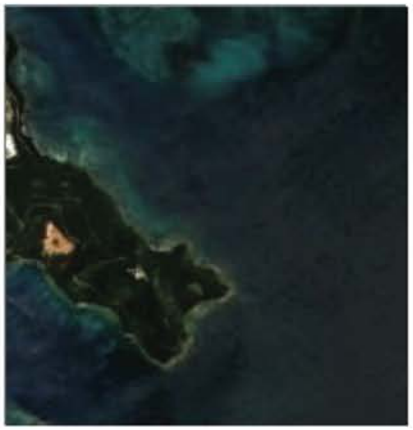


ROOSEVELT ROADS REDEVELOPMENT

INFRASTRUCTURE MASTER PLAN

JUNE 8, 2012

INTEGRA
architects & engineers, PSC

LOCAL REDEVELOPMENT AUTHORITY
ROOSEVELT ROADS - PUERTO RICO
COMMONWEALTH OF PUERTO RICO

Table of Contents

Table of Contents 2

1 Executive Summary 5

Transportation System *1-7*
Water System *1-9*
Wastewater System *1-9*
Electrical Distribution System *1-10*
Telecommunications Distribution System *1-11*
Stormwater System *1-12*
Improvements Projects and Cost Summary by Phase *1-12*

2 Existing Infrastructure Assessment 2-15

2.1 Studies and Documents 2-16
2.2 Technical Data & Related Documents 2-16
2.2.1 Water Distribution Sewer Systems *2-17*
2.2.2 Sanitary Sewer Systems *2-17*
2.2.3 Electrical Systems *2-17*
2.2.4 Communications Systems *2-17*
2.3 Assessment Findings 2-18
2.3.1 Transportation *2-18*
2.3.2 Water Utilities *2-32*
2.3.3 Electrical and Telecommunications Utilities *2-57*

3 Proposed Infrastructure Works 3-71
3.1 Zones Subdivisions 3-73
3.1.1 Zone 1: Port Caribe 3-75
3.1.2 Zone 2: Caribbean Riviera 3-76
3.1.3 Zone 3: El Yunque Grande 3-77
3.1.4 Zone 4: Marsh Vista 3-78
3.1.5 Zone 5: Eco-Outpost Base Camp 3-79
3.1.6 Zone 6: Uplands 3-80
3.1.7 Zone 7: Main Street 3-81
3.1.8 Zone 8: Sports Core 3-82
3.1.9 Zone 9: Island Paradise 3-83
3.1.10 Zone 10: Capehart 3-84
3.1.11 Zone 11: Ceiba Park 3-85
3.2 Proposed Infrastructure 3-86
3.2.1 Transportation 86
3.2.2 Water Distribution 3-107
3.2.3 Wastewater 3-121
3.2.4 Stormwater 3-130
3.2.5 Electricity Systems 3-134
3.2.6 Telecommunication / Data Systems 3-143
3.2.7 Landscape 3-146
3.2.8 Waterfront & Pier Development 3-151

4 Proposed Infrastructure Phasing 155
4.1 General Assumptions 4-156
4.2 Phases Description 4-157
4.2.1 Phase 1 4-157
4.2.2 Phase 2 4-157
4.2.3 Phase 3 4-158
4.2.4 Phase 4 4-158
4.2.5 Phase 5 4-159
4.2.6 Infrastructure Phasing Timeline 4-161
4.2.7 Environmental Factors Affecting Timeline 4-162
4.3 Phases Infrastructure Demand by Proposed Construction Phase 4-164
4.3.1 Infrastructure Demand Tables 4-164
4.3.2 Phase 1 Proposed Infrastructure 4-172

4.3.3 Phase 2 Proposed Infrastructure 4-179
4.3.4 Phase 3 Proposed Infrastructure 4-184
4.3.5 Phase 4 Proposed Infrastructure 4-189

5 Projected Capital Investment 193
5.1 General Considerations and Costs 5-194
5.1.1 Roads Costs by Phase 5-197
5.1.2 Potable Water Costs by Phase 5-199
5.1.3 Wastewater System Costs by Phase 5-201
5.1.4 Stormwater System Costs by Phase 5-203
5.1.5 Electrical System Costs by Phase 5-205
5.1.6 Telecommunication System Costs by Phase 5-207

6 Appendix 209
6.1 Index of Figures 210
6.2 Index of Tables 212
6.3 Support Documents 213

1 Executive Summary

ROOSEVELT ROADS REDEVELOPMENT
INFRASTRUCTURE MASTER PLAN

With the imminent re-development of "Former Naval Station Roosevelt Roads" (FNSRR or Roosevelt Roads) in Ceiba and Naguabo, planning for a proper infrastructure support is of utmost importance. Because of its age and prior uses, the existing facilities at FNSRR won't –at mid and long term- optimally satisfy the predicted demands as defined by the "2010 Addendum to the Roosevelt Roads Reuse Plan" (the Reuse Plan).

After the United States Navy ceased military operations in Roosevelt Roads in 2004, the Government of Puerto Rico created the "Local Redevelopment Authority – Roosevelt Roads" (LRA) as the government agency authorized to promote the re-development at the former base. The LRA's primary objectives for the 8,600-acre site include:

- to work with the private sector –in collaboration with the government- to provide incentives and tools needed to maximize the assets of this facility, its lush natural environment and to promote its conservation in a manner that will drive a robust economic development in the region;
- to enhance Puerto Rico as a premier eco-tourist, entertainment, commercial and recreational destination in the Caribbean; and
- to create jobs and spur economic development in the Eastern region and Puerto Rico as a whole.

The 2010 Addendum to the 2004 Reuse Plan –created by Chicago Consultants Studio for the Roosevelt Roads Local Redevelopment Authority- was prepared to supplement and redirect the focus of the development to better leverage site opportunities, current market potentials and strategic economic development opportunities in order to temperate new economic and social conditions. It proposes a well-balanced mix of uses and intensities, leveraging on FNSRR's privileged location, lush vegetation and unique physical assets (deep port, airport, marinas, etc.). It focuses on creating a world-class tourism destination for furthering regional economic development and job creation. After full build-up (in about 25 years), it is expected to create 21,000 jobs and bring $280 million from the construction and $600 million from the operation during the first 20-25 years. It will then support about 1,500 residential units, 3,000 hotel rooms, combined lodging, retail, office and light industrial space with an approximate total of 11,000,000 Square Feet.

In 2011 the PR Planning Board adopted the Roosevelt Roads Land Use Plan as the legal (zoning) base for new developments inside Roosevelt Roads. It was developed using the 2010 Addendum to the Reuse Plan as its base and takes into account existing environmental qualities of the lands, existing built facilities and local and federal regulations and restrictions.

This Roosevelt Roads Infrastructure Master Plan acts as a fundamental complement to the Reuse Plan and the Land Use Plan. It provides the guidelines and cost projections for the entire shared infrastructure and major utility components. It includes an assessment of the existing conditions based on data supplied by the former occupants as well as from technical reports prepared by numerous professionals since 2004.

The Infrastructure Master Plan compares the assessed infrastructure components (transportation, water distribution, sanitary sewer, storm sewer, electric power utilities and telecommunications) against the proposed projects (as per the Reuse and Land Use Plans) and determines the capacity and adequacy of each system. It provides a list of recommendations for improvements or changes –on a zone-by-zone basis- within all primary, shared utility corridors. It also incorporates development phases into its recommendations.

Being of a strategic nature, this Infrastructure Master Plan impacts the top-level services, i.e. primary electrical lines, main roadways, water treatment facilities, primary water distribution and sewer lines. It impacts public right of ways and doesn't go into detail within future

private development parcels. Nonetheless, capacities and demands assume all the private development proposed within the Reuse Plan for the whole redevelopment period.

It is of note that the existing infrastructure at Roosevelt Roads was developed throughout 60+ years to satisfy the demands of low-density, military uses, and while adequate to support some degree of reuse, it is likely that with the proposed reuse of FNSRR, most of the existing infrastructure will require updating and major modifications. For example, major improvements to the roads –which were not designed to service significant traffic generated by private vehicles- and the piers –which were sized to service naval and tanker vessels rather than passenger ferries or private charter boats- will need to be addressed within the redevelopment period.

In essence, the assessment concluded that:

- Given the age, most of the existing utility systems are obsolete and inefficient which will require major reinvestment to update/modernize or necessitate seeking alternative means of services (ie: existing nearby facilities/sources) to meet the capacities and objectives of the Addendum Plan
- The overall roadway system is generally sufficient, providing good access to nearly all areas of the site; however current roadway conditions will require rebuilding due to age/lack of maintenance, widening for increased capacity and aesthetic improvements (streetscape, landscape, signage, etc) to meet the objectives of the Addendum Plan
- Public transit and biking trail network are not operational and virtually non-existent, requiring an entirely new plan to make accessible the various area of the site as well as make transportation linkages to neighboring communities
- The telecommunication system is minimal and antiquated, requiring an entirely new system and delivery infrastructure to provide the site and area with modern phone, data communication service
- Much of the storm water management relies on a fairly unsophisticated system of swales, channels and culverts which will require both a comprehensive, site-wide strategy and development-specific approach when accommodating the demands of the full redevelopment

Given this assessment, there is a unique opportunity to create new modern utility corridors in conjunction with roadway improvements that will serve the long-term demands and future expansion of the Roosevelt Roads redevelopment.

Roosevelt Roads can serve as a model “city” of sorts, utilizing the latest design, technologies and practices (sustainability, integrated design, etc.) to rebuild its infrastructure for the future.

A synopsis of the planned improvements within the development follows.

Transportation System

Roosevelt Roads is composed of a vast network of main and secondary roads, avenues and local streets that provide access to practically all the components of the premises. It is essential to maintain and upgrade the existing network in order obtain a transportation system that provides a safe and efficient movement of people and goods within and through the site. This is to be accomplished through the planning of facilities that address on-site mobility in relation to both current and future transportation modes. General, site-wide recommendations include:

- Establishment of a public transportation system facilities on major corridor routes such as bus shelters and signage

- Develop a study to determine the best implementation of "Complete Streets" on main corridors, including separate bike lanes
- Re-utilization the pier/ bulkhead facilities for inter-island maritime transport services
- Preparation of an updated traffic study for further and elaborate design recommendations

After assessing the traffic volumes generated by the different development zones, the capacity of the road sections have been determined. The additional capacity needed to support the redevelopment results in the following improvements:

Gate 1 Access

- Improve asphalt surface.
- Install new traffic signage, road markings and lighting.
- Construct new security guardhouse after Ceiba Airport entrance.

Gate 3 Access

- Improve asphalt surface.
- Install new traffic signage, road markings and lighting.
- Construct new security guardhouse.

Tarawa Road

- Maintain existing alignment, except at intersection with Forrestal Drive ,where new roundabout shall be developed
- Improve asphalt surface. Provide new shoulders.
- Install new traffic signage, road markings and lighting.
- Construct new median and planting.

Forrestal Drive

- (On Zones 1 & 2) Maintain Existing Alignment
- Increase Right of Way to widen road section from 2 lanes to a total of 6 lanes (including parking lanes) with turn lanes provided at intersections where warranted. New bicycle lane, new median and planting
- Improve asphalt surface
- Install new traffic signage, road markings and lighting.

Langley Drive

- Maintain Existing Alignment on Zone 7
- Increase Right of Way to widen road section from 2 lanes to a total of 6 lanes (including parking lanes) with turn lanes provided at intersections where warranted. New bicycle lane, new median and planting
- Improve asphalt surface
- Install new traffic signage, road markings and lighting

Langley Drive

- Maintain Existing Alignment on Zone 8
- Increase Right of Way to widen road section from 2 lanes to a total of 4 lanes.
- Improve asphalt surface
- Install new traffic signage, road markings and lighting.

Bennington Road

- Maintain Existing Alignment on Zone 8
- Increase Right of Way to widen road section from 2 lanes to a total of 4 lanes.
- Improve asphalt surface
- Install new traffic signage, road markings and lighting

F.D.R. Drive

- (On Zone 8) Maintain Existing Alignment
- Widen existing 2 lanes road section for new median and planting

- Install new traffic signage, road markings and lighting.

Secondary Roads

- Improve asphalt surface.
- Install new traffic signage, road markings and lighting.

Water System

Inside NSRR there is an existing water treatment facility and distribution network, composed of a raw water pipe incoming from the Rio Blanco River in Naguabo, a raw water reservoir, and the water treatment plant. Water is distributed through a network of pipes and tanks to a vast majority of the premises. This system is operating in fair conditions. It is essential to maintain and upgrade the existing tank and pipes network in order obtain a water system that delivers potable water in a safe and efficient way through the site. This is to be accomplished through the planning of facilities that address water distribution in relation to both current and future water demands.

The water demand flows required by the different development zones have been determined in order to assess the capacity of the water system. The total demand for the redevelopment is approximately 4.0 Million Gallons per Day (MGD). The capacity and pressure zones of the piping systems, the existing system conditions, in addition to the probable sources of treated water and, and the cost analysis of the different alternatives, determine the recommendations fort the water system

The recommended improvements include the following:

Raw water intake

- Maintain intake and close discharge valves.
- Maintain raw water reservoir, with minor repairs

Water Treatment Plant

- Shut down operation. Mothball facilities (Preservation of facilities without using it to produce. Machinery in a mothballed facility is kept in working order so that production may be restored quickly if needed.)

Water Distribution

- Maintain the existing pipe network
- Perform a system wide leak study
- Repair leaks on system
- Open valves interconnecting the Base system (12” Ø pipes) with the Ceiba Airport system
- Install new 9,900 meters of 20” Ø transmission pipe from Forrestal Drive up to Puerto Rico Aqueduct and Sewer Authority’s 36” Ø Main on the Fajardo Water Treatment Plant, (9.9 kms.). This installation will be developed in two phases.
- Develop a new 4.0 MGD booster station and equalization tank next to Gate 1 access, for the new 20” Ø transmission pipe in order to maintain sustained pressures on the system and to fill Tank No.86
- Minor repairs to Distribution Tanks, No. 86 (TACAN) and No. 535 (Bundy)
- Relocate valves and hydrants affected by road widening

Wastewater System

There are three (3) existing wastewater treatment facilities and their related collection systems inside the Base. The systems are distributed through a network of gravity sewer pipes, sanitary lift stations and force lines located around the premises. The gravity

systems are operating in fair conditions, but all the lift stations, force lines and wastewater treatment plants are currently shut down. It is essential to maintain and upgrade some of the existing lift stations in order provide a wastewater system that collects and dispose in a safe and efficient way, all the wastewater needs through the site. This is to be accomplished through the planning of facilities that address wastewater collection in relation to both current and future wastewater generation demands.

The wastewater generation flows required by the different development zones have been determined in order to assess the capacity of the wastewater system. The total demand for the redevelopment is approximately 3.1 Million Gallons per Day (MGD). The capacity of the piping systems, the existing system conditions, in addition to the probable wastewater treatment solutions, and the cost analysis of the different alternatives, determine the following recommendations fort the wastewater system:

Wastewater Treatment Plants

- Convert Capehart and Bundy Wastewater Treatment Plants (WWTP) into regional lift stations
- Demolish Forrestal WWTP

Wastewater Collection Systems

- Replace the existing gravity sewer pipe network on main corridors
- Construct new centralized lift station on Zone 7 for collection wastewater from Bundy and Capehart proposed lift stations
- Install force lines from Capehart and Bundy lift stations up to lift station on Zone 7
- Re-furbish and expand lift station No. 39 on Zone 2, to a max capacity of 3.1 MGD
- Install force line from lift station 39 to Airport PRASA Connection (15" Ø gravity sanitary sewer) on short term
- Install new 13,200 meters of 12" Ø force line from lift station 39 to up to Puerto Rico Aqueduct and Sewer Authority's Main on the Fajardo Wastewater Treatment Plant, (13.2 kms.). This installation will be developed in two phases.
- Minor repairs to other lift stations

Electrical Distribution System

A 38 kV distribution line incoming provides the Base electric distribution system from a Puerto Rico Electric Power Authority (PREPA) 115 kV Electrical Main Substation at the Daguao Sector in Naguabo. The systems are composed of a network of 38, 13.2 and 4.16 kV aerial lines, substations and transformers located around the premises. The complete system is operating in fair condition, but all components such as poles, aerial lines and substations do not comply with current PREPA regulations, nor with the proposed redevelopment loads demand. It is essential to maintain and upgrade the whole infrastructure in order to provide an electrical system that services in a safe and efficient way, all the electric power load demands through the site. This is to be accomplished through the planning of facilities that address electrical supply and distribution in relation to both current and future power demands.

The electrical loads demand required by the different development zones have been determined in order to assess the capacity of the electrical distribution system. The total demand for the redevelopment is approximately 98,313 KVA. The capacity of the distribution systems, the existing system conditions, in addition to the probable distribution solutions, and the cost analysis of the different alternatives, determine the recommendations fort the electrical systems.

The recommended improvements include the following:

Electrical System Source

- Maintain PREPA Daguao connection point.
- Increase connection underground line from 38 kV to 115 kV

Substations

- Construct new 115 kV / 38 kV transmission center on Zone 8, near Daguao connection point
- Construct 2 new 38 kV / 13.2k V substations to serve Zones 3, 4, 5 and 6
- Convert existing 38kV / 4.16 kV to 38 kV / 132 kV on Zones 10 and Bundy
- Upgrade all other existing Substations
- Increase parcel size on all substation to comply with PREPA regulations

Distribution Systems

- Replace all existing aerial 13.2 and 38 kV aerial loop systems with new upgraded 13.2 and 38 kV aerial systems on all zones main corridors to comply with PREPA Standards
- Replace aerial 4.16 kV systems with new 13.2 kV systems on main corridors
- Install new 13.2 and 38 kV underground systems on Zones 1, 2 and 7 (Forrestal and Langley Drives future commercial zones)

Telecommunications Distribution System

An underground line incoming provides the Base telecommunications distribution system from communications carriers next to the Daguao Sector in Naguabo. The systems are composed of a network of fiber optics, copper aerial and underground lines, and distribution centers around the premises. The complete system is operating in fair condition, but all components such as poles, aerial and underground lines do not comply with current PR Telecommunications Regulatory Board (PRTRB) regulations, nor with the proposed redevelopment loads demand. It is essential to upgrade the whole infrastructure in order to provide a telecommunications system that services in a safe and efficient way, all the data/communications load demands through the site. This is to be accomplished through the planning of facilities that address data/communications supply and distribution in relation to both current and future demands.

The data/communications loads demand required by the different development zones shall be determined by the private carriers authorized by the PRTRB to provide services in the area such as CLARO, ATT and Liberty Cable. It is necessary to provide the infrastructure components in order for the service carries to install their lines and equipment. The existing system conditions, in addition to the requirements by the PRTRP solutions, and the cost analysis of the different alternatives, determine the following recommendations for the telecommunications systems:

Telecommunications System Source

- Maintain Daguao connection point (Near Gate 3)
- Provide a new connection point on Gate 1, in order to provide a redundant loop
- Request service and installations from authorized carriers and service providers

Distribution Center

- Replace and Construct new Main Telecommunications Center on Zone 7
- Construct new distribution centers on Zones 2, 8 and 10

Distribution Systems

- Replace all existing aerial and underground systems with new underground systems on all zones main corridors to comply with PRTRB Standards
- Install new underground conduits and junction boxes along main corridors
- Fiber optic lines shall be installed by service providers

Stormwater System

The stormwater systems is mainly composed of a series of surface systems that transport runoff through pipes, culverts, earth ditches and channels located along road corridors. Practically storm sewer systems composed of inlets and pipes are almost no-existent on most of the premises.

The systems are operating in fair conditions, but due to proposed road widening, many of them will need extensions and improvements, in addition there is a need to establish storm sewer systems on proposed commercial areas main corridors. It is essential to maintain and upgrade some of the existing systems in order provide a stormwater system that collects and dispose in a safe and efficient way, all the drainage needs through the site. This is to be accomplished through the planning of facilities that address stormwater collection in relation to both current and future drainage generation demands.

Each individual developer must address the stormwater generated flows required by the different development zones. Each developer is responsible to mitigate any increase in stormwater volume and any decrease in stormwater quality. The capacity of the piping systems, the existing system conditions, in addition to the cost analysis of the different alternatives, determine the following recommendations for the stormwater system:

Culverts and ditches

- Maintain location of existing systems
- Extend pipe or structures according to road widenings
- Clean, repair and/or replace damaged pipe sections

Stormwater Collection Systems

- Install new gravity sewer pipe and inlet networks on commercial zones main corridors on Zones 1,2 and 7, 10 (Forrestal, Langley and F.D.R. Drives)
- Provide and reserve adequate parcels on all zones in order to maintain a discharge point from the mitigation systems to be installed by each individual developers.

Improvements Projects and Cost Summary by Phase

Based on a the infrastructure recommendations and the proposed 25 year re-development (from the year 2012 to the year 2037 divided on five year phases), an order of magnitude cost summary by phase follows:

ORDER OF MAGNITUDE COST SUMMARY BY PHASE				
	Phase 1	**Phase 2**	**Phase 3**	**Phase 4**
Roads Improvements				
Gates	165,000	45,000		
Minor Improvements	861,343	72,000		240,000
Widening extisting roads to New road sections	2,674,873	4,925,038	6,102,960	2,845,306
New Roads	97,464			
	3,798,681	**5,042,038**	**6,102,960**	**3,085,306**
Water				
WTP Shut down	150,000			
Tanks Improvements	75,000		30,000	
Booster Pumps Improvements	35,000		400,000	15,000
System General Improvements[1]	621,000	201,440	176,400	142,620
Relocation of Valves and Hydrants	125,000	25,000	15,000	10,000
New Booster Pump and Pit Tank	800,000			
New Lines (project interior and small diameter)		936,567		842,670
Connection to PRASA System at Airport	45,000			
New 20" Pipe to PRASA connection point[2]	3,806,400	5,859,000		
	5,657,400	**7,022,007**	**621,400**	**1,010,290**
Wastewater				
Improvements to Lift Stations	600,000	75,000	300,000	75,000
New Gravity Lines	3,836,888	4,965,227	928,798	2,263,866
New Force Lines		898,067	5,469,750	1,000,985
New Lift Station		500,000	500,000	750,000
	4,436,888	**6,438,293**	**7,198,548**	**4,089,850**

	Phase 1	Phase 2	Phase 3	Phase 4
Stormwater System				
Pipes and Manholes Cleanning	18,840	15,390	31,290	9,210
New Pipes, manholes, Inlets and Headwalls	852,078	871,830	1,456,928	
Mitigation Areas		45,000	60,000	80,000
	870,918	**932,220**	**1,548,218**	**89,210**
Electrical System				
Improvements Required by PREPA[3]	6,400,000			
Improvements to Existing Substations	1,000,000	2,000,000	1,000,000	1,000,000
New Substations	2,750,000	9,750,000		
New Aerial Dist. Lines		5,046,020	3,783,290	3,334,940
New Underground Dist. Lines	6,437,902	16,865,222		
	16,587,902	**33,661,242**	**4,783,290**	**4,334,940**
Telecommunications System				
Telecommunications System	8,998,415	6,817,310	3,959,500	553,335
	8,998,415	**6,817,310**	**3,959,500**	**553,335**
Total per Phase for All Utilities	**$ 40,350,204.19**	**$ 59,913,110.91**	**$ 24,213,915.55**	**$ 13,162,930.85**

[1] Includes Piping and fittings and leak repairs

[2] This connection is divided in two phases, a first phase connecting toa 12" PRASA line and a second phase connecting to Fajardo WTP

[3] Excluding improvements related to substations

2 Existing Infrastructure Assessment

In order to assess the general condition and current location of the existing infrastructure components, it is necessary to compile and analyze all the available data regarding the design, construction and development of the Roosevelt Roads Naval Base.

The data includes the compilation of all the available printed and digital information, including previously prepared studies and analyses, describing the existing infrastructure and the proposed development.

All the information has been obtained either through the Local Redevelopment Authority for Roosevelt Roads (LRA), the U.S. Navy, Navy private contractor (Power Cooling Inc.) and the PR Ports Authority.

2.1 Studies and Documents

For the analysis, the following documents and/or studies have been used as a principal reference:

- Reuse Plan (CB Richard Ellis), December 2004
- Reuse Plan Addendum (The Chicago Consultants Studio, Inc.), April 2010 and June 2010 Revision
- Original Environmental Impact Statement (CSA) + Supplemental Environmental Assessment (E&E), November 2008
- Mobility Plan (CSA) (Transit Study), February 2008
- Airport Master Plan (PBS&J), September 2007
- Zoning Master Plan (Integra, ETi), October 2011
- ANPMMD Master Plan draft (Conservation Trust), May 2010
- PREPA Assessments (Puerto Rico Electric Power Authority), September 2010
- Waste Water and Potable Water Assessments (ERM,) May 2011
- Final Systems Assessment Report Bundy Wastewater Treatment Plant (ERM), May 2011
- Draft Systems Assessment Report Capehart Wastewater Treatment Plant (ERM), October 2006
- EDC Proposal for Parcel 3

Other documents and studies were also obtained and reviewed in order to complete the assessment. These include:

- Current Economic Development Conveyance Agreement (EDC) between LRA & U.S. Navy, January 2012
- Working Draft Report: Site, Context @ Market Conditions, April 2004
- Final Systems Assessment Report Forrestal Wastewater Treatment Plant (ERM), May 2011
- Final Systems Assessment Report Capehart Wastewater Treatment Plant (ERM), May 2011

2.2 Technical Data & Related Documents

Hard copy and digital versions of the technical data available for the analysis of the existing infrastructure include: bid plans, as-builds, technical specifications and operation manuals. Technical specifications and operation manuals were not considered on this assessment.

Hard copy versions of bid plans and as-builds that were available for the analysis of the existing infrastructure include: water, sanitary, storm sewer, electric power and telecommunications distribution systems. These mainly show improvements from the 1970's, 80's, and 1990's, especially major infrastructure renovations after the effects of Hurricane Hugo in 1990. No infrastructure plans dated previous to the year 1975 were obtained.

Digital versions of various Base Plans with buildings and utilities' locations, and a base key plan based on aerial photography were also obtained and analyzed. These plans were geo-referenced to the NAD-83 metric coordinate system for Puerto Rico to provide a workable database.

The Base Plan is being used to show the existing utilities and the proposed improvements recommendations on this report.

The following sections list per discipline, the hard copy drawings that were obtained during the data collection phase:

2.2.1 Water Distribution Sewer Systems

- Water Distribution System (U.S.N.S. Public Works Department), September 2010
- Cross Connections Repairs (U.S. Navy), 1976
- TACAN Building Expansion (U.S. Navy), 1977
- Hurricane Hugo Repairs to Water Distribution System (U.S. Navy), June 1990
- Repair Improvements to Filtration Pant (U.S. Navy), 1982
- Repairs to Filtration Plant (U.S. Navy), 1975
- Potable Water Distribution Systems Maps (U.S. Navy), February 2005
- Repairs to Water Distribution System Tank No. 86 (U.S. Navy), 1977
- Repairs to Fire Booster Pump (U.S. Navy), 1992
- Ceiba Airport - New Water and Sanitary Sewer Connections to PRASA (PR Ports Authority - PBS &J), June 2010

2.2.2 Sanitary Sewer Systems

- Sewage Distribution (U.S.N.S. Public Works Department), March 2010
- Sanitary Sewage Collection and Treatment (Paragon Energy Corp.), October 1983
- Sanitary Sewer Lift Stations (U.S. Navy), unknown date
- Upgrade Sanitary Collection Treatment System (U.S. Navy), 1990
- Sanitary Sewer collection System Improvements (U.S. Navy), 1979
- Repairs to Wastewater Collection Systems (U.S. Navy), 1993
- P-495 Upgrade Sanitary Collections Systems (U.S. Navy), 1993
- Sewage Treatment Plants Bundy and Industrial Area (U.S. Navy), 1970
- Airport - New Water and Sanitary Sewer Connections to PRASA (PR Ports Authority - PBS &J) , June 2010

2.2.3 Electrical Systems

- 38 KV Power Distribution (U.S.N.S. Public Works Department), March 2000
- PREPA Electrical Facilities Assessment Plans, June 2011
- Electric Utility Plan Section 1 (U.S. Navy), unknown date
- Electrical Single Line (U.S. Navy), unknown date

2.2.4 Communications Systems

- Outside Fiber Optic Intermodal Cable Distribution (U.S. Navy)
- Outside Telecommunications Cable Distribution System (U.S. Navy), July 1997

- Soc-south outside fiber optic and copper cable distribution system (U.S. Navy), June 1995
- Instalación de Fibra Optica (PRTC), June 2000
- Key Map Telephone and Communication Cable Plan (U.S. Navy), unknown date

From the data collection phase, the obtained digital plans in "dwg" format are the following:

- Base Map
- Sanitary Sewer Base
- Tele Com
- Communication Fiber
- Electrical Lines
- Water Base

All the digital plans were delivered to Integra in January 2011, but the production date is unknown.

A detailed revision and comparison between the hard copy versions and the digital plans was performed. From this comparison, the obtained information was field verified. Multiple field visits were performed in order determine the condition and confirm the type and location of all the infrastructure components. Based on this compiled data the initial findings were obtained.

2.3 Assessment Findings

After processing of all obtained data, reviewing the reports and documents and confirming and/or rectifying the information through field visits, it is possible to obtain a general overview of all the existing components of the infrastructure systems within the Base.

On this section we describe the existing facilities and their current conditions at the time of this report. This information will be used to determine the proposed improvements needed to provide a reliable and updated infrastructure that will support the proposed Master Plan for the Redevelopment of the Former Naval Station Roosevelt Roads.

2.3.1 Transportation

Roosevelt Roads is composed of a network of approximately 110 miles (177 kilometers) of main and secondary roads, avenues and local streets. There is road access to practically all the components on the premises. A vast majority of the roads were established on the 1940's during the initial Base development.

To accommodate the population growth within the base through various decades service facilities were expanded; roads were improved and widened to accommodate and complement the continuous development.

Almost all of the existing roads on the Base are asphalt paved, two-lane (one on each direction), roads without curbs and gutters, and with minimal lighting.

The Base was originally accessible through four gates, with direct access to State Road PR-53. During the last years of operation as a Naval Base, only two main gates were operational, Gate 1 at the north portion and Gate 3 at the southwest portion. There is another access, Gate 4 that can be rehabilitated as needed. The existing road network is depicted below. A brief description of the existing accesses, main roads and avenues follows:

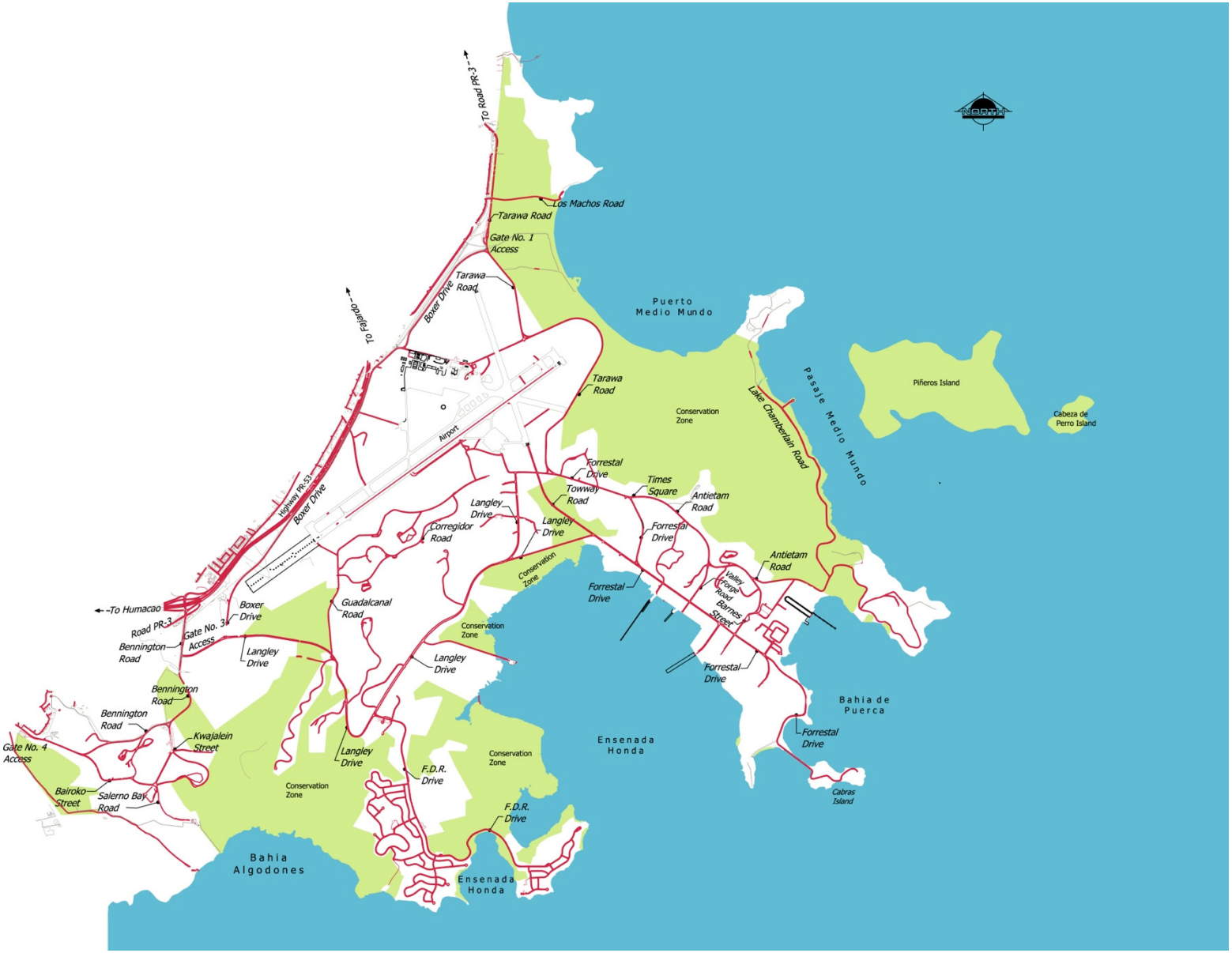


Figure 1: Existing Road and Gates Network

Gate 1 Access (Tarawa Road- Ceiba)

Gate 1 is located North of the premises. It provides access to state Road PR-3, either by interconnecting to Isabel Rosada Street or through a secondary branch up to Road PR-3 in the Municipality of Ceiba.

This access portion is in poor condition, mainly on its asphalt surface due to poor maintenance and trench excavations for utilities performed on its section. The existing road section is composed of two paved lanes, one on each direction without curbs with an approximate total width of 7.30 meters. Road signage is inadequate and the paved surface needs re-surfacing due to normal wear and poor maintenance.

A concrete guard house is located at the Base entrance, with additional width to accommodate an entrance and exit lanes as well as parking area is also located at this portion. In addition to the Base, this road also provides access to the Jose Aponte de La Torre Airport.

Figure 2: Existing Conditions at Gate 1

Figure 3: Existing Conditions at Gate 1

Gate 3 Access (Bennington Road- Ceiba)

Figure 4: Existing Conditions at Gate 3

This access is located Southwest of the premises. It provides direct access to state Road PR-3, and to a diamond interchange at the intersection of PR-53 and PR-3 with direct northbound and southbound ramps at approximately 100 meters from Gate 3 access.

This access provides a major advantage in terms of direct and fast access to a major highway with connections to San Juan or to Humacao.

This access roadway is in fair condition. The existing road section is composed of two lanes, one on each direction without curbs with an approximate total width of 7.30 meters. A concrete guardhouse is located at the Base entrance, with additional width to accommodate an entrance and exit lanes as well as parking area.

Gate 4 Access (Bennington Road -Naguabo)

Figure 5: Existing Conditions at Gate 4

This access is located at the most southwest corner of the premises. It is currently closed and provides access to state Road PR-3, by passing through Daguao Community.

This access roadway is poor condition, because it is practically abandoned, and major repairs are needed in order to rehabilitate it. The existing road section is composed of two lanes, one on each direction without curbs with an approximate total width of 6.00 meters.

Main Road (Tarawa Road)

- Location: Main access road incoming from Gate 1.
- General Condition: Fair
- Road composition: two paved lanes, one on each direction without curbs
- Approximate total width: 7.30 meters
- Approximate length: 3.8 kilometers (2.4 miles)
- Road signage: Inadequate
- Pavement marking: Inadequate
- Road surface: needs re-surfacing due to normal wear and poor maintenance.

Figure 6: Tarawa Road

Figure 7: Tarawa Road

Main Road (Bennignton Road)

Figure 8: Bennington Road

- Location: Main access road incoming from Gate 3 and up to Gate 4.
- General Condition: Fair
- Road composition: two paved lanes, one on each direction without curbs
- Approximate total width: 7.30 meters
- Approximate length: 2.9 kilometers (1.8 miles)
- Road signage: Inadequate
- Pavement marking: Inadequate
  - Road surface: needs res-surfacing due to normal wear and poor maintenance.

Main Road (Forrestal Drive)

Figure 9: Forrestal Drive

- Location: access road incoming from Tarawa Road and through waterfront
- General Condition: Fair
- Road composition: two paved lanes, one on each direction without curbs on one portion, and three lanes (two on one direction and one in the other) at waterfront portion.
- Approximate total width: varies from 7.30 meters to 10.00 meters
- Approximate length: 3.8 kilometers (2.4 miles)
- Road signage: Inadequate
- Pavement marking: Inadequate
- Road surface: needs res-surfacing due to normal wear and poor maintenance.

