies Contributing to the INRMP

Agency	Role
USDA Forest Service, Caribbean National Forest	Through coordination with the PRARNG, provide personnel and material to develop, review, and update the INRMP and supporting NEPA documentation.
U.S. Fish and Wildlife Service	Consultation and provide existing information on flora and fauna; concurrence with the NEPA documentation.
U.S. Geological Service	Provide maps and aerial photos.
USDA Natural Resources Conservation Service	Conduct planning level soil survey of the CSTC area.
U.S. Army Engineer Research and Development Center, Waterways Experiment Station	Conducted planning-level wetlands and other regulated waters inventory of the CSTC area.

5.6 Commonwealth Agencies

Commonwealth agencies contributing to the development and implementation of the INRMP are summarized in Table 5.2.

Table 5.2
Commonweath Agencies Contributing to the INRMP

Agency	Role
Puerto Rico Department of Natural Resources and Environment	Consultation and provide existing information on flora and fauna; concurrence with NEPA documentation; provide nursery stock for forest re-vegetation and riparian restoration initiatives.
State Historic Preservation Office	Consultation and provide existing information on cultural resources; concurrence with NEPA documentation.

5.7 Universities

Various local universities may play a role in the implementation and monitoring of the INRMP for the CSTC. For example, the PRARNG is exploring opportunities for faculty and students from the University of Puerto Rico at Ponce to help monitor various initiatives established in the INRMP.

5.8 Contractors

Local contractors would be hired to assist in the implementation of drainage structure and stream crossing improvement and/or installation, elimination of spot sediment sources, road maintenance, riparian restoration initiatives, and installation of fences around portions of the Training Center boundary.

During the INRMP's implementation, private contractors may be hired to survey and document the installation's boundary and to provide nursery stock and/or seed for re-forestation and riparian restoration initiatives.

5.9 Other Interested Parties

Parties interested in or possibly affected by the development and implementation of the INRMP include:

- The public and residents of Puerto Rico;
- Neighboring land and livestock owners - livestock owned by adjacent neighbors are currently trespassing and grazing within the Training Center. A neighboring land-owner currently has a permit to cut and harvest hay from designated areas within the Training Site;
- Two local businesses (Betteroads Asphalt Company and Salinas Gravel Company) – currently have permits to enter the Training Center and extract gravel and fill-dirt;
- Puerto Rico Conservation Trust Fund – is concerned about maintaining the unique scenic and visual values that the Training Center landscape provides.

Chapter 6: Natural Resources and Climate

6.1 Setting

Camp Santiago is located in the south-central coast of Puerto Rico, adjacent to the municipality of Salinas. The main gate is located right off Highway 52, approximately 51 miles south of San Juan, the Capital of Puerto Rico, and 30 miles east of Ponce, the second biggest city of Puerto Rico. The Camp is easily accessible by highway from virtually all points on the island. (Refer to Figure 2.1, Vicinity Map, page 2-3.)

According to the classification of ecological life zones made by Holdridge (Ewell and Whitmore, 1973), Camp Santiago and the south-central coast of Puerto Rico is included within the Sub-tropical Dry Forest Life Zone. This is the driest of the six life zones defined for Puerto Rico. The vegetation in this life zone tends to form a complete ground cover, and is almost entirely deciduous on most soils. Leaves are often small and succulent or coriaceous, and species with thorns and spines are common. Tree heights usually do not exceed 15 meters and the crowns are typically broad, spreading, flattened, and with sparse foliage. Fire is common on the better soils where the successional vegetation includes many grasses.


Cordillera Central Mountains

The CSTC's landscape presents a highly scenic view of the southern slope of the Cordillera Central Mountains. Key viewing points include Highway 1 just south of the training area, and the communities of Salinas, Sabana Llana, and Parcelas Penuelas. There is a Memorandum of Understanding entered with the Puerto Rico Conservation Trust Fund in order to preserve and maintain the unique and unspoiled scenery and vista both by day and night of the Camp Santiago area above the 100 meter topographic contour.

The predominant land use around Camp Santiago is farming and residential. There are several civilian homes and developments located around the borders of the training area.

6.2 Topography and Geology

Camp Santiago is situated on the southern slope of the Cordillera Central that forms the main drainage divide of Puerto Rico. The rugged mountains of the northern portion of the camp rise to 2,000 feet above sea level. In the southeast portion of the Camp, the San Lorenzo Batholith is present; it was formed during Maastrictian time, later followed by uplift and erosion. It has few lineaments that are generally north-south and occasionally east-west. The lineament pattern is different from that of the surrounding terrain and may represent fracturing caused by the cooling of intrusive rocks (McCann 2002).

A long east-west escarpment separates the Tertiary carbonate rocks of northern Puerto Rico from the mountainous central core of volcanic rocks and intrusive granodiorites (coarse-grained plutonic rocks) of Cretaceous and early Tertiary age (Briggs 1964) named the Cariblanco formation. The Puerto Rican central highlands include exposures of Cretaceous and lower Tertiary volcanic and sedimentary rock sequences, various intrusive rock bodies, Oligocene and Miocene sediments, large areas of floodplain deposits, terrace deposits, and landslide debris (Monroe 1980).

The only documented occurrences of hydrocarbons (crude oil) in the island of Puerto Rico are carbonate concretions of the Cretaceous Cariblanco Formation. Hydrocarbons in these concretions are preserved within calcite cements and light mature oil is present in voids in the concretions (González 2005). Petroleum exploration efforts in Puerto Rico have focused on Tertiary basins that are believed to hold the greatest potential of yielding exploitable hydrocarbons, yet, in these basins neither hydrocarbons nor potential source rocks have been discovered (González 2005).

6.3 Climate

Camp Santiago enjoys a warm subtropical dry forest climate due to its location near the equator. The temperature is mediated by the trade winds that blow constantly from the east. Daily temperatures rarely drop below 70 degrees in the winter and seldom exceed 95 degrees in the summer.

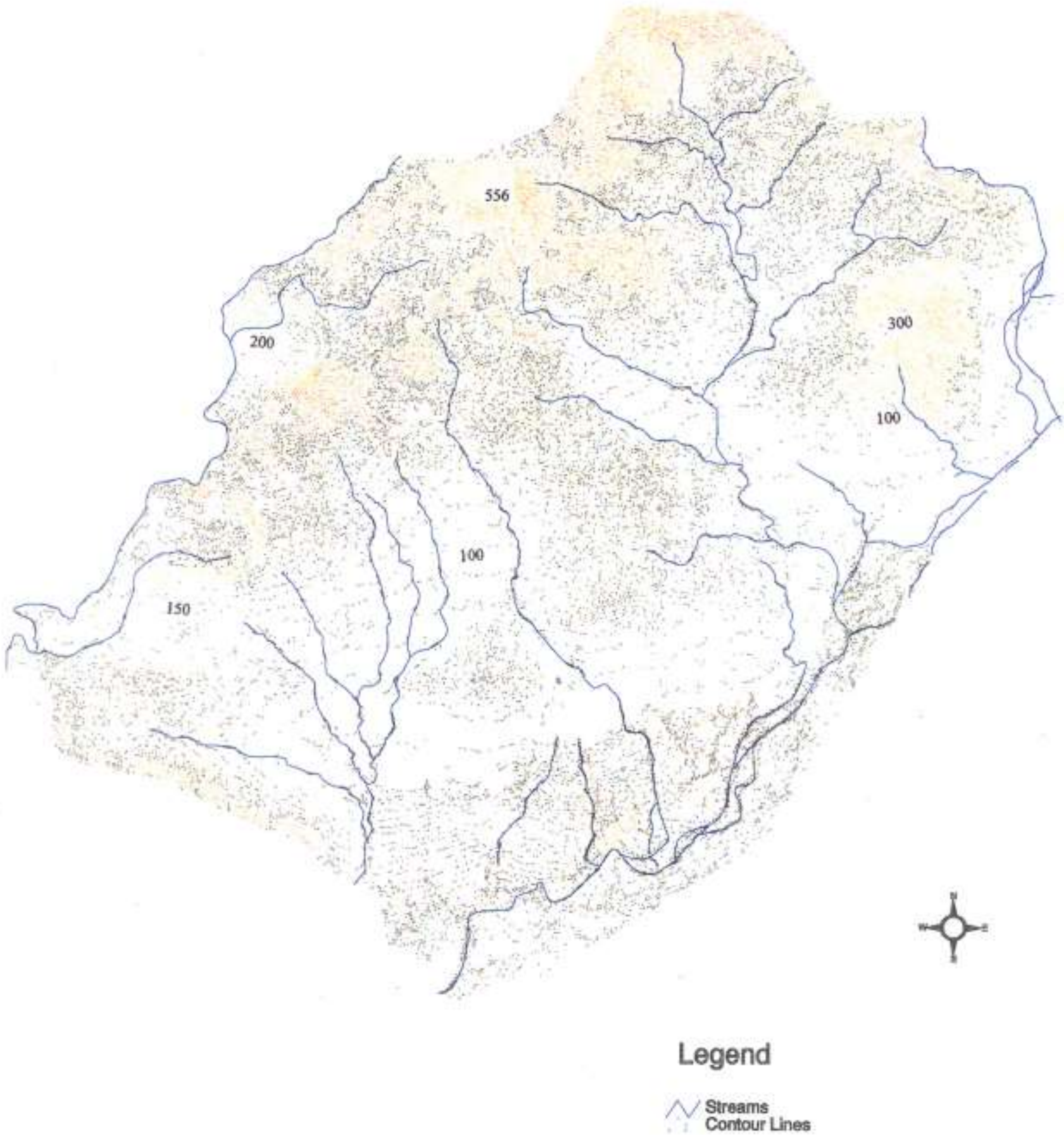
The climate is so uniform that the January and July average temperatures differ by only five degrees. Camp Santiago experiences few cloudy days with most rainfall occurring in brief squalls from September through December. The average rainfall is 25 to 40 inches of rain per year. The following table (source: USDA Natural Resources Conservation Service) provides the monthly moisture and temperature distribution for the CSTC area.

Table 6.1
Monthly Moisture and Temperature Distribution for Camp Santiago Training Center

Month	Mean Precipitation (inches)	Percent of Annual Precipitation (%)	Mean Temperature (◦F)
January	.78	2.36	76
February	.72	2.18	76
March	.86	2.63	77
April	1.92	5.82	78

Table 6.1 Monthly Moisture and Temperature Distribution for Camp Santiago Training Center			
Month	Mean Precipitation (inches)	Percent of Annual Precipitation (%)	Mean Temperature (◦F)
May	2.92	8.85	80
June	3.13	9.48	81
July	2.91	8.82	82
August	4.45	13.48	82
September	5.26	15.94	81
October	5.63	17.26	81
November	3.18	9.64	79
December	1.20	3.64	77
Mean Annual	**2.74**	**--**	**79.12**

Figure 6.1. Topography Map of Camp Santiago



The destructive force and frequent occurrence of hurricanes in the Caribbean plays a major role in shaping the vegetation composition. The passage of Hurricane Georges through Puerto Rico in September 1998 caused intense widespread damage to Camp Santiago.

1998 – Hurricane Georges

6.4 Petroleum and Minerals

There are no known commercially valuable petroleum resources within the Training Center. Two local businesses have permits to access the Training Center and extract gravel and fill-dirt.

6.5 Soils

In October 2001, the Natural Resource Conservation Service issued the report titled *Soil Survey of Camp Santiago and Fort Allen, Puerto Rico* (2001 NRCS Soil Survey) (Administrative Record Exhibit K-1). This soil survey updates the Camp Santiago part of the *Soil Survey of the Humacao Area of Eastern Puerto Rico* published in 1977 (Boccheciamp et al, 1977) and in included in the Administrative Record (Exhibit K-1). Eighteen taxonomic soil types are identified in the 2001 NRCS Soil Survey, compared to five soil associations presented in the 2001 INRMP.

The 2001 NRCS Soil Survey provides maps of the soil taxonomic units. The mappings objective is to separate the landscape into landforms or landform segments that have similar use and management requirements, not to delineate pure taxonomic classes. The delineation of such segments on the map provides sufficient information for the development of resource plans. Each description includes general facts about the unit and gives the principle hazards and limitations to be considered in planning for specific uses.

The 2001 NRCS Soil Report is a stand alone document that is part of this INRMP. The report provides numerous tables summarizing the potential of each soil type to accommodate various land use activities including: farming, recreation, wildlife habitat, building site development, sanitary facilities, construction materials, water resource related projects, and military trafficability (in wet and dry seasons). There are also numerous tables providing physical, chemical, and engineering properties/analyses of selected soils. A summary of the soil types follows:

AnC – Annaberg gravelly clay loam, 5 to 12 percent slopes

These are shallow, well drained soils of the uplands between elevations 150 to 500 feet. They are found on summits, shoulders, and backslopes of mountains and hills. They are unconsolidated, weathered or partly weathered mineral material that has accumulated as volcanic and siltstone rock disintegrated in place.

AnE – Annaberg cobbly clay loam, 20 to 40 percent slopes

These are shallow, well drained soils of the uplands between elevations 250 to 650 feet. They are found on summits, shoulders, and backslopes of mountains and hills. They are unconsolidated, weathered or partly weathered mineral material that has accumulated as volcanic and siltstone rock disintegrated in place.

ArF – Annaberg-Rock outcrop complex, 40 to 60 percent slopes

These are shallow, well drained soils of the uplands between elevations 250 to 1,800 feet. They are found on summits, shoulders, and backslopes of mountains and hills. They are unconsolidated, weathered or partly weathered mineral material that has accumulated as volcanic and siltstone rock disintegrated in place.

CaB – Camp Santiago loam, 2 to 5 percent slopes

These are very deep, well drained soils of the dry coastal plain and valleys between elevations 190 to 330 feet. They are found in footslopes and toeslopes of alluvial fans and were formed from mixed alluvium derived from volcanic and limestone rock. These soils are rated good for potential grain and seed crop, grasses and legumes, herbaceous plants, and shrub wildlife habitats. They are rated as fair as a potential source for sand, reclamation, and topsoil material and have a good potential as a source for roadfill. These soils have somewhat limited potential for developing pond reservoir areas and embankments, dikes, and levees.

CIB – Coama clay laom, 2 to 5 percent slopes

These are very deep, well drained soils of the dry coastal plain and valleys between elevations 65 to 360 feet. They are found in footslopes and treads of alluvial fans and terraces, and were formed from mixed alluvium derived from volcanic and limestone rock. These soils are rated good for potential grain and seed crop, grasses and legumes, herbaceous plants, and shrub wildlife habitat. These soils have a fair potential as a source for reclamation and roadfill material.

CtA – Constancia silty clay loam, 0 to 2 percent slopes, occasionally flooded

These are very deep, somewhat poorly drained soils of the coastal plains between elevations 20 to 40 feet. They are found in slightly concave areas of the flood plains and are formed from fine-textured sediments derived from volcanic rock and limestone. These soils are rated fair for potential shrub, wetland plant, and shallow water wildlife habitat. These soils have good potential for developing pond reservoir areas and are somewhat limited for developing embankments, dikes, and levees.

CxA – Cortada silty clay loam, 0 to 2 percent slopes, occasionally flooded

These are very deep, well drained soils of the dry coastal plains between elevations 15 to 30 feet. They are found in slightly convex to concave positions of flood plains and are formed of stratified medium to moderately fine alluvial sediments derived from volcanic and limestone rock. These soils are rated fair to good for potential grain and seed crop, grasses and legumes, herbaceous plants, and shrub wildlife habitat. They have a good potential as a source of roadfill material. They have somewhat limited potential for developing pond reservoir areas and embankments, dikes, and levees.

FrA – Fraternidad clay, 0 to 2 percent slopes

These are very deep, moderately well drained soils of the dry coastal plains between elevations 30 to 80 feet. They are found in convex and concave positions of alluvial fans and are formed of clayey sediments that weathered from volcanic and limestone rock. These soils are rated good for potential grain and seed crop, grasses and legumes, herbaceous plants, and shrub wildlife habitat.

GAA – Guamani and Arenales soils, 0 to 2 percent slopes, occasionally flooded

These are very deep, well to excessively drained soils of the dry coastal plains between elevations 30 to 330 feet. They are found in convex to concave positions of flood plains. These soils are formed of medium-textured sediments over sand, pebbles, and cobbles or stratified mixed alluvium derived from volcanic and limestone rock. These soils are rated fair to good for potential grasses and legumes, herbaceous plants, and shrub wildlife habitat. There is a fair potential to develop sand and reclamation material sources and fair to good potential to develop roadfill and topsoil material sources. They have a somewhat limited potential for developing embankments, dikes, and levees.

JaB – Jácana clay loam, 2 yo 5 percent slopes

These are moderately deep, well drained soils of the uplands between elevations 130 to 400 feet. They are found in the footslopes and toeslopes of volcanic hills and alluvial fans. These soils are unconsolidated, weathered or partly weathered mineral material, alluvium, and colluvium derived from volcanic rock. These soils are rated fair for potential grain and seed crop, grasses and legumes, herbaceous plants, and shrub wildlife habitat. There is a somewhat limited potential for developing pond reservoir areas and embankments, dikes, and levees with these soils.

JcC – Jácana-Camp Santiago complex, 5 to 12 percent slopes

These are moderately deep to very deep, well drained soils of the uplands between elevations 160 to 820 feet. They are found in the footslopes and toeslopes of hills and alluvial fans. These soils are formed from weather material volcanic rock and mixed alluvium from volcanic and limestone rock. These soils are rated fair to good for potential grain and seed crop, grasses and legumes, herbaceous plants, and shrub wildlife habitat. There is a fair potential to develop sand, reclamation, and topsoil material sources in these soils and a good potential to develop roadfill material sources. There is a somewhat limited potential for developing pond reservoir areas and embankments, dikes, and levees with these soils.

PrC – Pozo Blanco clay loam, 5 to 12 percent slopes

These are very deep, well drained soils of the uplands between elevations 130 to 390 feet. They are found in the summits, shoulders, backslopes, and footslopes of alluvial fans and limestone hills. They are derived from clayey and loamy marine sediments. These soils are rated fair to good for potential grain and seed crop, grasses and legumes, herbaceous plants, and shrub wildlife habitat. There is a fair potential to develop reclamation, and topsoil material sources in these soils and a good potential to develop roadfill material sources. There is a somewhat limited potential for developing pond reservoir areas and embankments, dikes, and levees with these soils.

SdF – San Germán-Düey complex, 20 to 60 percent slopes

These are shallow, well drained soils of the uplands between elevations 300 to 700 feet. They are found on the summits, ridgetops, and side slopes of limestone hills and mountains. These soils are formed from colluvium and weathered mineral material derived from limestone rock.

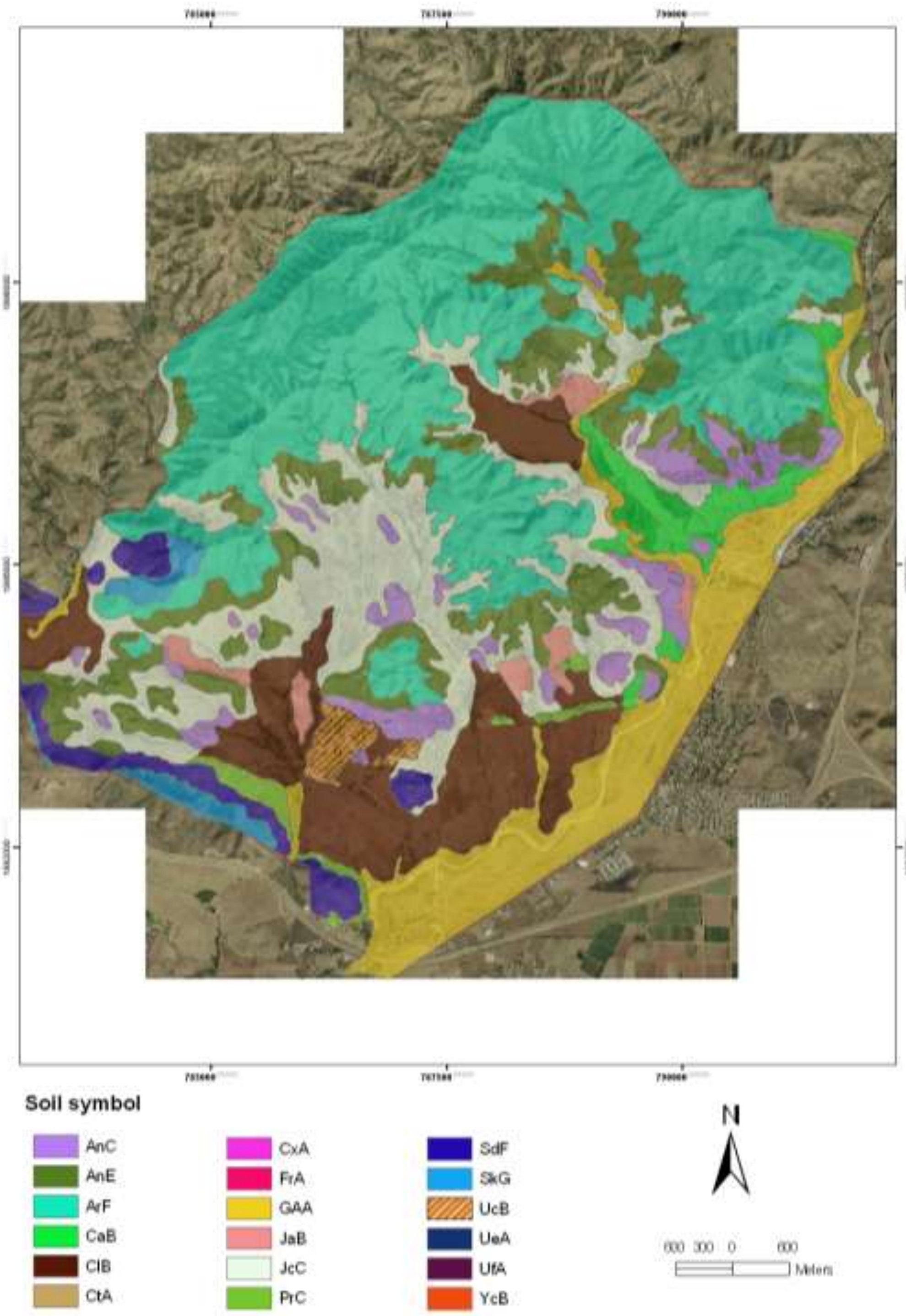
SkG - San Germán-Düey-Rock outcrop complex, 60 to 90 percent slopes

These are shallow, well drained soils of the uplands between elevations 500 to 750 feet. They are found on the summits, ridgetops, and side slopes of limestone hills and mountains. These soils are formed from colluvium and weathered mineral material derived from limestone rock.

UcB – Urban land-Coamo complex, 2 to 5 percent slopes

These are very deep, well drained soils of the dry coastal plains between elevations 130 to 165 feet. They are found on toeslopes and treads of alluvial fans and terraces. These soils are formed from mixed alluvium that weathered from limestone and volcanic rock. These soils are rated good for potential grain and seed crop, grasses and legumes, herbaceous plants, and shrub wildlife habitat. There is a fair potential to develop reclamation and roadfill material sources in these soils.

Figure 6.2 – Soils Map of Camp Santiago



UeA – Urban land–Fé complex, 0 to 2 percent slopes

These are very deep, somewhat poorly drained soils of the coastal plains between elevations 15 to 25 feet. They are found in concave toeslopes of alluvial fans and are formed from clayey sediments that weathered from igneous and limestone rock. These soils are rated fair for potential grain and seed crop, grasses and legumes, and herbaceous plant wildlife habitat.

UfA – Urban land-Fraternidad complex, 0 to 2 percent slopes

These are very deep, moderately well drained soils of the coastal plains between elevations 30 to 80 feet. They are found in footslopes and toeslopes of coastal plains and are formed from fine-textured alluvium from volcanic and limestone rock. These soils are rated good for potential grain and seed crop, grasses and legumes, herbaceous plants, and shrub wildlife habitat. There is a somewhat limited potential for developing pond reservoir areas with these soils.

YcB – Yauco silty clay loam, 2 to 5 percent slopes

These are moderately deep, well drained soils of the uplands between elevations 80 to 130 feet. They are found on the summits, side slopes, and footslopes of the hills and are formed from calcareous sediments over soft limestone bedrock. These soils are rated fair for potential grasses and legumes, herbaceous plants, and shrub wildlife habitat. There is a somewhat limited potential for developing pond reservoir areas and embankments, dikes, and levees with these soils.

The CSTC is comprised primarily of the Arf, JcC, ClB, and AnE soils types, comprising 34.7, 13.0, 11.5, and 10.8 percent of the acreage, respectively.

6.6 Water Resources

6.6.1 Delineation of Wetlands and Other Regulated Waters

The U.S. Army Engineer Research and Development Center, Waterways Experiment Station has conducted and published their finding of a planning-level wetland inventory for the CSTC. This publication, entitled *Delineation of Wetlands and other Regulated Waters at Camp Santiago, Puerto Rico,* dated 4 October 1999, is on file at the PRARNG Headquaters in San Juan, PR.

- There are no Jurisdictional wetlands found within the CSTC.
- There are approximately 144.4 miles of intermittent and perennial streams within the CSTC.
- There is one human-made pond (approximately 0.2 acres in size) within the CSTC.

6.6.2 Surface Water

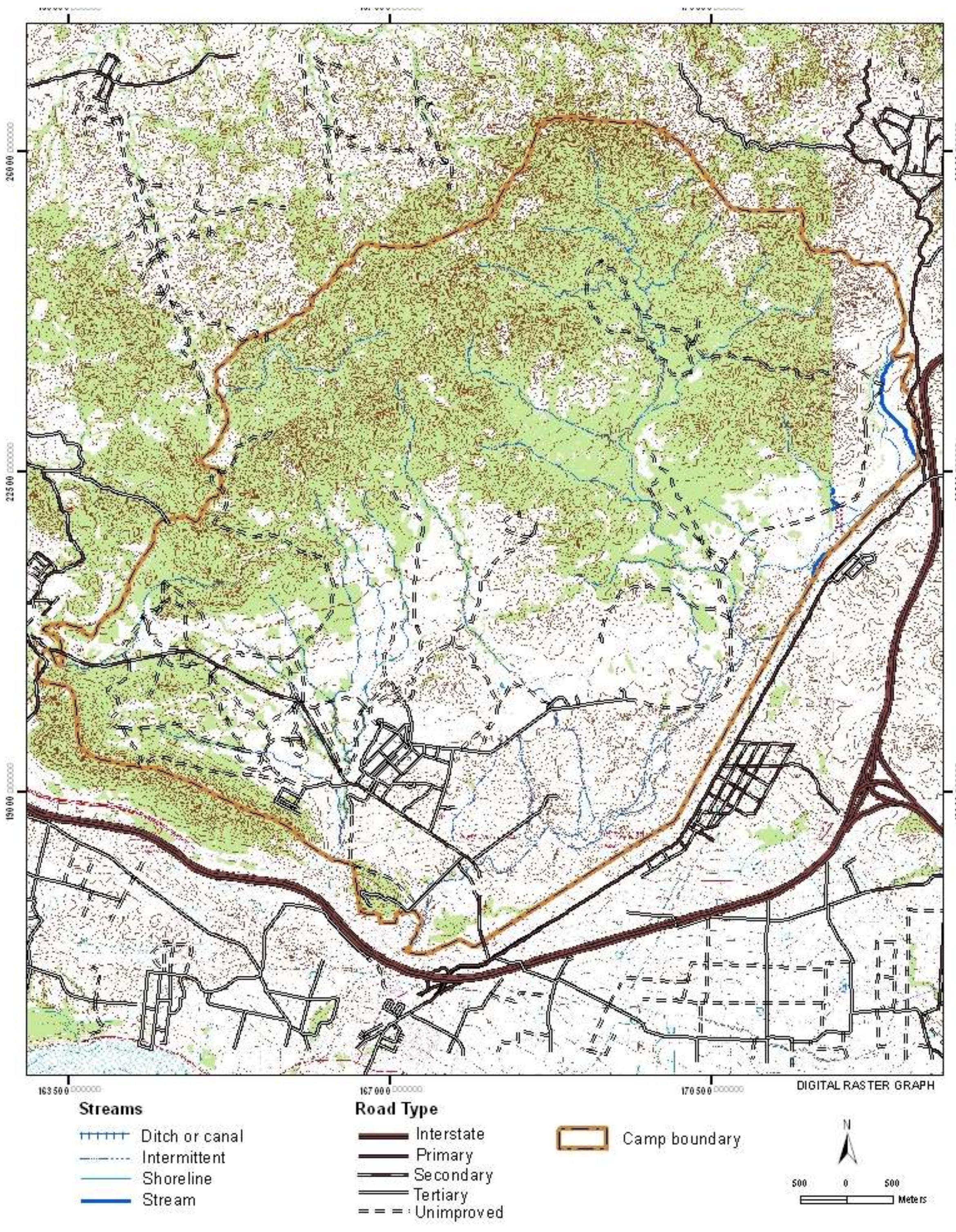
As illustrated on Figure 6.3 – Surface Water Features on Camp Santiago, page 6-11, there are approximately 144 miles of perennial or intermittent streams within the boundaries of CSTC. Most of the steams flowing through the active training areas are intermittent or ephemeral, with low gradients and sizable deposits of loosed gravels and sand. The unconsolitated material is very movable during high stream flow periods.

Rio Nigua

Where fires and live ammunition has removed native plants, only grass, herbaceous plants, and shrubs grow along the steam courses. These historic riparian areas can be seen by looking at aerial photos as lineal features that are greener than the surrounding areas. The old stream course topography is still shaped by water, and runs water during precipitation events. Numerous springs flow to the surface, but most run dry before accumulating any significant amounts of water, except during seasonal storm events.

The steep topography and shallow soils that occupy the upper elevations of the CSTC are along the southern slopes of the Cordillera Mountain Range. Here, boulders and bedrock outcrops form streambeds. Large deeply rooted trees help hold the stream banks together and in place. The boulders in the channel act as natural flow dissipaters and moderate the run off intensity of rainstorms. Similar conditions exist in the upper watershed of the Rio Nigua and Rio Jueyes outside the CSTC's boundary.

Figure 6.3. Surface Water Features of Camp Santiago



Only short sections of the Rio Jueyes and Rio Nigua have water throughout the year within the CSTC boundary. Several field reviews in 2000, 2004, and 2005 indicate that most of the surface water of the Rio Nigua goes sub-surface soon after it enters CSTC in the section of stream channel that is made of unconsolidated material that is being extracted for gravel and fill material.

Intense runoff events (mostly in the mountainous area to the north and east of CSTC) create flash flood conditions in the lower elevations. All low elevation areas can be flooded within hours of the onset of a storm, including the convoy routes and the shooting ranges on the CSTC, as well as in neighboring areas. The local geology and drainage patterns indicate that both portions of the Camp and the adjacent communities of El Coco and Salinas occupy historic floodplains.

Flooding in the lowest areas has been aggravated by alterations on the stream course and filling of the floodplains for development.

These “floods” or “over-bank” conditions are also increased in intensity and frequency where urbanization has paved the earth’s surface, making water run off before it has an opportunity to infiltrate into the ground. Brush fires across the island regularly burn the ground cover, and cattle browse has replaced native vegetation with grasses and shallowly rooted shrubs; both of which increase runoff rates and volumes.

In 2001, The Army Corps of Engineers, in conjunction with the Puerto Rico Department of Natural and Environmental Resources, finalized a detailed study focused on the formulation and evaluation of flood control plans to solve the serious flooding problems resulting from the overflow of Rio Nigua in the vicinity of the town of Salina, Puerto Rico. The Rio Nigua at Salinas Flood Control Project Design Documentation Report recommends improvements for the Rio Nigua south from Puerto Rico Highway 52 consisting of a 3.0 kilometer levee along the east bank of the river extending southward ending east of the mouth of the river in the coastal area. The plan includes protection measures against erosion for the east abutment of the highway bridge, a new bridge and ramp at Puerto Rico Highway 1, and a levee segment to protect the intersection between highways 52 and 1. The recommended plan also includes a 4.5 kilometers earthen levee to provide flood protection to the Coco community, upstream Puerto Rico Highway 52. The proposed levee projects are expected to contain the one percent chance exceedance frequency flood (100 year). The project calls for the use of a primary borrow area on the river’s west bank, immediately adjacent to the Coco Levee and an auxiliary borrow site further from for the project site, both within the boundary of the Camp Santiago Training Center.

Active erosion is present in many sections of the stream channels, especially where altered by vehicle use. Where the storm water runoff is concentrated in narrow valleys, brush and other vegetation is ripped out of the stream beds and carried down slope. While conducting the preliminary inventory of convoy routes and sediment sources, many locations were found where gullies are enlarging and moving in an uphill direction. In many cases there are indications that these have been formed by water flowing down the roads and entering stream courses on the downhill side of the crossing structure. This is also caused by changes in elevation of the streambed at the confluence of two stream courses. (This type of uphill erosion of gullies is called a “head cut.”)

When these types of runoff conditions occur, they have caused many stream crossing structures on CSTC to plug with rubble. This, in turn, has forced stream water flow to the sides of stream channels where it has eroded the routes where they approach stream crossing structures. (Similar conditions have occurred north of El Coco and other narrow valleys in surrounding areas.) Water flowing down tire ruts in the convoy routes has added to the erosion of stream channel, as has the expansion of excavated areas next to stream crossings. These excavated areas collect rain water and route it directly into the stream at crossings, thereby adding to stream flow downhill from each excavation. Together these situations are causing repeated damage to roads and road crossing structures and impairing access to CSTC lands.

The use of small diameter gravel rubble from building demolition to patch eroded stream crossings is an ongoing source of sediment to the stream and is actually aggravating the erosion problems down slope. Deposition of eroded material in low gradient areas plugs stream channels and contributes to amount of channel shifting that occurs.

In 2000, some stock water troughs were observed along the banks of Rio Jueyes. These structures were not reviewed in 2005; however, they were originally thought to be filled by water piped from springs. Either way, their presence would draw livestock to the river course and encourage the livestock to use the riparian area, which in turn makes the cattle paths deeper, more likely for intercept rainfall, and add to erosion.

6.6.3 Groundwater

The original document stated, “Three wells are listed by the USGS on Camp Santiago, but only two are still in use”. Water is currently piped to CSTC from Salinas. Water usage and increased salinity in the shallowest aquifer used as a drinking source for the area is a cause increased concern to all water users as of 2005.

6.6.4 Storm Water Management

The southern portion CSTC (and the area most heavily used for training maneuvers) is situated on a gently sloping valley bottom. Most of the water flowing through CSTC runs as some type of stream and comes from the northern-most mountainous portion (Figure 6.2 – Soils Map of Camp Santiago, page 6-6.) Within the Cantonment Area most rain runs off the paved roads and parking lots onto grassy fields throughout the encampment, which helps filter out sediment. A *Storm-Water Pollution Prevention Plan* (Administrative Record Exhibit O-2) was developed in December 2004 for three specific sites within the CSTC and one site on Fort Allen (see Administrative Record Exhibit O-2). This document contains no mention of water run-off control from the paved areas, like parking lots, at either facility. Some erosion and structure fatigue is evident at concrete pipe road crossings where the water leaves the site (Administrative Record Exhibit L-1).

6.6.5 Wetlands and Floodplains

As previously stated the CSTC contains no areas that have been mapped as Jurisdictional Wetlands within its boundaries, though there are many areas that are wet on a seasonal basis. Most of the area used for training on the CSTC is relatively dry with highly permeable soils supporting grasses and desert-like vegetation except during seasonal tropical rain storms.

Floodplain maps, “Mapas de Zonas Susceptibles a Inundaciones” dated 2003 (Administrative Record Exhibit L-18), show flood prone areas along the Rio Nigua within the eastern and southern boundaries of Camp Santiago and south through Salinas. No flood prone areas were mapped along the Quebrada Honda or its tributaries draining the western side of the Cantonment Area. Some floodplains also occur along and Rio Jueyes where the valley bottoms are broader and less steep. Most flood prone areas are only occupied during intense rainstorms, when several inches of rain falls during a short period of time and the water exceeds the infiltration rate of the soils and runs off as overland flow. Berming along several water ways is concentrating the flood flows in the lowest areas. As previously described, rain in the CSTC may be light and of short duration in the camp, but it is receiving a great deal of water from the upper watershed from tributaries of Rio Majada, such as Rio Jajome. A specific runoff volume can be calculated by using the watershed layer and a precipitation layer in GIS; this may be available from the U.S.G.S.

6.6.6 Wastewater Treatment Sites

In the past, CSTC had its own wastewater treatment plant to handle sewage generated on the installation. This system has shut down; and CSTC was connected to the Salinas sewage treatment system. The old treatment site has not been totally reclaimed; plastic pipes still protrude from an eroded bank along the lower segment of the Red Convoy Route.

6.7 Flora

6.7.1 Vegetative Cover

Three technical assessments (Department of Natural Resources, 1984; University of Oklahoma, 1994; and Project DY-96-S-0011, 1996) have identified several different vegetative covers that are described according to the investigators' interests. These include seven groups of plant formations, nine habitat types based on biological and physical characteristics, and eight ecosystem types based on plant species dominance.

As early as 1860, vegetative descriptions for the Salinas Municipality describe the area as dedicated to raising cattle for which it has "good and plentiful pastures." In 1897, it was estimated that 93 percent of the municipality was in "pasture for 10,314 head of cattle". After 1898, the land use activities turned to sugarcane production. Analysis of 1937 aerial photographs show that Camp Santiago lands were comprised of open pasture, shrubs, and two patches of closed forest (one at Cerro Modesto and the other at Cerro Respaldo). The 1950 aerial photographs show an increase in closed forest and shrub areas. More recently, 1996 aerial photographs show a continuation of the same successional trend, but the original closed forest had been mostly burned over by fire. The forest remnant on Cerro Respaldo has been reduced because of uncontrolled grass fires.

CSTC Overviews

Focusing on the concept of ecosystem management, Camp Santiago's vegetation will be referred to as "seral stages" in their successional path toward climatic conditions: Advanced Secondary Natural Forest, Early Secondary Natural Forest, Open Grasslands and Artificial

Regeneration Forest. This classification mode will facilitate and simplify future vegetation management directions.

Figure 6.4 (page 6-17) identifies actual and potential areas of floral seral stages for the purpose of vegetative description and management directions. The following table illustrates the current vegetative seral stage classification of the 12,489 acres within the CSTC:

Table 6.2
Current Seral Stage Classification of Vegetation within the Camp Santiago Training Center

Seral Stage Classification	Acres	Percent of Total Acreage
Advanced Secondary Natural Forest	4,279	35%
Early Secondary Natural Forest	162	1%
Open Grassland	7,021	56%
Artificial Reforestation Forest	1,027	8%

Vegetative analysis from 1936, 1950, and 1996 aerial photography shows advanced secondary forest increments in the drainage areas, some of the riparian zones, and in the foothills north and west of the camp. Most of the plant communities associated with the Subtropical Dry Forest at Camp Santiago are represented in these advanced secondary forest areas.

6.7.2 Plant Species of Concern

A survey done in October 2000 for the purpose of locating two federally listed plant species, *Solanum drymophilum* and *Zanthoxylum thomasianum*, did not find these species on Camp Santiago lands.

Three locations at Camp Santiago with a high number of endemic species deserve special protection; these are: Piedras Chiquitas, Cerro Cariblanco, and Cerro Pio Juan. Precipitous cliffs and rock outcrops in these areas are notably important for endemic plants.

6.7.3 Riparian Areas

Riparian areas have distinctive resource values and characteristics that are comprised of an aquatic ecosystem and adjacent upland forest areas that have direct relationships with the aquatic system. This includes flood plains and all areas within a horizontal distance of approximately 100 feet from the normal high waterline of a stream channel.

Figure 6.4 – Vegetation Map for Camp Santiago

The riparian ecosystem is a transition between the aquatic ecosystem and the adjacent upland terrestrial ecosystem. It is identified by soil characteristics and by distinctive vegetation communities that require free or unbounded water.

As mentioned in the previously description of surface water, there are approximately 144 miles of stream channels within the CSTC. There are approximately 1,270 acres of riparian areas that provide streamside buffer vegetation within the CSTC. (Refer to Figure 6.5, Riparian Buffers, page 6-19.)

6.8 Fauna

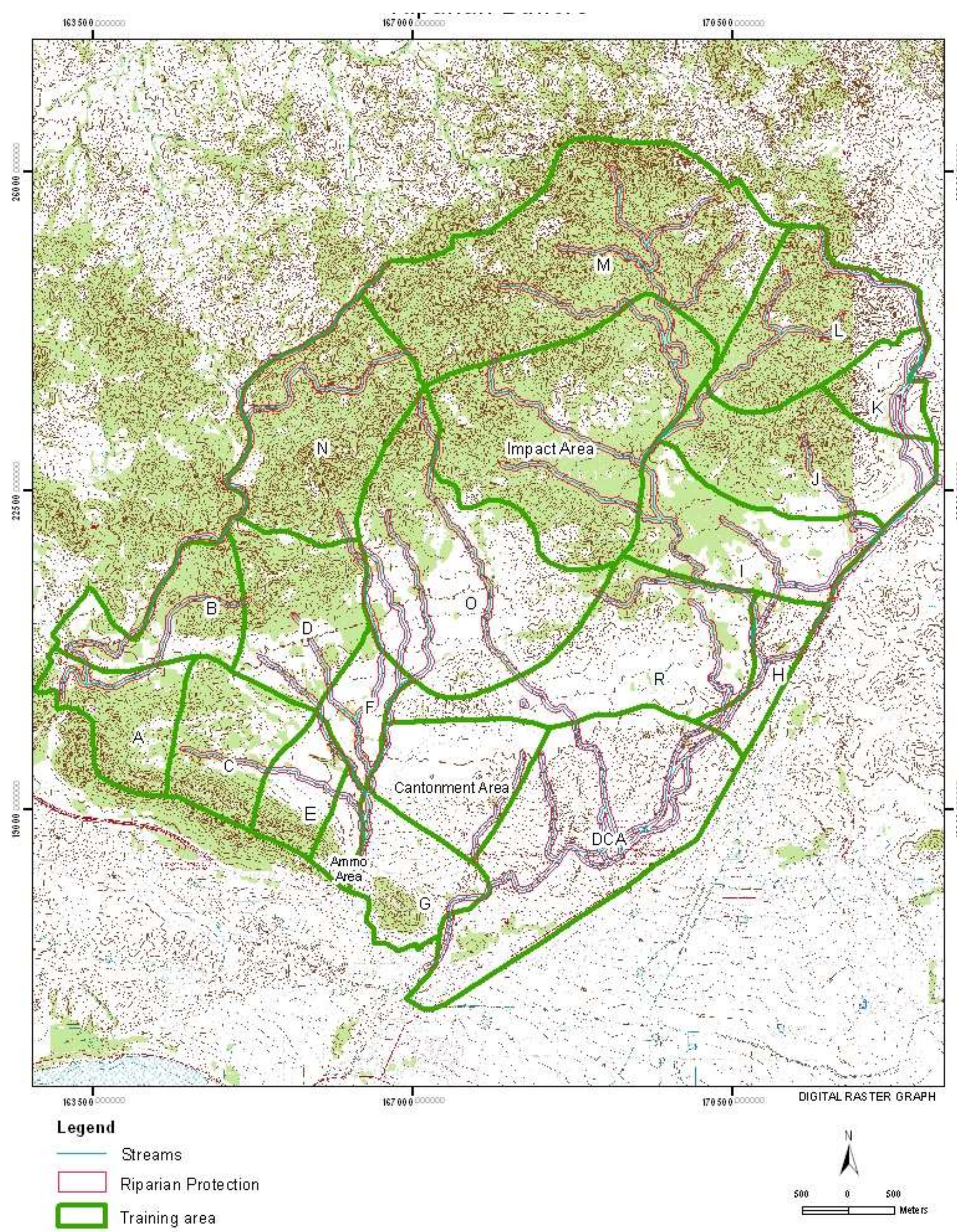
Faunal surveys at Camp Santiago have been documented in three written reports between 1984 and 1996. All three reports (Diaz et al 1984, Johnson et al 1994, and Rivera et al 1996) were prepared specifically for documenting the presence and observation of flora (plants) and fauna species (mammals, birds, reptiles, amphibians, and invertebrates) at Camp Santiago. The updated inventory for the INRMP includes 74 vertebrate animals and 62 invertebrates as listed in Appendix D. Included are domesticated and feral animals present at the CSTC that are also addressed as pests in Section 6.11.

All of the animal species recorded for Camp Santiago are generally common to the island of Puerto Rico. Abundance and diversity of animal species across Camp Santiago is higher in forested types and in areas of water. Forest types are important to many of the fauna species; and because of the limited availability of water, animal species diversity tends to be concentrated in and near the river and aquatic environments.

6.8.1 Birds and Mammals

Of the vertebrates, birds comprise the majority (53 of 74) of individual species documented on Camp Santiago. Collectively, they inhabit and use nearly every environment of Camp Santiago. Nearly all of the bird species observed at the CSTC are common to Puerto Rico and are generally associated with the forest ecosystem. Relative to the other vegetative types at Camp Santiago, forest environments offer more diversified foraging and nesting habitats to support a larger assemblage of bird species.

Figure 6.5. Riparian Buffers for Camp Santiago



Fifty-three bird species (Appendix D) have been recorded at the CSTC, with six being endemic to Puerto Rico (the island has a total of 16 endemic birds). Another five non-native species present at the CSTC were apparently introduced on the island either intentionally or by escaping from captivity.

Puerto Rican Tody

During the migratory season for neo-tropical birds, a rare or uncommon visitor might appear on the island. Warblers, vireos, flycatchers, doves, todies, euphonias, woodpeckers, and the kestrel are most commonly observed at Camp Santiago. Three species of falcons, one hawk species, one owl species, and a vulture species are present. Osprey has been added to the list as it has recently been observed at the CSTC.

For the mammal class, only bats are native to the CSTC and the island of Puerto Rico. Previous surveys for bats at the CSTC resulted in documenting only one species (*Molossus molossus*). It is suspected that two other bats species, Artibeus jamaicensis and Stenoderma rufum, could be present based on the suitability of habitat. Confirming the presence of other bats was limited by the effort required to physically capture bats in different areas of the CSTC for positive identification. Bats were observed in several of the building structures in the cantonment area.

Molossus molossus

All other mammals were brought to the island as domesticated stock, pets, or introduced for pest control. Rats and mice came from years past as stow-a-ways on sea vessels. Mongoose were, then, later brought to the island and released to prey upon the rats. Feral dogs and cats roam at large on the CSTC. Additionally, an undetermined number of unauthorized cattle, horses, goats, and sheep currently forage on portions of the CSTC.

6.8.2 Waterfowl

Although jurisdictional wetlands are essentially lacking on Camp Santiago, for the majority of the year waterfowl are not present at the CSTC. During seasonal rainstorms, small riparian systems grow in scope and water-habitat dependant bird species occur in higher numbers on the CSTC.

6.8.3 Amphibians and Reptiles

Reptiles found at the CSTC are represented by seven species; snakes (one species), lizards (four species), and geckos (two species). Lizards, especially the Annolis types, are the most common and abundant. Both arboreal and ground lizards are present. One of the gecko species is commonly associated with human developments and the other is secretive. The one species of snake (the Puerto Rican snake, Alsophis portoricensis) is found in the cactus-thorn environment. It is non-poisonous to humans, although its saliva is considered mildly toxic.

Existing habitat conditions at the CSTC support four amphibian species: two native species of coqui tree frogs, one native terrestrial toad, and an imported toad. The latter species, the giant toad, was imported to Puerto Rico between 1920 and 1926 to control a particular type of sugarcane grub. The giant toad is considered a problem predator for some native species.

Puerto Rican snake, *Alsophis portoricensis*

River, wetland, and aquatic environments that provide the primary habitats for amphibians are limited on the Training Center. There are no designated wetlands found within the general perimeter of the CSTC.

6.8.4 Aquatics

Aquatic invertebrates are found throughout CSTC's rivers. During the dry season, small insects and freshwater shrimp are found in and adjacent to bodies of water. These aquatic invertebrates are also accompanied by native and exotic species of fishes, such as the goby *(Sicydium plumieri)* and tilapia (*Oreochromis aureus)*. The rivers' existing water conditions are dependent on rainfall patterns feeding the headwaters of the two major rivers – Rios Nigua and Hueyes, which transect the CSTC. Use of the riparian areas by permitted industrial users is the limiting factor for local aqua fauna populations on the CSTC.

6.9 Threatened and Endangered Species

6.9.1 Flora

No federally listed threatened plant species have been detected at the Camp Santiago Training Center.

One federally listed endangered plant species, *Solanum drymophilum*, was recorded in the mountainous northern part of the Training Center during a 1994 floral inventory (Johnson et al 1994). An October 2000 survey conducted specifically for this plant and one other of interest (*Zanthophylum thomasianum*) on the Training Center was made in the areas with the greatest potential for detection.

Solanum drymophilum

An experienced team of field technicians searched the areas of Cerro Pio Juan, Cerro Cariblanco, and Las Piedras Chiquitas, but did not find *Solanum drymophilum* plants in these areas or within the boundaries of the CSTS.

Much of the area where *Solanum drymophilum* may have existed historically and as recent as 1994, has been impacted by livestock grazing. Cattle are the most common herbivores that occupy and graze the areas of Cerro Pio Juan, Cerro Cariblanco, and portions of Las Piedras Chiquitas. Only in some areas of steep terrain and dense forest is cattle grazing actually excluded. According to information documented by the surveyors, stock grazing may have eliminated this plant from the locale in which it was previously reported on the Camp Santiago Training Center.

6.9.2 Fauna

No federally listed threatened or endangered animals that have been detected at the Camp Santiago Training Center area. One federally listed endangered bird species, the yellow-shouldered blackbird (*Agelaius xanthomus*), was reported in the Salinas coastal area and in Cayey according to the U.S. Fish and Wildlife Service. This bird was not detected during faunal surveys conducted at the CSTC. The major habitats for this species are mangrove forest and associated scrub-lands. It wanders in the mountains during the non-breeding season. As such, it should be monitored for at Camp Santiago.

6.10 Pests

6.10.1 Fauna

Feral dogs and cats roam at large on Camp Santiago. Both have direct impacts on native fauna through predation. Cats are known predators of birds and other small animals. Dogs will kill and injure other animals. In addition, dogs can get into garbage and cause sanitation problems.

Domesticated livestock use vegetative and water resources at the CSTC. The maximum number of stock animals on the Training Center is in the hundreds. The actual numbers will vary as the livestock roam on and off CSTC lands. There is no management program in place to control the numbers, system, or seasons of foraging. In some areas of the CSTC, grazing is thought to occur at levels adversely affecting forest recovery (succession). Livestock are grazing on many areas of the CSTC and are only limited by fenced areas, dense vegetation, or very steep ground.

Rats are considered pests and pose problems for nesting birds. They can also cause problems for building maintenance and sanitation for humans. Rats have the potential to carry and transmit diseases to other mammals including humans. Bats are desired at the CSTC for their value in the natural ecosystem; however, they are considered a pest species when they roost in buildings.

6.10.2 Flora

In relation to the vegetation present at the CSTC, no plant pests (impacting overall health) have been reported and none were detected during the recent year 2000 surveys and field visits.

Bothriochloa pertusa

Currently, no vegetative species present pose a risk to health or life of personnel or animals. Exotics and/or naturalized vegetation species are present on the CSTC. Two exotic grasses, *Panicum maximum* and *Bothriochloa pertusa*, occupy a large proportion of the CSTC and preventing the colonization of pioneer species that would normally advance the secondary succession process.

Panicum maximum

Uncontrolled fires and unregulated livestock grazing continue to keep this area (open grassland) devoid of trees by killing young seedlings (a product of natural dispersion). These grasses, once overcome by forest trees, become another member of the ground cover and lose their dominance in the ecosystem, allowing a more diverse community to establish.

6.11 Fire Regimes

6.11.1 Description of Fire Regimes within the CSTC

The savannah grass fuel type is the major vegetation cover type within the analysis area. These types are common within the region and three general primeval fire regimes have been identified within the analysis area:

- A non-lethal regime with mean intervals of 2 to 10 years, and
- A mixed-severity regime ranging from non-lethal underburns to stand replacing fires at mean intervals of 7 to 25 years, and
- A regime of less frequent stand-replacing fires at mean intervals of 25 to 50 years.

Fire has been the major influence on vegetative patterns, composition, structure, age, and development of both individual stands and the larger landscape. The mixture of vegetation types found in this analysis area developed under mixed severity fire regimes, varying with moisture, temperature, and vegetative composition.

Vegetation within CSTC has undergone changes during the 20th century. The evidence is unmistakable from aerial photography interpretation and vegetation stand reconstruction. These changes are most profound in the lethal fire regime, where the advanced secondary natural forest found at the upper elevations within CSTC has decreased dramatically.

Today, replacing much of this old growth vegetation type, we find savannah grass type with a thick brush component. Fires start on the ground, spread quickly, and then climb through the branches of small trees, creating a “ladder” to the larger trees in the vegetation canopy.

This wholesale transformation happened with the increased occurrence of human-caused fires and the reduction of livestock grazing, which reduced the surface fuels.

Currently, approximately 60 percent of the analysis area would experience non-lethal or mixed severity fire regimes (Figure 6.6 – Fire Regimes of Camp Santiago Training Center).

The three generalized fire regimes currently occurring in the analysis area are a non-lethal, a mixed-severity, and a stand-replacement regime. Mixed-severity fire regime areas can experience the full range of severities during either a single event or consecutive events. Mixed-severity fire regime areas may experience fires of intermediate effects, often consisting of fine-grained spatial patterns resulting from a mosaic of varying severity. The mixed-severity fire regime in the analysis area is predominately of a moderately low frequency with moderate to high severity. In contrast, stand-replacement fire regimes typically have lethal fires with less than 10 percent of the vegetated canopy cover remaining after the fire; in the analysis area, these are low frequency with high severity events.

Table 6.3.
Percentage of Current Fire Regimes

Fire Type	Acres	Percent
Non-Lethal	7,169	34 %
MS-I	162	1 %
Lethal	4,275	57%
Plantations	943	8 %
TOTAL	12,549	100%

Figure 6.6. Fire Regimes of Camp Santiago Training Center

Legend

Fire Regime Class	Acres	% Area
LETHAL (Adv. Sec. Nat. For.)	4,275.31	30.66
MIXED SEVERITY 1 (Early Sec. Nat. For.)	1,026.38	7.36
NON - LETHAL (Open Grassland)	1,623.05	11.64
REFORESTATION AREA	7,015.77	50.33

Road Type

- INTERSTATE
- PRIMARY
- SECONDARY
- TERTIARY
- UNIMPROVED

6.11.2 Vegetation Management and Fire Suppression

Wildfire has created fuel mosaics, which are breaks or changes in vegetation and surface fuel patterns. These fuel mosaics, along with road access, increase the success of initial attack, allow for effective fire suppression under the appropriate management response, and decrease the risk of high intensity stand-replacement wildfire. The appropriate management response for all wildland fires under the existing CSTC Fire Management Plan (Administrative Record Exhibit M-3) requires that all fires be suppressed using the appropriate management response. The appropriate management response in the analysis area is suppression using aggressive initial attack actions to control a wildland fire with safety of fire management personnel being the first priority.