Main Road (Langley Drive)

- Location: access road incoming from Bennington Road through central portion of base premises
- General Condition: Fair condition
- Road composition: two paved lanes, one on each direction without curbs on one portion, and four lanes (two on each direction, with left turn lanes) at former Naval Exchange and entertainment portion.
- Approximate total width: varies from 7.30 meters to 14.60 meters,
- Approximate length: 6.4 kilometers (4.0 miles)
- Road signage: Fair, needs improvements
- Pavement marking: Fair, needs improvements
- Road surface: needs re-surfacing due to normal wear and poor maintenance. Shows potholes on some portions , especially at the connection with Towway Drive, passing through a Conservation Zone

Figure 10: Langley Drive

Figure 11: Langley Drive

Main Road (Towway Drive)

Figure 12: Towway Drive

- Location: access road incoming from Tarawa Drive and connection Forrestal Drive
- General Condition: Good condition
- Road composition: two paved lanes, one on each direction without curbs
- Approximate total width: 7.30
- Approximate length: 1.5 kilometers (0.9 miles)
- Road signage: Fair, needs improvements
- Pavement marking: Fair, needs improvements
- Road surface: good condition

Main Road (FDR Drive)

Figure 13: FDR Drive

- Location: access road incoming from Tarawa Drive and connection Forrestal Drive
- General Condition: Good condition
- Road composition: two paved lanes, one on each direction with curbs on some portions
- Approximate total width: 7.30
- Approximate length: 4.2 kilometers (2.6 miles)
- Road signage: Fair, needs improvements
- Pavement marking: Fair, needs improvements
  - Road surface: fair condition

Secondary Roads (Avenues and Local Streets)

This secondary road network interconnects the main roads with portions of the development were former residential areas, or support facilities are located.

Most of those secondary roads are partially abandoned due to the inexistence of activity or traffic at the current time. From the assessment performed, the overall conditions are the following:

- Location: all around the base premises
- General Condition: Fair to poor condition
- Road composition: mostly paved two lanes, one on each direction without curbs and paved two lanes with curbs on residential areas, some unpaved access roads to facilities (antennas and water tanks, wastewater treatment plants)
- Approximate total width: between 4.00 and 7.30 meters
- Approximate length: 150 kilometers (93 miles)
- Road signage: Poor, needs improvements
- Pavement marking: Poor, needs improvements
- Road surface: fair condition on paved roads, poor conditions on earth or unpaved roads

Figure 14: Secondary Road in Capehart

Figure 15: Secondary Road around Capehart

Figure 16: Secondary Road (Bundy WWTP Access)

Figure 17: Secondary Road (Antenna Facility)

Public Transportation Facilities (Bus Shelters)

There is a series of Bus Shelters located along the main road corridors on the Base. These are strategically located adjacent to building complexes, schools, and critical areas. The Bus Shelters were used for public transportation system and school buses for Navy personnel and families.

They are currently out of use, and show some degree of deterioration (paint damage, corrosion and broken Plexiglas components). If a new public transportation system is going to be initiated, the existing bus shelters can be used on the short term with some minor repairs.

Figure 18: Bus Shelter in Langley Drive

Maritime Transport (Piers and Docks)

The main waterfront is located around Ensenada Honda harbor and is approximately 160 acres in area. Ensenada Honda has a 1000 feet long and 40 feet deep navigation channel, adequate for large vessels access. This zone has adequate infrastructure for Maritime transportation and operation activities. Among the components of this zone are: a fuel mooring pier, 3 cargo/passenger piers, small boats marina, bulkhead facilities for ships docking, boat landing ramps and ports operation buildings. Other existing facilities on the site include a wide range of existing buildings left behind by the Navy. The main piers have varying depths from 32-to 44 feet depth and 15 feet depth on the bulkheads.

The facilities are in fair condition, although they are not currently being used. The 72-boat slip marina is in excellent condition, because it was maintained until recent months. Depending on the possible future uses, most of the facilities require minor repairs in order to provide a short term operation either as maritime terminals for cargo or passengers.

The fuel mooring pier is a concrete pile structure in good condition, about 15 years old and has an approximate length of 2,650 feet and a fueling platform that has 2 berths. The pier has 6 loading arms, able to handle diesel and JP5. Each also has a potable water feed. The water depth was about 40 feet deep at de-commissioning, and it is expected that today the same depth is likely to exist. It can be used for handling of fuel for storage on the tank farm located on the premises.

The other additional maritime facilities that are currently maintained and in good operating conditions are the Homeland Security boat ramp and the US Army shipyard and ramp, both located on the Ensenada Honda waterfront.

There is an additional pier facility located at Bahia de Puerca adjacent to the US Army/National Guard facilities. The Dry Dock is also located on the same area. It is currently abandoned and would need extensive repairs to rehabilitate its functionality.

Pier 1 is about 50 years old, located immediately adjacent the Fuel Pier, just off the seawall bulkhead. It is approximately 450 feet long and 38 feet wide. It is supported by concrete piles and continuous bent caps, and by beams of steel-encased concrete spanning between the bent caps. The pier has water service, F44 and JP5 fuel distribution, and 35’ deep water to the east. Since the pier is adjacent to the Fuel Pier, it only has berthing access on one side.

Pier 2, located about midway down the main seawall, is about 50 years old with a concrete deck on concrete pile structure. The water depth is about 38 feet, and there are two berths, one along each side. Each berth has 4 telephone connections, sanitary sewer, water and electrical connections. Pier 3, the most easterly pier, is about 46 years old. It is about 1,200 feet long by about 120 feet wide and in very good condition. It has two berths, one on each side. The water depth is about 40 feet on the North (east) side, and about 44 feet on the South (west) side. Massive light towers stand at each end of the pier. The pier has 14 fueling stations, each with 44 and JP5 fuel by tanker truck, diesel, potable water, sanitary sewer hook-ups, telephone and electrical service.

The seawall bulkhead that connects the piers is in very good shape, and is composed of 4 basic sections. Starting on the west, Bulkhead A is about 825 feet long, Bulkhead B about 1,000 feet long, Bulkhead C is about is about 800 feet long, and Bulkhead D, measured in 2 parts, is about 300 feet long on the west of Pier 3 and about 340 feet long on the east side of Pier 3. See Figure 19 of the existing facilities including the waterfront piers and bulkheads.

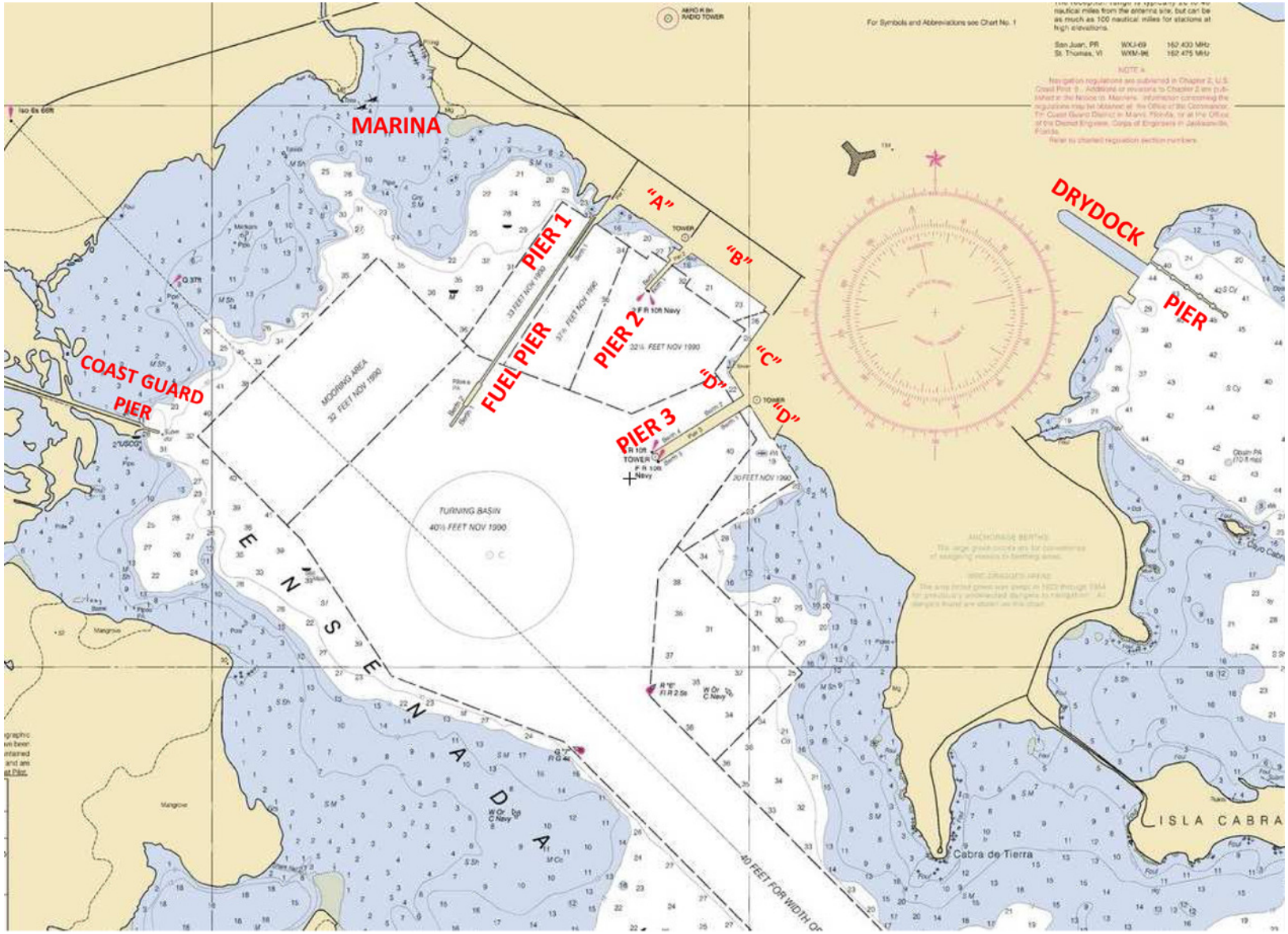


Figure 19: Piers and Bulkheads at Ensenada Honda

Figure 20: Fueling Pier

Figure 21: Waterfront at Pier 2

Figure 22: Dry Dock Area

Pedestrian or Bicycle Facilities

There are minimum facilities for pedestrian or bicycle traffic on the Base premises. The only pedestrian facilities are sidewalks portions mostly on the Capehart residential areas and around school zones. There are few pedestrian crossings, and the available are located on some intersections and school zones.

There are no bicycle paths on any of the road portions, nor there are curbs or shoulder dividers for cyclist protection

Figure 23: Pedestrian Crossing at Forrestal Dr.

2.3.2 Water Utilities

Currently the only potable water source for the Base is the product of the Water Treatment Plant (WTP), located inside the premises. The raw water supply for this WTP is received from the Rio Blanco River, located at approximately 11 miles southwest at the Municipality of Naguabo. The raw water is conveyed by gravity through a 27 inch diameter reinforced concrete pipe, up to a reservoir and then is conveyed either by gravity or by a booster pump system to the adjacent WTP.

After water is treated at the WTP, it is distributed through a network of pipes, tanks and booster stations all around the Base.

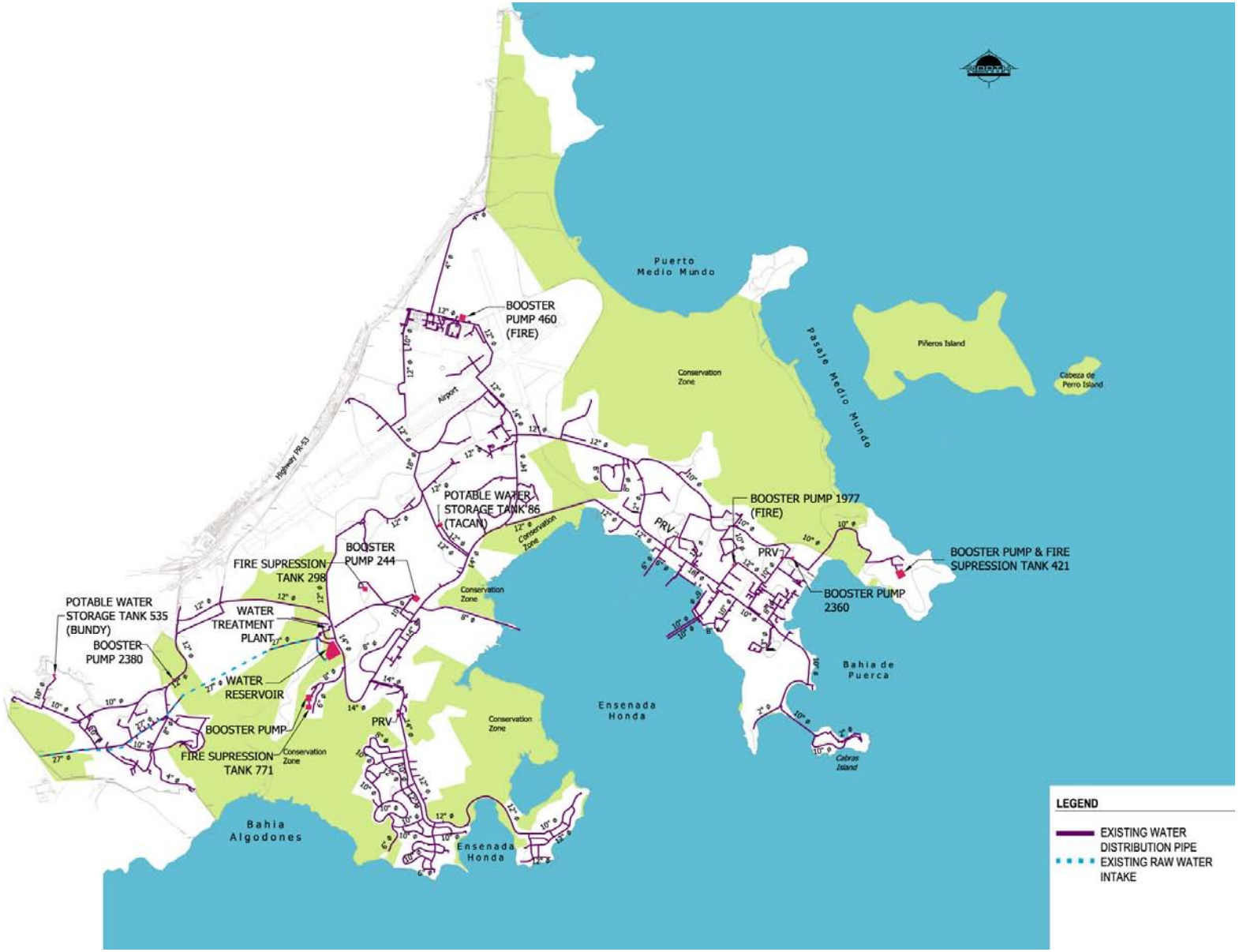


Figure 24: Existing Water Distribution System

Raw Water Reservoir

The open concrete-lined raw water reservoir is located adjacent to the WTP, with a capacity of 43.6 million gallons. It has a 5.6 acre surface area with a 30-feet design depth. A 24 inch discharge pipe extends to the WTP. The water flows either by gravity or may be discharged by booster pumps.

Figure 25: Raw Water Reservoir

Figure 26: Water Reservoir Outer Swale

The water reservoir shows the following:

- Erosion around the outer protection concrete swale
- Settlements on concrete slab walls
- Sedimentation
- Fence corrosion

Water Treatment Plant

The existing WTP (Building 88) is located in the premises between Zones 7 & 8 on Langley Drive. It is a conventional filter process plant, which includes rapid mixing and flocculation chambers, settling basins, dual media filtration and chlorination. With an estimated construction year of 1942, it has a design capacity of 4.0 Million Gallons per Day (MGD).

According to the "Naval Station Roosevelt Roads Potable Water System Assessment Report" prepared by Environmental Resources management (ERM) on May 2011, the plant is operational, but there is a need to perform renovations in order to have a fully automatic an efficient production. Currently the average water production is about 0.60 MGD. The main conclusions from that report state that:

- WTP is in overall fair condition, but showing signs of deterioration since no major renovations in recent years have been performed.
- At it's current condition (2011) it may not be capable of reaching the design capacity of 4.0 MGD without compromising the potable water quality.
- The WTP needs upgrades to restore the system to comply with PRASA's operating requirements.
- The WTP requires additional improvements to operate in full compliance with Environmental and Safety Programs and with federal and state regulations.
- The overall WTP instrumentation, control strategy, and installation require an update to reduce operational and maintenance costs.
- There is a priority to repair WTP pump systems, instrumentation and main building roof which is deteriorated.
- Currently the WTP is non-compliant with Puerto Rico Aqueduct and Sewer Authority Standards

Figure 27: Water Treatment Plant

Figure 28: Water Treatment Plant

Distribution System

After completing the raw water treatment, water is chlorinated and stored in a 120,000 gallons capacity "clearwell" and delivered to the distribution system by means of four centrifugal pumps located at the WTP's control building. The pumps capacities are as follows:

- 3 pumps Q (discharge)=1,000 gpm @ 275 ft, 125 HP, 1,780 rpm each
- 1 pump Q(discharge)=1,400 gpm @ 275 ft, 150 HP, 1,780 rpm (out of service)

The pumps work in parallel feeding the system through a common 16" Ø ductile iron pipeline. According to information provided by the plant's operator, the three pumps with a capacity of 1,000 gallons per minute (gpm) each, are activated one or two at a time, alternating between the three. In the past, the pump with a Q=1,400 gpm (currently out of service) was only used if necessary to fill Tacan Tank 86 at a faster rate.

The distribution system is composed of approximately 64.4 miles (103.6 kilometers) of distribution piping ranging in various sizes up to 18 inches in diameter. The composition of piping materials is distributed approximately of 76% PVC, 6% Cast Iron, 1% Galvanized iron, 1% Ductile Iron and 17% of unknown materials. The distribution system piping services virtually all the developed areas inside the Base and with interconnections (currently valves are closed) to the Jose Aponte de la Torre Airport.

The existing raw water pipeline is mostly located on cross country land, while the water distribution network is mostly located along the existing road corridors. The conditions of the existing piping's cannot be easily addressed, although based on collected data, major repairs and improvements were performed by the U.S. Navy under project "Hurricane Hugo Repairs to Water Distribution System" in 1990.

The pipeline network is interconnected to two domestic water storage tanks, three fire suppression tanks, three domestic and three fire suppression water booster pumping stations to maintain water pressure at areas with high elevations and farther away from distribution storage tanks. There are 179 hydrants distributed within the system.

The current pressure along the water distribution system ranges between 65 and 110 psi. Pressure to industrial areas is limited to 65 psi and pressure to all housing is controlled at 85 psi.

Storage Tanks

Water distribution storage is provided to ensure reliability of supply, maintain pressure, equalize pumping and treatment rates, reduce the size of transmission mains, and improve operational flexibility and efficiency. In addition to provide domestic water service, especially for smaller systems, storage tanks are a much more economical and operationally reliable means for meeting the short term large demands placed on a water supply system during firefighting.

The storage tanks are working in the "floating-on –the system" mode, this means that the storage volume is located at determined elevations so that the hydraulic grade line outside the tank is virtually the same as the water level in the tank. During low demand, the tanks fill and during peak demands, the tanks help supply the excess demand.

There are five storage tanks distributed on the different sites across the premises, two potable or domestic water tanks, and three fire protection tanks.

Figure 29: Water Distribution Tank 86

Potable Water Tanks

The main water storage, Tank 86 (Tacan) is located in Zone 6 on top of a hill on Gulf Road. This is an aboveground concrete tank with a 1,500,000 gallons capacity. The tank is 128 feet by 94 feet rectangular dimensions and 20 feet high.

A second storage tank, Bundy Tank 535 is located on top of a hill on Esperance Road. This is an underground concrete tank with a 750,000 gallon capacity. The tank is 84 feet by 63 feet rectangular dimensions and 19 feet high. This tank is currently out of use.

Figure 30: Water Distribution Tank 535

Figure 31: Fire Protection Cistern

Fire Protection Tanks

Fire Protection Tank 459 is located on Tarawa Drive next to pump station 460. This is an aboveground steel tank with a 400,000 gallon capacity. The tank is 46 in diameter by 32 feet high.

Fire Protection Tank 771 is located at South Princeton Road, on South Delicias Sector, Between Zones 7 & 8. This is an aboveground concrete tank with a 120,000 gallons capacity. The tank is 45 feet by 32 feet rectangular dimensions and 11 feet high.

Fire Protection Tank 2304 or 421 is located at Punta Puerca Sector, on Zone 3. This is an aboveground concrete tank with a 20,000 gallons capacity. The tank is rectangular and 6 feet high.

Figure 32: Fire Protection Cistern

Booster Pumping System

There are seven booster pump stations that provide sustained pressures as needed for different areas around the Base. There are seventeen pumps distributed inside the seven pump stations. Of the seventeen pumps, five are fire pumps, three are jockey pumps and nine are potable water pumps.

None of the booster stations are currently under operation.

There are three booster pump stations (BPS) serving the areas far from the tanks or in high places (pumps 2380, 1977, 2360). None of the BPS are currently in use because of the low water demand. The BPS need some maintenance and improvements before being put in use again.

Pumping Station 2360 is located on Barnes Street next to the Army /National Guard Reserve Center and to the Drydock, Pumping Station 2380 is located on Bennington Road, southwest of the golf course and Pumping Station 1977 is located close to the Hospital.

Because all the pumping stations have not been in operation, a complete checkup and maintenance service shall be implemented in order to assess the functioning of the systems. Table 2 summarizes the pump stations information (Fire protection pumps were not included).

Table 1: Existing Water Tanks Summary

Tank ID	Name	Capacity	Height		Floor Elevation		Top Elevation		Bottom Elevation	
		MG	m	ft	m	ft	m	ft	m	ft
535	Tacan	1.5	6.1	20	77.0	252.7	83.1	272.7	77.0	252.7
86	Bundy	0.75	5.8	19	88.2	289.3	88.2	289.3	82.4	270.3

Table 2: Existing Pump Station Summary

		Floor Elevation		Flow	Head	Power	
Pump Station ID	Pump Qty.	m	ft	gpm	ft	hp	Areas Currently Served
2380 (2361)	2	6.2	20.4	NA	NA	100	Bundy Tank, used only if an increment in pressure was necessary
1977	1	2.8	9.1	NA	NA		Hospital, Fire Protection System
2360	1	2.4	7.8	1,500	NA	100	Communication Building, Fire Protection and Water Supply

Figure 33: Booster Pump 2360

Figure 34: Booster Pump 1977

Pressure Regulating Valves

There are three pressure-regulating valves located on areas where high pressures from the distribution system can cause damage to pipes, hydrants and equipment inside buildings.

One is located next to the Armed Forces Reserve Center, and is established to reduce the pressure from 100 psi to values between 60 and 80 psi. Another is located on the pier and water front area and is established to reduce the pressure from 100 psi to 80 psi. The last one is located on F.D.R. Drive next to the Base Welcome Center in the Capehart area and is established to reduce the pressure from 100 psi to values between 60 and 80 psi.

From the assessment performed, the overall conditions are the following:

- Lack of interior drain pipe cause flooding conditions inside regulating valve boxes, during rain events
- Damaged access covers creates a safety hazard

Figure 35: Flooded Pressure Regulating Valve Box

Figure 36: Pressure Regulating Valve Box

Wastewater System

The wastewater collection system at Roosevelt Roads is composed of a series of gravity lines, lift stations, force lines and three wastewater treatment plants. About 90% of the occupied and developed portions of the Base are serviced by means of the wastewater collection system. All the systems are independent the Puerto Rico Aqueduct and Sewer Authority (PRASA) services.

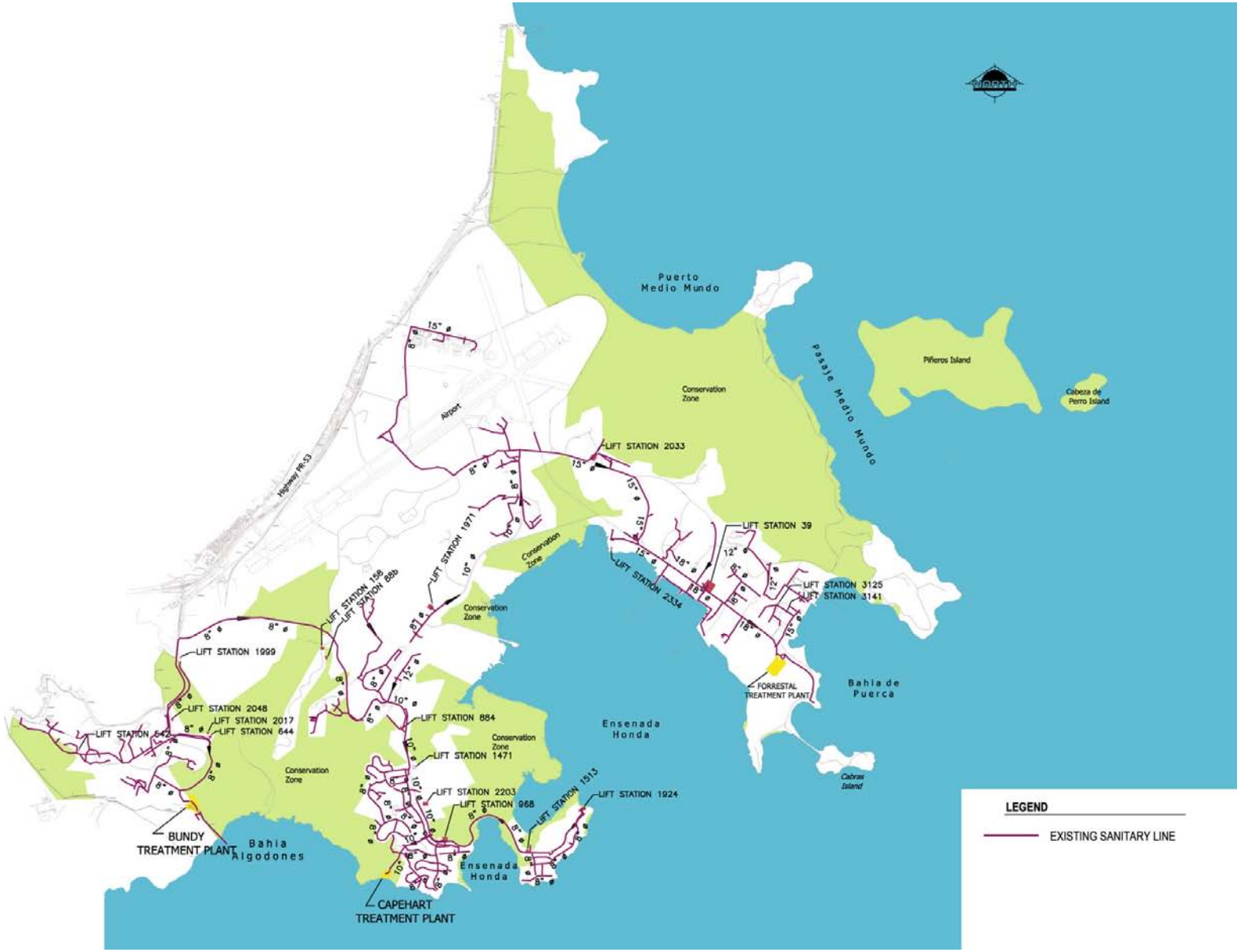


Figure 37: Existing Sanitary Sewer System

Gravity Collection System

The collection system is composed of approximately 32.5 miles (52.3 kilometers) of gravity pipes and 906 manholes.

Gravity lines Pipes range in various sizes up to 24 inches in diameter. The composition of gravity lines piping materials is distributed approximately of 45% PVC, 1% Asbestos, 1% Concrete and a remaining of unknown materials. The collection system piping services virtually all the developed areas inside the Base except Punta Puerca, Punta Medio Mundo and Cabras Island areas. These three areas are served by septic tanks.

The existing pipelines network is mainly located along the existing road corridors. The conditions of the existing piping's cannot be easily addressed, although based on collected data, major repairs and improvements were performed by the U.S. Navy under project "P-495 Upgrade to Sanitary Collections Systems" in 1993.

From the assessed analysis the main findings are:

- Most of the gravity sewer lines are non-compliant with PRASA regulations regarding minimum slopes and maximum distance between manholes.
- Existing manholes do not comply with safety regulations regarding location and cover protection

Figure 38: Existing Sanitary Sewer Manhole

Lift Stations and Force Lines

There are 28 pump stations and 6 grinder stations that discharge through a network of approximately 9.5 miles (15.3 kilometers) of force lines.

Force lines pipes range in various sizes up to 10 inches in diameter. The composition of force lines piping materials is distributed approximately of 81% PVC, 7% Ductile Iron and a remaining of unknown materials.

A vast majority of the force lines are located along the existing road corridors. The conditions of the existing piping's cannot be easily addressed, although based on collected data, major repairs and improvements were performed by the U.S. Navy under project "P-495 Upgrade to Sanitary Collections Systems" in 1993.

The lift stations distribute the discharges into three different wastewater treatment plants (WWTP's) depending on their location: Bundy WWTP, Capehart WWTP, and Forrestal WWTP.

Currently all the lift stations are kept out of operation.

From the assessed analysis the main findings are:

- Leaking or broken pumps
- Electrical panels with interior debris and corrosion
- Telemetry and alarm systems out of service
- Outdated automatic control systems
- Emergency Generators without battery systems
- Dry pit sump pump systems missing
- Vault doors corroded and non-working
- Buffer zone non compliance
- No trolley hoists for pumps servicing or removal
- Non Compliance with parcel dimensions and safety equipment required by PRASA Regulations

Figure 39: Existing Sanitary Sewer Lift Station

Wastewater Treatment Plants

There are three wastewater treatment plants (WWTP) inside the base. The collection system is divided in three separate systems that discharge into their respective WWTP which provide tertiary treatment and discharge into ocean outfalls. The three WWTP's provide a total combined capacity of approximately 3.26 million gallons per day (MGD).

Forrestal WWTP

Forrestal WWTP is located east of the Base, to the southeast of the Forrestal sector, north of the Base Landfill.

Forrestal provides wastewater treatment by means of clarification, biological treatment in trickling filters, nutrients removal, and disinfection after which the wastewater is discharged to the Ensenada Honda Bay it has a capacity of 0.97 MGD.

Currently the WWTP is kept out of operation.

From the assessed analysis the main findings are:

- WWTP is in general fair condition, but need repairs
- Grit chambers out of service
- Level sensors missing
- Sludge valve motors broken
- Sludge removal system broken
- PR Environmental Quality Board Permits are needed for local compliance

Those findings do not affect the continuous operation, but prevents any further increase in the quantity of discharge that can be treated.

Figure 40: Forrestal WWTP

Figure 41: Forrestal WWTP

Capehart WWTP

Capehart WWTP is located southwest of the Base, to the southeast of the Capehart sector.

Capehart provides wastewater treatment by means of clarification, biological treatment in trickling filters, nutrients removal, and disinfection after which the wastewater is discharged to the Vieques Passage it has a capacity of 0.66 MGD. Currently the WWTP is kept out of operation.

From the assessed analysis the main findings are:

- WWTP is in general fair condition, but need repairs
- Grit chambers out of service
- Anaerobic digester needs replacement
- Digester control room needs structural repairs
- Sludge removal system is broken
- Trickling filter has corrosion problems
- Sludge drying beds need repair
- PR Environmental Quality Board Permits are needed for local compliance

Those findings do not affect the continuous operation, but prevents any further increase in the quantity of discharge that can be treated.

Figure 42: Capehart WWTP

Figure 43: Capehart WWTP

Bundy WWTP

Bundy WWTP is located southwest of the Base, to the southeast of the Bundy sector.

Bundy provides wastewater treatment by means of clarification, biological treatment in trickling filters, nutrients removal, and disinfection after which the wastewater is discharged to the Vieques Passage it has a capacity of 0.66 MGD.

Currently the WWTP is kept out of operation.

From the assessed analysis the main findings are:

- WWTP is in general fair condition, but need repairs
- Grit chambers vacuum pump broken
- Clarifiers sludge removal system broken
- Anaerobic digester needs replacement
- Sludge removal system is broken
- Trickling filter has corrosion problems
- Sludge drying beds need repair
- PR Environmental Quality Board Permits are needed for local compliance

Those findings do not affect the continuous operation, but prevents any further increase in the quantity of discharge that can be treated.

Figure 44: Bundy WWTP

Figure 45: Bundy WWTP

Stormwater Collection System

The stormwater collection and disposal at Roosevelt Roads is mainly composed of a series of surface systems that transport runoff through pipe culverts, box culverts, earth ditches and channels. Those systems finally discharge into regulated and non-regulated outfalls at fresh water bodies such as wetlands and creeks and to salt water bodies such as mangroves and the ocean.

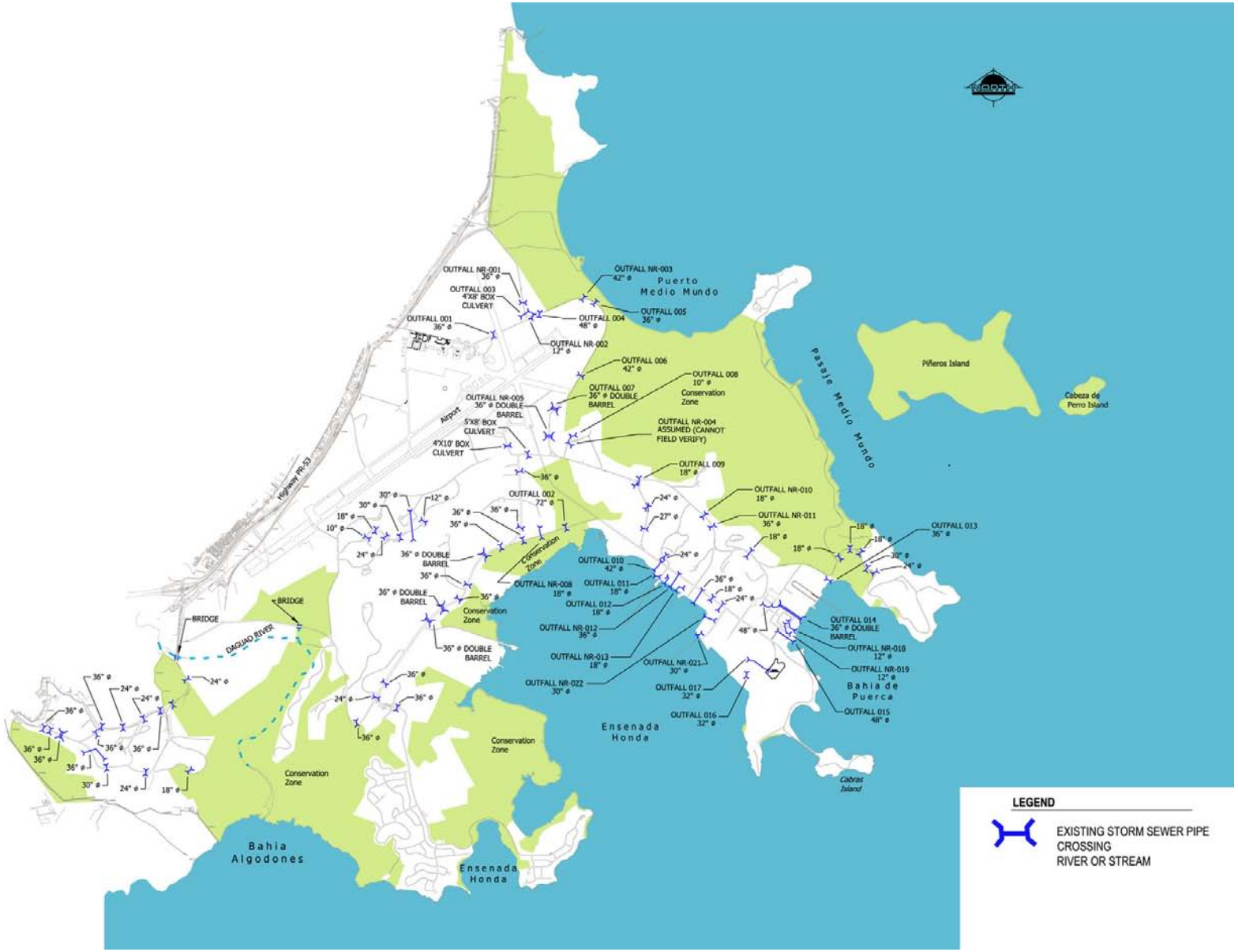


Figure 46: Exisitng Stormwater Sewer System Layout

Culvert and Ditches Systems

The runoff collection system is composed of approximately 48 miles (77 kilometers) of gravity pipes, culverts, earth ditches and channels all around the Base. The main purpose of the system is to convey the natural passage of runoff water from higher lands and through existing roads and facilities up to their discharge point. Pipes ranges in size up to 72" and consist of either concrete or corrugated metal pipes.

There are some minor storm sewer systems composed of catch basins, manholes and piping on some portions of the residential areas, but practically all the stormwater is surface runoff through gutters earth swales.

There are 17 EPA regulated outfalls and 27 non-regulated outfalls. The regulated outfalls are located on areas were former industrial works were performed.