Within the analysis area, there is a moderate to high probability of ignition. The highest probability of ignition occurs within training areas and gunnery ranges. On going fire prevention, pre-suppression, and information measures should continue to reduce the risks associated with wildland fire in this area. Fire risk has an important role in determining the acceptability of the current vegetative conditions. There is increasing risk of a fire start in the non-treated areas in the analysis area.

6.11.3 Fire Behavior and Resistance to Control

The difficulty of controlling a fire can be estimated from the flame length and rate of spread. The existing fuel profiles using Behave Models and Aids to Determining Fuel Models for Estimating Fire Behavior (Anderson 1982) (Administrative Record Exhibit M-4) indicate rates of spread of 13 chains (66 feet) per hour and flame lengths of 4 to 8 feet. Fires with flame lengths of 4 foot or less can generally be attacked and controlled with firefighters using hand tools. Fires with flame lengths of 4 to 8 feet typically require equipment such as dozers, fire engines, helicopters, and retardant aircraft to effectively control.

Fuels, weather and topography combine to determine how hot and fast a fire burns. Fuel conditions are described by quantity, arrangement and size and used as one of the inputs in the BEHAVE computer model to determine flame height and rate of spread for a wildfire. Behave runs based on an average bad day:

During average worse fire conditions, when dead fuel moisture averages 2 to 8 percent, live fuel moisture is 100 percent of dry matter content, and the effective wind speed at mid-flame height is 6 miles per hour, a fire in the various fuel models will have the characteristics shown in Table 6.4.

Table 6.4 Fuel Model 01 NFDRS Fuel Model C			
Wind Speed (mph)	3	6	9
Rate of Spread (ch/h)	27	68	130
Flame Lengths (feet)	6	9	12

The bulk of the biomass currently occupying the analysis area is in the form of accumulated grass or savannah fuels. When ignited under severe fire conditions, the combination of dead fuel and continuous to mosaic live vegetation from the vegetation floor to the upper vegetation canopy creates a complex of fuel that would leave little or no surviving above ground vegetation.

Dry fuels – Camp Santiago

Wildfires would still occur and may escape initial attack during severe fire conditions. The intensity of these fires would be dependent upon weather, fuels, and topography. Data suggests that wind, regardless of fuel moisture and relative humidity, is the driving force during fire events. When burning conditions are less than severe, fires may be of low to moderate severity and result in only moderate or no damage to over-story vegetation.

Fire behavior is influenced by fuels, weather, and topography. Fuels are the only factor that management can modify. Fuels are made up of the various components of vegetation, live and dead, that occur on a site. These components include litter and duff layers, grasses and forbs, shrubs, and regeneration.

Camp Santiago 2005 Wildfire (Underburn)

Fuel component characteristics contribute to fire behavior properties. Fuel loading, size class distribution of the load, and its arrangement (compactness or bulk density) govern whether an ignition will result in a sustaining fire. Horizontal continuity influences whether a fire will spread or not and how steady the rate of spread will be. Loading and its vertical arrangement will influence flame size and the ability of a fire to torch into the overstory. With the proper horizontal continuity in the overstory, the fire may develop into a crown fire. Fuel moisture content has a substantial impact upon fire behavior affecting ignition, spread, and intensity.

Fuel models are a tool to help the user realistically estimate fire behavior. Each fuel model is described by:

- The fuel load and the ratio of surface area to volume for each size class;
- The depth of the fuel bed involved in the fire front; and
- Fuel moisture, including that at which the fire will not spread (called the moisture of extinction).

These are based on Albini's (1976) paper entitled, Estimating Wildfire Behavior and Effects (Administrative Record Exhibit M-5). The criteria for choosing a fuel model includes the fact that the fire burns in the fuel stratum best conditioned to support the fire. The 13 fuel models for fire behavior estimation are for the severe period of the fire season, when wildland fires pose greater control problems and impact on land resources.

Those fuel models generally occurring within the CSTC are described below.

6.11.4 Grass Group

Fire Behavior Fuel Model 1

Fire spread is governed by the fine, very porous, and continuous grasses and herbaceous fuels that have cured or are nearly cured. Fires are surface fires that move rapidly through contiguous cured grass and associated material if untreated. Very little shrub or timber is present, generally less than one-third of the area. This would be the Non-Lethal Fire Regime.

Fire Behavior Fuel Model 2 (post timber harvest stands; nonstocked and seedling)

Fire spread is primarily through the fine herbaceous fuels, either curing or dead. These are surface fires where the herbadeous material, in addition to little and dead-down streamwood from the open shrub or timber overstory, contribute to the fire intensity.

Fire Behavior Fuel Model 3 (riparian marshgrass)

Fires in this fuel are the most intense of the grass group and display high rates of spread under the influence of wind. Wind may drive fire into the upper heights of the grass and across standing water. Stands are tall, averaging about 3 feet (1 meter), but considerable variation may occur. In this fuel model, approximately one-third or more of the stand is considered dead or cured and maintains the fire.

6.11.5 Shrub Group

Fire Behavior Fuel Model 5 (sapling stands and riparian shrub)

Fire is generally carried in the surface fuels that are made up of litter cast by the shrubs and the grasses or forbs in the understory. The fires are generally not very intense because surface fuel loads are light, the shrubs are young with little dead material, and the foliage contains little volatile material. Usually shrubs are short and almost totally cover the area. The riparian shrub portions of this fuel model in the analysis area are usually intermingled with riparian marshgrass. This would be the Mixed Severity Fire Regime.

6.11.6 Timber Litter Group

Fire Behavior Fuel Model 8 (closed timber litter)

Slow-burning ground fires with low flame lengths are generally the case, although the fire may encounter an occasional "jackpot" or heavy fuel concentration that can flare up. Only under severe weather conditions involving high temperatures, low humidities, and high winds do the fuels pose fire hazards. Close canopy stands of short-needle conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly leaves, and occasionally twigs because little undergrowth is present in the stand. This would be the Lethal Fire Regime.

Fire Behavior Fuel Model 8/10 Mosaic and 10 (timber litter and understory)

The fires burn in the surface and ground fuels with greater fire intensity than the other timber litter models. Dead and down fuels include greater quantities of 3 inch (7.6 cm) or larger limbwood resulting from overmaturity or natural events that create a large load of dead material on the vegetation floor. Crowning out, spotting, and torching of individual trees are more frequent in this fuel situation, leading to potential fire control difficulties. Any vegetation type may be considered if heavy downed material is present; examples are insect or disease-ridden stands, windthrown stands, overmature situations with deadfall, naturally thinned stands, and aged light thinning. These types may have a well-developed vertical or ladder fuel component.

Chapter 7: Land Uses and Management

7.1 Land Uses

Camp Santiago has a total of 12,590 acres within its boundaries (refer to Figure 2.2, Training Center Map, page 2-4). The following table illustrates current land use allocations.

Table 7.1
Camp Santiago Training Center Land Use Allocations

Land Use Allocation	Acres	Percent of Total Acres.
Cantonment Area	405	3%
Ammunitions Storage Area	140	1%
Light vehicle and dismounted maneuver	9,497	76%
Individual and crew served weapons ranges (23 separate ranges)	400	3%
Restricted Impact Area	988	8%
US Navy Operations – Defense Communications Area (DCA). Limited light vehicle and dismounted maneuver	1,160	9%

The cantonment area has 180 structures that can support up to 3,500 garrison soldiers on a daily basis (refer to Figure 3, Cantonment Area Map, on page 4-2).

The road system includes approximately 12 miles of improved roads and 150 miles of unimproved roads (refer to Figure 4, Convoy Routes, page 4-5).

There are no non-Army lands within the CSTC boundary, although 1,160 acres are currently utilized by the U.S. Navy for communications purposes.

Camp Santiago's primary users are light infantry combat arms and Special Forces units. Support provided to users of the CSTS includes 24-hour operation of maneuver-training areas and ranges for an assortment of individual and light infantry weapon and aviation systems.

Land uses for military training include weapons training, indirect (mortar and artillery firing), dismounted navigation and patrolling, assembly area operations (bivouacking), drop zones, and light vehicle convoy and cross-country maneuver training.

There are no opportunities for the local public to hunt, fish, hike, or camp within the Training Center.

Examples of non-military groups that use Training Center land include state and federal law enforcement agencies, local fire departments, Puerto Rico Correctional Administration, Youth Conservation Corps, and Girl/Boy Scouts of America.

The Training Center has issued a permit to allow the harvest of hay within portions of the training area for reducing the hazard of range fires.

The impacts to natural resources resulting from the land uses are described in the following table by ecosystem element.

Table 7.2

Impact on Natural Resources as a Result of Land Use Allocations

Ecosystem Element	Impacts
Human Uses	▪ Public recreation opportunities are limited and/or restricted. ▪ Disturbance and/or limiting public access to important areas within the Training Center that are locally significant and important contributors to the sense of place of the area. ▪ Degrade the scenery of the landscape. ▪ Disturb or degrade historical sites and artifacts. ▪ Commodities: o Commercial extraction of gravel and fill-dirt creates sediment and degrades stream channel characteristics. o Unauthorized cattle and horse grading impacts vegetation, stream channel characteristics, and water quality
Watershed Health	▪ Disturb soils, loss of soil productivity, and create sediment sources. ▪ Alter natural stream flow and discharge characteristics. ▪ Damage stream banks and degrade stream channel stability. ▪ Increase nutrient (nitrogen and phosphorus) levels in surface waters. ▪ Impact aquatic species and their habitat.
Vegetation	▪ Alter vegetation cover type, patch size and pattern from historic conditions.

Table 7.2 Impact on Natural Resources as a Result of Land Use Allocations	
Ecosystem Element	**Impacts**
	▪ Degrade special habitats, such as small isolated plant communities. ▪ Degrade riparian areas. ▪ Contribute to the presence of non-native, invasive plant species, and disturb rare or sensitive plants.
Fire and Air	▪ Fires associated with land uses impact vegetation and wildlife habitat. ▪ Contribute to erosion and sediment sources. ▪ Smoke and dust associated with land uses degrade air quality.
Wildlife	▪ Impact wildlife species and their habitat.

7.2 Management Units

7.2.1 Functional Areas – A, B, C, E

These functional areas are tactical training areas (approximately 1,073 acres). The sites are mostly open grassland with portions of artificial reforestation areas; there is a small inclusion of advanced secondary natural forest in Functional Area A. There are protected stream courses within these functional areas.

Desired Future Condition:

Tactical Training Area

Goal:

Maximize military training opportunities while protecting natural and cultural resources.

Objectives:

- Maintain training areas for optimum use;
- Minimize impacts on advanced secondary natural forest habitats;
- Minimize impacts on artificial reforestation forest;

- Protect stream channel and steam bank stability;
- Improve wildfire prevention and suppression capabilities;
- Minimize wildlife displacement;
- Inventory and protect cultural resources.

7.2.2 Functional Areas – D, F, G, O, R

These functional areas are tactical training areas (approximately 4,725 acres). The sites are mostly open grassland. There are protected stream courses within these functional areas.

Desired Future Condition:

Tactical Training Area

Goal:

Maximize military training opportunities while protecting natural and cultural resources.

Objectives:

- Maintain training areas for optimum use;
- Improve wildfire prevention and suppression capabilities;
- Protect stream channel and stream bank stability;
- Minimize wildlife displacement;
- Inventory and protect cultural resources.

7.2.3 Functional Areas – H, I, DCA

These functional areas are tactical training areas (approximately 2,026 acres). The sites are mostly open grassland and artificial reforestation sites. There are protected stream courses within these functional areas.

Desired Future Condition:

Tactical Training Areas

Goal:

Protect forest succession in the advanced secondary natural forest areas, reforestation areas, and stream courses, while providing military training opportunities.

Objectives:

- Maximize training area for optimum use;
- Minimize wildlife displacement;
- Minimize impacts in artificial reforestation areas;
- Protect stream channel and steam bank stability;
- Inventory and protect cultural resources.

7.2.4 Functional Area – Cantonment Area

This functional area is a base camp and is used for administrative purposes (approximately 405 acres). The site is mostly open grassland. There is an opportunity for bat habitat management in this area; and there is one protected stream course.

Desired Future Condition:

Administrative Use

Goal:

Support PRARNG in their mission to maximize military training opportunities.

Objectives:

- Support training opportunities;
- Improve bat habitat where appropriate;
- Maintain administrative site for optimum use;
- Protect stream channel and stream bank stability.

7.2.5 Function Area – Ammo Area

This function area is used for munitions storage (approximately 144 acres). The site is a mix of open grassland, early secondary natural forest, advanced secondary natural forest, and artificial reforestation.

Desired Future Condition:

Munitions storage

Goal:

Support PRARNG in their mission to maximize military training opportunities.

Objectives:

- Munitions storage area and ammunitions supply point;
- Support logistical and security training;
- Support individual/crew serviced weapons training;
- Troop security and safety.

7.2.6 Functional Area – Impact Area

This functional area is Camp Santiago's main impact area (approximately 989 acres). The site consists of open grasslands and still has unexploded ordinances on site. For safety reasons, this area is a restricted area and not used for maneuvers. The public is not allowed into the Impact Area.

Desired Future Condition:

Impact Area

Goal:

Support PRARNG in their mission to maximize military training opportunities.

Objectives:

- Support gunnery training;
- Protect military and civilian personnel from unexploded ordinances;
- Prevent stray domestic animals and livestock from entering the Impact Area.

Table 7.3

Functional (Training Area) Description (refer to Figure 2.2, page 2-4)

Training Areas	Acres	Projected Use	Restrictions[1]
A	256.4	Tactical training area, maneuvering, and bivouac area. Includes demolitions range, gas chamber, and artillery firing points.	Demolition up to 2 lbs. No digging without previous clearance and authorization from the Plans, Operations, and Training Office. Reforestation areas (tree plantations) are restricted areas.
B	347.7	Tactical training area, maneuvering, and bivouac areas. Includes artillery firing points.	No digging without previous clearance and authorization from the Plans, Operations, and Training Office.
C	282.5	Tactical training area, maneuvering, and bivouac areas. Includes artillery firing points	No digging without previous clearance and authorization from the Plans, Operations, and Training Office. Reforestation areas (tree plantations) are restricted areas.
D	584.4	Tactical training area, maneuvering, and bivouac area. Includes mortar and artillery firing points, and M52 and M6 Range.	No digging without previous clearance and authorization from the Plans, Operations, and Training Office.

[1] All historic sites within the Functional Areas are restricted areas.

Table 7.3 Functional (Training Area) Description (refer to Figure 2.2, page 2-4)			
Training Areas	**Acres**	**Projected Use**	**Restrictions[1]**
E	185.9	Tactical training area, maneuvering, and bivouac area. Includes artillery firing points and an Ammo Supply Point (ASP); approximately 140 acres.	The AMMO Supply Point (ASP) is off limits to training. On the remaining 46 acres, there is no digging without previous clearance and authorization from the Plans, Operations, and Training Office. Reforestation areas (tree plantations) are restricted areas.
F	209.9	Tactical training area, maneuvering, and bivouac area.	No digging without previous clearance and authorization from the Plans, Operations, and Training Office.
G	312.1	Tactical training area, maneuvering, and bivouac area. Includes an airfield, shotgun mg, combat pistol mg, DZ, and rappel tower.	No digging without previous clearance and authorization from the Plans, Operations, and Training Office.
H	230.7	Tactical training area, maneuvering, and bivouac area.	No digging without previous clearance and authorization from the Plans, Operations, and Training Office. Reforestation areas (tree plantations) are restricted areas.
I	636.1	Tactical training area, maneuvering, and bivouac area. Includes mortar firing points and a small arms mg.	No digging without previous clearance and authorization from the Plans, Operations, and Training Office. Reforestation areas (tree plantations) are restricted areas.
J	689.2	Tactical training area, maneuvering, and bivouac area. Includes mortar firing points and a small arms mg.	No digging without previous clearance and authorization from the Plans, Operations, and Training Office. Reforestation areas (tree plantations) are restricted areas.
K	327.2	Tactical training area, maneuvering, and bivouac area. Includes mortar firing points and a small arms mg.	No digging without previous clearance and authorization from the Plans, Operations, and Training Office. Reforestation areas (tree plantations) are restricted areas.

Table 7.3
Functional (Training Area) Description (refer to Figure 2.2, page 2-4)

Training Areas	Acres	Projected Use	Restrictions[1]
L	755.2	Tactical training area, maneuvering, and bivouac area.	No digging without previous clearance and authorization from the Plans, Operations, and Training Office.
M	1,421.7	Tactical training areas, maneuvering, and bivouac area.	No digging without previous clearance and authorization from the Plans, Operations, and Training Office.
N	896.4	Tactical training area maneuvering, and bivouac area. Includes mortar firing points.	No digging without previous clearance and authorization from the Plans, Operations, and Training Office.
O	2,572.1	Tactical training and maneuvering area. Includes live fire range, ambush operations, aerial bomb drop zone, company defensive training machine gun, aerial gunnery, and squad live fire machine gun.	
R	1,046.4	Tactical training and maneuvering area. Includes M16 machine gun; NGC fam, MG 10-M machine gun, rifle marksmanship machine gun, AT4 subcaliber machine gun, grenade launch machine gun, and indirect firing points.	
DCA	1,159.4	Tactical training area, maneuvering, and bivouac area.	No digging without previous clearance and authorization from the Plans, Operations, and Training Office. Reforestation areas (tree plantations) are restricted areas.
Impact Area		Impact Area	Off limits to all training activities and the public.
Ammo Area	140.5	Munitions storage	Off limits to all training activities.
Cantonment Area	405.0	Administrative Use; base camp	
Totals	11,056	Acres available for maneuver and ranges	
	1,534	Acres not available for maneuver and ranges	

Chapter 8: Natural Resources Management

8.1 Introduction

This chapter includes decisions, referred to as *initiatives*, which will be implemented to manage the CSTC natural resources during the next 5 years.

Table 8.1, on the following page, provides a summary of the initiatives and their associated benefits. Initiative maps and illustrations located at the end of this chapter provide additional details about the initiatives.

A description of existing conditions, identified initiatives, and the expected benefits resulting from implementation of the initiatives are summarized by natural resource component.

The effectiveness of the decisions made will be evaluated on an annual basis and the INRMP will be revised at the end of the 5-year period. Chapter 9 of this document provides a description of the monitoring initiatives.

Chapter 16 of this document provides the strategy for initiative implementation; Tables 16.1 through 16.8, Initiative Implementation Matrixes, on pages 16-3 through 11 provide the costs associated with the implementation of the initiatives. Appendix G displays costs associated with implementing the initiatives.

8.2 Objectives

The fundamental goal of this INRMP is to achieve optimum, sustainable use of training lands while protecting natural and cultural resources.

8.2.1 General objectives of the INRMP include:

- No net loss in the capability of CSTC lands to support the military mission.
- Protecting the ecosystem and maintaining biological diversity.
- Improving the quality of wildlife habitat (No hunting allowed).
- Protecting and improving watershed health.
- Restoring damaged training areas and maintaining training areas for optimum use.

8.2.2 Specific objectives of the INRMP include:

- Protection of cultural resources.
- Improving the visual / scenic qualities of the Training Center.

- Preventing stray domestic animals and livestock from entering the training area and causing damage to the natural resources.
- Minimizing impacts on forest vegetation and implementing actions to restore and/or re-establish vegetation communities.
- Reducing human and livestock activity within riparian areas and implement riparian area restoration projects.
- Restoring and protecting stream channel and stream bank stability.
- Reducing sediment and pollution sources.
- Minimizing wildlife and aquatic species displacement and impacts on their habitat.
- Minimizing the impact on training and natural resources resulting from wildfires by improving wildfire prevention and suppression capabilities.

8.3 Summary of Initiatives

The following table summarizes the benefits of the major initiatives identified:

Table 8.1
Initiatives and Associated Benefits

Initiative	Description	Benefits
Security and Public / Soldier Safety within the CSTC	Install approximately 3.0 miles of cyclone fence and 11 miles of barbed-wire fence along portions of the CSTC boundary.	▪ Reduction of lost military training time due to the unauthorized presence of civilians, livestock, and stray domestic animals within the CSTC. ▪ Eliminate illegal dumping and littering. ▪ Eliminate illegal or unauthorized use of the Training Area; i.e., cattle grazing, extraction and/or collection of commodities, compromise military security, theft of military property.
Identify Cultural Resources	Conduct cultural resources surveys within project-specific areas proposed for all INRMP ground-disturbing activities, prior to the INRMP activity implementation	▪ Protection and preservation of cultural resources

Table 8.1
Initiatives and Associated Benefits

Initiative	Description	Benefits
Protect Cultural Resources	Install barbed-wire fencing to protect sensitive cultural sites and artifacts.	▪ Maintain the integrity of sensitive cultural sites.
	Modify Training Area Map to show known cultural sites as "restricted, off-limits areas."	▪ Maintain the integrity of sensitive cultural sites.
	Initiate stabilization measures at cultural resource sites where erosion is impacting the site.	▪ Maintain the integrity of sensitive cultural sites.
	Include an interpretation of selected cultural resources themes in NG museums and programs, emphasizing the importance of protecting sites.	▪ Increase the awareness and appreciation of the importance of natural resources and help maintain the integrity of sensitive cultural sites.
Restore and Protect Riparian Areas	Cease current travel and fill-dirt extraction; ensure future extraction operations meet applicable environmental laws and standards.	▪ Protect habitats for riparian dependant species. ▪ Improve water quality by eliminating a major sediment source, and protecting stream channel stability and critical habitat for aquatic species. ▪ Reduce the risk of accidental petroleum and toxic material spills.
	Plant approximately 200 acres of riparian areas.	▪ Restore habitats for riparian dependent species. ▪ Improve water quality by stabilizing stream banks with deeply rooted woody plants. ▪ Restore stream channel stability and protect critical habitat for aquatic species.

Table 8.1
Initiatives and Associated Benefits

Initiative	Description	Benefits
Restore and Protect Riparian Areas	Modify Training Area Map to show sensitive riparian areas as "restricted, off limit areas."	▪ Protect habitats for riparian dependent species. ▪ Improve water quality by eliminating a sediment source, and protect stream channel stability and critical habitat for aquatic species. ▪ Reduce the risk of accidental petroleum and toxic material spills.
	Restrict livestock grazing in riparian areas.	▪ Protect habitats for riparian dependant species. ▪ Improve water quality by eliminating a sediment source. ▪ Protect stream channel stability and critical habitat for aquatic species.
Restore and Protect Forest Vegetation	Maintain and operate the on-site nursery facility.	▪ The continued operation of the on-site green (shade) houses provides a cost-effective process for seeding stock care (acclimatization and seed germination).
	Perform site preparation and plant approximately 65 acres (approximately 11-13 acres per year).	▪ Provides for and maintains camouflage and concealment training. ▪ Provides and/or improves noise and dust buffer areas from adjacent public zones and private lands. ▪ Improved soil stability and productivity. ▪ Enhanced biological diversity. ▪ Improved watershed health. ▪ Enhanced wildlife forest habitat. ▪ Enhanced landscape scenery value conditions.

Table 8.1
Initiatives and Associated Benefits

Initiative	Description	Benefits
Restore and Protect Forest Vegetation	Vegetation cover surveys: Inventory of all CSTC lands on 5-year cycle (establish permanent plot clusters in all vegetation classification types and conduct walk-through inventories).	▪ Findings provide base-line information on forest vegetation. Subsequent surveys will help in identifying forest vegetation trends and will provide information to: ○ Assess the effectiveness of the management initiatives to restore and maintain forest vegetation and wildlife habitat, and ○ Help determine and prioritize future management actions.
	Plantation Surveys: Inventory plantations (forest and riparian areas to determine seedling survival and the need to replant and/or thin.	▪ Findings from the plantation surveys will help determine the effectiveness (survival rate) of the hand planting and subsequent plantation care. These findings will be useful in modifying, as necessary, hand planting and plantation management procedures to increase their effectiveness.
	Re-planting and thinning within the plantations.	▪ Re-planting and thinning within the plantations would improve the health and vigor of the plantations.
	Maintain and operate existing irrigation systems. Purchase and install above ground irrigation system capable of watering 11 acres.	▪ Increase seedling survival and enhance growth and vigor of the plantations. ▪ Supports range fire suppression operations and would lessen the threat of a potential range fire causing damage to the plantations.
Identify Sediment Sources	Conduct sediment source surveys.	▪ Maintain access needed for training operations and emergency medial evacuation during and after intense rainstorms. ▪ Improve water quality on-site and down stream by reducing the amount of soil erosion at road/stream intersections. ▪ Restore critical habitat for aquatic species.
Identify Sediment Sources	Inspect road drainage structures to identify required repair and/or replacement; work includes preparing a road-log and	▪ Maintain ‘safe’ and reliable access needed for training operations and emergency medical evacuation, especially during and after intense rainstorms; ▪ Improved water quality on site and down

Table 8.1 Initiatives and Associated Benefits		
Initiative	Description	Benefits
	inventory of drainage structures.	stream by reducing the amount of soil erosion and road/stream crossings; and ▪ Restore and maintain critical habitat for wildlife and aquatic species.
	Inspect road drainage structures to identify required repair and/or replacement; work includes preparing a road-log and inventory of drainage structures.	▪ Maintain 'safe' and reliable access needed for training operations and emergency medical evacuation, especially during and after intense rainstorms; ▪ Improved water quality on site and down stream by reducing the amount of soil erosion and road/stream crossings; and, ▪ Restore and maintain critical habitat for wildlife and aquatic species.
Eliminate Sediment Sources	Improve stream crossings by repairing and/or replacing existing drainage structures.	▪ Maintain 'safe' and reliable access needed for training operations and emergency medical evacuation, especially during and after intense rainstorms; ▪ Improved water quality on site and down stream by reducing the amount of soil erosion and road/stream crossings; and, ▪ Restore and maintain critical habitat for wildlife and aquatic species.
Eliminate Sediment Sources	Reconstruct and/or relocate segments of existing roads to eliminate sediment sources	▪ Maintain 'safe' and reliable access needed for training operations and emergency medical evacuation, especially during and after intense rainstorms; ▪ Improved water quality on site and down stream by reducing the amount of soil erosion and road/stream crossings; and ▪ Restore and maintain critical habitat for wildlife and aquatic species.
	Restrict cross-country vehicle maneuver within riparian areas.	▪ Improve water quality by eliminating a sediment source; ▪ Protect habitats for riparian dependant species; ▪ Protect stream channel stability and critical habitat for aquatic species; and ▪ Reduce the risk of accidental petroleum

Table 8.1 Initiatives and Associated Benefits		
Initiative	Description	Benefits
		and toxic material spills.
Conduct Stream Channel Surveys	Conduct stream channel stability surveys to determine current stream channel and bank conditions and to monitor changes over time. Surveys will identify restoration opportunities	▪ The findings of stream channel stability surveys would assist in identifying and prioritizing stream channel and riparian restoration work.
	Establish permanent stream cross-section stations; stations to be located above and below stream segments where gravel has/is being extracted and where channel cleaning operations are routinely conducted.	▪ The findings of the permanent stream cross-section stations would provide base-line (current conditions), help identify water quality and aquatic habitat trends, and would be useful in identifying and prioritizing stream channel and riparian restoration work.
Protect and Enhance Wildlife Habitat	Bat habitat improvement: Construct & place 5 bat boxes within the Cantonment Area.	▪ Minimize the health and safety hazards created by bats nesting in cantonment structures.; and ▪ Maintain and enhance wildlife habitat and species diversity within the CSTC.
Protect and Enhance Wildlife Habitat	Document presence of threatened or endangered, neo-tropical migratory and local resident birds. Conduct inventories on yearly basis; schedule inventories from December through the breeding season of native species.	▪ Findings provide baseline information on the presence of wildlife species. Subsequent surveys will help in identifying wildlife occurrence trends and will provide information to: ○ Assess the effectiveness of the management initiatives to restore and wildlife habitat, and ○ Help determine and prioritize future management actions.
Range (Wildfire) Fire Suppression	Acquire: two 1-ton fire trucks or two slip-on water tank/pump units.	The availability of the proposed on-site fire trucks would greatly increase CSTC's ability to extinguish range fire starts when they are small. Associated benefits include: ▪ Minimizing lost training time due to disruptions caused by wildfire; ▪ Force protection – minimize the safety hazards and threat to equipment from a potential range fire;

Table 8.1 Initiatives and Associated Benefits		
Initiative	Description	Benefits
		▪ The threat from a potential range fire to CSTC facilities and to the local community would be reduced; ▪ Minimize the damage to natural resources caused by range fires.
	Maintenance and operation of the remote automated weather station (RAWS).	▪ Weather station data is being used to monitor range fire risks and is being used to assist commanders in developing their risk assessments. ▪ The availability of on-site weather data assists CSTC users in calibrating their weapon systems and in conducting safety hazard risk assessments.
Range (Wildfire) Fire Suppression	Construct and maintain fuelbreaks (to prevent fire from encroaching into the plantation areas).	▪ Minimizing lost training time due to disruptions caused by wildfire; ▪ Force protection – minimize the safety hazards and threat to equipment from a potential range fire; ▪ The threat from a potential range fire to CSTC facilities and to the local community would be reduced; ▪ Minimize the damage to natural resources caused by range fires.
	Acquire portable water source devices to be available for initial attack during a range fire event.	▪ Minimize lost training and damage to natural resources caused by a potential range fire.
	Provide fire suppression training for selected personnel. Acquire fire suppression personal protective items and fire suppression equipment (no-mex clothing, hardhats, gloves, eye protection, fire hoses, hand tools, etc.).	▪ Force Protection - minimize the safety hazards to firefighters and the threat to equipment from a potential range fire. ▪ Minimize lost training and damage to natural resources caused by a potential range fire.

Refer to the following initiative maps / illustrations:

8.4 Forest Vegetation Management

8.4.1 Introduction

The main purpose of the forest vegetation management at the CSTC is for ecosystem restoration and protection; the direct benefits of these initiatives are soil protection, biological diversity, watershed health, increase of wildlife habitat, and maintenance / enhancement of landscape scenery values.

The main instruments needed to implement these management practices are artificial regeneration (direct planting), protection of advanced secondary natural regeneration areas, control of grassland fires, and uncontrolled grazing.

These directions will increase the participation of the PRARNG in the mission of steward of the natural resources actually present and/or potentially capable of being developed on the lands at the CSTC.

8.4.2 Existing Condition

There is no potential for commercial use of the CSTC forest, except for selected species such as *Guaiacum sanctum (*Guayacan*) or Bucidas bucera (*Ucar*)* for timber or artcrafts manufacturing. Some species could also be used for charcoal production or fence posts.

The current vegetation conditions of Camp Santiago are classified with four seral stages: advanced secondary natural forest, early secondary natural forest, open grassland, and artificial reforestation forests (refer to Figure 6.4, Vegetation Map of Camp Santiago Training Center, page 6-17).

The areas targeted for artificial reforestation, approximately 65[1] acres during this planning period, are currently classified as open grassland.

Almost all of the advanced secondary forest is within the high terrain (over the 100 meters of elevation contour line) of the CSTC and on protected drainage areas.

Insects and diseases are not of concern over the ecosystem, but fire and grazing activities are considerably shaping and guiding the natural succession. Forest patches are shrinking secondary to fire kill of edges, reduction in natural regeneration seedlings due to selective grazing and fires, increases of species densities that are non-palatable to grazing animals and are resistant to fire disturbance.

No tree species at Camp Santiago can be considered fire resistant; several episodes of fires or grazing can kill the most resilient trees allowing the exotic grasses to overcome the ecosystem and arrest natural succession.

8.4.3 Management Initiatives

- Maintain and operate the on-site nursery facilities to produce seedling stock for the CSTC plantations. Only species already present at the CSTC will be considered for use as planting stock.
- Approximately 11-13 acres yearly of site preparation and hand planting within forest areas at the CSTC. (Refer to Figure 8-7, Forest Restoration Initiatives, page 8-85).
- Conduct plantation surveys to determine seedling survival and the need to re-plant and/or thin.
- Re-planting and/or thinning within the plantations.
- Maintenance of the existing above-ground irrigation system and the purchase of an additional irrigation system capable of watering 11 acres.
- Conduct vegetation surveys of all CSTC lands on a 5-year cycle. This initiative includes the re-measurement of permanent plot clusters and walk-through surveys.
- Restriction of cross-country vehicle maneuver within plantation areas will be mandatory.
- Monitoring - It is expected that the diversity in planting species used will reduce the risk of severe damage by insects and

[1] A total of 943 acres have been identified for reforestation at CSTC; 64 acres are targeted for accomplishment during this planning period.

diseases, but an annual monitoring survey for this type of damage to the plantation areas is required until the planted site is considered established.

- Restrict cross-country vehicle maneuver in training areas M and L to protect the existing advanced secondary forest stages within these two training areas (refer to Figure 2.2, Training Center Map, page 2-4).
- With the exception of designated stream crossings, restrict cross-country vehicle maneuver in riparian areas (refer to Figure 6.5, Riparian Buffers Map, on page 6-19).

The potential and need for salvage activities resulting from hurricane damage is an element needed to incorporate any vegetation management plan associated with Puerto Rico. The CSTC will require TSI activities to reduce fuels, thin the forest, salvage usable products, maintain drainage channels integrity, and restore scenery landscapes. After a hurricane event, an assessment will be prepared to address natural resources impacts and mitigation recommendations.

8.4.4 Expected Benefits

Implementation of the forest vegetation management initiatives described above will provide and maintain camouflage and concealment training conditions. In addition, the plantations will provide vegetation to buffer noise and dust resulting from training activities from adjacent public zones.

The initiatives will directly allow natural forest succession to continue; thus, total forest cover and its associated benefits are expected to increase over time.

With the reduction of fire and grazing impacts to the vegetation, species diversity is expected to increase, species densities will begin to show natural population dynamics, forest structure will begin to evolve to advanced features or even mature structure, and wildlife habitat and its associated faunal populations will increase.

The plantations will provide visual, noise, and dust buffer zones from public areas.

In the future, the plantation areas will provide forested landscapes to perform camouflage and concealment training operations.

8.5 Agricultural/Grazing Outleases

8.5.1 Existing Condition

Domestic livestock occurring at Camp Santiago includes cattle, horses, sheep, and goats. A majority of the use is by cattle and horses. These animals forage and use water resources throughout many areas of the CSTC. Currently, there is no management system in place to regulate the kind, numbers, and distribution of livestock for conservation of the vegetative and water resources.

Cattle are able to roam over large areas of Camp Santiago and may be limited only by fences, dense vegetation, or steep ground. Roads and trails currently allow livestock to move freely across the training areas. Along portions of the Training Site boundary, such as in the Rio Jueyes area, fences were constructed for livestock restriction on private lands. Access to water remains an important issue for livestock owners in the surrounding communities.

Free Ranging Horses on CSTC Lands

There is concern that grazing is occurring at levels inhibiting forest recovery and succession. Grazing pressures and ground disturbance from livestock can be readily observed in the field. The amount of barren ground, livestock trails, and bedding sites indicate that livestock are causing degradation to soil and forest vegetation resources, most notably on steeper grounds.

Free roaming livestock can pose problems for military operations. Livestock can interfere and hamper the efficiency of training exercises. Cattle manure may present unpleasant experiences for soldiers training in the field. Recent command emphasis has the amount of livestock grazing reduced dramatically.

Hay cutting and harvest is currently conducted by permit on portions of the training area to help reduce the risk of fire and to use a renewable agricultural resource.

8.5.2 Management Initiatives

- Survey and install boundary fence to include approximately 3.0 miles of cyclone fence and 11 miles of barbed-wire fence. (Refer to Figure 8.8.8, Fencing Initiative Map, page 8-87.)

In order to minimize potential conflicts between livestock and military operations and to limit damage to land resources caused by livestock, the CSTC must totally restrict grazing. This will require fencing to control the drift of livestock from adjacent private lands onto the CSTC. Fence locations will generally coincide with the general exterior perimeter of the Training Center. However, fence line construction can be located to facilitate maintenance and to take advantage of natural barriers to livestock movement.

- All future hay cutting and harvest permits will be prepared and administered in accordance with Army Regulation 200-3, Natural Resources - Land, Forest, and Wildlife Management; Army Regulation 405-80, Management of Title and Granting Use of Real Property, and 10 U.S.C. 2667.

8.5.3 Expected Benefits

The fencing initiative will improve training conditions by providing increased security and control of training lands and reducing the amount of training time lost caused by unauthorized domestic animal and civilian use of the training lands. This initiative will increase public and soldier safety by helping prevent unauthorized entry of civilians onto the Training Center maneuver and weapons impact areas.

The fencing initiative will help eliminate unauthorized livestock grazing and associated impacts on riparian and upland forest habitats. Forest and riparian wildlife habitat will improve and associated faunal populations will increase.

In addition, this initiative will help reduce illegal dumping of trash within the Training Center, prevent stray domestic animals (primarily dogs) access onto the Training Center, deter unauthorized collection of commodities from the Training Center, and lessen the risk of military security compromise.

8.6 Habitat Management

8.6.1 Introduction

In general, conserving habitats for wildlife at Camp Santiago must focus on:

- Land uses that conserve existing forest;
- Promoting the recovery of forest succession (reforestation) in designated areas for that purpose;
- Limiting physical impacts and restoring tree conservation in stream course environments.

Forests found in training areas M and L are considered important for habitat conservation. In the remainder of the training areas, riparian areas along the stream courses and river channels are of special importance to retaining fauna diversity.

8.6.2 Special Habitats

8.6.2.1 Existing Condition

Special habitats within the CSTC include the cliffs and rock outcrop areas consisting of Cerro Pio Juan, Cerro Cariblanco, Cerro Piedras Chiquitas, and an old growth forest patch area at Cerro Respaldo.

Special Habitat – Cerro Las Tetas

Photo analysis from 1936 indicates the presence of forest at Cerro Modesto and Cerro Respaldo, and these two points were expected to presently contain old growth forest on the CSTC; but, Cerro Modesto's 1936 vegetation has been totally obliterated due to uncontrolled fires and the vegetation at Cerro Respaldo has been dramatically reduced by uncontrolled fires from the Training Center and private activities to the southwest side of the Cerro. The Camp boundary runs over the ridge of the Cerro Respaldo.

Cerro Pio Juan, Cerro Cariblanco and Cerro Piedras Chiquitas are unique types of habitat present within the CSTC that contain several endemic species of the region and are part of the highest elevation zone at the Training Center. Cerro Pio Juan and Cariblanco are actually overgrassed, and exotic grasses have invaded most of the area of these Cerros.

Cerro Piedras Chiquitas is actually the least impacted by grazing, but is not excluded from grazing activities; it is surrounded by secondary advanced vegetation that is difficult, but not impossible, to access by grazing animals. With the presence of grasses in these Cerros, there is a continuous threat of wildfires. Controlling these fires would be difficult due to the remoteness of the sites, particularly Cerro Cariblanco and Piedras Chiquitas.

8.6.2.2 Management Initiatives

Initiatives shown in Table 8.1 (page 8-2) responding to the need to protect the values of special habitats include the fencing, restoration / protection of forest vegetation, and the wildland fire suppression initiatives.

8.6.2.3 Expected Benefits

The implementation of the proposed initiatives, particularly the control of fires and grazing, will directly benefit the vegetative conditions of the special areas mentioned.

Biodiversity will increase, natural succession will initiate reforestation of the areas, and rare and endemic species populations will increase and be protected in those remote forest patches. There is a good chance that species previously reported to exist in those areas would return once the microhabitat conditions are restored and the grazing pressure is eliminated.

Natural habitat restoration will be the most obvious cumulative effect expected from the implementation of these initiatives. Re-introduction or development of healthy populations of highly specialized habitat species will occur naturally.

8.6.3 Riparian Areas

8.6.3.1 Existing Condition

There are approximately 1,270 acres or riparian area within the CSTC. (Refer to Figure 6.5, Riparian Buffers Map, page 6-19.)

The CSTC watershed drains the Rio Jueyes, Rio Nigua, Rio Lapa (tributary to Rio Nigua River), and other unnamed tributaries to Rio Nigua including Quebrada Honda.

There is a well developed, advanced secondary forest patch west where the Rio Lapa meets Rio Majada (both tributaries to Rio Nigua) that represents an excellent example of riparian gallery forest with probably some old growth remnants of *Guaiacum sanctum (*Guayacan*)* specimens considering their total height and structure.

Riparian Area on CSTC Lands

Another good example is at Rio Jueyes near La Zanja where *Bucida buceras* (Ucar) is the predominant species and at an area of Quebrada Honda between Cerro Modesto and Respaldo where *Guaiacum sanctum (*Guayacan*)* specimens are abundant and well developed. These areas deserve special attention and provide excellent seed sources toward efforts of re-vegetating riparian gallery forests at the CSTC.

Most of the CSTC watershed drainage system is devoid of trees necessary to protect the banks from erosion, to maintain stream integrity, to produce quality water and aquatic habitat, and to regulate the flow of water from the CSTC lands to the town of Salinas. This is particularly noted in the drainage system of the Rio Nigua, whose flow during the Hurricane Georges event (1998) dislodged and destroyed the main access bridge to the CSTC.

8.6.3.2 Management Initiatives

- Cease current gravel and fill-dirt extraction from riparian areas and ensure that future gravel extraction operations meet all environmental laws and standards and incorporate timely restoration of disturbed sites.

- Re-establish native, deeply rooted vegetation along watercourses by planting approximately 200 acres of riparian area with native or naturalized plant species. (Refer to Figure 8.9 - Riparian Restoration Map, page 8-89.).
- Restrict livestock grazing within flood plain and riparian areas (fencing initiative). (Refer to Figure 8.8, Fencing Initiative Map, on page 8-89.)
- Restrict cross-country vehicle maneuver within riparian areas.
- Complete a detailed survey and map of locations and extent of stream channels, ephemeral draws and riparian areas based on environmental characteristics (soils, topography, vegetation, and hydrology). This needs to be completed to estimate the amount of funding and time needed to implement the riparian restoration and protection measures.
- Conduct surveys on primary and secondary road systems to identify and map environmental characteristics such as soils, topography, vegetation, and hydrology; and problems with erosion and road / stream intersections.

The sediment source surveys need to be completed to estimate the amount of funding and time required and to prioritize the following sediment reduction initiatives:

- Installation of additional drainage structures and/or repair and maintenance of existing road drainage structures.
- Schedule road reconstruction and watershed improvement projects based on prioritization process. This may include identification of critical areas for sensitive aquatic habitats, magnitude of water quality impacts, and a cost versus benefit analysis.

8.6.3.3 Expected Benefits

The drainage structure and road improvement initiatives will improve vehicle maneuver training conditions by improving road stability and eliminating safety hazards.

Implementation of the initiatives will protect the existing riparian areas and create additional acres of this type of forest by natural and artificial means, resulting in a reduction of riverbank erosion.

The quality of water that drains out of the CSTC lands will increase and the overall landscape will be enhanced. Also, the preservation of several unique examples of riparian forest patches on the region will be attained.

There will be an overall improvement of watershed health, rehabilitation of the aquatic habitat, and the reduction of impacts from floods to the CSTC facilities and the neighboring town of Salinas. There will also be an increase in bio-diversity and wildlife habitat.

8.6.4 Floodplains and Wetlands

8.6.4.1 Existing Condition

Camp Santiago contains no areas meeting the criteria for Jurisdictional Wetlands within the training boundaries, though there are many areas that are wet on a seasonal basis.

Most of the area occupied by the Camp is relatively dry, with highly permeable soils supporting desert-like vegetation.

Broad floodplains occur along the Rio Nigua and Rio Jueyes where the valley bottoms are broad and flat.

Most flood prone areas are only inundated during intense rainstorms, when several inches of rain falls during a short period and the water exceeds the infiltration rate of the soils and runs off as overland flow.

Most of the time, the rain is of short duration and low intensity allowing the water to percolate into the soil.

Flood plain maps, “Mapas de Zonas Susceptibles a Inundaciones” dated 20 February 1988, were inspected at the Puerto Rico Planning Board. These maps show flood prone areas along the Rio Nigua within the eastern and southern boundaries of Camp Santiago and south through Salinas. No flood prone areas were mapped along the Quebrada Honda or its tributaries that drain the western side of the Cantonment Area.

Floodplains are currently being impacted from livestock gazing, gravel extraction, stream channel clearing and off-road vehicle use. Intense runoff events are able to overflow banks and wash out roads. Large amounts of gravel and sediment are deposited in flood prone areas during runoff events then later cleared out by bulldozers; this causes a constant state of streambed and stream channel instability that, in turn, adversely affects the aquatic environment.

8.6.4.2 Management Initiatives

In addition to the initiatives listed in paragraph 8.5.2 on pages 8-13 and 8-14, the Training Center map will be modified to show sensitive riparian areas as "restricted, off-limit areas" for cross-country vehicle maneuver.

8.6.4.3 Expected Benefits

The improved stream crossings will improve training conditions by providing better and more reliable access to training areas and elimination of existing safety hazards.

The implementation of the initiatives will greatly reduce the amount of alterations being made to vegetation and soils within the floodplains. The direct effect will be the reduction of habitat destruction along the waterways. The indirect effect will be the reconnection of travel ways for species dependant on the streamside environment.

Overall, the initiatives will lead to improvement of streamside habitats and an improved ability for the stream to handle storm flows without damaging stream crossing structures.

8.7 Game Harvest Management

Currently, hunting is not permitted at Camp Santiago. There are no game animals present within or adjacent to the Training Center. While potential game species are limited to birds (primarily doves), hunting is deemed incompatible with operations at the CSTC.

A manageable fisheries resource is not present within the streams and rivers on the Camp Santiago Training Center.

8.8 Rare, Threatened, or Endangered Species Management

8.8.1 Flora

8.8.1.1 Existing Condition

Solanum drymophilum

Although the search for two federally listed plant species (*Solanum drymophilum* and *Zanthoxylum thomasianum*) produced a negative report, the CSTC contains several sites that can be classified as potential habitat for these two species (see P. Rivera, Administrative Record Exhibit H-1). These same sites contain several endemic and rare species (see Floral Inventories, 1984, 1994, and 1996).

Populations are at risk due to uncontrolled grazing activities and fire hazard potential.

The presence of exotic grasses creates the potential that continuous disturbance may shift grass populations to take over the sites.

8.8.1.2 Management Initiatives

Initiatives shown in Table 8.1 (page 8-2) responding to the need to preserve and enhance rare, threatened, or endangered plant species include the fencing, restoration / protection of forest vegetation, restoration and protection of riparian areas, and the wildland fire suppression initiatives.

8.8.1.3 Expected Benefits

The implementation of the initiatives, particularly the control of fires and grazing, will directly benefit the vegetative conditions of the special areas mentioned.

Biodiversity will increase, natural succession will initiate reforestation of the areas, and rare and endemic species populations will increase and be protected in those remote forest patches. There is a good chance that species previously reported to exist in those areas would return once the microhabitat conditions are restored and the grazing pressure is eliminated.

Natural habitat restoration is expected to be produced over time by implementing these initiatives. Re-introduction or development of healthy populations of highly specialized habitat species will occur naturally.

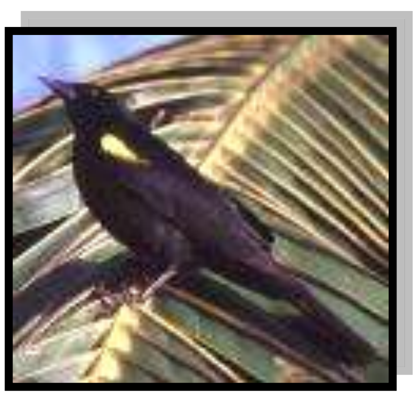
8.8.2 Fauna

8.8.2.1 Existing Conditions

Based on previous detection surveys, federally listed threatened or endangered animals in the vicinity of the CSTC area are limited to one bird species, the endangered yellow-shouldered blackbird (*Agelaius xanthomus*).

The U.S. Fish and Wildlife Service referenced a sighting of this bird in the Salinas coastal area and in the area of Cayey; this species was not detected during bird surveys conducted at the CSTC in 1996.

No specific requirements are necessary to pro-actively manage habitats and environments for rare, threatened, or endangered animal species. Therefore, there is no requirement for an endangered animal species management plan for the Camp Santiago INRMP. However, monitoring for the presence of the endangered yellow-shouldered blackbird will be conducted in conjunction with additional bird surveys and any reported sighting of this species will be forwarded to the U.S. Fish and Wildlife Service for further discussion regarding the conservation of this species, if needed, at Camp Santiago.



Yellow-shouldered Blackbird (*Agelaius*

The major habitats for the yellow-shouldered blackbird are mangrove forest and associated scrublands, which occur to the south of the CSTC along the coast. It has been known to wander in the mountains during the non-breeding season. While nesting habitat does not appear to occur within the Training Center, it is possible the birds move through the area during the non-breeding season.

8.8.2.2 Management Initiatives

Initiatives shown in Table 8.1 (page 8-2) responding to the need to preserve and enhance rare, threatened, or endangered plant species include the fencing, restoration / protection of forest vegetation, restoration and protection of riparian areas, and the wildland fire suppression initiatives. (Refer to Figure 8-10, Wildlife Initiatives Map, on page 8-91.)

8.8.2.3 Expected Benefits

The implementation of the fencing and the wildland fire initiatives will enhance wildlife habitat and species diversity at Camp Santiago.

8.9 Other Non-game Species Management

8.9.1 Existing Condition

Species diversity and abundance at Camp Santiago are greater in forested areas and along stream courses.

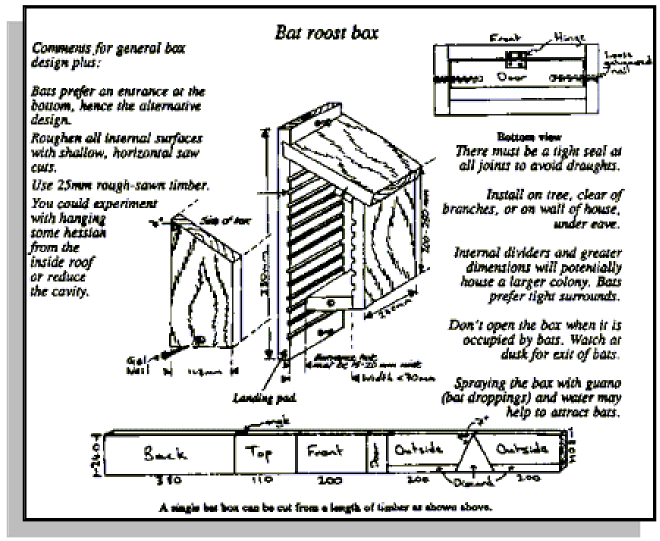
Past treatment and management of the landscape has resulted in deforestation and conversion to grasslands. Tree cuttings, former agricultural practices, grazing, military operations, and fires have allowed grasslands to dominate as the most common vegetative type.

Hurricanes have also affected forest vegetation by causing damage to trees and stream channels. Hurricane Georges impacted Camp Santiago in 1994 and likely had some effect on wildlife habitats.

Because of past and more recent events, forest remnants and secondary forest on Camp Santiago lands remain important habitats for fauna species. The larger occurrences of forest habitat are found in the areas of Las Piedras Chiquitas, Cerro Pio Juan, and Cerro Respaldo. The urban forest in the Cantonment Area also offers a cultivated type of habitat suitable for birds, bats, and reptiles.

8.9.2 Management Initiatives

Initiatives shown in Table 8.1 (page 8-2) responding to the need to maintain and enhance wildlife habitat include the fencing, restoration / protection of forest vegetation, restoration and protection of riparian areas, and the wildland fire suppression initiatives. (Refer to Figure 8.10, Wildlife Initiatives Map, on page 8-91.)



Because bats are important to the environment, as they are pollinators and seed dispersers, it is recommended that bats be conserved at Camp Santiago. This can be facilitated by the construction and placement of bat boxes in the Cantonment Area. The idea is to encourage bat roosting in boxes rather than buildings. Larger buildings in the Cantonment Area can be searched for bats and boxes placed in proximity to those where bats are found.

Natural rock piles and outcrops are to be left undisturbed to the greatest extent feasible. These sites often provide refuge and shelter to small animals such as lizards and snakes.

Dead standing trees are to be left on site, unless they pose a safety hazard to humans or facilities. Dead standing trees are used for perching and observation posts by birds. This is particularly true for isolated trees (in open environments) that are used extensively by raptors. Woodpeckers excavate dead trees and provide benefits to other species of cavity nesting birds.

To better manage the natural biological resources of CSTS, the Caribbean National Forest (CNF) is proposing a structured approach in measuring local populations. The approach is based on the CNF monitoring plan that consists of tracking the trends of management indicator species and exotic species through annual indices. Improvements for wildlife and aquatic habitats are monitored for effectiveness in reaching desired conditions of local fauna populations to ensure that proper stewardship is provided. The monitoring would be accomplished by the PRARNG in partnership with the Forest Service. Appropriate administration of the natural resources will enhance the quality of training and security for all users. Fauna monitoring will enable to rapid and consistent evaluation of biological resources on the CSTS throughout the planning session. The following monitoring initiatives are proposed to be conducted on an annual basis:

Conduct annual monitoring during the wet season (August – September) of populations of river shrimp (*Atya lanipes*), rosy barb (*Barbus conchonius*), and Tilapia *(Tilapia mossambica*) in the Rio Nigua. The monitoring protocol includes electrofishing at long-term reaches. The findings from this monitoring will provide long-term data of the river's native aquatic species composition, assist in predicting trends, and help in evaluating the effectiveness of management initiatives designed to protect and improve water quality and aquatic habitat values.

Conduct annual monitoring of populations of the common coqui (*Eleutheryldactyl us coqu*) to measure occurrence of native amphibians. The monitoring protocol includes evening 50-meter coqui call point counts conducted within three nights during the late spring timeframe**.** The findings from this monitoring will provide long-term data of the occurrence of native amphibians (coqui and possible species presence) at the CSTC, assist in predicting trends, and help in evaluating the effectiveness of management initiatives designed to protect and improve forest and riparian area habitat values.