From the assessed analysis the main findings are:

- Corrugated metal pipes show corrosion
- Earth channels and ditches need cleaning due to sediment accumulation
- Grass and vegetation obstruction on culverts inlet and outlet headwalls
- Inadequate amount of storm sewer systems (inlets, catch basins)
- No stormwater quantity mitigation systems on developed areas
- No stormwater quality mitigation system on developed areas
- Based on the analysis prepared, most of the systems have the adequate capacity to handle the flows of the 25 yrs -1 hr storm event

Figure 47: Corrugated Metal Pipe Culvert

Figure 48: Concrete Box Culvert

Flood zones

Due to the location on a coastal zone, mangroves areas and natural drainage zones on lowlands, the Base is subject to the 100 yrs frequency flooding mostly caused by tidal wave action. According to Federal Emergency Management Agency (FEMA) on maps panel 72000C0820J, 72000C0840J, 72000C1285J and 72000C1305J, with effective date November 18, 2009. The following flood areas are located on the premises:

- Zones VE (Tidal Zone)
- Zones AE
- Zone X

As can be seen on the FEMA Flood Maps, the flood zones affect the majority of the coastal areas, pier area and mangrove areas. Also portions of main corridors such as Langley and Forrestal are affected

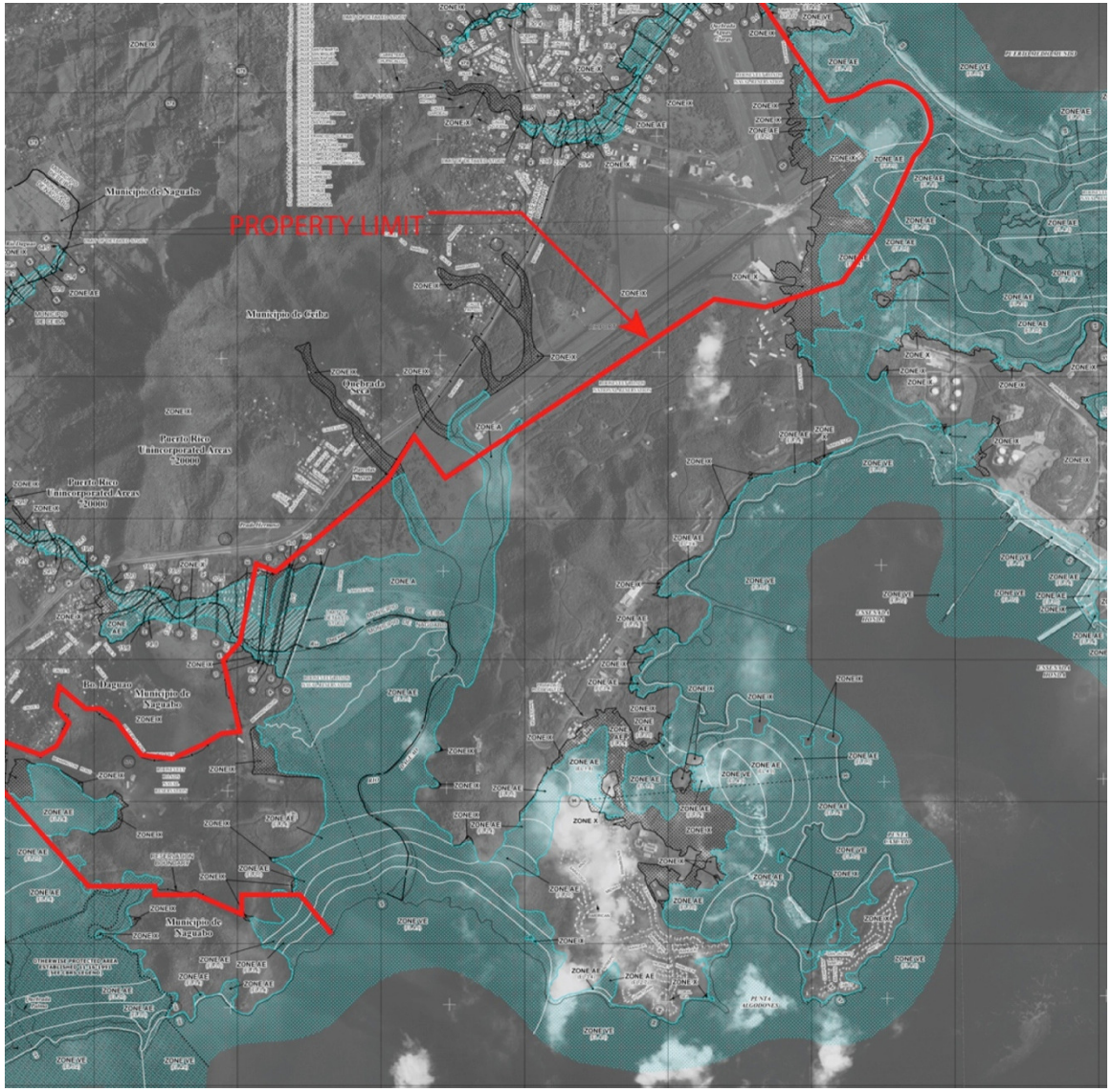


Figure 49: FEMA 100 yr Flood Zones (West RR)

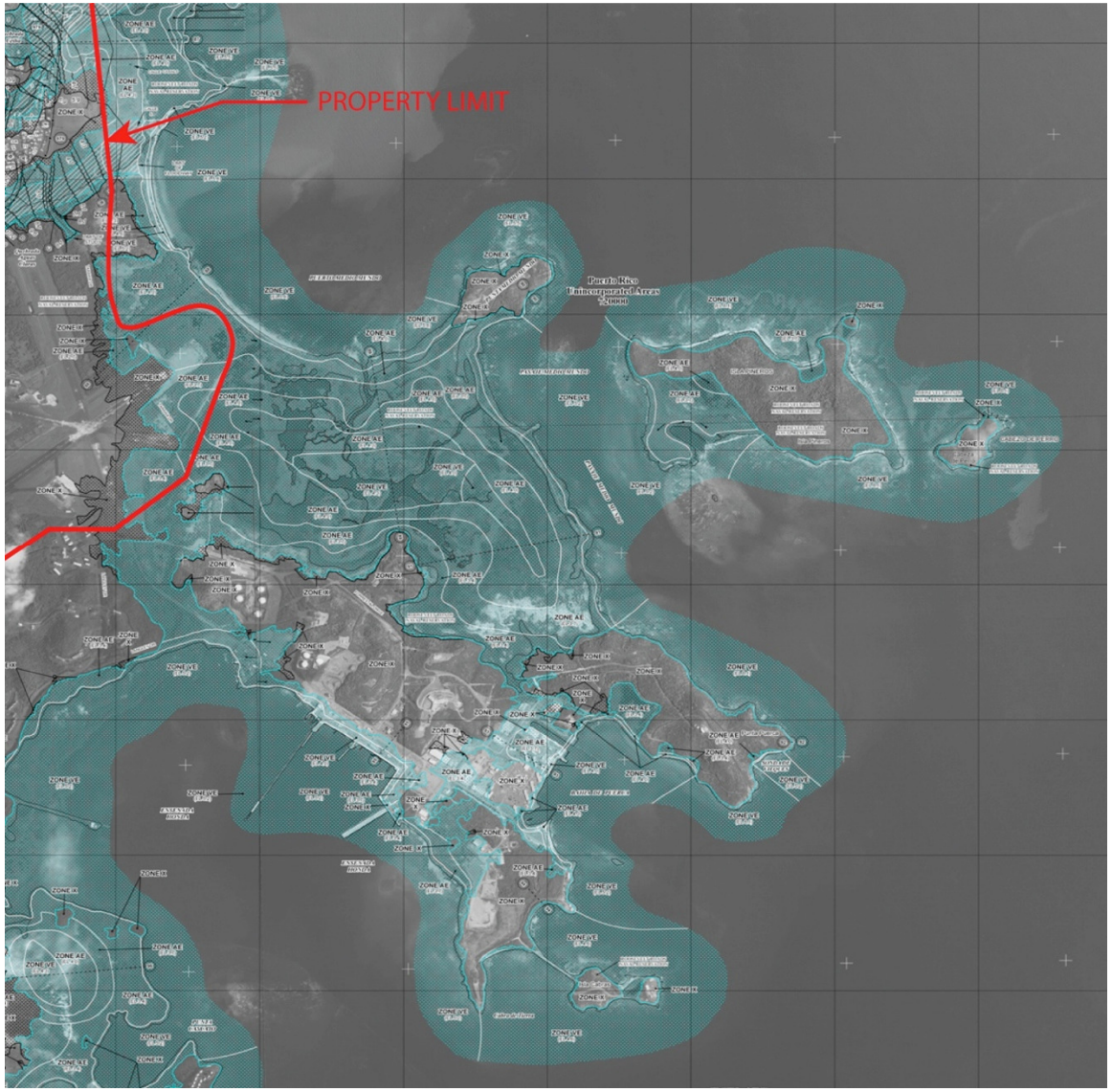


Figure 50: FEMA 100 yr Flood Map (East RR)

The development of all the utilities located on those zones shall consider the design according to regulations on flood zones, that includes the application of hydrodynamic loads and the provision for the water proofing and water tightness on all underground utilizes to be installed

2.3.3 Electrical and Telecommunications Utilities

The Roosevelt Roads electrical facilities are connected to the Puerto Rico Electric Power Authority (PREPA) through a 115 KV Electrical Main Substation located in Daguao Sector, in Ceiba. It is transformed from 115 KV to 38 KV for two main 38 KV circuits that enter the Base. These two sub-transmission lines 38,000 volts for industrial type private substations feed other substations for distribution electrical lines and feeders of 13.2 KV and 4.16 KV used mainly for Commercial and Residential loads.

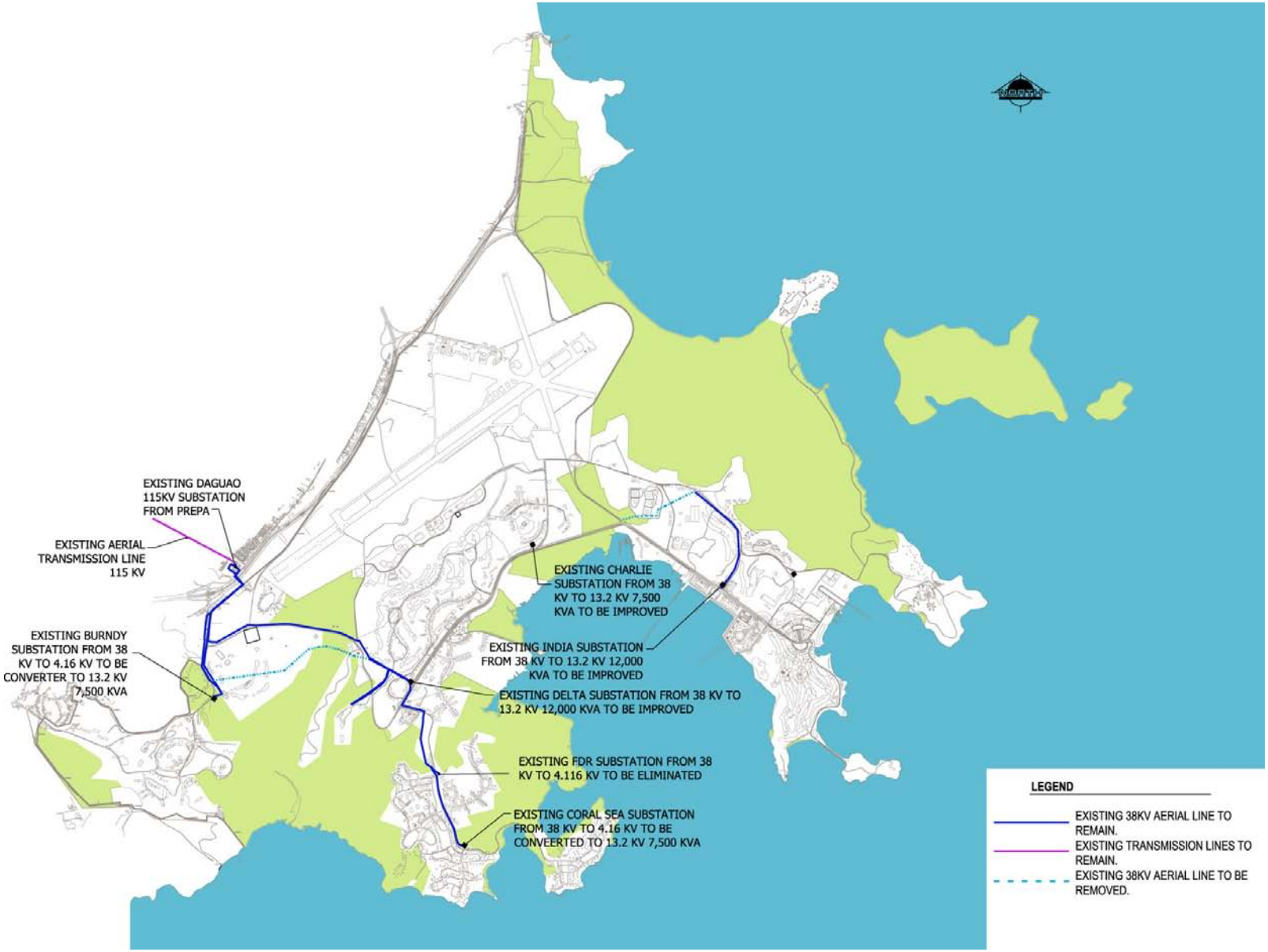


Figure 51: Existing 38KV Electrical Distribution Lines

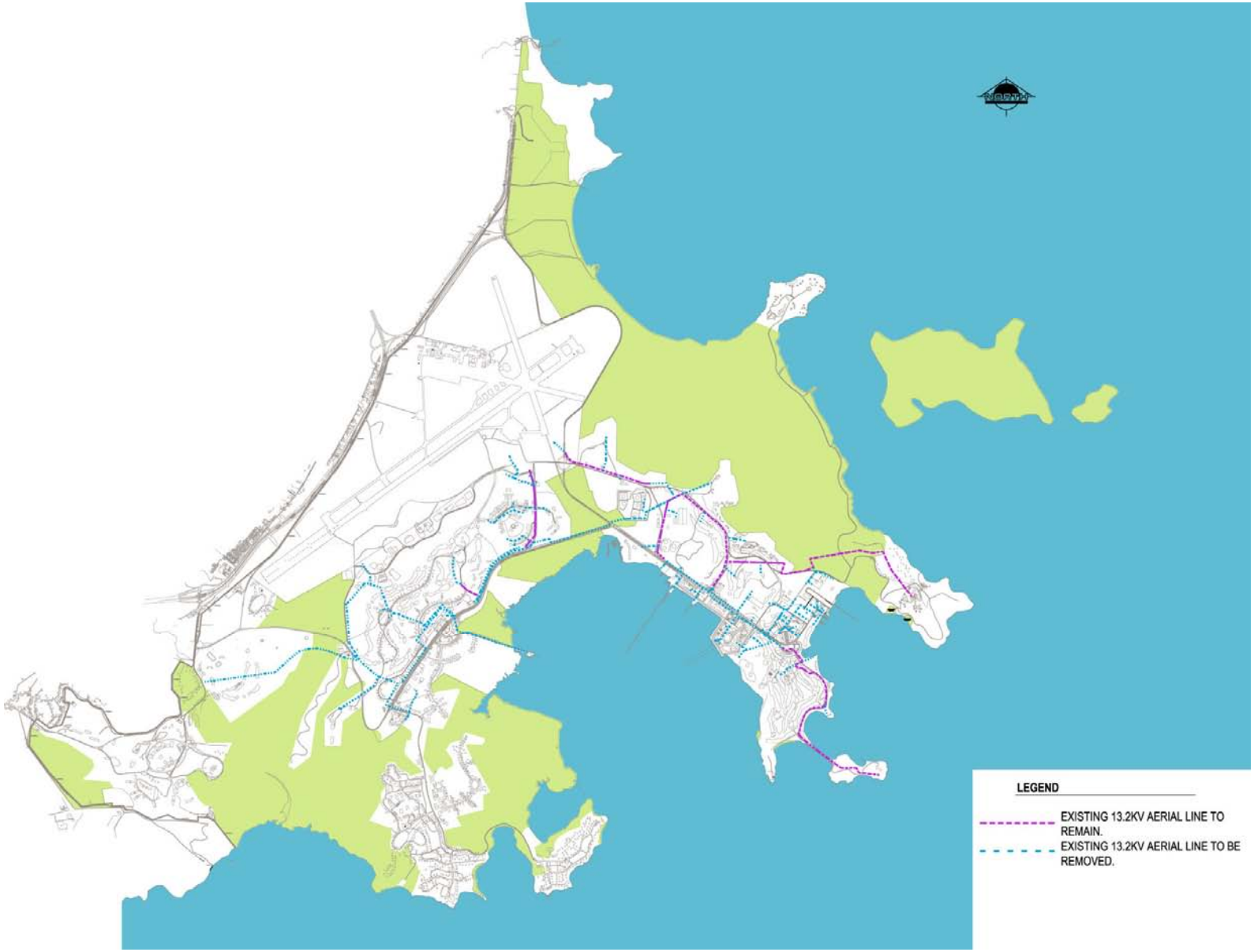


Figure 52: Existing 13.2KV Electrical Distribution Lines

Figure 53: PREPA Daguao Main Electrical Substation

For the availability of 13.2 KV and 4.16 KV distribution voltages, the facilities have 7 main substations:

Table 3: Main Electrical Substations

Substation	Capacity (KVA)	Primary (KV)	Secondary (KV)
Alpha	3000	38	13.2
Delta	5000	38	13.2
Charlie	6500	38	13.2
India	5000	38	13.2
Bundy	3000	38	4.16
FDR	5000	38	4.16
Coral Sea	5000	38	4.16

Substation Alpha

This is the substation that services the Airport. It has two 1,500 KVA transformer from 38 KV to 13.2 KV. The owner of the Substation is the Puerto Rico Ports Authority and will not be incorporated into the Roosevelt Roads Redevelopment Plan.

Substation Delta

Figure 54: Substation Delta

This substation is located between Nimitz Road and Langley Road. This substation has a 5,000 KVA transformer from 38 KV to 13.2 KV. It serves mainly the 13.2 distribution aerial lines of the area for then, with transformer, converting to 120/240 volts, 120/208 volts and 277/480 volts services.

Figure 55: Switchgear at Substation Delta (13.2KV)

Substation Charlie

Figure 56: Substation Charlie

This substation is located in Langley Road. This substation has two main transformers: 5,000 KVA and 1,500 KVA from 38 KV to 13.2 KV. It provides the 13.2 distribution aerial lines for the area and also provides, through distribution transformers the 120/240 volts, 120/208 volts and 277/480 volts services.

Figure 57: Switchgear at Substation Charlie (13.2KV)

Substation India

Figure 58: Substation India

This substation is located between Valley Forge Road and Forrestal Drive. This substation has a main transformer of 5,000 KVA from 38 KV to 13.2 KV. It provides the 13.2 distribution aerial lines for the area and also provides, through distribution transformers the 120/240 volts, 120/208 volts and 277/480 volts services.

Figure 59: Switchgear at Substation India (13.2KV)

Pier Substations

Figure 60: Substation at Card Street

There are two additional main substations at the Piers that serve mainly the Pier Area at 480 volts, transforming from 38 KV. The substation located at the Card Street is 2,000 KVA and the substation located at Breton Street with two transformer of 2,500 KVA each.

Figure 61: Substation at Breton Street

Substation Bundy

Figure 62: Substation Bundy

This substation is located at the Bennington Road. This substation has two transformer of 1,500 KVA each transforming from 38 KV to 4.16 KV. It provides 4.16 KV distribution aerial lines for the area for the 120/240 volts, 120/208 volts and 277/480 volts services.

Figure 63: Substation Bundy

Substation FDR

Figure 64: Substation FDR

This substation is located at the corner of FDR Drive and Saratoga Road. This substation has a transformer of 5,000 KVA transforming from 38 KV to 4.16 KV. It provides 4.16 KV distribution aerial lines for the area for the 120/240 volts, 120/208 volts and 277/480 volts services.

Figure 65: Switchgear at FDR Substation (4.16KV)

Substation Coral Sea

Figure 66: Substation Coral Sea

Figure 67: Switchgear at Substation Coral Sea (4.16KV)

This substation is located at the corner of FDR Drive and Coral Sea Road. This substation has a transformer of 5,000 KVA transforming from 38 KV to 4.16 KV. It provides 4.16 KV distribution aerial lines for the area for the 120/240 volts, 120/208 volts and 277/480 volts services.

Figure 68: Existing Poles

Figure 69: Existing Poles

PREPA Evaluation Report

The Puerto Rico Electric Power Authority (PREPA) did an evaluation report of the Roosevelt Roads Facilities in September 10, 2010, and may take over of the electrical systems under the following requirements:

- PREPA has a public policy for electrical distribution loads conversion from 4.16 KV to 13.2 KV in order to eliminate the voltage of 4.16 KV from Puerto Rico's electrical system.
- Substation FDR and Coral Sea are limited in capacity and recommend that the substation must be removed or converted to 13.2 KV..
- If Substation Bundy serves exclusively the federal agencies facilities, this substation can be maintained as a private substation. If not, then shall be removed or converted to 13.2 KV.

- Any new development must be connected to the 13.2 KV distribution systems. PREPA may accept the 13.2 KV substations Delta, Charlie and India, the 13.2 KV distribution lines and 38 KV sub-transmissions lines, and their corresponding right of ways.
- Existing substations 13.2 KV must have a minimum area of 2,000 square meters, so PREPA can comply with the spacing required for the proper maintenance, repair works, safety clearance and will also permit to increase the capacity of the 13.2 KV substation for serving the new projects that will be develop in the future.
- Sub-transmission lines 38 KV and distribution lines 13.2 KV are limited in capacity (gauges of the lines) and must be increased to 556.5 kcmil ACSR and pole replacement to concrete poles.
- All equipment, electrical installations and land shall have a negative pollutants certification.
- Estimated cost for all improvements describe before is $9.2 million dollars

Figure 70: Existing IP Distribution

Telecommunication Utilities

The Roosevelt Roads telecommunication system consist of a limited (or none) infrastructure complying with current requirements of the "Junta Reglamentadora de Telecomunicaciones de Puerto Rico" (JRTPR). There are areas with fiber optics cabling, cable tv and old telephone infrastructure. Existing infrastructure is not capable of handling new telecommunication requirements. Existing underground conduits are not usable for future developments.

Figure 71: Existing Telecommunications Pull Box

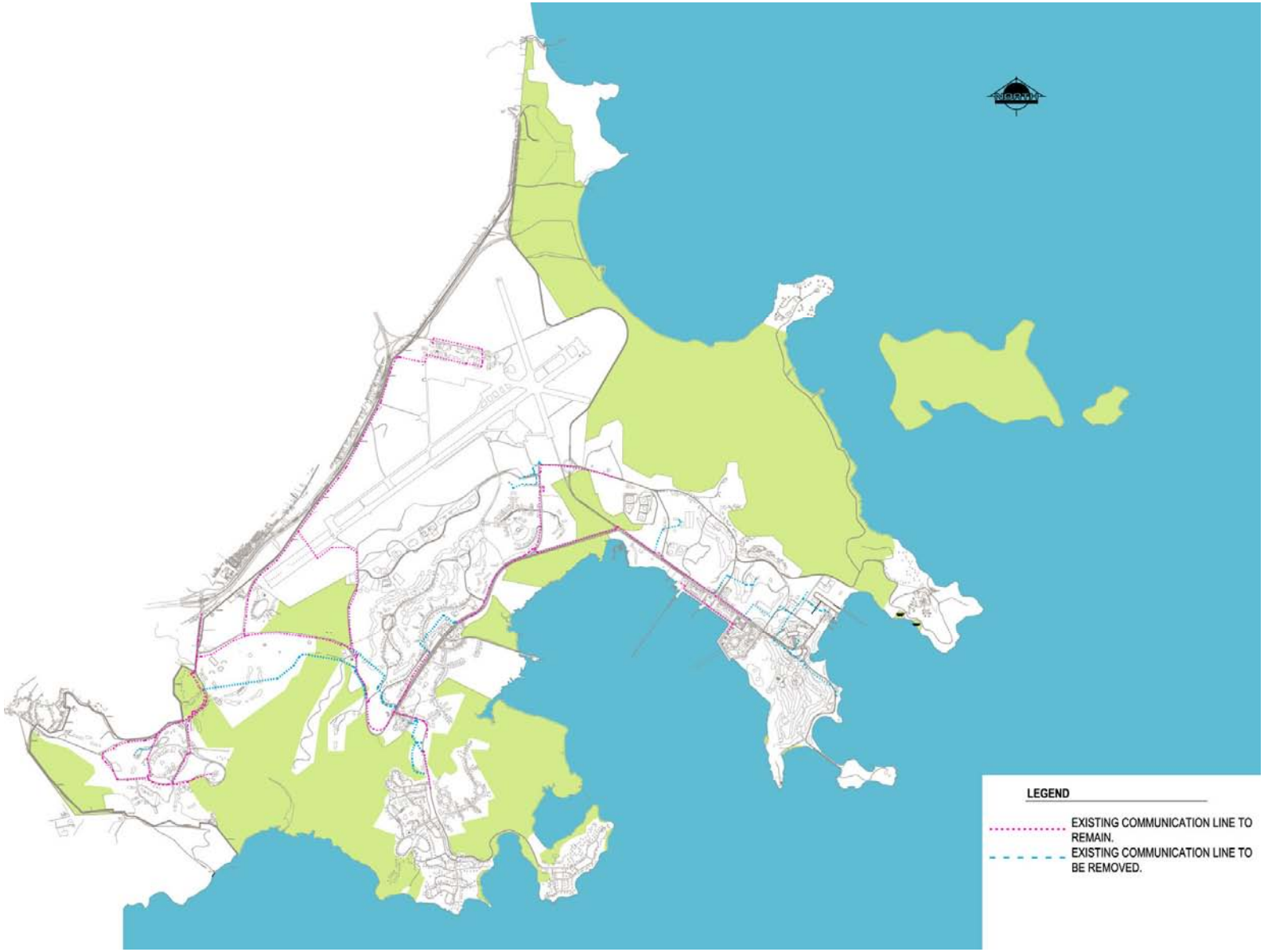


Figure 72 Existing Telecommunications System Layout

3 Proposed Infrastructure Works

ROOSEVELT ROADS REDEVELOPMENT
INFRASTRUCTURE MASTER PLAN

After a full assessment and analysis of the available data on the existing infrastructure, the findings are correlated to the Land Use Master Plan.

The Land Use Master Plan was defined according to the proposed development defined on the 2010 Addendum to the 2004 Re-use Plan. The Land Use Master Plan was approved by the Puerto Rico Planning Board on October, 2011. The 2010 Addendum to the 2004 Re-use Plan addresses a series of “zones” which together make up the “fabric” of the redevelopment:

3.1 Zones Subdivisions

For purposes of the Master Plan, the Former Naval Station Roosevelt Roads (FNSRR) has been divided into 11 zones, plus the airport land, federal properties and the Area Natural Protegida Medio Mundo y Daguao (ANPMMD). Figure 73 illustrates zone location within the FNSRR followed by a brief description of each zone.

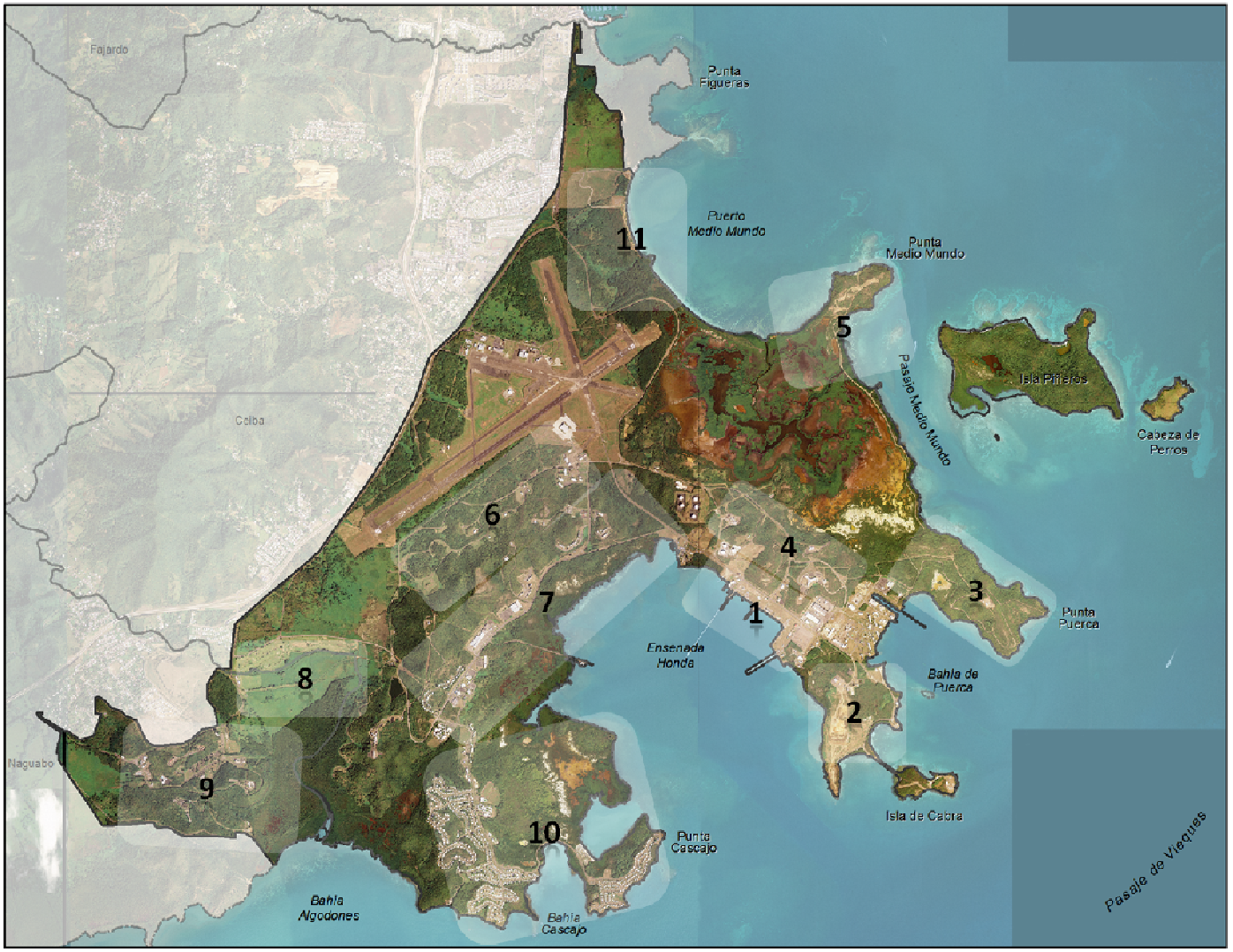


Figure 73: Redevelopment Plan Zones

3.1.1 Zone 1: Port Caribe

"The Commercial Heart"

Port Caribe's waterfront location and good port infrastructure make this zone ideal for dense, mixed uses related to tourism. It is intended to be the commercial heart of the overall redevelopment by providing a signature Caribbean style harbor front development with the following uses:

- Waterfront promenade with entertainment
- Retail
- Restaurants
- Recreational marina
- International cruise ship terminal
- Ferry terminal to Vieques and Culebra
- Tourist services and other related uses

In addition to the waterfront district Port Caribe also has a light industrial component. The "Tank Farm" area is located north of the waterfront. The proposed uses for this area are:

- Fuel storage tanks
- Recycling facility
- Treatment plant
- Electrical infrastructure

Existing Conditions

This area is mostly urban, with marine components. It is located in the waterfront of Bahia Ensenada Honda. This is a port area which houses two marinas, one for small boats and one with a deeper draft for larger boats. The area also includes the hospital facilities and the fuel tanks ("tank farm").

3.1.2 Zone 2: Caribbean Riviera

"The Destination Anchor"

Located between Ensenada Honda and Bahia de Puerca, the Caribbean Riviera is the ideal location for the anchor hotel development. Access is via an esplanade boulevard through Port Caribe. The Main uses of this zone are:

- Hotel with casino
- Golf course
- Civic gardens
- Other tourist-oriented entertainment amenities

Existing Conditions

Located between the bays of Puerca and Ensenada Honda and includes the Isla de Cabras. These are lands mostly urban with areas of forest and bushes.

Between here and Zone 3 is Camp Moscrip that includes residential barracks and other urban infrastructure. Within this zone is located the old dump.

3.1.3 Zone 3: El Yunque Grande

"The Premiere Eco-Tourism Resort"

El Yunque Grande includes Punta Puerca and the dry-dock facility Punta Puerca is where the ecological tourism component of the Reuse plan is located. The dry-dock facility is a smaller scale harbour than the larger port in Zone 1 Port Caribe. The main uses for this zone are:

- Low density eco-lodge
- Sustainable residential resort villas
- El Yunque National Forest and Conservation Trust Visitor Center
- Waterfront promenade with entertainment
- Retail, restaurants, recreational
- Marina and cruise ship terminal
- Fishing village
- Sailing retail amenities
- Other related tourist services

Existing Conditions

Zone 3 includes the area of Punta Puerca, which is undeveloped land of dry forest and bushes. To the south, this area has a small pier in Puerca Bay among other urban infrastructure. The urban area is known as Moscrip and was transferred to the Army.

3.1.4 Zone 4: Marsh Vista

"The Golf/Country Club Amenity"

Marsh Vista is located on highlands, adjacent to the Conservation Trust lands of Area Natural Protegida Medio Mundo y Daguao (ANPMMD). This zone is intended to be a transitional/buffer area between Conservation Trust land and the new development proposed for zones Port Caribe and El Yunque Grande. The main uses for this zone are:

- Ecological golf course and clubhouse
- Low density sustainable residential
- Mixed commercial, entertainment, retail, restaurants
- Other tourist support uses

Existing Conditions

Marsh Vista covers the areas of dry forest and bushes which are between the waterfront of Ensenada Honda and the mangrove Los Machos. It is bordered on the east by lands of the ANPMMD.

3.1.5 Zone 5: Eco-Outpost Base Camp

"The Environmentalist Retreat"

Located in Punta Medio Mundo and surrounded by Conservation Trust lands, water and the island of Pineros, Eco-Outpost Base Camp can be accessed only through Area Natural Protegida Medio Mundo y Daguao (ANPMMD) lands. To maintain a low impact in these areas, uses in this zone will relate to low-density conservation and ecologic research. These include:

- Small sustainable lodge
- Office and research space that may host sustainability studies on ANPMMD lands.

Existing Conditions

This area is dominated by the mangrove wetlands of Los Machos, which belongs to ANPMMD, managed by the Conservation Trusteeship of Puerto Rico (FCPR).

To the Northwest, includes the non-flooded land of Punta de Medio Mundo, which are outside the protected area and houses a shooting range.

3.1.6 Zone 6: Uplands

"The Collateral Development"

The Uplands is located on Las Delicias hills, alongside the airport runway and although set back from the waterfront, this location offers a wide range of collateral development potentials given its higher elevation, proximity to the airport and adjacency to other key development zones. Low and medium density developments are proposed. The main uses include:

- Airside business/industrial
- Office, warehousing and other uses related to an airside industrial park
- Potable water filtration plant
- Golf course, clubhouse, hotel/ lodging, spa
- Detached, environmentally friendly residential
- Light commercial
- Retail, office and other institutional uses

Existing Conditions

Located on the hills of Las Delicias and to the southeast of the airport runway. These lands are largely rural, with a vegetation of forest and bushes and an urban development limited to an interior road and few structures.

3.1.7 Zone 7: Main Street

"The Town Center"

Zone 7 is located in an area apt for dense redevelopment and urban infill because of its readily available infrastructure and central location. The existing structures in this area represent inherent reuse and adaptive reuse value. The existing with strategic infill of new buildings include:

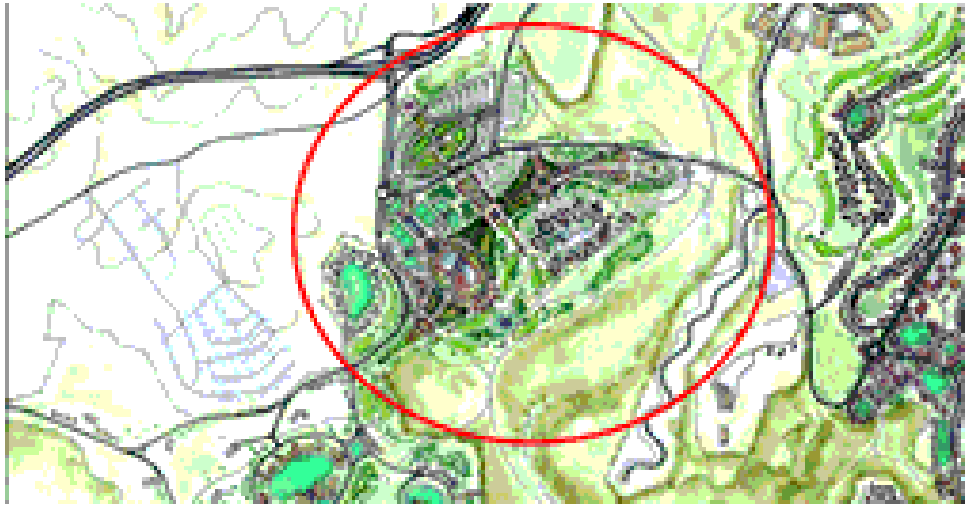
- Navy Lodge hotel
- Schools and Community College
- Bowling alley
- Commercial structures
- Retail and related support facilities
- Residential village with full range of community housing types

Existing Conditions

This zone includes the area known as Downtown, which has structures used for commercial and tourism purposes, such as the Navy Lodge, schools, a dental clinic and the bowling alley. It has direct access to the Bahia Ensenada Honda and covers areas of mangroves and beaches that are part of Area Natural Protegida Medio Mundo y Daguao (ANPMMD).

3.1.8 Zone 8: Sports Core

"The Community's Recreational Hub"



Located alongside Gate 3 and with direct access from the PR-53 highway in Naguabo, this zone is intended to be a landscaped gateway to the new community, free of commercial development. The main uses in this zone include:

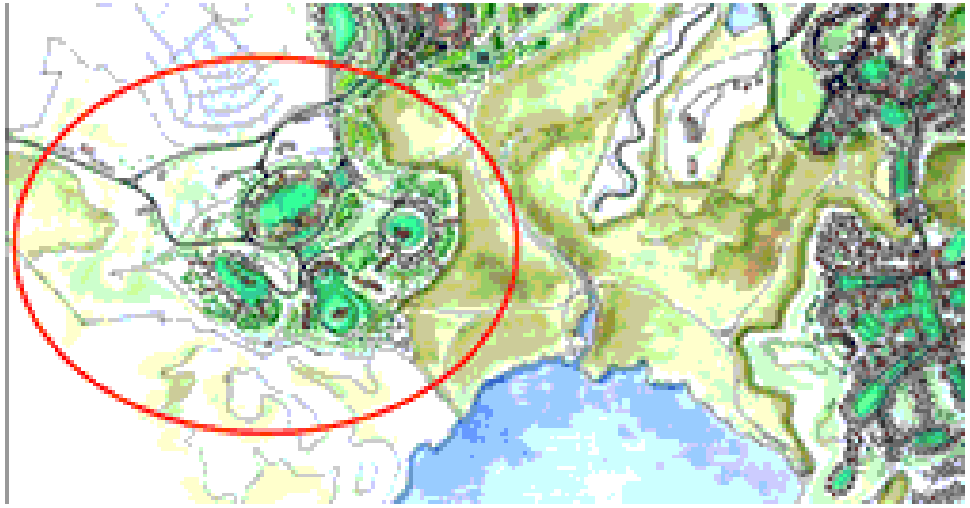
- Active outdoor sports venues such as soccer pitches, equestrian trails and other community exercise facilities
- Passive parks, recreational areas and facilities
- Limited residential and lodging

Existing Conditions

This area houses the oldest golf course of the Navy, to the west boundary of the FNSRR. The lack of maintenance of this facility has led to the saturation of the ground and the growth of emergent wetland. Also in this area is located another entrance to the FNSRR in the municipality of Naguabo through the PR-53 road (Exit 10 Aguas Claras).