Conduct annual monitoring for the occurrence of the black-faced grassquit (*Tiaris bicolor*) at the CSTC. The monitoring protocol includes evening 50-meter bird call point counts conducted during three days within the late spring timeframe. The findings from this monitoring will provide information on native bird species composition, assist in predicting trends, and help in evaluating the effectiveness of management initiatives designed to protect and improve forest and riparian area habitat values.


Black-faced grassquit

Conduct annual monitoring for the Pallas' Mastiff Bat (*Molossus molussus*) at the CSTC. The monitoring protocol includes evening bat mist netting during three nights within the summer timeframe. The findings from the monitoring would provide estimated bat populations, assist in predicting trends, and help in evaluating the effectiveness of management initiatives designed to maintain and improve wildlife habitat.

8.9.3 Expected Benefits

The implementation of the fencing and wildland fire initiatives will help retain and potentially enhance habitats that provide for wildlife diversity at Camp Santiago.

8.9.3.1 Effects on Birds

Implementation of the initiatives will improve habitat conservation for native species of birds at Camp Santiago. Initiatives to conserve and enhance the forest ecosystem, both through protection measures and reforestation, will increase habitat availability for local bird species dependent upon trees and tall shrubs.

Efforts to control the spread of fire to prevent the destruction of forest types on the Training Center will add to the level of conservation and management of habitat important to many birds inhabiting the area.

Eliminiation of livestock will reduce impacts on birds caused by grazing, trailing, bedding, and watering. The long-term trend of forest succession on areas where livestock use is excluded will lead to an increase of forest habitat availability and quality for avian species.

8.9.3.2 Effects on Mammals

Measures to attract and promote bat occurrence at Camp Santiago will benefit bats and many of the other species of wildlife. The plant pollination and seed dispersal activities of bats would help to establish tree growth and habitat.

It is expected that trees established from bat dispersal would be damaged by training operations; but, over time, some of the trees would survive to maturity and provide habitat for bats, birds, and arboreal lizards.

8.9.3.3 Effects on Amphibians

Protection of aquatic areas by limiting activities in such areas (e.g., off limits to vehicle travel) will reduce direct and indirect impacts to sites containing the greater abundance of fauna species diversity. This is especially important for amphibians that are limited by the small amount of suitable aquatic habitat on the CSTC.

8.9.3.4 Effects on Reptiles

The species composition of reptiles found at the Training Center would remain the same. The proposed initiatives are expected to enhance forestland protection over time. Habitat for arboreal lizards would increase with reforestation over time.

8.10 Transplants and Stocks

8.10.1 Flora

In accordance with U.S. Army Environmental Center's *Tactical Concealment Area Planning and Design Guidance Document*, August 1999, the CSTC currently has plans to plant approximately 10,000 trees in portions of training areas E and DCA. This planting project is intended to create additional vegetation to enhance future tactical concealment training. (Refer to Appendix E for a listing of recommended plant species to be used in the reforestation projects outlined in this INRMP.)

The forest restoration and protection initiatives include the planting of 65 acres during this planning period within open grassland with native or naturalized plant species.

The riparian area restoration and protection initiatives include the planting of 200 acres of native or naturalized plant species within riparian areas.

Research currently being conducted at the CSTC includes a plant study by the USDA Forest Service, International Institute of Tropical Forestry. This study includes the establishment of a tree nursery for experiments in culturing aggressive plant species for possible use in harsh-site re-vegetation efforts. Chapter 10 of this document provides additional information about the research being conducted by the International Institute of Tropical Forestry.

8.10.2 Fauna

Currently, there are no specific conservation needs to re-introduce or augment animal and fish populations at Camp Santiago.

8.11 Wetlands Management

Camp Santiago contains no areas that meet the criteria for Jurisdictional Wetlands within the training boundaries, though there are many areas that are very wet on a seasonal basis.

Refer to floodplains and riparian area management (page 8-19) and floodplains and wetlands management (page 8-16).

8.12 Water Quality Management

8.12.1 Existing Condition

Water quality is being impacted in the form of sediment created by ongoing gravel and fill-dirt extraction operations, sediment eroded from roads, livestock grazing within riparian areas, and methods that are currently being used to keep stream channels clear of debris (channel cleaning). Sediment is also being recruited into waterways from the upland forest areas where frequent wildland fires and cattle grazing have kept trees and brush from re-establishing on the hillsides.

Active erosion is most evident in the steepest portions of the streams within the active training areas of CSTC. In some cases, water runoff has formed gullies that have migrated up to the tops of ridges. In the most confined areas, brush and other vegetation is ripped out and carried downstream during rain events. This situation is not occurring in training areas L, M, and N where mostly native woody plants with deep roots line the streams. It is also not apparent in the upper watershed outside of CSTC where there has been less continuous soil disturbance.

Active erosion upslope from stream crossing structures is contributing to the rate of pipe erosion, plugging, and failure. When pipes plug, it forces rain-swollen stream water to flow along the roadbeds, across down slope stream crossing structures, and causes great damage to both roads and streams.

Although “channel cleaning” is not occurring at the same level that is was as recently as 2000, there were some ditches noted within the Cantonment Area being bladed to mineral soil, and small streams are being cleared with equipment. These practices still cause large surges in sediment to be transported down slope during rain events, which then changes the natural stream shape and size down stream. It also hinders the stream’s ability to handle large rain events. Implementation of “Best Management Practices” along the convoy routes would greatly reduce sedimentation problems. (See Chapter 16 for recommendations.)

Gravel and fill-dirt extraction operations along the Rio Nigua have impacted both water quality, riparian area vegetation and thereby flood flow dissipation. The three sites have been GPS'd for monitoring and photo-documented in February 2005 (Administrative Record Exhibit L-2). The location furthest downstream is the point where the last signs of water disappear into the stream bank. It appears that the water is following the stream's historic flow path. The upper two sites show a good amount of water still flowing. The primary source of the water is the Rio Majada above its confluence with the Rio Nigua. Rio Majada is very large watershed, while the upper Rio Nigua (3,540 acres) is perhaps a third its size and dry most of the year. It appears that the streambed areas that have not had active extraction in the recent past are growing over with grasses and herbaceous plants relatively quickly and that the recommendation for a moratorium on specific reaches of the river may be an affective mitigation in site-specific areas.

Another source of sediment is secondary cross-country trails used by military and private vehicles and travel of heavy equipment on convoy routes when the trails and routes are wet or boggy. This has caused damage to the riparian areas and created dangerous training conditions for those using the facilities by causing deep ruts and gullies. To reduce this damage and creation of unsafe training conditions, areas with potential for rutting and gullying should be delineated on maps and alternate routes should be found for training.

Eventually, all designated convoy routes and training sites need to be "storm proofed" with proper drainage to handle storm flows. All vehicles should stay 100 feet from stream courses and valley bottoms to avoid damaging seasonal wet areas or change the course of groundwater. Encampments should also stay a minimum of 50 feet from stream courses and trampling of riparian vegetation avoided. "Borrow" areas need to be reshaped and revegetated immediately after use. Regularly used soil extraction areas should be designated and designed to include proper drainage at all times.

Sediment generated from roads, livestock grazing within riparian areas, uncontrolled vehicular traffic and soil extraction is a contributing impact to area streams and water quality. This in turn impacts aquatic habitat both in the stream's increased sediment delivered to the bays in the nearby Salinas area where the rivers enter the sea.

8.12.2 Management Initiatives

8.12.2.1 Sediment Source Surveys

Conduct sediment surveys on the CSTC secondary convoy routes and areas used for assembly area and combat / field trains operations. During the first year (2006), focus surveys on the secondary convoy routes. In the subsequent years (2007-2010) place emphasis on monitoring the CSTC primary and secondary routes and assembly areas to identify existing sediment sources. The surveys would be accomplished by the PRARNG in partnership with the Forest Service. The identification and elimination of sediment sources is responsive to the INRMP goals related to troop safety/protection and the protection and the protection of natural resources values.

8.12.2.2 Culvert Inspection and Cleaning

Inspect primary convoy routes during severe rainstorm events to allow timely identification and clearing/cleaning debris for above, within and below culverts to prevent potential erosion issues. The inspections and culvert maintenance would be accomplished by the PRARNG in partnership with the Forest Service. This initiative supports the timely identification and corrective actions required to minimize erosion and potential damage to stream crossings. The initiative is responsive to the INRMP goals related to troop safety, maximizing available training time and resources, and the protection of natural resources values.

8.12.2.3 Stream Channel Surveys

Conduct stream channel surveys to determine current stream channel (baseline) conditions, monitoring over time, and to predict trends. The surveys are expected to help identify stream channel and riparian area restoration opportunities. These surveys would be conducted twice annually during February and October during the 2006-2010 timeframe. The surveys could be conducted through a partnership with the PRARNG and Forest Service and/or through a Memo of Understanding with local universities. The initiative is responsive to the INRMP goals related the protection of riparian and aquatic habitat.

8.12.2.4 Stream Monitoring

Establish permanent stream cross-sections in year 1 (2006) both above and below the stream segment where gravel and fill-dirt extraction operations have been and are currently be conducted adjacent to the Rio Nigua. The permanent cross-sections would be re-measured in 2007 and again in 2010. The surveys could be conducted through a partnership with the PRARNG and Forest Service and/or through a Memo of Understanding with local universities. Findings from this monitoring would track sediment levels, assist in predicting trends, and help identify management actions needed to maintain and/or improve riparian area and aquatic habitat values. This initiative is responsive to the INRMP goals related to the protection and enhancement of water quality and riparian area and aquatic habitat values.

8.12.2.5 Overview – Eliminate Sediment Sources Associated with the CSTC Primary Convoy Routes – THIS IS A HIGH PRIORITY INITIATIVE!

The supplemental INRMP took a planning level look at reducing and eliminating sediment sources along the six primary convoy routes. This field survey identified general surface erosion and sediment sources associated with the traveled surface. A cost estimate to design and construct general surface drainage and sediment reduction improvements was prepared for each route (see the drainage deficiency and sediment sources for each route in Appendix G and Sections 8.12.2.5.1 through 8.12.2.5.14). These improvements follow general "Best Management Practices" (BMP's) that protect water quality and watershed soils. BMP's are not only aimed at reducing sediment sources, but also provide solid guidance in designing safe and efficient travel ways. A travel route that incorporates BMP's provides adequate surface drainage through outsloping, in sloping, or crowning roads and installing proper drainage features. The drainage features are spaced so that peak drainage flow will not erode the surface, drain, or shoulder material. The total cost estimates to implement BMP's along each route (includes survey/design, construction, and construction management) are detailed in Appendix G.

The field survey also identified other sites along the routes that were sediment sources, experiencing degradation or failure. These sites are outside the scope of the general surface drainage and sediment source improvements associated with BMPs. These sites include undersized culverts or crossings, sites with severe bank and toe erosion, or sites requiring a higher level of design and funding. A cost estimate to design and construct these site-specific improvements was also prepared for each specific site along each route (see the site-specific estimate for each route in Chapter 16). The total cost estimates to address the erosion and safety concerns at each specific site along each route (includes survey/design, construction, and construction management) are detailed in Appendix G.

The initiative would be accomplished by the PRARNG in partnership with the Forest Service and/or through a public works contract. This initiative responds to the INRMP goals related to troop safety, maximizing available training time and resources, and the protection of natural resources values.

8.12.2.6 Route Blue – Elimination of Sediment Sources

As shown on Figure 8.1 – Blue Convoy Route, page 8-38, the Blue Convoy Route provides access to the Cantonment Area, Impact Area, and Training Areas DCA, R, H, I, J, K, L, M, and O. Convoy Routes Green and Brown can be accessed from the Blue Convoy Route. Ranges accessed directly from the Blue Convoy Route are 17, 18, 19, 20A, 20B, 22, 23, 25, 26, 27, 28, and 30.

The Blue Convoy Route requires surface drainage structures (e.g., drain dips, water bars, outsloping) installed over half of its length. There are few areas where surface erosion has resulted in gullying of the travel way (these occur primarily near the end of the road near Ranges 20, 27, and 28).

It is recommended that a detailed route survey be completed to specify and design improvements for surface drainage and sediment source problems. To protect water resources, route surface drainage should not occur at stream crossings. Route surface drainage should be diverted off the route prior to stream crossings. In the areas where a shoulder berm exists, it is recommended that the berm be removed and/or pulled back onto the route to fill gullies. The interval of surface drainage structures depends on route grade and local drainage patterns. The recommended interval is between 200 and 400 feet. It is recommended that outlet and outlet ditches of the surface drainage structures be hardened with riprap to prevent erosion of the route shoulder.

The following points along the Blue Convoy Route were identified in the field survey as specific sites of concern, interest, or reference. Some of the recommendations provided in these site specific survey points can be addressed in the survey, design, and construction for the general surface drainage and sediment source improvements and the associated costs are included in the above. Site specific estimated costs are provided for other points due to the scope of the recommended work. Having the estimated costs for these specific points separate will allow flexibility in prioritization and scheduling.

Blue Route Point 1:

Double drain from Contonment Area with concrete outlet wingwalls and apron. There is excessive scour at the toe of the apron and erosion on the left bank. The scour depth is approximately 4 feet deep and the apron width is approximately 10 feet wide. The left bank height is approximately 10 feet high and the eroded area extends approximately 10 feet downstream.

- Recommend that the left bank be stabilized and that the toe scour be armored with filter material and riprap.

Blue Route Point 2:

Channel migration is eroding the left bank and encroaching on the Blue Route. The bank is nearly vertical and approximately 30 feet in height. It appears to be natural channel migration processes, though, due to the extent of channel incision, the entire channel likely degraded in the past. A drain pipe from the Contonment Area discharges into the stream in this area, though it does appear abandoned.

- Recommend installing approximately 200 feet of gabions or riprap along the toe of the bank to prevent additional bank erosion. Gabions/riprap should be keyed into the channel bed a minimum of 3 feet and into the bank at least 10 feet at the upstream and downstream ends. Gabions/riprap should extend approximately 10 feet in height. Slope the remaining bank at 1.5:1 slope and re-vegetate.

Blue Route Point 3:

Drainage off of parking area has eroded inlet areas upstream of drain pipe and is undercutting asphalt “drainage ramp.”

Drainage erosion off parking lot at Point 3 along the Blue Route.

- Recommend hardening the grassed/soil areas with filter cloth and small riprap.

Outlet of four-barrel 60-inch crossing along Convoy Route Blue at Point 4.

Blue Route Point 4:

Four 60-inch concrete pipes, 40 feet in length comprise this stream crossing. The outside two pipes are receiving little flow due to vegetation buildup and debris. The upstream channel appears stable. There is approximately 4 feet of scour at the toe of the outlet concrete apron. There is some erosion off of the south shoulder and one curb on the north abutment is damaged.

- Recommend that the inlets be cleaned and vegetation cleared so that all four pipes are used to carry the flow.
- Recommend that riprap toe protection be provided at the outlet apron (35 feet by 10 feet by 2 feet) and minor bank stabilization.
- Recommend a concrete or asphalt patch be placed to address erosion off of south shoulder.

Blue Route Point 5:

A gabion drain was installed under access to Range 22. The outlet ditch is not complete.

- Recommend that the banks of the outlet ditch be sloped back so they are not a safety hazard to fill the ditch with riprap. Ensure that there is negative slope on the ditch.

Blue Route Point 6:

Stream crossing is comprised of a 36-inch concrete culvert. The first pipe joint from the inlet is separating and road fill is falling into the culvert. The outlet wingwall on the right bank is damaged.

- Recommend that the separated pipe joint be sealed and possibly re-grouted.

Blue Route Point 7:

Crossing appears stable.

Blue Route Point 8:

The 36-inch concrete pipe sections are not aligned and joints are separating. The inlet concrete is damaged. The upstream channel appears stable. There is a large scour hole at the toe of the outlet apron. Pipe is likely undersized. Drainage off of road has eroded fill around abutment and wingwalls.

- Recommend replacing the existing deteriorating pipe with two 36-inch culverts to increase capacity.
- Recommend installing local drainage features to keep surface flows from draining off travel way and eroding fill around wingwalls.

Blue Route Point 9:

An existing 24-inch concrete pipe. There is a small scour hole at the outlet apron and the pipe may be slightly undersized. The outlet abutment has been damaged.

Blue Route Point 10:

An existing 18-inch concrete pipe. The upstream channel appears stable. Surface drainage from both directions is eroding fill along both outlet wingwalls.

Surface drainage into stream around at crossing at Point 10 on the Blue Convoy Route.

- Recommend installing surface drainage features along the route to prevent surface flows from draining off the travel way at the stream crossing.
- Recommend considering constructing a drain on the northwest side to prevent overland flows from reach the travel way.
- Recommend checking capacity of pipe, it may need to be upsized.

Blue Route Point 11:

- Recommend outsloping surface to take advantage of natural drainage.

Blue Route Point 12:

Damaged inlet structure at Point 12 along the Blue Convoy Route.

An existing 36-inch concrete pipe. Debris and woody vegetation have built up at the pipe inlet. The inlet abutment and wingwall are seriously damaged. There is a large scour hole at the toe of the outlet apron that appears to have had concrete dumped to protect the concrete apron. The pipe may be undersized due to the deposition upstream and scour hole downstream. There is ditch erosion on the north side of the travel way.

- Recommend increasing the capacity of the culvert.
- Recommend installing local surface drainage features.
- Recommend replacing inlet wingwalls.

Route Point 13:

This is an existing low water bridge consisting of five 24-inch concrete pipes and two 30-inch CMP's. Most are plugged and have little to no capacity. The curbs are badly damaged or destroyed. There is a stream/drainage entering the channel from the left bank immediately upstream of the crossing. The current crossing is not only a sediment source but also a safety hazard due to deteriorated curbs and potential for being over topped.

- Recommend replacing the existing structure with a crossing with the additional capacity of a bridge (approximately a 100 feet long bridge). A hydrologic analysis to determine design flows will be required.
- Recommend placing drainage features in the area to prevent surface flows from entering stream channel.

Blue Route Point 14:

Junction with the "Hike" route.

Blue Route Point 13 - Plugged

Blue Route Point 13 - Approach

Blue Route Point 13 - Overflow

Blue Route Point 15:

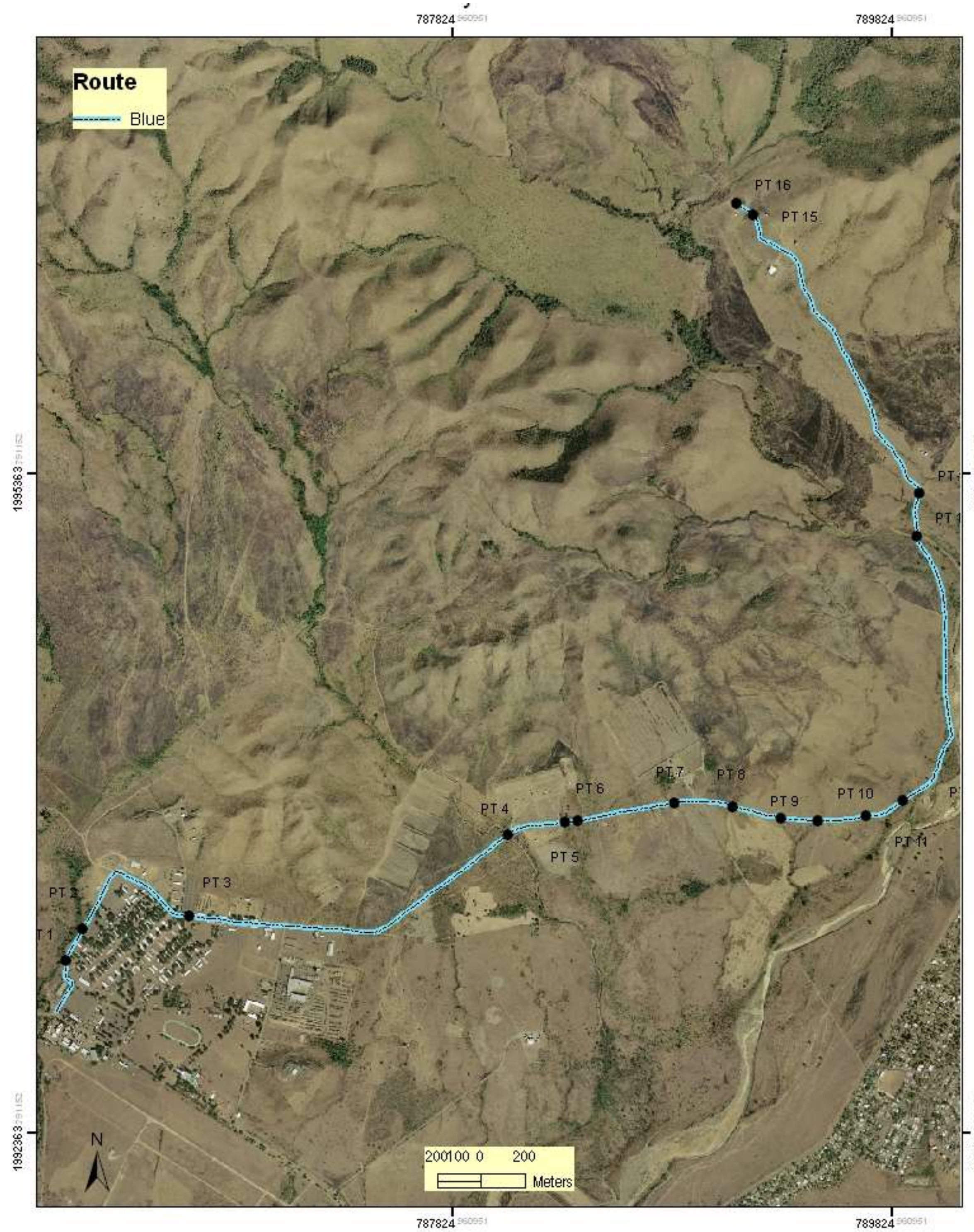
Low area, likely wet and boggy during wet season. Monitor.

- Recommend installing drainage structures to remove surface water off travel way.

Blue Route Point 16:

End of Route Blue

Figure 8.1. Blue Convoy Route



8.12.3.5.2 Route Brown – Elimination of Sediment Sources

The Brown Convoy Route, which is approximately 2 miles in length, provides access to Training Areas F, O, R, and DCA. The Violet Convoy Route is accessed from the Brown Convoy Route. Ranges access directly from the Brown Convoy Route include 7, 15, and 18.

The Brown Route requires surface drainage structures (e.g., drain dips, water bars, outsloping) installed over most of its length.

It is recommended that a detailed route survey be completed to specify and design improvements for surface drainage and sediment source problems. To protect water resources, route surface drainage should not occur at stream crossings. Route surface drainage should be diverted off the route prior to stream crossings. In the areas where a shoulder berm exists, it is recommended that the berm be removed and/or pulled back onto the route to fill gullies. The interval of surface drainage structures depends on route grade and local drainage patterns. The recommended interval is between 200 and 400 feet. It is recommended that outlet and outlet ditches of the surface drainage structures be hardened with riprap to prevent erosion of the route shoulder. It is also recommended that where possible the berm that has developed on the outside shoulder be removed and/or pulled back onto the route to fill gullies. If possible, the route could be outsloped in areas to facilitate surface drainage.

The following points along the Brown Convoy Route were identified in the field survey as specific sites of concern, interest, or reference (Figure 8.2. Brown Convoy Route). The recommendations provided in these site specific survey points can be addressed in the survey, design, and construction for the general surface drainage and sediment source improvements and the associated costs are included in the above.

The Violet Route was originally included in the Brown Route field survey. The Violet Route and corresponding field survey points (points 10 through 13) have been separated. Therefore, the field points 10 through 13 are not included in the Brown Route list provided below.

Brown Route Point 1:

Junction with paved road of Cantonment Area and Blue Route.

Brown Route Point 2:

Junction with "Bog" trail (drainage work accomplished in 2004).

- Recommend beginning drainage features approximately every 100 to 150 feet.

Brown Route Point 3:

Intersection with trail from tower new Range Control. This trail can get 2 to 3 feet gullies.

- Recommend installing drainage features on the Brown Route and tower trail.

Unfinished construction along the Brown Convoy Route, Point 4

Brown Route Point 4:

There is an existing head cut on the west shoulder. A gabion was installed last year with a riprap apron with filter cloth placed on tip of the apron. This is the beginning of the road improvement project completed last year to "firm" the road surface by placing filter cloth down with surface material on top. An outlet ditch to the west was constructed. A blade was used to create a portion of the outlet ditch and soil was pushed into the stream channel.

- Recommend that filter cloth be placed under the riprap apron and that larger riprap be used in a layer 2 feet thick.
- Recommend that the material bladed into the stream channel be removed and that future work around stream channels not leave fill in the stream channel.
- Recommend that outlet ditch be filled with riprap or the side slopes be sloped back at 2:1 or 3:1.

Brown Route Point 5:

Route detours around un-exploded ordinance, junction with the Orange Convoy Route.

Brown Route Point 6: Route surface is insloped through this area.

- Recommend installing surface drainage features and removing berm.

Brown Route Point 7:

Watershed drains across route but appears stable. Monitor.

Brown Route Point 8:

The route is in a draw and drainage flows across route surface. The route appears stable in this area. There is surface gullying in this general area, especially down station from this point.

Dry draw and route surface, Point 8 Brown Convoy Route.

- Recommend continuing installation of surface drainage features.

Brown Route Point 9:

Junction with Violet Convoy Route leg that borders Range 18 and heads north to Urban Assault Course.

Brown Route Point 14: Wingwall around culvert inlet is damaged.

Brown Route Point 15:

Route side drain is eroding as it enters ditch.

- Recommend hardening this area.

Figure 8.2. Brown Convoy Route

Brown Route Point 16: End of Brown Convoy Route, intersection with Red Convoy Route.

8.12.2.7 Route Green – Elimination of Sediment Sources

The Green Convoy Route begins at the Blue Convoy Route and heads in a southerly direction for approximately half a mile to its intersection with the road to the radio towers. The route is approximately 0.6 mile in length, and provides access to Training Area DCA. This native material route has only a couple of surface drainage problems to address.

Green Route Point 1:
Junction with Blue Route.

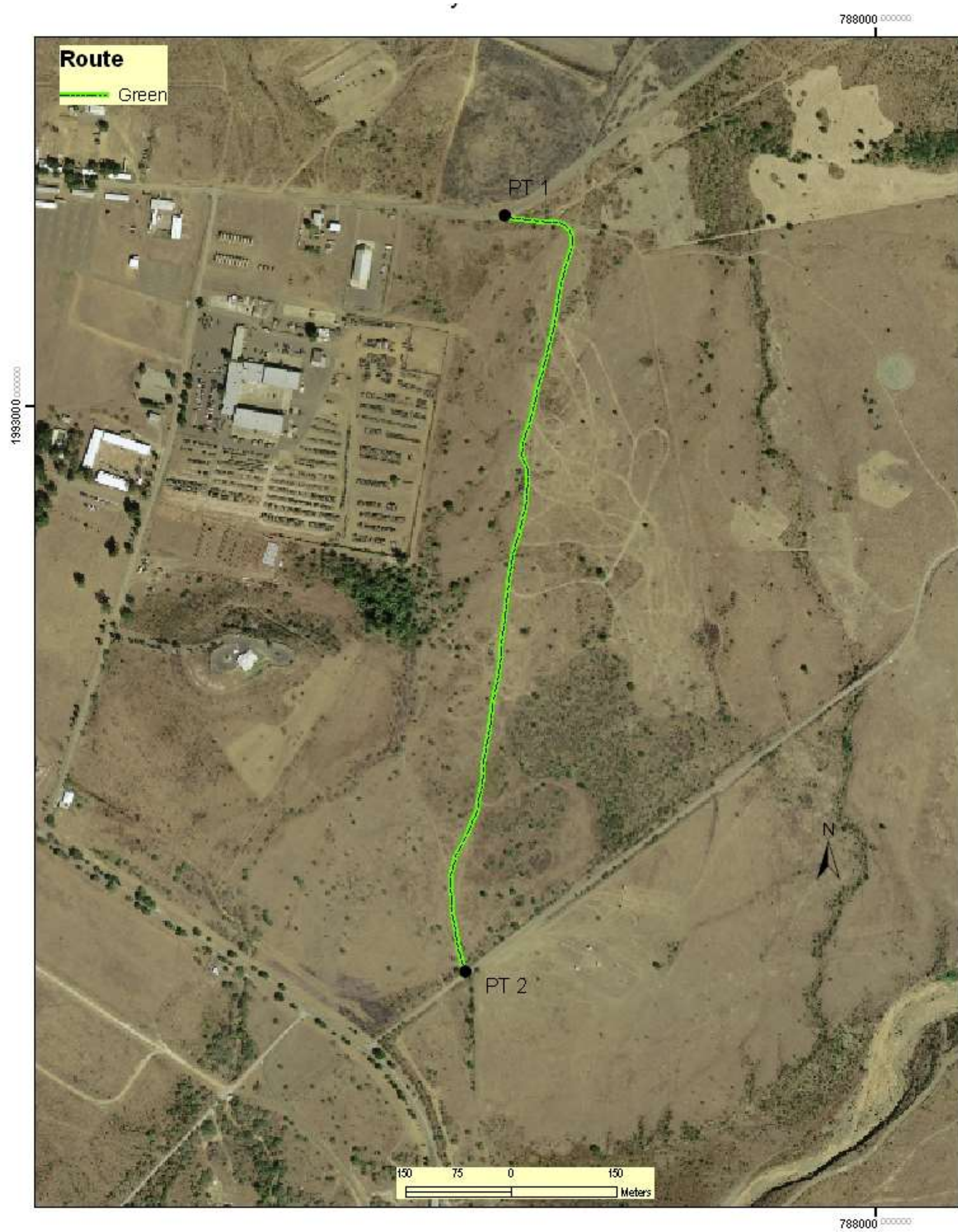
The Green Route requires limited surface drainage structures (e.g., drain dips, water bars). The interval of these structures depends on route grade and local drainage patterns.

- Recommended that outlet and outlet ditches be hardened with riprap to prevent erosion of the route shoulder. Area A is approximately 300 feet in length and appears to be a soft area and prone to becoming boggy.
- Recommend laying filter cloth and placing 1 foot of surface material to stabilize the driving surface.

Green Route Point 2: End of Green Route

Boggy area along Green Convoy Route.

Figure 8.2. Green Convoy Route



8.12.2.8 Route Orange – Elimination of Sediment Sources

The Orange Convoy Route begins off the Red Convoy Route and makes a loop through Training Areas D, N, and O to its intersection with the Brown Convoy Route (see Figure 4.2 - Convoy Routes, page 4-5). The total length of this route is approximately 5 miles and is comprised of native surface material. This route provides access to Firing Ranges 40.

The Orange Convoy Route requires surface drainage structures (e.g., drain dips, water bars, outsloping) installed over most its length. There are many areas where surface erosion has resulted in gullying of the travel way.

It is recommended that a detailed route survey be completed to specify and design improvements for surface drainage and sediment source problems. To protect water resources, route surface drainage should not occur at stream crosses. Route surface drainage should be diverted off the route prior to stream crossings. In the areas where a shoulder berm exists, it is recommended that the berm be removed and/or pulled back onto the route to fill gullies. The interval of surface drainage structures depends on route grade and local drainage patterns. The recommended interval is between 200 and 400 feet. It is recommended that outlet and outlet ditches of the surface drainage structures be hardened with riprap to prevent erosion of the route shoulder.

The following points along the Orange Convoy Route were identified in the field survey as specific sites of concern, interest, or reference. Some of the recommendations provided in these site specific survey points can be addressed in the survey, design, and construction for the general surface drainage and sediment source improvements and the associated costs are included in the above. Site specific estimated costs are provided for other points due to the scope of the recommended work. Having the estimated costs for these specific points separate will allow flexibility in prioritization and scheduling.

Orange Route Point 1:

Begin Orange Route off of Red Route.

- Recommend improving drain dips/water bars that were installed over the last year. Many appear to be too shallow to be effective and vehicle use has leveled out a number of them. The berm on the outside should be removed to allow water to drain off of the route surface.

Orange Route Point 2:

The crossing is comprised of a 24-inch CMP with concrete wingwalls. The upstream and downstream channel appears stable. The right bank below the outlet wingwall has been hardened with a gabion. Water is still eroding bank material at edges of gabion. Excess water appears to be coming from the barrow pit located northwest of crossing.

- Recommend constructing a dip and diversion to direct flows coming out of the barrow pit into the stream upstream of the crossing.

Orange Route Point 3:

Hardened ford/water bar, material may be too small, need to monitor.

- Recommend hardening the outlet using larger riprap or stair step gabions. Filter fabric should be used under either method and the top invert of the hardened outlet should begin slightly below the elevation of the route surface.

Orange Route Point 4:

Existing gully is encroaching on route shoulder. A single wrapped

Erosion around gabion, Orange Route Point 4

gabion was placed to halt the gully migration, but the flow is eroding material around the gabion. The gully is approximately 12 feet in depth and 10 feet wide. Flow from the watershed crosses the route and into the gully.

- Recommend that the route be hardened with filter material and rock. Approximately 1.5 feet of route would be excavated for a length of approximately 35 feet and width of 12 feet. Filter fabric would be placed with 1.5 feet of rock on top. This would essentially be a hardened drive through dip. The outlet would be stabilized with filter material and gabions/riprap.

Orange Route Point 5:

Existing gully/headcut is encroaching on the route. The drainage from the watershed crosses the road and into the gully, continuing down the drainage. The route surface and upstream areas appear stable. The gully is approximately 15 feet in depth and approximately 15-20 feet in width.

- Recommend that the gully be stabilized with filter material and gabions/riprap. The gabions should be stair stepped or the riprap placed at no steeper than 1.5:1. Drainage dips/diversions should be installed in the immediate area.

Gully along Oragne Convoy Route. Point 5.

Orange Route Point 6:

The route drops into the Rio Jueyes and continues along the channel corridor for approximately 250 feet. The route makes two river crossings. At this time the banks were gradual and route transition into and out of the channel were drivable. During previous visits by Forest Service personnel, the banks were up to 4 feet vertical drops.

- Recommend that PRARNG consults with appropriate agency regarding establishing route through channel. Permanent crossing locations with hardened approaches may be required to minimize sediment introductions to the river.

Orange Route Point 7:

The route leaves the Rio Jueyes corridor.

Orange Route Point 8:

A large gully has formed in the route. The gully is approximately 4 feet deep, 5 feet wide, and 100 feet in length.

Rio Jueyes looking upstream at Orange Convoy Route crossing. Point 6.

- Recommend filling in the gully and constructing 8 to10 diversion dips/water bars in this area.

Orange Route Point 9:

There is evidence of past shoulder erosion. This should be monitored and the route may need to be hardened with a hardened outlet.

Orange Route Point 10:

A large gully/headcut has formed in the drainage outlet. The gully is approximately 15 feet deep and forms an estimated 30-feet diameter semi circle.

- Recommend hardening the gully knick point with filter material and gabions or riprap.

- Recommend installing drainage dips/diversion structures in this area. Monitor gully off shoulder.

Gully along Orange Convoy Route, Point 10.

Orange Route Point 11:

- Recommend installing drainage dips/diversion structures in this area. Monitor gully off shoulder.

Orange Route Point 12:

Gully migrating into route travel way.

- Recommend filling in gully with approximately 5 cubic yards of fill material and hardening the outlet with filter material and gabions/riprap.

Orange Route Point 13:

There is an existing gully and headcut on the route shoulder and route is insloped.

- Recommend adding drainage structures to remove water from insloped route. Recommend outsloping the travel way if drainage structures do not address gullying.

Orange Route Point 14:

This is Firing Point 40. The travel way into Firing Point 40 has a gully encroaching on the west side approximately 100 feet from junction with Orange Route. Minor surface gullying has occurred do to the lack of drainage structures removing water from the route surface.

- Recommend hardening the gully with filter material and gabions/riprap and constructing drainage dips/diversion structures.

Orange Route Point 15:
Junction with travel way to Firing Point 40.

Orange Route Point 16:
The route has a gully along its surface on the north shoulder and the outlet has a large headcut approximately 10-feet deep, 15-feet wide at the top.

- Recommend installing local diversion structures and harden the outlet with filter material and gabions/riprap. Remove berm along the route in this area.

Orange Route Point 17:
Similar to Orange Route Point 16 with a surface gully along the route.

- Recommend removing shoulder berm and implementing appropriate road drainage.

Orange Route Point 18:
Similar to Orange Route Points 16 and 17.

- Recommend that uphill areas not be used as barrow areas, as these collect and concentrate water on the road surface. If barrow areas are developed, provide appropriate drainage.

Orange Route Point 19:
Outlet ditch is gullying.

- Recommend redefining drainage dip and hardening outlet with filter material and gabions/riprap.

Orange Route Point 20:
Route gully is approximately 3 feet wide and 2.5 feet deep.

- Recommend pulling berm material into the gully and installing

Gully along Orange Convoy Route, Point 20.

drainage features and outlet ditches through the berm.

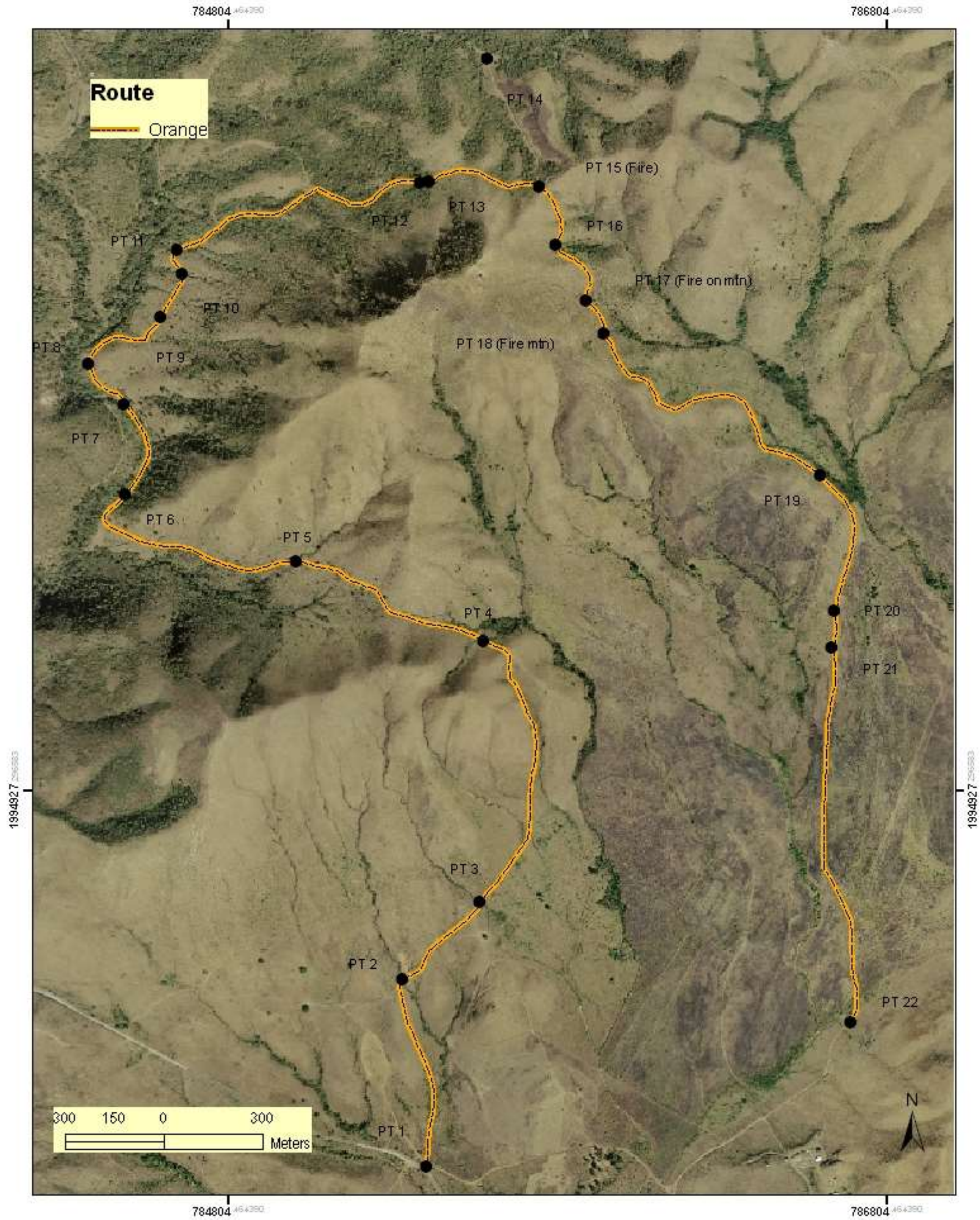
Orange Route Point 21:

Un-exploded ordinances found in route.

Orange Route Point 22:

End of Orange Route, intersection with Brown Route.

Figure 8.4. Orange Convoy Route



8.12.2.9 Route Red – Elimination of Sediment Sources

The Red Convoy Route makes two loops, one west of the Cantonment Area to the gas chamber and the other south of the Cantonment Area around the airfield (see Figure 8.5 – Red Convoy Route). The total route length is approximately 7.5 miles.

The Red Convoy Route provides access to the Cantonment Area and Training Areas A, B, C, D, E, F, and G. Ranges 3, 4, and 5 are also accessed directly from this route.

Construction and Facilities Management has plans to place asphalt surfacing and outlet drainage on 2.41 miles of unimproved section (Gas Chamber Route) of the western loop of the Red Route. A contract to complete Phase I has been awarded to asphalt the first approximate 1.5 miles along the southern portion of west loop and provide outlet drainage approximately every 300 feet. The contract cost for Phase I is approximately $150,000. A contract to complete Phase II has been prepared and is waiting funding to asphalt and install drainage outlets over the native surface route remaining on the west loop. It is estimated that approximately $100,000 in additional funding is required to finish asphalt surfacing.

Due to this foreseeable work by Construction and Facilities Management, the first 11 drainage deficiencies and sediment sources identified during the field work associated with the INRMP revision will not be detailed or included in the route improvement cost estimate. Local scour around culverts and drainage outlets and migrating headcuts should be evaluated for stability. Anticipate needing to harden and stabilize banks and stream channels using filter cloth, rock filled gabions and riprap.

General Surface Drainage and Sediment Reduction Improvements:

The Red Convoy Route requires surface drainage structures (e.g., drain dips, water bars, outsloping) installed primarily along the south end of the eastern loop (south of the airfield). Many of these general surface drainage and sediment reduction improvements are related to drainage off of the airfield and onto the route surface.

It is recommended that a detailed route survey be completed to specify and design improvements for surface drainage and sediment source problems. To protect water resources, route surface drainage should not occur at stream crossings. Route surface drainage should be diverted off the route prior to stream crossings. The interval of surface drainage structures depends on route grade and local drainage patterns. The recommended interval is between 200 and 400 feet. It is recommended that outlet and outlet ditches of the surface drainage structures be hardened with riprap to prevent erosion of the route shoulder.

The following points along the Red Convoy Route were identified in the field survey as specific sites of concern, interest, or reference. Some of the recommendations provided in these site-specific survey points can be addressed in the survey, design, and construction for the general surface drainage and sediment source improvements and the associated costs are included in the above. Site specific estimated costs are provided for other points due to the scope of the recommended work. Having the estimated costs for these specific points separate will allow flexibility in prioritization and scheduling.

Red Route Point 12 – Romero Bridge:

A double barrel crossing over the Quebrada Honda consisting of two 22-feet in diameter structural plate metal pipes. Upstream and downstream concrete aprons should be maintained free of vegetation.

Inlet of the Quebrada Honda

Vehicles have been driving into the Quebrada Honda and ramps into the stream channel are evident immediately downstream. Vehicle operations within the stream channel and riparian area should be restricted and enforced.

Outlet of the 60-inch double barrel crossing at Red Convoy Route Point 13.

Red Route Point 13:

Double barrel, 60-inch concrete pipes, 80 feet in length. Appears to be slightly undersized as some deposition is found upstream of the culverts and approximately 1-2 feet of scour downstream of the concrete apron. Drain ditches on each side of the route drain into the channel from the right bank, the upstream ditch discharge through an 18-inch CMP through the concrete wingwall. Debris has collected at the pipe entrances. Upstream and downstream channel appear stable.

- Recommend cleaning debris at pipe inlets.
- Recommend reshaping and stabilizing the left bank upstream of the inlet wingwall with riprap and filter material for approximately 15 feet.
- Recommend protecting the outlet concrete apron by placing 5 to 8 feet of riprap along the entire width of the apron.
- Recommend stabilizing both banks downstream from the outlet wingwalls for a distance of approximately 10 feet using filter material and riprap.

Red Route Point 14:

Triple barrel, 60-inch concrete pipes, longest is 80 feet in length. Upstream have main channel from Red Route Point 13 and a drain channel from airfield coming in on the right bank. Upstream channel appears stable. Channel from the airfield is likely headcutting into the airfield, but recent dozer work has smoothed the ground and banks. On east end of airfield it appears that berms have been constructed to force water to this drainage channel. These berms may actually force the water down the access trail to the airfield, which would direct the flows towards the crossings outlet wingwall. This causes erosion around the wingwall as the flows drop into the channel. May want to construct large armored dip in trail to airfield so that water deflected by the berms cross the airfield trail and enter the drainage channel.

Outlet wingwall and pipe sections may have failed in the past. New concrete is apparent and a pipe section is located downstream. It appears a headcut from the Rio Nigua has migrated to this crossing structure and this structure is acting like a grade control. There is 5+ feet of scour and concrete dumped to fill the scour hole. There is no evidence of another headcut moving upstream from the river. The outlet wingwalls and apron have settled due to toe and base material being under eroded by the headcut. Waste concrete from demolition projects is being used as bank protection.

Outlet of the 60-inch triple barrel crossing at Red Convoy Route Point 14.

- Recommend reshaping and stabilizing the right bank upstream of the inlet wingwall with filter cloth and riprap (approximately 25 feet long and 10 feet high).
- Recommend cleaning debris and pipe inlets.
- Recommend pumping more concrete along the outlet apron to fill scour hole and protect concrete apron toe or removing existing dumped concrete and placing a riprap toe protection. The apron is approximately 35 feet wide and the scour is 5+ feet in depth.
- Recommend extending both outlet wingwall 25 feet downstream for a height of approximately 15 feet. Banks will have to be reshaped with fill material and filter cloth and riprap used as bank stabilization / erosion protection.
- Recommend removing all waste concrete and construction debris being used as “bank/scour protection.” This material is not appropriate or effective for bank protection and becomes a safety concern when people and animals are walking in the area.

Red Route Point 15:

A singe 60-inch concrete culvert approximately 56 feet in length is in place. Very little water is using this drainage and woody vegetation has established in the channel. It is likely the water source for this drainage is being diverted by the berm at the airfield. The outlet apron has about 1 foot of scour at the toe. The back sides of the outlet wingwall have experienced erosion in the past and large areas of past scour/erosion at the outlet wingwall/bank interfaces exist. It is possible that flows diverted by the airfield berms following the airfield trail access to the Red Route may have also followed the Red Route to this crossing and entered the downstream channel.

Outlet of the 60-inch crossing - Red Convoy Route Point 15.

- Recommend removing the trees that have been established in the channel, leaving the soils as undisturbed as possible.
- Recommend removing berms on the south end of the airfield and allowing natural drainage to resume flowing in the channel.
- Recommend extending both outlet wingwalls 20 feet downstream for a height of approximately 10 feet. Banks will have to be reshaped with fill material and filter cloth and riprap used as bank stabilization / erosion protection.

Red Route Point 16:

Double barrel, 60-inch concrete culverts. Upstream channel appears stable with defined banks, established vegetation, and no signs of backwater from the culverts. The downstream channel is deeply incised and similar to Red Route Point 14, a head cut initiating at the Rio Nigua may have migrated to this culvert structure. This structure is acting like a grade control. There is approximately 10 feet of scour at the toe of the outlet apron. Waste material from what appears to be barrack demolition and broken concrete is being used as fill material.

Channel incision downstream of Point 16 crossing on the Red Convoy Route.

- Recommend stabilizing toe of outlet apron and both downstream banks for 30 feet with filter material and riprap. Outlet apron width is approximately 20 feet wide. Bank heights are 10 to 15 feet high.
- Recommend removing all waste concrete and construction debris being used as "bank/scour protection." This material is not appropriate or effective for bank protection and becomes a safety concern when people and animals are walking in the area.

Quebrada Honda bank erosion at Point 17

Red Route Point 17:

Channel migration is eroding the left bank and encroaching on the Red Route. The top of bank has migrated to within approximately 10 feet of the route. The bank is nearly vertical and approximately 30 feet in height. The bank erosion appears to be natural channel migration processes, though due to the extent of channel incision, the entire channel likely degraded in the past. Old sewage drain pipes discharged into the channel just downstream of the site.

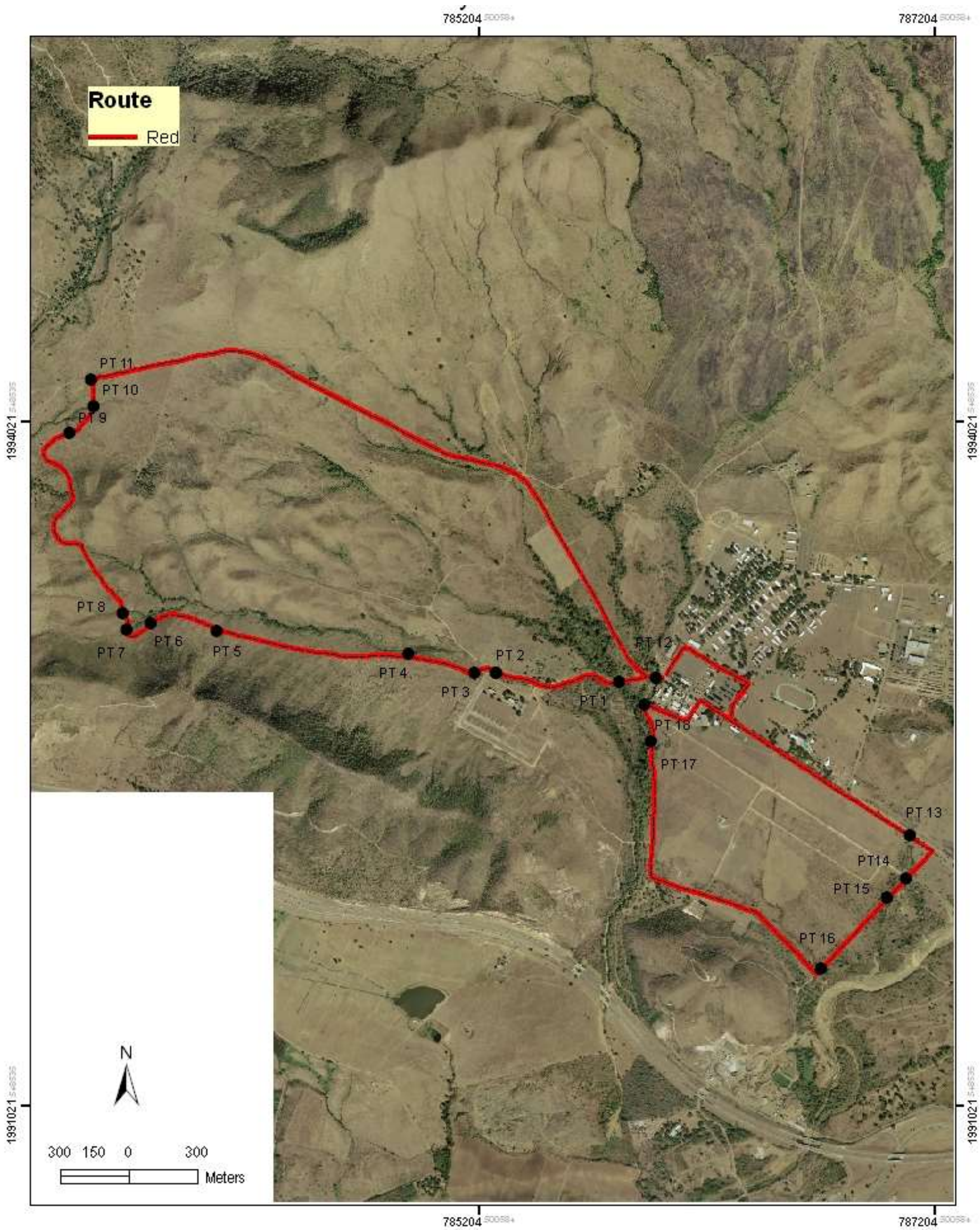
- Recommend installing approximately 200 feet of gabions or riprap along the toe of the bank to prevent additional bank erosion. Gabions/riprap should be keyed into the channel bed a minimum of 3 feet and into the bank at least 10 feet at the upstream and downstream ends. Gabions and riprap should extend approximately 10 feet in height. Slope the remaining bank at 1.5:1 and re-vegetate.

Red Route Point 18:

The drainage crossing is comprised of a 36-inch CMP with concrete abutment and wingwall upstream and a failed concrete wingwall downstream. Downstream channel is severely eroded and a headcut from the main channel may be responsible. From the route surface to the channel bottom is approximately 15 feet. The distance from the outlet pipe invert to the channel bottom is approximately 5 feet.

- Recommend extending the pipe 20 feet and stabilizing the outlet and immediate banks and fill material with filter material and riprap. Slope the banks and fill slopes back at a 2:1 and re-vegetate.

Figure 8.5. Red Convoy Route



8.12.2.10 Route Violet – Elimination of Sediment Sources

The Violet Convoy Route originates off of the Brown Convoy Route along the west side of Range 18 and heads in a northeasterly direction and then a northern direction for a total route length of approximately 0.5 miles. The Violet Convoy Route provides access to the western portion of Training Area R and direct access to Ranges 15A and 18. This native material route has only a couple of surface drainage problems to address.

The Violet Route requires surface drainage structures (e.g., drain dips, water bars, outsloping) installed over most of its length. It is recommended that a detailed route survey be completed to specify and design improvements for surface drainage and sediment source problems. To protect water resources, route surface drainage should not occur at stream crossings. Route surface drainage should be diverted off the route prior to stream crossings. In the areas where a shoulder berm exists, it is recommended that the berm be removed and/or pulled back onto the route to fill gullies. The interval of surface drainage structures depends on route grade and local drainage patterns. The recommended interval is between 200 and 400 feet. It is recommended that outlet and outlet ditches of the surface drainage structures be hardened with riprap to prevent erosion of the route shoulder.

The following points along the Violet Convoy Route were identified in the field survey as specific sites of concern, interest, or reference (see Figure 8.6 – Violet Convoy Route, page 8-64). Most of the recommendations provided in these site specific survey points can be addressed in the survey, design, and construction for the general surface drainage and sediment source improvements and the associated costs are included in the above. Site specific estimated costs are provided for other the points due to the scope of the recommended work.