3.1.9 Zone 9: Island Paradise

"The Retreat, Conference, Learning Center"



This zone is characterized by is relatively isolated location relative to the rest of Former Naval Station Roosevelt Roads (FNSRR). The remote character is suitable for the proposed corporate training and conference development. Main uses include:

- Corporate conference/training center
- Corporate and/or institutional headquarters
- Research installation
- Tourism/hospitality school and training center
- Hotels to serve conference and training center
- Tourist-oriented commercial
- Detached, environmentally friendly residential
- Sanitary treatment plant

Existing Conditions

This is the area known as Bundy, a rural area that has structures that were used as residences and offices. To the southwest, adjacent to the mangroves of the Rio Daguao, which belong to Area Natural Protegida Medio Mundo y Daguao (ANPMMD). This area is the oldest part of the FNSRR.

3.1.10 Zone 10: Capehart

"The Residential, Corporate, Institutional Community"

Even though Capehart has shown a residential character since the FNSRR beginnings the likely best reuse potential may be a combined residential, corporate and institutional community as a fitting completion to the overall redevelopment of the FNSRR. These uses include:

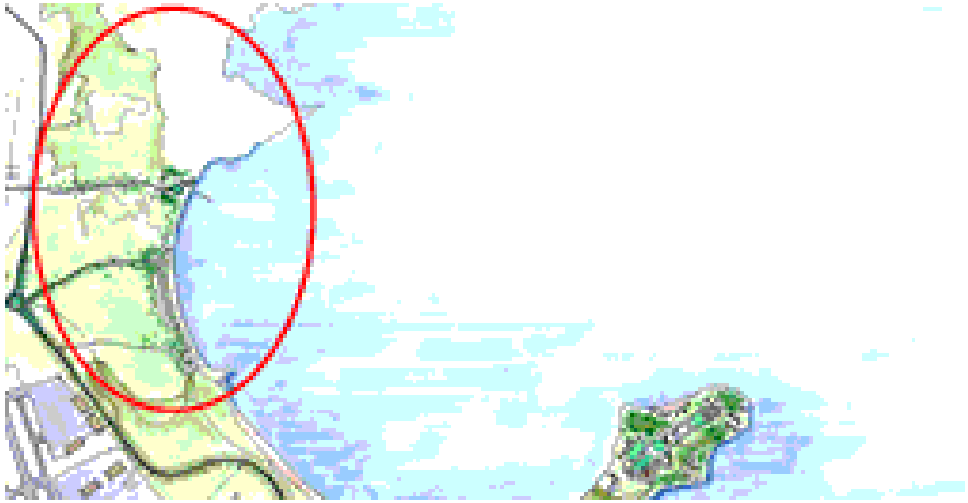
- First homes and vacation villas and condos, small inns
- Single family and multifamily residential
- Basic commercial uses serving the immediate neighborhood
- Hotel, corporate offices, institutional, retail, residential and restaurants
- Public beach
- Sanitary treatment plant

Existing Conditions

This zone covers the areas of Capehart and the peninsula of Punta Cascajo. The uses in this zone are mostly residential and of conservation, being surrounded by the mangrove of the Rio Daguao and Ensenada Honda, beaches, reefs and sea grass. The wetlands in this area and its coast belong to the Area Natural Protegida Medio Mundo y Daguao (ANPMMD). The FNSRR high school is included among the urban uses.

3.1.11 Zone 11: Ceiba Park

"Gateway to Redevelopment Amenities"



Ceiba Park is located next to Gate 1, close to the airport and urban Ceiba. This location includes a plot in the North of the Beach Los Machos. It is envisioned to be a key community portal with institutional, public service and entertainment uses, which include:

- Beaches
- Fishing piers
- Water sports venues
- Restaurants
- Waterside dining and similar amenities
- Related commercial opportunities

Existing Conditions

The FNSRR high school main entrance to the road through the PR-979 is located here. The area includes land in the coastal area of Medio Mundo. A portion of this coast is the beach Los Machos, which was transferred to the municipality of Ceiba. This zone also locates a radar antenna, close to the road Tarawa Drive.

3.2 Proposed Infrastructure

The re-use of the existing infrastructure to the extent possible is the main goal of the LRA and its Land Use Plan for Roosevelt Roads. Based on this goal an analysis was performed and consideration was given to the existing systems, before and during development of the Land Use Plan.

The existing infrastructure on the Base, with the exception of stormwater collection system which is quite simple, is fairly extensive and was developed and maintained by the Navy for their installations. Since the Navy installations were spread throughout the base, the basic roadways and utility systems already extend into the vicinity of each zone considered for reuse. Based on interviews with Navy personnel on site, review of technical data prepared by the Navy, age of systems, maintenance records, and cursory visual inspection, some of the existing system components are in fair working order, but major improvements and new systems are needed in order to satisfy current codes, regulatory requirements and increase in load demands.

The different Infrastructure components: Transportation, Water, Wastewater, Stormwater, Electric, Telecommunications Systems, are analyzed and the improvements and recommendations for the proposed redevelopment are presented here.

3.2.1 Transportation

Road Network

As stated in *Chapter 2- Existing Infrastructure Assessment*, the existing road network provides access to most facilities or sectors inside the Base. In addition, the majority of the proposed new developments described on the 2010 Addendum to the 2004 Reuse Plan are being contemplated along existing road corridors. Hence the stance of the Infrastructure Master Plan is to minimize new road developments and maximize the re-use potential of the existing corridors that comprise the road network in the premises and utilize the existing road corridors for the location of the new or upgraded utilities to allow for a rapid development in the short term.

The proposed road system within the developments is an important part of the vision for the community and is intended to provide connectivity and allow for other modes of transportation to create an attractive space and character of place. It is planned in conjunction with the circulation character outlined within the Reuse Plan. The goal is to create a road network that provides focus on the street as it relates to its surrounding form as prescribed on the Reuse Plan. This focus promotes street vitality and improves the quality of the pedestrian experience.

The generated trips or the average daily (24 Hour Two-Way) traffic volumes for each Master Plan zone were calculated, based on the recommended Trip Generation Rates published by the Institute of Transportation Engineers, Trip Generation Manual, 8th Edition, and by the City of San Diego, California, Trip Generation Manual (2003). The volumes for each zone are shown on Table 4: Trip Generation by ZoneTable 4 and Table 5.

Table 4: Trip Generation by Zone

Zone	Location	Projected Use	Development Area (Gross Square Feet)	Dev. Area (acres)	Hospital Beds	Hotel Rooms	Dwelling Units	Passengers/ Students	Boat Slips	Golf Course Holes	Passengers / Visitors	Trip Generation Rate	Trip Generation per day
1	Port Caribe	**Commercial Heart**											
		Retail/ Restaurants/ Entertainment District	200,000									40 trip/1,000 sq. ft.	8,000
		Hospital	130,000		300							20 trip/bed	6,000
		Office	50,000	1.15								450 trip/acre	517
		Marina	25,000	0.57					400			2.95 trip/slip	1,180
		International Cruise Terminal	150,000					1500				0.60 trip/passenger	900
		Industrial/ Back of House	50,000									16 trip/1,000sq. Ft.	800
		National Guard Boat Ramp	9,500									5 trip/1,000sq. Ft.	48
		Homeland Security Boat Ramp	2,500									5 trip/1,000sq. Ft.	13
		Ferry Terminal	50,000									25 trip/1,000sq. Ft.	1,250
		Zone Total	**667,000**									**Zone Total =**	**18,707**
2	Caribbean Riviera	**Destination Anchor**											
		Casino	210,000	4.82								80 trip/acre	2,169
		Casino Hotel	2,000,000			2,000						8 trip/room	16,000
		Retail/ Restaurants/ Entertainment	200,000									40 trip/1,000 sq. ft.	8,000
		Cabras Island (Coast Guard)	2,000									5 trip/1,000sq. Ft.	10
		Wastewater Treatment Plant	1,000									5 trip/1,000sq. Ft.	5
		Zone Total	**2,413,000**									**Zone Total =**	**26,184**
3	El Yunque Grande	**Premier Eco-Tourism Resort**											
		Hotels- "Lodge"	120,000			150						8 trip/room	1,200
		Eco Museum/Visitor's Center	50,000	1.15								80 trip/acre	92
		Office	30,000	0.69								450 trip/acre	310
		Retail/ Restaurants/ Entertainment "Village"	100,000									40 trip/1,000 sq. ft.	4,000
		Residential Villas	450,000				200					9 trip/dwelling unit	1,800
		Marina	25,000	0.57					200			2.95 trip/slip	590
		US Army Reserve/ National Guard	46,500									10 trip/1,000sq. Ft.	465
		Armed Forces Reserve Center	72,000									10 trip/1,000sq. Ft.	720
		Water Taxi Terminal/ Pier	20,000									25 trip/1,000sq. Ft.	500
		Zone Total	**913,500**									**Zone Total =**	**9,677**
4	Marsh Vista	**Golf/Country Club Amenity**											
		18 Hole Golf Course - Clubhouse and Dining	35,000							18		40 trip/hole	720
		Residential	250,000				125					9 trip/dwelling unit	1,125
		Zone Total	**285,000**									**Zone Total =**	**1,845**
5	Eco-Outpost Camp	**Environmental Retreat**											
		Dining/ Conference	25,000									10 trip/1,000 sq. ft.	250
		Lodging	100,000			100						8 trip/room	800
		Office/ Research	25,000	0.57								450 trip/acre	258
		Zone Total	**150,000**									**Zone Total =**	**1,308**

Table 5: Trip Generation by Zone (cont.)

Zone	Location	Projected Use	Development Area (Gross Square Feet)	Dev. Area (acres)	Hospital Beds	Hotel Rooms	Dwelling Units	Passengers/ Students	Boat Slips	Golf Course Holes	Passengers / Visitors	Trip Generation Rate	Trip Generation per day
6	Airport Uplands	**Collateral Development**											
		Airport, Govermment, Military	250,000									8 trip/1,000 sq. ft.	2,000
		Industrial/ Warehouse	250,000									8 trip/1,000 sq. ft.	2,000
		Specialty Industrial	200,000									16 trip/1,000 sq. ft.	3,200
		Office	75,000	1.72								450 trip/acre	775
		Residential	250,000				100					9 trip/dwelling unit	9,000
		18-hole Golf Course - Clubhouse	35,000							18		40 trip/hole	720
		Radar Station	1,025									5 trip/1,000sq. Ft.	5
		PotableWater Treatment Plant	3,800									5 trip/1,000sq. Ft.	19
		Zone Total	**1,064,825**									**Zone Total =**	**17,719**
7	Main Street	**Town Center**											
		Educational Facilities/ Schools	80,000					530				2.9 trip/student	1,537
		Office	100,000	2.30								450 trip/acre	1,033
		Retail, Restaurant, Entertainment	400,000									40 trip/1,000 sq. ft.	16,000
		Residential	1,450,000				650					9 trip/dwelling unit	5,850
		Industrial/ Back of House / Support Services	200,000									16 trip/1,000sq. Ft.	3,200
		Hotel	320,000			400						8 trip/room	3,200
		Community College	200,000	4.59				1300				1.6 trip/student	2,080
		Coast Guard Pier	8,910									10 trip/1,000sq. Ft.	89
		Zone Total	**2,758,910**									**Zone Total =**	**32,989**
8	Sports Core	**Community Sports**											
		9 Hole Golf Course - Clubhouse	15,000							9		40 trip/hole	360
		Retail, Restaurant, Entertainment	30,000									40 trip/1,000 sq. ft.	1,200
		Industrial	50,000									8 trip/1,000 sq. ft.	400
		Office	50,000	1.15								450 trip/acre	517
		Sports Complex/ Recreation Fields	200,000	4.59								50 trip/acre	230
		Residential	200,000				90					9 trip/dwelling unit	810
		Zone Total	**545,000**									**Zone Total =**	**3,516**
9	Island Paradise	**Retreat, Conference, Learning**											
		Retail, Restaurant, Entertainment	50,000									40 trip/1000 sq. ft.	2,000
		Hotels	320,000			300						8 trip/room	2,400
		Back of House / Support Services	50,000									16 trip/1,000sq. Ft.	800
		Conference/ Educational	500,000	11.48								100 trip/acre	1,148
		Zone Total	**920,000**									**Zone Total =**	**6,348**
10	Capeheart	**Residential/ Corporate**											
		Corporate/ Institutional	500,000									10 trip/1,000 sq. ft.	5,000
		Retail, Restaurant, Entertainment	50,000									40 trip/1,000 sq. ft.	2,000
		Residential	650,000				300					9 trip/dwelling unit	2,700
		Zone Total	**1,200,000**									**Zone Total =**	**9,700**
11	Ceiba Park	**Gateway**											
		Concessions	10,000									40 trip/1,000 sq. ft.	400
		Office	20,000	0.46								450 trip/acre	207
		Pier	25,000									5 trip/1,000sq. Ft.	125
		Zone Total	**55,000**									**Zone Total =**	**732**
												TOTAL TRIP GENERATION=	**128,725**

In order to determine the number of required lanes, a 50% directional distribution is assumed. Traffic tends to be more equally divided by direction near the center of an urban area or on loop facilities. Design guidelines were obtained from the PR Department of Transportation Highway Design Manual (1979,) and from the Mobility Plan prepared by CSA (2008).

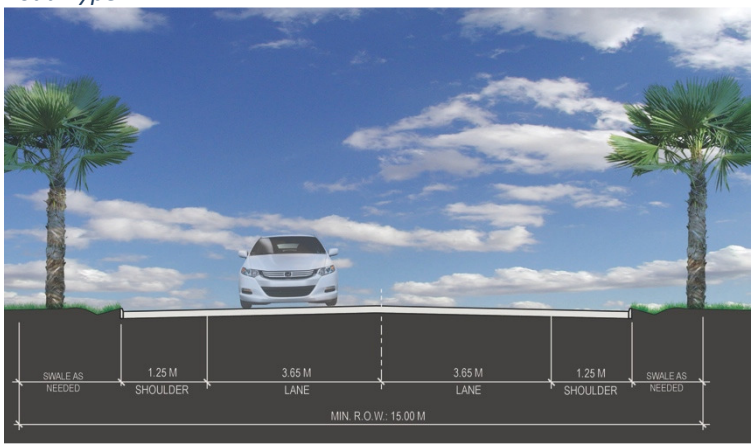
It should be noted, that an updated Traffic Study and Mobility Plan should be prepared by the LRA, before a project design phase is developed, in order to consider a more detailed analysis and to obtain an endorsement of the Master Plan from the PR Highway Authority.

A series of recommended proposed road sections was determined by taking in consideration different factors: traffic volumes, location, land use and existing easements. There are improvements to be performed on the existing road corridors' in order to increase the capacity for the expected traffic flows to be generated and to develop the recommended road sections.

The proposed road sections are:

Low Traffic Volume Roads

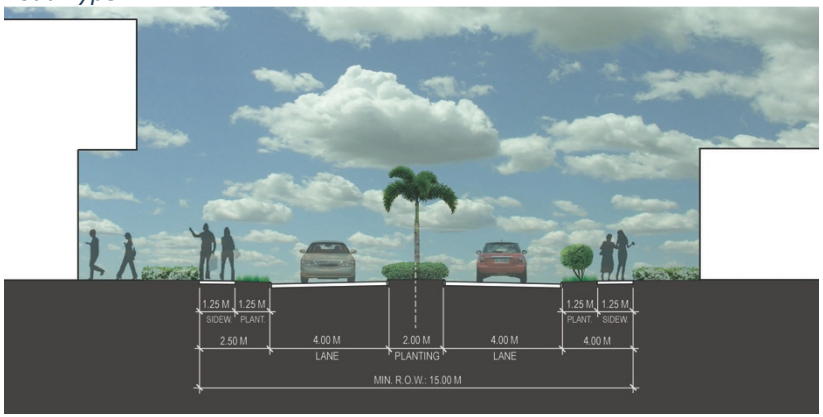
Road Type "A"



This is a low traffic volume road section, where pedestrian traffic is limited, due to the lack of residential or commercial facilities along its right of way, and where easement is limited due to sensitive areas on the surroundings. This road type can handle average daily traffic of up to 8,000 vehicles.

It is composed of two undivided lanes (one on each direction) and their respective shoulders. This road section shall be developed inside a maximum easement width of 15.00 meters.

Road Type "D"

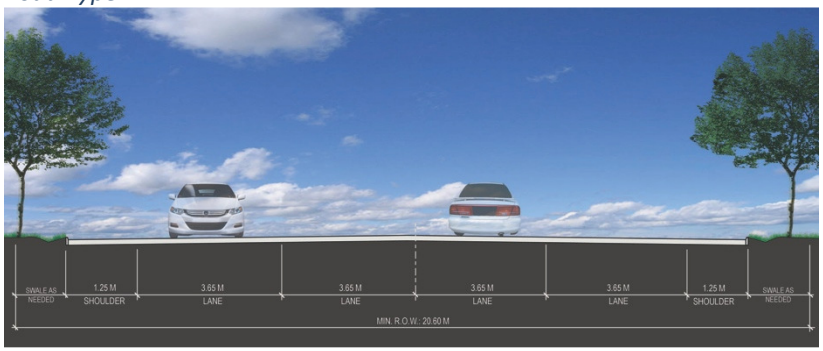


This is a low volume road section, where pedestrian traffic is considered, but easement width is limited. In order to provide a more urban environment and to include landscaping space, a median is also considered. This road type can handle average daily traffic of up to 8,000 vehicles.

It is composed of two divided lanes (one on each direction), planting area and sidewalks. This road section shall be developed inside a maximum easement width of 15.00 meters

Medium-high Traffic Volume Roads

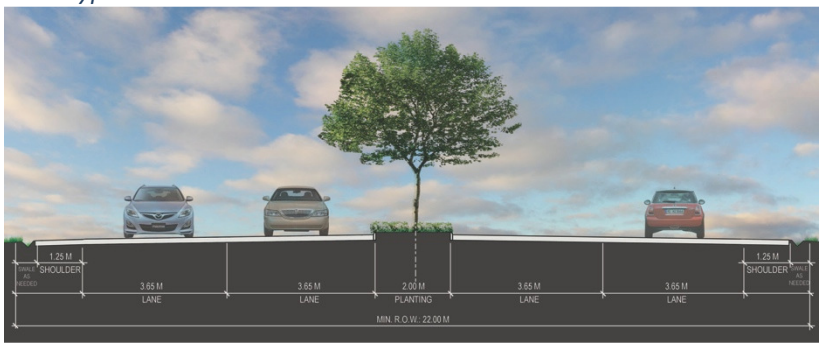
Road Type "B"



This is a medium to high traffic volume road section, where pedestrian traffic is limited, due to the lack of residential or commercial facilities along its right of way, and where easement is limited due to sensitive areas on the surroundings. This road type can handle average daily traffic of up to 20,000 vehicles.

It is composed of four undivided lanes (two on each direction) and their respective shoulders. This road section shall be developed inside a maximum easement width of 20.60 meters.

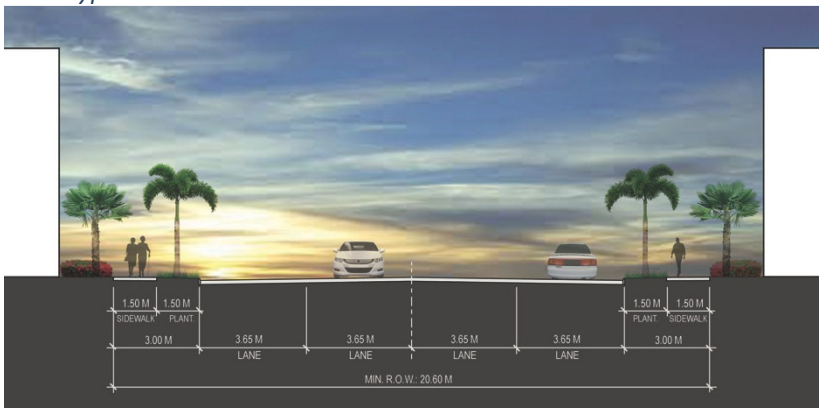
Road Type "C"



This is a medium to high traffic volume road section, where pedestrian traffic is limited due to the lack of residential or commercial facilities along its right of way, but easement width is not limited. In order to provide a more urban environment and to include landscaping space, a median is also considered. This road type can handle average daily traffic of up to 20,000 vehicles.

It is composed of four divided lanes (two on each direction) and their respective shoulders. This road section shall be developed inside a maximum easement width of 22.00 meters.

Road Type "E"

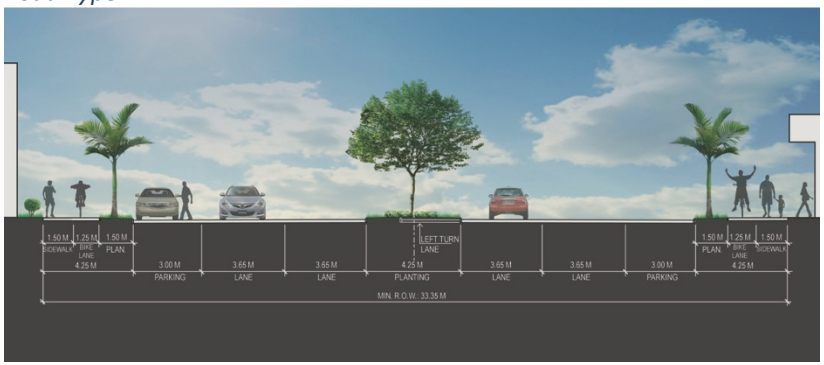


This is a medium to high volume road section, where pedestrian traffic is considered, and easement width is not limited. This road type can handle average daily traffic of up to 20,000 vehicles.

It is composed of four lanes (two on each direction), planting area and sidewalks. This road section shall be developed inside a maximum easement width of 20.60 meters.

High Traffic Volume Roads

Road Type "F"



This is a high volume road section, where pedestrian traffic is considered, and easement width is not limited. In order to provide a more urban environment and to include landscaping space, a median is also considered. For locations where commercial activity is considered, a parking lane is provided on each side. This road type can handle average daily traffic of up to 20,000 vehicles.

It is composed of four divided lanes (two on each direction), two parking lanes (one on each direction), planting area, sidewalks, bicycle lanes and a left turning lane on major intersections. This road section shall be developed inside a maximum easement width of 33.35 meters.

Road Type "G"

This is a high volume road section, where pedestrian traffic is considered, and easement width is not limited. In order to provide a more urban environment and to include landscaping space, a median is also considered. For locations where commercial activity is considered, a parking lane option is available on each side. This road type can handle average daily traffic of up to 30,000 vehicles.

It is composed of six lanes (three on each direction), two of the six lanes can be used as drop off or parking lanes as needed (one on each direction), planting area, sidewalks, bicycle lanes and a planting median that includes a left turning lane on major intersections. This road section shall be developed inside a maximum easement width of 36.90 meters.

The proposed type of road section of each main or secondary road corridors is shown on Figure 74.

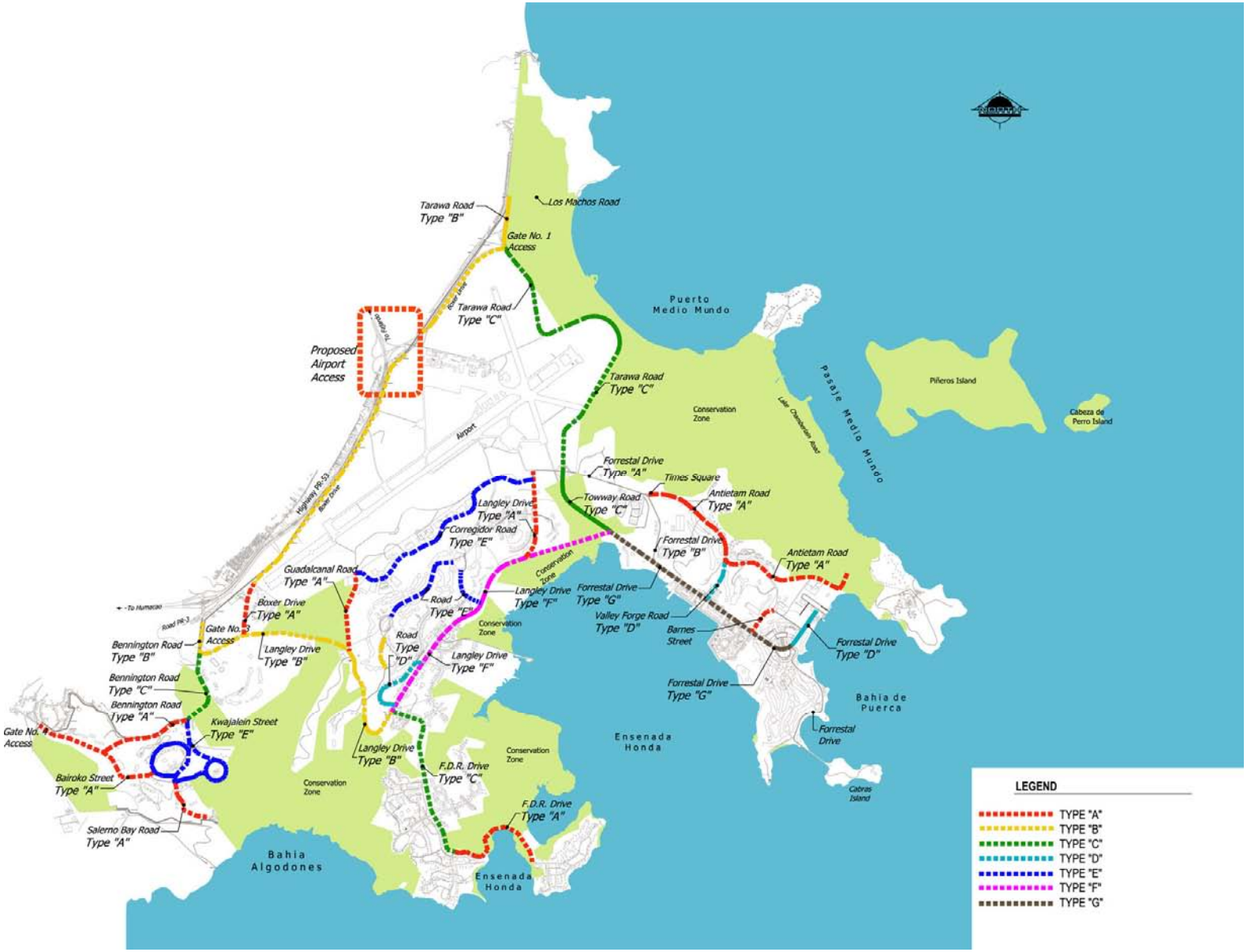


Figure 74: Proposed Roads Network

Access Points

Currently there are two readily available access points to the Base: Gate 1 in the North portion and Gate 3 on the South portion. There is a third access, Gate 4, also on the South portion that is abandoned and can be rehabilitated as an auxiliary access as needed. In addition, a fourth access point is being considered to be developed as-per the Airport Master Plan.

Based on the analysis of the proposed traffic flows there are improvements that shall be incorporated as described below.

Gate 1 Access (Tarawa Road- Ceiba)

Figure 75: Gate 1 (Tarawa Road-Ceiba)

Gate 1 access shall be maintained open and improved in order to accommodate incoming and outgoing traffic from State Roads PR-53 and PR-3 in direction to the San Juan Area. See location on Figure 75.

The major improvements to be considered are:

- The pavement surface shall be scarified and re-asphalted
- Lane widening
- New traffic marking and signage
- New road lighting

- Demolition of existing guardhouse
- Construction of new guardhouse after the intersection with the Boxer Drive (Airport access)

During the initial phases of the development, the existing two lane traffic can handle traffic flows up to 8,000 vehicles per day. Because of the expected increase in traffic flow, widening works are needed to provide a four lane undivided roadway section. The proposed section shall be a Road Section "B", this will provide a four lane undivided road; composed of two lanes on each direction with their respective shoulders. This widening shall begin at the intersection of Tarawa Drive, Isabel Rosada Street and Los Machos Road intersection up to the intersection of Boxer Drive, where the access to the Airport is located.

Currently there is a 15.00 meter wide easement through this road that goes through Los Machos Parcels 1 & 2, the Airport Parcel and Conservation Zone No. 39 Parcel. Due to the sensitivity of this portion, it is recommended to maintain the proposed improvements inside the existing easement width. There shall be coordination with the Puerto Rico ports Authority in order to provide a combined access.

Gate 3 Access (Bennington Road- Ceiba)

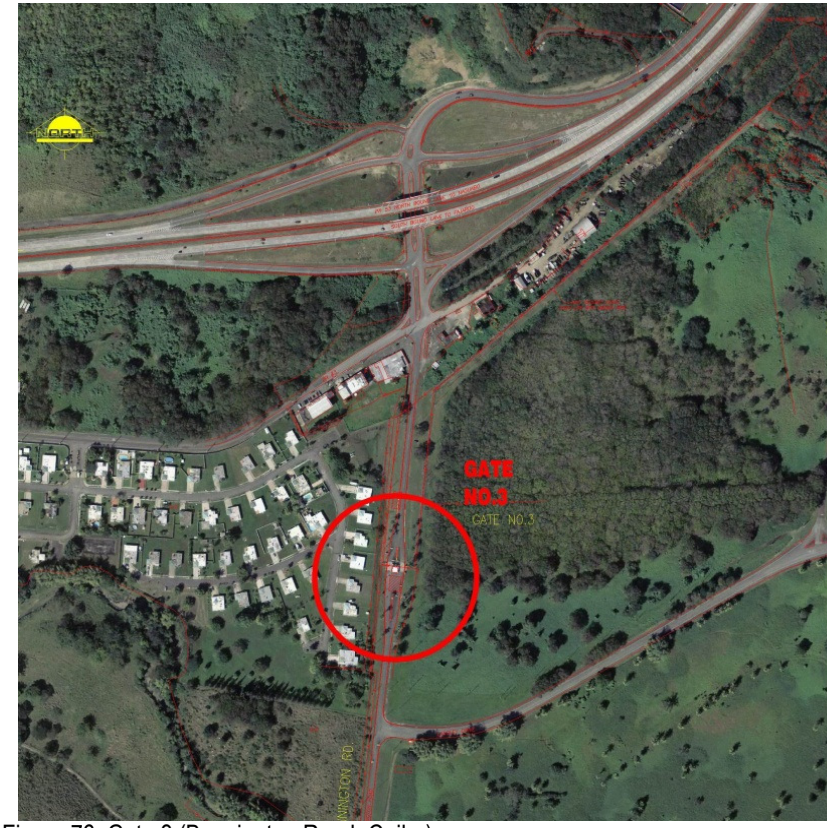


Figure 76: Gate 3 (Bennington Road- Ceiba)

Gate 3 access shall be maintained open and improved in order to accommodate incoming and outgoing traffic from State Roads PR-53 and PR-3 in direction to the Humacao Area. See location on Figure 76.

The major improvements to be considered are:

- The pavement surface shall be scarified and re-asphalted
- Lane widening
- New traffic marking and signage

- New road lighting
- Demolition of existing guardhouse
- Construction of new guardhouse at the same location

During the initial phases of the development the existing two lane traffic can handle traffic flows up to 8,000 vehicles per day. Because of the expected increase in traffic flow, widening works are needed to provide a four lane undivided roadway section. The proposed section shall be a Road Section "B", this will provide a four lane undivided road.

The CSA Mobility Plan also recommends the following improvements:

- New traffic light shall be installed on both intersection access ramps to Highway PR-53
- Access ramps from Highway PR-53 shall be incremented from two to three lanes
- Egress ramps from PR-3 to PR-53 shall have a section from two lanes to one lane on both directions (Humacao-Fajardo and Fajardo-Humacao).

Currently there is no easement through this road but, there will be a need to create an easement or right of way to a total width of 20.60 meters in order to accommodate the widening and other improvements as needed. There is available clean land width section for these improvements and no private land acquisitions are expected.

Gate 4 Access (Bennington Road -Naguabo)

Figure 77: Gate 4 (Bennington Road- Naguabo)

Gate 4 access shall be rehabilitated completely. It is currently abandoned and deteriorated. This can be considered as an optional future auxiliary service road to provide support for commercial services at the Bundy portion of the Development. In addition it can be considered for the beneficial use for developers on Zone 9, Island Paradise Conference & Learning Center, and used as a buffer to reduce traffic thru Gate 3 access, for special heavy traffic activities. See location on Figure 77

For purposes of the Master Plan and on the Mobility Plan, Gate 4 is not being considered as a permanent access to the premises.

The major improvements to be considered are:

- New full pavement section
- Lane widening
- New traffic marking and signage
- New road lighting
- New Guardhouse and security gate

The pavement surface on the Daguao Community local street shall be scarified and re-asphalted up to the intersection with State Road PR-3.

The proposed section shall be a Road Section "A". This will provide a two lane undivided road with a maximum easement of 15 meters.

Other improvements can be considered at the local street through the community up to the intersection with State Road PR-3. This may be subject to coordination with the Municipality of Naguabo.

Proposed Future Airport Access (Ceiba)

Figure 78: Proposed Highway Ramp at Airport

Currently the only access to the Airport is through Gate No.1, which does not have a direct access to Highway PR-53. The future development of the Airport and its surrounding areas is critical for the development of Roosevelt Roads. Based in this consideration, there is a plan to provide a new direct access to the Airport facilities through the development of an interchange on PR-53 as part of the Ceiba Airport Master Plan (PR Ports Authority). The timeframe for the development of this intersection could not be obtained at the time of this report. See location on Figure 78.

Although this proposed access is in direct benefit to the Airport, it will produce indirect benefits to the Roosevelt Roads Redevelopment.

Once this new direct access road from Highway PR-5 to the Airport is completed passenger traffic flow at Gate No.1 will be significantly reduced.

In addition it will provide another entrance for the redevelopment through Boxer Drive up to the intersection of Tarawa Road on the North or through Boxer Drive up to the intersection of Langley Drive at the South.

Based on Puerto Rico Ports Authority Master Plan for the Airport and the Mobility Plan prepared by CSA, it is recommended that a "Trumpet" Interchange be developed at a point where Highway PR-53 is in close proximity with the Airport Main Terminal Entrance. This intersection shall have loop ramps with two lanes on each direction. It is also recommended to establish acceleration and deceleration lanes on both directions (Humacao to Fajardo / Fajardo to Humacao) with a minimum length of 150 meters on each lane.

This intersection shall be included in the Ports Authority and Puerto Rico Highway Authority plans for the next 10 years period in order to complement the Roosevelt Roads redevelopment plan.

All the main corridors have been analyzed in order to recommend improvements that will satisfy the requirements of the future development. The location of the main corridors and the proposed road type for improvements is shown in Figure 74.

Main Corridors (Zones 1-5)

A description of each main corridor based on their location is included here:

Tarawa Road From Gate No. 1 to Boxer Drive intersection

The access road from the Gate No.1 will need improvements as stated on the previous sub-section " Gate 1 Access (Tarawa Road- Ceiba)". This road portion will be widened to a full section of four lanes (two on each direction), within the existing easement of 15.00 meters.

Current conditions show a deteriorated pavement surface, mostly caused due to the lack of proper maintenance and by the construction works due to the installation of the sanitary sewer and water system for the Airport. It is expected that new asphalt re-coating be applied after the completion of the water and sewer construction project. This will satisfy the short term need for upgrades to remedy the current conditions. Widening of the lanes will still be required to comply with long term goals.

The proposed road section Type "B" will begin at the intersection of the access road to Zone 11- Ceiba Park (Machos Beach) and will continue up to the intersection of Boxer Drive, where there is a separate access through Boxer Drive up to Airport terminal building and up to the intersection of Antietam Road.

The major improvements to be considered are:

- The pavement surface shall be scarified, and re-asphalted
- Lane widening
- New traffic marking and signage
- New road lighting

Tarawa Road From Boxer Drive to Forrestal Drive Intersection

The access road beginning at from Boxer Drive and ending at the intersection with Antietam Road will also need improvements.

Current conditions show a fair pavement surface with some minor pavement distress mostly caused due to the lack of proper maintenance. The existing road width is approximately is 7.30 meters.

This road section is not capable of handling the expected traffic volumes thus, a new proposed road section Type "C" will be

implemented. This road portion will be widened to a full section of four lanes (two on each direction). The existing 15.00 meter wide easement shall be incremented to a total of 22.00 meters.

The existing road section can be maintained by scarifying the asphalt surface, filling any voids and proof rolling the sub base. A new "roundabout" or circular junction at the intersection of Tarawa and Antietam Roads shall be implemented. This type of intersection gives priority to circulating traffic and is physically designed to slow traffic entering the junction to improve safety, so that the roads typically approach the junction radially. This eliminates the need for a traffic light, produces a more pleasant and aesthetic intersection and provides space for additional landscaping or other architectural features.

The existing 15 meter wide easement shall be incremented to a total of 20.60 meters an additional width will be required at the "roundabout" location. This will affect Airport parcel (PR Ports Authority) and Conservation Zone 39 (PR Natural Resources Department). A land swap between those public entities involved may be performed in order to compensate for the increased easement.