The route points included below were originally part of the Brown Route. The Violet Route was separated from the Brown Route. Therefore, the route point numbering begins at Point 10.

Violet Route Point 10:

Downstream photo of channel maintenance clearing,

Stream channel through Range 18. Upstream channel appears stable. Downstream channel is cleared of vegetation through the range so that targets can be viewed from firing lanes. Channel clearing maintenance completed with dozers working in channel.

- Recommend that shrub and woody vegetation be eradicated along channel through Range 18, but that grass vegetation be established and maintained to stabilize soils. Various methods are available to accomplish this recommendation from “chaining” (dragging a chain between two dozers to uproot trees) and piling the woody vegetation, to hand sawing the woody vegetation to chemical treatment. The goal is to have minimal disturbed ground that could be washed away during runoff events. Due to the recent channel clearing activities, chemical treatment of individual woody plants may be most economical and effective in keeping tall vegetation clear. Seeding of native grasses and regular maintenance is also required.
- Recommend monitoring the channel upstream from the Violet Route for possible head cuts. The soil disturbance from recent channel clearing may lead to head cuts or gullies forming and moving upstream.

Violet Route Point 11:

Existing stream and culvert. Double barrel 21-inch CMPs encased in concrete. The channel is incised, but stable upstream and downstream. Approximately 20 feet downstream of the outlet the channel bottom is stair stepped through what appears to be volcanic bedrock. This provides an idea of what stepped gabions could look like.

- Recommend cleaning pipes and pipe inlets.

Violet Route Point 12:

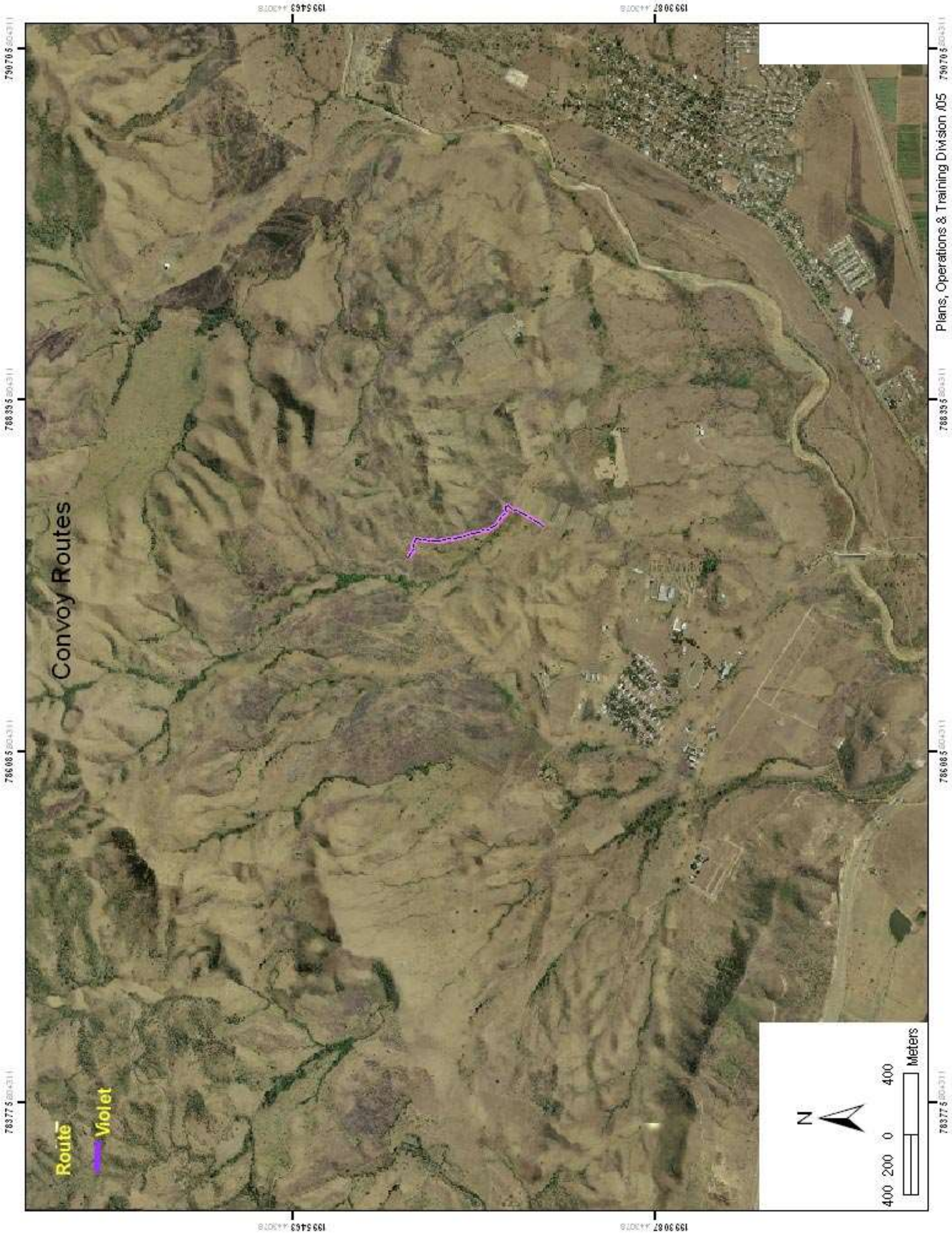
Urban Assault Course training site.

Violet Route Point 13:

The travel way crosses a low drainage area. This area may get boggy during the wet season. Monitor.

Outlet along Violet Convoy Route, Point 11.

Figure 8.6. Violet Convoy Route



8.12.2.11 Firing Range 22 Drainage Improvements

Firing Range 22 has an elevated firing line that is approximately 15 feet above natural ground elevation. There is an 18-inch diameter concrete culvert through the embankment to drain water that is impounded on the north side of the structure. Water from overland flows are impounded by the firing line and either drain through the culvert or flow around the east end of the structure. Impounded water has been over 2 feet in depth on occasion. The existing culvert appears to be undersized to adequately drain water without behind the structure. Additionally, the culvert outlet is below elevation and water must develop head (back up) to drain. Because of the water impounding behind the firing line and flowing to the east, the drainage on the east side of Range 22 is experiencing higher flows.

It is recommended that the drainage culvert through the firing line embankment be upsized to drain incoming flows with minimal backwater. A drainage ditch should be constructed from the outlet of the new culvert to the nearby natural drainage channel. The outlet channel may need to be hardened to prevent erosion of its bed or banks.

This initiative would be accomplished by the PRARNG in partnership with the Forest Service and/or through a public works contract. The initiative responds to the INRMP goals to maximize military training opportunities by eliminating lost training caused by impounded water within the firing lanes, and protect and improve water quality by reducing existing sediment sources.

8.12.2.12 Ammo Area Drainage Improvements

The Ammo Area appears to be lacking in sufficient drainage features due to the rill erosion observed from overland flows coming off of the Ammo Area south of the Red Convoy Route. Additionally, the recent channel maintenance of the drainage located just south of the Red Convoy Route rectified eroded banks. The Ammo Area disrupts the natural drainage pattern of numerous drainages. A field survey of the Ammo Area and the corresponding drainage patterns and upper watershed was not completed in this supplemental INRMP. Therefore, recommended planning level improvements are not provided. Howerever, it is recommended that a detailed survey and analysis of the Ammo Area drainage patterns be completed to identify possible deficiencies and sediment sources.

This initiative would be accomplished by the PRARNG in partnership with the Forest Service and/or through a Memo of Understanding with local universities. The initiative would help identify and subsequently eliminate existing sediment sources and is responsive the INRMP goal to protect and improve water quality.

8.12.2.13 Eliminate Sediment Sources at the CSTC Entrance Bridges

This initiative would be accomplished by the PRARNG in partnership with the Forest Service and/or through a public works contract. The initiative is responsive the INRMP goals to protect and improve water quality and maintain and enhance riparian area and aquatic habitat values by eliminating existing sediment sources.

8.12.2.14 Lower Entrance Bridge

The lower entrance bridge appears to have been designed as a low water crossing that is overtopped during high flow events. The bridge no longer serves as the primary entrance into the camp, though it remains as a alternate access route. The concrete structure has experienced severe erosion at each end (the approaches) and all along the downstream toe. The northern approach has been eroded away, and it is currently being filled in with fill and construction waste.

Downstream view and toe scour along the lower entrance crossing.

The structure contributes sediment to river flows due to inadequate toe and bank protection. Because of this toe and bank erosion, the northern approach to the bridge has washed away, there is up to 10 feet of toe scour, and the southern approach has severe shoulder and bank erosion. These erosion problems are threatening the structural integrity of the crossing and the long term sustainability of this alternate access route.

- Recommend that a detailed survey and design be initiated to evaluate opportunities to protect the toe and banks of the low water crossing and provide stability during high water events. Current measures to reduce scour and erosion and to protect the structure (e.g., utilizing undersized fill, construction waste and scrap concrete) are not appropriate or effective in protecting erodeable material and becomes a safety concern when people and animals are walking in the area.. Toe and bank protection may include extensive use of large diameter riprap and filter material.

8.12.2.15 Main Entrance Bridge

The main entrance bridge is experiencing erosion along the north bank and general scour around the piers. It appears that construction debris and concrete have been used to slow the rate of erosion.

Scour/erosion around main entrance bridge columns

This material is not appropriate or effective in protecting erodeable material and becomes a safety concern when people and animals are walking in the area. It is recommended that a detailed survey and design be initiated to evaluate opportunities to protect the toe and banks of the low water crossing and provide stability during high water events. Toe and bank protection may include extensive use of large diameter riprap and filter material. The pier scour may not be excessive and within the design considerations of the bridge (this can be determined during further analysis.

8.12.3 Expected Benefits from the Implementation of the Initiatives

The implementation of the water quality management initiatives summarized above is expected to protect and improve the CSTC natural resources values. Specifically, these initiatives respond to the INRMP goals to: 1) increase soldier safety and help maximize military training opportunities by eliminating existing and potential safety hazards associated with the convoy routes; 2) improve water quality by reducing sediment sources; and 3) improve riparian area and aquatic habitat.

In addition, the implementation of the INRMP management initiatives designed to: protect and enhance forest vegetation and riparian area habitat (planting of seedlings), to increase range fire suppression operations, and eliminate domestic animal encroachment onto CTCS lands (boundary fenching) would help stabilize and protect the soil resource, which would improve water quality by reducing erosion and sediment flow into stream channels.

Removal of livestock and off-road vehicles will reduce stream bank slumping and further promote the establishment of bank vegetation. Eliminating livestock and cross-country travel from sensitive soils will allow trails to heal over and reduce the amount and speed of water that they transport. These actions will have a large positive direct and indirect effect on channel health and associated dependant aquatic biota.

8.13 Land Rehabilitation and Maintenance

The Land Rehabilitation and Maintenance (LRAM) program plans, designs, and executes land rehabilitation, maintenance, and reconfiguration projects based on requirements and priorities identified in the Training Requirements Integration (TRI) component of the ITAM program. The objective of the LRAM program is to sustain training lands to ensure their availability to support U.S. Armed Forces training and mission requirements indefinitely. This is accomplished through active management to repair degraded areas in a timely manner and to minimize future damage. As a primary link between environmental and training considerations, LRAM will integrate projects with related programs to maximize resources allocations.

Specific land rehabilitation (restoration and maintenance actions) initiatives are discussed in the previous sections of this chapter. Table 8.1, pages 8-2 through 8-9, provides a summary of initiatives to be implemented. Maps and illustrations of the initiatives are provided on pages 8-85 through 8-97 of this chapter.

8.14 Soil Resources Management

8.14.1 Existing Condition

The soils types and classifications found on the CSTC are described in Chapter 6 of this document.

Long-term use of the terrain for vehicle maneuver, assembly operations, and weapons training has changed the vegetation characteristics across much of the area within the boundaries of Camp Santiago. Where trees and shrubs once existed, there are now mostly grasses and short brush with isolated islands of trees across approximately two thirds of the area. This, in turn, has caused accelerated erosion to occur, especially where mineral soil is exposed.

The most severe erosion problems are on the road systems, especially on steeper slopes. Years of rutting and runoff during intense rainstorms have washed away the roadbeds not only at stream crossings, but wherever water accumulates and runs. Much of the primary road system is now incised into the land's surface, making it nearly impossible for storm water to do anything but run down the roads and further erode the driving surfaces. Washouts at stream crossings are a regular occurrence.

Cattle have also changed the soil properties. Trailing along the hillsides is evident through much of the Camp. In some areas, the cattle trails give the hillsides the appearance of terraces. These trenches catch rainwater that would otherwise move down slope and create small streams. Gullies are formed where these small streams intersect with road systems and this has severely impacted road access to some areas of the Camp.

Channel clearing activities, both for commercial gains and road maintenance, have led to a continuous state of erosion at stream crossings and within stream channels. Fine textured soils that are bladed into piles are easily eroded. When this occurs in or near streams, they are an immediate source of sediment at the onset of the next rain event. These are readily transported downhill, down stream, and into the harbors and bays.

8.14.2 Management Initiatives

Management initiatives that directly or indirectly provide protection and enhancement of soil productivity at the CSTC include:

- All of the initiatives described for riparian area management on pages 8-17 to 8-18.
- All of the initiatives described for forest vegetation management on pages 8-10 to 8-12.
- The wildland fire suppression initiatives are described on 8-74 to 81.
- Use of recommended federal and commonwealth Soil and Water Conservation measures.
- Roads and livestock trails will be included in a sediment source survey and the findings displayed on a map and prioritized for mitigation. Prioritization can be based on a cost versus benefit analysis and on the value of affected environments; i.e., if water quality is being affected by soil erosion at a given site, it may have a higher priority than soil that is being eroded but never reaching an aquatic environment.

8.14.3 Expected Benefits

Implementation of Soil and Water Conservation Measures will greatly reduce the amount of soils that are disturbed during road maintenance and storm repairs.

The planting of seedlings in open grasslands will reduce erosion and allow areas to become re-vegetated by native place communities.

The elimination of livestock grazing, repair of drainage structures, and road maintenance to fix erosion and spot sediment sources will reduce soil displacement and compaction and allow a vegetative cover to re-establish. This will help maintain the nutrient balance and productivity of the soil profile.

Eliminating gravel extraction from along the Rio Nigua will allow floodplain vegetation to be rejuvenated and will reduce erosion of top soil during seasonal floods. Elimination or restriction of off-road vehicles along the river bottom would have a similar positive effect.

Increasing the emphasis for fire prevention and suppression will have a positive direct effect on the soil profile of the steeper hillsides. By reducing the spatial distribution, intensity, and size of fires caused by training operations and access, less surface soil will be eroded during seasonal storms, especially in areas of steep slopes and shallow soils.

These actions also have positive indirect effects off site. By allowing vegetation to re-establish a continuous cover, less soil will be moved off site during intense rainstorms.

As more emphasis is placed on integrated resource management, less soil will become exposed to conditions that would lead to erosion and compaction. As increased efforts are made to re-vegetate exposed soils in all projects, there will be long-term site productivity and reduced off-site impacts.

8.15 Cantonment Area Management

The Cantonment Area at the CSTC contains what can be addressed as an urban forest producing direct ecological benefits to the facilities. Some of those values are production of shade, reduction of noise and dust, increase of wildlife habitat and biological diversity, and landscape values for scenery and leisure time. Also, it contains environmental education values and potential for developing vegetation awareness areas by introducing regional endemic species.

Reforestation in the Cantonment Area

Maintenance of this type of forest requires a more intensive management dealing with species on a one-by-one basis. This setting would require pruning to protect structures, thinning to maintain scenery values, and a long-term growth analysis to avoid problems in the future regarding the compatibility of tree size, etc., with the existing facilities and the proposed general use of the area surrounding the tree.

This forest requires a yearly Tree Condition and Hazard Analysis Survey in order to prevent accidents or damage to humans and property. The product of this survey can also be used to develop maintenance plans and schedules of work for the area.

8.16 Pest Management

The CSTC has a Pest Management Plan (August 1998) to guide actions for controls of pests. The fencing initiative will help the pest management immensely. The pests of primary concern are free roaming dogs, feral cats, rats, and mice.

Rats are controlled in the Cantonment Area buildings and are, apparently, not a sanitation problem.

Dogs are commonly found in the Cantonment Area and may present a nuisance. More specifically, dogs can get into garbage creating an undesirable sanitation condition. Without any form of dog control, it becomes a matter of securing refuse so it is unavailable to dogs. Intentional feeding of feral dogs must be avoided. The local animal control warden could handle the removal of free roaming dogs from the Training Center.

Lizards observed in buildings are not necessarily considered pests as they play a major role in insect control in and around residential structures.

8.16.1 Management Initiatives

Conduct annual monitoring for the mongoose* (*Herpestes auropunctatus*), feral dogs* (*Canis familiaris*), feral cats (*Felis domesticus*), and rats (*Rattus spp*) at the CSTC. The monitoring protocol includes live trapping (20 live traps and 20 bait stations) during an estimated 40 days within each fiscal year. The findings from the monitoring would provide a population estimate and distribution of ‘pests’ within the CSTC, and would be used to correlate the number of human-species interactions.

8.16.2 Expected Benefits

Exotic species populations are becoming a greater threat to all users at CSTS. Health concerns have prompted the CNF to implement monitoring of the following non-native species: feral dogs & cats, mongoose, and rats. There is a need for the assistance from the USDA Animal Plant & Health Inspection Service (APHIS) Wildlife

Services to train present technicians in deploying live-traps and bait stations. GPS data points will be collected to visualize the dispersion of exotics. Fauna monitoring will enable to rapidly and consistently evaluate biological resources on the CSTS throughout the planning session. The following monitoring initiative is proposed to be conducted on an annual basis:

8.17 Fire Management

8.17.1 Existing Condition

As areas burn on a yearly basis, there is a continual increase in acres of grassland habitat and a decrease in forested areas.

Fire disturbance is one of several factors that maintain the ecosystem on Camp Santiago in a secondary dry forest and secondary thorn-shrub type of vegetation. A 1984 study on the flora of Camp Santiago indicates that there are few remnants of the original climax forest that once existed on the Camp. Fire, grazing, and disturbance by vehicle travel have all been a part of the gradual conversion of the old forest to drier, more open grass types. Fire will continue to be a disturbance factor at least in portions of the Training Center.

February 2005 Wildfire

The risks associated with fire will continue to be a part of the ecosystem. Fire presents a risk to people using the Camp, to the facilities, and to adjacent landowners. The ecosystem on the CSTC is at risk as it continues to convert from a forested area to a drier grass type of vegetation.

The CSTC and the surrounding communities are affected by wildland fires and associated smoke. The areas most directly affected are the drier grasslands that have repeatedly burned in the past and with this continual burning cycle, there is very little opportunity for new trees to regenerate and grow in the burned over areas.

While most of the acres burned are in the dry grassy areas, there are several sites of secondary forest areas that have burned in the last year. Fire on these sites will continue to keep the areas from moving towards the original vegetation types that previously existed on Camp Santiago. Each time one of these areas burns, there is a significant time loss for the area to reach a mature climax forest.

8.17.2 Management Initiatives

8.17.2.1 Prescribed Burning

At this time, prescribed burning is not proposed. A more detailed fire prevention and fire suppression plan would work to keep fire out of the forested habitats where the fires are damaging the forest ecosystems.

8.17.2.2 Fire Prevention and Suppression

Fire prevention is the best way to reduce new fire starts within the Training Area. Almost all fire starts are caused by human activities such as debris burning, cigarettes, and activities associated with individual and crew-served weapons training. Fire prevention initiatives included in the CSTC INRMP are:

- Establishment of a permanent weather station at Camp Santiago - this is the preferred method for identifying the days and specific times of the days that have a higher potential for new fire starts. Scheduling of different training activities could also be used to reduce the potential for wildfire starts. Activities with a high potential to start fires could be scheduled during the rainy season and activities with a low potential to start fires could occur during times of high fire danger. (Refer to Figure 8-11, Remote Automated Weather Station, page 8-95.)

Fire Suppression

All fires that start within the forested environment must be suppressed. The best way to avoid a new fire start is through proper prevention during periods of high fire danger. The Camp Santiago Operating Plan describes the process for shutting down operations and extinguishing fires immediately on Ranges 22 and 27. The Operating Plan includes the same statement for training areas N, M, and L.

In the current Operating Plan, the Company that is using the area is responsible for extinguishing any fires that start in the area where they are training.

Powerline Fuelbreak on CSTC Lands

When fires occur in the forested areas, it would be advantageous for the Camp to have its own wildfire engine and group of trained fire fighters that would respond to the fires in these areas. Fire suppression initiatives included in the CSTC INRMP are:

- Acquisition of two 1-ton wildland fire trucks. To meet National Wildland Fire Standards, each truck is to be equipped with 200 to 400 gallon water tanks, pumps with a minimum capacity of 50 gallons per minute, 300 feet of 1½-inch hose, 300 feet of 1-inch hose, and 6 hand-tools per truck. Each truck is to be staffed with three qualified fire fighters. (Refer to Figure 8.13, Fire Suppression Water Tank / Pump Initiative, on page 8-97.)
- Fuelbreaks will be developed and maintained around all new plantations on Camp Santiago. These fuelbreaks would include the removal of all fuels and vegetation covering a 5-foot wide zone, at the minimum, along the area to be protected. Again, it would be good for the Camp to have its own wildland fire engine and crew of wildland firefighters to assure that any fire will be contained prior to reaching the plantation.

Proposed fuelbreaks would use the lateral prism of existing roads, and extent 10 to 15 feet on each side with a fuel-free or reduced-fuel area. These reduced-fuel zones could be mowed and maintained with conventional mechanized machinery from the road and would create a fuelbreaks, in conjunction with the existing road width of 40 to 50 inches wide. During a fire event, a wet line would be created by an engine, a sprinkler system, or other method on one or both sides of the road, creating an effective fuelbreak. Wet lines can be used anywhere the savannah grass fuel exists and will generally be effective for about an hour.

Fuelbreaks Adjacent to Plantations

The proposed construction of 300 meters of fuelbreaks (see Figure 8.13, page 8-97) along existing and proposed plantations would enable initial attack forces to rapidly deploy along pre-determined containment lines.

- Recommend that existing plantations be accomplished first.

As described before, these fuelbreaks may not stop fire on an average worst day scenario, without fire personnel and equipment to support them. They would, however, function as anchor points for prescribed fire treatments, if prescribed fire were to become an available tool for fuel maintenance and reduction with CSTC. These fuelbreaks would be most effective if proposed hydrants (see Figure 8.13, page 8-97 are integrated along proposed locations. These hydrants would also be used in plantation maintenance.

Fuelbreaks Adjacent to Ranges

Assess the need and feasibility of the construction of fuelbreaks adjacent to firing ranges to contain potential wildland fire events.

Fuelbreaks around existing and proposed ranges would enable initial attack forces to rapidly deploy along pre-determined containment lines. These fuelbreaks may not stop fire on an average worst day scenario, without fire personnel and equipment to support them. These fuelbreaks would be most effective if proposed hydrants (Figure 8.13, page 8-97) are integrated along proposed locations.

- Recommend that hydrants or other portable sources of water (such as porta-tanks) be available at all ranges during fire season for rapid response and refill capability in the event of a fire in the vicinity of the range.

- Recommend refill capability in the event of a fire in the vicinity of the range.

- Recommend that this strategy be incorporated into all training plans that occur during fire season.

Fuelbreaks Adjacent to the Ammo Area

- Recommend accessing the need and feasibility of the construction of fuelbreaks adjacent to the Ammo Area to protect the facility from a potential range fire.

Sprinklers

- Recommend installing a sprinkler system for use in suppressing fires.

Sprinklers are an effective and economical method of creating wet lines in advance of a wildland fire event and have been proven to work well in the fuel type common on the CSTC. These systems may be as simple as sprinkler heads fabricated onto a standpipe of suitable height, separated by an appropriate distance of sufficient diameter hose, or hard line, and connected to an adequate water source.

These systems can be installed prior to fire season adjacent to a high value resource, such as a tree plantation, and left in place. They are then charged during a fire event and can be left along or serve as a safe zone for personnel or equipment during the fire event. They should be tested throughout the season and maintained during the fire event. They should be tested throughout the season and maintained in a ready condition. The domestic water capacity at CSTC and age and capacity of existing water storage tanks need to be considered to charge and sustain such a system.

Sprinklers can also be pre-loaded on a trailer or vehicle to be rapidly deployed in the event of a wildland fire. These units can be purchased or fabricated by on-site personnel with welding skills.

Portable Water Sources

- Recommend acquiring portable water source devices to be available for initial attack during a wildland fire.

Portable water sources, such as folda-tanks, can be pre-positioned on site for use in refilling engines and backpack pumps. It is recommended in lieu of, or in addition to, hydrants at each firing range, a source of water is made available at strategic points for rapid response to wildland fire. A larger porta tank, or pumpkin, either pre-positioned or brought to the fire site, would allow for helicopter dip operations and initial attack ability into rough terrain not normally accessible by vehicles.

Folda-tank

Pumpkin

Other Equipment / Supplies

- Recommend acquiring other equipment and supplies for use in fire suppression activities.

No-Mex Clothing - All wildland firefighters are required to wear approved fire resistant clothing and fire shelters. CSTC should have an adequate inventory of approved firefighting clothing, gloves, hardhats, fire shelters, etc. for all qualified personnel.

Fire Hose – CTSC's fire cache should have an adequate supply of wildland fire hose in increments of ¾ inch, 1 inch, and 1½ inches. Thread specifications should be considered if it is likely that other hose, with dissimilar thread, would be connected. Appropriate valves, nozzles, and connectors should also be considered.

Belt Weather Kits - These portable weather kits allow on site weather information, such as ambient temperature, relative humidity, and wind speed, to be readily available. There are also small digital instruments, such as the Kestral model, which retrieve and store this data.

Hydrant(s) and Hydrant Lines

- Install additional hydrant and hydrant lines (refer to Figure 8-13).

This initiative would provide better on-site water sources to assist in initial attack during range fire suppression operations. This additional water source would also provide support for the maintenance of the CSTC plantations.

Other Alternative Fuel Reduction Methods

- Recommend assessing effectiveness of alternative fuel reduction methods

Grazing - Evidence indicates that part of the reason there is more wildland fire incidence is the cessation of grazing at CSTC. Range cattle consume the fine fuels, which, when cured during fire season, are the main component of wildland fire spread at CSTC. Selected areas could be fenced, either electrically or barbed, and allowed to be grazed, reducing hazardous fuels.

Herbicide - Herbicides, when applied properly and during the right time of the year, are also effective at reducing fine fuel accumulation.

Other Initiatives

- Recommend continuing to develop and maintain weather and wildfire data in the GIS database and other formats, such as Excel spreadsheet, to enable users to query historical data. Recommend that permanent vegetation response plots to measure post-fire plant succession be established in all burned areas over 10 acres (as per recommendation of USFWS letter dated June 19, 2001.

- Recommend that additional surveys be conducted in the area in order to provide further documentation of the areas of flora."

- Recommend fire suppression training.

All firefighters on federal lands, or under the auspices of a federal agency, need to be qualified under the National Fire Training Qualifications System. Some of the basic courses every firefighter must have are:

- S-260 Fire Business Management
- S-131 Advanced Firefighter
- S-132 Standards for Survival
- S-133 Look up, Look down
- I-200 Intro to ICS
- S-215 Urban Interface
- S-234 Ignition Operations
- S-290 Fire Behavior

These courses could be taught by a small cadre of trainers. For example, these courses are taught, along with many others, at the training academy on the Flathead National Forest every year for minimal cost per student. To keep costs down, materials are produced in-house and government facilities are used.

- Recommend establishing a Fire Danger Rating System at CSTC

Establish a Fire Danger Rating (FDR) system for CSTC to be monitored and implemented by a qualified individual during fire season. According to weather data, fires burn readily during fire season when the following conditions occur:

Temperature	>65º
RH	<60%
Wind	>12 mph
Wind Gusts	>20 mph

We recommend a FDR of "HIGH" be implemented when the above parameters are reached, or are forecasted. Wind is the driving factor for most fires at CSTC. When wind gusts are forecasted at greater than 20 mph, a "Red Flag" alert should be issued. This strategy needs to be coordinated with the Bomberos de Estatal and other adjacent cooperators and posted at central places at CSTC and the surrounding communities. Training managers at CSTC need to determine what activities are appropriate, if any, and in what locations, when fire danger is HIGH.

Expected Benefits

The Camp currently has a good Operating Plan for fire prevention and suppression, but this alternative would add a wildland fire suppression organization to their existing plan and would ensure trained personnel were responsible for fire suppression.

There would be a better chance of extinguishing wildland fires while they are small, which would lessen the risk of fire encroachment into forested areas, plantations, and riparian areas. Through time, there would be an overall increase in acres of secondary forest types and a decrease in acres of grassland types.

The fuelbreaks will prevent fires from burning into the plantation areas.

The threat from wildfire to facilities at the CSTC and to the local community will be reduced.

The amount of lost training time due to disruptions caused by wildland fires would be reduced.

8.18 Special Interest Area Protection

8.18.1 Upland Forest Vegetation and Riparian Areas

Training Areas M and L have valuable forest habitat for wildlife. Riparian areas along watercourses in other areas have special values for wildlife and habitat diversity. Emphasis is on protecting these areas from deforestation and then allowing forest succession to expand. In the case of stream course riparian areas, it is desirable to have wider widths of forest tree cover.

The fire management and fencing initiatives are the most effective tools for protecting and allowing succession of forest growth. These initiatives incorporate the needs for protecting forested wildlife habitats to the extent feasible with training operations. Streamside and river improvements with reforestation and other plantings will be compatible with wildlife habitat needs.

Training exercises that integrate operations for limiting physical impacts to the forest vegetation and streamside vegetation during maneuvers, bivouacs, and firings would meet the needs for wildlife habitat protection.

8.18.2 Cultural Resources

The CSTC is considered rich in terms of historic sites and artifacts present within the Training Area. Initiatives to identify and protect cultural resources include:

- Historic site inventory.
- The requirement that cultural resource inventories must be conducted within areas proposed for ground disturbing activities prior to the activity taking place.
- Modify the Training Site operations map to show known cultural sites as "restricted, off-limits areas."
- Install barbed-wire fencing around (selected) identified historic sites.

Chapter 13 of this document discusses the CSTC cultural resources in detail.

8.19 Outdoor Recreation

8.19.1 Military Mission Considerations

Recreation activities are prohibited in the main impact area. Other designated areas, such as the ammo supply point, are designated as off limits or restricted. Range Control may also close active training areas for public use. The installation can be closed at the discretion of the Installation Commander when deemed necessary.

8.19.2 Public Access

The public is only allowed access for recreation purposes within the Cantonment Area where activities are limited to social events for Training Site users, their families, and local civic groups such as the Girl/Boy Scouts.

Civilians trespass onto the training facility for purposes of recreation.

8.19.3 Hunting, Fishing and Trapping Programs

There is no hunting, trapping, or fishing allowed on the CSTC.

8.19.4 Recreation and Ecosystem Management

Human uses and their social needs are an integral part of ecosystem management. The outdoor recreation program is based on providing quality experiences while sustaining ecosystem integrity. Special considerations will be given to protecting critical areas (e.g., cultural resource sites) from negative impacts due to outdoor recreation.

8.20 Training Requirements Integration (TRI)

A Range and Training Land Program (RTLP) Development Plan (RDP) for the CSTC is currently being prepared through coordination between the PRARNG, U.S. Army Engineering and Support Center, and Nakata Planning Group, LLC. A preliminary draft of this RTLP was published in August 2000.

The Integrated Training Area Management (ITAM) program is currently being developed for Camp Santiago. The Training Requirement Integration (TRI) component of the ITAM program will identify Camp Santiago's training requirements and determine the areas that can best support various training activities. TRI is a major land protection phase of ITAM. It uses information from LCTA and GIS to determine viable training load carrying capacities and to locate military training exercises accordingly. Load carrying capacity takes into account the status of the natural and cultural environment of training areas at the time the training events take place.

Figure 8.7. Forest Restoration Initiative Map

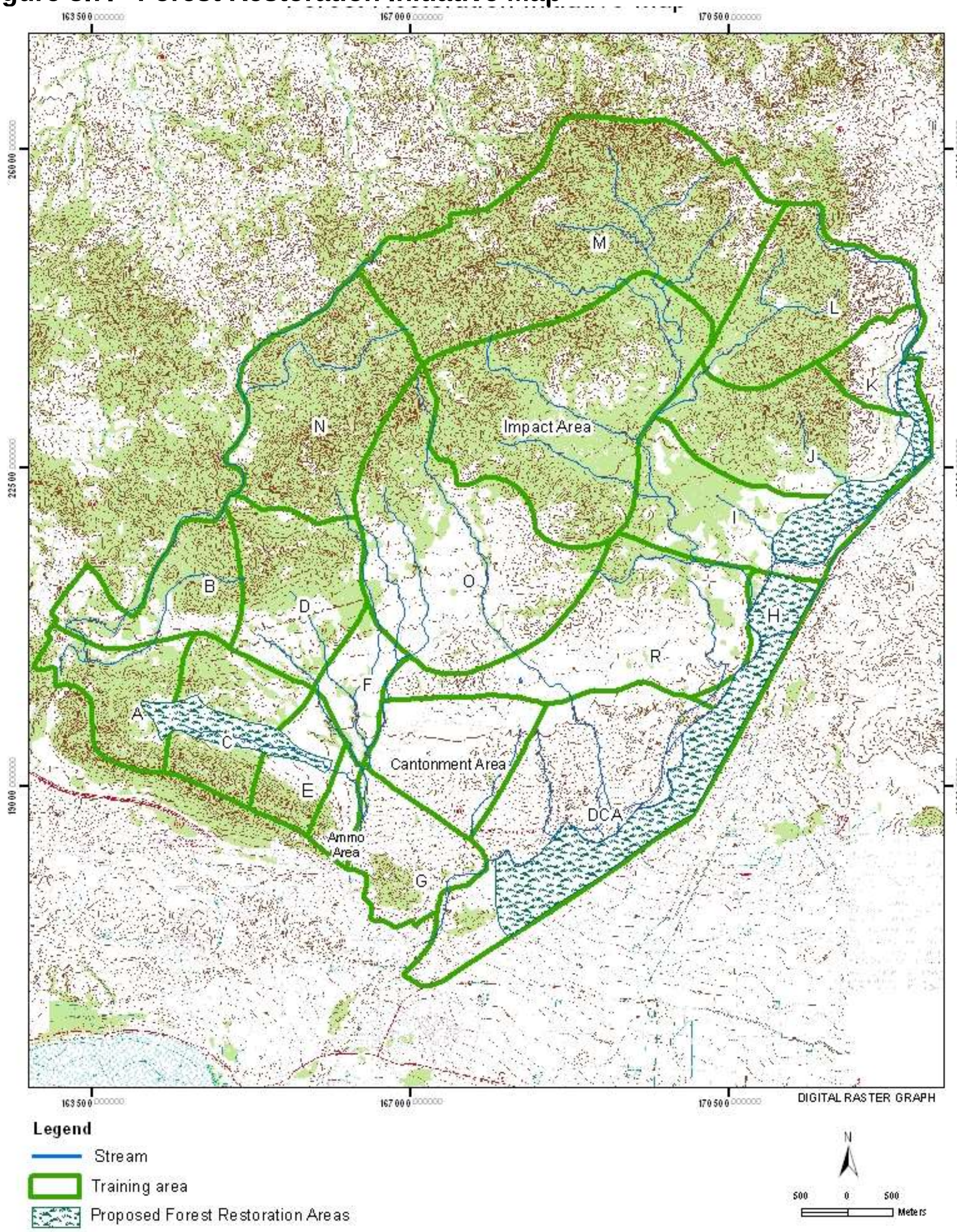


Figure 8.8. Fencing Initiative Map

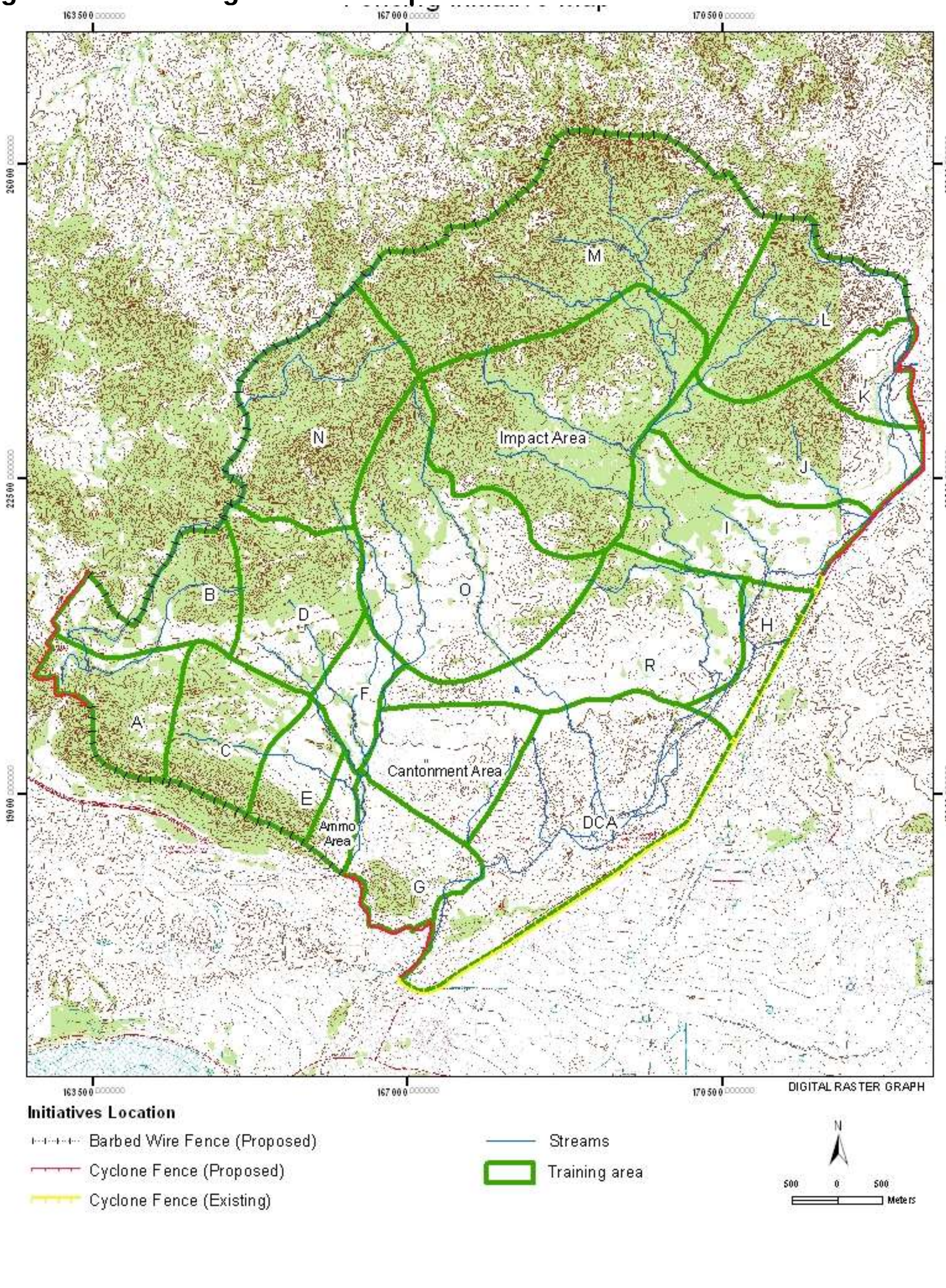


Figure 8.9. Riparian Area Restoration Initiative Map

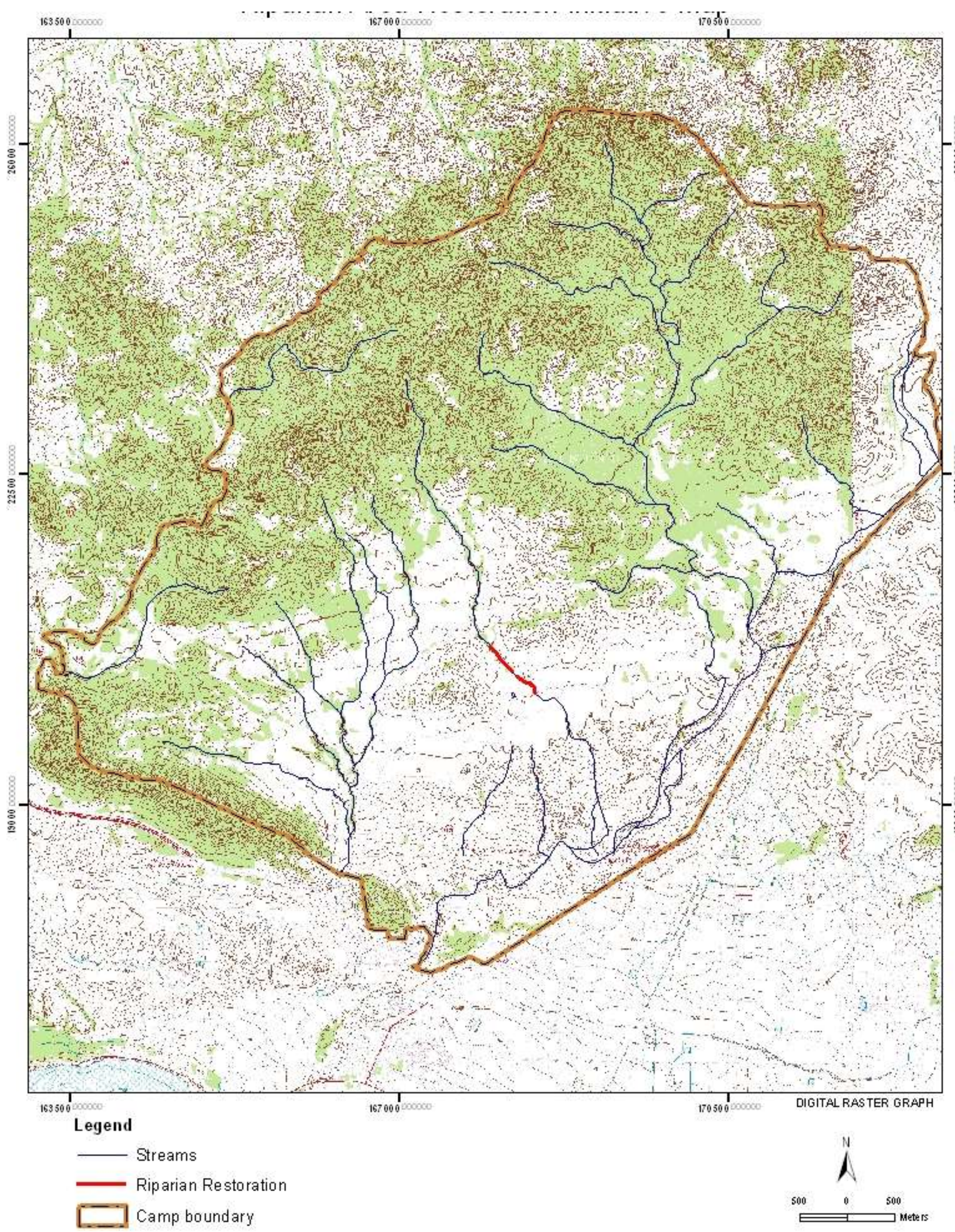


Figure 8-10. Wildlife Habitat Improvement Initiative Map

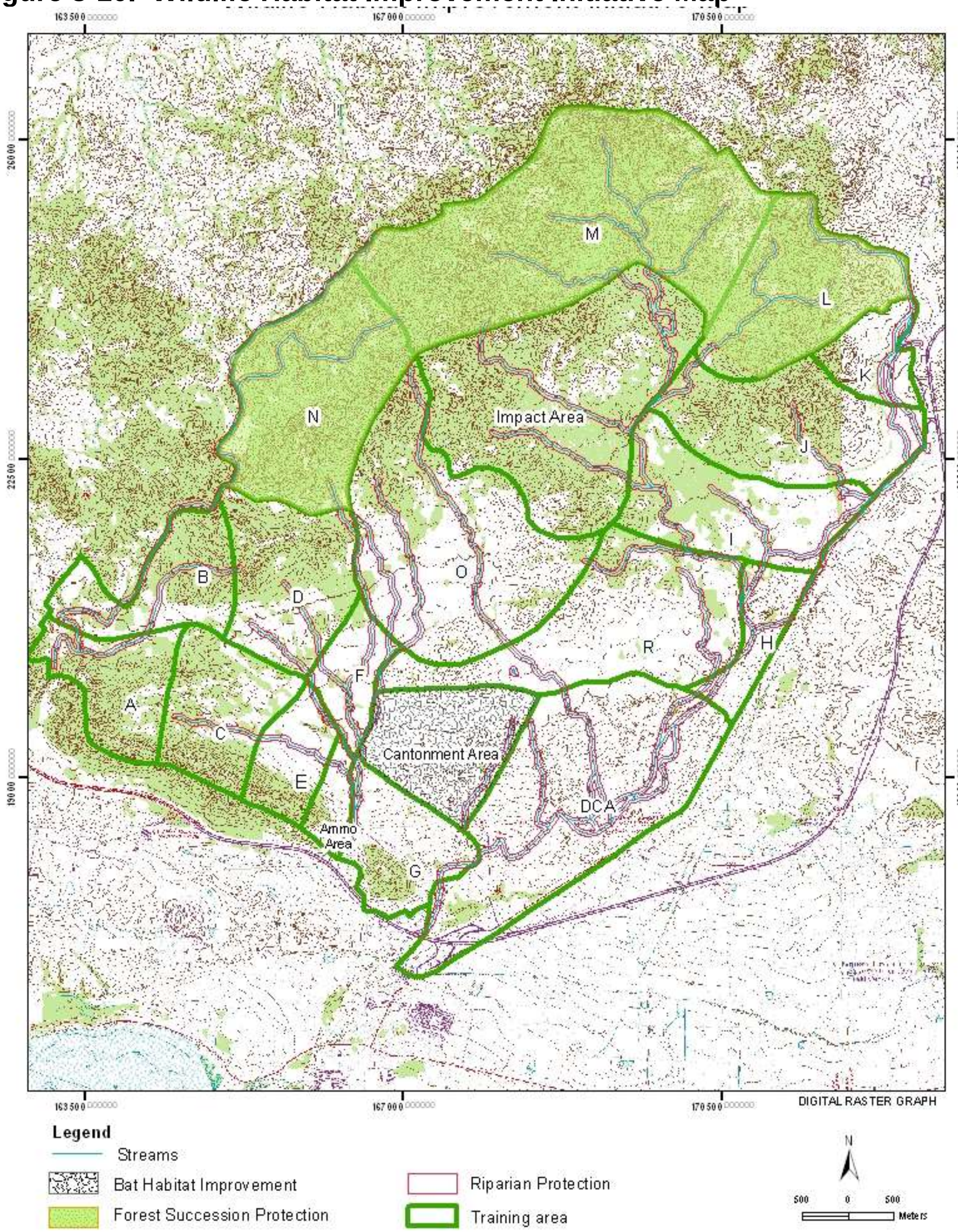
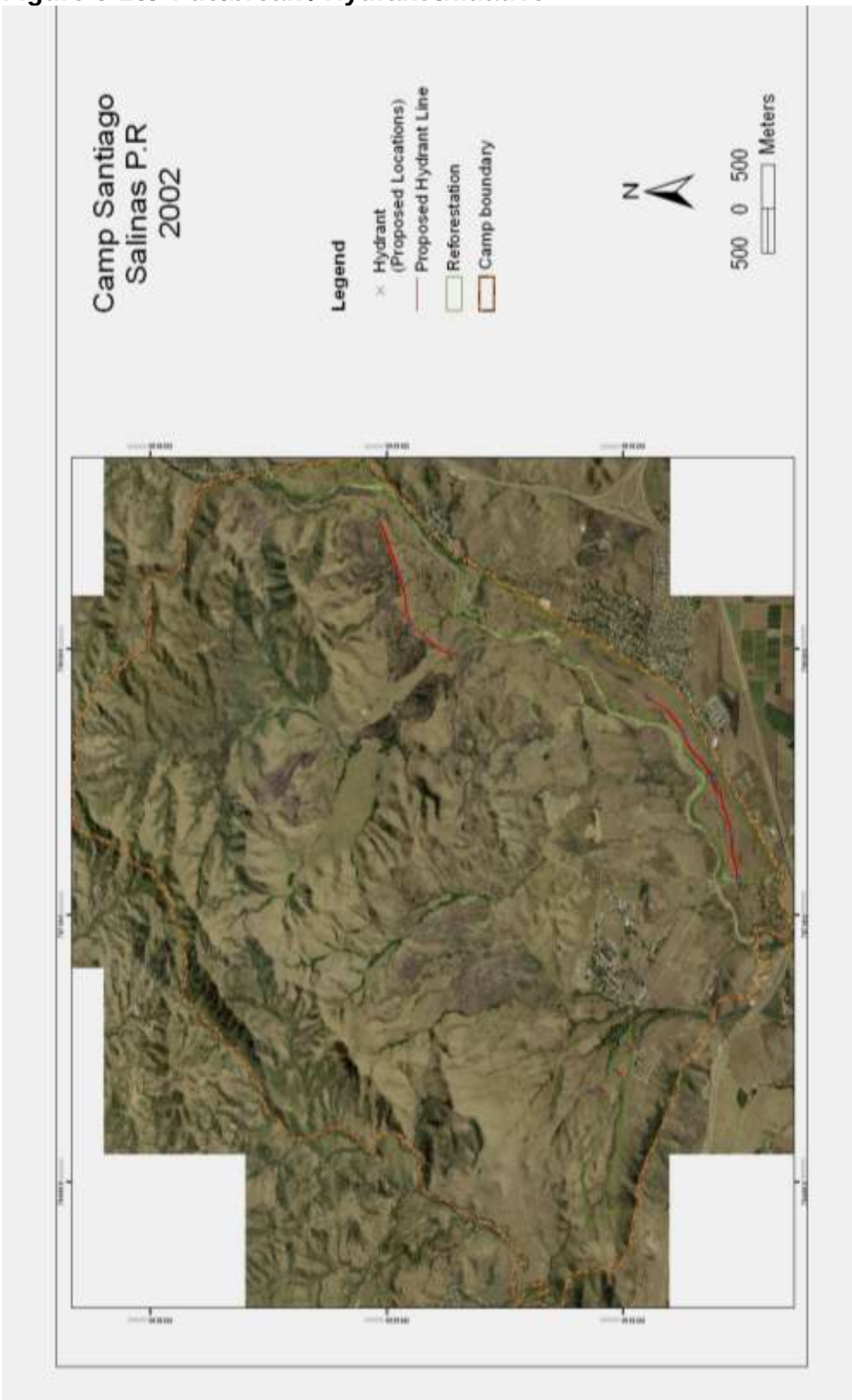


Figure 8.11. Remote Automated Weather Station Initiative

Figure 8.12. Fire Suppression Water Tank / Pump Initiative

Figure 8-13. Fuelbreak / Hydrant Initiative



Chapter 9: Inventory and Monitoring

9.1 Objectives

The objectives to the inventory and monitoring initiatives are to:

- Document the existing condition of the natural resources within the CSTC;
- Determine the effectiveness of the INRMP initiatives to protect, restore, and enhance natural resources ;
- Monitor changes and predict trends for natural resources;
- Identify additional management actions that are required for the protection and preservation of natural resources.

9.2 General

This chapter describes the inventory and monitoring initiatives that are required to make determinations about the effectiveness of the CSTC INRMP. Natural resources to be inventoried / monitored include flora, fauna, and water quality; additionally, weather data and information on wildland fire starts will be gathered.

The inventory/monitoring protocols provided for each resource to be evaluated include:

▪ **What**	Specifically what is to be monitored,
▪ **Where**	The area or location where the inventory/monitoring will be conducted;
▪ **When**	The timeframes and/or frequency of the inventory/monitoring;
▪ **Why**	The purpose for conducting the inventory/monitoring;
▪ **Expected results and uses**	Describes how the inventory/monitoring information will be used.

The inventory/monitoring protocols provided do not include:

▪ **How**	The methods used to conduct the inventory/monitoring;
▪ **Who**	Organization/individuals who will conduct the inventory/monitoring.

The *"how and who"* of the inventory/monitoring protocols must be developed through a collaborative effort with partners; partners who have expressed interest in participating with the PRARNG in the CSTC INRMP inventory/monitoring include:

- University of Puerto Rico (Ponce);
- Puerto Rico Department of Natural Resources and Environment;
- USDA, Forest Service, Caribbean National Forest;
- USDA, National Resources Conservation Service;
- U.S. Fish and Wildlife Service;
- U.S. Geological Service.

The Integrated Training Area Management (ITAM) for the CSTC includes a Land Condition Trend Analysis (LCTA) Program; this program includes monitoring of Training Center usage, potential usage, and trends. The results of the LCTS will provide useful information in evaluating the results of the INRMP inventories and monitoring projects.

Tables 9.1 through 9.5, Inventory and Monitoring Plan, on pages 9-5 through 9-12 provide a summary of the INRMP inventory and monitoring initiatives.

9.3 Flora Inventory and Monitoring

Flora inventory and monitoring initiatives include:

- Vegetation cover monitoring surveys of all the CSTS lands on a 5-year cycle to determine overall forest recovery within areas currently dominated by invasive grasses. The surveys will also allow continual assessments of vegetation conditions and wildlife habitat and assist in predicting trends. This inventory meets the intent of AR 200-3 to complete an inventory of all the CSTS on a 10-year cycle.
- Monitoring the effectiveness of the forest and riparian planting initiatives and to determine if additional planting or thinning is required. These inventories are to be conducted yearly for 5 years from the date of the planting.
- Annual inventory of urban forest conditions to identify safety hazards and monitor overall forest health.

9.4 Fauna Inventory and Monitoring

Fauna monitoring initiatives includes:

9.4.1 Bird Surveys

Conducting bird surveys to determine the presence of threatened or endangered species, neo-tropical migratory birds, and to monitor the local resident bird community. Depending on available funding, these surveys are to be conducted on either a 1, 3 or 5-year cycle.

Conduct annual monitoring for the occurrence of the black-faced grassquit (Tiaris bicolor) at the CSTC. The monitoring protocol includes evening 50-meter bird call point counts conducted during three days within the late spring timeframe. The findings from this monitoring will provide information on native bird species composition, assist in predicting trends, and help in evaluating the effectiveness of management initiatives designed to protect and improve forest and riparian area habitat values.

9.4.2 Native Aquatic Species Monitoring

Annual monitoring of populations of river shrimp (*Atya lanipes*), rosy barb (*Barbus conchonius*), and Tilapia (*Tilapia mossambica*) in the Rio Nigua. This monitoring would be conducted during the wet season (August – September) and includes electrofishing at long-term reaches. The findings from this monitoring will provide a long-term data of the river's native aquatic species composition, assist in predicting trends, and help in evaluating the effectiveness of management initiatives designed to protect and improve water quality and aquatic habitat values.

9.4.3 Native Amphibian Species Monitoring

Annual monitoring of populations of the common coqui (Eleutheryldactyl us coqu). This monitoring would be conducted within three nights during the late spring timeframe and includes evening 50-meter coqui call point counts. The findings from this monitoring will provide a long-term data of the occurrence of native amphibians (coqui and possible species presence) at the CSTC, assist in predicting trends, and help in evaluating the effectiveness of management initiatives designed to protect and improve forest and riparian area habitat values.

9.4.4 Pest Monitoring

Conduct annual monitoring of populations of the mongoose* (*Herpestes auropunctatus*), feral dogs* (*Canis familiaris*), feral cats (*Felis domesticus*), and rats (*Rattus spp*) at the CSTC. The monitoring protocol includes live trapping (20 live traps and 20 bait stations) during an estimated 40 days within each fiscal year. The findings from the monitoring would provide a population estimate and distribution of 'pests' within the CSTC and would be used to correlate the number of human-species interactions.

9.5 Water Quality Monitoring

Water quality monitoring initiatives include:

- Conduct sediment source surveys on roads to determine effectiveness of road drainage structures and to identify sites where structures need to be added and/or improved. These surveys are to be conducted annually and after any severe tropical storm.

- Conduct stream channel surveys to determine the effectiveness of stream channel and riparian restoration initiatives. Surveys to be conducted twice annually, once during the expected high stream flow in October and once during the expected low stream flow in February.
- Establish permanent stream cross-sections above and below areas where gravel is currently being extracted or is planned to be extracted from areas in or adjacent to stream channels. Monitoring of the cross-sections will identify major shifts in stream channel stability, water quality, and impact on riparian habitat and associated wildlife and aquatic species. Surveys to be conducted twice annually, once during the expected high stream flow in October and once during the expected low stream flow in February.

9.6 Wildland Fire Monitoring

Wildland fire monitoring initiatives include:

- Establish and maintain a database to record all fire starts by cause, size, location, temperature, relative humidity, and wind speed. This monitoring will provide a means for predicting hazard level of potential fire ignitions and predict fire behavior trends.
- Establish a remote automated weather station to monitor daily weather conditions.

9.7 Data Storage, Retrieval, and Analysis

Survey data will be stored in Geographical Information System (GIS) format and referenced in Global Positioning System (GPS), as possible, with applicable points, lines, and polygons. Existing paper files of survey information should be converted to GIS format. Digital orthophotos, digital raster graphic maps, and digital photo images will be used to reference actual CSTS vegetation conditions to compare with future conditions.

The data collected through the inventory and monitoring plan will be kept at the CSTC. This information will be made available, upon request, to interagency resource specialists whom would assist the Training Site Commander in managing the CSTC natural resources in the future.

9.8 Inventory and Monitoring Plan

Inventory and monitoring projects to be accomplished during the next 5-years include:

Table 9.1 to 9.5, Inventory and Monitoring Plan, pages 9-12, provides a summary of the INRMP inventory and monitoring initiatives.

Table 9.1
5-Year Inventory and Monitoring Plan (2006-2010 INRMP for the CSTC)
Cultural Resources

What	How	Where	When/Duration	Why	Who	Expected Results and Uses
Monitoring of on-going projects with potential to impact cultural resources	On-site spot checks, routine inspections, and involvement in project planning	Potential ground-disturbing sites associated with the implementation of INRMP initiatives.	FY-06 - FY-10	• To ascertain if undiscovered cultural resources are found during project implementation. • To assure that recorded sites are protected and not impacted during project activities.	USDA FS in partnership with PRARNG	Avoid unnecessary impacts to sensitive sites.

Table 9.2
5-Year Inventory and Monitoring Plan (2006-2010 INRMP for the CSTC)
Flora (Vegetation)Resources

What	How	Where	When/Duration	Why	Who	Expected Results and Uses
Vegetation cover surveys	Re-measurement of permanent plot clusters and walk-through inventories	All CSTC lands	Conducted one during each 5-year cycle starting in 2006 may need to complete a portion (20%) each year	• To determine overall forest recovery within areas currently dominated by invasive grasses • Provide for periodic assessments of vegetation conditions and wildlife habitat.	PRARNG and partnership with local universities and/or other government agencies	• Evaluate the effectiveness of initiatives designed to protect and enhance forest and riparian vegetation and wildlife habitat. • Document changes and predict trends.
Plantation surveys	Survey methods to be determined (TBD).	Within plantations	Conducted yearly	• To assess seedling survival rates and to determine if additional planting or thinning is required. • Document changes and predict trends.	PRARNG and partnership with local universities and/or other government agencies	Evaluate the effectiveness of the plantations (site preparation & planting methods and irrigation systems); verify that the planting stock used adapted to the site; determine if additional areas should be planted.
Urban forest conditions	Walk through	Cantonment area and adjacent to roads and convoy routes	Conducted yearly	• To identify and eliminate safety hazards and to monitor overall urban forest health	PRARNG and partnership with local universities and/or other government agencies	• Identify and eliminate safety hazards. • Determine the effectiveness urban plantations.

Table 9.3
5-Year Inventory and Monitoring Plan (2006-2010 INRMP for the CSTC)
Fauna (Wildlife) Resources

What	How	Where	When/Duration	Why	Who	Expected Results and Uses
Bird surveys to document presence of threatened or endangered species; neo-tropical migratory birds; and the local resident bird community	TBA	Selected points at the CSTC' points TBA	• December through breeding season of native species. • Depending on availability of funding, conduct yearly, 3-year, or 5-year cycle surveys.	• Determine the bird presence and usage of the CSTC forest and riparian habitat. • Establish baseline data for future comparison and analysis	PRARNG and partnership with others TBA	• Compliance with Endangered Species Act and to conduct further dialogue with USFWS on future resource management of the CSTC. • Surveys will provide bas-line information to be used for future comparison analysis, INRMP revisions, and predicting trends.
Evening 50-meter bird call point counts	Selected points at the CSTC' points TBA	• During three days within the lae spring timeframe.	• Provide information native bird species composition.		PRARNG and partnership with others (TBA)	• Assist in predicting trends. • Help in evaluating the effectiveness of management initiatives designed to protect and improve forest and riparian area habitat values.

Table 9.3 5-Year Inventory and Monitoring Plan (2006-2010 INRMP for the CSTC) Fauna (Wildlife) Resources						
What	**How**	**Where**	**When/Duration**	**Why**	**Who**	**Expected Results and Uses**
Bat surveys (Pallas' Mastiff Bat (*Molossus molussus*)	Monitoring bat boxes for occupation; Bat population monitoring	Bat box locations Location points TBD	Monthly Evening bat netting during three nights during the summer timeframe	• Provide information on bat population and occurrence	PRARNG and partnership with others (TBD)	Assist in predicting trends and in evaluating the effectiveness of management initiatives designed to maintain and improve wildlife habitat.
Native aquatic species monitoring emphasis on the river shrimp (*Atya lanipes*), rosy barb (Barbus conchonius), and Tilapia *(Tilapia mossambica*)	Electrofishing at long-term reaches	Selected sites along the Rio Nigua (locationsTBD)	Annually during the wet season (Aug-Sep)	• Provide information on native aquatic species population and occurrence	PRARNG and partnership with others (TBD)	• Provide long-term data of the river's native aquatic species composition. • Assist in predicting trends. • Help in evaluating the effectiveness of management initiatives designed to protect and improve water quality and aquatic habitat values.

Table 9.3
5-Year Inventory and Monitoring Plan (2006-2010 INRMP for the CSTC)
Fauna (Wildlife) Resources

What	How	Where	When/Duration	Why	Who	Expected Results and Uses
Native amphibian species monitoring emphasis on the common coqui (*Eleutheryldactyl us coqu*).	Establishment of 50-meter coqui call point counts	Selected sites (locationsTBD)	Annually during three nights during the late spring timeframe	• Provide information on native amphibian species population and occurrence	PRARNG and partnership with others (TBD)	• Provide long-term data of the occurrence of native amphibians. • Assist in predicting trends. • Help in evaluating the effectiveness of management initiatives designed to protect and improve water quality and aquatic habitat values.
Pest Monitoring emphasis on Mongoose (*Herpestes auropunctatus),* Feral Dogs* (*Canis familiaris*), Feral Cats (*Felis domesticus*), and Rats (*Rattus spp*)	Live trapping (20 live trap and 20 bait stations)	Selected sites (locations TBD)	Annually during an estimated 40 days within each year	• Provide information on pest population and occurrence	PRARNG and partnership with others (TBD) *There is a need for the assistance from the USDA Animal Plant & Health Inspection Service (APHIS) Wildlife Services to train present technicians in deploying live-traps and bait stations.*	• Findings from the monitoring would provide a population estimate and distribution of 'pests' within the CSTC. • Information would be sued to correlate the number of human-species interactions.

Table 9.4
5-Year Inventory and Monitoring Plan (2006-2010 INRMP for the CSTC)
Water Quality Resources

What/	How	Where	When/Duration	Why	Who	Expected Results and Uses
Sediment source surveys	TBD	CSTC road network, focus on improved roads	Conducted annually and after any sever tropical storm	• Determine the effectiveness of road drainage designs; • Identify sites where structures need to be added or improved to reduce erosion from roads.	PRARNG and partnership with others (TBD)	Develop a prioritized listing of road drainage structure maintenance / repair projects. Improved road designs will eliminate sediment source and thereby improve water quality.
Stream channel stability surveys	TBD	All CSTC stream channels	Conducted twice annually (October & February)	• Determine current stream channel and stream bank conditions and to monitor changes over time. • Monitor the establishment and growth of seedlings planted within the riparian areas	PRARNG and partnership with others (TBD)	Determine effectiveness of INRMP initiatives to improve stream channel stability and restore / enhance riparian vegetation.

Table 9.4
5-Year Inventory and Monitoring Plan (2006-2010 INRMP for the CSTC)
Water Quality Resources

What/	How	Where	When/Duration	Why	Who	Expected Results and Uses
Establish permanent stream cross sections	TBD	Above and below stream segments where gravel has / is being extracted and where channel cleaning operations are routinely conducted	Conducted twice annually (October & February)	• Determine current conditions and establish baseline for future analysis. • Monitor to identify changes in stream channel stability, water quality, and impact on riparian habitat and associated wildlife and aquatic species.	PRARNG and partnership with others (TBD)	• The surveys are expected to show an obvious difference in the amount of channel shifting caused by extreme rain events at cross-sections established below the operations when compared to “reference sites” above the extraction sites. These differences will diminish in magnitude when extraction ceases and riparian areas are replanted with deeply rooted vegetation. • Determine effectiveness of INRMP initiatives to improve stream channel stability and restore/ enhance riparian vegetation.

Table 9.5
5-Year Inventory and Monitoring Plan (2006-2010 INRMP for the CSTC)
Range Fire Condition Monitoring

What/	How	Where	When/Duration	Why	Who	Expected Results and Uses
Maintain a remote automated weather station; record all fire starts by date, cause, size, location, and temperature, relative humidity, and wind speed.		Locate near the Range Control building	Conducted year-round whenever weather data is needed particularly during the fire season	To determine current and forecasted fire danger rating	PRARNG and USDA FS	• Consistent method of monitoring and forecasting fire weather data; • Information can be used in cooperation with Bomberos de Estatal to determine wildland fire risk; • Information can also be used to calibrate weapon systems and in the preparation of the commander’s risk assessment.

Chapter 10: Research and Special Projects

10.1 Objectives

The main objectives of special projects or research to be carried out on CSTS lands would be to accumulate base data from which to develop sound management directives and to obtain criteria elements to evaluate the performance of those directives.

10.2 Research Mechanisms

Research should be done through partnerships with non-governmental organizations interested in the conservation of natural and cultural resources and with universities (locals or from mainland) interested in the natural resources dynamics of the subtropical dry ecosystems and dry ecosystems recovery ecology. The International Institute of Tropical Forestry (IITF), the research unit of the Forest Service Southern Region located in Rio Piedras, Puerto Rico, is a great asset and an excellent partner to develop research proposals that could clarify management questions related to the resources of the CSTS. Also, some research can be pursued in-house, in partnership with any interested parties, or cooperative agreements with local or federal agencies.

10.3 Planned Research / Special Projects

There are two research proposals being implemented that actually relate to the CSTC and its natural resources. One study plan (FS-IITF-4151-2541) with title “Protection and Planting to Accelerate Increases in Biodiversity on Deforested Sites” has the objective to evaluate the protection from grazing and/or fire, tree planting, and seedlings as techniques for promoting the re-establishment of diverse forest stands and to seek clues to the underlying principles driving natural increases in biodiversity during reforestation (Francis and Parrotta, IITF 1994). The other study plan (FS-IITF-4151-2548), is titled “A Historical Investigation of Deforestation by Fire and other Causes and Natural Reforestation in the Salinas Area.” This study uses qualitative and quantitative methods to explore the progress of deforestation by fire (and port-fire recovery) and other agents, and post-disturbance forest recovery from 1940s to the present using locally available aerial photographs and other remotely sensed imagery (Rodriguez et al., IITF, 1997). Although this project includes all of the Municipality of Salinas, most of the CSTS is part of the analysis.

There is need for an aquatic fauna and flora survey and their history on intermittent aquatic ecosystems and population studies of the fauna present at the CSTS. These projects should be implemented concurrently with the introduction of the implementation initiatives proposed in this plan. This will give the PRARNG a measuring point to compare success or need to change any of the management directives implemented.

Chapter 11: Enforcement

11.1 Natural Resources Law Enforcement

A natural resources law enforcement program does not exist at CSTC for enforcing hunting and fishing activities; hunting and fishing opportunities do not exist at CSTC.

The CSTC security program includes patrol of the Training Center by military police, other designated military personnel, and local animal wardens. These patrols provide protection to natural resources by:

- Limiting civilian trespass and unauthorized extraction of commodities such as vegetation and minerals, disturbance of cultural resources or the theft of artifacts, and the dumping of trash;
- Limiting the trespass of livestock and associated natural resource damage;
- Limiting the presence of domestic pets and stray dogs and associated natural resource damage.

Chapter 12: Environmental Awareness

12.1 General

Camp Santiago's Training Center Commanders have consistently placed an emphasis on sound land stewardship practices and promoting the protection of natural resources within the Training Center. Current Training Site Range Standing Operating Procedures, dated 1 October 2000, place emphasis on protection of natural resources (Appendix VI – Training Areas and Facilities Requirements, Appendix VIII – Range Safety Procedures and Operating Requirements, and Appendix X – Movement on Roads and Trails).

The CSTS has an effective environmental awareness program in place; therefore, it is not necessary to address the issue of environmental awareness.

12.2 Objectives

To protect the natural resources, Camp Santiago's Training Center Commanders have placed strong emphasis on promoting environmental education and awareness of the Training Site users. The Environmental Awareness component of the ITAM Program provides a means to develop and conduct CSTS Environmental Awareness.

Environmental awareness is a people-oriented, education and consciousness-raising program to encourage environmental stewardship and responsible use of the CSTC natural resources. The purpose of environmental awareness is to prevent unnecessary damage to the environment and, in particular, training lands by providing information to all Center users. It has a two-fold thrust: one for unit leaders and the other for non-military Training Center users. Environmental awareness is designed to improve their understanding of the effects of their mission, training, or activity on the natural resources of the CSTC.

12.3 Military Personnel and Public Awareness

Environmental awareness also serves to educate the public and gain their support by effectively communicating the nature of the military mission at the CSTC and the level of success of natural resources management at the Training Center. When military users and the public are informed and educated about management practices, they tend to give their support rather than opposition to the practices.

The PRARNG has an aggressive and progressive command climate in which existing and potential environmental stewardship conditions, issues, and constraints are fully integrated into all mission training support and installation planning activities.

The following vision statement for Camp Santiago by the Training Site Commander reflects his emphasis on ecosystem management and good land stewardship:

"…to be clean, well organized, free of vandalism, secure, respectful, available, warm, peaceful, and appealing to the senses"

Goals for military personnel and public environmental awareness include:

- Develop and distribute to the Training Site users range standard operating procedures and training bulletins that identify environmental requirements, considerations and guidelines for military tenants using the facilities and resources.

- Develop other troop environmental awareness materials for use at CSTC.

- Provide public service announcements and news releases to inform the public of events occurring at the CSTC.

Chapter 13: Cultural Resource Protection

13.1 Objectives

The CSTC's immediate objective is that none of the ground disturbing activities resulting from the implementation of this INRMP will adversely impact cultural resources.

The CSTC's ultimate objectives of the Cultural Resources Program are to identify, inventory, protect, enhance and preserve the cultural resources within the facility. While serving as the stewards of these irreplaceable cultural resources, CSTC has the opportunity to use the environmental data available in the sites to learn about the region's past environments, use this information to evaluate current conditions and project these findings into the future, and educate the general public and military personnel on the importance of protecting, preserving and learning from cultural resources.

The objectives of the Cultural Resources Program as stated in the Draft Integrated Cultural Resources Management Plan are to ensure that implementation of this INRMP is consistent with protecting cultural resources at CSTC.

13.2 Cultural and Historic Resources

13.2.1 Previous Research

Though earlier archaeologists investigated sites in the Salinas area, it was Archaeologist Miguel Rodriguez (1985), under contract with CSTC, who was first to record any sites within the boundaries of CSTC. In 1984,in his partial inventory of the training facility, he employed a stratified random sample to systematically survey 10 percent of CSTC. The survey covered various high and low probability zones based on environmental criteria. An additional undetermined percentage of the Camp was incidentally surveyed while accessing the randomly located survey blocks; wholly 17 of the 22 prehistoric sites were found outside the pre-selected units.

Rodriguez's CSTC survey identified 22 prehistoric, and 2 historic sites. The prehistoric sites all date to the Ceramic Age, with sites representing Rouse's Periods III and IV (600 –1200 A.D. and 1200-1500 A.D., respectively); no Archaic Age or Saladoid sites were identified. Eighteen of the sites recorded have components dating to the older Period III and are known as the "Elenan/Ostionan Ostionoid" or "Pre-Taino". It is generally agreed that these groups developed in place from earlier South American migrations of ceramic-making agriculturalists -- the Saladiod and Huecoid groups. During the Ostionoid, they gradually changed their material culture; more marked changes occurred in the diet, with a shift away from heavy reliance on land crabs towards heavy exploitation of shellfish -- an abundant resource on the south coast – but continued dependence on manioc as a staple.

These groups began inhabiting areas further inland than their Saladoid predecesors, probably because of increasing population pressure and greater familiarity with inland resources; this theory is well supported by Rodriguez’s (1985:74-75) findings at Camp Santiago. Most, but not all of the Elenan Ostionoid sites at CSTC were abandoned before the subsequent Period IV began.

The seven Period IV prehistoric sites found in CSTC represent the emergence of the Taino between 1200 to 1500 A.D. The Tainos continued expansion into the interior and developed more elaborate religious and political organizations. By the time of European contact, regional caciques exerted considerable control over large parts of the island. With the increase in political activity, ceremonialism became more public, the evidence is a greater focus on plaza architecture. Three of the CSTC sites with plaza-batey stone enclosures have a Taino element. The drop in the number of recorded sites from the Pre-Taino to the Taino Periods might reflect abandonment of marginal lands due to minor climatic fluctuations, or might reflect the rising influence of the caciques during the Taino period, where people were drawn to live concentrated around this central authority figure.

So far, there is no evidence of the proto-historic contact period at CSTC. In fact, the absence of data suggests only sporadic use of the area for the nearly 300 years of Spanish colonialism. This reflects Spanish land-use practices, with a dry-land pastoral economy resulting in less permanent archaeological evidence than the agricultural activities taking place in moister habitats elsewhere in Puerto Rico. The two historic sites located during Rodriguez’s CSTC survey are: 1) the severely impacted ruins of Hacienda Lago; and 2) a well preserved, small, brick and rock dam across a creek. Both date to the early 1900’s and apparently are related to ranching activities.

CSTC has contracted several project-specific cultural resources surveys, among them is a Phase IA/IB report that tested a proposed sewer line (ANICA, 2000). The Phase IA section includes a brief overview of the history of the region, citing primary ethnohistoric and historic sources. Surface and sub-surface testing for the Phase IB study found no cultural resources within the training facility.

Archaeologist Eduardo Questell conducted a Phase 1B archaeological survey and testing of three proposed ranges for CSTC. He did not locate any new sites, but apparently did relocate prehistoric material scattered on the surface of one of these areas, that he identified as the SN-32 site (L-13-01). When first reported by Rodriguez (1985), he noted that this site was extensively disturbed. Questell, though not specifically stating that the site was not NRHP eligible, recommended that the proposed project proceed as planned and that no addition archaeological work be performed.

The most comprehensive history of the PRARNG is Jose Angel Norat Martinez's (1987) Guardia Nacional de Puerto Rico: Historia y Tradiciones. Norat traces the beginnings of a national guard in Puerto Rico to the Spanish tradition of local militia, which began in the 16th Century.

He includes occasional references to the Camp Salinas training facility, known as Camp Santiago since 1975. Norat indicates a substantial portion of the Guard's military training activities until the 1960's occurred at other facilities, notably Camp Losey (now Fort Allen) and Camp Tortugero. The PRARNG has a historical museum at its headquarters in San Juan that houses numerous photographs, publications and artifacts pertinent to Camp Santiago's history, and there is a small museum at CSTC as well; both are open to the public.

13.2.2 The Land Use History of Salinas and Camp Santiago

There are few records to indicate what the land use patterns for CSTC were in the past; therefore it is necessary to draw inferences from the general patterns for the area, citing specific information when available.

Prior to the arrival of Europeans, the Tainos inhabited the area. In general, the coast was more densely populated, because of the abundant marine resources, and the salt flats that, according to historic sources, were still important in proto-historic times. The south coast of the island has a particularly high density of prehistoric sites from both Archaic and Ceramic Ages (Lothrop 1916; Rouse 1952).

Further inland there are large sites, as well as many smaller ones, including a series of them along the upper Lapa River. Most of these sites are habitation sites, some with plazas and bateys, but petroglyph and cave sites have also been reported. In contrast, the recorded prehistoric sites in CSTC are small and limited to only two periods.

Evidence points to a pattern where the major prehistoric population concentrated along the coast, with a sparse occupation along the arid coastal plain and foothills, with denser populations not reoccurring until far inland, where the orographic effect produced high enough rainfall to allow sustainable agriculture. Rainfall may have been a limiting factor, and the pattern of only small prehistoric sites at CSTC, suggests that the area might have had a low rainfall regime for the last millennium or two.

There is little specific historic data available for CSTC until the 1900's, but the land use patterns common to the region as a whole probably applied to CSTC as well. Historical sources indicate that in the 1500's the Spaniards did not settle this part of the island because warring Caribs inhabited the region (Juan Melgarejo, 1582 as cited in ANICA 2000).

According to Tomas de Cordova, in 1838 (1968:vol. 373, as cited in ANICA 2000):

> *"The one [river] called Lapa, is born on the mountain of the same name, meanders somewhat distant from the town to the SSE, and empties into the ward of Salinas, which is S¼ to the SE from the town, it's not abundant in waters and only runs when there is much rain."*

This historic record about the Lapa River watershed is significant – even before intensive deforestation and large-scale irrigated agriculture were common in the region, this river only carried abundant water after intense rains. This would have dictated historic land-use practices, have impeded agriculture without irrigation, and limited occupation to proximity to permanent water sources, such as natural springs and man-made wells.

Even into the late 1800's there was apparently little agriculture in the area. In 1878, Ubeda y Delgado (1878:255-256, as cited in ANICA 2000) reports there were "good and plentiful pastures" and that cattle raising was the primary economy of the recently formed Municipality of Salinas de Coamo. According to Cayetano Coll y Toste (as cited in ANICA 2000), in 1897, of all the lands in production in the Municipality of Salinas, 21,499 cuerdas was pasture, with 10,314 head of cattle. This means that in 1897, on the brink of the Spanish-American War, pasturage accounted for nearly 93 percent of the land in production in the municipality, with sugar cane a distant second, with a mere 906 cuerdas in production.

Following the Spanish-American, War Puerto Rico was ceded to the United States by Spain. In 1917, the Puerto Rican Legislature authorized the organization of the National Guard, and the U.S. Congress, under the National Defense Act, assigned funds in 1919. We learn that, the following year:

> *The first training camp used by the Puerto Rico National Guard was nearby (sic) the boundaries of Camp Santiago, where more than one thousand troops of the 1st Infantry*

> *Regiment attended from 6 through 20 December 1920. (History section of the Camp Santiago Site Information Booklet.)*

The earliest aerial photographs, taken in 1937, substantiate the fact that, aside from military exercises, cattle ranching was the primary historic use of the land within what is today CSTC. The aerial photographs also show various structures, some were apparently military, and others appear to be residential and ranch-related.

Between 1920 and 1940, areas elsewhere on the island were used for training At some point during this period, don Manuel Gonzalez ceded use of some of his land in Salinas to the military for training exercises, for one dollar (personal communications: Antonio Daubon Vidal, September 19, 2000; and retired Col. Mario Jimenez Lopez, Sept. 28, 2000). During World War II and through the end of the Korean War, Camp Santiago (at that time called the “Salinas Training Area”) was the only official training area used for Advanced Military Training.

The training facility was smaller in the mid-40’s than today. During the 1940’s and 50’s Manuel Gonzalez’s cattle still ranged freely over the facility, and the cattlemen who worked them lived with their families at the nearby communities of Sabana Llana and Coco (personal communication, retired Col Mario Jimenez Lopez; Sept. 28, 2000).

As late as 1946, these communities, and historic sites such as Hacienda Lago, and as many as 70 residences and strucutures were still outside CSTC boundaries, becoming part of CSTC years later when bordering acreage was acquired.

In 1967, the U.S. Government leased Camp Santiago to the PRARNG. In 1975, the Camp Salinas Training Facility was renamed “Camp Santiago,” in honor of Specialist Fourth Class Hector Santiago Colon, a native of Salinas who died in 1968 in Vietnam, and was posthumously awarded the Congressional Medal of Honor.

13.2.3 Cultural Resource Compliance Issues

Cultural resources are protected in accordance with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, its implementing regulations 36 CFR 800, the Antiquities Act of 1906 (16 USC 431-433), the Archaeological Resources Protection Act (16 USC 470aa-11, and AR 420-40). The Army will locate and inventory all sites, buildings, districts, and objects under their jurisdiction or control, and will formally nominate for listing on the National Register of Historic Places those qualifying properties that it intends to interpret, commemorate, or otherwise manage as sites of popular interest that are normally open to the general public. Most military training activities, e.g., engineering training and other ground disturbing activities, are considered "undertakings," as defined by the above regulations.

Formal determinations of NRHP eligibility were not prepared for the sites reported by Rodriguez (1985:72-82), though in considering site protection priorities the majority of the prehistoric sites he found were classified as having "'High' Preliminary Significance" and "'High' Integrity," criteria used to determine NRHP eligibility. In 1985 Rodriguez suggests, "Additional research is needed in Camp Santiago, and it should be oriented toward the more careful study of the sites that we feel are eligible for inclusion in the National Register of Historic Places." At that time, he called for establishing 50-meter buffers around sensitive sites, but argued against installing signs or fences, which he felt, would alert potential looters as to site locations.

The PRARNG has considered the 27 October 1999 Annotated Department of Defense American Indian and Alaska Native Policy; there are no State or Federally recognized tribes in Puerto Rico; thus, issues relating to consultation with Indian tribes do not apply. The Native American Graves Protection and Repatriation Act as written, excludes Puerto Rico.

Evaluation of all the prehistoric and historic sites is imperative and at least formal determinations of eligibility, but preferably NRHP nomination of those sites that are eligible, is necessary in order to make well-reasoned management decisions on these irreplaceable heritage resources.

During the 2001-2004 timeframe, the PRARNG has made significant accomplishments in conducting and documenting cultural resources surveys on CSTC lands. These accomplishments are summarized below:

Table 13.1
2001-2004 PRARNG Accomplishments in Conducting and Documenting Cultural Resources Surveys on CSTC Lands

Year (FY)	Accomplishment
01	Completion of Archeological Report *(Documentation of 31 new sites for the record and surveyed 34 sites)*
	Completion of "Los Tamaraindos" archeological site evaluation *(in partnership with Wake Forest University)*
02	Completion of Archeological Report *(Documentation of 3 sites for NRHP eligibility and surveyed 97 acres)*
	Conducted an Archeological Inventory
	Archeological testing of "El Baty" site *(in cooperation with Wake Forest University)*

Year (FY)	Table 13.1 2001-2004 PRARNG Accomplishments in Conducting and Documenting Cultural Resources Surveys on CSTC Lands Accomplishment
03	Completion of Archeological Report *(Documentation of 9 new sites for the record and surveyed 97.5 acres)*
	Testing “Ocho Concheros” archeological site *(in collaboration with Wake Forest University*
	Completion of Archeological Report *(Documentation of 23 new sites and 4 old sites; 20 sites evaluated for NRHP eligibility; surveyed 583.2 acres)*
04	Preparation of Archeological Report *(265 acres surveyed; 15 sites documented, 4 sites evaluated for NRHP eligibility)*

13.3 Natural Resources Management Implications

To prevent activities from affecting significant cultural resources, natural resources projects involving ground-disturbing activities must be processed through the PRARNG Cultural Resources Manager. Natural resources projects in areas where eligibility of sites for the National Register of Historic Places (NRHP) has not been determined require coordination and consultation that is prescribed in Section 106 of the NHPA. For management purposes, sites deemed eligible for the NRHP are treated in exactly the same manner as sites that are actually listed in the NRHP. Concessions may need to be made to protect these sites.

Conversely, excavations of archeological sites may adversely affect natural resources. Any activities will be evaluated, as needed, via the NEPA process for such impacts. Adverse effects will be mitigated through avoidance, minimization, or compensatory mitigation.

The Integrated Cultural Resources Management Plan (ICRMP) guides the treatment of cultural resources at a facility. The ICRMP for Camp Santiago is still in draft (projected to be completed by November 2001), therefore, the relationship between natural resources management and implementing the ICRMP cannot be determined in detail.

However, there are standard procedures that should be followed in order to protect the cultural resources from impacts because of INRMP activities. Specific steps that can be taken when implementing the INRMP to ensure consistency with routine cultural resource management practices are:

- Follow Section 106 procedures for all undertakings until the cultural resources survey is completed, the ICRMP is accepted as final and implemented.
- The POTO will contact the PRARNG Cultural Resources Manager (CRM) before implementing any activity in order to check maps, files and possible coordination with the PR SHPO.

- If the area has been thoroughly surveyed to standards, and no cultural resources were found, and consultation with the SHPO concurs, the proposed activity could be carried out.
- If, however, any cultural resources are found, during implementation of the undertaking, or incidentally in the project area, then all work in the vicinity of the find will stop and the CRM will be notified immediately to determine proper action. Once the ICRMP is finalized (projected for November 2001), the Standard Operating Procedure presented in said document will apply in such cases of inadvertent discovery.
- Report any artifacts or archaeological sites that may be discovered during training exercises or routine maintenance to Range Control and/or the Environmental Office.

13.4 Potential Impacts by INRMP Activities and Mitigation Measurers

Any ground disturbing activity has the potential to destroy the irreplaceable prehistoric and historic properties described herein. All previous investigators make the point that many of the prehistoric sites at Camp Santiago are exposed on the surface. Recent on-site re-examination of several of the sites reveal that many of them are either exposed on the surface or very shallowly buried -- this is not typical. Usually prehistoric sites are buried under a few inches or even a few feet of protective soil. The specific reasons for the large number of exposed sites will be a matter for continued study, but may be a combination of the xeric climate, repeated fires, and severe over grazing, all resulting in less ground cover and an accelerated rate of erosion, in concert with the unusually thin and erosion-prone soils in this area. Therefore, these cultural resources are extremely vulnerable to even minor surface disturbances, to damage from erosion and weathering, and readily accessible to looters. The exposed nature of many of these sites makes them likely candidates for stabilization and protection efforts beyond standard avoidance measures. Monitoring and evaluation of the erosion at cultural resource sites must to be conducted to determine what resource values can be protected through mitigation measures such as fencing, re-seeding, fire control measures, and stabilization measures.

It is recommended that certain of these measures be implemented at once, concentrating on those that have the most immediate and productive results and that will provide protection at low costs. Site fencing – erecting barbed wire fencing around vulnerable sites -- in conjunction with signing these as “Off Limits” areas, should be effective in reducing several types of impacts. This is an efficient and inexpensive way to protect cultural resource sites without drawing undue attention to them. More aggressive protection measures, such as erosion control measures and stabilization, can be used on specific sites as particular protection needs are identified.

Several of the actions proposed in this INRMP have the potential for adverse impacts to the cultural resources unless accompanied by mitigation measures. Specific examples proposed in this INRMP include fence construction, building erosion control structures and stream crossings, construction and maintenance of fuelbreaks, tree planting, seeding, and other proposed activities.

Prior to implementation, each INRMP activity will be evaluated to determine its potential for disturbing cultural resources, and proper procedures will be followed in those cases where this is a possibility. Mitigation measures will be developed on a case-by-case basis, because each cultural resource and setting is unique and will require different measures to ensure its protection.

In addition to INRMP activities, certain related military mission and training activities have the potential to impact these sites. Direct ground disturbing activities, such as construction, shelling with mortars and other live fire, overland vehicle use, have the highest potential for adversely affecting cultural resources at CSTC.

Nevertheless, even less impacting activities such as pedestrian traffic, grazing, fires, and similar low impact practices also have the potential to impact these resources because of their extreme vulnerability.

It must be emphasized that only 10 percent of the entire Camp has been systematically surveyed for cultural resources, leaving a substantial part of Camp Santiago that has never been surveyed. Given the high density of sites discovered during previous surveys, it is projected that a significant number of prehistoric and historic sites have still not been located or documented. This fact points to the requirement that all the projects proposed, herein, as part of the INRMP (as well as other ground-disturbing projects) will require intensive cultural resources survey prior to getting underway. New sites will undoubtedly be located through these efforts, so mitigation decisions in these cases will need to be made for individual cases. Survey of these project areas will be a top priority.

Once a complete survey for cultural resources in Camp Santiago has been conducted, and the ICRMP is in place, then planning efforts can focus on site improvement measures, interpretation, education, NRHP nominations and research goals. Activities promoting education and public awareness, such as interpretive displays, oral histories, archaeology protection, and teaching materials will be future priorities. Projects such as community outreach activities during “Historic Preservation Week,” inviting school groups to participate with archaeologists in the excavation of sites, and restoration and enhancement of key cultural resources sites are all possibilities to consider.

Chapter 14: National Environmental Policy Act

14.1 Introduction

Army Regulations 200-2, *Environmental Effects of Army Actions,* implements National Environmental Policy Act (NEPA) requirements and requires mitigation to limit damage to the environment. The purpose of NEPA is to identify environmental problems and attempt to resolve them using planning at early stages of project development.

14.2 Objectives

The objectives for NEPA include:

- Identifying projects and activities on the installation that might impact natural resources.
- Working with project planners to resolve issues early in the planning process.
- Ensuring that this INRMP is documented according to guidance in AR200-2.

14.3 NEPA Responsibilities and Implementation

The Deputy Director of the Army National Guard Bureau is responsible for signing all Findings of No Significant Impact for Environmental Assessments prepared for ARNG actions across the country. The CSTC commander is the responsible official for the NEPA supporting the implementation of the INRMP. TAG of the PRANG is directly responsible for ensuring coordination of INRMP initiatives between his environmental, training and engineering staffs. The Environmental Engineer, ECA Environmental Manager, and Hazardous Waste Specialist are responsible to the Facilities Manager Officer for advising the CSTS on the best ways to comply with federal and state environmental laws and regulations.

14.4 NEPA and Natural Resource Management

14.4.1 2001 – 2005 INRMP

In accordance with the National Environmental Policy Act, an Environmental Assessment (EA) and Finding of No Significant Impact (FNSI) support the 2001-2005 CSTC INRMP.

Scoping and coordination associated with the preparation and review of the proposed action is described in Chapter 2 of the Final EA and scoping records are in the Administrative Record, tabs C and D.

In accordance with the Sikes Act, the development of the EA supporting this INRMP was a cooperative effort with the U.S. Fish and Wildlife Service and the Puerto Rico Department of Natural Resources and Environment. Appendices A and E of the Final EA define the role of the natural resource specialists and other agencies respectively, who participated in the development of the 2001-2005 INRMP.

As required by the Sikes Act, the PRARNG has completed a formal review of the 2001-2005 INRMP for the CSTC. This review was conducted in accordance with DoD memo dated November 01, 2004, from the Assistant Deputy Under Secretary of Defense (Environmental, Safety, and Occupational Health), Subject: *Implementation of the Sikes Act Improvement Amendments: Supplemental Guidance concerning INRMP Reviews*.

The review validated that the development and implementation of the 2001-2005 INRMP is consistent with the NGB-JA Legal Opinion, "Appropriate Environmental Analysis for Integrated Natural Resources Management Plans Prepared Pursuant to the Sikes Act Implementation Act," dated 14 March 2000. The review was completed during February 2005, and the findings of this review are included in Appendix G to the 2006-2010 CSTC INRMP.

14.4.2 2006 – 2010 INRMP

In accordance with the terms and conditions of a Memorandum of Agreement between the PRARNG and the USDA Forest Service, Caribbean National Forest, an Interdisciplinary Team (ID Team) of natural resource specialists updated the CSTC INRMP for the 2006-2010 timeframe.

A Record of Environmental Review (RER) was conducted in accordance with direction provided by the NGB NEPA Handbook – Guidance on Preparing Environmental Documentation for Army National Guard Actions in Compliance with the National Environmental Policy Act of 1969. The findings of the RER indicate that a new environmental document is not necessary, and that implementation of the CSTC INRMP, as supplemented, should continue for the 2006-2010 timeframe. Appendix H of this INRMP includes the RER documentation.

The NEPA documentation to support this INRMP is consistent with the Council on Environmental Quality requirements and guidance contained in AR 200-2.

The NEPA process ensures that consequences of potential natural resources impacts resulting from the proposed actions are identified, analyzed, and disclosed. The EA provides an evaluation of various management activities of the CSTC natural resources. If future natural resource projects fall outside the scope of significance criteria established in the EA, the projects will be individually reviewed to determine whether additional NEPA review (according to AR 200-2) is required. As a minimum, both the INRMP and its EA can be referenced with regard to describing the affected environment to reduce verbiage in future NEPA documentation.

The NEPA process ensures compliance with the 27 October 1999 Annotated Department of Defense American Indian and Alaska Native Policy and with Executive Order 12892, Environmental Justice.

In accordance with the Sikes Act, the development of the EA supporting this INRMP was a cooperative effort with the U.S. Fish and Wildlife Service and the Puerto Rico Department of Natural Resources and Environment (refer to Appendix B to this INRMP).

Chapter 15: Biopolitical Issue Resolution

15.1 Biopolitical Issue Resolution

One of the main issues at Camp Santiago relates to the use of the Training Center by civilians from the surrounding communities. Because the post is open, civilians can enter the Training Center from various locations. The boundary is not well defined or recognized by the public.

There is concern expressed by PRARNG personnel about the following issues:

- Illegal dumping of refuse.
- Continual trespass of horses and cattle.
- Random entry of civilians gathering livestock or collecting materials.

Since trespass on the Training Center has become, over time, a perceived right for the community, regaining control of the boundary will be a difficult challenge. The concerns for safety will only increase with the opening of new firing ranges.

The key to the future existence of Camp Santiago as a viable training area is controlling public access. Surveying and fencing is only one component to the solution. Further restrictions in uncontrolled public access will strain friendly relationships that currently exist with the status quo. Resolving this issue in short order to the satisfaction of both the PRARNG and the local community may be unrealistic. Animosity towards the military can be quickly and easily elevated as evidenced in recent events at nearby military installations.

The resolution of this issue will need to be pursued through a combination of political and legal avenues. The PRARNG and the CSTC Commander will work with local community officials and law enforcement to seek common resolution of this issue.

Chapter 16: Implementation

Implementation is the final step in the planning process, marking the end of the planning and the beginning of the action. Monitoring is an integral part of the implementation phase; Chapter 9 of this document provides a detailed summary of the monitoring initiatives included in the INRMP.

16.1 Manpower

A balanced team of trained professional and technical staff is essential for the successful implementation of the CSTC INRMP. Staffing sources for implementation of the CSTC INRMP include:

- Permanent Staff:
  - CSTS Commander and Staff
  - Local Commonwealth-funded maintenance and security workers
- Traditional National Guard Soldiers
- Special Contractors (as described in Chapter 5)
- Assistance from and collaboration with the following agencies/organizations:
  - Local universities (initial coordination has been made with the University of Puerto Rico in Ponce)
  - Puerto Rico Department of Natural Resources and Environment
  - USDA, Forest Service, Caribbean National Forest
  - USDA, Forest Service, International Institute of Tropical Forestry
  - USDA, National Resources Conservation Service
  - U.S. Fish and Wildlife Service
  - U.S. Geological Service

16.2 Organization, Roles, and Responsibilities

Chapter 5 – Responsible and Interested Parties of this document summarizes the parties, roles, and responsibilities for implementation of the INRMP.

16.3 Project/Program Priorities

Refer to Table 8.1, on pages 8-2 through 8-8, for a summary of initiatives described in this INRMP, and Tables 9.1 through 9.5, pages 9-12, provides a summary of inventory and monitoring initiatives identified in the INRMP.

16.4 Implementation Funding Options

Tables 16.1 to 16.8, Initiative Implementation Matrix, pages 16-3 through 6-10, lists the projects that will be implemented because of this plan. How the project would be accomplished, the project schedule (by fiscal years [FY]), and the source of funding are also shown. Estimated project costs are not subject to public disclosure, but are available from PRARNG to authorized persons. Projects will be established in the NGB Environmental Program Requirements Report or ITAM Workplan and undertaken as funding becomes available. Inclusion of projects on this list does not obligate the PRARNG to complete required actions if funding is not available from federal sources.

16.5 Command Support

The Training Center Commander is responsible for and committed to the successful implementation of the INRMP. His leadership in the integration of the INRMP with training activities will result in sound land stewardship and the preservation of natural resources within the CSTC.

16.6 Consultation with Other Agencies

In compliance with 16 U.S.C., Section 670a(a)(2), the PRARNG has prepared this INRMP and supporting NEPA documentation in cooperation with the U.S. Fish and Wildlife Service and the Puerto Rico Department of Resources and Environment. Appendix B of this INRMP contains copies of correspondence with both of the above-mention agencies that document their comments and input towards the development of the CSTC INRMP.

Table 16 Initiative Implementation Matrix (2006-2010 INRMP for the CSTC)			
Initiative Description	**Implementation Year**	**Materials and Work Provided By**	**Remarks / Comments**
Security and Public / Soldier Safety with the CSTC			
Survey, post, and map the CSTC boundary	FY 07 – FY 09	PRARNG in coordination with USDA Forest Service, US Army Corps of Engineers, and/or private contractor	Prior to installing the CSTC perimeter fencing, a survey of the CSTC boundary needs to be completed.
Install approximately 3.0 miles of cyclone and 11 miles of barbed-wire fence along portions of the training boundary *(Refer to Figure 8.8 – Fencing Initiative Map, page 8-87)*	FY 06 – FY 09	PRARNG in coordination with USDA Forest Service, US Army Corps of Engineers, and/or private contractor	
Restrict livestock from grazing in riparian areas on the CSTC.	FY 06 – FY 10	PRARNG	
Identify and Protect Historic Resources			
Conduct cultural resource surveys within project specific areas proposed for all INRMP ground-disturbing activities, prior to the INRMP activity implementation	FY 06 – FY 10	USDA Forest Service or archaeological contractor	Inventory and monitoring initiative
Install barbed-wire fencing to protect sensitive cultural sites and artifacts.	FY 06 – FY 10	CSTC personnel	Estimated ½ mile of fencing
Modify Training Center Map to shown known cultural sites as “restricted, off-limit areas.”	FY 06	CSTC personnel	Currently, there are two sensitive sites that have been fenced-off, which are not shown on the Training Center Map as being “off-limits.”
<u>If needed:</u> Initiate stabilization measures at cultural resource sites where erosion is impacting the site.	FY 06 – FY 10	CSTC personnel or contractor	Based on current trends, it is unlikely that this initiative will be needed.

Table 16
Initiative Implementation Matrix (2006-2010 INRMP for the CSTC)

Initiative Description	Implementation Year	Materials and Work Provided By	Remarks / Comments
Interpret selected cultural resources themes in NG museums and programs, emphasizing the importance of protecting sites.	FY 06 – FY 10	USDA Forest Service or archaeological contractor	Emphasis is on establishing a cultural resource theme at the CSTC museum.
Restore and Protect Forest Vegetation			
Maintain and operate the on-site green houses (seed germination, seedling stock care, acclimatization)	FY 06 – FY 10	Nursery stock provided by DENR & PR Conservation Trust, planting completed by USDA FS or contractor.	
Perform site preparation and plant approximately 265 acres within forest and riparian areas (*Refer to Figure 8.9 – Riparian Area Restoration Map, INRMP, page 8-89)*	FY 06 – FY 10	CSTC personnel, contractor, and/or MOU with local universities	Approximately 13 acres planted annually, 400 trees planted per acre
Vegetation cover surveys: Inventory all of CSTC lands on 5-year cycle (re-measure permanent plot clusters, which have been established in all vegetation classification types. Conduct walk-through inventories.	FY 06 – FY 10	CSTC personnel, contractor, MOU with local universities and/or other government agencies	*Inventory/monitoring initiative.* Information collected will also allow the periodic assessment of wildlife habitat.
Plantation Surveys: Inventory plantations (forest and riparian areas) to determine seedling survival and the need to re-plant and/or thin.	FY 06 – FY 10	CSTC personnel, contractor, MOU with local universities and/or other government agencies	
Re-planting and thinning within the plantations.	FY 06 – FY 10 (as needed)	CSTC personnel, contractor, and/or MOU with local universities	

Table 16
Initiative Implementation Matrix (2006-2010 INRMP for the CSTC)

Initiative Description	Implementation Year	Materials and Work Provided By	Remarks / Comments
• Maintain and operate existing irrigation system. • Purchase and install above-ground irrigation system capable of watering 13 acres.	FY 06 – FY 10	CSTC personnel and/or contractor	
Restore and Protect Riparian Areas			
Cease current gravel and fill-dirt extraction within the Rio Nigua stream channel and adjacent riparian areas; ensure future extraction operations meet applicable environmental laws and standards.	FY 06	PRARNG in partnership with the PR DNRE Note: The current extraction operation is permitted and administered by the PR DNRE.	***This is a high priority initiative*** – the on-going gravel and fill-dirt extraction is resulting in negative impacts on water quality, aquatic habitat, and riparian area habitat.
Plant approximately 200 acres of riparian areas *(Refer to Figure 8.7 – Riparian Area Restoration Map, page 8-85)*	FY 06 – FY 10	Nursery stock provided by PR Conservation Trust and DNRE	Plant 40 acres per year; approximately 400 seedlings per acre.
• Restrict cross-country vehicle maneuver within riparian areas. • Modify Training Center Map to show sensitive riparian areas as "restricted, off-limit areas."	FY 06	CSTC personnel	
Restrict livestock grazing in riparian areas	FY 06 – FY 10	CSTC personnel	Command emphasis and the Fencing Initiative will effectively restrict livestock from grazing in the riparian areas.
Identify Sediment Sources			
Conduct sediment surveys; emphasis is on **secondary convoy routes** and assembly areas. Note: During year 1 (2006), focus surveys on secondary convoy routes; during the 2nd to 5th year (2007-2010) focus in on monitoring the secondary and secondary convoy routes and road system.	FY 06 – FY 10	PRARNG in partnership with the USDA FS and/or contractor	*The identification of sediment sources and subsequent elimination of these sediment sources is responsive to troop safety and protection / enhancement of natural resources values.*

Table 16 Initiative Implementation Matrix (2006-2010 INRMP for the CSTC)			
Initiative Description	**Implementation Year**	**Materials and Work Provided By**	**Remarks / Comments**
Inspect **primary convoy routes** during rain storms; clearing debris from above, within, and below culverts.	FY 06 – FY 10	PRARNG in partnership with the USDA FS and/or contractor	***This is a high priority initiative!*** It is expected that with improved drainage structures on the roads and increased vegetation along the streams that plugged culverts and washed out roads will gradually decrease over time.
Eliminate Sediment Sources, Improve Stream Crossings, and Eliminate Safety Hazards Associated with CSTC Convoy Routes			
Work on the primary convoy routes: • Improve surface drainage and reduce surface erosion and sediment sources by implementing water quality Best Management Practices on convoy routes. • Improve stream crossings by repairing and/or replacing existing drainage structures. • Perform road maintenance to eliminate sediment sources and associated safety hazards. Note: Work includes design/construction of both general surface drainage sediment sources and site specific sediment sources.	FY 06 – FY 10	PRARNG in partnership with the USDA FS and/or contractor	This is the #1 priority identified in the 2006-2010 INRMP ***The stream crossing repair/replacement and elimination of sediment sources is responsive to troop safety and protection of natural resources values.***
Design and construction on entrance bridges • Repair and stabilize old entrance approaches and protect channel banks and bed from erosive channel flows. • Protect eroding channel banks at new entrance bridge. Note: Work includes design/construction of old entrance crossing and bank stabilization of new entrance.	FY 07 & FY 09	PRARNG in partnership with the USDA FS and/or contractor	This is a high priority initiative! **And is responsive to troop safety and protection/enhancement of water quality**

Table 16
Initiative Implementation Matrix (2006-2010 INRMP for the CSTC)

Initiative Description	Implementation Year	Materials and Work Provided By	Remarks / Comments
Design and construction of firing ranges and Ammo Area. • Improve surface drainage and reduce surface erosion associated with Firing Range 22 and Ammo Area. Note: Work includes design/construction of firing range and Ammo Area drainage improvements.	FY 09	PRARNG in partnership with the USDA FS and/or contractor	*This is responsive to addressing overland drainage and erosion problems and is responsive to troop safety and protection/enhancement of water quality*.
Conduct Stream Channel Surveys / Monitoring			
Conduct stream channel surveys – to determine current stream channel and bank conditions and to monitor changes over time.	FY 06 – FY 10 To be conducted twice annually (February and October)	PRARNG in partnership with the USDA FS and/or contractor or MOU with local universities	Surveys would identify restoration opportunities
Stream monitoring: Establish permanent stream cross-sections. Year 1 (2006) includes establishing the permanent cross-sections, with three repetitions. Following years (2007-2010) are re-measurement at established sites.	FY 06, FY 08, FY 10	PRARNG in partnership with the USDA FS and/or contractor or MOU with local universities	
Protect and Enhance Wildlife Habitat			
Wildlife monitoring: Monitoring for the presence of species requiring special habitats and ecological indicator species on an annual basis. *(Refer to chapter 8, pages 8-23 to 8-23, and 8-72 for a detailed description of wildlife and pest monitoring initiative. Refer to Chapter 9 for a detailed description of the proposed monitoring protocols.)*	FY 06 – FY 10	CSTC personnel, contractor, MOU with local universities, and/or other government agencies	**Information collected will assist in assessing the effectiveness of management initiatives designed to maintain and/or enhance forest and riparian habitat and to achieve desired conditions of local fauna populations.**
Wildland (Range) Fire Suppression			

Table 16 Initiative Implementation Matrix (2006-2010 INRMP for the CSTC)			
Initiative Description	**Implementation Year**	**Materials and Work Provided By**	**Remarks / Comments**
Acquire two 1-ton fire trucks or two-slip on water tank/pump units *(Refer to Figure 8.12, page 8-95 – Fire Suppression Initiative.)*	FY 06	PRARNG	***This is a high priority initiative!*** and is responsive to troop safety, maximizing training opportunities, and protection/enhancement of natural resources.
Upgrade Fire Suppression Capabilities			
Access the need and feasibility of the construction of fuelbreaks adjacent to the Ammo Area (ASP) to protect the facility from a potential range fire. Assess the need and feasibility of the construction of fuelbreaks to contain potential fire starts from the use of pyrotechnics or tracer rounds.	FY 06 - FY 07	PRARNG	
Construction and subsequent maintenance of approximately 300 meters of fuelbreaks to prevent potential range fires from encroaching into the plantation areas. *(Refer to Figure 8.12 – Fire Suppression Initiative, page 8-97.)*	FY 06 – FY 10	PRARNG in partnership with the USDA FS and/or contractor	
Maintenance and operation of CSTC's remote automated weather station (RAWS)	FY 06 - FY 10	PRARNG in partnership with the USDA FS	
Acquire portable water source devices to be available for initial attack during a range fire event.	FY 07	PRARNG	
Acquire fire suppression personal protective equipment, such as no-mex clothing, fire shelters, fire hoses, belt-weather kits.	FY 06 – FY 07	PRARNG	

Table 16
Initiative Implementation Matrix (2006-2010 INRMP for the CSTC)

Initiative Description	Implementation Year	Materials and Work Provided By	Remarks / Comments
Install hydrant(s) and hydrant lines	FY 08	PRARNG in partnership with USDA FS and/or contractor	
Implement Fire Danger/Awareness Rating System	FY 06	PRARNG in partnership with USA FS	
Train personnel in fire suppression techniques and fire weather data interpretations	FY 06	PRARNG in partnership with USDA FS and/or contractor	
Continue to develop and maintain a GIS data base for the CSTC Note: This initiative would provide support to the collective management of the natural and cultural resource values at CSTC.	FY 06 – FY 10	PRARNG in partnership with the USDA FS	

Camp Santiago
Camp Santiago
Salinas, PR 00751

Inquiry Number: 5714997.17
July 12, 2019

Certified Sanborn® Map Report

EDR®

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

Certified Sanborn® Map Report

07/12/19

Site Name:

Camp Santiago
Camp Santiago
Salinas, PR 00751
EDR Inquiry # 5714997.17

Client Name:

AECOM
12120 Shamrock Plaza
Omaha, NE 68154
Contact: Hans Sund

The Sanborn Library has been searched by EDR and maps covering the target property location as provided by AECOM were identified for the years listed below. The Sanborn Library is the largest, most complete collection of fire insurance maps. The collection includes maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow, and others. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by the Sanborn Library LLC, the copyright holder for the collection. Results can be authenticated by visiting www.edrnet.com/sanborn.