The major improvements to be considered are:

- The pavement surface shall be scarified, and re-asphalted
- Lane widening
- New traffic marking and signage
- New road lighting

Towway Road From Forrestal Drive to Langley Drive intersection

Towway Road begins at the intersection with Forrestal Drive and ends at the intersection with Langley Drive. It will also need improvements. Current conditions show a fair pavement surface with some minor pavement distress mostly caused due to the lack of proper maintenance. The existing road width is approximately is 11.00 meters.

This road section will need a geometric realignment in order to compose the south portion of the "roundabout" that intersects Tarawa Road as mentioned in the previous section description. The realignment will be about 300 meters long with a new closed arch curvature. This will produce a smooth transition from Tarawa to Towway and will be a significant improvement in safety and comfort. It will also bring a more direct connection to Zones 1 and 2 in the Development.

A new proposed road section Type "C" will be implemented. This road portion will be widened to a full section of four lanes (two on each direction). The existing 15 meter wide easement shall be incremented to a total of 22.00 meters.

The existing road section can be maintained by scarifying the asphalt surface, filling any voids and proof rolling the sub base. An improved intersection shall be implemented at the ending portion of this road segment at the intersection of Langley Drive. There will be a need to incorporate a traffic light based on expected traffic flows.

The existing 18 meter wide easement shall be incremented and also additional width will be required at the "roundabout" location. This will affect Airport parcel (PR Ports Authority) and Conservation Zone 28 (PR Natural Resources Department). A land swap between those public entities involved may be performed in order to compensate for the increased easement.

The major improvements to be considered are:

- The pavement surface shall be scarified, and re-asphalted
- Lane widening
- New traffic marking and signage
- New road lighting

Forrestal Drive From Tarawa Drive to Times Square Intersection

The Forrestal Drive segment which begins at the intersection with Tarawa Drive and ends at the intersection Times Square Road Drive will also need improvements.

Current conditions show a fair pavement surface with some minor pavement distress mostly caused due to the lack of proper maintenance. The existing road width is approximately is 7.30 meters.

The improvements of this road section will begin at the east leg of the proposed "roundabout" that will be established at the intersection with Tarawa Road and will provide a principal access to Zones 3, 4 and 5 and a secondary access to Zones 1 and 2.

A new proposed road section Type "A" will be implemented. The existing road portion will be widened to a full section of two lanes (one on each direction).

The existing road section can be maintained by scarifying the asphalt surface, filling any voids and proof rolling the sub base.

An improved at "Y" type at grade intersection with channelizing islands shall be implemented at the ending portion of this road segment at the intersection of Times Square in order to provide greater traffic safety. There will be a need to incorporate a traffic light based on expected traffic flows.

The existing 15 meter wide easement shall be incremented to a total of 20.60 meters. Additional width will also be required at the "roundabout" location. This will affect Conservation Zone 39 parcel (PR Natural Resources Department). A land swap between those public entities involved may be performed in order to compensate for the increased easement.

The major improvements to be considered are:

- The pavement surface shall be scarified, and re-asphalted
- Lane widening
- New traffic marking and signage
- New road lighting

Forrestal Drive From Times Square to Towway Intersection intersection

The Forrestal Drive segment that begins at the intersection with Times Square and ends at the intersection with Towway Drive, also needs improvements.

Current conditions show a fair pavement surface with some minor pavement distress mostly caused due to the lack of proper maintenance. The existing road width is approximately is 7.30 meters.

The improvements of this road section will begin at the east leg of the proposed "roundabout" that will be established at the intersection with Tarawa Road and will provide a principal access to Zones 3, 4 and 5 and a secondary access to Zones 1 and 2.

A new proposed road section Type "A" will be implemented. The existing road portion will be widened to a full section of 2 lanes (one on each direction).

There is no current easement thus, a new easement of 20 meters shall be established.

The existing road section can be maintained by scarifying the asphalt surface, filling any voids and proof rolling the sub base.

An improved at "Y" type at grade intersection with channelizing islands shall be implemented at the ending portion of this road segment at the intersection of Towway Road in order to provide greater traffic safety. There will be a need to incorporate a traffic light

based on expected traffic flows. No Conservation zones or sensitive land portions shall be affected by the easement establishment.

The major improvements to be considered are:

- The pavement surface shall be scarified, and re-asphalted
- Lane widening
- New traffic marking and signage
- New road lighting
- New intersections

Forrestal Drive From Towway Drive up to Zone 2 Hotel/Casino

The Forrestal Drive segment which begins at the intersection with Towway Drive and ends at the intersection Times Square Road Drive will need major improvements in order to satisfy the expected traffic flows in an urban setting and context.

Current conditions show a fair pavement surface with some minor pavement distress mostly caused due to the lack of proper maintenance. The existing road has a variable width from 9.00 to 10.00 meters with portions of two lanes and three lanes.

A new proposed road section Type “G” will be implemented. This road portion will be widened to a full section of six lanes (two on each direction plus additional parking lanes).

This road section provides the facilities for pedestrian traffic in an urban setting as well as landscaping on wide planting sections. In addition taking in account a service drop-off or parking lane on each side to provide support for commercial activities.

The existing road section can be maintained by scarifying the asphalt surface, filling any voids and proof rolling the sub base.

New “T” type at grade intersection with traffic lights shall be implemented along the route, especially at proposed development intersections on the future Ferry Terminal, Valley Forge road intersection and Cruise Ship Terminal.

The existing 18 meter wide easement shall be incremented to a total of 36.00 meters. This will affect Homeland Security and National Guard Boat Ramps parcels. A land swap between those public entities involved may be performed in order to compensate for the increased easement.

The major improvements to be considered are:

- The pavement surface shall be scarified, and re-asphalted
- Lane widening
- New traffic marking and signage
- New road lighting
- New intersections with left turn lanes and traffic lights

Antietam Road From Time Square up to Zone 3

Antietam Road begins at the intersection with Forrestal Drive at Time Square intersection. This Road provides main access to the Hospital facilities and to Zone 3 and a secondary access to the Army Reserve and National Guard Facilities. It also provides a connection to Lake Chamberlain Road which is the only access to Punta Medio Mundo or Zone 5.

Current conditions show a fair pavement surface with some minor pavement distress mostly caused due to the lack of proper maintenance. The existing road width is approximately is 7.30 meters at the beginning and is reduced to approximately 6.00 meters at is ending portion.

A new proposed road section Type “A” will be implemented. The existing road portion will be widened to a full section of 2 lanes (one on each direction).

The existing road section can be maintained by scarifying the asphalt surface, filling any voids and proof rolling the sub base. Neither intersections improvements nor installation of traffic lights are needed based on expected traffic flows.

The existing 15 meter wide easement can be maintained and no additional land portions or easements should be affected.

The major improvements to be considered are:

- The pavement surface shall be scarified, and re-asphalted
- Lane widening
- New traffic marking and signage
- New road lighting

Lake Chamberlain Road From Antietam Road up to Zone 5

Lake Chamberlain Road begins at the intersection with Antietam Road, north of the Army Reserve and National Guard Facilities. This Road provides main access to the Zone 5 (Punta Medio Mundo) area through Conservation Zone 39.

The existing road has a variable width approximately between 6.00 and is 7.30 meters.

Because of the Nature of development of Zone 5 as an Eco-Tourist Outpost in an environmentally sensitive area at Conservation Zone 39, no major improvements or widening are deemed necessary.

The existing road section can be maintained by minor surface improvements, filling any voids and proof rolling the sub base.

Neither intersections improvements nor installation of traffic lights are needed based on expected traffic flows. The existing 15 meter wide easement can be maintained and no additional land portions or easements should be affected.

The improvements to be considered are:

- New traffic marking and signage
- New road lighting

Main Corridor Zone 11

There is an existing unnamed Road that interconnects the Gate No.1 Road up to Los Machos Beach where Zone 11 is going to be developed.

Current conditions show good pavement surface. The existing road width is approximately is 8.00 meters. Because of the nature of development of Zone 11 in an environmentally sensitive area and expected low traffic volume, no major improvements or widening are deemed necessary. The existing road section can be maintained.

Neither intersections improvements nor installation of traffic lights are needed based on expected traffic flows.

The improvements to be considered are:

- New traffic marking and signage
- New road lighting

Other Secondary Roads

Valley Forge

Valley Forge road begins at the intersection with Antietam Road and ends at the intersection with Forrestal Drive.

Current conditions show a fair pavement surface with some minor pavement distress mostly caused due to the lack of proper maintenance. The existing road width is approximately is 7.00 meters.

A new proposed road section Type "D" will be implemented. This road portion will be widened to a full section of two lanes (one on each direction). There is no current easement, thus a new easement of 15.00 meters shall be established.

The existing road section can be maintained by scarifying the asphalt surface, filling any voids and proof rolling the sub base.

An improved at "T" type at grade intersection shall be implemented at the ending portion of this road segment at the intersection of Forrestal Drive in order to provide greater traffic safety. There will be a need to incorporate a traffic light based on expected traffic flows.

The easement establishment shall affect no Conservation zones or sensitive land portions.

The major improvements to be considered are:

- The pavement surface shall be scarified, and re-asphalted
- Lane widening
- New traffic marking and signage
- New road lighting

Palau Street & Gilbert Island Road

Palau Street and Gilbert Island Road are existing roads that provide access to the some of the fuel storage tanks and other facilities such as antenna tower and pole yard on the premises. They begin at the intersection with Antietam Road and end at the intersection with Forrestal Drive to provide access to the Homeland Security boat ramp.

Current conditions show good pavement surface. The existing road has a variable width approximately between 4.00 and is 5.00 meters.

Because of the nature of storage facility of the area and the expected low volume traffic, no major improvements or widening are deemed necessary. The existing road section can be maintained.

Neither intersections improvements nor installation of traffic lights are needed based on expected traffic flows. No Conservation zones or sensitive land portions shall be affected by the establishment of an easement with the existing roads width.

Barnes Street (National Guard / Armed Forces Reserve Access)

Barnes Street is an existing road that provides access to the Armed Forces Reserve Center and the National Guard Army reserve Center. It begins at the intersection with Forrestal Drive and continues up to the access gate of the reserve center and intersects Antietam Road.

Current conditions show good pavement surface. The existing road width is approximately is 7.30 meters.

Because of the nature of the facilities, area location and the expected low volume traffic, no major improvements or widening are deemed necessary. The existing road section can be maintained.

Neither intersections improvements nor installation of traffic lights are needed based on expected traffic flows. No Conservation zones or sensitive land portions shall be affected by the establishment of an easement with the existing roads width.

Access to Wetslip internal roads former Camp Moscrip

There are some secondary roads located inside the former Camp Moscrip located on Zone 2. Those secondary roads interconnect buildings and facilities on that area and provide access to the Wet slip or "Dry docks area. Based on the proposed development of Zone2, it will be necessary to provide a permanent access to this portion by developing a new access road from Forrestal Drive.

The new road shall be implemented after the development of The Hotel /Casino is defined.

A new proposed road section Type "D" will be implemented. This road portion will be widened to a full section of two lanes (one on each direction). There is no current easement thus, a new easement of 15 meters shall be established.

This road section provides the facilities for pedestrian traffic in an urban setting as well as landscaping on wide planting sections. In addition taking inconsideration a service or parking lane on each side for providing support for commercial activities. No Conservation zones or sensitive land portions shall be affected by the establishment of an easement with the existing roads width.

Forrestal Drive up to Cabras Island

Forrestal Drive continues after intersecting Barnes Street up to the existing Forrestal Water Treatment plant and up to Cabras Island.

Current conditions show good pavement surface. The existing road has a variable width approximately between 7.30 meters and ending at 6.00 meters at Cabras Island.

Because of the nature of the development of the area and the expected low volume traffic, no major improvements or widening are deemed necessary. The existing road section can be maintained.

Neither intersections improvements nor installation of traffic lights are needed based on expected traffic flows. No Conservation zones or sensitive land portions shall be affected by the establishment of an easement with the existing roads width.

Main Corridors (Zones 6-10)

Langley Drive From Water Treatment Plant to Towway Drive intersection

This access road will need improvements. The existing road width varies from approximately 7.30 meters up to 14.60 meters.

Current conditions show a fair pavement surface with some minor pavement distress mostly caused due to the lack of proper maintenance.

A new proposed road section Type "F" will be implemented. This road portion will be widened to a full section of six lanes (two on each direction plus additional parking lanes).

This road section provides the facilities for pedestrian traffic in an urban setting as well as landscaping on wide planting sections. In addition taking in account a service drop-off or parking lane on each side to provide support for commercial activities.

The existing road section can be maintained by scarifying the asphalt surface, filling any voids and proof rolling the sub base.

New "T" type at grade intersection with traffic lights shall be implemented along the route, especially at proposed development intersections.

The existing easement width ranges from 15.00 to 30.00 meters and shall be incremented to a total width of 30.85 meters

The major improvements to be considered are:

- The pavement surface shall be scarified, and re-asphalted
- Lane widening
- New traffic marking and signage
- New road lighting

- New intersections with left turn lanes and traffic lights

Corregidor Road From Guadalcanal Road to Langley Drive intersection

This access road will need improvements. The existing road width is approximately 4.50 meters.

Current conditions show a fair pavement surface with some minor pavement distress mostly caused due to the lack of proper maintenance.

A new proposed road section Type "E" will be implemented. This road portion will be widened to a full section of four lanes (two on each direction).

The existing road section can be maintained by scarifying the asphalt surface, filling any voids and proof rolling the sub base.

A proposed easement of 22.00 meters shall be established.

The major improvements to be considered are:

- The pavement surface shall be scarified, and re-asphalted
- Lane widening
- New traffic marking and signage
- New road lighting

Guadalcanal Road From Langley Drive to Corregidor Road

This access road will need improvements. The existing road width is approximately 4.50 meters.

Current conditions show a fair pavement surface with some minor pavement distress mostly caused due to the lack of proper maintenance.

A new proposed road section Type "A" will be implemented. This road portion will be widened to a full section of two lanes (one on each direction).

The existing road section can be maintained by scarifying the asphalt surface, filling any voids and proof rolling the sub base.

A proposed easement of 15.00 meters shall be established.

The major improvements to be considered are:

- The pavement surface shall be scarified, and re-asphalted
- Lane widening
- New traffic marking and signage
- New road lighting

F.D.R. Drive From Langley Drive

This access road will need improvements. The existing road width is approximately 7.30 meters.

Current conditions show a fair pavement surface with some minor pavement distress mostly caused due to the lack of proper maintenance.

For the first 2.0 kilometers a new proposed road section Type "C" will be implemented. This road portion will be widened to a full section of four lanes (two on each direction).

For the remaining length of the road a new proposed road section Type "A" will be implemented. This road portion will be widened to a full section of two lanes (one on each direction).

The existing 15 meter wide easement shall be incremented to a total of 22.00 meters on the proposed road type "C" portion.

The major improvements to be considered are:

- The pavement surface shall be scarified, and re-asphalted
- Lane widening
- New traffic marking and signage
- New road lighting
- New intersections with left turn lanes and traffic lights

Langley Drive From Bennington Road to Water Treatment Plant Intersection

This access road will need improvements. The existing road width is approximately 7.30 meters.

Current conditions show a fair pavement surface with some minor pavement distress mostly caused due to the lack of proper maintenance.

A new proposed road section Type "B" will be implemented. This road portion will be widened to a full section of four lanes (two on each direction).

The existing easement width of 18.00 meters shall be incremented to a total width of 20.60 meters

The major improvements to be considered are:

- The pavement surface shall be scarified, and re-asphalted
- Lane widening
- New traffic marking and signage
- New road lighting

Bennington Road Drive From Gate 3 Access to Langley Drive

This access road will need improvements. The existing road width is approximately 7.30 meters.

Current conditions show a fair pavement surface with some minor pavement distress mostly caused due to the lack of proper maintenance.

From Gate 3 access up to the intersection of Kwajalein Street, a new proposed road section Type "C" will be implemented. This road portion will be widened to a full section of four lanes (two on each direction).

For the remaining length of the road, up to Gate 4, a new proposed road section Type "A" will be implemented. This road portion will be widened to a full section of two lanes (one on each direction).

The existing 15 meter wide easement shall be incremented to a total of 22.00 meters on the proposed road type "C" portion, and a new easement of 15.00 meters shall be established from Kwajalein Street intersection up to Gate 4.

The major improvements to be considered are:

- The pavement surface shall be scarified, and re-asphalted
- Lane widening
- New traffic marking and signage
- New road lighting

Other secondary roads

Improvements are needed on other secondary roads. The major improvements to be considered for the indicated secondary roads are:

- The pavement surface shall be scarified, and re-asphalted
- Lane widening as indicated
- New traffic marking and signage
- New road lighting

3.2.2 Water Distribution

The existing water infrastructure was inventoried to identify the quantity and capacity of the wells, reservoirs, booster pumps, and distribution system. This information was analyzed to establish existing system reliability and recommendations for future improvements. This section provides an overview of the design factors, assumptions, and recommendations discussed within the Master Plan.

The treatment, distribution and supply of potable water are key factors for a sustainable development. Uses of water include:

- Agricultural
- Industrial
- Household
- Recreational
- Environmental Activities

Virtually all of these human uses require fresh water. Local water utilities must make significant investments to install, upgrade, or replace equipment in order to deliver safe drinking water and protect public health.

In order to produce potable water in an economic which derives in an asset to the client it is essential to have and efficient system that produces and delivers the highest quality product with the least expensive cost. It is the scope of the LRA to provide a constant and efficient potable water supply that is essential to the successful development of the project

By a combination of improvements to the existing system and the provision of new pipelines, connections and support systems, the future demands can be satisfied. This can only be accomplished in conjunction with the support provided by the Puerto Rico Aqueduct and Sewer Authority (PRASA).

Although currently the water supply and distribution is fully independent from the PRASA system, it is expected that a future connection to the PRASA service will provide redundancy and economies in the operation of the whole system.

Water System Demands

The first step in the design of the improvements to the water distribution system is the determination of the quantity of water that will be required, with provision for the estimated requirements for the future.

In terms of total quantity, the water demand in a community is usually estimated on the basis of per capita demand. The variations in demand depend on geographic location, climate, size of the community, extent of industrialization, and other factors. In terms of how the total water use is distributed within a community throughout the day, perhaps the best indicator is land use.

The Zones and their respective Land Uses were defined in the 2010 Addendum to the 2004 Reuse Plan, and subsequent revision of June 18, 2010. The proposed land uses incorporate any future growth for a period of 25 years from the beginning of the redevelopment process. The projected uses, development areas and other factors such as number of hotel rooms, number of passengers on ship terminal facilities, number of classrooms on educational facilities, were obtained. By using that information in conjunction with the estimated water use rates, the estimated water demand can be calculated.

The estimated water use rates for Puerto Rico are indicated on the Design Norms Regulation or “Reglamento de Normas de Diseño”, 2003 Edition published by the Puerto Rico Aqueduct and Sewer

Authority (PRASA). This Regulation provides the major water use rates by land use types. Because this Regulation does not specify the water use rates for all the possible uses in the redevelopment, other regulations were also used, such as the Typical Rates of Water Use, published by Metcalf and Eddy (1979).

From the performed calculations it was determined that a maximum demand of approximately 4.0 Million Gallons per Day (MGD), when the project is fully developed.

The water demands for each specific land use inside each development zone were calculated and are presented here on Table 6 and Table 7.

Table 6: Water Demand By Zone

Zone	Location	Projected Use	Development Area (Gross Square Feet)	Dev. Area (acres)	Hospital Beds	Hotel Rooms	Dwelling Units	Students	Boat Slips	Passengers / Visitors	Use Rate per Day	Water Demand (GPD)
1	Port Caribe	**Commercial Heart**										
		Retail/ Restaurants/ Entertainment Dist	200,000								300 gallons/1,000 sq. ft.	60,000
		Hospital	130,000		85						350 gallons/bed	29,750
		Office	50,000								300 gallons/1,000 sq. ft.	15,000
		Marina	25,000						400		30 gallons/boat slip	12,000
		International Cruise Terminal	150,000							1,500	10 gallons/passenger	15,000
		Industrial/ Back of House	50,000								350 gallons/1,000 sq. ft.	17,500
		National Guard Boat Ramp	9,500								300 gallons/1,000 sq. ft.	2,850
		Homeland Security Boat Ramp	2,500								300 gallons/1,000 sq. ft.	750
		Ferry Terminal	50,000							1,200	5 gallons/passenger	6,000
		Zone Total	**667,000**								**Zone Total =**	**158,850**
2	Caribbean Riviera	**Destination Anchor**										
		Casino	210,000								300 gallons/1,000 sq. ft.	63,000
		Casino Hotel	2,000,000			2,000					700 gallons/room	1,400,000
		Retail/ Restaurants/ Entertainment	200,000								300 gallons/1,000 sq. ft.	60,000
		Cabras Island (Coast Guard)	2,000								300 gallons/1,000 sq. ft.	600
		Wastewater Treatment Plant	1,000								300 gallons/1,000 sq. ft.	300
		Zone Total	**2,413,000**								**Zone Total =**	**1,523,900**
3	El Yunque Grande	**Premier Eco-Tourism Resort**										
		Hotels- "Lodge"	120,000			150					700 gallons/room	105,000
		Eco Museum/Visitor's Center	50,000								0.17 gallons/1 sq. ft.	8,500
		Office	30,000								300 gallons/1,000 sq. ft.	9,000
		Retail/ Restaurants/ Entertainment "Vill	100,000								300 gallons/1,000 sq. ft.	30,000
		Residential Villas	450,000				200				400 gallons/dwelling unit	80,000
		Marina	25,000						200		30 gallons/boat slip	6,000
		US Army Reserve/ National Guard	46,500								300 gallons/1,000 sq. ft.	13,950
		Armed Forces Reserve Center	72,000								300 gallons/1,000 sq. ft.	21,600
		Water Taxi Terminal/ Pier	20,000							600	5 gallons/passenger	3,000
		Zone Total	**913,500**								**Zone Total =**	**277,050**
4	Marsh Vista	**Golf/Country Club Amenity**										
		18 Hole Golf Course									(reclaimed water)	
		Clubhouse and Dining	35,000								300 gallons/1,000 sq. ft.	10,500
		Residential	250,000				125				400 gallons/dwelling unit	50,000
		Zone Total	**285,000**								**Zone Total =**	**60,500**
5	Eco-Outpost Camp	**Environmental Retreat**										
		Dining/ Conference	25,000								300 gallons/1,000 sq. ft.	7,500
		Lodging	100,000			100					700 gallons/room	70,000
		Office/ Research	25,000								300 gallons/1,000 sq. ft.	7,500
		Zone Total	**150,000**								**Zone Total =**	**85,000**

Table 7: Water Demand by Zone (cont.)

Zone	Location	Projected Use	Development Area (Gross Square Feet)	Dev. Area (acres)	Hospital Beds	Hotel Rooms	Dwelling Units	Students	Boat Slips	Passengers / Visitors	Use Rate per Day	Water Demand (GPD)
6	Airport Uplands	**Collateral Development**										
		Airport, Govermment, Military	250,000								350 gallons/1,000 sq. ft.	87,500
		Industrial/ Warehouse	250,000								350 gallons/1,000 sq. ft.	87,500
		Specialty Industrial	200,000								350 gallons/1,000 sq. ft.	70,000
		Office	75,000								300 gallons/1,000 sq. ft.	22,500
		Residential	250,000				100				400 gallons/dwelling unit	40,000
		18-hole Golf Course									(reclaimed water)	
		Clubhouse	35,000								300 gallons/1,000 sq. ft.	10,500
		Radar Station	1,025								300 gallons/1,000 sq. ft.	308
		PotableWater Treatment Plant	3,800								300 gallons/1,000 sq. ft.	1,140
		Zone Total	**1,064,825**								**Zone Total =**	**319,448**
7	Main Street	**Town Center**										
		Educational Facilities/ Schools	80,000					530			30 gallons/student	15,900
		Office	100,000								300 gallons/1,000 sq. ft.	30,000
		Retail, Restaurant, Entertainment	400,000								300 gallons/1,000 sq. ft.	120,000
		Residential	1,450,000				650				400 gallons/dwelling unit	260,000
		Industrial/ Back of House / Support Serv	200,000								350 gallons/1,000 sq. ft.	70,000
		Hotel	320,000			400					700 gallons/room	280,000
		Community College	200,000					1300			30 gallons/student	39,000
		Coast Guard Pier	8,910								300 gallons/1,000 sq. ft.	2,673
		Zone Total	**2,758,910**								**Zone Total =**	**817,573**
8	Sports Core	**Community Sports**										
		9 Hole Golf Course									(reclaimed water)	
		Clubhouse	15,000								300 gallons/1,000 sq. ft.	4,500
		Retail, Restaurant, Entertainment	30,000								300 gallons/1,000 sq. ft.	9,000
		Industrial	50,000								350 gallons/1,000 sq. ft.	17,500
		Office	50,000								300 gallons/1,000 sq. ft.	15,000
		Sports Complex/ Recreation Fields	200,000	4.59							2,020 gallons/acre	9,272
		Residential	200,000				90				400 gallons/dwelling unit	36,000
		Zone Total	**545,000**								**Zone Total =**	**91,272**
9	Island Paradise	**Retreat, Conference, Learning**										
		Retail, Restaurant, Entertainment	50,000								300 gallons/1,000 sq. ft.	15,000
		Hotels	320,000			300					700 gallons/room	210,000
		Back of House / Support Services	50,000								350 gallons/1,000 sq. ft.	17,500
		Conference/ Educational	500,000								300 gallons/1,000 sq. ft.	150,000
		Zone Total	**920,000**								**Zone Total =**	**392,500**
10	Capeheart	**Residential/ Corporate**										
		Corporate/ Institutional	500,000								300 gallons/1,000 sq. ft.	150,000
		Retail, Restaurant, Entertainment	50,000								300 gallons/1,000 sq. ft.	15,000
		Residential	650,000				300				400 gallons/dwelling unit	120,000
		Zone Total	**1,200,000**								**Zone Total =**	**285,000**
11	Ceiba Park	**Gateway**										
		Concessions	10,000								300 gallons/1,000 sq. ft.	3,000
		Office	20,000								300 gallons/1,000 sq. ft.	6,000
		Pier	25,000								300 gallons/1,000 sq. ft.	7,500
		Zone Total	**55,000**								**Zone Total =**	**16,500**
											TOTAL WATER DEMAND=	**4,027,592**

System Improvements

Given the location, distribution and size of the existing water infrastructure, most of the main components (WTP, tanks, main branches and booster pump stations) can be maintained and upgraded without any major relocation or new construction.

New undeveloped areas will require water infrastructure that will be serviced from the main components as specified above. The internal distribution system for each specific land use on each Zone must be addressed by individual developers. Nerveless the capacity of the main branches according to the required demands will be supplied by the infrastructure upgrade system as recommended on this report.

A hydraulic model of the existing water distribution network incorporating the proposed demands was prepared by Integra (see Appendix at the end of this document). The model is a simplification of the whole network, but takes into account all of the principal components that are essential for a complete hydraulic assessment. This simplified model can be reliable, by considering that the secondary branches that are located inside specific minor streets or roads are assumed to be replaced with the proposed Master Plan layouts or distribution by proposed developers.

From the model results, the capacities and performance of the system is assessed, in order to define the improvements that must be considered and included in a proposed model.

The improvements include:

- Minor upgrades of existing facilities (water lines, water tanks booster pump stations)
- New interconnections with PRASA systems

The proposed redevelopment plans require a maximum potable water capacity of 4.03 MGD or 2,797 GPM. Although the capacity of the existing Water Treatment Plant (4.0 MGD) can supply this demand, the WTP will be shut down as will be explained later on. This limitation creates the need for an interconnection to a PRASA system.

The short-term option for this interconnection is available through the improvements that the PR Ports Authority is implementing with an offsite water distribution system connected to PRASA. The long-term option is available through a new offsite main line up to the Fajardo WTP, to be developed by the LRA.

A schematic outline of Roosevelt Roads' proposed water system operations in the short and long term is shown in Figure 79.

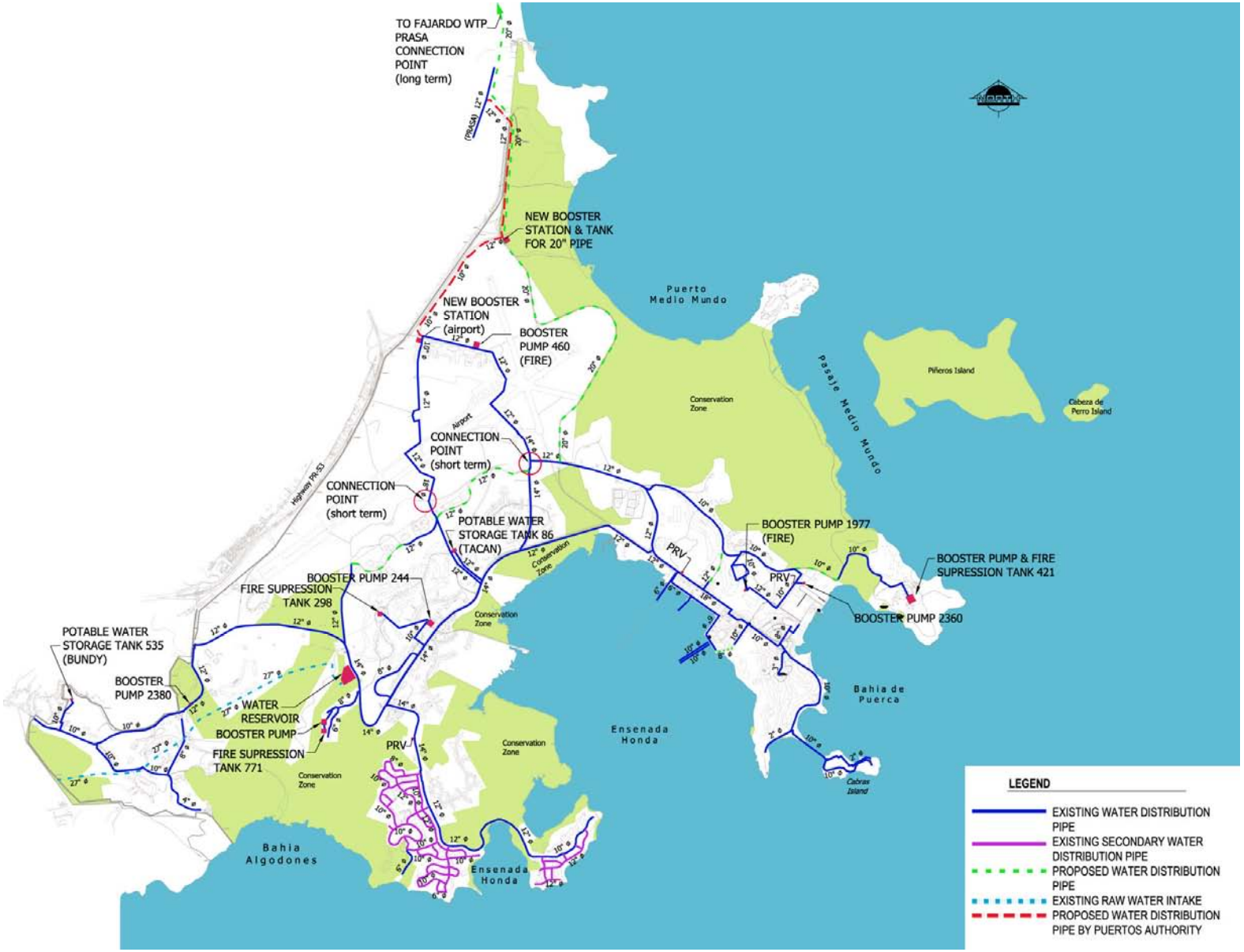


Figure 79: Proposed Water Distribution System

All the main water systems have been analyzed in order to recommend improvements that will satisfy the requirements of the future development.

A description of each main system based on their location is included here:

Zone 1 (Port Caribe)

This Zone encompasses most of the waterfront re-development and the Hospital.

On this zone the water service is distributed by an existing 12"Ø PVC water main that begins at a junction on Langley Drive, then runs by the Marina By Pass and Tow Way Road and continues through Forrestal Drive where its diameter is increased to 18"Ø PVC at the junction of Valley Forge Road. There is a transition of the 18" Ø pipe where it diverges besides Building 1207 and behind the Hospital. At the same diversion, the 18"Ø pipe is reduced to a 10" Ø PVC pipe which continues thru Forrestal Drive into Zone 2.

There is also another 12"Ø PVC main interconnection that runs from Forrestal Drive passing through the Tank Farm and next to the existing Athletic Field.

There are secondary branches that also serve the Port Area. There is a 6"Ø that provides service to Pier No.1, an 8"Ø that serves Pier No.2 and a branch that runs through Bulkheads A, B and C with 8", 10" and 12"Ø looped pipes. Another secondary 8"Ø branch provides services to the Marina Area.

Due to high pressures that can build up along Forrestal Drive, there is a pressure-regulating valve located next to the main entrance to Pier No. 1. There is also a fire booster pump (1977) behind Building 31 that services the Hospital.

All the existing main pipelines on this Zone were installed in 1990, when a major water distribution system renovation was done by replacing the old existing system.

Improvements

From the hydraulic model results it was determined that the 10" and 12"Ø PVC pipes have adequate flow capacities for the expected demand of Zone 1 and the additional service for Zones 2 and a portion of Zone 3. The peak demands can be achieved without producing low pressures. The current system will be able to provide the capacity and pressures for the future development with only minor upgrades.

All existing fire hydrants and pressure regulators along the Forrestal Drive shall be relocated due to the proposed widening of the road section.

A new 10" Ø PVC pipe segment with an approximate length of 350 meters shall be installed on Valley Forge Road up to Corvius Corner and Antietam Road in order to provide service to a portion of that road where new developments are expected.

The existing secondary 6", 8" and 10" Ø branches that serve the Ports Area can be maintained and used to provide service for the proposed ports improvements. Minor 2" to 4 "Ø pipes should be abandoned or discarded for future use within the ports and the remaining areas.

Zone 2 (Caribbean Riviera)

This Zone encompasses the development of the Hotel/Casino and other entertainment and retail amenities.

On this zone the water service is distributed by an existing 10"Ø PVC incoming water main from Forrestal Drive. This 10" pipe continues through Forrestal Drive up to Cabras Island. There is also a 10" branch into Forrestal Treatment Plant.

There are secondary 6" and 8" branches into former Camp Moscrip Area and into Zone 3. All the existing main pipelines on this section were installed in 1990, replacing old existing ones.

Improvements

From the hydraulic model results it was determined that the 10"Ø PVC pipe have flow capacities that are adequate for the expected demand of Zone 2 and the additional service for a portion of Zone 3. The peak demands can be achieved without producing low pressures. The current system will be able to provide the capacity and pressures for the future development with only minor upgrades.

No pipes substitutions will be needed to maintain a minimum pressure in the system of 60 psi.

All existing fire hydrants and pressure regulators along the Forrestal Drive shall be relocated due to the proposed widening of the road section.

The existing secondary 6", 8" Ø shall be abandoned. Their location will interfere with the proposed zone developments. Minor 2" to 4 "Ø pipes should also be abandoned or discarded for future use.

Zone 3 (El Yunque Grande) South Portion (Drydock)

This portion of Zone 3 encompasses the development of the entertainment and retail amenities, hotel, marina, water taxi, residential villages and Army and Armed Forces Reserve Centers.

On this zone the water service is distributed by an existing 6" and 8" Ø PVC on minor streets inside former Camp Moscrip, incoming from a 10" Ø water main from Forrestal Drive on Zone 2.

All the existing main pipelines on this section were installed in 1990, replacing old existing ones.

Improvements

From the hydraulic model results it was determined that the main 10"Ø PVC pipe branch have flow capacities that are adequate for the expected demand of this portion of Zone 3. The peak demands can be achieved without producing low pressures. The current system will be able to provide the capacity and pressures for the future development with only minor upgrades.

No pipes substitutions will be needed to maintain a minimum pressure in the system of 60 psi.

All existing fire hydrants and pressure regulators along the Forrestal Drive shall be relocated due to the proposed widening of the road section.

The existing secondary 2", 4", 6" and 8" Ø shall be abandoned or discarded for future uses. Their location will interfere with the proposed zone developments.

Zone 4 (Marsh Vista)

This Zone encompasses the development of a Golf Course, clubhouse and residential area.

On this zone the water service is distributed by an existing 12"Ø PVC on Forrestal Drive beginning at the intersection of Tarawa Drive and continuing up to the intersection with Antietam Road on Times Square where it is reduced to a 10"Ø PVC pipe which continues up to the intersection of Barnes Street and into the Zone 3.

There are secondary 6" and 8" branches into Manila Bay Street, the Fuel tank farm, Sicily Circle, and a 10"Ø PVC into the Hospital area.

All the existing main pipelines on this section were installed in 1990, replacing old existing ones.

Improvements

From the hydraulic model results it was determined that the 10" and 12"Ø PVC pipes have flow capacities that are adequate for the expected demand of Zone 4 and a portion of Zone 3 of 0.12 MGD. The peak demands can be achieved without producing low pressures. The current system will be able to provide the capacity and pressures for the future development with only minor upgrades.

No pipes substitutions will be needed to maintain a minimum pressure in the system of 60 psi.

All existing fire hydrants along the Forrestal Drive and Antietam Road shall be relocated due to the proposed widening of the road section.

The existing secondary 6" and 8" Ø into the Tank Farm Zone, as well as the 10"Ø into the Hospital shall remain.

All other smaller pipe diameters on other areas shall be abandoned or discarded for future uses, because their location will interfere with the proposed zone developments.

The Golf Course shall be serviced from a reclaimed water system or natural stormwater retention ponds.

Zone 5 (Eco-Outpost Camp)

This Zone encompasses the development of an Environmental Retreat, with lodging, dining/conference and research facilities.

On this zone, there is no existing water service.

Improvements

Due to the nature of the ecological purpose of the development on this zone, no major demands are expected.

There are service options that must be incorporated into the zone, including rain water harvesting to provide the necessary water demand.

Nerveless, the installation of a 4"Ø PVC pipe along Chamberlain Road and interconnected from the existing 10" Ø PVC pipe located on Zone 3 on Antietam Road, shall be considered. This can be used to service or compliment the domestic water and fire demand cisterns inside the zone.

Zone 6 (Airport Uplands)

This Zone encompasses the development of an industrial area, office buildings, government and military facilities, residential area and a golf course.

On this zone the water service is distributed by an existing 14"Ø PVC main on Langley Drive, which provides connections to two parallel 12"Ø PVC pipes up to water distribution Tank 86. An 18"Ø PVC pipe is also connected to the distribution tank and continues into Bogue Road and into the Airport Zone. Another 12"Ø PVC main is incoming from the Water Treatment Plant through Guadalcanal Road and continues through Corregidor Road.

There are secondary 6" and 8" Ø PVC pipe branches into other areas within the zone.

All the existing main pipelines on this section were installed in 1990, replacing old existing ones.

Improvements

From the hydraulic model results it was determined that the 12" and 18"Ø PVC pipes have flow capacities that are adequate for the expected demand of Zone 6 of 0.63 MGD. The peak demands can be achieved without producing low pressures. The current system will be

able to provide the capacity and pressures for the future development with only minor upgrades.

It is expected that the main distribution pipes that provides service into the Airport will be disconnected to the Base distribution system either by closing valves or capping ends. The Airport is currently developing their independent water distribution and connection to PRASA system.

No pipes substitutions will be needed to maintain a minimum pressure in the system of 60 psi.

All existing fire hydrants along the Corregidor Road shall be relocated due to the proposed widening of the road section.

The existing secondary 6" and 8" Ø and other smaller pipe diameters on other areas shall be abandoned or discarded for future uses. Their location will interfere with the proposed zone developments.

The Golf Course shall be serviced from a reclaimed water system or natural stormwater retention ponds.

Zone 7 (Main Street)

This Zone encompasses the development of an industrial area, office buildings, entertainment and retail areas, a hotel, community college and educational facilities.

On this zone the water service is distributed by an existing 14"Ø PVC main on Langley Drive. This main is incoming from the Water Treatment Plant and continues through Langley Road up to the intersection with Forrestal Drive .

There is also a connection that continues thru F.D.R. Drive into Zone 10.

There are secondary 8" Ø PVC pipe branches into Kearsage Road (for Coast Guard Pier), the Naval Exchange, Borinquen Heights and Lunga Pt. Road.

All the existing main pipelines on this section were installed in 1990, replacing old existing ones.

Improvements

From the hydraulic model results it was determined that the 14" Ø PVC pipe has flow capacity that is adequate for the expected demand of Zone 7 and the service for Zones 1,2,3,4 and 6 which are also interconnected the 14 Ø pipe from Langley Drive.

The peak demands can be achieved without producing low pressures. The current system will be able to provide the capacity and pressures for the future development with only minor upgrades.

No pipes substitutions will be needed to maintain a minimum pressure in the system of 60 psi.

All existing fire hydrants along the Langley Drive shall be relocated due to the proposed widening of the road section.

The existing secondary 6", 8" and 10"Ø pipe portions on Kearsag Road and Lunga Pt. Road shall remain to provide service to existing and proposed facilities.

Other smaller pipe diameters on other areas shall be abandoned or discarded for future uses. Their location will interfere with the proposed zone developments.

Zone 8 (Sports Core)

This Zone encompasses the development of an industrial area, office buildings, entertainment and retail areas, golf course, sports complex and residential areas.

On this zone the water service is distributed by an existing 14"Ø PVC main on Langley Drive. This main is incoming from the Water Treatment Plant and continues through Langley Road up to the intersection with Bennington Road, where it is reduced to a 12" Ø that continues into Zone 9.

There are secondary 4" Ø PVC pipe branches .

All the existing main pipelines on this section were installed in 1990, replacing old existing ones.

Improvements

From the hydraulic model results it was determined that the 14" Ø PVC pipe has flow capacity that is adequate for the expected demand of Zone 8 and the service for Zones 9 which is also interconnected the 14 Ø pipe from Langley Drive.

The peak demands can be achieved without producing low pressures. The current system will be able to provide the capacity and pressures for the future development with only minor upgrades.

No pipes substitutions will be needed in order to maintain a minimum pressure in the system of 60 psi.

There are no existing fire hydrants along the Langley Drive. New fire hydrants shall be installed on this Zone, in order to comply with government regulations.

The existing secondary 4"Ø pipe portions into Boxer Drive and into the former golf course shall be abandoned or discarded for future uses, because their location will interfere with the proposed zone developments.

The Golf Course shall be serviced from a reclaimed water system or natural stormwater retention ponds.

Zone 9 (Island Paradise)

This Zone encompasses the development of a retreat, conference and learning areas.

On this zone the water service is distributed by an existing 12"Ø PVC main on Bennington Road that is connected to a 14"Ø PVC main on Langley Drive. The 12"Ø pipe continues on Bennington Road where it is reduced to 10"Ø and continues up to Gate No. 4 and up to Distribution Tank No. 535. Also the 12" Ø is distributed into secondary branches.

There are multiple secondary 8" Ø PVC pipe branches into Bairoko Street, and other internal streets. There are other minor secondary 6" and 4" Ø PVC pipe branches distributed on the zone.

All the existing main pipelines on this section were installed in 1990, replacing old existing ones.

Improvements

From the hydraulic model results it was determined that the 10" and 12"Ø PVC pipe mains have flow capacity that is adequate for the expected demand of Zone 9.

The peak demands can be achieved without producing low pressures. The current system will be able to provide the capacity and pressures for the future development with only minor upgrades.

No pipes substitutions will be needed in order to maintain a minimum pressure in the system of 60 psi.

All existing fire hydrants along the Bennington Road shall be relocated due to the proposed widening of the road section.

Some portions of the secondary 8"Ø pipe portions on Bairoko Street shall remain to provide service to existing and proposed facilities.

Other smaller pipe diameters on other areas shall be abandoned or discarded for future uses. Their location will interfere with the proposed zone developments.

Zone 10 (Capeheart)

This Zone encompasses the development of corporate-institutional buildings, entertainment and retail areas and residential communities.

The calculated potable water demand for this zone is 285,000 GPD (0.28 MGD or 197.9 GPM).

On this zone the water service is distributed by an existing 14"Ø PVC main on F.D.R. Drive that is connected to a 14"Ø PVC on Langley Drive. This main continues through F.D.R. Drive up to the intersection of Saratoga Road where it is reduced to 12"Ø PVC. The 12"Ø pipe continues thru F.D.R. Drive up to the intersection of Cowpens Drive where it is again reduced to 10" Ø.

There are secondary 6", 8", 10" and 12"Ø PVC pipe branches into the existing residential zones.

All the existing main pipelines on this section were installed in 1990, replacing old existing ones.

Improvements

From the hydraulic model results it was determined that the 10", 12" and 14" Ø PVC pipes have flow capacities that are adequate for the expected demand of Zone 10.

The peak demands can be achieved without producing low pressures. The current system will be able to provide the capacity and pressures for the future development with only minor upgrades.

No pipes substitutions will be needed in order to maintain a minimum pressure in the system of 60 psi.

All existing fire hydrants along the F.D.R. Drive shall be relocated due to the proposed widening of the road section.

The existing secondary 6", 8" and 10"Ø pipe portions inside the existing residential areas shall be abandoned or discarded for future uses. Their location will interfere with the proposed zone developments.

Zone 11 (Ceiba Park)

This Zone encompasses the development of a community gateway with concessions, office and a pier.

Currently there is no water service on Los Machos Road or on the access Road to Gate No. 1 entrance.

Improvements

Water service for this zone can be obtained from the proposed 12" Ø water main to be installed by the Ports Authority for the Airport.

The installation of a 2"Ø PVC pipe interconnected to the proposed water main shall be considered.

This connection will be more efficient because the closest main pipeline inside the base is located at approximately 5 kilometers at the intersection of Tarawa Drive and Forrestal Drive.

Hydraulic Evaluation of the Water System Capacity

A hydraulic analysis was performed to evaluate the capacity of the existing distribution system to account for future development and subsequent increment in water demand.

A computerized hydraulic model was constructed using EPANET, a public software package for modeling the hydraulic and water quality behavior of water distribution systems over an extended period of

time. EPANET was developed for the U.S. Environmental Protection Agency, (U.S.EPA). The software allows tracking the pipes' flow, checking the pressure in the nodes, model constant or variable speed pumps, it can assist in evaluating alternatives to operate the distribution system between other capabilities.

In the present analysis, the software was used to evaluate the existing pipes' capacity to satisfy the demands for the future development planned for Roosevelt Roads Base without affecting pressures in the system. The obtained water pressures along the system were in the 30 to 100 psi range.

Alternative of Supply Analyzed

Different scenarios or alternatives to supply the water distribution system were modeled, to verify if the pipes have the capacity to convey water without affecting the pressure in the different nodes, or areas.

A scenario where the existing WTP will be operating with upgrades and expanded capacity was considered. After discussions and meetings with PRASA and the LRA, this option was discarded as both agencies are not interested in maintaining the WTP, due to high operating costs.

For that reason scenarios were the Puerto Rico Aqueduct and Sewer Authority System (PRASA) is the main source of water to satisfy the demands were considered.

The connection to the PRASA system was initially modeled considering a 12" pipe, under construction by the Puerto Rico Ports Authority (PRPA) (estimated completion at the end of year 2012) to serve the Airport located in Roosevelt Roads premises. The proposed pipe will run along Tarawa Drive, up to PRPA's property limits. From there, it will run a 10" diameter pipe along Boxer Drive, and into Leyte Drive's proposed tank. The minimum pressure at the connection point was assumed 30 psi.

As mentioned on the engineering report titled "Main Water Feeder, Fire Protection, and Sanitary System, Ceiba International Airport" prepared for the PRPA by PBS&J Caribe, LLP in the 2010 year, the Airport future water demand will be initially of550 gpm (0.79 MGD), with a future expansion up to of 1,100 gpm (1.6 MGD).

The existing PRASA infrastructure at the connection point (on State Road PR-3) is also a 12" diameter main, thus a further hydraulic analysis is recommended to verify if the PRASA system needs additional improvements to provide the water and minimum pressure required at the connection point.

The summary of the initial assumptions for this scenario were as follows:

Short-Term

- Source of Water: PRASA shall provide the water to supply the initial years (2012-2015) of Phase 1 of the Roosevelt Roads Re-development and for the Airport through the Airport New Potable Water Distribution System for a total of 0.79 MGD.
- The main pipes under construction by the PRPA to supply the Airport, are 12" and 10" pipes. Those pipes will be used to convey the total water needed for the project, on the short term.
- The proposed Airport Booster station and Tank shall deliver the necessary pressure (100 psi).
- Tacán and Bundy Tanks will operate in floating mode in the system. (In this type of storage operation, water can flow freely into and out of the tank as needed to satisfy demands).
- None of the pumps were modeled (those pumps do not affect the general system operation).

Long-Term

- Source of Water: PRASA shall provide the water to supply the remaining phases of the Roosevelt Roads Re-development and for a total of 4.0 MGD.
- The connection to the Airport tank and booster pump established on the short term will be shut down.
- A new main 9,900 meters, 20" pipe feeder from PRASA connection point at the Fajardo WTP to the interconnection with the existing distribution system in the intersection between Tarawa Drive and Forrestal Drive was modeled.
- This scenario assumes that the minimum pressure that PRASA will provide at the connection point with the Roosevelt Road Development shall be 30 psi
- A booster pump station is proposed at the connection point to supply water to the system and Tacán Tank
- Tacán and Bundy Tanks will be floating in the system
- None of the existing booster pumps inside the Base were modeled (those pumps do not affect the general system operation).

Results from this scenario:

- The 20" pipeline modeled has the capacity to convey the water demands for the complete redevelopment demand (4.0 MGD).
- A Pit tank and a new booster pump station with a capacity of Q=4.0 MGD and TDH= 350 ft is recommended close to the connection point due to the assumption that PRASA cannot provide enough pressure at the connection point.

Recommendations for Water Distribution

From the different scenarios included in the hydraulic modeling and analysis process, it was determined that the most efficient and economical alternative for the re-development process will be the implementation of the recommendations listed below.

- Shutdown and "mothball" existing Water Treatment Plant.
- Maintain raw water intake and close discharge valves.
- Maintain raw water reservoir, with minor repairs.
- The existing pipes have the hydraulic capacity to convey the future water demands, and can be maintained.
- From a comparison between the existing WTP current production rates (0.50 MGD) and the estimated current demand (0.04 MGD), there are signs of major leaks along the water system that must be repaired. A leak study shall be performed by the LRA.
- Perform minor repairs to Tacan and Bundy Tanks.
- Relocate valves and hydrants affected by road widenings.
- Re-open currently closed valves interconnecting the Airport system (2-12" pipes) in order to satisfy short term demands.
- The 12" pipe proposed to serve the Airport by the PRPA only have the capacity to convey the total flow from the Airport and Roosevelt Roads future facilities up to the year 2015.
- Install a new 20" pipe, tank and booster pump station connected to PRASA Fajardo WTP system to supply the 4.0 MGD demand.
- The existing Booster Pump Station 2360 should be improved to supply the future facilities to be located in the Zone 3, currently the Base Communications Building Site.
- The existing 2380 (2361) pump station on Bundy area shall be improved. This pump shall be normally off and shall be used only when the pressures in Bundy area being low or if is necessary to fill Bundy tank faster.
- Developers shall install fire protection systems on their developments according to current codes
- Developers shall install pressure-reducing valves at their connection points with the existing distribution system, as needed.
- Additional hydraulic analysis is recommended to verify the PRASA's system capacity and the necessity of a new pipeline.

3.2.3 Wastewater

An effective sanitary sewer collection and treatment system is essential to the safety and well-being of humans. It is the essential to provide a constant and efficient sanitary sewer collection and treatment system that result in a high quality effluent that can be returned to the environment without adverse impact. In fact, when wastewater is reused as reclaim water, it protects the environment by helping to conserve water. Also, effective sanitary sewer systems help minimize the need for septic tanks, which cannot achieve the same level of highly effective treatment provided by treatment plants. The collection, treatment, and disposal of domestic wastewater are key factors for a sustainable development.

By a combination of improvements to the existing system and the provision of new pipelines, lift stations and connections, the future demands can be satisfied. This can only be accomplished in conjunction with the support provided by the Puerto Rico Aqueduct and Sewer Authority (PRASA).

Although during the Base operation, the wastewater collection and treatment systems were fully independent from the PRASA system, it is expected that a service connection with PRASA, will provide redundancy and economies in the operation of the whole system.

The existing wastewater infrastructure was inventoried to identify the quantity and capacity of the pipelines, lift stations and wastewater treatment plants (WWTP's). This information was analyzed to establish existing system reliability and recommendations for future improvements. This section provides an overview of the design factors, assumptions, and recommendations discussed within the Master Plan.

System Demands

The first step in the design of the improvements to the sanitary sewage system is the determination of the quantity of wastewater that will be produced, with provision for the estimated requirements for the future.

In terms of total quantity, the wastewater production in a community is usually estimated on the basis of per capita demand. The variations in demand depend on geographic location, climate, size of the community, extent of industrialization, and other factors. In terms of how the total wastewater is produced within a community throughout the day, perhaps the best indicator is land use.

The Zones and their respective Land Uses were defined in the 2010 Addendum to 2004 Reuse Plan, and subsequent program revision of June 18, 2010. The proposed land uses incorporate any future growth for a period of 25 years from the start of the redevelopment process. The projected uses, development areas and other factors such as number of hotel rooms, number of passengers on ship terminal facilities, number of classrooms on educational facilities, were obtained. By using that information in conjunction with the estimated wastewater production rates, the estimated wastewater quantities can be calculated.

The estimated wastewater production rates for Puerto Rico are indicated on the Design Norms Regulation or "*Reglamento de Normas de Diseño*", 2003 Edition published by the Puerto Rico Aqueduct and Sewer Authority (PRASA). This Regulation provides the major wastewater production rates by land use types. Because this Regulation does not specify the wastewater production rates for all the possible uses in the redevelopment, other regulations were also used, such as the Typical Rates of Water Use form "*Wastewater Engineering, Treatment, Disposal Reuse*" published by Metcalf and Eddy (1991).

From the performed calculations it was determined a maximum wastewater generation of approximately 3.1 Million Gallons per Day (MGD), when the project is fully developed.

The wastewater quantities for each specific land use inside each development zone where calculated and are presented here on Table 8 and Table 9.

Table 8: Wastewater Generation by Zone

Location	Projected Use	Development Area (Gross Square Feet)	Dev. Area (cuerda)	Hospital Beds	Hotel Rooms	Dwelling Units	Students	Boat Slips	Passengers / Visitors	Generation Rate per Day	Wastewater Generation (GPD)
Port Caribe	**Commercial Heart**										
	Retail/ Restaurants/ Entertainment District	700,000								0.25 gallons/sq. ft.	50,000
	Hospital	130,000		85						300 gallons/bed	25,500
	Offices	50,000								300 gallons/1,000 sq. ft.	15,000
	Marina	75,000						400		30 gallons/boat slip	12,000
	International Cruise Terminal	150,000							1,500	5 gallons/passenger	7,500
	Industrial/ Back of House	50,000	1.15							6000 gallons/acre	6,887
	National Guard Boat Ramp	9,500								300 gallons/1,000 sq. ft.	2,850
	Homeland Security Boat Ramp	2,500								300 gallons/1,000 sq. ft.	750
	Ferry Terminal	50,000							1,200	5 gallons/passenger	6,000
	Zone Total	**667,000**								**Zone Total =**	**126,487**
Caribbean Riviera	**Destination Anchor**										
	Casino	210,000								300 gallons/1,000 sq. ft.	63,000
	Casino Hotel	2,000,000			2,000					525 gallons/room	1,050,000
	Retail/ Restaurants/ Entertainment	700,000								0.25 gallons/sq. ft.	50,000
	Cabras Island (Coast Guard)	2,000								300 gallons/1,000 sq. ft.	600
	Wastewater Treatment Plant	1,000								300 gallons/1,000 sq. ft.	300
	Zone Total	**2,413,000**								**Zone Total =**	**1,163,900**
El Yunque Grande	**Premier Eco-Tourism Resort**										
	Hotels- "Lodge"	170,000			150					525 gallons/room	78,750
	Eco Museum/Visitor's Center	50,000								0.25 gallons/sq. ft.	12,500
	Offices	30,000								300 gallons/1,000 sq. ft.	9,000
	Retail/ Restaurants/ Entertainment "Village"	100,000								0.25 gallons/sq. ft.	25,000
	Residential Villas	450,000				200				350 gallons/dwelling unit	70,000
	Marina	25,000						200		30 gallons/boat slip	6,000
	US Army Reserve/ National Guard	46,500								300 gallons/1,000 sq. ft.	13,950
	Armed Forces Reserve Center	72,000								300 gallons/1,000 sq. ft.	21,600
	Water Taxi Terminal/ Pier	20,000							600	5 gallons/passenger	3,000
	Zone Total	**913,500**								**Zone Total =**	**239,800**
Marsh Vista	**Golf/Country Club Amenity**										
	18 Hole Golf Course										
	Clubhouse and Dining	35,000								300 gallons/1,000 sq. ft.	10,500
	Residential	250,000				125				350 gallons/dwelling unit	43,750
	Zone Total	**285,000**								**Zone Total =**	**54,250**
Eco-Outpost Camp	**Environmental Retreat**										
	Dining/ Conference	25,000								300 gallons/1,000 sq. ft.	7,500
	Lodging	100,000			100					525 gallons/room	52,500
	Offices/ Research	25,000								300 gallons/1,000 sq. ft.	7,500
	Zone Total	**150,000**								**Zone Total =**	**67,500**

Table 9: Wastewater Generation by Zone (cont.)

Location	Projected Use	Development Area (Gross Square Feet)	Dev. Area (acres)	Hospital Beds	Hotel Rooms	Dwelling Units	Students	Boat Slips	Passengers / Visitors	Generation Rate per Day	Wastewater Generation (GPD)
Airport Uplands	**Collateral Development**										
	Airport, Government, Military	250,000	5.74							6000 gallons/acre	34,436
	Industrial/ Warehouse	250,000	5.74							6000 gallons/acre	34,436
	Specialty Industrial	200,000	4.59							6000 gallons/acre	27,548
	Office	75,000								300 gallons/1,000 sq. ft.	22,500
	Residential	250,000				100				350 gallons/dwelling unit	35,000
	18-hole Golf Course										
	Clubhouse	35,000								300 gallons/1,000 sq. ft.	10,500
	Radar Station	1,025								300 gallons/1,000 sq. ft.	308
	PotableWater Treatment Plant	3,800								300 gallons/1,000 sq. ft.	1,140
	Zone Total	**1,064,825**								**Zone Total =**	**165,867**
Main Street	**Town Center**										
	Educational Facilities/ Schools	80,000					530			70 gallons/student	10,600
	Office	100,000								300 gallons/1,000 sq. ft.	30,000
	Retail, Restaurant, Entertainment	400,000								0.25 gallons/sq. ft.	100,000
	Residential	1,450,000				650				350 gallons/dwelling unit	227,500
	Industrial/ Back of House / Support Services	200,000	4.59							6000 gallons/acre	27,548
	Hotel	370,000			400					525 gallons/room	210,000
	Community College	200,000					1300			70 gallons/student	26,000
	Coast Guard Pier	8,910								300 gallons/1,000 sq. ft.	2,673
	Zone Total	**2,758,910**								**Zone Total =**	**634,321**
Sports Core	**Community Sports**										
	9 Hole Golf Course										
	Clubhouse	15,000								300 gallons/1,000 sq. ft.	4,500
	Retail, Restaurant, Entertainment	30,000								0.25 gallons/sq. ft.	7,500
	Industrial	50,000	1.147851							6000 gallons/acre	6,887
	Office	50,000								300 gallons/1,000 sq. ft.	15,000
	Sports Complex/ Recreation Fields	200,000	4.59							2020 gallons/acre	9,272
	Residential	200,000				90				350 gallons/dwelling unit	31,500
	Zone Total	**545,000**								**Zone Total =**	**74,659**
Island Paradise	**Retreat, Conference, Learning**										
	Retail, Restaurant, Entertainment	50,000								0.05 gallons/sq. ft.	2,500
	Hotels	370,000			300					525 gallons/room	157,500
	Back of House / Support Services	50,000	4.59							6000 gallons/acre	27,540
	Conference/ Educational	500,000								300 gallons/1,000 sq. ft.	150,000
	Zone Total	**920,000**								**Zone Total =**	**337,540**
Capeheart	**Residential/ Corporate**										
	Corporate/ Institutional	500,000								300 gallons/1,000 sq. ft.	150,000
	Retail, Restaurant, Entertainment	50,000								0.25 gallons/sq. ft.	12,500
	Residential	650,000				300				350 gallons/dwelling unit	105,000
	Zone Total	**1,200,000**								**Zone Total =**	**267,500**
Ceiba Park	**Gateway**										
	Concessions	10,000								300 gallons/1,000 sq. ft.	3,000
	Office	20,000								300 gallons/1,000 sq. ft.	6,000
	Pier	25,000								300 gallons/1,000 sq. ft.	7,500
	Zone Total	**55,000**								**Zone Total =**	**16,500**
										TOTAL WASTEWATER DISCHARGE=	**3,148,324**

Gravity Collection System

From the assessed analysis the main findings are:

- Most of the existing gravity sewer lines are non-compliant with PRASA regulations regarding minimum slopes and maximum distance between manholes.
- Existing manholes do not comply with safety regulations regarding location and cover protection.
- Some segments do not have the adequate capacity to handle the proposed development future flows.

Based on those findings it is recommended that all the main gravity sewer lines located on the principal road corridors be substituted with a new sewer collection system.

In addition new gravity sewer systems shall be installed on portions of Zones 2, 3, 4, 6 and 8, on their respective main road corridors in order to provide a main collection system to the proposed individual developments on those areas.

The new systems will be located along the main roads corridors or their respective right of ways, and shall be designed in according with current PRASA regulations.

It will be the responsibility of individual developers to provide the adequate collection systems on their respective developments, and to provide a connection either by gravity or by force lines, to the new main lines to be installed.

Lift Stations and Force Lines

Currently all the lift stations are kept out of operation and would need to be retrofitted and rehabilitated in order to provide the required service for the proposed demand loads.

The improvements to all the lift stations shall include:

- Replacing of leaking or broken pumps
- Installation of new electrical panels
- Installation of telemetry and alarm systems
- Installation of automatic control systems
- Installation of new emergency generators
- Installation of dry pit sump pump systems
- Vault doors corroded and non-working
- Definition of new" buffer" or setback zones
- Installation of trolley hoists for pumps servicing or removal
- Structural upgrades of lift stations
- Increase in lift stations parcel areas for compliance with PRASA Regulations

In addition to the existing lift stations, new lift stations shall be developed on the following zones:

- New lift station at the current location of the Bundy WWTP on Zone 9 to collect all the wastewater generated on that zone
- New lift station at the current location of the Capehart WWTP on Zone 10 to collect all the wastewater generated on that zone
- New lift station on Langley Drive near the intersection with FDR Drive on Zone 7 to collect all the wastewater transferred from the new lift stations on zones 9 and 10

Other lift stations improvements include:

- Increase capacity of lift station 1999 on Bennington Road, to handle the expected flows from Zone 8
- Increasing the capacity of Lift Station 39 on Zone 1, to handle the expected flows from other zones

New force lines shall be installed on the following zones:

- New force line from the proposed Bundy Lift Station to the proposed lift station on Zone 7
- New force line from the proposed Capehart Lift Station to the proposed lift station on Zone 7
- New force line from the proposed Zone 7 Lift Station to the Lift Station 39 on Zone 1
- New force line from Lift Station 39 on Zone 1 to PRASA connection point

Wastewater Treatment Plants

Currently the existing three wastewater treatment plants (WWTP) inside the base, are not operating and all the generated wastewater is being collected by Tank Trucks and disposed on adequate facilities outside the Base. The recommendations for the WWTP's under the redevelopment are discussed here.

A scenario where the existing Forrestal WWTP will be operating with upgrades and expanded capacity was considered. After discussions and meetings with PRASA and the LRA, this option was discarded as both agencies are not interested in maintaining the Forrestal or a new WWTP, due to high operating costs.

For that reason scenarios were the Puerto Rico Aqueduct and Sewer Authority System (PRASA) is the main source of wastewater treatment to satisfy the demands were considered.

Forrestal WWTP

Forrestal WWTP is located east of the Base, to the southeast of the Forrestal sector, north of the Base Landfill, on Zone 2. It has a capacity of 0.97 MGD.

One of the alternatives for the redevelopment was to re-open this WWTP, but PRASA recommended keeping this WWTP out of operation. In addition, its location within the Hotel/Casino Golf development area on Zone 2, would have created logistic and aesthetic issues that should have been addressed.

Currently the WWTP is out of operation. Under the redevelopment, this WWTP will be eliminated.

Capehart WWTP

Capehart WWTP is located southwest of the Base, to the southeast of the Capehart sector, on zone 10. It has a capacity of 0.66 MGD.

Currently the WWTP is out of operation. Under the redevelopment, this WWTP will be eliminated and converted to a centralized Lift Station to handle and transfer all the wastewater generated on Zone 10.

Bundy WWTP

Bundy WWTP is located southwest of the Base, to the southeast of the Bundy sector on Zone 9. It has a capacity of 0.66 MGD.

Currently the WWTP is out of operation. Under the redevelopment, this WWTP will be eliminated and converted to a centralized Lift Station to handle and transfer all the wastewater generated on Zone 9.

Hydraulic Evaluation of the Wastewater System Capacity and Wastewater Treatment Alternatives

Hydraulic analysis was performed to evaluate the capacity of the existing wastewater collection system to account for future development and subsequent increment in wastewater demand.

A computerized hydraulic model was constructed using Hydraflow Sewers, a software package for modeling the hydraulic behavior of sewer collection systems. Hydraflow was developed by Intellisolve Software.

In the present analysis, the software was used to evaluate the existing pipes' capacity to satisfy the demands for the future development planned for Roosevelt Roads.

Alternatives of Wastewater Treatment Analyzed

Different scenarios or alternatives to provide wastewater treatment were considered;

New WWTP

An alternative that was considered is to eliminate the Forrestal WWTP, due to its location adjacent to the proposed Hotel/Casino development are on Zone 2.

Under this scenario, a new 3.5 MGD WWTP would be located at the existing location of the athletic fields and facilities on Forrestal Drive near the Tank Farm. In addition a new discharge pipeline should have been installed, up to the existing discharge point of the Forrestal WWTP, at Ensenada Honda.

This alternative was discussed with PRASA, but they recommended discarding it mostly because of the time consuming process (3-5 years) of obtaining all the necessary environmental permits such as the EPA discharge permit. In addition, PRASA is not in the position to operate and maintain a new WWTP in the Fajardo region.

PRASA Connections

For the reasons already stated, scenarios were the Puerto Rico Aqueduct and Sewer Authority System (PRASA) is the main source of wastewater treatment to satisfy the demands were considered.

The connection to the PRASA system will be considered initially thru a 15" gravity sewer pipe, under construction by the Puerto Rico Ports Authority (PRPA) (estimated completion at the end of year 2012) to serve the Airport located in Roosevelt Roads premises. The proposed PRPA system will run along Tarawa Drive and inside PRPA's property limits. From there, it will discharge at a proposed lift station into the Airport and then thru a 10" forceline up to the former Ceiba WWTP.

As mentioned on the engineering report titled "Main Water Feeder, Fire Protection, and Sanitary System, Ceiba International Airport" prepared for the PRPA by PBS&J Caribe, LLP in the 2010 year, the Airport future wastewater demand will be initially of 750 gpm (1.08 MGD), with a future expansion up to of 1,000 gpm (1.44 MGD).

It is recommended that the LRA verifies with PRASA if the connection point at the former Ceiba WWTP needs additional improvements in order to provide the required capacity.

The summary of the initial assumptions for this scenario were as follows:

Short-Term

- Source of Water: PRASA shall provide the wastewater treatment for the initial years (2012-2015) of Phase 1 of the Roosevelt Roads Re-development and for the Airport through the Airport New Sanitary Sewer System for a total of 1.08 MGD.
- A new 2,500 meters, 12" sewer forceline from Lift Station 39 on Zone 1 up to the Airport gravity sewer system at the Aviation School connection point is considered.
- The main pipes under construction by the PRPA to supply the Airport, is a 15" gravity sanitary sewer pipes and a 10" forceline. Those pipes will be used to convey the total wastewater generated by the project, on the short term.
- The proposed Airport Lift Station and forceline shall have the required capacity.

Long-Term

- Source of Water: PRASA shall provide the wastewater treatment for the remaining phases of the Roosevelt Roads Re-development for a total of 3.1 MGD.
- The connection to the Airport gravity sewer system installed on the short term will diverted to a new system.
- A new 10,100 meters, 12" sewer forceline from the Airport short term connection point up to the PRASA connection point at the Fajardo WWTP is considered.

Results from this scenario:

- The 12" forceline modeled has the capacity to convey the wastewater demands for the complete redevelopment (3.1 MGD).
- The refurbished Lift Station 39 should have the capacity to handle the 3.1 MGD.

Recommendations for Wastewater System

From the different scenarios included in the hydraulic modeling and analysis process, it was determined that the most efficient and economical alternative for the re-development process will be the implementation of the recommendations listed below.

- Replace the existing gravity collection sewers on all main corridors, to have adequate hydraulic capacity to convey the future wastewater demands and to comply with PRASA Standards and regulations.
- Install new gravity collection sewers on portions of Zones 2, 3, 4, 6 and 8, on their respective main road corridors in order to provide a main collection system to the proposed individual developments on those areas.
- Demolish Forrestal WWTP
- Convert Bundy and Capehart WWTP's into centralized Lift Stations to handle and transfer all the wastewater generated on Zones 9 and 10.
- Develop a new lift station on Langley Drive near the intersection with FDR Drive on Zone 7 to collect all the wastewater transferred from the new lift stations on zones 9 and 10.
- Install force lines from new Bundy and Capehart Lift Stations up to the new lift station on Zone 7.
- Install force lines from new lift station on Zone 7 up to Lift Station 39 on Zone 1.
- Perform minor repairs to existing lift stations.
- Re-furbish and expand Lift Station no. 39 on Zone 1 to a maximum capacity of 3.1 MGD.
- Install a new 2,500 meters, 12" sewer forceline from Lift Station 39 on Zone 1 up to the Airport gravity sewer system at the Aviation School for PRASA service on the short term up to the year 2015.
- Install a new 10,100 meters, 12" sewer forceline from the Airport short term connection point up to the PRASA connection point at the Fajardo WWTP on the long term.
    - Additional hydraulic analysis is recommended to verify the PRASA's system capacity and the necessity of the new pipelines.

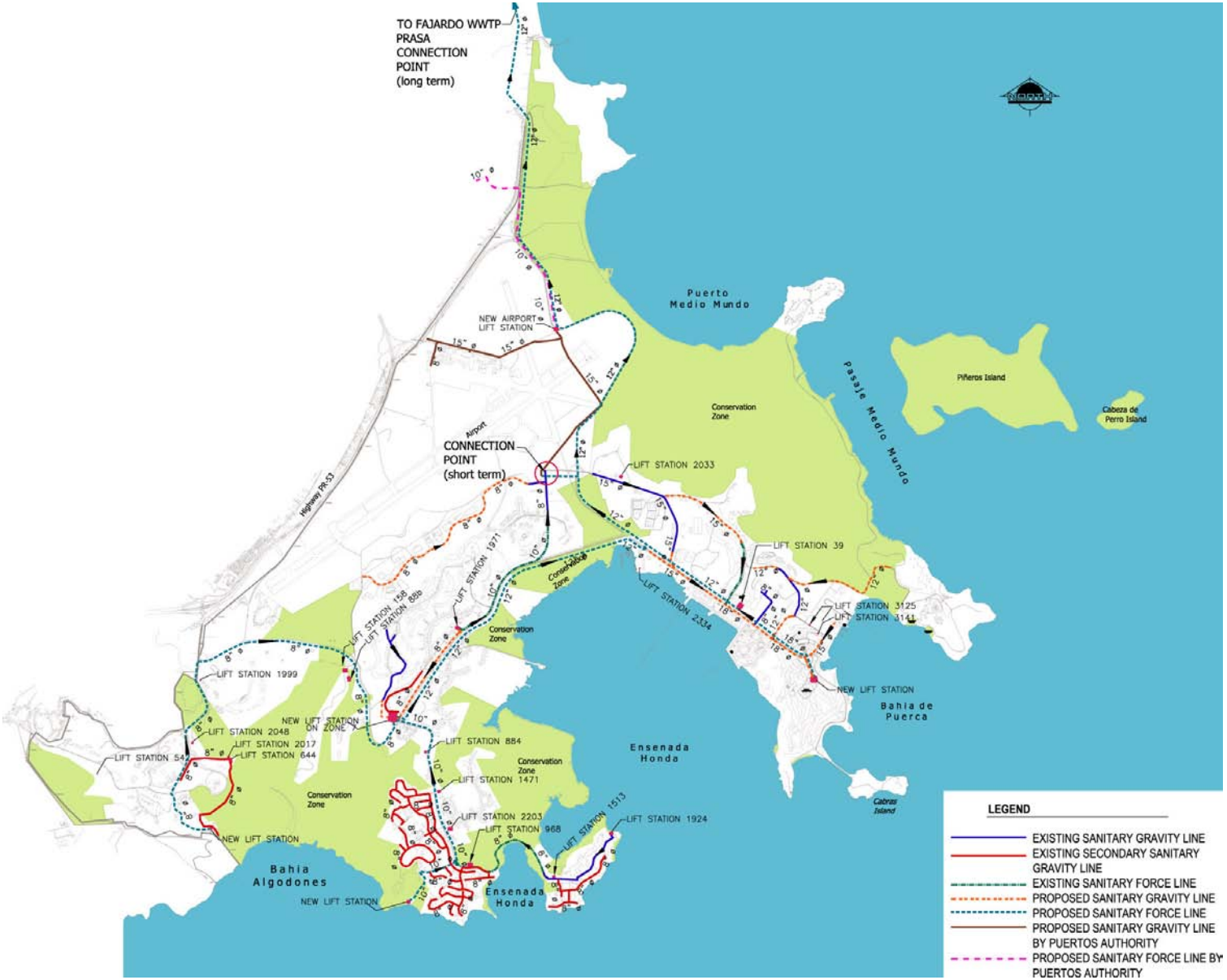


Figure 80: Proposed Wastewater System

3.2.4 Stormwater

As mentioned on the assessment of the existing infrastructure, the collection and disposal systems for stormwater at Roosevelt Roads are mainly composed of a series of surface systems that transport runoff through pipe culverts, box culverts, earth ditches and channels.

Due to the fact that a vast majority of those systems are located on existing road corridors, they will be affected by the improvements recommended on those corridors.

In addition to the improvements to the existing systems, there is a need to develop new stormwater infrastructure on waterfront areas where new developments are contemplated, especially on Zones 1 and 2. The new developments will create an obstruction to the natural drainage patterns thus new systems shall be considered to address this situation.

Other factor to take into account is the lack of adequate runoff quantity and quality control systems that shall comply with State and Federal regulations. It is essential to consider the provisions of available land parcels, so individual developers can install their quantity and quality control systems on those areas.

Also it is important to maintain the location of the existing regulated and non-regulated outfalls at fresh water bodies such as wetlands and creeks and to salt water bodies such as mangroves and the ocean, in order to not disrupt the natural drainage patterns and the delicate ecosystems on those water bodies.

Culvert, Channels and Ditches Systems

The existing culverts, channels and ditches systems shall be maintained on their current locations. The majority of those systems has the hydraulic capacity for the management of 25 years frequency storm or flood events. Depending on their location, the capacity can be increased and other improvements shall be performed.