The Sanborn Library is continually enhanced with newly identified map archives. This report accesses all maps in the collection as of the day this report was generated.

Certified Sanborn Results:

Certification # A112-4C2D-AE1C

PO # NA

Project Camp Santiago

UNMAPPED PROPERTY

This report certifies that the complete holdings of the Sanborn Library, LLC collection have been searched based on client supplied target property information, and fire insurance maps covering the target property were not found.

Sanborn® Library search results

Certification #: A112-4C2D-AE1C

The Sanborn Library includes more than 1.2 million fire insurance maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow and others which track historical property usage in approximately 12,000 American cities and towns. Collections searched:

- ✔ Library of Congress
- ✔ University Publications of America
- ✔ EDR Private Collection

The Sanborn Library LLC Since 1866™

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AECOM (the client) is permitted to make up to FIVE photocopies of this Sanborn Map transmittal and each fire insurance map accompanying this report solely for the limited use of its customer. No one other than the client is authorized to make copies. Upon request made directly to an EDR Account Executive, the client may be permitted to make a limited number of additional photocopies. This permission is conditioned upon compliance by the client, its customer and their agents with EDR's copyright policy; a copy of which is available upon request.

Camp Santiago
Camp Santiago
Salinas, PR 00751

Inquiry Number: 5714997.16s
July 12, 2019

The EDR Radius Map™ Report with GeoCheck®

EDR®

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

TABLE OF CONTENTS

GEOCHECK ADDENDUM

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13), the ASTM Standard Practice for Environmental Site Assessments for Forestland or Rural Property (E 2247-16), the ASTM Standard Practice for Limited Environmental Due Diligence: Transaction Screen Process (E 1528-14) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

CAMP SANTIAGO
SALINAS, PR 00751

COORDINATES

Latitude (North):	18.0071120 - 18˚ 0' 25.60''
Longitude (West):	66.2949770 - 66˚ 17' 41.91''
Universal Tranverse Mercator:	Zone 19
UTM X (Meters):	786440.1
UTM Y (Meters):	1992943.8
Elevation:	161 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	5964450 COAMO, PR
Version Date:	2013
South Map:	5964474 SALINAS, PR
Version Date:	2013

MAPPED SITES SUMMARY

Target Property Address:
CAMP SANTIAGO
SALINAS, PR 00751

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
Reg	CAMP SANTIAGO U.S. M		DOD	Same	1 ft.

EXECUTIVE SUMMARY

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL National Priority List
Proposed NPL Proposed National Priority List Sites
NPL LIENS Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL National Priority List Deletions

Federal CERCLIS list

FEDERAL FACILITY Federal Facility Site Information listing
SEMS Superfund Enterprise Management System

Federal CERCLIS NFRAP site list

SEMS-ARCHIVE Superfund Enterprise Management System Archive

Federal RCRA CORRACTS facilities list

CORRACTS Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-LQG RCRA - Large Quantity Generators
RCRA-SQG RCRA - Small Quantity Generators
RCRA-CESQG RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

LUCIS Land Use Control Information System
US ENG CONTROLS Engineering Controls Sites List

EXECUTIVE SUMMARY

US INST CONTROL Sites with Institutional Controls

Federal ERNS list

ERNS Emergency Response Notification System

State- and tribal - equivalent CERCLIS

SHWS This state does not maintain a SHWS list. See the Federal CERCLIS list and Federal NPL list.

State and tribal leaking storage tank lists

LUST Leaking Underground Storage Tanks
INDIAN LUST Leaking Underground Storage Tanks on Indian Land

State and tribal registered storage tank lists

FEMA UST Underground Storage Tank Listing
UST Underground Storage Tank Facilities
INDIAN UST Underground Storage Tanks on Indian Land

State and tribal voluntary cleanup sites

INDIAN VCP Voluntary Cleanup Priority Listing

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

INDIAN ODI Report on the Status of Open Dumps on Indian Lands
DEBRIS REGION 9 Torres Martinez Reservation Illegal Dump Site Locations
ODI Open Dump Inventory
IHS OPEN DUMPS Open Dumps on Indian Land

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL Delisted National Clandestine Laboratory Register
US CDL National Clandestine Laboratory Register

Local Land Records

LIENS 2 CERCLA Lien Information

Records of Emergency Release Reports

HMIRS Hazardous Materials Information Reporting System

Other Ascertainable Records

RCRA NonGen / NLR RCRA - Non Generators / No Longer Regulated

EXECUTIVE SUMMARY

FUDS - Formerly Used Defense Sites
SCRD DRYCLEANERS - State Coalition for Remediation of Drycleaners Listing
US FIN ASSUR - Financial Assurance Information
EPA WATCH LIST - EPA WATCH LIST
2020 COR ACTION - 2020 Corrective Action Program List
TSCA - Toxic Substances Control Act
TRIS - Toxic Chemical Release Inventory System
SSTS - Section 7 Tracking Systems
ROD - Records Of Decision
RMP - Risk Management Plans
RAATS - RCRA Administrative Action Tracking System
PRP - Potentially Responsible Parties
PADS - PCB Activity Database System
ICIS - Integrated Compliance Information System
FTTS - FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
MLTS - Material Licensing Tracking System
COAL ASH DOE - Steam-Electric Plant Operation Data
COAL ASH EPA - Coal Combustion Residues Surface Impoundments List
PCB TRANSFORMER - PCB Transformer Registration Database
RADINFO - Radiation Information Database
HIST FTTS - FIFRA/TSCA Tracking System Administrative Case Listing
DOT OPS - Incident and Accident Data
CONSENT - Superfund (CERCLA) Consent Decrees
INDIAN RESERV - Indian Reservations
FUSRAP - Formerly Utilized Sites Remedial Action Program
UMTRA - Uranium Mill Tailings Sites
LEAD SMELTERS - Lead Smelter Sites
US AIRS - Aerometric Information Retrieval System Facility Subsystem
US MINES - Mines Master Index File
ABANDONED MINES - Abandoned Mines
FINDS - Facility Index System/Facility Registry System
ECHO - Enforcement & Compliance History Information
UXO - Unexploded Ordnance Sites
DOCKET HWC - Hazardous Waste Compliance Docket Listing
FUELS PROGRAM - EPA Fuels Program Registered Listing

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP - EDR Proprietary Manufactured Gas Plants
EDR Hist Auto - EDR Exclusive Historical Auto Stations
EDR Hist Cleaner - EDR Exclusive Historical Cleaners

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA LUST - Recovered Government Archive Leaking Underground Storage Tank

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

EXECUTIVE SUMMARY

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

ADDITIONAL ENVIRONMENTAL RECORDS

Other Ascertainable Records

DOD: Consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

A review of the DOD list, as provided by EDR, and dated 12/31/2005 has revealed that there is 1 DOD site within approximately 1 mile of the target property.

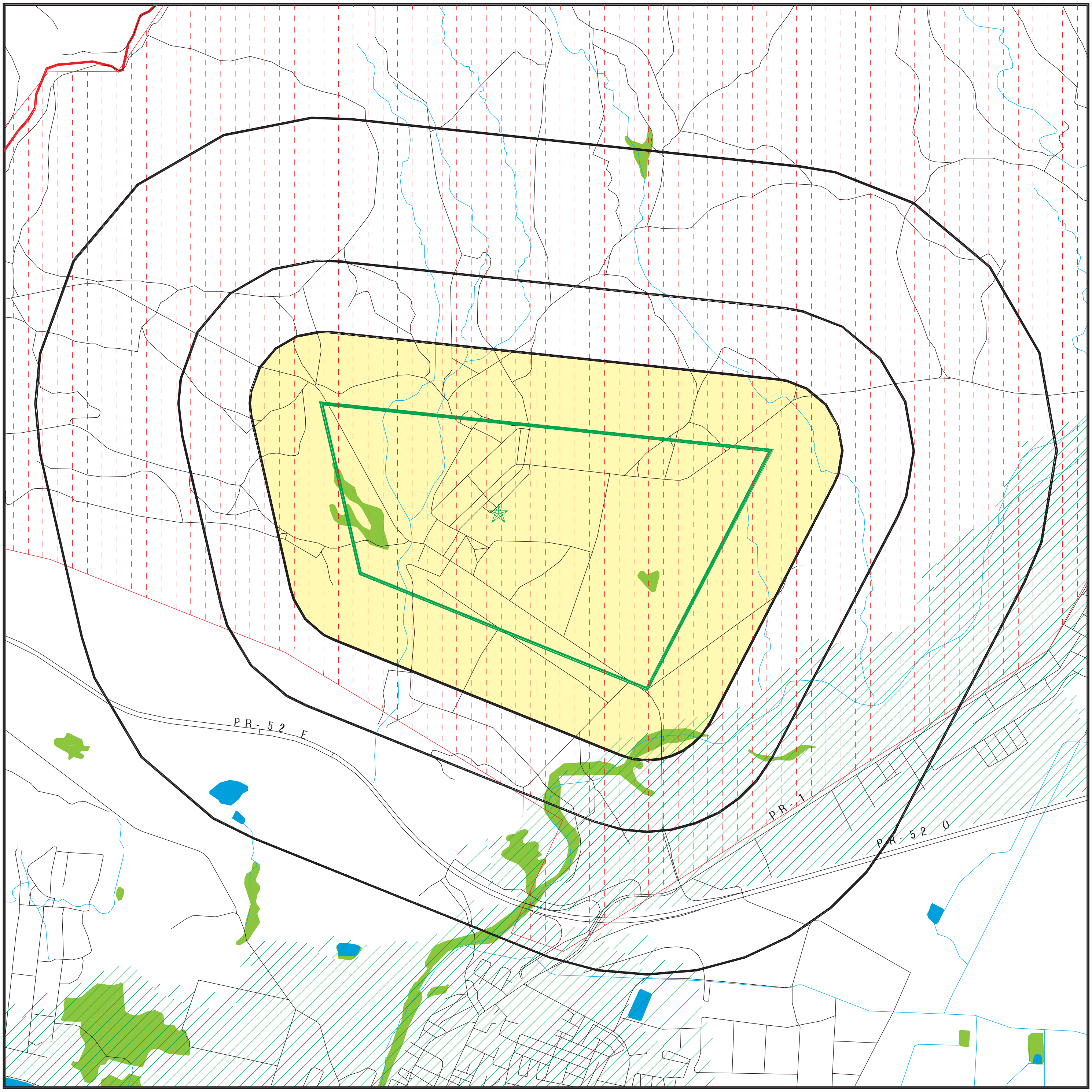
Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
CAMP SANTIAGO U.S. M		0 - 1/8 (0.000 mi.)	0	7

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped. Count: 1 records.

Site Name	Database(s)
CAMP SANTIAGO TROOP STORE	UST

OVERVIEW MAP - 5714997.16S



Target Property

Sites at elevations higher than or equal to the target property

Sites at elevations lower than the target property

Manufactured Gas Plants

National Priority List Sites

Dept. Defense Sites

Indian Reservations BIA

County Boundary

100-year flood zone

500-year flood zone

National Wetland Inventory

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Camp Santiago ADDRESS: Camp Santiago Salinas PR 00751 LAT/LONG: 18.007112 / 66.294977	CLIENT: AECOM CONTACT: Hans Sund INQUIRY #: 5714997.16s DATE: July 12, 2019 2:36 pm

DETAIL MAP - 5714997.16S

Target Property

Sites at elevations higher than or equal to the target property

Sites at elevations lower than the target property

Manufactured Gas Plants

Sensitive Receptors

National Priority List Sites

Dept. Defense Sites

Indian Reservations BIA

100-year flood zone

500-year flood zone

National Wetland Inventory

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Camp Santiago	CLIENT:	AECOM
ADDRESS:	Camp Santiago Salinas PR 00751	CONTACT:	Hans Sund
LAT/LONG:	18.007112 / 66.294977	INQUIRY #:	5714997.16s
		DATE:	July 12, 2019 2:37 pm

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	1.000		0	0	0	0	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
SEMS	0.500		0	0	0	NR	NR	0
Federal CERCLIS NFRAP site list								
SEMS-ARCHIVE	0.500		0	0	0	NR	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS	1.000		0	0	0	0	NR	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Federal RCRA generators list								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	0	NR	NR	NR	0
RCRA-CESQG	0.250		0	0	NR	NR	NR	0
Federal institutional controls / engineering controls registries								
LUCIS	0.500		0	0	0	NR	NR	0
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	TP		NR	NR	NR	NR	NR	0
State- and tribal - equivalent CERCLIS								
SHWS	N/A		N/A	N/A	N/A	N/A	N/A	N/A
State and tribal leaking storage tank lists								
LUST	0.500		0	0	0	NR	NR	0
INDIAN LUST	0.500		0	0	0	NR	NR	0
State and tribal registered storage tank lists								
FEMA UST	0.250		0	0	NR	NR	NR	0
UST	0.250		0	0	NR	NR	NR	0
INDIAN UST	0.250		0	0	NR	NR	NR	0
State and tribal voluntary cleanup sites								
INDIAN VCP	0.500		0	0	0	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
INDIAN ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
IHS OPEN DUMPS	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US HIST CDL	TP		NR	NR	NR	NR	NR	0
US CDL	TP		NR	NR	NR	NR	NR	0
Local Land Records								
LIENS 2	TP		NR	NR	NR	NR	NR	0
Records of Emergency Release Reports								
HMIRS	TP		NR	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		0	0	NR	NR	NR	0
FUDS	1.000		0	0	0	0	NR	0
DOD	1.000		1	0	0	0	NR	1
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
TSCA	TP		NR	NR	NR	NR	NR	0
TRIS	TP		NR	NR	NR	NR	NR	0
SSTS	TP		NR	NR	NR	NR	NR	0
ROD	1.000		0	0	0	0	NR	0
RMP	TP		NR	NR	NR	NR	NR	0
RAATS	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
DOT OPS	TP		NR	NR	NR	NR	NR	0
CONSENT	1.000		0	0	0	0	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
INDIAN RESERV	1.000		0	0	0	0	NR	0
FUSRAP	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	TP		NR	NR	NR	NR	NR	0
US AIRS	TP		NR	NR	NR	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
ABANDONED MINES	0.250		0	0	NR	NR	NR	0
FINDS	TP		NR	NR	NR	NR	NR	0
ECHO	TP		NR	NR	NR	NR	NR	0
UXO	1.000		0	0	0	0	NR	0
DOCKET HWC	TP		NR	NR	NR	NR	NR	0
FUELS PROGRAM	0.250		0	0	NR	NR	NR	0
EDR HIGH RISK HISTORICAL RECORDS								
EDR Exclusive Records								
EDR MGP	1.000		0	0	0	0	NR	0
EDR Hist Auto	0.125		0	NR	NR	NR	NR	0
EDR Hist Cleaner	0.125		0	NR	NR	NR	NR	0
EDR RECOVERED GOVERNMENT ARCHIVES								
Exclusive Recovered Govt. Archives								
RGA LUST	TP		NR	NR	NR	NR	NR	0
- Totals --		0	1	0	0	0	0	1

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

N/A = This State does not maintain a SHWS list. See the Federal CERCLIS list.

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
DOD Region	**CAMP SANTIAGO U.S. MILITARY RESERVATION**	**DOD**	**CUSA147804**
			N/A
	CAMP SANTIAGO U.S. MILITA (County), PR		
< 1/8			
1 ft.			

DOD:

Feature 1:	Army DOD
Feature 2:	Not reported
Feature 3:	Not reported
URL:	Not reported
Name 1:	Camp Santiago U.S. Military Reservation
Name 2:	Not reported
Name 3:	Not reported
State:	PR
DOD Site:	Yes
Tile name:	PRSALINAS

Count: 1 records. ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
SALINAS	U004021929	CAMP SANTIAGO TROOP STORE	BL 20 CAMP SANTIAGO	00751	UST

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 26

Source: EPA
Telephone: N/A
Last EDR Contact: 07/02/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 3
Telephone 215-814-5418

EPA Region 4
Telephone 404-562-8033

EPA Region 5
Telephone 312-886-6686

EPA Region 10
Telephone 206-553-8665

EPA Region 6
Telephone: 214-655-6659

EPA Region 7
Telephone: 913-551-7247

EPA Region 8
Telephone: 303-312-6774

EPA Region 9
Telephone: 415-947-4246

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 26

Source: EPA
Telephone: N/A
Last EDR Contact: 07/02/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: No Update Planned

Federal Delisted NPL site list

Delisted NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 26

Source: EPA
Telephone: N/A
Last EDR Contact: 07/02/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Quarterly

Federal CERCLIS list

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPA Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 04/03/2019
Date Data Arrived at EDR: 04/05/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 703-603-8704
Last EDR Contact: 07/03/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Varies

SEMS: Superfund Enterprise Management System

SEMS (Superfund Enterprise Management System) tracks hazardous waste sites, potentially hazardous waste sites, and remedial activities performed in support of EPA’s Superfund Program across the United States. The list was formerly know as CERCLIS, renamed to SEMS by the EPA in 2015. The list contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This dataset also contains sites which are either proposed to or on the National Priorities List (NPL) and the sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 35

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 07/02/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Quarterly

Federal CERCLIS NFRAP site list

SEMS-ARCHIVE: Superfund Enterprise Management System Archive

SEMS-ARCHIVE (Superfund Enterprise Management System Archive) tracks sites that have no further interest under the Federal Superfund Program based on available information. The list was formerly known as the CERCLIS-NFRAP, renamed to SEMS ARCHIVE by the EPA in 2015. EPA may perform a minimal level of assessment work at a site while it is archived if site conditions change and/or new information becomes available. Archived sites have been removed and archived from the inventory of SEMS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list the site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. The decision does not necessarily mean that there is no hazard associated with a given site; it only means that. based upon available information, the location is not judged to be potential NPL site.

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 35

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 07/02/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/27/2019
Date Made Active in Reports: 04/17/2019
Number of Days to Update: 21

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/27/2019
Date Made Active in Reports: 04/17/2019
Number of Days to Update: 21

Source: Environmental Protection Agency
Telephone: (212) 637-3660
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/27/2019
Date Made Active in Reports: 04/17/2019
Number of Days to Update: 21

Source: Environmental Protection Agency
Telephone: (212) 637-3660
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 03/25/2019	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/27/2019	Telephone: (212) 637-3660
Date Made Active in Reports: 04/17/2019	Last EDR Contact: 06/26/2019
Number of Days to Update: 21	Next Scheduled EDR Contact: 10/07/2019
	Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 03/25/2019	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/27/2019	Telephone: (212) 637-3660
Date Made Active in Reports: 04/17/2019	Last EDR Contact: 06/26/2019
Number of Days to Update: 21	Next Scheduled EDR Contact: 10/07/2019
	Data Release Frequency: Quarterly

Federal institutional controls / engineering controls registries

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 02/22/2019	Source: Department of the Navy
Date Data Arrived at EDR: 03/07/2019	Telephone: 843-820-7326
Date Made Active in Reports: 04/17/2019	Last EDR Contact: 05/10/2019
Number of Days to Update: 41	Next Scheduled EDR Contact: 08/26/2019
	Data Release Frequency: Varies

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 01/31/2019	Source: Environmental Protection Agency
Date Data Arrived at EDR: 02/04/2019	Telephone: 703-603-0695
Date Made Active in Reports: 03/08/2019	Last EDR Contact: 05/29/2019
Number of Days to Update: 32	Next Scheduled EDR Contact: 09/09/2019
	Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 01/31/2019	Source: Environmental Protection Agency
Date Data Arrived at EDR: 02/04/2019	Telephone: 703-603-0695
Date Made Active in Reports: 03/08/2019	Last EDR Contact: 05/29/2019
Number of Days to Update: 32	Next Scheduled EDR Contact: 09/09/2019
	Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System
Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/26/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 36

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

State- and tribal - equivalent CERCLIS

SHWS: This state does not maintain a SHWS list. See the Federal CERCLIS list and Federal NPL list.
State Hazardous Waste Sites. State hazardous waste site records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. Available information varies by state.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: Environmental Quality Board
Telephone: 787-767-8181
Last EDR Contact: 08/22/2005
Next Scheduled EDR Contact: 11/21/2005
Data Release Frequency: N/A

State and tribal leaking storage tank lists

LUST: Leaking Underground Storage Tanks
Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 07/27/2018
Date Data Arrived at EDR: 11/08/2018
Date Made Active in Reports: 01/03/2019
Number of Days to Update: 56

Source: Environmental Quality Board
Telephone: 787-767-8056
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Varies

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 10/17/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Varies

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 10/10/2018
Date Data Arrived at EDR: 03/08/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 54

Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Varies

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 10/16/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Varies

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 02/19/2019
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Varies

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 11/01/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Varies

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 09/24/2018
Date Data Arrived at EDR: 03/12/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 50

Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Varies

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 10/13/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Varies

INDIAN LUST R5: Leaking Underground Storage Tanks on Indian Land
Leaking underground storage tanks located on Indian Land in Michigan, Minnesota and Wisconsin.

Date of Government Version: 10/12/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA, Region 5
Telephone: 312-886-7439
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Varies

State and tribal registered storage tank lists

FEMA UST: Underground Storage Tank Listing
A listing of all FEMA owned underground storage tanks.

Date of Government Version: 05/15/2017
Date Data Arrived at EDR: 05/30/2017
Date Made Active in Reports: 10/13/2017
Number of Days to Update: 136

Source: FEMA
Telephone: 202-646-5797
Last EDR Contact: 07/10/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Varies

UST: Underground Storage Tank Facilities
Underground storage tank site locations.

Date of Government Version: 01/01/2008
Date Data Arrived at EDR: 03/26/2008
Date Made Active in Reports: 04/23/2008
Number of Days to Update: 28

Source: Environmental Quality Board
Telephone: 787-767-8056
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Semi-Annually

INDIAN UST R5: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 10/12/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Varies

INDIAN UST R4: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 09/24/2018
Date Data Arrived at EDR: 03/12/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 50

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Varies

INDIAN UST R1: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 10/03/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 11/01/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Varies

INDIAN UST R10: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 10/17/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Varies

INDIAN UST R7: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 11/07/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Varies

INDIAN UST R8: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 10/16/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Varies

INDIAN UST R9: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 10/10/2018
Date Data Arrived at EDR: 03/08/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 54

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Varies

State and tribal voluntary cleanup sites

INDIAN VCP R1: Voluntary Cleanup Priority Listing

A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 07/27/2015
Date Data Arrived at EDR: 09/29/2015
Date Made Active in Reports: 02/18/2016
Number of Days to Update: 142

Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 06/20/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Varies

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng

A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites

Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by EPA Brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on Targeted Brownfields Assessments performed by EPA Regions. A listing of ACRES Brownfield sites is obtained from Cleanups in My Community. Cleanups in My Community provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

Date of Government Version: 12/17/2018
Date Data Arrived at EDR: 12/18/2018
Date Made Active in Reports: 01/11/2019
Number of Days to Update: 24

Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 06/04/2019
Next Scheduled EDR Contact: 09/30/2019
Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands
Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/12/2019
Data Release Frequency: Varies

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations
A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137

Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 04/22/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: No Update Planned

ODI: Open Dump Inventory
An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

IHS OPEN DUMPS: Open Dumps on Indian Land
A listing of all open dumps located on Indian Land in the United States.

Date of Government Version: 04/01/2014
Date Data Arrived at EDR: 08/06/2014
Date Made Active in Reports: 01/29/2015
Number of Days to Update: 176

Source: Department of Health & Human Serivces, Indian Health Service
Telephone: 301-443-1452
Last EDR Contact: 04/23/2019
Next Scheduled EDR Contact: 08/12/2019
Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL: National Clandestine Laboratory Register
A listing of clandestine drug lab locations that have been removed from the DEAs National Clandestine Laboratory Register.

Date of Government Version: 02/24/2019
Date Data Arrived at EDR: 02/26/2019
Date Made Active in Reports: 04/17/2019
Number of Days to Update: 50

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 05/24/2019
Next Scheduled EDR Contact: 09/09/2019
Data Release Frequency: No Update Planned

US CDL: Clandestine Drug Labs
A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 02/24/2019
Date Data Arrived at EDR: 02/26/2019
Date Made Active in Reports: 04/17/2019
Number of Days to Update: 50

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 05/24/2019
Next Scheduled EDR Contact: 09/09/2019
Data Release Frequency: Quarterly

Local Land Records

LIENS 2: CERCLA Lien Information

A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 35

Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 07/02/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Semi-Annually

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System

Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/26/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 49

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

Other Ascertainable Records

RCRA NonGen / NLR: RCRA - Non Generators / No Longer Regulated

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/27/2019
Date Made Active in Reports: 04/17/2019
Number of Days to Update: 21

Source: Environmental Protection Agency
Telephone: (212) 637-3660
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 03/07/2019
Date Data Arrived at EDR: 04/03/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 50

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 05/21/2019
Next Scheduled EDR Contact: 09/02/2019
Data Release Frequency: Varies

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 11/10/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 62

Source: USGS
Telephone: 888-275-8747
Last EDR Contact: 07/09/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Semi-Annually

FEDLAND: Federal and Indian Lands

Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 02/06/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 339

Source: U.S. Geological Survey
Telephone: 888-275-8747
Last EDR Contact: 07/10/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: N/A

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing

The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 01/01/2017
Date Data Arrived at EDR: 02/03/2017
Date Made Active in Reports: 04/07/2017
Number of Days to Update: 63

Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 05/13/2019
Next Scheduled EDR Contact: 08/26/2019
Data Release Frequency: Varies

US FIN ASSUR: Financial Assurance Information

All owners and operators of facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the clean up, closure, and post-closure care of their facilities.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/26/2019
Date Made Active in Reports: 05/07/2019
Number of Days to Update: 42

Source: Environmental Protection Agency
Telephone: 202-566-1917
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

EPA WATCH LIST: EPA WATCH LIST

EPA maintains a "Watch List" to facilitate dialogue between EPA, state and local environmental agencies on enforcement matters relating to facilities with alleged violations identified as either significant or high priority. Being on the Watch List does not mean that the facility has actually violated the law only that an investigation by EPA or a state or local environmental agency has led those organizations to allege that an unproven violation has in fact occurred. Being on the Watch List does not represent a higher level of concern regarding the alleged violations that were detected, but instead indicates cases requiring additional dialogue between EPA, state and local agencies - primarily because of the length of time the alleged violation has gone unaddressed or unresolved.

Date of Government Version: 08/30/2013
Date Data Arrived at EDR: 03/21/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 88

Source: Environmental Protection Agency
Telephone: 617-520-3000
Last EDR Contact: 05/06/2019
Next Scheduled EDR Contact: 08/19/2019
Data Release Frequency: Quarterly

2020 COR ACTION: 2020 Corrective Action Program List

The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 09/30/2017
Date Data Arrived at EDR: 05/08/2018
Date Made Active in Reports: 07/20/2018
Number of Days to Update: 73

Source: Environmental Protection Agency
Telephone: 703-308-4044
Last EDR Contact: 05/10/2019
Next Scheduled EDR Contact: 08/19/2019
Data Release Frequency: Varies

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2016
Date Data Arrived at EDR: 06/21/2017
Date Made Active in Reports: 01/05/2018
Number of Days to Update: 198

Source: EPA
Telephone: 202-260-5521
Last EDR Contact: 06/18/2019
Next Scheduled EDR Contact: 09/30/2019
Data Release Frequency: Every 4 Years

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2016
Date Data Arrived at EDR: 01/10/2018
Date Made Active in Reports: 01/12/2018
Number of Days to Update: 2

Source: EPA
Telephone: 202-566-0250
Last EDR Contact: 05/24/2019
Next Scheduled EDR Contact: 09/02/2019
Data Release Frequency: Annually

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 12/10/2010
Date Made Active in Reports: 02/25/2011
Number of Days to Update: 77

Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 04/24/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Annually

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 35

Source: EPA
Telephone: 703-416-0223
Last EDR Contact: 07/01/2019
Next Scheduled EDR Contact: 09/16/2019
Data Release Frequency: Annually

RMP: Risk Management Plans

When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 04/25/2019
Date Data Arrived at EDR: 05/02/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 21

Source: Environmental Protection Agency
Telephone: 202-564-8600
Last EDR Contact: 04/22/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Varies

RAATS: RCRA Administrative Action Tracking System
RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

PRP: Potentially Responsible Parties
A listing of verified Potentially Responsible Parties

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-6023
Last EDR Contact: 07/01/2019
Next Scheduled EDR Contact: 08/19/2019
Data Release Frequency: Quarterly

PADS: PCB Activity Database System
PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 03/20/2019
Date Data Arrived at EDR: 04/10/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 34

Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 04/10/2019
Next Scheduled EDR Contact: 07/22/2019
Data Release Frequency: Annually

ICIS: Integrated Compliance Information System
The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 11/18/2016
Date Data Arrived at EDR: 11/23/2016
Date Made Active in Reports: 02/10/2017
Number of Days to Update: 79

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 07/03/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
Last EDR Contact: 08/18/2017
Next Scheduled EDR Contact: 12/04/2017
Data Release Frequency: No Update Planned

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA
Telephone: 202-566-1667
Last EDR Contact: 08/18/2017
Next Scheduled EDR Contact: 12/04/2017
Data Release Frequency: No Update Planned

MLTS: Material Licensing Tracking System
MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 08/30/2016
Date Data Arrived at EDR: 09/08/2016
Date Made Active in Reports: 10/21/2016
Number of Days to Update: 43

Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 04/22/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Quarterly

COAL ASH DOE: Steam-Electric Plant Operation Data
A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 08/07/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 76

Source: Department of Energy
Telephone: 202-586-8719
Last EDR Contact: 06/07/2019
Next Scheduled EDR Contact: 09/16/2019
Data Release Frequency: Varies

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List
A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 07/01/2014
Date Data Arrived at EDR: 09/10/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: N/A
Last EDR Contact: 06/07/2019
Next Scheduled EDR Contact: 09/16/2019
Data Release Frequency: Varies

PCB TRANSFORMER: PCB Transformer Registration Database
The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 05/24/2017
Date Data Arrived at EDR: 11/30/2017
Date Made Active in Reports: 12/15/2017
Number of Days to Update: 15

Source: Environmental Protection Agency
Telephone: 202-566-0517
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Varies

RADINFO: Radiation Information Database
The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 04/02/2019
Date Data Arrived at EDR: 04/02/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 42

Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 07/01/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing

A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing

A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

DOT OPS: Incident and Accident Data

Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 12/03/2018
Date Data Arrived at EDR: 01/29/2019
Date Made Active in Reports: 03/21/2019
Number of Days to Update: 51

Source: Department of Transporation, Office of Pipeline Safety
Telephone: 202-366-4595
Last EDR Contact: 04/30/2019
Next Scheduled EDR Contact: 08/12/2019
Data Release Frequency: Quarterly

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 03/31/2019
Date Data Arrived at EDR: 04/23/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 30

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 07/08/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Varies

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2015
Date Data Arrived at EDR: 02/22/2017
Date Made Active in Reports: 09/28/2017
Number of Days to Update: 218

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Biennially

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

INDIAN RESERV: Indian Reservations

This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2014
Date Data Arrived at EDR: 07/14/2015
Date Made Active in Reports: 01/10/2017
Number of Days to Update: 546

Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 07/10/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Semi-Annually

FUSRAP: Formerly Utilized Sites Remedial Action Program

DOE established the Formerly Utilized Sites Remedial Action Program (FUSRAP) in 1974 to remediate sites where radioactive contamination remained from Manhattan Project and early U.S. Atomic Energy Commission (AEC) operations.

Date of Government Version: 08/08/2017
Date Data Arrived at EDR: 09/11/2018
Date Made Active in Reports: 09/14/2018
Number of Days to Update: 3

Source: Department of Energy
Telephone: 202-586-3559
Last EDR Contact: 05/02/2019
Next Scheduled EDR Contact: 08/19/2019
Data Release Frequency: Varies

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 06/23/2017
Date Data Arrived at EDR: 10/11/2017
Date Made Active in Reports: 11/03/2017
Number of Days to Update: 23

Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 05/24/2019
Next Scheduled EDR Contact: 09/02/2019
Data Release Frequency: Varies

LEAD SMELTER 1: Lead Smelter Sites

A listing of former lead smelter site locations.

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 26

Source: Environmental Protection Agency
Telephone: 703-603-8787
Last EDR Contact: 07/01/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Varies

LEAD SMELTER 2: Lead Smelter Sites

A list of several hundred sites in the U.S. where secondary lead smelting was done from 1931and 1964. These sites may pose a threat to public health through ingestion or inhalation of contaminated soil or dust

Date of Government Version: 04/05/2001
Date Data Arrived at EDR: 10/27/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 36

Source: American Journal of Public Health
Telephone: 703-305-6451
Last EDR Contact: 12/02/2009
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

US AIRS (AFS): Aerometric Information Retrieval System Facility Subsystem (AFS)

The database is a sub-system of Aerometric Information Retrieval System (AIRS). AFS contains compliance data on air pollution point sources regulated by the U.S. EPA and/or state and local air regulatory agencies. This information comes from source reports by various stationary sources of air pollution, such as electric power plants, steel mills, factories, and universities, and provides information about the air pollutants they produce. Action, air program, air program pollutant, and general level plant data. It is used to track emissions and compliance data from industrial plants.

Date of Government Version: 10/12/2016
Date Data Arrived at EDR: 10/26/2016
Date Made Active in Reports: 02/03/2017
Number of Days to Update: 100

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 09/26/2017
Next Scheduled EDR Contact: 01/08/2018
Data Release Frequency: Annually

US AIRS MINOR: Air Facility System Data
A listing of minor source facilities.

Date of Government Version: 10/12/2016
Date Data Arrived at EDR: 10/26/2016
Date Made Active in Reports: 02/03/2017
Number of Days to Update: 100

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 09/26/2017
Next Scheduled EDR Contact: 01/08/2018
Data Release Frequency: Annually

US MINES: Mines Master Index File
Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 11/27/2018
Date Data Arrived at EDR: 02/27/2019
Date Made Active in Reports: 04/01/2019
Number of Days to Update: 33

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 05/29/2019
Next Scheduled EDR Contact: 09/09/2019
Data Release Frequency: Semi-Annually

US MINES 2: Ferrous and Nonferrous Metal Mines Database Listing
This map layer includes ferrous (ferrous metal mines are facilities that extract ferrous metals, such as iron ore or molybdenum) and nonferrous (Nonferrous metal mines are facilities that extract nonferrous metals, such as gold, silver, copper, zinc, and lead) metal mines in the United States.

Date of Government Version: 12/05/2005
Date Data Arrived at EDR: 02/29/2008
Date Made Active in Reports: 04/18/2008
Number of Days to Update: 49

Source: USGS
Telephone: 703-648-7709
Last EDR Contact: 05/31/2019
Next Scheduled EDR Contact: 09/09/2019
Data Release Frequency: Varies

US MINES 3: Active Mines & Mineral Plants Database Listing
Active Mines and Mineral Processing Plant operations for commodities monitored by the Minerals Information Team of the USGS.

Date of Government Version: 04/14/2011
Date Data Arrived at EDR: 06/08/2011
Date Made Active in Reports: 09/13/2011
Number of Days to Update: 97

Source: USGS
Telephone: 703-648-7709
Last EDR Contact: 05/31/2019
Next Scheduled EDR Contact: 09/09/2019
Data Release Frequency: Varies

ABANDONED MINES: Abandoned Mines
An inventory of land and water impacted by past mining (primarily coal mining) is maintained by OSMRE to provide information needed to implement the Surface Mining Control and Reclamation Act of 1977 (SMCRA). The inventory contains information on the location, type, and extent of AML impacts, as well as, information on the cost associated with the reclamation of those problems. The inventory is based upon field surveys by State, Tribal, and OSMRE program officials. It is dynamic to the extent that it is modified as new problems are identified and existing problems are reclaimed.

Date of Government Version: 03/27/2019
Date Data Arrived at EDR: 03/28/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 34

Source: Department of Interior
Telephone: 202-208-2609
Last EDR Contact: 06/19/2019
Next Scheduled EDR Contact: 09/23/2019
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 02/15/2019
Date Data Arrived at EDR: 03/05/2019
Date Made Active in Reports: 03/15/2019
Number of Days to Update: 10

Source: EPA
Telephone: (212) 637-3000
Last EDR Contact: 06/05/2019
Next Scheduled EDR Contact: 09/16/2019
Data Release Frequency: Quarterly

DOCKET HWC: Hazardous Waste Compliance Docket Listing

A complete list of the Federal Agency Hazardous Waste Compliance Docket Facilities.

Date of Government Version: 05/31/2018
Date Data Arrived at EDR: 07/26/2018
Date Made Active in Reports: 10/05/2018
Number of Days to Update: 71

Source: Environmental Protection Agency
Telephone: 202-564-0527
Last EDR Contact: 05/24/2019
Next Scheduled EDR Contact: 09/09/2019
Data Release Frequency: Varies

ECHO: Enforcement & Compliance History Information

ECHO provides integrated compliance and enforcement information for about 800,000 regulated facilities nationwide.

Date of Government Version: 04/07/2019
Date Data Arrived at EDR: 04/09/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 44

Source: Environmental Protection Agency
Telephone: 202-564-2280
Last EDR Contact: 07/09/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Quarterly

UXO: Unexploded Ordnance Sites

A listing of unexploded ordnance site locations

Date of Government Version: 12/31/2017
Date Data Arrived at EDR: 01/17/2019
Date Made Active in Reports: 04/01/2019
Number of Days to Update: 74

Source: Department of Defense
Telephone: 703-704-1564
Last EDR Contact: 04/15/2019
Next Scheduled EDR Contact: 07/29/2019
Data Release Frequency: Varies

FUELS PROGRAM: EPA Fuels Program Registered Listing

This listing includes facilities that are registered under the Part 80 (Code of Federal Regulations) EPA Fuels Programs. All companies now are required to submit new and updated registrations.

Date of Government Version: 02/19/2019
Date Data Arrived at EDR: 02/21/2019
Date Made Active in Reports: 04/01/2019
Number of Days to Update: 39

Source: EPA
Telephone: 800-385-6164
Last EDR Contact: 05/21/2019
Next Scheduled EDR Contact: 09/02/2019
Data Release Frequency: Quarterly

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP: EDR Proprietary Manufactured Gas Plants

The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

EDR Hist Auto: EDR Exclusive Historical Auto Stations

EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR Hist Cleaner: EDR Exclusive Historical Cleaners

EDR has searched selected national collections of business directories and has collected listings of potential dry cleaner sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include dry cleaning establishments. The categories reviewed included, but were not limited to dry cleaners, cleaners, laundry, laundromat, cleaning/laundry, wash & dry etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA LUST: Recovered Government Archive Leaking Underground Storage Tank

The EDR Recovered Government Archive Leaking Underground Storage Tank database provides a list of LUST incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Environmental Quality Board in Puerto Rico.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 01/04/2014
Number of Days to Update: 187

Source: Environmental Quality Board
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

NJ MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2018
Date Data Arrived at EDR: 04/10/2019
Date Made Active in Reports: 05/16/2019
Number of Days to Update: 36

Source: Department of Environmental Protection
Telephone: N/A
Last EDR Contact: 07/09/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Annually

RI MANIFEST: Manifest information
Hazardous waste manifest information

Date of Government Version: 12/31/2017
Date Data Arrived at EDR: 02/23/2018
Date Made Active in Reports: 04/09/2018
Number of Days to Update: 45

Source: Department of Environmental Management
Telephone: 401-222-2797
Last EDR Contact: 05/17/2019
Next Scheduled EDR Contact: 09/02/2019
Data Release Frequency: Annually

Oil/Gas Pipelines
Source: PennWell Corporation
Petroleum Bundle (Crude Oil, Refined Products, Petrochemicals, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)) N = Natural Gas Bundle (Natural Gas, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)). This map includes information copyrighted by PennWell Corporation. This information is provided on a best effort basis and PennWell Corporation does not guarantee its accuracy nor warrant its fitness for any particular purpose. Such information has been reprinted with the permission of PennWell.

Electric Power Transmission Line Data
Source: PennWell Corporation
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Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.
Source: FEMA
Telephone: 877-336-2627
Date of Government Version: 2003, 2015

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

Current USGS 7.5 Minute Topographic Map
Source: U.S. Geological Survey

STREET AND ADDRESS INFORMATION

GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

CAMP SANTIAGO
CAMP SANTIAGO
SALINAS, PR 00751

TARGET PROPERTY COORDINATES

Latitude (North):	18.007112 - 18˚ 0’ 25.60’’
Longitude (West):	66.294977 - 66˚ 17’ 41.92’’
Universal Tranverse Mercator:	Zone 19
UTM X (Meters):	786440.1
UTM Y (Meters):	1992943.8
Elevation:	161 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	5964450 COAMO, PR
Version Date:	2013
South Map:	5964474 SALINAS, PR
Version Date:	2013

EDR’s GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principle investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

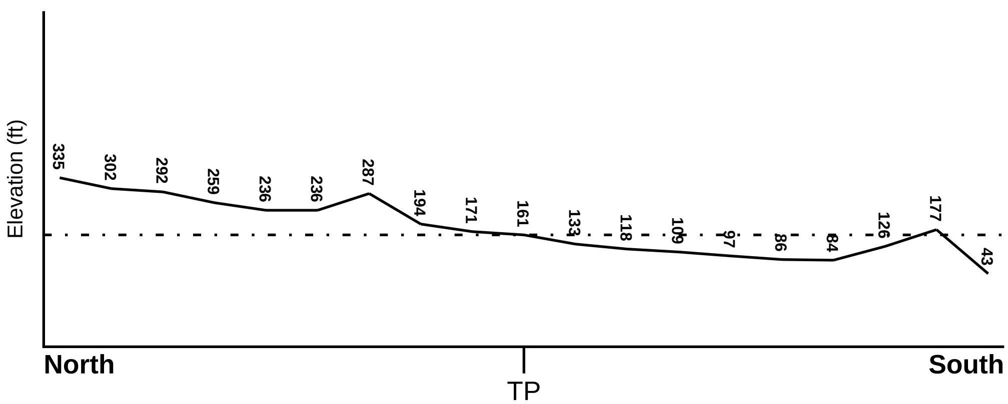
TOPOGRAPHIC INFORMATION

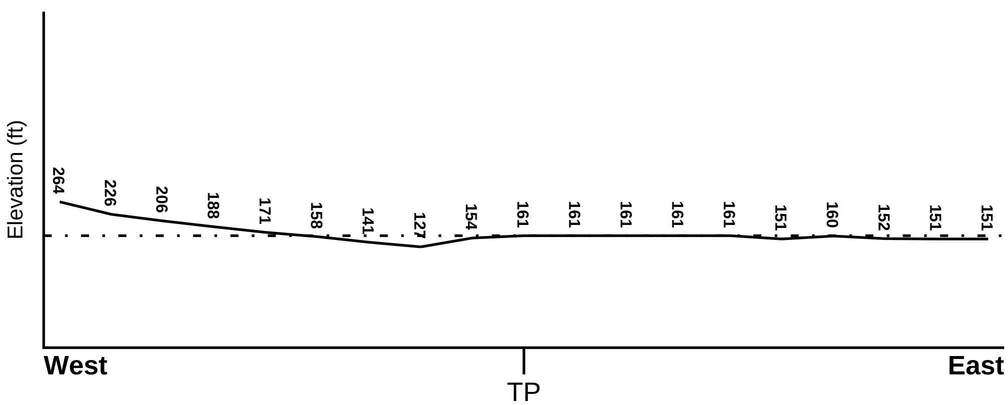
Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General SSW

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES





Target Property Elevation: 161 ft.

Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Flood Plain Panel at Target Property	FEMA Source Type
7200000234B	FEMA Q3 Flood data

Additional Panels in search area:	FEMA Source Type
7200000292C	FEMA Q3 Flood data

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
NOT AVAILABLE	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

Era: -
System: -
Series: -
Code: N/A *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: -

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps. The following information is based on Soil Conservation Service STATSGO data.

Soil Component Name:	COAMO
Soil Surface Texture:	clay loam
Hydrologic Group:	Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.
Soil Drainage Class:	Well drained. Soils have intermediate water holding capacity. Depth to water table is more than 6 feet.

Hydric Status: Soil does not meet the requirements for a hydric soil.

Corrosion Potential - Uncoated Steel:	LOW
Depth to Bedrock Min:	> 60 inches
Depth to Bedrock Max:	> 60 inches

Soil Layer Information							
	Boundary			Classification			
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil	Permeability Rate (in/hr)	Soil Reaction (pH)
1	0 inches	15 inches	clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 0.60 Min: 0.20	Max: 6.50 Min: 6.10
2	15 inches	25 inches	clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit 50% or more), Fat Clay.	Max: 0.60 Min: 0.20	Max: 7.80 Min: 7.40
3	25 inches	38 inches	gravelly - clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Clayey sand.	Max: 6.00 Min: 2.00	Max: 8.40 Min: 7.90
4	38 inches	48 inches	stratified	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel. COARSE-GRAINED SOILS, Gravels, Gravels with fines, Clayey Gravel.	Max: 20.00 Min: 6.00	Max: 8.40 Min: 7.90

OTHER SOIL TYPES IN AREA

Based on Soil Conservation Service STATSGO data, the following additional subordinant soil types may appear within the general area of target property.

Soil Surface Textures: silty clay loam
clay
loam
silty clay
sandy loam

Surficial Soil Types: silty clay loam
clay
loam
silty clay
sandy loam

Shallow Soil Types: clay loam
sandy clay loam
loamy sand
coarse sand

Deeper Soil Types: silt loam

loamy sand
clay loam
loam
very gravelly - coarse sand

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
1	USGS40001042678	1/4 - 1/2 Mile SW

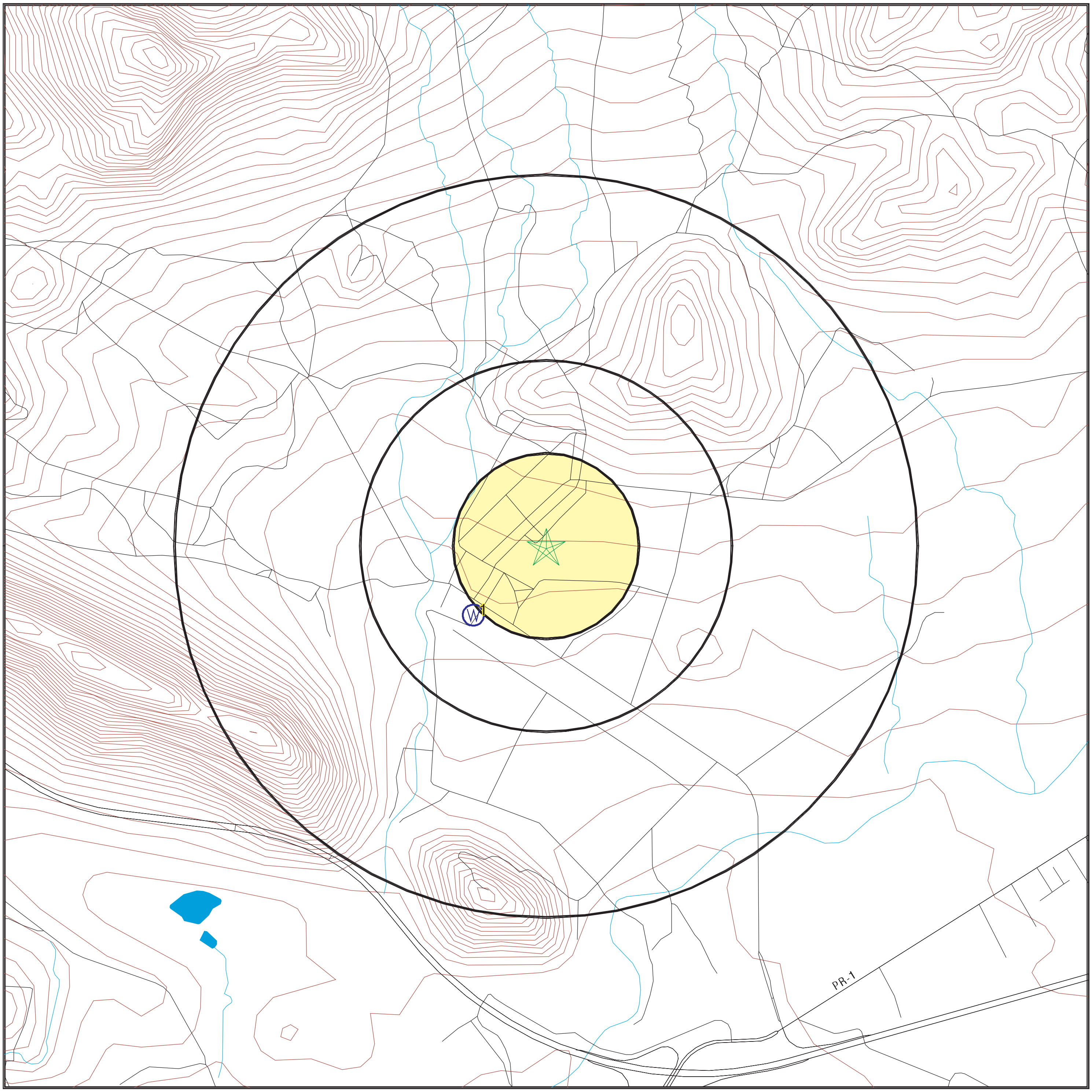
FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP

No PWS System Found

Note: PWS System location is not always the same as well location.

PHYSICAL SETTING SOURCE MAP - 5714997.16s



County Boundary
Major Roads
Contour Lines
Earthquake epicenter, Richter 5 or greater
Water Wells
Public Water Supply Wells
Cluster of Multiple Icons

Groundwater Flow Direction
GI Indeterminate Groundwater Flow at Location
GV Groundwater Flow Varies at Location

SITE NAME: Camp Santiago ADDRESS: Camp Santiago Salinas PR 00751 LAT/LONG: 18.007112 / 66.294977	CLIENT: AECOM CONTACT: Hans Sund INQUIRY #: 5714997.16s DATE: July 12, 2019 2:37 pm

Map ID Direction Distance Elevation	Database	EDR ID Number
1 **SW** **1/4 - 1/2 Mile** **Lower**	**FED USGS**	**USGS40001042678**

Organization ID:	USGS-PR		
Organization Name:	USGS Puerto Rico Water Science Center		
Monitor Location:	THEATRE 1 WELL, SALINAS, PR		
Type:	Well	Description:	Not Reported
HUC:	21010004	Drainage Area:	Not Reported
Drainage Area Units:	Not Reported	Contrib Drainage Area:	Not Reported
Contrib Drainage Area Unts:	Not Reported	Aquifer:	Not Reported
Formation Type:	Not Reported	Aquifer Type:	Not Reported
Construction Date:	19490601	Well Depth:	80
Well Depth Units:	ft	Well Hole Depth:	150
Well Hole Depth Units:	ft		

Ground water levels,Number of Measurements:	86	Level reading date:	1989-07-19
Feet below surface:	61.30	Feet to sea level:	Not Reported
Note:	Not Reported		
Level reading date:	1989-07-19	Feet below surface:	61.30
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-09-23	Feet below surface:	50.78
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-09-23	Feet below surface:	50.78
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-08-14	Feet below surface:	51.95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-08-14	Feet below surface:	51.95
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-07-11	Feet below surface:	51.57
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-07-11	Feet below surface:	51.57
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-06-17	Feet below surface:	51.39
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-06-17	Feet below surface:	51.39
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-05-13	Feet below surface:	50.48
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-05-13	Feet below surface:	50.48
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-04-14	Feet below surface:	49.44
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-04-14	Feet below surface:	49.44
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1980-03-27	Feet below surface:	48.70
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1980-03-27	Feet below surface:	48.70
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-12-17	Feet below surface:	40.54
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-12-17	Feet below surface:	40.54
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-11-30	Feet below surface:	39.89
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-11-30	Feet below surface:	39.89
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-10-15	Feet below surface:	39.38
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-10-15	Feet below surface:	39.38
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-08-21	Feet below surface:	48.40
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-08-21	Feet below surface:	48.40
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-07-24	Feet below surface:	49.02
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-07-24	Feet below surface:	49.02
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-06-19	Feet below surface:	51.05
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-06-19	Feet below surface:	51.05
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-05-23	Feet below surface:	51.69
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-05-23	Feet below surface:	51.69
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-04-24	Feet below surface:	51.26
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-04-24	Feet below surface:	51.26
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-03-20	Feet below surface:	50.72
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-03-20	Feet below surface:	50.72
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-02-22	Feet below surface:	49.90
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1979-02-22	Feet below surface:	49.90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-01-16	Feet below surface:	48.52
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1979-01-16	Feet below surface:	48.52
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-12-13	Feet below surface:	46.52
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-12-13	Feet below surface:	46.52
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-11-22	Feet below surface:	47.32
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-11-22	Feet below surface:	47.32
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-10-12	Feet below surface:	54.33
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-10-12	Feet below surface:	54.33
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-09-18	Feet below surface:	54.07
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-09-18	Feet below surface:	54.07
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-08-04	Feet below surface:	60.97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-08-04	Feet below surface:	60.97
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-07-20	Feet below surface:	57.79
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-07-20	Feet below surface:	57.79
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-06-13	Feet below surface:	59.50
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-06-13	Feet below surface:	59.50
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-04-14	Feet below surface:	53.44
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-04-14	Feet below surface:	53.44
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-03-21	Feet below surface:	58.65
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-03-21	Feet below surface:	58.65
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1978-02-07	Feet below surface:	57.23
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1978-02-07	Feet below surface:	57.23
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-12-09	Feet below surface:	52.79
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-12-09	Feet below surface:	52.79
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-10-13	Feet below surface:	56.72
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-10-13	Feet below surface:	56.72
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-09-13	Feet below surface:	58.63
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-09-13	Feet below surface:	58.63
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-08-11	Feet below surface:	54.90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-08-11	Feet below surface:	54.90
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-07-07	Feet below surface:	61.57
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-07-07	Feet below surface:	61.57
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-05-31	Feet below surface:	61.54
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-05-31	Feet below surface:	61.54
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-05-10	Feet below surface:	53.84
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-05-10	Feet below surface:	53.84
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-04-12	Feet below surface:	55.80
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-04-12	Feet below surface:	55.80
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-02-15	Feet below surface:	56.01
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-02-15	Feet below surface:	56.01
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1977-01-10	Feet below surface:	52.48
Feet to sea level:	Not Reported	Note:	Not Reported

Level reading date:	1977-01-10	Feet below surface:	52.48
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-12-09	Feet below surface:	51.45
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-12-09	Feet below surface:	51.45
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-11-09	Feet below surface:	49.68
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-11-09	Feet below surface:	49.68
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-10-06	Feet below surface:	50.94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1976-10-06	Feet below surface:	50.94
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1949-06-08	Feet below surface:	58.0
Feet to sea level:	Not Reported	Note:	Not Reported
Level reading date:	1949-06-08	Feet below surface:	58.0
Feet to sea level:	Not Reported	Note:	Not Reported

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

Not Reported

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Current USGS 7.5 Minute Topographic Map
Source: U.S. Geological Survey

HYDROLOGIC INFORMATION

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.
Source: FEMA
Telephone: 877-336-2627
Date of Government Version: 2003, 2015

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

HYDROGEOLOGIC INFORMATION

AQUIFLOW^{R} Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Service, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

OTHER STATE DATABASE INFORMATION

RADON

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

Earthquake Fault Lines: The fault lines displayed on EDR’s Topographic map are digitized quaternary faultlines, prepared in 1975 by the United State Geological Survey

STREET AND ADDRESS INFORMATION

Camp Santiago

Camp Santiago

Salinas, PR 00751

Inquiry Number: 5714997.19

July 15, 2019

The EDR Aerial Photo Decade Package

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

07/15/19

Site Name:	Client Name:
Camp Santiago	AECOM
Camp Santiago	12120 Shamrock Plaza
Salinas, PR 00751	Omaha, NE 68154
EDR Inquiry # 5714997.19	Contact: Hans Sund

Environmental Data Resources, Inc. (EDR) Aerial Photo Decade Package is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's professional researchers provide digitally reproduced historical aerial photographs, and when available, provide one photo per decade.

Search Results:

Year	Scale	Details	Source
1994	1"=1125'	Acquisition Date: November 24, 1994	USGS/DOQQ
1993	1"=1125'	Flight Date: December 17, 1993	USGS
1983	1"=1125'	Flight Date: February 08, 1983	USGS
1977	1"=1125'	Flight Date: March 25, 1977	USGS
1968	1"=1125'	Flight Date: March 04, 1968	USGS
1958	1"=1125'	Flight Date: December 22, 1958	USGS

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INQUIRY #: 5714997.19

YEAR: 1994

N

= 1125'

EDR

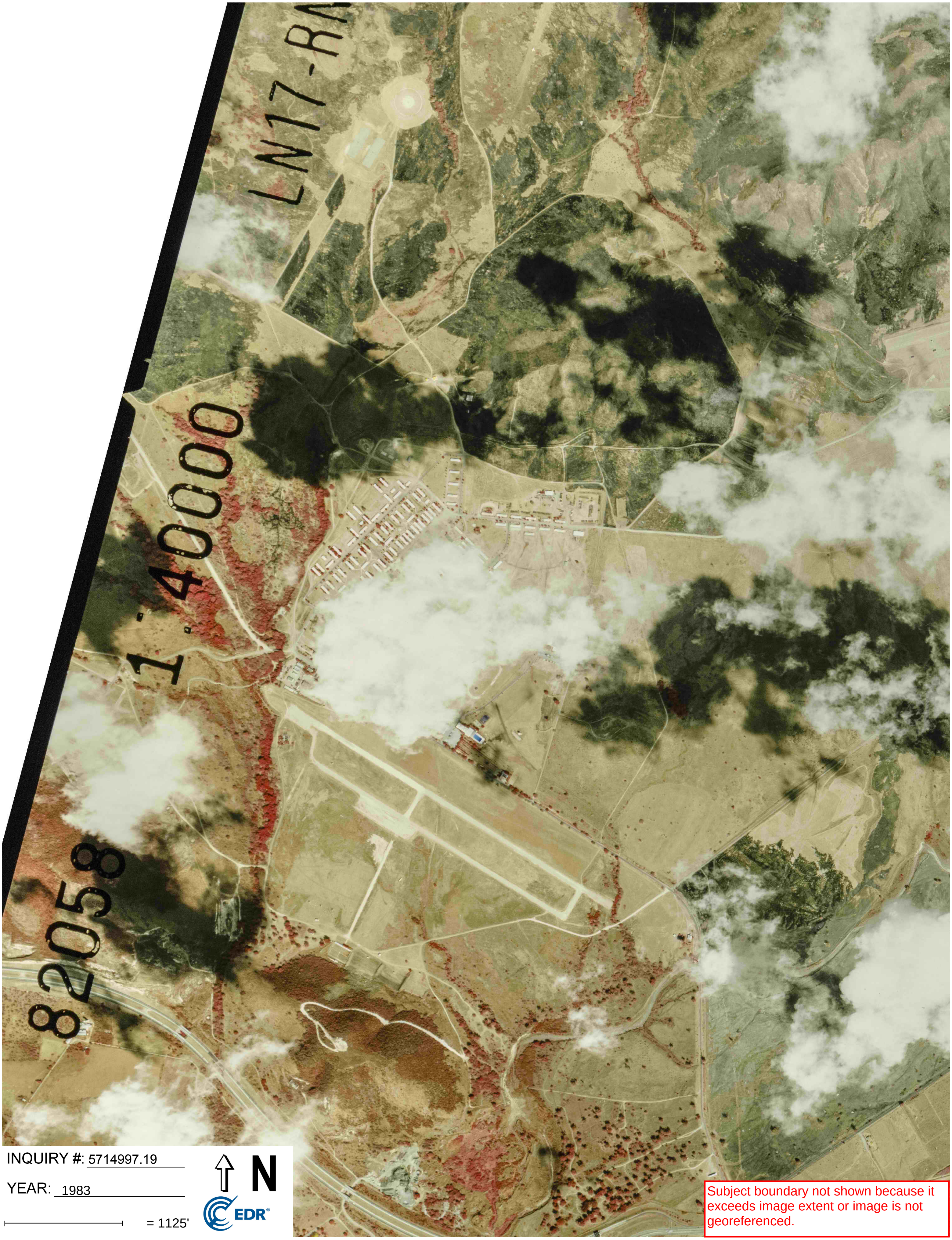
INQUIRY #: 5714997.19

YEAR: 1993

= 1125'

N

EDR



INQUIRY #: 5714997.19

YEAR: 1983

= 1125'

N

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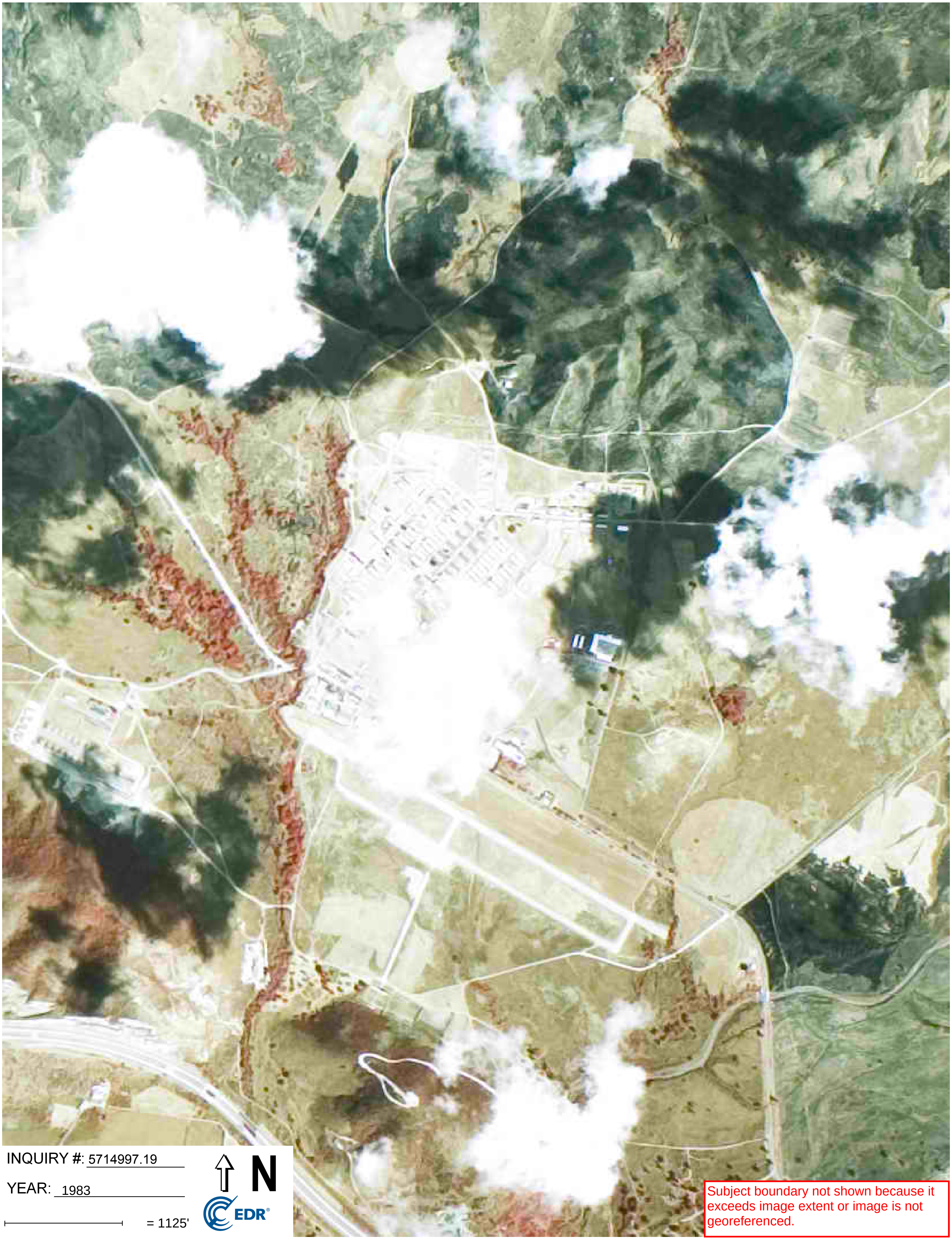


INQUIRY #: 5714997.19

YEAR: 1983

= 1125'

N

Subject boundary not shown because it exceeds image extent or image is not georeferenced.

INQUIRY #: 5714997.19

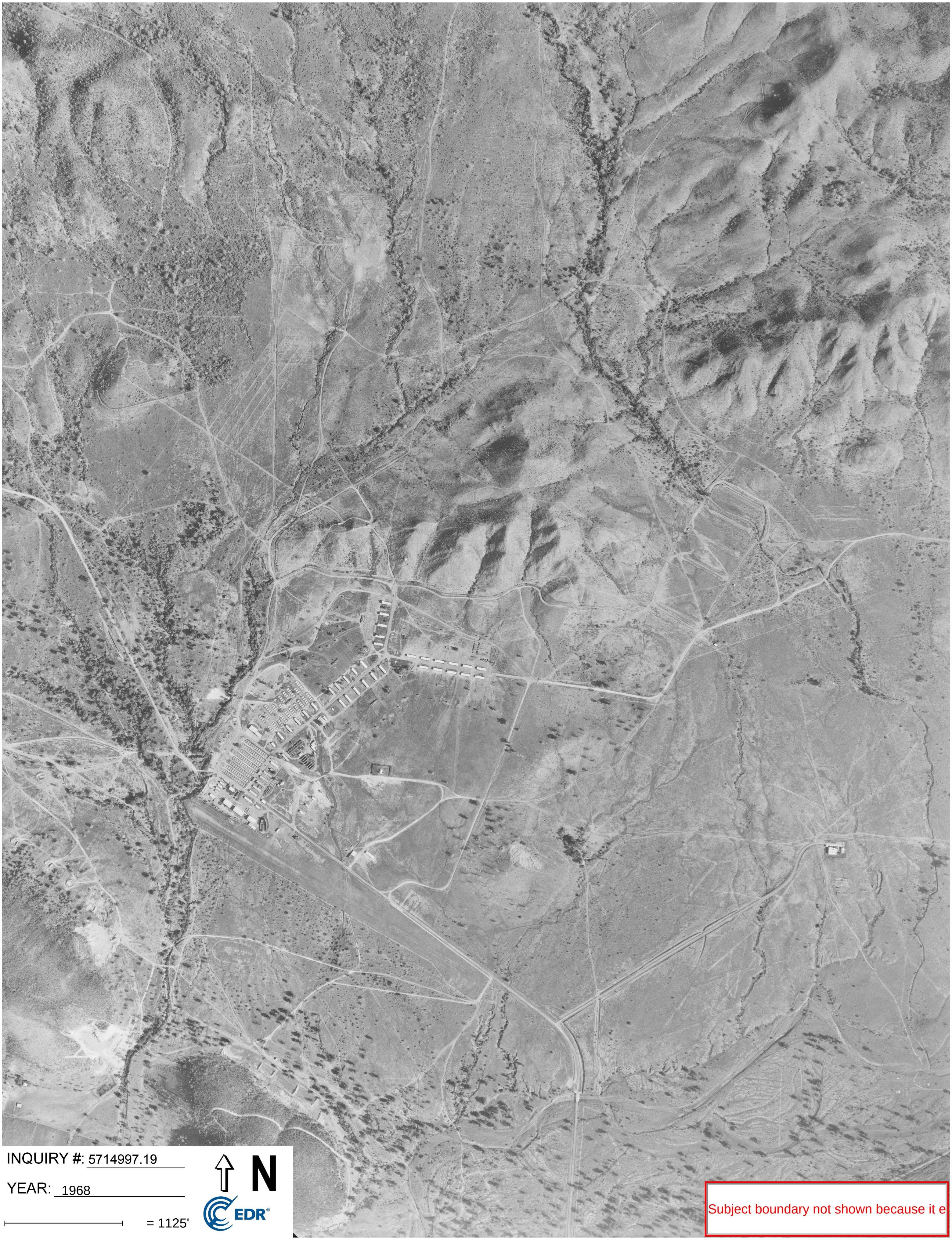
YEAR: 1977

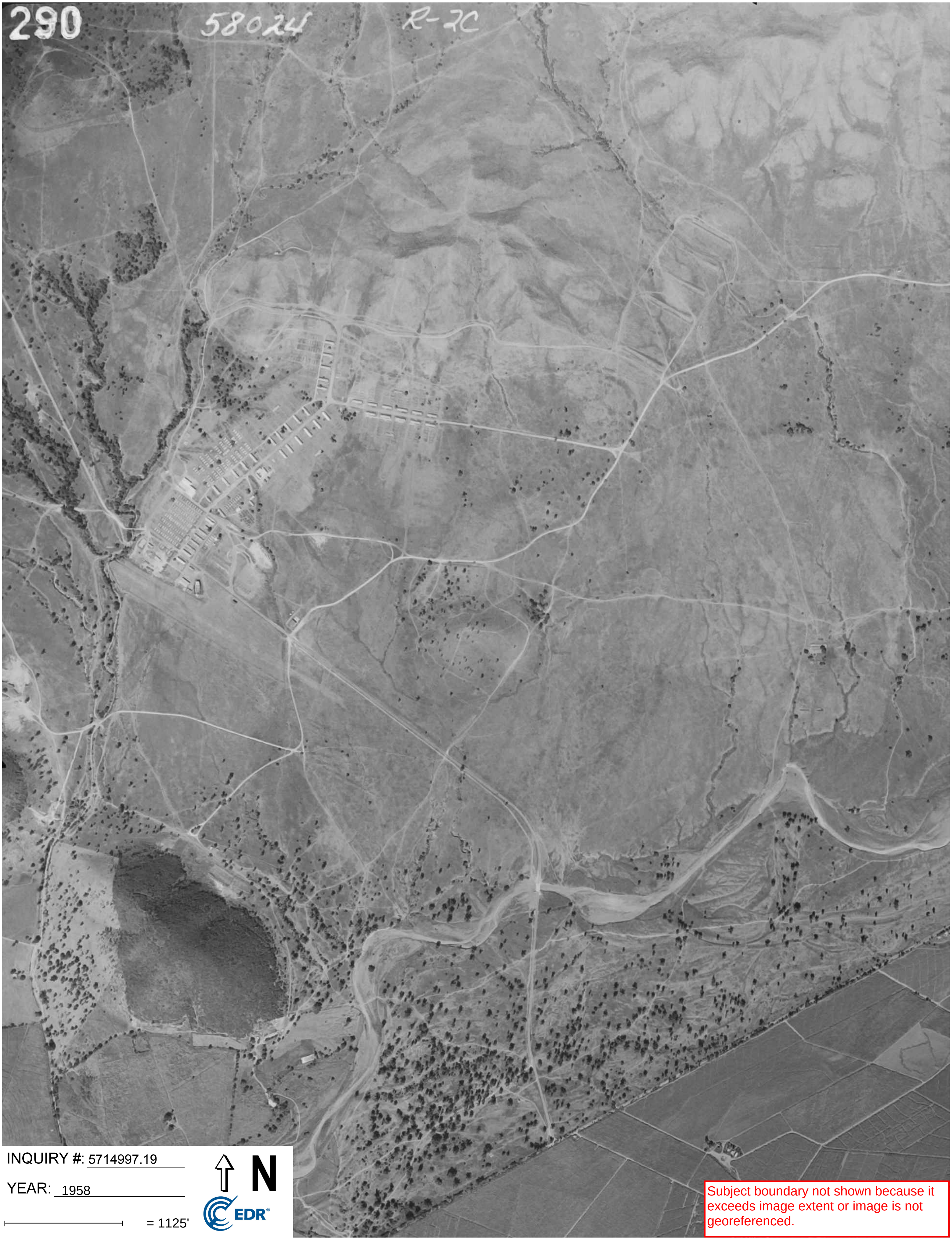
= 1125'

N

EDR

Subject boundary not shown because it exceeds image extent or image is not georeferenced.


INQUIRY #: 5714997.19
YEAR: 1968
= 1125'
N
EDR
Subject boundary not shown because it e



INQUIRY #: 5714997.19

YEAR: 1958

= 1125'

N

Subject boundary not shown because it exceeds image extent or image is not georeferenced.

INQUIRY #: 5714997.19

YEAR: 1958

= 1125'

N

EDR

Subject boundary not shown because it exceeds image extent or image is not georeferenced.

CHEMGUARD

Safety Data Sheet

This safety data sheet complies with the requirements of: 2012 OSHA Hazard Communication Standard (29CFR 1910.1200)

Product name Chemguard C303 3% AFFF (C303P)

1. Identification

Green

1.1. Product Identifier

Product name	Chemguard C303 3% AFFF (C303P)

1.2. Other means of identification

Product code	770106
Synonyms	None
Chemical Family	Fire fighting foam, surfactant

1.3. Recommended use of the chemical and restrictions on use

Recommended use	Fire extinguishing agent.
Uses advised against	None known.

1.4. Details of the Supplier of the Safety Data Sheet

Company Name	Tyco Fire Protection Products One Stanton Street Marinette, WI 54143-2542 Telephone: 715-735-7411
Contact point	Product Stewardship at 1-715-735-7411
E-mail address	psra@tycofp.com

1.5. Emergency Telephone Number

Emergency telephone	CHEMTREC 001-800-424-9300 or 001-703-527-3887

2. Hazards Identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Serious eye damage/eye irritation - Category 1

2.2. Label Elements

Signal Word
DANGER

Hazard Statements
Causes serious eye damage

Precautionary Statements

Prevention
Wear protective gloves/protective clothing/eye protection/face protection.

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/physician.

2.3. Hazards Not Otherwise Classified (HNOC)
Not Applicable.

2.4. Other Information

3. Composition/information on Ingredients

3.1. Mixture
The following component(s) in this product are considered hazardous under applicable OSHA(USA)

Chemical name	CAS No.	weight-%
2-(2-Butoxyethoxy)ethanol	112-34-5	3 - 7
Sodium Decyl Sulfate	142-87-0	1 - 5
Sodium Octyl Sulfate	142-31-4	1 - 5

4. First aid measures

4.1. Description of first aid measures

General Advice Keep victim under observation. Move victim to a safe isolated area. Move victim to fresh air. Remove contaminated clothing and shoes. If symptoms persist, call a physician.

Eye Contact Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a physician.

Skin contact Wash skin with soap and water. Get medical attention if irritation develops and persists.

Inhalation Remove to fresh air. If breathing is difficult, give oxygen. (Get medical attention immediately if symptoms occur.).

Ingestion Rinse mouth. Do not induce vomiting without medical advice. If swallowed, call a poison control center or physician immediately.

4.2. Most Important Symptoms and Effects, Both Acute and Delayed
Symptoms No information available.

4.3. Indication of Any Immediate Medical Attention and Special Treatment Needed
Note to physicians Treat symptomatically.

5. Fire-fighting measures

5.1. Suitable Extinguishing Media
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

5.2. Unsuitable Extinguishing Media
None.

5.3. Specific Hazards Arising from the Chemical
None known.

Hazardous Combustion Products Carbon oxides, Fluorinated oxides, Nitrogen oxides (NOx), Oxides of sulfur

5.4. Explosion Data

Sensitivity to Mechanical Impact None.
Sensitivity to Static Discharge None.

5.5. Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Personal Precautions Ensure adequate ventilation, especially in confined areas.

For emergency responders Use personal protection recommended in Section 8.

6.2. Environmental Precautions

Environmental Precautions Prevent further leakage or spillage if safe to do so. Prevent entry into waterways, sewers, basements or confined areas. See Section 12 for additional Ecological Information.

6.3. Methods and material for containment and cleaning up

Methods for Containment Prevent further leakage or spillage if safe to do so.

Methods for Cleaning Up Pick up and transfer to properly labeled containers.

7. Handling and Storage

7.1. Precautions for Safe Handling

Advice on safe handling Avoid contact with skin and eyes. Handle in accordance with good industrial hygiene and safety practice.

7.2. Conditions for safe storage, including any incompatibilities

Storage Conditions Keep containers tightly closed in a dry, cool and well-ventilated place.

Incompatible Materials Strong oxidizing agents. Strong acids. Strong bases.

8. Exposure Controls/Personal Protection

8.1. Control Parameters

Exposure guidelines

Chemical name	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL
2-(2-Butoxyethoxy)ethanol 112-34-5	TWA: 10 ppm inhalable fraction and vapor	-	-	-

ACGIH (American Conference of Governmental Industrial Hygienists) OSHA (Occupational Safety and Health Administration of the US Department of Labor) NIOSH IDLH Immediately Dangerous to Life or Health

8.2. Appropriate Engineering Controls

Engineering controls Ensure adequate ventilation, especially in confined areas.

8.3. Individual protection measures, such as personal protective equipment

Eye/Face Protection Avoid contact with eyes. Tight sealing safety goggles.

Skin and Body Protection Wear protective gloves and protective clothing.

Respiratory Protection If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.

Ventilation Use local exhaust or general dilution ventilation to control exposure with applicable limits

8.4. General hygiene considerations

Do not eat, drink or smoke when using this product. Handle in accordance with good industrial hygiene and safety practice.

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State	Liquid		
Odor	Slight solvent	**Color**	Amber
Odor Threshold	No data available		

Property	**Values**	**Remarks • Method**
pH	7.0	
Melting point/freezing point	-2 °C / 28 °F	
Boiling point / boiling range	100 °C / 212 °F	
Flash Point	> 100 °C / > 212 °F	
Evaporation Rate	No data available	
Flammability (solid, gas)	No data available	
Flammability limit in air		
Upper flammability limit:	No data available	
Lower flammability limit:	No data available	
Vapor Pressure	No data available	
Vapor Density	No data available	
Specific gravity	1.00 - 1.25	
Water Solubility	Completely soluble	
Solubility in Other Solvents	No data available	
Partition coefficient	No data available	
Autoignition Temperature	No data available	
Decomposition Temperature	No data available	
Kinematic viscosity	No data available	

VOC content (%) 6.44963

10. Stability and Reactivity

10.1. Chemical Stability

Stable under recommended storage conditions.

10.2. Reactivity
No data available

10.3. Possibility of hazardous reactions

None under normal processing.

Hazardous Polymerization Hazardous polymerization does not occur.

10.4. Conditions to Avoid

Extremes of temperature and direct sunlight.

10.5. Incompatible Materials

Strong oxidizing agents. Strong acids. Strong bases.

10.6. Hazardous decomposition products

Carbon oxides. Nitrogen oxides (NOx). Oxides of sulfur. Fluorinated oxides.

11. Toxicological Information

11.1. Information on Likely Routes of Exposure

Product information No data available

Inhalation No data available.

Eye Contact Severely irritating to eyes.

Skin contact May cause irritation.

Ingestion No data available.

Component Information
Acute Toxicity

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
2-(2-Butoxyethoxy)ethanol 112-34-5	= 5660 mg/kg (Rat)	= 2700 mg/kg (Rabbit)	-
Sodium Decyl Sulfate 142-87-0	= 1950 mg/kg (Rat)	-	-
Sodium Octyl Sulfate 142-31-4	= 3200 mg/kg (Rat)	-	-

11.2. Information on Toxicological Effects

Symptoms No information available.

11.3. Delayed and immediate effects as well as chronic effects from short and long-term exposure
Skin Corrosion/Irritation Irritating to skin.
Serious eye damage/eye irritation Severely irritating to eyes.
Carcinogenicity No information available.
Reproductive Toxicity No information available.
STOT - Single Exposure No information available.
STOT - Repeated Exposure No information available.
Aspiration Hazard No information available.

11.4. Numerical Measures of Toxicity - Product information

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral)	10229 mg/kg
ATEmix (dermal)	45000 mg/kg

12. Ecological Information

12.1. Ecotoxicity

Chemical name	Algae/aquatic plants	Fish	Crustacea
2-(2-Butoxyethoxy)ethanol 112-34-5	EC50 (96h) > 100 mg/L Desmodesmus subspicatus	LC50 (96h) static = 1300 mg/L Lepomis macrochirus	EC50 (48h) > 100 mg/L Daphnia magna EC50 (24h) = 2850 mg/L Daphnia magna
Cumene sulfonate, sodium salt 28348-53-0	EC50 (72h) > 1000 mg/L Desmodesmus subspicatus	-	EC50 (24h) > 1000 mg/L Daphnia magna
1,2-Propanediol 57-55-6	EC50 (96h) = 19000 mg/L Pseudokirchneriella subcapitata	LC50 (96h) static = 51600 mg/L Oncorhynchus mykiss LC50 (96h) static = 51400 mg/L Pimephales promelas LC50 (96h) = 710 mg/L Pimephales promelas LC50 (96h) static 41 - 47 mL/L Oncorhynchus mykiss	EC50 (48h) Static > 1000 mg/L Daphnia magna EC50 (24h) > 10000 mg/L Daphnia magna
Sodium chloride 7647-14-5	-	LC50 (96h) flow-through 4747 - 7824 mg/L Oncorhynchus mykiss LC50 (96h) semi-static = 7050 mg/L Pimephales promelas LC50 (96h) static = 12946 mg/L Lepomis macrochirus LC50 (96h) static 6020 - 7070 mg/L Pimephales promelas LC50 (96h) flow-through 5560 - 6080 mg/L Lepomis macrochirus LC50 (96h) static 6420 - 6700 mg/L Pimephales promelas	EC50 (48h) Static 340.7 - 469.2 mg/L Daphnia magna EC50 (48h) = 1000 mg/L Daphnia magna
t-Butanol 75-65-0	EC50 (72h) > 1000 mg/L Desmodesmus subspicatus	LC50 (96h) flow-through 6130 - 6700 mg/L Pimephales promelas	EC50 (48h) = 933 mg/L Daphnia magna EC50 (48h) Static 4607 - 6577 mg/L Daphnia magna
2-Methyl-2,4-pentanediol 107-41-5	-	LC50 (96h) static = 10700 mg/L Pimephales promelas LC50 (96h) static = 10000 mg/L Lepomis macrochirus LC50 (96h) flow-through = 8690 mg/L Pimephales promelas LC50 (96h) flow-through 10500 - 11000 mg/L Pimephales promelas	EC50 (48h) 2700 - 3700 mg/L Daphnia magna
Formaldehyde 50-00-0	-	LC50 (96h) static 100 - 136 mg/L Oncorhynchus mykiss LC50 (96h) flow-through 0.032 - 0.226 mL/L Oncorhynchus mykiss LC50 (96h) flow-through 22.6 - 25.7 mg/L Pimephales promelas LC50 (96h) static 23.2 - 29.7 mg/L Pimephales promelas LC50 (96h) static = 41 mg/L Brachydanio rerio LC50 (96h) static = 1510 µg/L Lepomis macrochirus	LC50 (48h) = 2 mg/L Daphnia magna EC50 (48h) Static 11.3 - 18 mg/L Daphnia magna

12.2. Persistence and Degradability

. .

Biodegradability (B.O.D./C.O.D.)	38 %
Total Organic Carbon	33,600 mg/l

12.3. Bioaccumulation
No information available.

12.4. Other Adverse Effects
No information available

13. Disposal Considerations

13.1. Waste Treatment Methods

Disposal of wastes	Disposal should be in accordance with applicable regional, national and local laws and regulations.
Contaminated Packaging	Do not reuse container.

14. Transport Information

DOT	NOT REGULATED
TDG	NOT REGULATED
MEX	NOT REGULATED
ICAO (air)	NOT REGULATED
IATA	NOT REGULATED
IMDG	NOT REGULATED

15. Regulatory Information

15.1. International Inventories

TSCA	Complies
DSL/NDSL	Does not comply
ENCS	Does not comply
IECSC	Does not comply
KECL	Does not comply
PICCS	Does not comply
AICS	Does not comply

Legend:
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
AICS - Australian Inventory of Chemical Substances

15.2. US Federal Regulations

SARA 313
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product contains a chemical or chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

Chemical name	SARA 313 - Threshold Values %
2-(2-Butoxyethoxy)ethanol - 112-34-5	1.0

SARA 311/312 Hazard Categories

Acute Health Hazard	Yes
Chronic health hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

CWA (Clean Water Act)
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

CERCLA
This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

15.3. US State Regulations

California Proposition 65
This product contains the following Proposition 65 chemicals

Chemical name	California Proposition 65
Formaldehyde - 50-00-0	Carcinogen
Perfluorooctanoic acid - 335-67-1	Developmental Toxicity

U.S. State Right-to-Know Regulations

Chemical name	New Jersey	Massachusetts	Pennsylvania
2-(2-Butoxyethoxy)ethanol 112-34-5	X	-	X
t-Butanol 75-65-0	X	X	X
2-Methyl-2,4-pentanediol 107-41-5	X	X	X
Formaldehyde 50-00-0	X	X	X

16. Other information, including date of preparation of the last revision

NFPA	**Health Hazards** 2	**Flammability** 1	**Instability** 0	**Physical and chemical properties** -
HMIS	**Health Hazards** 2	**Flammability** 1	**Physical Hazards** 0	**Personal Protection** X

Revision date 13-Jan-2019
Revision note SDS sections updated, 2.
Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

End of Safety Data Sheet

CHEMGUARD

Safety Data Sheet

This safety data sheet complies with the requirements of: 2012 OSHA Hazard Communication Standard (29CFR 1910.1200)

Product name CHEMGUARD 3% AFFF C306-MS-C

1. Identification

RED

1.1. Product Identifier

Product name	CHEMGUARD 3% AFFF C306-MS-C

1.2. Other means of identification

Product code	770809
Synonyms	None
Chemical Family	No information available

1.3. Recommended use of the chemical and restrictions on use

Recommended use	Fire extinguishing agent.
Uses advised against	Consumer use.

1.4. Details of the Supplier of the Safety Data Sheet

Company Name	Tyco Fire Protection Products One Stanton Street Marinette, WI 54143-2542 Telephone: 715-735-7411
Contact point	Product Stewardship at 1-715-735-7411
E-mail address	psra@tycofp.com

1.5. Emergency Telephone Number

Emergency telephone	CHEMTREC 001-800-424-9300 or 001-703-527-3887

2. Hazards Identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Serious eye damage/eye irritation - Category 1
Skin Sensitization - Category 1B

2.2. Label Elements

Signal Word
DANGER

Hazard Statements
Causes serious eye damage
May cause an allergic skin reaction

Precautionary Statements

Prevention
Wear protective gloves/protective clothing/eye protection/face protection. Avoid breathing dust/fume/gas/mist/vapors/spray. Contaminated work clothing should not be allowed out of the workplace.

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/physician.
IF ON SKIN: Wash with plenty of soap and water. If skin irritation or rash occurs: Get medical advice/attention. Wash contaminated clothing before reuse.

Disposal
Dispose of contents/container to an approved waste disposal plant.

2.3. Hazards Not Otherwise Classified (HNOC)
Not Applicable.

2.4. Other Information

3. Composition/information on Ingredients

3.1. Mixture
The following component(s) in this product are considered hazardous under applicable OSHA(USA)

Chemical name	CAS No.	weight-%
2-(2-Butoxyethoxy)ethanol	112-34-5	10 - 30
Laurylamidopropyl betaine	4292-10-8	1 - 5
Caprylcaprilyl glucoside	68515-73-1	1 - 5
Polyfluorinated alkyl polyamide	Proprietary	1 - 5
Octylphenoxypolyethoxyethanol	9036-19-5	1 - 5
Polyfluorinated alkyl quaternary amine chloride	Proprietary	0.1 - 1

4. First aid measures

4.1. Description of first aid measures

Eye Contact Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a physician.

Skin contact Wash skin with soap and water. Get medical attention if irritation develops and persists.

Inhalation Remove to fresh air. If breathing is difficult, give oxygen. (Get medical attention immediately if symptoms occur.).

Ingestion Rinse mouth. Do not induce vomiting without medical advice. If swallowed, call a poison control center or physician immediately.

4.2. Most Important Symptoms and Effects, Both Acute and Delayed
Symptoms No information available.

4.3. Indication of Any Immediate Medical Attention and Special Treatment Needed
Note to physicians Treat symptomatically.

5. Fire-fighting measures

5.1. Suitable Extinguishing Media
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

5.2. Unsuitable Extinguishing Media
None.

5.3. Specific Hazards Arising from the Chemical
None known.

Hazardous Combustion Products	Carbon oxides, Fluorinated oxides, Nitrogen oxides (NOx), Oxides of sulfur

5.4. Explosion Data
Sensitivity to Mechanical Impact None.
Sensitivity to Static Discharge None.

5.5. Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Personal Precautions	Ensure adequate ventilation, especially in confined areas.
For emergency responders	Use personal protection recommended in Section 8.

6.2. Environmental Precautions

Environmental Precautions	Prevent further leakage or spillage if safe to do so. Prevent entry into waterways, sewers, basements or confined areas. See Section 12 for additional Ecological Information.

6.3. Methods and material for containment and cleaning up

Methods for Containment	Prevent further leakage or spillage if safe to do so.
Methods for Cleaning Up	Pick up and transfer to properly labeled containers.

7. Handling and Storage

7.1. Precautions for Safe Handling

Advice on safe handling	Avoid contact with skin and eyes. Handle in accordance with good industrial hygiene and safety practice.

7.2. Conditions for safe storage, including any incompatibilities

Storage Conditions	Keep containers tightly closed in a dry, cool and well-ventilated place.
Incompatible Materials	Strong oxidizing agents. Strong acids. Strong bases.

8. Exposure Controls/Personal Protection

8.1. Control Parameters

Exposure guidelines

Chemical name	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL
2-(2-Butoxyethoxy)ethanol 112-34-5	TWA: 10 ppm inhalable fraction and vapor	-	-	-

ACGIH (American Conference of Governmental Industrial Hygienists) OSHA (Occupational Safety and Health Administration of the US Department of Labor) NIOSH IDLH Immediately Dangerous to Life or Health

8.2. Appropriate Engineering Controls

Engineering controls Ensure adequate ventilation, especially in confined areas.

8.3. Individual protection measures, such as personal protective equipment

Eye/Face Protection Avoid contact with eyes. Tight sealing safety goggles.

Skin and Body Protection Wear protective gloves and protective clothing.

Respiratory Protection If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.

Ventilation Use local exhaust or general dilution ventilation to control exposure with applicable limits

8.4. General hygiene considerations

Do not eat, drink or smoke when using this product. Handle in accordance with good industrial hygiene and safety practice.

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State Liquid
Odor Characteristic **Color** Light yellow
Odor Threshold No data available

Property	Values	Remarks • Method
pH	7 - 8.5	
Melting point/freezing point	No data available	
Boiling point / boiling range	No data available	
Flash Point	No data available	
Evaporation Rate	No data available	
Flammability (solid, gas)	No data available	
Flammability limit in air		
Upper flammability limit:	No data available	
Lower flammability limit:	No data available	
Vapor Pressure	No data available	
Vapor Density	No data available	
Specific gravity	No data available	
Water Solubility	No data available	
Solubility in Other Solvents	No data available	
Partition coefficient	No data available	
Autoignition Temperature	No data available	
Decomposition Temperature	No data available	
Kinematic viscosity	No data available	

VOC content (%) 18.7575
Density 1.02

10. Stability and Reactivity

10.1. Chemical Stability

Stable under recommended storage conditions.

10.2. Reactivity

No data available

10.3. Possibility of hazardous reactions

None under normal processing.

Hazardous Polymerization Hazardous polymerization does not occur.

10.4. Conditions to Avoid

Extremes of temperature and direct sunlight.

10.5. Incompatible Materials

Strong oxidizing agents. Strong acids. Strong bases.

10.6. Hazardous decomposition products

Carbon oxides. Nitrogen oxides (NOx). Oxides of sulfur. Fluorinated oxides.

11. Toxicological Information

11.1. Information on Likely Routes of Exposure

Product information

Inhalation	No data available.
Eye Contact	Corrosive to the eyes and may cause severe damage including blindness.
Skin contact	May cause allergic skin reaction.
Ingestion	No data available.

Component Information
Acute Toxicity

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
2-(2-Butoxyethoxy)ethanol 112-34-5	= 5660 mg/kg (Rat)	= 2700 mg/kg (Rabbit)	-
Laurylamidopropyl betaine 4292-10-8	> 2000 mg/kg (Rat)	-	-
Polyfluorinated alkyl polyamide	>2000 mg/kg	>2000 mg/kg	>5.11 mg/l
Octylphenoxypolyethoxyethanol 9036-19-5	= 4190 mg/kg (Rat) = 1700 mg/kg (Rat)	-	-
Polyfluorinated alkyl quaternary amine chloride	>300 - <2000 mg/kg	-	-

11.2. Information on Toxicological Effects

Symptoms No information available.

11.3. Delayed and immediate effects as well as chronic effects from short and long-term exposure

Component Information					
Polyfluorinated alkyl quaternary am ne chloride					
Method	species	Exposure Route	Effective dose	Exposure time	Results
OECD Test No. 439: In Vitro Skin Irritation: Reconstructed Human Epidermis Test Method	EPISKIN™	in vitro			Non-irritant

Serious eye damage/eye irritation Risk of serious damage to eyes.

Component Information					
Polyfluorinated alkyl polyamide					
Method	species	Exposure Route	Effective dose	Exposure time	Results
OECD Test No. 405: Acute Eye Irritation/Corrosion	Rabbit	eye			Class 4 on a 1 to 8 scale according to a modified Kay and Calandra classification system. Mild eye irritation

Sensitization May cause sensitization by skin contact.

Component Information			
Polyfluorinated alkyl polyamide			
Method	species	Exposure Route	Results
OECD Test No. 429: Skin Sensitisation: Local Lymph Node Assay	mouse	dermal	sensitizing

Polyfluorinated alkyl quaternary amine chloride			
Method	species	Exposure Route	Results
OECD Test No. 429: Skin Sensitisation: Local Lymph Node Assay	mouse	dermal	sensitizing

Component Information		
Polyfluorinated alkyl polyamide		
Method	species	Results
OECD Test No. 473: In vitro Mammalian Chromosome Aberration Test	in vitro	Non-clastogenic to human lymphocytes in vitro.

Carcinogenicity No information available.
Reproductive Toxicity No information available.
STOT - Single Exposure No information available.
STOT - Repeated Exposure No information available.
Aspiration Hazard No information available.

11.4. Numerical Measures of Toxicity - Product information

The following values are calculated based on chapter 3.1 of the GHS document
ATEmix (oral) 5101 mg/kg
ATEmix (dermal) 12061 mg/kg
ATEmix (inhalation-dust/mist) 129.5 mg/l

12. Ecological Information

12.1. Ecotoxicity

Chemical name	Algae/aquatic plants	Fish	Crustacea

2-(2-Butoxyethoxy)ethanol 112-34-5	EC50 (96h) > 100 mg/L Desmodesmus subspicatus	LC50 (96h) static = 1300 mg/L Lepomis macrochirus	EC50 (48h) > 100 mg/L Daphnia magna EC50 (24h) = 2850 mg/L Daphnia magna
2-Methyl-2,4-pentanediol 107-41-5	-	LC50 (96h) static = 10700 mg/L Pimephales promelas LC50 (96h) static = 10000 mg/L Lepomis macrochirus LC50 (96h) flow-through = 8690 mg/L Pimephales promelas LC50 (96h) flow-through 10500 - 11000 mg/L Pimephales promelas	EC50 (48h) 2700 - 3700 mg/L Daphnia magna
t-Butanol 75-65-0	EC50 (72h) > 1000 mg/L Desmodesmus subspicatus	LC50 (96h) flow-through 6130 - 6700 mg/L Pimephales promelas	EC50 (48h) = 933 mg/L Daphnia magna EC50 (48h) Static 4607 - 6577 mg/L Daphnia magna
Polyethylene Glycol 25322-68-3	-	LC50 (24h) > 5000 mg/L Carassius auratus	-
Sodium chloride 7647-14-5	-	LC50 (96h) flow-through 4747 - 7824 mg/L Oncorhynchus mykiss LC50 (96h) semi-static = 7050 mg/L Pimephales promelas LC50 (96h) static = 12946 mg/L Lepomis macrochirus LC50 (96h) static 6020 - 7070 mg/L Pimephales promelas LC50 (96h) flow-through 5560 - 6080 mg/L Lepomis macrochirus LC50 (96h) static 6420 - 6700 mg/L Pimephales promelas	EC50 (48h) Static 340.7 - 469.2 mg/L Daphnia magna EC50 (48h) = 1000 mg/L Daphnia magna
4,4'-bis-(sulfostyryl)-biphenyl disodium salt 27344-41-8	EC50 (72h) = 10 mg/L Desmodesmus subspicatus EC50 (96h) 10.0 - 11.0 mg/L Desmodesmus subspicatus	LC50 (96h) static = 76 mg/L Brachydanio rerio	EC50 (48h) = 1000 mg/L Daphnia magna

Polyfluorinated alkyl polyamide					
Method	Species	Endpoint type	Effective dose	Exposure time	Results
OECD Test No. 203: Fish, Acute Toxicity Test	Oncorhynchus mykiss (rainbow trout)	LC50	>14 mg/l	96h	NOEC: 14 mg/L No toxic effects at saturation.
OECD Test No. 201: Freshwater Alga and Cyanobacteria, Growth Inhibition Test	Algae	ErC50	>15 mg/l	72h	Growth rate >15, Yield 13. NOEC: 4.0 mg/L, LOEC: 8.5 mg/L
OECD Test No. 202: Daphnia sp., Acute Immobilization Test	Daphnia magna	EC50	>20 mg/l	48h	NOEC: 20 mg/L No toxic effects at saturation.

Polyfluorinated alkyl quaternary amine chloride					
Method	Species	Endpoint type	Effective dose	Exposure time	Results
OECD Test No. 211: Daphnia magna Reproduction Test	Daphnia magna	NOEC	5.38 mg/L	21 days	
OECD Test No. 202: Daphnia sp., Acute Immobilization Test	Daphnia magna	EC50	2.6 mg/L	48h	
OECD Test No. 210: Fish, Early-Life Stage Toxicity Test	Pimephales promelas	NOEC	11.8 mg/L	33 days	
OECD Test No. 203: Fish, Acute Toxicity Test	Cyprinus carpio	LC50	98 mg/L	96h	
OECD Test No. 201: Freshwater Alga and Cyanobacteria, Growth Inhibition Test	Pseudokirchneriella subcapitata	EC50	788 mg/L	96h	

12.2. Persistence and Degradability

No information available.

12.3. Bioaccumulation
No information available.

12.4. Other Adverse Effects
No information available

13. Disposal Considerations

13.1. Waste Treatment Methods

Disposal of wastes	Disposal should be in accordance with applicable regional, national and local laws and regulations.
Contaminated Packaging	Do not reuse container.

14. Transport Information

DOT	NOT REGULATED
TDG	NOT REGULATED
MEX	NOT REGULATED
ICAO (air)	NOT REGULATED
IATA	NOT REGULATED
IMDG	NOT REGULATED

15. Regulatory Information

15.1. International Inventories

TSCA	Complies
DSL/NDSL	Does not comply
ENCS	Does not comply
IECSC	Does not comply
KECL	Does not comply
PICCS	Does not comply
AICS	Does not comply

Legend:
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
AICS - Australian Inventory of Chemical Substances

15.2. US Federal Regulations

SARA 313
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product contains a chemical or chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

Chemical name	SARA 313 - Threshold Values %
2-(2-Butoxyethoxy)ethanol - 112-34-5	1.0

SARA 311/312 Hazard Categories

Acute Health Hazard	Yes
Chronic health hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

CWA (Clean Water Act)
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

CERCLA
This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

15.3. US State Regulations

California Proposition 65
This product contains the following Proposition 65 chemicals

Chemical name	California Proposition 65
Perfluorooctanoic acid - 335-67-1	Developmental Toxicity

U.S. State Right-to-Know Regulations

Chemical name	New Jersey	Massachusetts	Pennsylvania
2-(2-Butoxyethoxy)ethanol 112-34-5	X	-	X

16. Other information, including date of preparation of the last revision

NFPA	**Health Hazards** 2	**Flammability** 0	**Instability** 0	**Physical and chemical properties** -
HMIS	**Health Hazards** 2	**Flammability** 0	**Physical Hazards** 0	**Personal Protection** X

Revision date 11-Jan-2019
Revision note SDS sections updated, 2, 11, 12.
Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

End of Safety Data Sheet

PORTABLE WHEELED FIRE EXTINGUISHERS

A-150-SP ABC DRY CHEMICAL WHEELED STORED PRESSURE FIRE EXTINGUISHER

DESCRIPTION

The A-150-SP ABC Dry Chemical Wheeled Stored Pressure Fire Extinguisher is a monoammonium phosphate-based fire extinguisher that is suitable for use on Class A, Class B, and Class C fires.

Designed for one-man operation, these units are easily transportable through doorways and over rough terrain. Tow loops can be added if you need easy vehicle transport capability.

The A-150-SP is rechargeable and can also be configured as a stationary unit.

Ideal for use on offshore rigs, ship docks, refineries, chemical plants, construction sites, and storage and loading facilities.

FEATURES

- Manufactured in accordance with ANSI/UL 299 and ANSI/UL 711 Standards.
- Key Features:
  - DOT/TC compliant steel cylinder
  - Rugged welded steel cart frame
  - Semi-pneumatic rubber tires
  - Epoxy powder coating
  - All-metal valve and discharge nozzles
  - Available with optional tow loop
  - US Coast Guard Approved for marine use
- ABC Dry Chemical agent is available in 50 lb. containers for recharging Buckeye extinguishers. (Part Number 61000)

SPECIFICATIONS

Agent Capacity: 125 lbs. / 56.7 kg

UL Rating: 30-A:240-B:C

Weight: 300 lbs. / 136 kg

Height: 51 in. / 128 cm

Width: 26 in. / 66 cm

Discharge Time: 47 seconds

Discharge Range: 30 - 40 ft. / 9.1-12.2 m

Operating Pressure: 240 psi / 1655 kPa

Operating Temperature Range:
-65° F to 120° F / -54° C to 49° C

ORDERING INFORMATION

Model A-150-SP
ABC Dry Chemical
Wheeled Fire Extinguisher

P/N 30110

Refer to the Buckeye Spare Parts List for replacement parts

110 Kings Road, Kings Mountain, NC 28086-0428 • Ph. 704.739.7415 • Fax 704.739.7418 • email: bfec@buckeyef.com

Garrison/ Installation/ Site/ Facility	WATER SAMPLE TYPE	SAMPLE LOCATIC	SAMPLE ID #	SAMPLE COLLEC	ANALYTE NAME	CONCENTRATION LEVEL	RESULT UNIT OF MEASUREMENT	MINIMUM REPORTABLE LEVEL	CLP FLAGS	ANALYTICAL METHOD	VALIDATED	SDG	Date_Lab_Complete	Date_Complete	Notes
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00002	E-PR-SANT-001-12JUN17	06/12/2017	6:2FTS		NG/L	9.90	U	537	No	320-29025-1	20170721	20170724	Well 00002. Sample collected from spout inside building 002. Spout was before clorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00003	E-PR-SANT-002-12JUN17	06/12/2017	6:2FTS		NG/L	9.86	U	537	No	320-29025-1	20170721	20170724	Well 00003. Sample collected from spout inside building 003. Spout was before chlorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00003	E-PR-SANT-002-12JUN17	06/12/2017	8:2FTS		NG/L	9.86	U	537	No	320-29025-1	20170721	20170724	Well 00003. Sample collected from spout inside building 003. Spout was before chlorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00002	E-PR-SANT-001-12JUN17	06/12/2017	8:2FTS		NG/L	9.90	U	537	No	320-29025-1	20170721	20170724	Well 00002. Sample collected from spout inside building 002. Spout was before clorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00002	E-PR-SANT-001-12JUN17	06/12/2017	N-ethyl perfluorooctane sulfonamidoace		NG/L	14.9	U	537	No	320-29025-1	20170721	20170724	Well 00002. Sample collected from spout inside building 002. Spout was before clorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00003	E-PR-SANT-002-12JUN17	06/12/2017	N-ethyl perfluorooctane sulfonamidoace		NG/L	14.8	U	537	No	320-29025-1	20170721	20170724	Well 00003. Sample collected from spout inside building 003. Spout was before chlorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00003	E-PR-SANT-002-12JUN17	06/12/2017	N-methyl perfluorooctane sulfonamidoa		NG/L	14.8	U	537	No	320-29025-1	20170721	20170724	Well 00003. Sample collected from spout inside building 003. Spout was before chlorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00002	E-PR-SANT-001-12JUN17	06/12/2017	N-methyl perfluorooctane sulfonamidoa		NG/L	14.9	U	537	No	320-29025-1	20170721	20170724	Well 00002. Sample collected from spout inside building 002. Spout was before clorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00002	E-PR-SANT-001-12JUN17	06/12/2017	Perfluorooctanoic acid (PFOA)		NG/L	1.98	U M	537	No	320-29025-1	20170721	20170724	Well 00002. Sample collected from spout inside building 002. Spout was before clorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00002	E-PR-SANT-001-12JUN17	06/12/2017	Perfluorobutanesulfonic acid (PFBS)	2.00	NG/L	1.98	J	537	No	320-29025-1	20170721	20170724	Well 00002. Sample collected from spout inside building 002. Spout was before clorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00002	E-PR-SANT-001-12JUN17	06/12/2017	Perfluorobutanoic acid (PFBA)	2.66	NG/L	0.990	J	537	No	320-29025-1	20170721	20170724	Well 00002. Sample collected from spout inside building 002. Spout was before clorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00002	E-PR-SANT-001-12JUN17	06/12/2017	Perfluorodecanoic acid (PFDA)		NG/L	0.990	U M	537	No	320-29025-1	20170721	20170724	Well 00002. Sample collected from spout inside building 002. Spout was before clorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00002	E-PR-SANT-001-12JUN17	06/12/2017	Perfluorododecanoic acid (PFDoA)		NG/L	1.98	U	537	No	320-29025-1	20170721	20170724	Well 00002. Sample collected from spout inside building 002. Spout was before clorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00002	E-PR-SANT-001-12JUN17	06/12/2017	Perfluoroheptanoic acid (PFHpA)		NG/L	1.98	U	537	No	320-29025-1	20170721	20170724	Well 00002. Sample collected from spout inside building 002. Spout was before clorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00002	E-PR-SANT-001-12JUN17	06/12/2017	Perfluorohexanesulfonic acid (PFHxS)	4.83	NG/L	1.98	J	537	No	320-29025-1	20170721	20170724	Well 00002. Sample collected from spout inside building 002. Spout was before clorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00002	E-PR-SANT-001-12JUN17	06/12/2017	Perfluorohexanoic acid (PFHxA)		NG/L	1.98	U	537	No	320-29025-1	20170721	20170724	Well 00002. Sample collected from spout inside building 002. Spout was before clorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00002	E-PR-SANT-001-12JUN17	06/12/2017	Perfluorononanoic acid (PFNA)		NG/L	1.98	U	537	No	320-29025-1	20170721	20170724	Well 00002. Sample collected from spout inside building 002. Spout was before clorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00002	E-PR-SANT-001-12JUN17	06/12/2017	Perfluorooctanesulfonic acid (PFOS)	1.67	NG/L	2.97	J M	537	No	320-29025-1	20170721	20170724	Well 00002. Sample collected from spout inside building 002. Spout was before clorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00002	E-PR-SANT-001-12JUN17	06/12/2017	Perfluoropentanoic acid (PFPeA)	2.00	NG/L	1.98	J	537	No	320-29025-1	20170721	20170724	Well 00002. Sample collected from spout inside building 002. Spout was before clorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00002	E-PR-SANT-001-12JUN17	06/12/2017	Perfluorotetradecanoic acid (PFTeA)	0.601	NG/L	0.990	J M	537	No	320-29025-1	20170721	20170724	Well 00002. Sample collected from spout inside building 002. Spout was before clorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00002	E-PR-SANT-001-12JUN17	06/12/2017	Perfluorotridecanoic Acid (PFTriA)	0.647	NG/L	1.98	J	537	No	320-29025-1	20170721	20170724	Well 00002. Sample collected from spout inside building 002. Spout was before clorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00002	E-PR-SANT-001-12JUN17	06/12/2017	Perfluoroundecanoic acid (PFUnA)		NG/L	1.98	U	537	No	320-29025-1	20170721	20170724	Well 00002. Sample collected from spout inside building 002. Spout was before clorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00003	E-PR-SANT-002-12JUN17	06/12/2017	Perfluorooctanoic acid (PFOA)		NG/L	1.97	U	537	No	320-29025-1	20170721	20170724	Well 00003. Sample collected from spout inside building 003. Spout was before chlorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00003	E-PR-SANT-002-12JUN17	06/12/2017	Perfluorobutanesulfonic acid (PFBS)	1.43	NG/L	1.97	J	537	No	320-29025-1	20170721	20170724	Well 00003. Sample collected from spout inside building 003. Spout was before chlorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00003	E-PR-SANT-002-12JUN17	06/12/2017	Perfluorobutanoic acid (PFBA)	3.26	NG/L	0.986	J	537	No	320-29025-1	20170721	20170724	Well 00003. Sample collected from spout inside building 003. Spout was before chlorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00003	E-PR-SANT-002-12JUN17	06/12/2017	Perfluorodecanoic acid (PFDA)		NG/L	0.986	U	537	No	320-29025-1	20170721	20170724	Well 00003. Sample collected from spout inside building 003. Spout was before chlorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00003	E-PR-SANT-002-12JUN17	06/12/2017	Perfluorododecanoic acid (PFDoA)		NG/L	1.97	U	537	No	320-29025-1	20170721	20170724	Well 00003. Sample collected from spout inside building 003. Spout was before chlorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00003	E-PR-SANT-002-12JUN17	06/12/2017	Perfluoroheptanoic acid (PFHpA)		NG/L	1.97	U	537	No	320-29025-1	20170721	20170724	Well 00003. Sample collected from spout inside building 003. Spout was before chlorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00003	E-PR-SANT-002-12JUN17	06/12/2017	Perfluorohexanesulfonic acid (PFHxS)	5.43	NG/L	1.97	J	537	No	320-29025-1	20170721	20170724	Well 00003. Sample collected from spout inside building 003. Spout was before chlorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00003	E-PR-SANT-002-12JUN17	06/12/2017	Perfluorohexanoic acid (PFHxA)	1.74	NG/L	1.97	J	537	No	320-29025-1	20170721	20170724	Well 00003. Sample collected from spout inside building 003. Spout was before chlorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00003	E-PR-SANT-002-12JUN17	06/12/2017	Perfluorononanoic acid (PFNA)		NG/L	1.97	U	537	No	320-29025-1	20170721	20170724	Well 00003. Sample collected from spout inside building 003. Spout was before chlorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00003	E-PR-SANT-002-12JUN17	06/12/2017	Perfluorooctanesulfonic acid (PFOS)	2.90	NG/L	2.96	J M	537	No	320-29025-1	20170721	20170724	Well 00003. Sample collected from spout inside building 003. Spout was before chlorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00003	E-PR-SANT-002-12JUN17	06/12/2017	Perfluoropentanoic acid (PFPeA)	3.45	NG/L	1.97	J	537	No	320-29025-1	20170721	20170724	Well 00003. Sample collected from spout inside building 003. Spout was before chlorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00003	E-PR-SANT-002-12JUN17	06/12/2017	Perfluorotetradecanoic acid (PFTeA)	0.585	NG/L	0.986	J	537	No	320-29025-1	20170721	20170724	Well 00003. Sample collected from spout inside building 003. Spout was before chlorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00003	E-PR-SANT-002-12JUN17	06/12/2017	Perfluorotridecanoic Acid (PFTriA)		NG/L	1.97	U	537	No	320-29025-1	20170721	20170724	Well 00003. Sample collected from spout inside building 003. Spout was before chlorination/lead/copper treatment injection point. Purged 5 minutes.
CAMP SANTIAGO TRAINING CENTER	Pre-Treatment/Source	00003	E-PR-SANT-002-12JUN17	06/12/2017	Perfluoroundecanoic acid (PFUnA)		NG/L	1.97	U	537	No	320-29025-1	20170721	20170724	Well 00003. Sample collected from spout inside building 003. Spout was before chlorination/lead/copper treatment injection point. Purged 5 minutes.