The recommended improvements are the following:

- Replace or rehabilitate corroded corrugated metal pipes
- Cleaning and rehabilitation of earth channels and ditches
- Cleaning and repair of culverts inlet and outlet headwalls
- Extension of culvert lengths according to road corridors widening's

Catch Basins, Inlets Systems

Currently the availability of catch basins or inlets is almost non-existent on the Base premises. Due to the development of new street corridors with their respective medians, curbs and sidewalks, it will be necessary to provide adequate storm sewer systems with catch basins and inlets on those improved areas.

The new systems to be considered are:

- New storm sewer systems shall be developed along Langley Drive on zones 6 and 7
- New storm sewer systems shall be developed along Forrestal Drive on Zones 1 and 2
- New storm sewer systems shall be developed along Corregidor Road on Zone 6
- New storm sewer systems shall be developed along FDR Drive on Zone 10

The systems shall be designed following drainage regulations required by the PR Highway and Transportation Authority and shall have the hydraulic capacity for the management of the 25 years frequency storm or flood events.

Stormwater Quantity and Quality Control

Currently the availability of quantity and quality control systems is non-existent on the Base premises. Due to the proposed redevelopment, it is essential to provide new systems for complying with Environmental Protection Agency (EPA) and State stormwater discharge regulations.

To prevent harmful pollutants from being washed or dumped into storm sewer systems, the LRA must obtain a National Pollutant Discharge Elimination System (NPDES) permit from the EPA and develop a stormwater management program. At the current master-planning phase, it would impractical to develop a stormwater management program for each zone. As the Master Plan evolves with more detailed information about specific developments on each zone, the stormwater management program shall be prepared.

The proposed redevelopment will produce an increase in stormwater runoff quantities that must be mitigated by implementing different systems such as: retention or detention ponds, underground recharge systems, pervious pavements and others. The systems shall be implemented on each individual development, by addressing the future projects' characteristics.

In addition as new areas are re-developed, the stormwater quality is also greatly reduced. This shall be addressed on each individual development, taking in consideration the specific physical characteristics for each future project.

In order to provide a more comprehensive and coordinated stormwater system, we recommend that the LRA implement the following as part of the stormwater infrastructure development:

- Parcels or easements shall be created within the Base, in order to provide adequate areas for developers to incorporate their specific quantity and quality control systems, before discharging into the stormwater infrastructure
- Develop guidelines for the design and implementation of stormwater quantity and quality mitigation measures
- Develop a stormwater management plan

The potential stormwater improvements are shown in Figure 81.

Recommendations for Stormwater System

From analysis process, it was determined that the most efficient and economical alternative for the re-development process will be the implementation of the recommendations listed below.

- Replace or rehabilitate corroded corrugated metal pipes.
- Clean and rehabilitate earth channels and ditches, culverts inlet and outlet headwalls
- Extend culvert lengths according to road corridors widening's.
- Install new storm sewer systems along Forrestal Drive on Zones 1 and 2, along Corregidor Road on Zone 6, along Langley Drive on zones 6 and 7and along FDR Drive on Zone 10.
- Maintain the location of the existing regulated and non-regulated outfalls at fresh water bodies such as wetlands and creeks and to salt water bodies such as mangroves and the ocean, in order to not disrupt the natural drainage patterns and the delicate ecosystems on those water bodies.
    - LRA must obtain a National Pollutant Discharge Elimination System (NPDES) permit from the EPA.
- Parcels or easements shall be created within the Base, in order to provide adequate areas for developers to incorporate their specific quantity and quality control systems, before discharging into the stormwater infrastructure

- Develop guidelines for the design and implementation of stormwater quantity and quality mitigation measures.
- Develop a stormwater management plan.

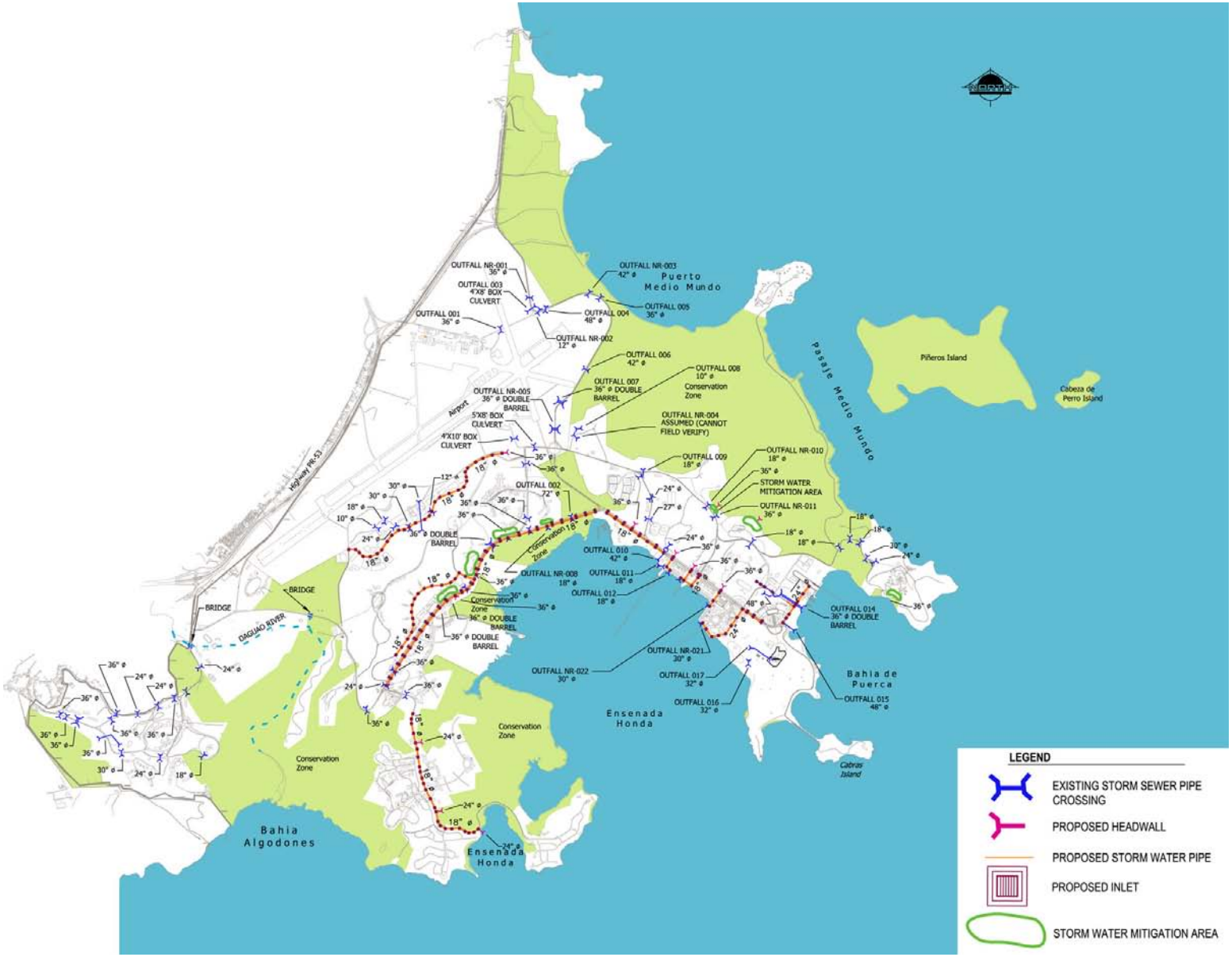


Figure 81: Potential Stormwater Infrastructure

3.2.5 Electricity Systems

Electrical System Requirement and Demands

The existing electrical system of Roosevelt Roads shall be improved in order to comply with the requirements of the Puerto Rico Electric Power Authority (PREPA), which will be owner of the system after a formal transfer is completed. The requirements were summarized on the "Transference Summary Report" prepared by PREPA on September 2010 (see Appendix at the end of this document).

In addition, major improvements must be considered due to the increased electrical load demand needed for the complete redevelopment.

An analysis was performed to determine the electrical load demands on the different zones. The estimated total expected electrical load for the Master Plan is approximately 100,000 KVA.

The electrical load demands for each specific land use inside each development zone where calculated and are presented here on Table 10 and Table 11.

Table 10: Electrical Load Demand by Zone

Zone	Location	Projected Use	Development Area (Gross Square Feet)	13.2 KV	38 KV
1	Port Caribe	**Commercial Heart**			
		Retail/ Restaurants/ Entertainment District	200,000	2,700	0
		Hospital	130,000	0	1,820
		Office	50,000	690	0
		Marina	25,000	13	0
		International Cruise Terminal	150,000	1,425	0
		Industrial/ Back of House	50,000	360	0
		National Guard Boat Ramp	9,500	5	0
		Homeland Security Boat Ramp	2,500	1	0
		Ferry Terminal	50,000	375	0
		18 Hole Golf Course			
		Zone Total	**667,000**	**5,569**	**1,820**
2	Caribbean Riviera	**Destination Anchor**			
		Casino	210,000	0	2,835
		Casino Hotel	2,000,000	0	23,000
		Retail/ Restaurants/ Entertainment	200,000	2,700	0
		Cabras Island (Coast Guard)	2,000	27	0
		Waste Water Treament Plan	1,000	750	0
		Zone Total	**2,413,000**	**3,477**	**25,835**
3	El Yunque Grande	**Premier Eco-Tourism Resort**			
		Hotels- "Lodge"	170,000	960	0
		Eco Museum/Visitor's Center	50,000	675	0
		Office	30,000	414	0
		Retail/ Restaurants/ Entertainment "Village"	100,000	1,350	0
		Residential Villas - Eco-lodge	450,000	2,048	0
		Marina	25,000	13	0
		US Army Reserve/ National Guard[1]	46,500	647	0
		Armed Forces Reserve Center[1]	72,000	994	0
		Water Taxi Terminal/ Pier	20,000	10	0
		Zone Total	**913,500**	**7,104**	**0**
4	Marsh Vista	**Golf/Country Club Amenity**			
		18 Hole Golf Course		300	0
		Clubhouse and Dining	35,000	354	0
		Residential	250,000	1,148	0
		Zone Total	**285,000**	**1,801**	**0**
5	Eco Outpost Camp	**Environmental Retreat**			
		Dining/ Conference	25,000	253	0
		Lodging	100,000	800	0
		Office/ Research	25,000	345	0
		Zone Total	**150,000**	**1,398**	**0**

Table 11: Electrical Load Demand by Zone (Cont.)

Zone	Location	Projected Use	Development Area (Gross Square Feet)	13.2 KV	38 KV
6	Airport Uplands	**Collateral Development**			
		Airport, Government, Military	250,000	0	3,450
		Industrial/ Warehouse	250,000	0	1,800
		Specialty Industrial	200,000	0	2,340
		Office	75,000	1,035	0
		Residential	250,000	1,148	0
		18-hole Golf Course		300	0
		Clubhouse	35,000	354	0
		Potable Water Treatment Plan	3,800	1,500	0
		Radar Station	1,025	14	0
		Zone Total	**1,064,825**	**4,350**	**7,590**
7	Main Street	**Town Center**			
		Educational Facilities/ Schools	80,000	970	0
		Office	100,000	1,380	0
		Retail, Restaurant, Entertainment	400,000	5,400	0
		Residential	1,450,000	0	6,548
		Industrial/ Back of House / Support Services	200,000	0	1,440
		Hotel	370,000	0	2,560
		Community College	200,000	90	2,000
		Coast Guard Pier	8,910	0	300
		Zone Total	**2,758,910**	**7,790**	**12,848**
8	Sports Core	**Community Sports**			
		9 Hole Golf Course		150	0
		Clubhouse	15,000	157	0
		Retail, Restaurant, Entertainment	30,000	405	0
		Industrial	50,000	360	0
		Office	50,000	690	0
		Sports Complex/ Recreation Fields	200,000	600	0
		Residential	200,000	973	0
		Zone Total	**545,000**	**3,129**	**0**
9	Island Paradise	**Retreat, Conference, Learning**			
		Retail, Restaurant, Entertainment	50,000	675	0
		Hotels	370,000	0	2,560
		Back of House / Support Services	50,000	150	0
		Conference/ Educational	500,000	0	5,750
		Zone Total	**920,000**	**825**	**8,310**
10	Capeheart	**Residential/ Corporate**			
		Corporate/ Institutional	500,000	0	2,273
		Retail, Restaurant, Entertainment	50,000	675	0
		Residential	650,000	2,948	0
		Zone Total	**1,200,000**	**3,623**	**2,273**
11	Ceiba Park	**Gateway**			
		Concessions	10,000	135	0
		Office	20,000	276	0
		Pier	25,000	13	0
		Zone Total	**55,000**	**424**	**0**
		Total Electrical Demand		**98,313**	
				39,638	**58,675**

Electrical System Improvements

There is a need to perform multiple improvements on the transmission and distribution systems to provide an efficient service for the redevelopment.

Due to the fact that the proposed total load demand exceeds the current available load, it is necessary to consider the construction of a new 115 KV/38 KV transmission center. This construction requires the cession to PREPA of a parcel of land of approximately 5 acres and a new easement of 200 feet width for new 115 KV transmission lines. A suggested location of this 115 KV substation is at the South of Langley Drive at Zone 8: Sport Complex Zone. The 115 KV line must be installed on an underground easement from the PREPA Daguao Transmission Center to this new parcel in order to avoid interference with the Airport Air Right of Way. See location of the new transmission center on Figure 82

In order to satisfy the need of the electrical load for the re-development, it is necessary to establish an electrical distribution comprised of sub-transmission voltage of 38,000 volts (38 KV) and distribution voltage 13,200 volts (13.2 KV). The use of 38,000 volts system is primarily for the industrial type loads greater than 1,500 KVA. The electrical loads at or below 1,500 KVA must be served by 13.2 KV distribution lines with private substations. The light commercial and residential electrical loads will be served by service voltages of 120/240 volts, 120/208 volts and 277/480 volts. Those services are possible through the distribution of 13.2 KV lines strategically located to serve the future loads.

The proposed Main Electrical System shall be composed of new 38 KV and 13.2 KV aerial electrical lines located on or adjacent to the main road corridors distributed throughout the Base.

There are two alternatives for the transmission and distribution systems at Langley Drive on Zones 6 and 7 and on Forrestal Drive on Zones 1 and 2. One option is to install underground transmission and distribution systems for maintaining the aesthetic look of these proposed urban and commercial areas. The other option is to install aerial transmission and distribution systems on those proposed urban and commercial areas, due to a lower installation cost when compared with underground systems. The improvements discussed here are shown on Figure 82 and Figure 83.

All other roads on the Base will have main sub-transmission and distribution aerial electrical lines. A vast majority of the existing electrical systems will be located on the existing aerial electrical systems right of ways.

Based on the estimated electrical load per zone, substations are needed to supply the electrical need. A total of 98,313 KVA estimated electrical load is needed where is divided as follows: 39,638 KVA at 13.2 KV and 58,675 KVA at 38 KV:

Table 12: Total Electrical Load Per Zone

Zone	Location	Estimated Electrical Load at 13.2 KV	Estimated Electrical Load at 38 KV	Total Estimated Electrical Load per Zone
1	Port Caribe	5,569 KVA	1,820 KVA	7,389 KVA
2	Caribbean Riviera	3,477 KVA	25,835 KVA	29,312 KVA
3	El Yunque Grande	7,104 KVA	0 KVA	7,104 KVA
4	Marsh Vista	1,801 KVA	0 KVA	1,801 KVA
5	Eco-Outpost Camp	1,398 KVA	0 KVA	1,398 KVA
6	Airport Uplands	4,350 KVA	7,590 KVA	11,940 KVA
7	Main Street	7,790 KVA	12,848 KVA	20,637 KVA
8	Sports Core	3,279 KVA	0 KVA	3,279 KVA
9	Island Paradise	825 KVA	8,310 KVA	9,135 KVA
10	Capeheart	3,623 KVA	2,273 KVA	5,896 KVA
11	Ceiba Park	424 KVA	0 KVA	424 KVA
	Total:	**39,638 KVA**	**58,675 KVA**	**98,313 KVA**

New main 38 KV and 13.2 KV electrical loops for all the loads to be connected in the future shall be considered. The electrical aerial loops would begin at the Main 115 KV Substation at Langley Drive; continue on Corregidor Road, Forrestal Drive, Antietam Road and Valley Forge Road. Then they will continue underground (if this option is selected) or aerial through Forrestal Drive and Langley Drive, until it connects again to the beginning point. The loops improvements discussed here are shown on Figure 84.

Strategically we need to locate the substations in order to supply this future electrical load spread in a 25 year development period. We recommend keeping the location and increasing the parcel sizes of the India, Charlie and Delta Substations as per PREPA recommendation of a minimum parcel of 2,000 square meters. The recommended substations capacities as per the zones areas are:

- 38KV/13.2KV Substation India improved to 12,000 KVA covering zones 1 (portion) and 2.
- 38KV/13.2KV Substation Charlie improved to 7,500 KVA covering zones 1 (portion) and 7 (portion).
- 38KV/13.2KV Substation Delta improved to 12,000 KVA covering zones 6 (portion) and 7 (portion).
- New 38KV/13.2KV 5,000 KVA Substation A to serve zones 6 (portion) and 11.
- New 38KV/13.2KV 10,000 KVA Substation B to serve zones 3, 4 and 5.

- New 38KV/13.2KV Substation Coral Sea improved to 7,500 KVA, from the existing 4.16 KV and shall be converted to 13.2 KV covering zone 10.
- New 38KV/13.2KV Substation Bundy improved to 7,500 KVA, from the existing 4.16 KV and shall be converted to 13.2 KV covering zones 8 and 9. Unless it kept as a private substation for the Federal Government, then a new substation of this capacity shall be constructed in this area.

The electrical systems needed inside each individual development areas, will be a responsibility of each individual developer according to their proposed layout.

Recommendations for Electrical System

From analysis process, it was determined that the most efficient and economical alternative for the re-development process will be the implementation of the recommendations listed below.

- Maintain PREPA's Daguao Transmission Center connection point.
- Install new 115 kV transmission line in substitution of the existing 38 kV line from PREPA's Daguao Transmission Center.
- Construct new 115 kV / 38 kV transmission center on Zone 8, near Daguao connection point.
- Construct 2 new 38 kV / 13.2k V substations to serve Zones 3, 4, 5 and 6.
- Convert existing 38kV / 4.16 kV to 38 kV / 132 kV on Zones 10 and Bundy.
- Upgrade all other existing Substations.
- Increase parcel size on all substations to comply with PREPA regulations.
- Replace all existing aerial 13.2 and 38 kV aerial loop systems with new upgraded 13.2 and 38 kV aerial systems on all zones main corridors to comply with PREPA Standards.
- Replace aerial 4.16 kV systems with new 13.2 kV systems on main corridor.
- Install new 13.2 and 38 kV underground systems on Zones 1, 2 and 7 (Forrestal and Langley Drives future commercial zones).

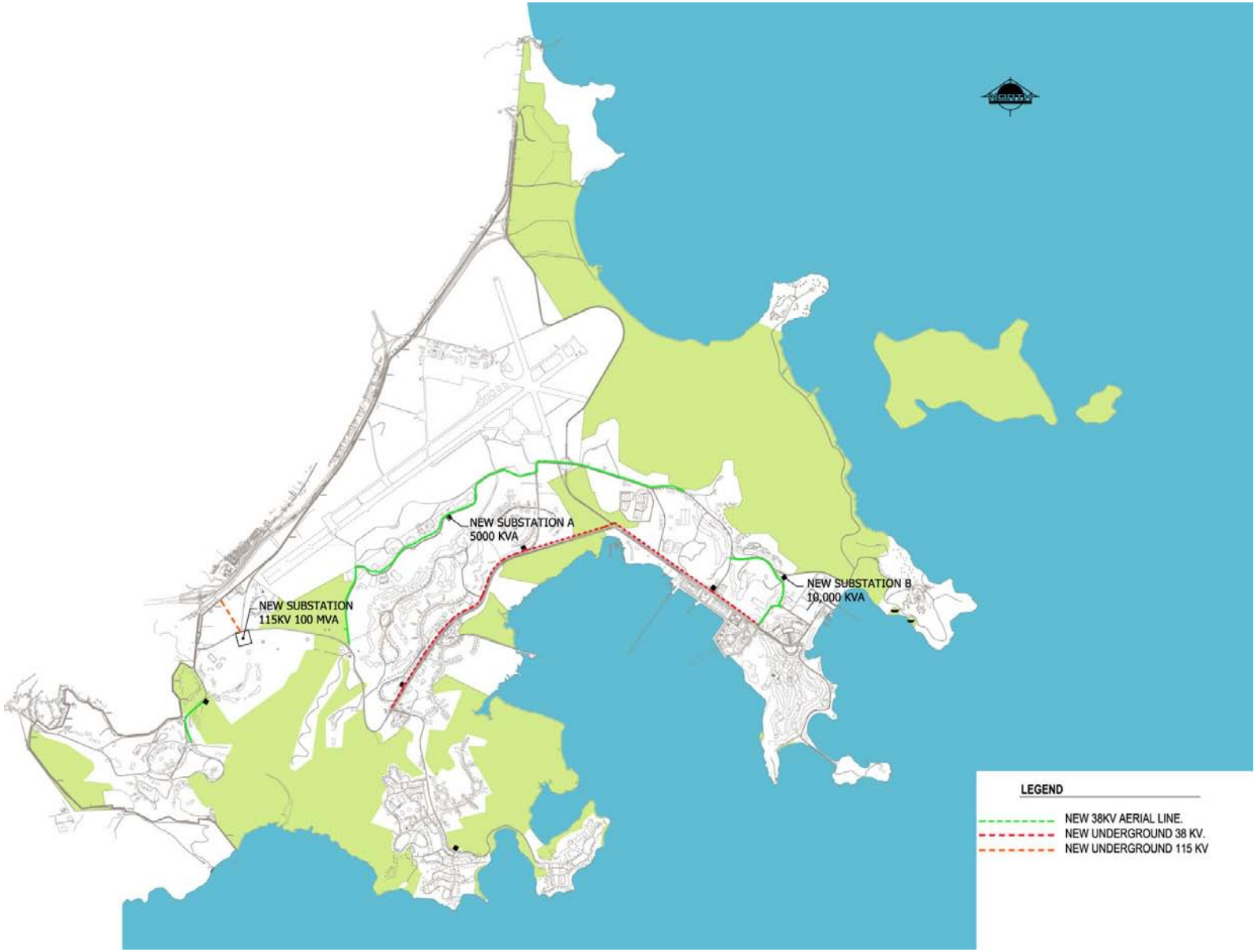


Figure 82: Proposed Electrical 38KV System

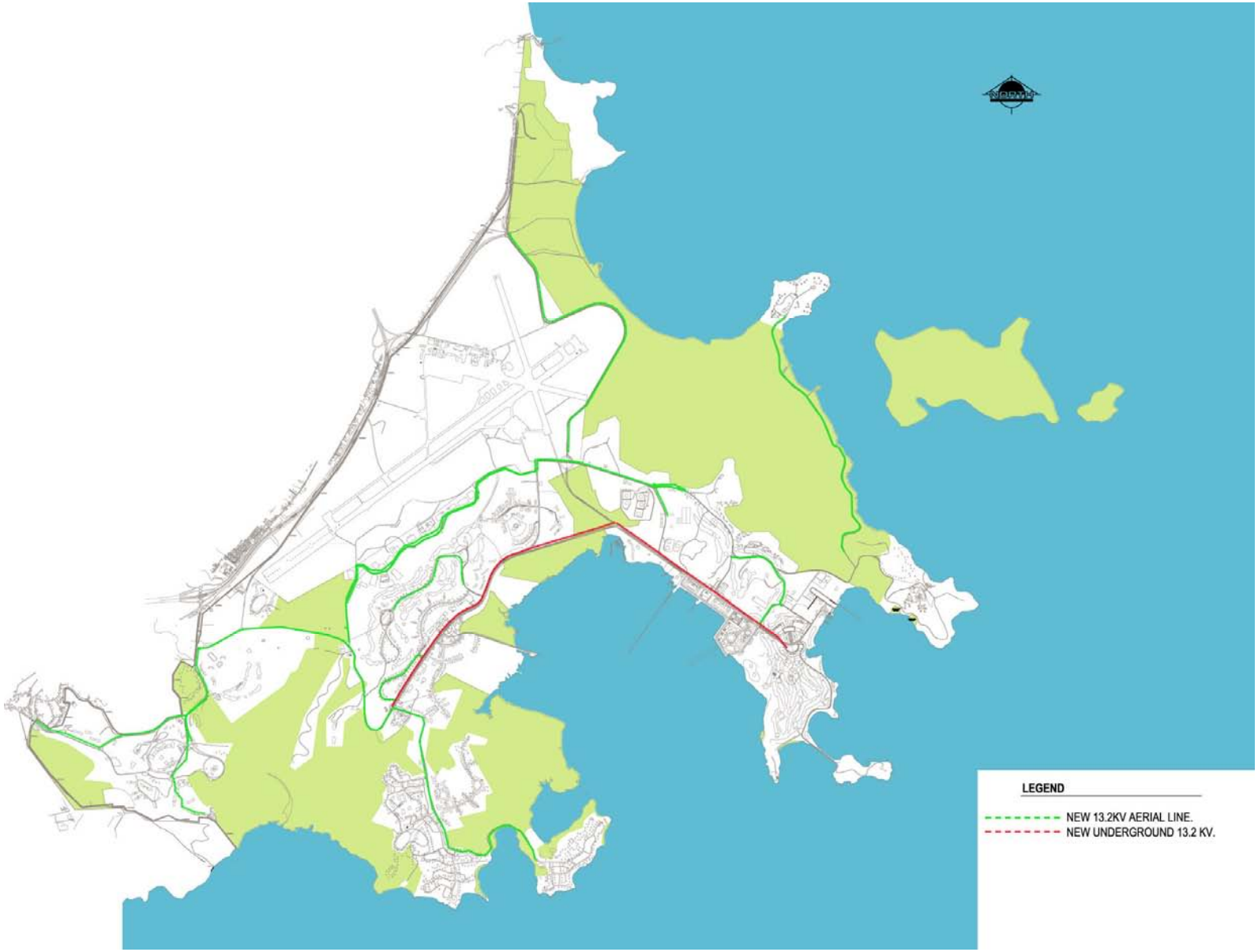


Figure 83: Proposed Electrical 13.2KV System

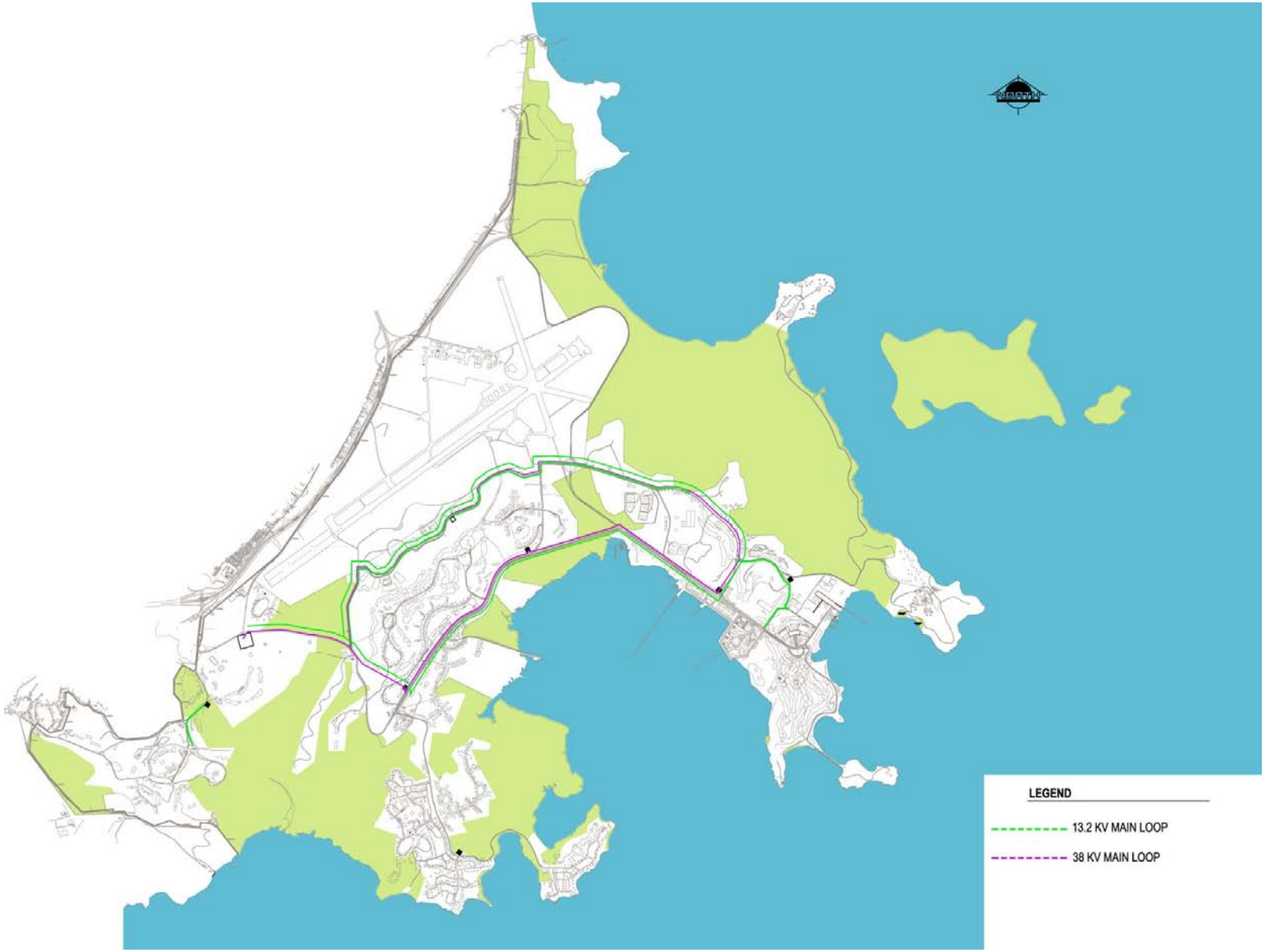


Figure 84: Proposed Electrical 13.2KV & 38KV Loop Systems

3.2.6 Telecommunication / Data Systems

Existing telecommunications/data infrastructure system does not comply with current State regulations. A new system shall be installed for the Roosevelt Roads redevelopment in order to comply with the requirements of the "Junta Reglamentadora de Telecomunicaciones de Puerto Rico" (JRTPR or PR Telecommunications Regulatory Board).

In addition, a new system must be considered due to the increased data/communications load demand needed for the complete redevelopment.

Also a new infrastructure right of way to be transferred to the JRTPR shall be created for the installation of the new system. This right of ways shall be established along existing and proposed road corridors. JRTPR need to make sure that all telecommunications providers will have access to this infrastructure to allow for the best competitive pricing and services to the customers.

An analysis was performed to determine the data/communications load demands on the different zones. As per a study of Bank of America on Subscriber Services and Bandwidth Demand (2005) a 20 Mb/s bandwidth is required for future need. See Figure 85,

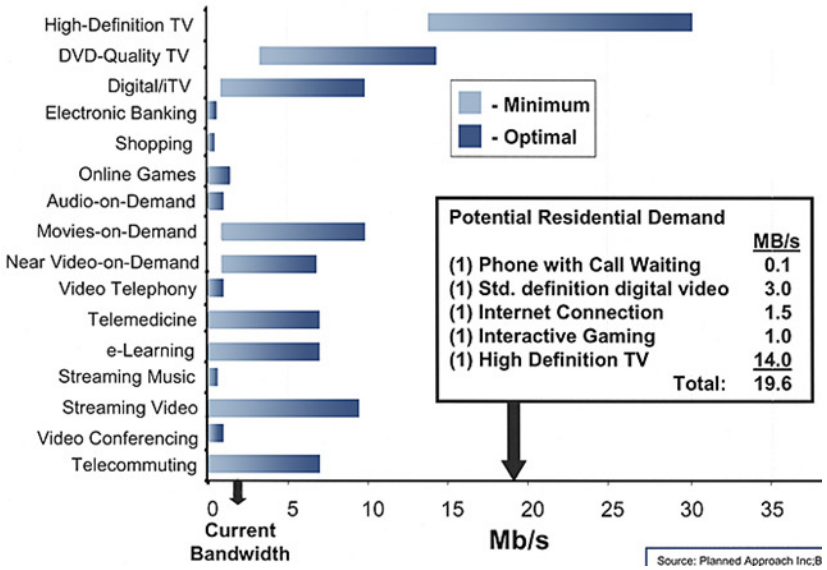


Figure 85: Subscriber Services & Bandwidth Demand (Bank of America)

In order for the telecommunication infrastructure to supply this need, a broadband optic fiber backbone network is required. JRTPR will requires the provision of the infrastructure easements and conduits installation in order that qualified providers can install the optic fiber and related equipment to create their own network for the future developments.

A redundant underground loop with two connection points (at Gates 1 and Gate 3) for all services providers shall be installed with 10 conduits of 4 inches diameter each and 8 conduits of 2 inches diameter each. This infrastructure will connect at a Main Central Building (1,000 square meter lot size) where it is going to provide a space for each of the qualified service providers of Puerto Rico to serve the communities with high speed internet, cable tv, telephone and other services. This will be possible through the installation of fiber optics cable (installed by the providers) from the points of connection in the outside of the main gates up to the Main Central

Building and then through different zones where new support facilities (approx. 500 square meters parcel size) will be strategically located as per the need of zone's developments. With this infrastructure a fiber path redundancy is created to help ensure failure free operation in spite of fiber cuts.

The basic infrastructure consist of the preparation of the Main Central Building (approximately 1,000 square feet), underground conduits as per details in phase construction, telecommunication manholes, lot preparation for the support facilities and cession of right of way under the name of JRTPR. Any qualified telecommunication provider must use the JRTPR infrastructure to install their central equipment and cables to service the new developments. The infrastructure improvements discussed here are shown on Figure 86.

The data/communications loads demand required by the different development zones shall be determined by the private carriers authorized by the JRTPR to provide services in the area such as CLARO, ATT and Liberty Cable. It is necessary to provide the infrastructure components in order for the service carries to install their lines and equipment. The existing system conditions, in addition to the requirements by the PRTRP solutions, and the cost analysis of the different alternatives, determine the recommendations for the telecommunications systems.

Recommendations for Telecommunications Systems

From analysis process, it was determined that the most efficient and economical alternative for the re-development process will be the implementation of the recommendations listed below.

- Maintain CLARO's Daguao connection point (Near Gate 3).
- Provide a new connection point on Gate 1, in order to provide a redundant loop.
- Request service and installations from authorized carriers and service providers.
- Replace and Construct new Main Telecommunications Center on Zone 7.
- Construct new distribution centers on Zones 2, 8 and 10.
- Replace all existing aerial and underground systems with new underground systems on all zones main corridors to comply with JRTPR Standards.
- Install new underground conduits and junction boxes along main corridors.
- Fiber optic lines shall be installed by service providers.

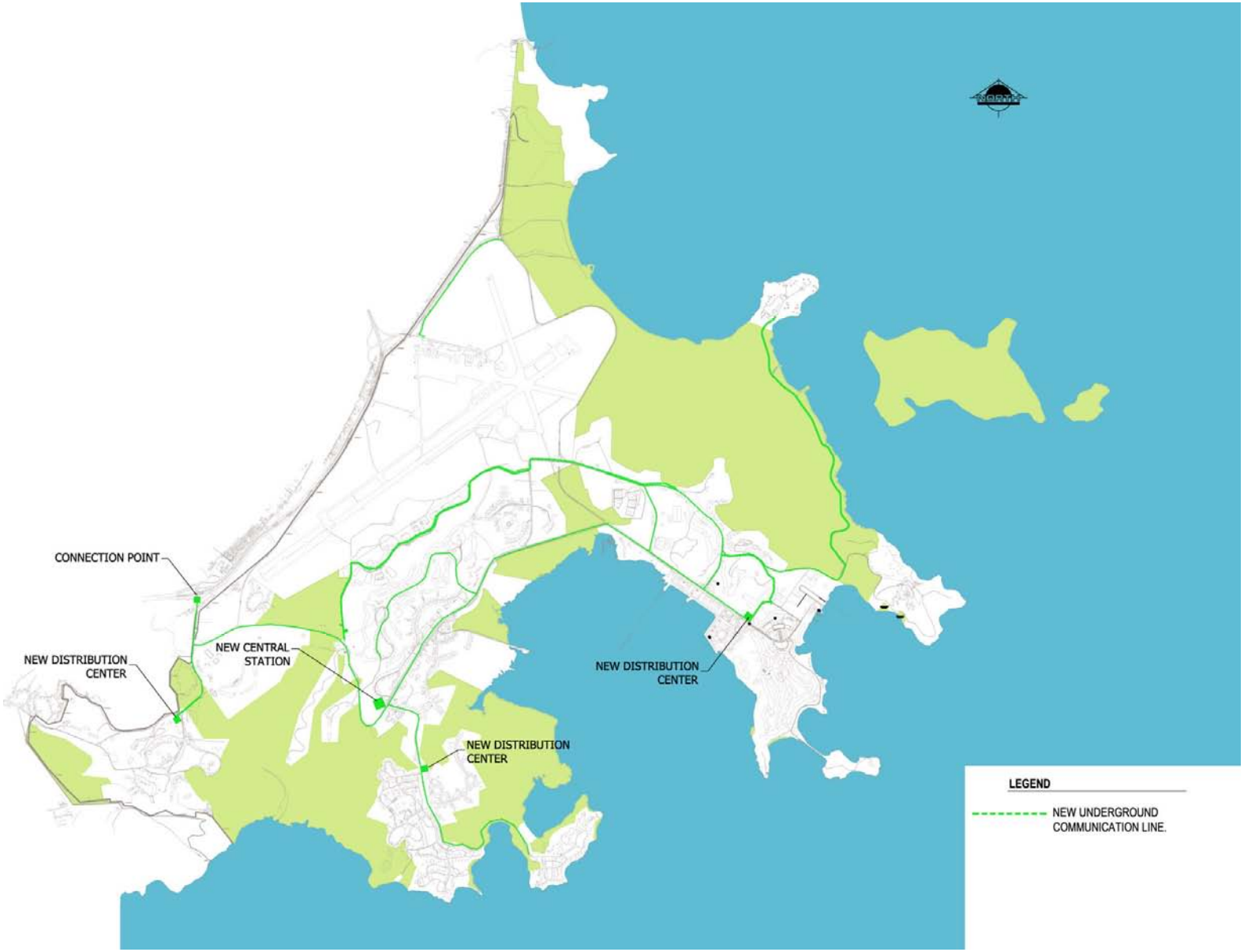


Figure 86: Proposed Telecom Distribution Map

3.2.7 Landscape

Landscaping is a critical component of any development. It should be used as a major visual element to unify the proposed building, existing streetscape and the surrounding environment as an entity and functionally for directing the circulation of pedestrian and vehicular traffic. It must mitigate the visual impacts of parking areas, loading docks, garbage containers, storage areas, etc.