Amendment No. 11
Department of the Army
License No. DACA17-3-67-3002
Camp Santiago Military Reservation
Salinas, Puerto Rico

THIS AMENDMENT, completed this 7th day of October, 2004, by and between the Secretary of the Army and the Commonwealth of Puerto Rico,

WITNESSETH:

WHEREAS, the Secretary of the Army granted License Number DACA17-3-67-3002 to the Commonwealth of Puerto Rico for a term of five (5) years, commencing on 1 July 1967 and ending 30 June 1972 for use and occupancy of 11,379.18 acres of land and certain improvements at the Salinas Maneuver Site Military Reservation, Salinas, Puerto Rico, as more particularly described in the said license, for year-round training and support of the Puerto Rico Army National Guard; and

WHEREAS, by Amendments No. 1 through 10, the said license was amended to revise the licensed area, re-identify the property as Camp Santiago Military Reservation, and extend the license to an indefinite term; and

WHEREAS, the U.S. Air Force relinquished to the Department of the Army the use of 354 acres of land used and occupied jointly with the Puerto Rico Army National Guard, upon termination of the Department of the Army Permit No. DACA17-4-84-4002 and Department of the Air Force License No. DACA17-3-92-0001, respectively; and

WHEREAS, it is now mutually desired to further amend this license to provide for the above.

NOW THEREFORE, Department of the Army License No. DACA DACA17-3-67-3002, as amended, is hereby further amended as follows:

Effective 17 May 2004, the Commonwealth of Puerto Rico recovers the exclusive use and occupancy of the approximately 354 acres for year-round training and support of the Puerto Rico Army National Guard.

The quantity of the land licensed continues to be 11,930.31 acres fee-owned.

Except as herein provided, all other terms and conditions of said license shall remain unchanged.

Amendment No. 11
Department of the Army
License No. DACA17-3-67-3002
Camp Santiago Military Reservation
Salinas, Puerto Rico

This Amendment No. 11 is not subject to Title 10, United States Code, Section 2662.

IN WITNESS WHEREOF, I have hereunto set my hand by authority of the Secretary of the Army as of the date first above written.

Sharon W. Conkl

SHARON W. CONKLIN
Chief, Management and Disposal Branch
Real Estate Division
U.S. Army Engineer District
Jacksonville, Florida

The foregoing amendment, including all the conditions thereof, is hereby accepted as of the date first above written.

COMMONWEALTH OF PUERTO RICO

By: ______________________
BG Francisco A. Marquez
The Adjutant General
Puerto Rico National Guard

Appendix B
Preliminary Assessment Documentation

Appendix B.1
Interview Records

PA Interview Questionnaire – Fire Station

Facility: Camp Santiago
Interviewer: J. Witte
Date/Time: 5/24/2019

Interviewee: [redacted] **Title:** Fire Chief **Phone Number:** [redacted] **Email:** [redacted]	Can your name/role be used in the PA Report? **Y** or N Can you recommend anyone we can interview? Y or **N**

1. Roles or activities with the Facility/years working at the Facility.

Formerly the station chief at Vega Baja (2003-2017); MilTech at Camp Santiago (2010-present). Became Fire Chief in 2018.

2. What can you tell us about the history of AFFF at the Facility? Was it used for any of the following activities, circle all that apply and indicate years of active use, if known? Identify these locations on a facility map.

   Maintenance (e.g., ramp washing) – Truck maintenance occurrs at Camp Santiago MATES
   Fire Training Areas – Two FTAs at Camp Santiago (Station #4 and the rubble pile). Water only
   Firefighting (Active Fire) – AFFF was used off-facility at the 2009 Fort Buchanan Capeco Fire. No other AFFF uses.
   Crash – No known crashes requiring AFFF response.
   Fire Suppression Systems (Hangers/Dining Facilities) – No AFFF in a fire suppression system
   Fire Protection at Fueling Stations – No AFFF suppression/protection systems.
   Non-Technical/Recreational/ Pest Management – None

3. Are any current buildings constructed with AFFF dispensing systems or fire suppression systems? What are the AFFF/suppression system test requirements? What is the frequency of testing at the AFFF/suppression systems?

No. Sprinkler systems exist at MATES, PX. DFAC has a purple K suppression system.

4. Are fire suppression systems currently charged with AFFF or have they been retrofitted for use of high expansion foam?

No

5. How is AFFF procured? Do you have an inventory/procurement system that tracks use?

AFFF procurement is unclear, but it was procured first around 2007 after the first AFFF capable fire truck was received in 2006 at Camp Santiago. The only AFFF capable truck at Fort Allen was delivered there from previous storage/use at Camp Santiago around 2015.

6. What type of AFFF has been/is being used (3%, 6%, Mil Spec Mil-F-24385, High Expansion)? Manufacturer (3M, Dupont, Ansul, National Foam, Angus, Chemguard, Buckeye, Fire Service Plus)?

Chemguard 3% AFFF is stored on a fire truck at the Fire Station.

7. Is AFFF formulated on base? If so, where is the solution mixed, contained, transferred, etc.?

AFFF is formulated at the scene of its use within an AFFF-capable truck. It is not mixed at Camp Santiago. AFFF is stored in 5-gallon buckets as well as within fire trucks.

8. Where is the AFFF stored? How is it stored (tanks, 55-gallon drums, 5-gallon buckets)? What size are the storage tanks? Is the AFFF stored as a mixed solution (3% or 6%) or concentrated material?

AFFF is stored in buckets at the Camp Santiago fire station as well as in at least one E-One pumper truck at the fire station.

Trimaxes staged throughout Camp Santiago are all dry chemical (non-AFFF) extinguishers.

9. How is the AFFF transferred to emergency response vehicles, suppression systems, flightline extinguishers? Is/was there a specified area on the facility where vehicles are filled with AFFF and does this area have secondary containment in case of spills? How and where are vehicles storing AFFF cleaned/decontaminated?

See response to #8.

10. Provide a list of vehicles that carried AFFF, now and in the past, and where are/were they located?

See response to question #21.

11. Any vehicles have a history of leaking AFFF? Do you/did you test the vehicles spray patterns to make sure equipment is working properly? How often are/were these spray tests performed and can you provide the locations of these tests, now and in the past?

No trucks at Camp Santiago have a history of leaking or other problems.

12. How many FTAs are/were on this facility and where are they? Locate on a map. How many FTAs are active and inactive? For inactive FTAs, when was the last time that fire training using AFFF was conducted at them?

Training occurs at two areas at Camp Santiago. At Station #4 only water is used for training purposes. At the rubble pile, rescue training occurs. No fire training.

No AFFF is used for fire training anywhere at Camp Santiago.

13. What types of fuels/flammables were used at the FTAs?

Diesel, lubricating oils, gasoline at the PX.

14. What was the frequency of AFFF use at each location? When a release of AFFF occurs during a fire training exercise, now and in the past, how is/was the AFFF cleaned and disposed of? Were retention ponds built to store discharged AFFF? Was the AFFF trickled to the sanitary sewer or left in the pond to infiltrate?

AFFF is not known to have ever been used at Camp Santiago.

15. Are there mutual aid/use agreements between county, city, local fire department? Please list, even if informal. If formalized, may we have a copy of the agreement? Can you recall specific times when city, county, state personnel came on-post for training? If so, please state which state/county agency, military entity? Do you have any records, including photographs to share with us?

If available, these have been requested.

16. Did individual units come on-post with their own safety personnel, did they also bring their own AFFF? Was training with AFFF part of these exercises? How were emergencies handled under these circumstances?

No fire training with AFFF occurs at Camp Santiago, nor have any outside units come to Camp Santiago for hands-on training that uses AFFF. All fire training uses water only.

17. Did military routinely or occasionally fire train off-post? List units that you can recall used/trained at various areas. The 215th Firefighter Engineer Department trains at Camp Santiago, and has trained at Ft Buchanan.
18. Are there specific emergency response incident reports (i.e., aircraft or vehicle crash sites and fires)? If so, may we please copy these reports? Who (entity) was the responder? Forest/brush fires are common at Camp Santiago, but they are not responded to with AFFF. No AFFF has been used at Camp Santiago, and thus no records of such use exist.
19. Do you have records of fuel spill logs? Was it common practice to wash away fuel spills with AFFF? Is/was AFFF used as a precaution in response to fuel releases or emergency runway landings to prevent fires? No records of fuel spill logs that AFFF was used in response to. A fuel spill occurred at the PX, but AFFF was not used in response. The PX has its own fire suppression systems, but it does not include AFFF. The PX has sprinkler systems and dry chemical extinguishers.
20. Was AFFF used for forest fires or fire management on-post/off-post? If so, please describe what happened and who was involved? Forest fires at Camp Santiago are responded to the by the fire department, but only with water and only when they are accessible. Some fires occur in mountainous, remote areas as a result of live fire training on downrange.
21. Can you provide any other locations where AFFF has been stored, released, or used (i.e. hangars, buildings, fire stations, firefighting equipment testing and maintenance areas, emergency response sites, storm water/surface water, waste water treatment plants, and AFFF ponds)? AFFF capable trucks are/have been stored at Vega Baja, Fort Allen, and Camp Santiago: **Vega Baja** – 1 Osh Kosh Water Tanker Truck (50-gal AFFF [empty]) **Fort Allen** – 1 Rosenbauer R-1 Airwolf Firetruck (40-gal AFFF) **Camp Santiago** – 2 Humvee Skid Units (1 can carry 10-gal AFFF, the other only water); 1 E-One Pumper Truck (carries 50 gallons of 3% AFFF [unknown if it is full]). 1 more truck – information has been requested.

PA Interview Questionnaire – Fire Station

Facility:__Camp Santiago__
Interviewer:__J. Witte________
Date/Time:__5/24/2019______

22. Are you aware of any other creative uses of AFFF? If so, how was AFFF used? What entities were involved? No known creative uses of AFFF.
23. How is off-spec AFFF disposed (used for training, turned in, or given to a local Fire Station)? If applicable, do you know the name of the vendor that removes off-spec AFFF? Do you have copies of the manifest or B/L? AFFF has not been disposed of since it has been received, except in the case that it was used during the 2009 fuel fire at Fort Buchanan.
24. Do you recommend anyone else we can interview? If so, do you have contact information for them? The former fire chief passed away.

PA Interview Questionnaire - Environmental Manager

Facility: Camp Santiago
Interviewer: J. Witte
Date/Time: 5/24/2019 0900

Interviewee: LTC [redacted] **Title:** DPW Director **Phone Number:** [redacted] **Email:** [redacted]	Can your name/role be used in the PA Report? **Y** or N Can you recommend anyone we can interview? **Y** or N [redacted] (CFMO)
1. Roles or activities with the Facility/years working at the Facility. LTC [redacted]; DPW Director since 2015 COL [redacted]; Safety Officer since 2007	
2. Where can I find previous facility ownership information? Camp Santiago has been used for military purposes since the 1920s; was established as a PRARNG facility in 1967. CFMO may have real property/title/lease information.	
3. What can you tell us about the history of PFAS including aqueous film forming foam (AFFF) at the Facility? Was it used for any of the following activities, circle all that apply and indicate years of active use, if known? Identify these locations on a facility map. Maintenance – Firefighting trucks are serviced at MATES, but no known releases of AFFF Fire Training Areas – FTAs exist, but only known to have ever used water during training Firefighting (Active Fire) – Brush fires are common, but only water is used to fight them Crash – No crashes requiring AFFF response Fire Suppression Systems (Hangers/Dining Facilities) – Sprinkler systems at MATES, PX, EOD/MILCON (Bldg 880); no AFFF Fire Protection at Fueling Stations – Dry chemical Trimax extinguishers at various locations Non-Technical/Recreational/ Pest Management - None Metals Plating Facility – MATES may include metal work Waterproofing Uniforms (Laundry Facilities) – Bldg 33 has laundry but not industrial size nor water proofing services Other – None	
4. Fill out CSM Information worksheet with the Environmental Manager.	
5. Are any current buildings constructed with AFFF dispensing systems or fire suppression systems? What are the AFFF/suppression system test requirements? What is the frequency of testing the AFFF/suppression system? Do you have “As Built” drawings for the buildings? No buildings are, or ever have been (to the knowledge of interviewees), constructed with AFFF suppression systems. AFFF is only stored in buckets and on trucks at the Fire Station.	

6. Are fire suppression systems currently charged with AFFF or have they been retrofitted for use of high expansion foam? If retrofitted, when was that done? NA. No AFFF fire suppression systems.
7. How is AFFF procured? Do you have an inventory/procurement system that tracks use? AFFF was procured prior to the tenure of interviewees or without their direct involvement
8. What type of AFFF has been/is being used (3%, 6%, Mil Spec Mil-F-24385, High Expansion)? Manufacturer (3M, Dupont, Ansul, National Foam, Angus, Chemguard, Buckeye, Fire Service Plus)? Chemguard C303 and C 306 3% AFFF concentrate (SDSs provided by Sgt [redacted])
9. Where is the AFFF stored? How is it stored (tanks, 55-gallon drums, 5-gallon buckets)? What size are the storage tanks? Is the AFFF stored as a mixed solution (3% or 6%) or concentrated material? AFFF is stored at the fire station and on fire trucks.
10. How many FTAs are/were on this facility and where are they? Locate on a map. How many FTAs are active and inactive? For inactive FTAs, when was the last time that fire training using AFFF was conducted at them? Station No. 4 at Range 15 and the Rubble Pile identified as FTAs. Others may exist – Sgt [redacted] can clarify. No AFFF has ever been used for fire training.

11. When a release of AFFF occurs during a fire training exercise, now and in the past, how is the AFFF cleaned and disposed of? Were retention ponds built to store discharged AFFF? Was the AFFF trickled to the sanitary sewer or left in the pond to infiltrate? AFFF releases have never occurred to the knowledge of interviewees.
12. Can you recall specific times when city, county, and/or state personnel came on-post for training? If so, please state which state/county agency or military entity? Do you have any records, including photographs to share with us? Local fire departments (Ponce, Salinas, Guayama) have trained occasionally at Camp Santiago but only with water. Other DoD and civilian entities also come to Camp Santiago for classroom training.
13. Did military routinely or occasionally fire train off-post? List the units that you can recall used/trained at various areas. The fire department has trained at Fort Buchanan, a US Army operated facility near San Juan
14. Did individual units come with their own safety personnel, did they also bring their own AFFF? Was training with AFFF part of these exercises? How were emergencies handled under these circumstances? Training at Ft Buchanan used only water.
15. Are there specific emergency response incident reports (i.e., aircraft or vehicle crash sites and fires)? If so, may we please copy these reports? Who (entity) was the responder? Large brush fire in 2016; large brush fire in 2017; 2017 jeep crash; tanker fuel spill at the PX. Emergency response records (if available) will be requested via email.

16. Do you have records of fuel spill logs? Was it common practice to wash away fuel spills with AFFF? Is/was AFFF used as a precaution in response to fuel releases or emergency runway landings to prevent fires? No known fuel spills large enough to have been recorded. No AFFF used in response to a fuel spill.
17. Was AFFF used for forest fires or fire management on-post/off-post? If so, please describe what happened and who was involved? Forest/brush/wildfires are common at Camp Santiago and Fort Allen, but AFFF is never used in response. Only water is used to fight forest fires.
18. Are there mutual aid/use agreements between county, city, and local fire department? Please list, even if informal. If formalized, may we have a copy of the agreement? If available, these have been requested
19. Can you provide any other locations where AFFF has been stored, released, or used (i.e. hangars, buildings, fire stations, firefighting equipment testing and maintenance areas, emergency response sites, storm water/surface water, waste treatment plants, and AFFF ponds)? A landfill exists at Camp Santiago. Closure began in 1993. The landfill included medical waste, household debris, construction material, etc. Burning also took place at the landfill. No other burn pits exist at Camp Santiago. Fires occur on the training ranges, but no AFFF us known to have been used in response.
20. Are you aware of any other creative uses of AFFF? If so, how was AFFF used? What entities were involved? No known creative uses of AFFF.

21. Are there past studies you are aware of with environmental information on plants/animals/ groundwater/soil types, etc., such as Integrated Cultural Resources Management Plans or Integrated Natural Resources Management Plans?

[redacted], through CFMO, can provide previous investigation materials.

22. What other records might be helpful to us (environmental compliance, investigation records, admin record) and where can we find them?

See response to #21.

23. Do you have or did you have a chrome plating shop on base? What were/are the years of operation of that chrome plating shop?

No known chrome plating shop; however, MATES may have had some sort of plating.

24. Do you know whether the shop has/had a foam blanket mist suppression system or used a fume hood for emissions control? If foam blanket mist suppression was used, where was the foam stored, mixed, applied, etc.?

MATES has a sprinkler syste with dry chemical trimixes staged in various areas.

25. How is off-spec AFFF disposed (used for training, turned in, or given to a local Fire Station)? If applicable, do you know the name of the vendor that removes off-spec AFFF? Do you have copies of the manifest or B/L?

AFFF has never been disposed of since its been received. Its been used only once at Ft Buchanon during the Capeco fire in 2009.

26. Do you recommend anyone else we can interview? If so, do you have contact information for them?

Sgt [redacted] at CFMO, [redacted].

PA Interview Questionnaire – MATES Station

Facility:__Camp Santiago__
Interviewer:__J. Witte________
Date/Time:__5/24/2019______

Interviewee:_[redacted]___ **Title:**__MATES Superintendent_____________ **Phone Number:**__[redacted]____________ **Email**[redacted]__	Can your name/role be used in the PA Report? **Y** or N Can you recommend anyone we can interview? Y or **N** ___________________________
1. Roles or activities with the Facility/years working at the Facility. 25 years total with PRARNG, 6 years as Shop Chief at Camp Santiago MATES	
2. What can you tell us about the history of AFFF at the Facility? Was it used for any of the following activities, circle all that apply and indicate years of active use, if known? Identify these locations on a facility map. Maintenance (e.g., ramp washing) –MATES serves trucks from Fort Allen and Camp Santiago only Fire Training Areas – MATES staff train twice a year with dry chemical trimaxes Firefighting (Active Fire) – Fire department responds to fires, MATES supports if they can Crash – No known crashes requiring AFFF response. Fire Suppression Systems (Hangers/Dining Facilities) – MATES has a water fire suppression system Fire Protection at Fueling Stations – No AFFF suppression/protection systems. Non-Technical/Recreational/ Pest Management – None	
3. Are any current buildings constructed with AFFF dispensing systems or fire suppression systems? What are the AFFF/suppression system test requirements? What is the frequency of testing at the AFFF/suppression systems? No. Sprinkler systems exist at MATES, and dry chemical trimixes are staged throughout the complex.	
4. Are fire suppression systems currently charged with AFFF or have they been retrofitted for use of high expansion foam? No	
5. How is AFFF procured? Do you have an inventory/procurement system that tracks use? AFFF has never been procured for, used at, or stored at MATES	

PA Interview Questionnaire – MATES Station

Facility: Camp Santiago
Interviewer: J. Witte
Date/Time: 5/24/2019

6. What type of AFFF has been/is being used (3%, 6%, Mil Spec Mil-F-24385, High Expansion)? Manufacturer (3M, Dupont, Ansul, National Foam, Angus, Chemguard, Buckeye, Fire Service Plus)? Only known AFFF is stored at the Fire Station.
7. Is AFFF formulated on base? If so, where is the solution mixed, contained, transferred, etc.? Speak to the fire department.
8. Where is the AFFF stored? How is it stored (tanks, 55-gallon drums, 5-gallon buckets)? What size are the storage tanks? Is the AFFF stored as a mixed solution (3% or 6%) or concentrated material? AFFF is stored at the Camp Santiago fire station and no other locations at Camp Santiago. Trimaxes staged throughout Camp Santiago (and at MATES) are all dry chemical (non-AFFF) extinguishers.
9. How is the AFFF transferred to emergency response vehicles, suppression systems, flightline extinguishers? Is/was there a specified area on the facility where vehicles are filled with AFFF and does this area have secondary containment in case of spills? How and where are vehicles storing AFFF cleaned/decontaminated? Speak to fire department. When trimixes were delivered, MATES staff began training and now train 2x annually on the units.
10. Provide a list of vehicles that carried AFFF, now and in the past, and where are/were they located? Speak to fire department. No vehicles at MATES contain or use AFFF. MATES services the fire trucks from Fort Allen and Camp Santiago but not trucks have a history of leaking or corrosion. Corrosion is a problem at Vega Baja due to the nearby coast.
11. Any vehicles have a history of leaking AFFF? Do you/did you test the vehicles spray patterns to make sure equipment is working properly? How often are/were these spray tests performed and can you provide the locations of these tests, now and in the past? No trucks at Camp Santiago have a history of leaking or other problems.

PA Interview Questionnaire – MATES Station

Facility:__Camp Santiago__
Interviewer:__J. Witte________
Date/Time:__5/24/2019______

12. How many FTAs are/were on this facility and where are they? Locate on a map. How many FTAs are active and inactive? For inactive FTAs, when was the last time that fire training using AFFF was conducted at them? MATES staff train at the MATES facility but with no AFFF.
13. What types of fuels/flammables were used at the FTAs? Diesel, lubricating oils (break free/WD-40), gasoline at the PX. Lubricating oils are not procured in large drums, only small containers.
14. What was the frequency of AFFF use at each location? When a release of AFFF occurs during a fire training exercise, now and in the past, how is/was the AFFF cleaned and disposed of? Were retention ponds built to store discharged AFFF? Was the AFFF trickled to the sanitary sewer or left in the pond to infiltrate? AFFF is not known to have ever been used at Camp Santiago.
15. Are there mutual aid/use agreements between county, city, local fire department? Please list, even if informal. If formalized, may we have a copy of the agreement? Can you recall specific times when city, county, state personnel came on-post for training? If so, please state which state/county agency, military entity? Do you have any records, including photographs to share with us? Speak to fire department
16. Did individual units come on-post with their own safety personnel, did they also bring their own AFFF? Was training with AFFF part of these exercises? How were emergencies handled under these circumstances? No fire training with AFFF occurs at Camp Santiago, nor have any outside units come to Camp Santiago for hands-on training that uses AFFF. All fire training uses water only.

17. Did military routinely or occasionally fire train off-post? List units that you can recall used/trained at various areas. The 215th Firefighter Engineer Department trains at Camp Santiago, and has trained at Ft Buchanan.
18. Are there specific emergency response incident reports (i.e., aircraft or vehicle crash sites and fires)? If so, may we please copy these reports? Who (entity) was the responder? Brush fire season occurs between March and September. A few years ago (~2017) a battery caused a fire east of the MATES complex in the equipment staging area. The fire was responded to with dry chemical extinguishers.
19. Do you have records of fuel spill logs? Was it common practice to wash away fuel spills with AFFF? Is/was AFFF used as a precaution in response to fuel releases or emergency runway landings to prevent fires? Fuel spills at MATES are responded to with collapsible berms, not AFFF.
20. Was AFFF used for forest fires or fire management on-post/off-post? If so, please describe what happened and who was involved? Forest fires at Camp Santiago are responded to the by the fire department, but only with water and only when they are accessible.
21. Can you provide any other locations where AFFF has been stored, released, or used (i.e. hangars, buildings, fire stations, firefighting equipment testing and maintenance areas, emergency response sites, storm water/surface water, waste water treatment plants, and AFFF ponds)? *Information provided by the fire department* AFFF capable trucks are/have been stored at Vega Baja, Fort Allen, and Camp Santiago: **Vega Baja** – 1 Osh Kosh Water Tanker Truck (50-gal AFFF [empty]) **Fort Allen** – 1 Rosenbauer R-1 Airwolf Firetruck (40-gal AFFF) **Camp Santiago** – 2 Humvee Skid Units (1 can carry 10-gal AFFF, the other only water); 1 E-One Pumper Truck (carries 50 gallons of 3% AFFF [unknown if it is full]). 1 more truck – information has been requested.

22. Are you aware of any other creative uses of AFFF? If so, how was AFFF used? What entities were involved? No known creative uses of AFFF.
23. How is off-spec AFFF disposed (used for training, turned in, or given to a local Fire Station)? If applicable, do you know the name of the vendor that removes off-spec AFFF? Do you have copies of the manifest or B/L? Speak to the fire deparment.
24. Do you recommend anyone else we can interview? If so, do you have contact information for them? No, but other notes: This MATES is scheduled for a replacement. It was constructed in 1985. Hurricane Maria damage included removal of the roof (no roof for a year) and bay doors (still missing bay doors). Floor drains at MATES connect to OWS and then sanitary sewers.

Appendix B.2
Visual Site Inspection Checklists

Facility ST
Visual Survey Inspection Log

Recorded by: C. Sandoval
ARNG Contact: Col. S. Velazquez
Date: 24-May-19

Site Name / Area Name / Unique ID: Camp Santiago
Site / Area Acreage: ~13,000 acres
Historic Site Use (Brief Description): Military training

Current Site Use (Brief Description): Maintenance, Fire Training, various other military purposes, Army National Guard.

1 Was AFFF used at the site/area? Y / **N**

1a. If yes, document how AFFF was used and usage time (e.g. *fire fighting training 2001 to 2014*)

2 Has usage been documented? Y / **N**

2a. If yes, keep a record (place electronic files on a disk)

Significant Topographical Features:

1 Has the infrastructure changed at the site/area? **Y** / N

1a. If so, please describe change (ex. *Structures structures longer exist*) MATES needs completely new buildings w/ new (water) fire suppression systems. No longer active landfill.

2 Is the site/area vegetated? **Y** / N

2a. If not vegetated, briefly describe the site/area composition Much of the camp has brush and forest covered areas used for training.

3 Does the site or area exhibit evidence of erosion? Y / **N**

3a. If yes, describe the location and extent of the erosion

4 Does the site/area exhibit any areas of ponding or standing water? Y / **N**

4a. If yes, describe the location and extent of the ponding

Migration Potential:

1 Does site/area drainage flow off installation? **Y** / N

1a. If so, please note observation and location Water flows South west towards Rio Jueyes.

2 Is there standing water or drainage issues within the site/area? Y / **N**

2a. If so, please note observation and location

3 Is there channelized flow within the site/area? **Y** / N

3a. If so, please note observation and location Floor Drains located at MATES connect to on-site water treatment system and then to Sanitary sewers

4 Have man-made drainage channels been constructed within the site/area? Y / **N**

4a. If so, please note the location of the channel

Additional Notes

Visual Site Inspection Checklist

Names(s) of people performing VSI: J. Witte, C. Sandoval, T. Peck, CPT Hess, M. Santiago

Recorded by: J. Witte

ARNG Contact: CPT Hess

Date and Time: 24 May 2019

Method of visit (walking, driving, adjacent): Walking

Source/Release Information

Site Name / Area Name / Unique ID: Fire Station

Site / Area Acreage: 0.15 acres

Historic Site Use (Brief Description): Fire Station

Current Site Use (Brief Description): Fire Station

Physical barriers or access restrictions: Installation boundary

1. Was PFAS used (or spilled) at the site/area? **Y / N**

1a. If yes, document how PFAS was used and usage time (e.g., fire fighting training 2001 to 2014):

No, but AFFF is stored at the site.

2. Has usage been documented? **Y / N**

2a. If yes, keep a record (place electronic files on a disk):

No, but SDSs are available

3. What types of businesses are located near the site? **Industrial / Commercial / Plating / Waterproofing / Residential**

3a. Indicate what businesses are located near the site

Located within Camp Santiago

4. Is this site located at an airport/flightline? **Y / N**

4a. If yes, provide a description of the airport/flightline tenants:

No

Visual Survey Inspection Log

Other Significant Site Features:

1. Does the facility have a fire suppression system? **Y / N**

1a. If yes, indicate which type of AFFF has been used:

No

1b. If yes, describe maintenance schedule/leaks:

NA

1c. If yes, how often is the AFFF replaced:

NA

1d. If yes, does the facility have floor drains and where do they lead? Can we obtain an as built drawing?

NA

Transport / Pathway Information

Migration Potential:

1. Does site/area drainage flow off installation? **Y / N**

1a. If so, note observation and location:

Not naturally, but drains connect to municipal sanitary sewers

2. Is there channelized flow within the site/area? **Y / N**

2a. If so, please note observation and location:

No

3. Are monitoring or drinking water wells located near the site? **Y / N**

3a. If so, please note the location:

Drinking water wells are located in the southeastern portion of the installation; approximately 0.25 miles away

4. Are surface water intakes located near the site? **Y / N**

4a. If so, please note the location:

No

5. Can wind dispersion information be obtained? **Y / N**

5a. If so, please note and observe the location.

No

6. Does an adjacent non-ARNG PFAS source exist? **Y / N**

6a. If so, please note the source and location.

Salinas Fire Station exists off-facility down-gradient to the southeast

6b. Will off-site reconnaissance be conducted? **Y / N**

Visual Survey Inspection Log

Significant Topographical Features:

1. Has the infrastructure changed at the site/area? **Y / N**

1a. If so, please describe change (ex. Structures no longer exist):

No

2. Is the site/area vegetated? **Y / N**

2a. If not vegetated, briefly describe the site/area composition:

Yes

3. Does the site or area exhibit evidence of erosion? **Y / N**

3a. If yes, describe the location and extent of the erosion:

No

4. Does the site/area exhibit any areas of ponding or standing water? **Y / N**

4a. If yes, describe the location and extent of the ponding:

No

Receptor Information

1. Is access to the site restricted? **Y / N**

1a. If so, please note to what extent:

Yes

2. Who can access the site? **Site Workers / Construction Workers / Trespassers / Residential / Recreational Users / Ecological**

2a. Circle all that apply, note any not covered above:

Camp Santiago employees

3. Are residential areas located near the site? **Y / N**

3a. If so, please note the location/distance:

Off-facility to the east and south, down-gradient, approximately 1 mile at the nearest

4. Are any schools/day care centers located near the site? **Y / N**

4a. If so, please note the location/distance/type:

No, but there are schools in the off-facility residential areas

5. Are any wetlands located near the site? **Y / N**

5a. If so, please note the location/distance/type:

The installation has several streams, wetlands, and rivers. None within the vicinity of the fire station.

Visual Survey Inspection Log

Additional Notes

Photographic Log

Photo ID/Name	Date & Location	Photograph Description

Visual Site Inspection Checklist

Names(s) of people performing VSI: J. Witte, C. Sandoval, T. Peck, CPT Hess, M. Santiago

Recorded by: J. Witte

ARNG Contact: CPT Hess

Date and Time: 24 May 2019

Method of visit (walking, driving, adjacent): Walking

Source/Release Information

Site Name / Area Name / Unique ID: MATES Complex

Site / Area Acreage: 20 acres

Historic Site Use (Brief Description): MATES Complex

Current Site Use (Brief Description): MATES Complex

Physical barriers or access restrictions: Installation boundary

1. Was PFAS used (or spilled) at the site/area? **Y / N**

   1a. If yes, document how PFAS was used and usage time (e.g., fire fighting training 2001 to 2014):

   No, but firefighting vehicles are maintenanced at the site. No known AFFF releases have occurred.

2. Has usage been documented? **Y / N**

   2a. If yes, keep a record (place electronic files on a disk):

   No

3. What types of businesses are located near the site? **Industrial / Commercial / Plating / Waterproofing / Residential**

   3a. Indicate what businesses are located near the site

   Located within Camp Santiago

4. Is this site located at an airport/flightline? **Y / N**

   4a. If yes, provide a description of the airport/flightline tenants:

   No

Visual Survey Inspection Log

Other Significant Site Features:

1. Does the facility have a fire suppression system? **Y / N**

1a. If yes, indicate which type of AFFF has been used:

Yes, but it is only water; dry chemical extinguishers also present

1b. If yes, describe maintenance schedule/leaks:

NA

1c. If yes, how often is the AFFF replaced:

NA

1d. If yes, does the facility have floor drains and where do they lead? Can we obtain an as built drawing?

NA

Transport / Pathway Information

Migration Potential:

1. Does site/area drainage flow off installation? **Y / N**

1a. If so, note observation and location:

Site drains connect to municipal sanitary sewers

2. Is there channelized flow within the site/area? **Y / N**

2a. If so, please note observation and location:

No

3. Are monitoring or drinking water wells located near the site? **Y / N**

3a. If so, please note the location:

Drinking water wells are located in the southeastern portion of the installation; approximately 0.5 miles down-gradient to the south

4. Are surface water intakes located near the site? **Y / N**

4a. If so, please note the location:

No

5. Can wind dispersion information be obtained? **Y / N**

5a. If so, please note and observe the location.

No

6. Does an adjacent non-ARNG PFAS source exist? **Y / N**

6a. If so, please note the source and location.

Salinas Fire Station exists off-facility down-gradient to the south

6b. Will off-site reconnaissance be conducted? **Y / N**

Visual Survey Inspection Log

Significant Topographical Features:

1. Has the infrastructure changed at the site/area? **Y / N**

1a. If so, please describe change (ex. Structures no longer exist):

No

2. Is the site/area vegetated? **Y / N**

2a. If not vegetated, briefly describe the site/area composition:

Mixed pavement and natural surfaces

3. Does the site or area exhibit evidence of erosion? **Y / N**

3a. If yes, describe the location and extent of the erosion:

No

4. Does the site/area exhibit any areas of ponding or standing water? **Y / N**

4a. If yes, describe the location and extent of the ponding:

No

Receptor Information

1. Is access to the site restricted? **Y / N**

1a. If so, please note to what extent:

Yes

2. Who can access the site? **Site Workers / Construction Workers / Trespassers / Residential / Recreational Users / Ecological**

2a. Circle all that apply, note any not covered above:

Camp Santiago employees

3. Are residential areas located near the site? **Y / N**

3a. If so, please note the location/distance:

Off-facility to the east and south, down-gradient, approximately 1 mile at the nearest

4. Are any schools/day care centers located near the site? **Y / N**

4a. If so, please note the location/distance/type:

No, but there are schools in the off-facility residential areas

5. Are any wetlands located near the site? **Y / N**

5a. If so, please note the location/distance/type:

The installation has several streams, wetlands, and rivers. None within the vicinity of the MATES Complex.

Visual Survey Inspection Log

Additional Notes

Photographic Log

Photo ID/Name	Date & Location	Photograph Description

Visual Site Inspection Checklist

Names(s) of people performing VSI: J. Witte, C. Sandoval, T. Peck, CPT Hess, M. Santiago

Recorded by: J. Witte

ARNG Contact: CPT Hess

Date and Time: 24 May 2019

Method of visit (walking, driving, adjacent): Walking

Source/Release Information

Site Name / Area Name / Unique ID: Post Exchange

Site / Area Acreage: 1.2 acres

Historic Site Use (Brief Description): Post Exchange

Current Site Use (Brief Description): Post Exchange

Physical barriers or access restrictions: Installation boundary

1. Was PFAS used (or spilled) at the site/area? **Y / N**

1a. If yes, document how PFAS was used and usage time (e.g., fire fighting training 2001 to 2014):

No, but dry chemical extinguishers are staged at the site.

2. Has usage been documented? **Y / N**

2a. If yes, keep a record (place electronic files on a disk):

NA

3. What types of businesses are located near the site? **Industrial / Commercial / Plating / Waterproofing / Residential**

3a. Indicate what businesses are located near the site

Located within Camp Santiago

4. Is this site located at an airport/flightline? **Y / N**

4a. If yes, provide a description of the airport/flightline tenants:

No, but the former Camp Santiago Airfield is adjacent to the site to the south

Visual Survey Inspection Log

Other Significant Site Features:

1. Does the facility have a fire suppression system? **Y / N**

1a. If yes, indicate which type of AFFF has been used:

Dry chemical extinguishers present, and a water fire suppression system exists

1b. If yes, describe maintenance schedule/leaks:

NA

1c. If yes, how often is the AFFF replaced:

NA

1d. If yes, does the facility have floor drains and where do they lead? Can we obtain an as built drawing?

NA

Transport / Pathway Information

Migration Potential:

1. Does site/area drainage flow off installation? **Y / N**

1a. If so, note observation and location:

Drainage may follow PR-Highway 154 off the installation

2. Is there channelized flow within the site/area? **Y / N**

2a. If so, please note observation and location:

Site drains connect to municipal sewers

3. Are monitoring or drinking water wells located near the site? **Y / N**

3a. If so, please note the location:

Drinking water wells are located in the southeastern portion of the installation; approximately 0.5 miles down-gradient to the southeast

4. Are surface water intakes located near the site? **Y / N**

4a. If so, please note the location:

No

5. Can wind dispersion information be obtained? **Y / N**

5a. If so, please note and observe the location.

No

6. Does an adjacent non-ARNG PFAS source exist? **Y / N**

6a. If so, please note the source and location.

Salinas Fire Station exists off-facility down-gradient to the south

6b. Will off-site reconnaissance be conducted? **Y / N**

Visual Survey Inspection Log

Significant Topographical Features:

1. Has the infrastructure changed at the site/area? **Y / N**

1a. If so, please describe change (ex. Structures no longer exist):

No

2. Is the site/area vegetated? **Y / N**

2a. If not vegetated, briefly describe the site/area composition:

Mostly paved surfaces exist at the site

3. Does the site or area exhibit evidence of erosion? **Y / N**

3a. If yes, describe the location and extent of the erosion:

No

4. Does the site/area exhibit any areas of ponding or standing water? **Y / N**

4a. If yes, describe the location and extent of the ponding:

No

Receptor Information

1. Is access to the site restricted? **Y / N**

1a. If so, please note to what extent:

Yes

2. Who can access the site? **Site Workers / Construction Workers / Trespassers / Residential / Recreational Users / Ecological**

2a. Circle all that apply, note any not covered above:

Anyone

3. Are residential areas located near the site? **Y / N**

3a. If so, please note the location/distance:

Off-facility to the east and south, down-gradient, approximately 1.5 miles at the nearest

4. Are any schools/day care centers located near the site? **Y / N**

4a. If so, please note the location/distance/type:

No, but there are schools in the off-facility residential areas

5. Are any wetlands located near the site? **Y / N**

5a. If so, please note the location/distance/type:

The installation has several streams, wetlands, and rivers. None within the immediate vicinity of the PX.

Visual Survey Inspection Log

Additional Notes

Photographic Log

Photo ID/Name	Date & Location	Photograph Description

Visual Site Inspection Checklist

Names(s) of people performing VSI: J. Witte, C. Sandoval, T. Peck, CPT Hess, M. Santiago

Recorded by: J. Witte

ARNG Contact: CPT Hess

Date and Time: 24 May 2019

Method of visit (walking, driving, adjacent): Walking

Source/Release Information

Site Name / Area Name / Unique ID: Track/Helicopter Landing Zone

Site / Area Acreage: 3.4 acres

Historic Site Use (Brief Description): Track/Helicopter Landing Zone

Current Site Use (Brief Description): Track/Helicopter Landing Zone

Physical barriers or access restrictions: Installation boundary

1. Was PFAS used (or spilled) at the site/area? **Y / N**

1a. If yes, document how PFAS was used and usage time (e.g., fire fighting training 2001 to 2014):

No, but firefighting vehicles are maintenanced at the site. No known AFFF releases have occurred. Dry chemical mobile extinguishers are staged at the site.

2. Has usage been documented? **Y / N**

2a. If yes, keep a record (place electronic files on a disk):

NA

3. What types of businesses are located near the site? **Industrial / Commercial / Plating / Waterproofing / Residential**

3a. Indicate what businesses are located near the site

Located within Camp Santiago

4. Is this site located at an airport/flightline? **Y / N**

4a. If yes, provide a description of the airport/flightline tenants:

No, but the track is used as a landing zone for helicopters

Visual Survey Inspection Log

Other Significant Site Features:

1. Does the facility have a fire suppression system? **Y / N**

1a. If yes, indicate which type of AFFF has been used:

Dry chemical extinguishers present, no fire suppression system

1b. If yes, describe maintenance schedule/leaks:

NA

1c. If yes, how often is the AFFF replaced:

NA

1d. If yes, does the facility have floor drains and where do they lead? Can we obtain an as built drawing?

NA

Transport / Pathway Information

Migration Potential:

1. Does site/area drainage flow off installation? **Y / N**

1a. If so, note observation and location:

No

2. Is there channelized flow within the site/area? **Y / N**

2a. If so, please note observation and location:

No

3. Are monitoring or drinking water wells located near the site? **Y / N**

3a. If so, please note the location:

Drinking water wells are located in the southeastern portion of the installation; approximately 0.5 miles down-gradient to the southeast

4. Are surface water intakes located near the site? **Y / N**

4a. If so, please note the location:

No

5. Can wind dispersion information be obtained? **Y / N**

5a. If so, please note and observe the location.

No

6. Does an adjacent non-ARNG PFAS source exist? **Y / N**

6a. If so, please note the source and location.

Salinas Fire Station exists off-facility down-gradient to the south

6b. Will off-site reconnaissance be conducted? **Y / N**

Visual Survey Inspection Log

Significant Topographical Features:

1. Has the infrastructure changed at the site/area? **Y / N**

1a. If so, please describe change (ex. Structures no longer exist):

No

2. Is the site/area vegetated? **Y / N**

2a. If not vegetated, briefly describe the site/area composition:

Mixed pavement and natural surfaces; mostly natural surfaces

3. Does the site or area exhibit evidence of erosion? **Y / N**

3a. If yes, describe the location and extent of the erosion:

No

4. Does the site/area exhibit any areas of ponding or standing water? **Y / N**

4a. If yes, describe the location and extent of the ponding:

No

Receptor Information

1. Is access to the site restricted? **Y / N**

1a. If so, please note to what extent:

Yes

2. Who can access the site? **Site Workers / Construction Workers / Trespassers / Residential / Recreational Users / Ecological**

2a. Circle all that apply, note any not covered above:

Camp Santiago employees

3. Are residential areas located near the site? **Y / N**

3a. If so, please note the location/distance:

Off-facility to the east and south, down-gradient, approximately 1.5 miles at the nearest

4. Are any schools/day care centers located near the site? **Y / N**

4a. If so, please note the location/distance/type:

No, but there are schools in the off-facility residential areas

5. Are any wetlands located near the site? **Y / N**

5a. If so, please note the location/distance/type:

The installation has several streams, wetlands, and rivers. None within the vicinity of the track.

Visual Survey Inspection Log

Additional Notes

Photographic Log

Photo ID/Name	Date & Location	Photograph Description

Appendix B.3
Conceptual Site Model Information

Preliminary Assessment – Conceptual Site Model Information

Site Name: Camp Santiago, PR

Why has this location been identified as a site?

The site is a large ARNG installation historically used for training, and includes a former airfield

Are there any other activities nearby that could also impact this location?

The city of Salinas has a fire station, and the Puerto Rico Fire Academy is located in Salinas

Training Events

Have any training events with AFFF occurred at this site? No

If so, how often? NA

How much material was used? Is it documented? NA, AFFF has only been stored

Identify Potential Pathways: Do we have enough information to fully understand over land surface water flow, groundwater flow, and geological formations on and around the facility? Any direct pathways to larger water bodies?

Surface Water:

Surface water flow direction? South

Average rainfall? 35 to 45 inches per year

Any flooding during rainy season? No flooding

Direct or indirect pathway to ditches? Direct

Direct or indirect pathway to larger bodies of water? Indirect - streams to Rio Nigua to Caribbean Sea

Does surface water pond any place on site? Some wetlands, streams, and rivers

Any impoundment areas or retention ponds? None observed

Any NPDES location points near the site? Unknown, documentation unavailable

How does surface water drain on and around the flight line? The flightline is not used. SW drains SE

Preliminary Assessment – Conceptual Site Model Information

Groundwater:

Groundwater flow direction? South

Depth to groundwater? 10-13 ft bgs

Uses (agricultural, drinking water, irrigation)? drinking

Any groundwater treatment systems? Yes, potable water treatment

Any groundwater monitoring well locations near the site? Drinking water wells located on and offsite

Is groundwater used for drinking water? Yes

Are there drinking water supply wells on installation? Yes

Do they serve off-post populations? No

Are there off-post drinking water wells downgradient Yes

Waste Water Treatment Plant:

Has the installation ever had a WWTP, past or present? Formerly

If so, do we understand the process and which water is/was treated at the plant? No

Do we understand the fate of sludge waste? No

Is surface water from potential contaminated sites treated? No

Equipment Rinse Water

1. Is firefighting equipment washed? Where does the rinse water go?

Vehicles are maintenanced at the MATES Complex but no AFFF releases are said to have occurred.

2. Are nozzles tested? How often are nozzles tested? Where are nozzles tested? Are nozzles cleaned after use? Where does the rinse water flow after cleaning nozzles?

No

3. Other?

Preliminary Assessment – Conceptual Site Model Information

Identify Potential Receptors:

Site Worker Yes

Construction Worker Yes

Recreational User Yes

Residential Yes

Child No

Ecological Yes

Note what is located near by the site (e.g. daycare, schools, hospitals, churches, agricultural, livestock)?

Schools are located in the adjacent city of Salinas (nearest school approx 1 mile southeast), agricultural areas are located approximately 2 miles southeast and 1 mils southwest

Documentation

Ask for Engineering drawings (if applicable).

Has there been a reconstruction or changes to the drainage system? When did that occur?

Appendix C
Photographic Log

Appendix C - Photographic Log

Army National Guard, Preliminary Assessment for PFAS	Camp Santiago	Salinas, Puerto Rico

Photograph No. 1

Date 5/24/2019

Time

Description:

Kidde and Buckeye dry chemical fire extinguishers stationed at the Camp Santiago track/helicopter landing zone.

Orientation:

Southeast

Photograph No. 2

Date 5/24/2019

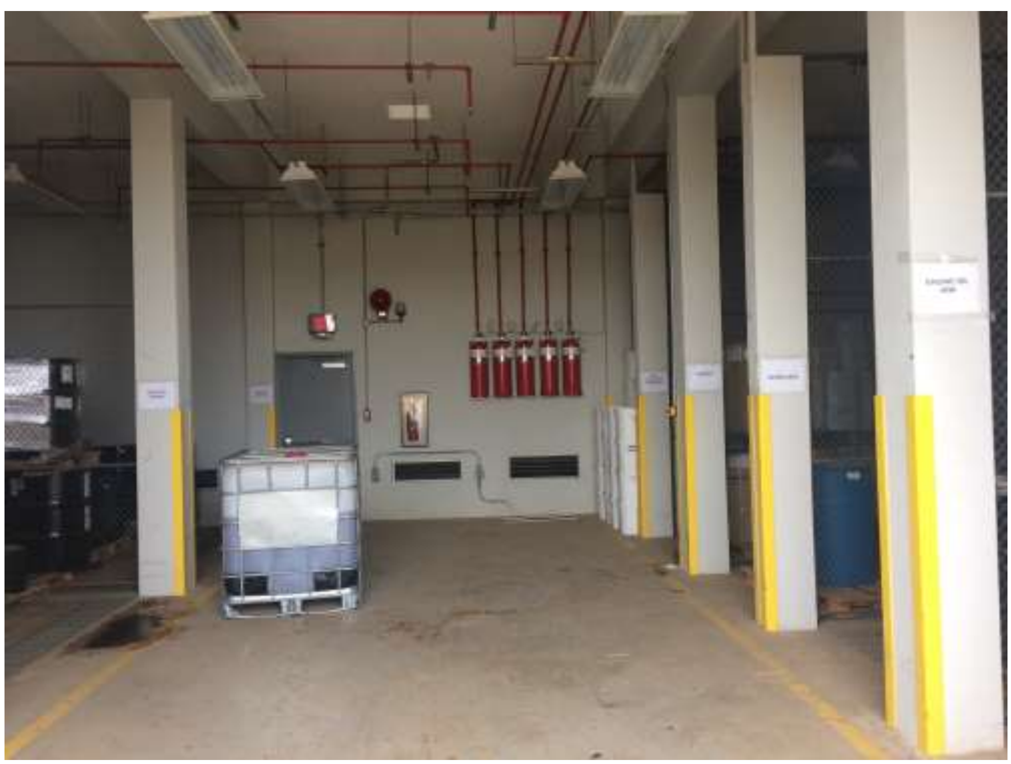
Time 14:53

Description:

Dry chemical fire extinguishers connected to overhead nozzles at the HAZMAT storage area within the MATES facility complex at Camp Santiago.

Orientation:

29.0758377425044



Appendix C - Photographic Log

Army National Guard, Preliminary Assessment for PFAS	Camp Santiago	Salinas, Puerto Rico

Photograph No. 3

Date 5/24/2019

Time 14:47

Description:

Kidde Dry Chemical Fire Exinguisher stationed within the Mates facility complex at Camp Santiago.

Orientation:

305.496350364964

Photograph No. 4

Date

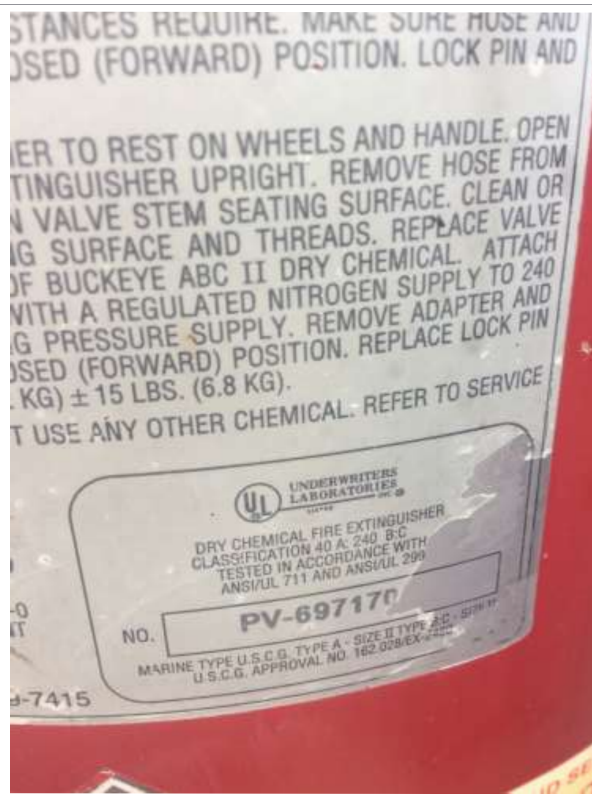
Time

Description:

Label on the Buckeye model A-150-SP mobile fire extinguisher stationed at the Camp Santiago track confirming it contains only dry chemical extinguishant.

Orientation:

333.412955465587



Appendix C - Photographic Log

Army National Guard, Preliminary Assessment for PFAS	Camp Santiago	Salinas, Puerto Rico

Photograph No. 5

Date 5/24/2019
Time 15:21

Description:
Buckeye model A-150-SP mobile fire extinguisher containing dry chemical extinguishant positioned at the Camp Santiago track, which is also used as a helicopter landing zone.

Orientation:
Southeast

Photograph No. 6

Date 5/24/2019
Time 11:14

Description:
Both types of AFFF kept by the Camp Santiago Fire Department stored within the firefighting material storage container at the Camp Santiago Fire Station. Both AFFF types are Chemguard 3% AFFF.

Orientation:
NA

Appendix C - Photographic Log

Army National Guard, Preliminary Assessment for PFAS	Camp Santiago	Salinas, Puerto Rico

Photograph No. 7

Date 5/24/2019

Time 11:13

Description:

One humvee skid unit capable of spraying AFFF stored at the Camp Santiago Fire Station.

Orientation:

West

Photograph No. 8

Date 5/24/2019

Time 14:35

Description:

ABC fire extinguished stationed within the MATES facility complex at Camp Santiago.

Orientation:

NA

Appendix C - Photographic Log

Army National Guard, Preliminary Assessment for PFAS	Camp Santiago	Salinas, Puerto Rico

Photograph No. 9

Date 5/24/2019

Time 11:23

Description:

One humvee skid unit capable of spraying AFFF, one E-one Pumper fire truck capable of spraying AFFF, and one water pumper truck capable of spraying AFFF stored at the Camp Santiago Fire Station.

Orientation:

East

Photograph No. 10

Date 5/24/2019

Time 11:20

Description:

AFFF foam tank cap on an E-One Pumper fire truck stored at the Camp Santiago Fire Station.

Orientation:

NA