Existing Conditions

The coastal area of Puerto Rico near Ceiba, including NAPR, is classified as a subtropical dry forest ecological life zone (Department of the Navy 2007). Historical land use of the property, which has included grazing and development associated with FNAPR, has lead to the replacement of the historic climax upland community with scrub/forest communities (Department of the Navy 2007). The majority of the undeveloped terrestrial areas at FNAPR are characterized as coastal scrub forest communities. The secondary growth of thick scrub is dominated by leadtree (*Leucaena* spp.), box briar (*Randia aculeate*), sweet acacia (*Acacia farnesiana*), and Australian corkwood tree (*Sesbania grandiflora*) that grew in areas that were cleared for grazing prior to acquisition by the Navy. Tree species include ucar (*Bucida buceras*), sandbox (*Hura crepitans*), figs (*Ficus* sp.), flamboyant tree (*Delonix regia*), Puerto Rican royal palm (*Roystonea borinquena*), ginep (*Melicoccus bijugatus*), and Indian almond (*Terminalia catappa*) (Department of the Navy 2007). Tree heights rarely exceed 50 feet and the vegetation has minimal commercial value, but it does provide erosion protection and promotes groundwater recharge, providing valuable watershed protection (Department of the Navy 2007).

Terrestrial freshwater wetland environments at FNAPR include wet meadows and marshes dominated by cattails (*Typha* spp.) and grasses (*Panicum* spp. and *Paspalum* spp.) and wet coastal scrub forests (Department of the Navy 2007). These freshwater wetlands serve as habitat for birds and reptiles, act as filters to trap sediments that could otherwise harm coral reefs and seagrass beds, and buffer the impact of flash flooding that results from steep slopes, torrential rains, and land use outside FNAPR (Department of the Navy 2007).

Mangrove forests comprise about 2,100 acres (25%) of FNAPR (Department of the Navy 2007).

There are five main areas of mangrove forests within FNAPR, including the Demajagua Mangrove Forest which is east and adjacent to the proposed Ceiba Park (Zone 11); Los Machos Forest which is adjacent to the proposed Marsh Vista (Zone 4) and the Eco-Outpost Base Camp (Zone 5); and Ensenada Honda Mangrove Forest which is adjacent to the proposed Main Street (Zone 7), Marsh Vista (Zone 4) and Port Caribe (Zone 1). Several main arterial roads that may require expansion, including Marine Bypass Road, Forrestal Drive, and PR-3, are also wholly or partially located within these large mangrove tracts. For example, Marine Bypass Road and Forrestal Drive traverse the Ensenada Honda Mangrove Forest, and PR-3 and Lake Chamberlain Road traverse Los Machos Forest. The main mangrove tracts within FNAPR have all been altered in some manner by human activities. Impoundment and dredge disposal are key contributors to mangrove alteration at FNAPR.

The Los Machos mangroves are located in the northeast portion of FNAPR and cover about 1,000 acres. This mangrove complex has been impacted over time by events such as base construction in the 1940s, construction of Lake Chamberlain Road (which reduced tidal circulation in the forest), oil spills, and hurricanes (Department of the Navy 2007). An ecological and hydrological restoration plan was developed for the mangrove complex in 1996 (Department of the

Navy 1996). Los Machos mangroves are also the subject of a 2004 Damage Assessment and Restoration Plan Environmental Assessment. The plan was prepared to address the restoration of the natural resources and their functions that were damaged by a JP-5 fuel spill that occurred in October 1999 at FNSRR.

The Ensenada Honda mangrove tract has been impacted primarily by dredge disposal. When harbor development began within Ensenada Honda in the 1940s, the dredge material was placed in the nearby mangrove forest, directly impacting approximately 40 acres of the mangrove forest. Subsequent dredge spoil was disposed by the Navy at permitted dredge spoil disposal sites. The three large mangrove areas (i.e., (Demajagua Mangrove Forest, Los Machos Forest, and Enseñada Honda Mangrove Forest), were part of a 2008, 3,340-acre land transfer between the Department of the Interior and the Puerto Rico DNER and were subsequently entered into an administrative agreement with the Puerto Rico Conservation Trust to administer these lands. These properties, which are zoned conservation (PR), are protected from future development. In addition, the conservation lands abutting developable parcels (including Zones 1, 3, 4, 5, 7, and 11), shall respect a development buffer zone as established in the 2010 Reuse Plan Addendum. In addition to these large tracts of mangroves, smaller areas of mangroves are located within or at the boundary of parcels within the proposed Port Caribe (Zone 1), the Caribbean Riviera (Zone 2), Marsh Vista (Zone 4) Eco-Outpost Base Camp (Zone 5), and Main Street (Zone 7).

One plant federally and Commonwealth-listed as a threatened species is known to occur at FNAPR. The Cobana negra (*Stahlia monosperma*), is a medium-sized evergreen tree that reaches 25 to 50 feet in height and 1 to 1.5 feet in diameter. It is found on the edge of salt flats in brackish, seasonally flooded wetlands. Critical habitat has not been designated for this species (USFWS 2011e). A Cobana negra tree was identified in a mangrove stand near the Coast Guard (old ammunition) pier in Ensenada Honda in 1989 (Vicente *et al.* 1989). Rare species surveys were conducted at FNAPR in August 2004 and identified a single individual of this species in a coastal scrub forest area west of American Circle (NAVFAC LANTDIV 2006).

The terrestrial vegetation found within undeveloped areas of each proposed zone is described below and illustrated on Figure 87.

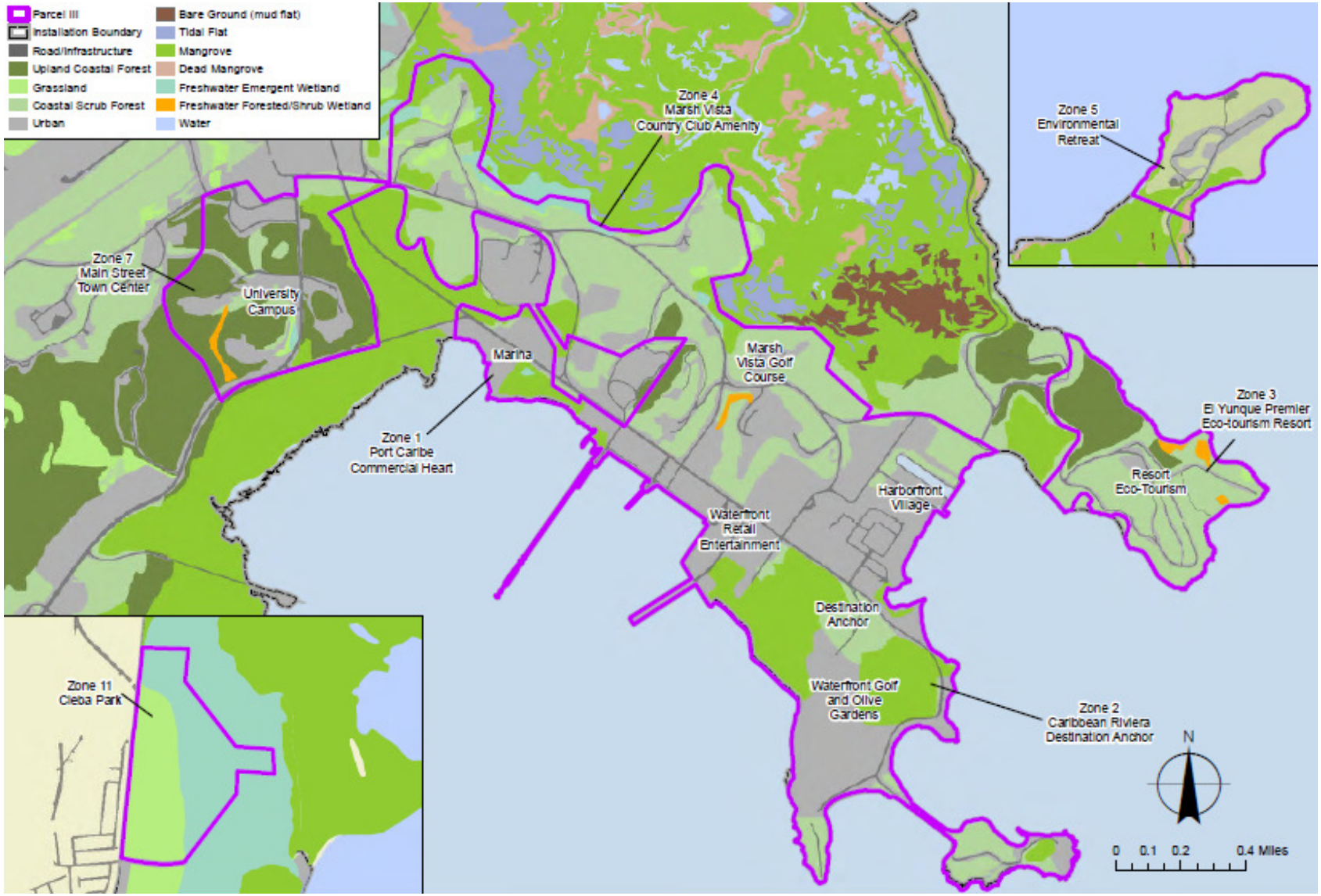


Figure 87: Vegetative Communities and Land Cover, Roosevelt Roads

Port Caribe (Zone 1)

The majority of the Port Caribe area consists of developed areas associated with the waterfront area bordering Ensenada Honda. Undeveloped areas include a small area of coastal scrub forest, and several small mangroves along the east side of Ensenada Honda. Currently no buffer exists between existing developed areas and the mangroves and Ensenada Honda (site visit conducted by Ecology and Environment, Inc., October 26, 2010). No freshwater wetlands lie within or adjacent to the Port Caribe area. The vegetative communities in Zone 1 are illustrated in Figure 87.

Caribbean Riviera (Zone 2)

Undeveloped areas within the proposed Caribbean Riviera area consist of coastal scrub forest and mangroves. No freshwater wetlands lie within or adjacent to the Caribbean Riviera area. Mangroves associated with Ensenada Honda lie along the western and southeastern boundary of the Caribbean Riviera area and an additional mangrove areas lies within Isla Cabras. The vegetative communities in Zone 2 are illustrated in Figure 87.

El Yunque Grande (Zone 3)

The portion of Zone 3 which lies along the north side of the Bahia de Puerca (i.e., where the proposed Harbor Front Village would be located) is composed almost entirely of developed urban areas with a few small areas of coastal scrub forest. The undeveloped areas within El Yunque Grande on Punta Puerca consist primarily of coastal scrub forest, and upland coastal forest. Small freshwater forested/shrub wetlands exist along the northern edge of Punta Puerca. The vegetative communities in Zone 3 are illustrated in Figure 87.

Marsh Vista (Zone 4)

Undeveloped areas within the Marsh Vista area consist primarily of coastal scrub forest, upland coastal forest and grassland. Shallow tidal flats, mangroves, freshwater emergent wetlands, and open water lie along this zones northern boundary which is adjacent to the Los Machos Forest, a tidal wetland complex that includes mangroves, tidal flats, mud flats, and open water environments. To the west of Marsh Vista are mangroves associated with Ensenada Honda. The vegetative communities in Zone 4 are illustrated in Figure 87.

Eco-Outpost Base Camp (Zone 5)

The proposed Eco-Outpost Base Camp is located on Punta Media Mundo. Undeveloped areas consist of coastal scrub forest communities. Punta Medio Mundo has an elevation of approximately 40 m and is surrounded by mangroves and tidal wetlands (see further discussion in Section 3.7.4) associated with the Los Machos Forest and Puerto Medio Mundo. Lake Chamberlain Road traverses coastal scrub forest along the southern portion Los Machos Forest, and mangrove and dead mangrove communities along the coastline. The vegetative communities in Zone 5 are illustrated in Figure 87.

Main Street (Zone 7)

Undeveloped areas within the proposed Main Street area include primarily upland coastal forest, coastal scrub forest, and small areas of mangroves in the extreme northeast corner and north of Marina Bypass Road; along the southern boundary of the parcel boundary. Two small freshwater wetlands lie within the Main Street area. These wetlands are located along the southern boundary of the Main Street area just north of Langley Drive. Mangroves associated with Ensenada Honda lie to the southern and eastern boundaries. Currently undeveloped forested and scrub vegetation in the Main Street area

act as a buffer zone for adjacent freshwater, tidal, and marine ecosystems.

Vegetation slows surface water movement during storm events and allows excess surface water to infiltrate to groundwater. This infiltration provides protection against erosion on the slopes and protects the existing residential and commercial area at the foot of the slopes from potential flooding (Department of the Navy 2007). The vegetative communities in Zone 7 are illustrated in Figure 87.

Ceiba Park (Zone 11)

Undeveloped areas within the Ceiba Park area include a mix of grassland, and freshwater emergent wetlands, the majority of which are currently used for grazing (Department of the Navy 2007).

Freshwater emergent wetlands are located along the eastern half of the Ceiba Park area (see Figure 87).

Landscape Guidelines

A Landscape Master Plan should be developed to establish specific Landscape Guidelines to complement the 2010 Addendum to the 2004 Reuse Plan and Infrastructure Master Plan for the redevelopment of the FNSRR.

General considerations for landscape improvements include the following guidelines outlined below:

- Encourage high quality in landscape design consistent with the distinct character of this redevelopment and the natural features of the landscape.
- Preservation of existing trees, woodlots and features wherever possible.
- Diversity of plant material and indigenous species wherever possible in appropriate areas.
- Ensure integration with stormwater management features.
- Enhance the public perception of a proposed development in terms of aesthetic quality, comfort and convenience of pedestrians and screening of less attractive elements of the development (screening of parking, service & storage areas, privacy areas, etc.). This may be accomplished through the use of landscaped islands and buffer planting strips.
- Contribute to the overall redevelopment image.

Additional general landscape design guidelines include:

- Provide landscaping at the street-line, which contributes to the continuity of experience between adjacent properties.
- Maintain unobstructed visibility to building entrances, key architectural features, and signage and public spaces. Locate plant material in a manner that provides adequate site lines for both motorists and pedestrians.
- Group trees and shrubs to frame building elevations and to add visual interest to blank facades and open spaces.
- Install landscape elements that provide color and decoration, derived from local/native vegetation.
- Install plant material to soften building elevations, maintain a pedestrian scale and provide definition to public walkways and open spaces.
- Provide landscaping to screen and buffer parking areas, open storage and other site service elements.
- Provide protection from excessive summer sun and winds, especially adjacent to outdoor areas where people congregate.
- Select plant materials that are ecologically sound, appropriate for the existing and future site conditions and suitable for the climate.
- Incorporate drought resistant plant material in order to reduce long-term maintenance requirements and conserve water (xeriscaping).

- Select native plant materials where appropriate and avoid the use of invasive plant species.

Impacts on terrestrial vegetation should be minimized by using previously developed areas and by siting new development within these areas or immediately adjacent to previously developed areas to the extent practical. Terrestrial vegetation serves to protect against soil erosion, filters and traps sediments.

Sustainable Golf Course Design Guidelines

The 2010 Addendum to the 2004 Reuse Plan for the FNSRR proposes three new golf courses on Zones 2, 4 and 6. The design of these golf courses should follow the Sustainable Development Guidelines for Golf Courses created by the Golf Environment Organization (GEO), a not-for-profit organization that helps integrate sustainability to golf facilities. The main focus of these guidelines Respect the surroundings and honor the natural environment by enhancing natural habitats and treading lightly on natural resources. Best practices that should be implemented on the design of sustainable golf courses include:

- The protection of the Conservation Trust lands, ecosystems and coastal zones
- Enhance the existing habitat value and biodiversity of the Base
- Control run-off by efficient drainage design
- Improve water quality by reduced or efficient use of pesticide and fertilizer

3.2.8 Waterfront & Pier Development

Waterfront and Pier Improvements

The waterfront of Bahia Ensenada Honda is located in *Zone 1: Port Caribe*, which is the commercial heart of the redevelopment. It is an unparalleled opportunity to reorient the redevelopment's connection to Bahia Ensenada Honda, and reclaim the waterfront as a public asset that the entire region can enjoy.

Port Caribe is intended to become a signature Caribbean style harbor front development by creating a dynamic public waterfront, which will become an exciting destination with vibrant public and cultural spaces, access to the water and a new urban street that will accommodate all modes of travel and provide an important connection in the region's transportation system.

Figure 88: View of Waterfront and Pier Area from Pier 3

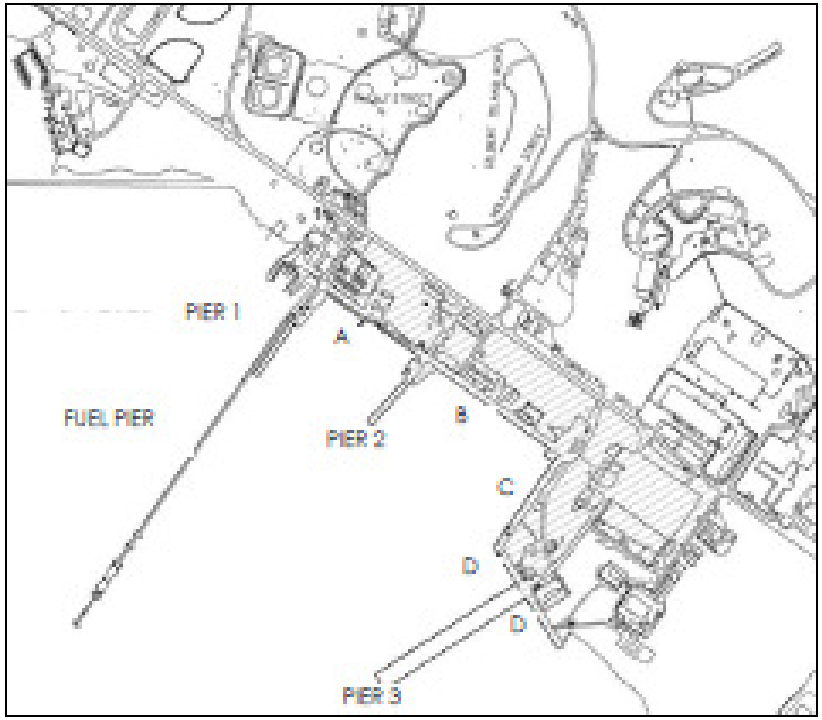


Figure 89: Site Plan Showing Existing Piers and Bulkheads

The Proposed Reuse

The recommendations included on this section for the waterfront and pier infrastructure improvements are based on the proposed uses included on the 2010 Addendum to the 2004 Reuse Plan.

The Reuse Plan revolves around the creation of a water-dependent, mixed use development that supports the re-use of this waterfront property. The plan includes the incorporation of a strategic mix of uses that are all integral to the creation of a viable maritime center activities—the ferry complex and the potential future development of a cruise terminal—and results in the transformation of the Navy Facilities into a "port village".

The existing waterfront and pier area have adequate infrastructure for maritime transportation and operation activities. The facilities are in fair condition, although they are not currently being used. In general the existing piers and bulkheads should be upgraded and/or refurbished to accommodate the new waterfront uses.

The fuel mooring pier is in good condition but to reinstate it to it's former function of handling fuel for storage on the tank farm located on the premises the pipe lines need to be re-open and refurbished as they were closed once the pier operations ceased.

Pier 1 has water service, F44 and JP5 fuel distribution, and 35' deep water to the east. This is the only side with berthing access. The pipe lines need to be re-open and refurbished.

The Reuse Plan proposes to relocate the current Ferry operations in Fajardo, which operates service from the main island to the islands of Vieques and Culebra, to the existing Pier 2. This will require upgrades to the existing Pier 2 to comply with the Ports Authority safety operation requirements.

In addition to the ferry complex, the redevelopment of the central waterfront contemplates the long-term reuse of Pier 3 at the southeastern end of the site. Upgrades to Pier 3 may be required to accommodate the new waterfront use.

The four basic sections of the seawall bulkhead that connects the piers: sections A, B, C and D are all in very good condition and may be incorporated in the future development with minor repairs.

The 72-boat slip marina was maintained until recent months and it is in excellent condition. Depending on the possible future uses, most of the facilities require minor repairs in order to provide a short term operation either as maritime terminal for cargo or passengers.

All of the existing building structures will be demolished to accommodate the proposed new uses depicted on the 2010 Addendum to the 2004 Reuse Plan.

4 Proposed Infrastructure Phasing

ROOSEVELT ROADS REDEVELOPMENT
INFRASTRUCTURE MASTER PLAN

4.1 General Assumptions

This Infrastructure Master Plan is organized using the development zones as defined in the Roosevelt Roads 2010 addendum to the 2004 Reuse Plan. The assumed redevelopment time frame for the former naval base assumes a 25 year built-out beginning from the second half of 2012.

Although the location of Solid Waste Management Units (SWMU's) and Areas of Concern (AoC's) have been considered when preparing this master plan, it is important to consider that the actual cleanup schedule for these areas –under the control of the US Navy- will affect the infrastructure development timing. SWMU's and AoC's affecting the proposed construction area of each infrastructure phase (see Figure 97) should be conveyed clean to the LRA before impacting such sites with infrastructure construction works.

The most basic approach of this master plan to improve and expand utilities services within the Roosevelt Roads redevelopment is to provide adequate infrastructure with the capacity to supply the demands required by all projects to be developed in a specific zone in a pre-defined span of time. Based on this basic premise, the infrastructure construction schedule has been distributed within five phases and into eleven development zones.

Other general assumptions within this document relating the development of an infrastructure phasing strategy include:

- The baseline for the infrastructure phasing is based on the proposed redevelopment phasing as described in the 2011 Economic Development Conveyance (EDC), both in the EDC Application and its Business Plan.
- Both the improvement and new construction of utilities leverages the existing infrastructure to be reused.
- Capacity of existing and proposed infrastructure has been computed based on an expected design demand, which often differs (increases) for each redevelopment phase.
- Special attention has been given to maintain continuity of services for basic utilities during the span of redevelopment phases.
- Only primary roads and utility distribution have been considered for this study. Infrastructure works dependent on specific development projects are not part of this Master Plan.

4.2 Phases Description

4.2.1 Phase 1

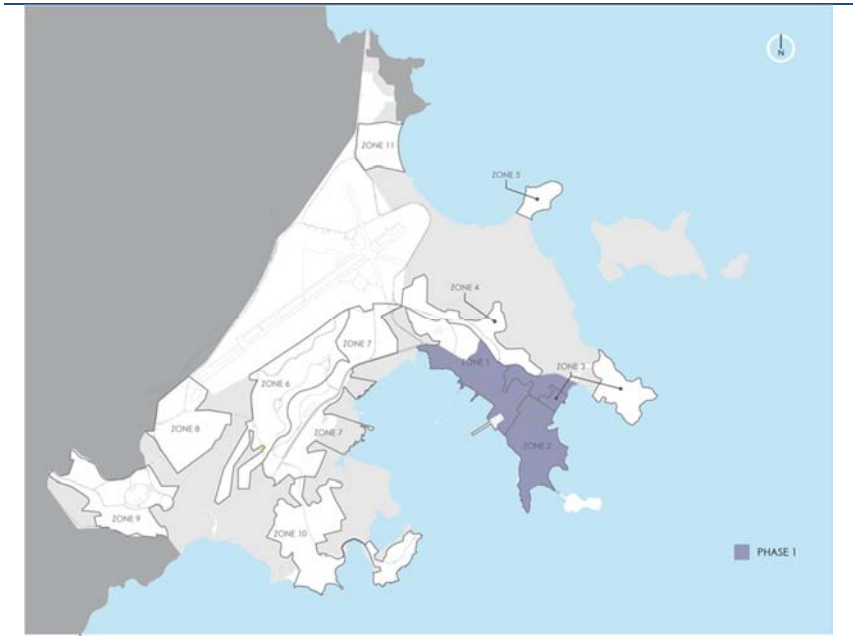


Figure 90: Redevelopment Areas for Phase 1

This initial phase involves the basic maintenance of basic infrastructure to allow for continued service to existing tenants inside Roosevelt Roads. It includes most of the proposed developments within Port Caribe (Zone 1), Caribbean Riviera (Zone 2) and some areas of El Yunque Grande (Zone 3).

Total development area considered to this phase is 3,150,000 square feet approximately.

4.2.2 Phase 2

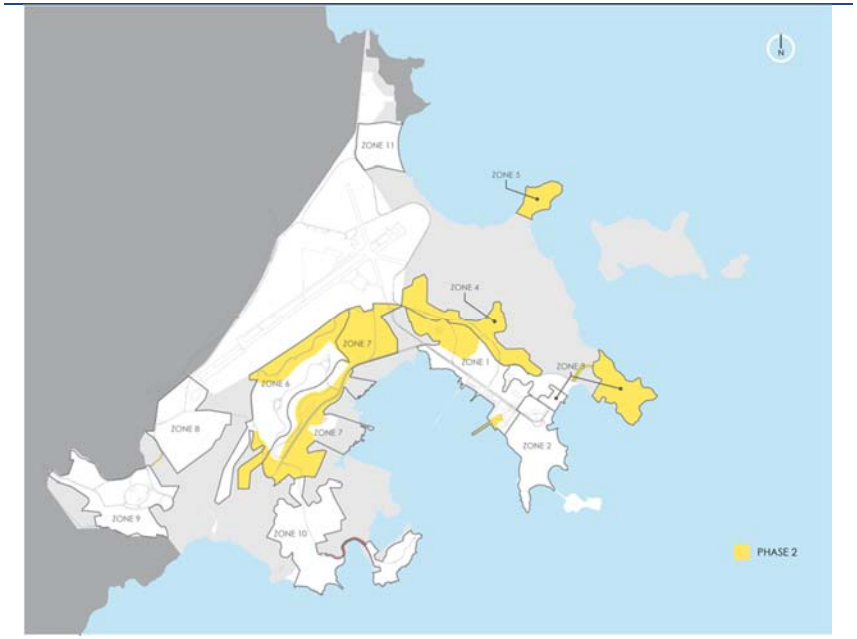


Figure 91: Redevelopment Areas for Phase 2

In order to continue the densification of the ports areas and promote redevelopment of the Main Street and surrounding areas, this second phase includes the remaining developments from Zone 1 and Zone 2 and most projects envisioned for Marsh Vista (Zone 4), Airport Uplands (Zone 6) and Main Street (Zone 7).

The aggregate redevelopment area considered for Phase 2 is approximately 3,200,000 square feet.

4.2.3 Phase 3

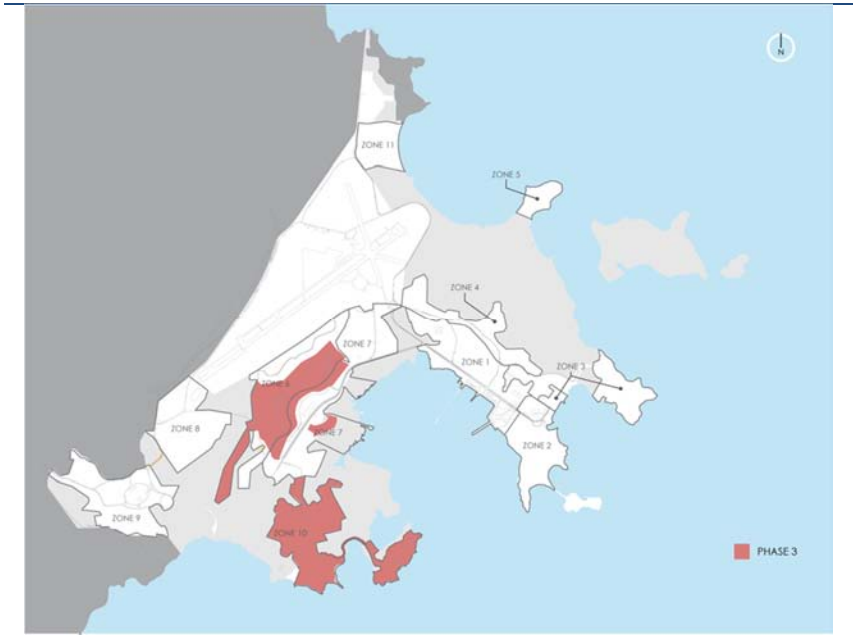


Figure 92: Redevelopment Areas for Phase 3

After the waterfront and Main Street redevelopments are performed, the next infrastructure investment will focus in providing essential improvements to allow redevelopment at the Eco-Outpost Camp (Zone 5) and the commercial area and Golf Course of the Airport Uplands (Zone 6). In addition, Phase 3 includes Capehart (Zone 10), and the Residential Area of Main Street (Zone 7).

Total Phase 3 development area is around 3,100,000 square feet.

4.2.4 Phase 4

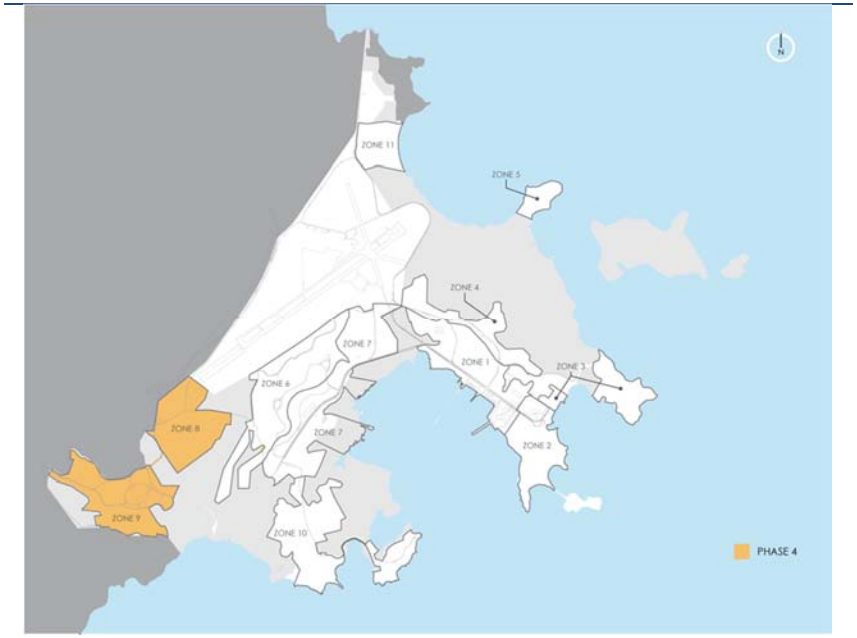


Figure 93: Redevelopment Areas for Phase 4

The development projects considered for Phase 4 is concentrated within the Sports Core (Zone 8) and Island Paradise (Zone 9).

Phase 4 development totals approximately 1,500,000 square feet.

4.2.5 Phase 5

Figure 94: Redevelopment Areas for Phase 5

This last phase includes Ceiba Park (Zone 11).

Given the remote location of this Zone relative to the rest of the Master Plan and because of the relatively small demands and loads within this area (approximately 50,000 square feet of construction), Phase 5 of this Master Plan is considered to be best served from within the greater Ceiba municipality. Uses and demands projected for this Zone are tightly related to municipal uses and are located near public utility connection points that occur adjacent to this parcel.

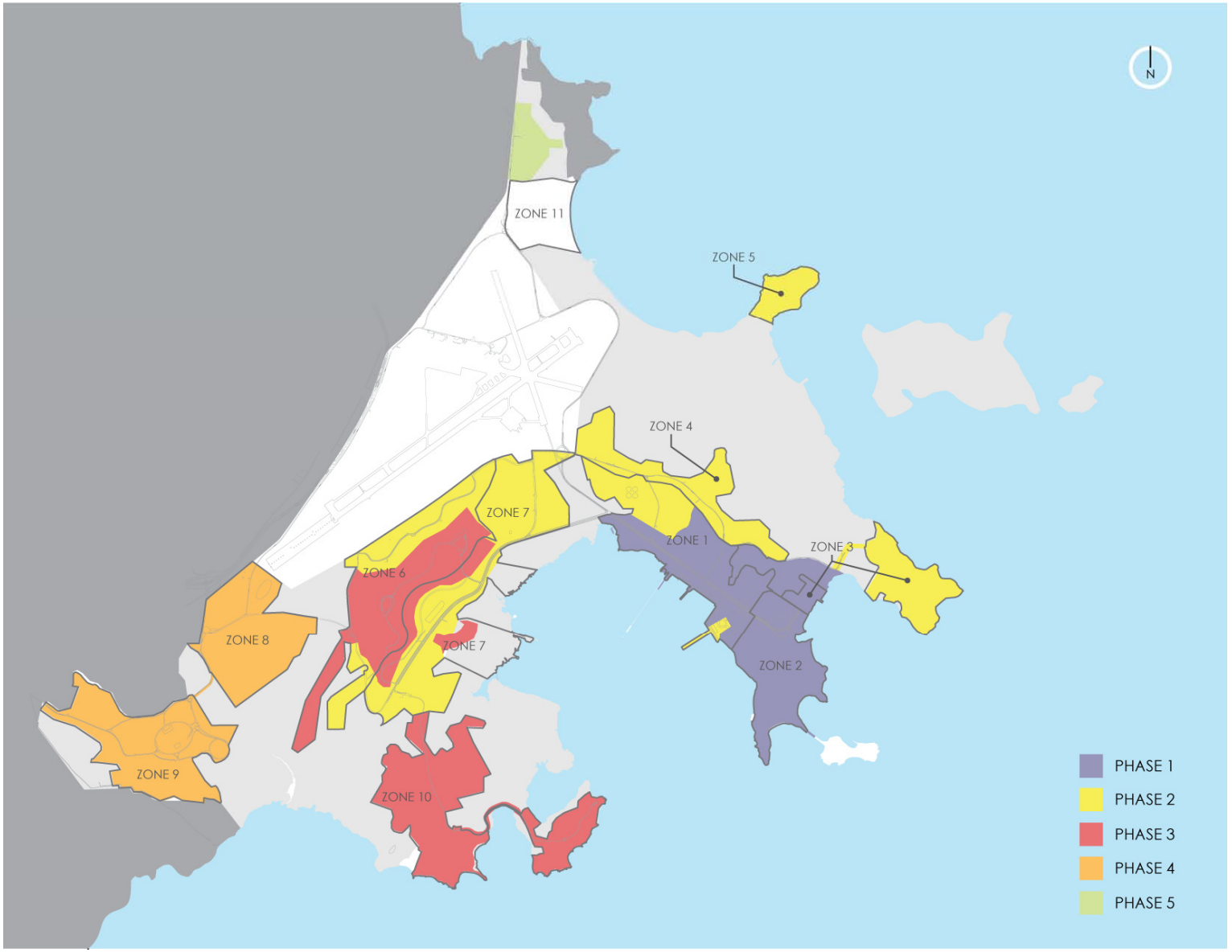


Figure 95: Infrastructure Master Plan Phasing Summary

4.2.6 Infrastructure Phasing Timeline

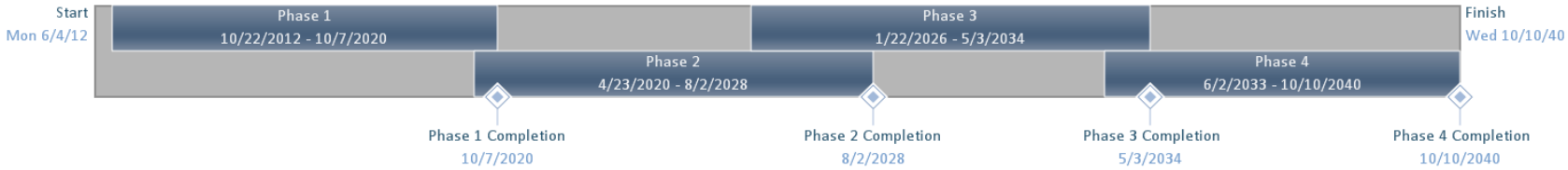


Figure 96: Infrastructure Phasing Timeline

An estimated planning and construction schedule for all the phases is presented in the Appendix at the end of this report.

4.2.7 Environmental Factors Affecting Timeline

As the redevelopment parcels are being located next to the existing main road corridors, these existing right-of-ways will be used for the location of the main utility lines. These roadways will be enhanced to comply with the redevelopment requirements as described in Section 3.2.1 (Transportation).

The Infrastructure Phasing Timeline (Figure 96), indicates 10/22/2012 as the start date for Phase 1. As Zone 1 is included on Infrastructure Phase 1, this means that utility layout and roadwork for Zone 1 will start on that date.

There are some portions of the redevelopment that are affected by Solid Waste Management Units (SWMU) and Areas of Concern (AOC), which are geographic areas that show environmental degradation, but are under a mitigation or corrective action program by the U.S. Navy.

Existing road systems in Zone 1 include Forrestal Drive and Valley Forge Road. Sections of Forrestal Drive run across SWMU's and AOCs. Forrestal Drive runs through SWMU 59 at the north side of Zone 1, SWMU 74 Hill at the west side of Zone 1, through SWMU 74 Port at the south side of Zone 1, through AOC F 124 and through SWMU 7/8 at the south side of Zone 1. A smaller portion of Forrestal Drive is adjacent to SWMU 60 at the south side of Zone 1. Remediation work for these SWMU's will not be completed by the start date of work of Phase 1, which is scheduled to begin 10/22/2012.

The affected areas are currently under corrective action and it its expected the they will not interfere with the redevelopment phases timeline in a critical way.

The following table shows the estimated Dates of Remediation for SWMUs and AOCs within Zone 1:

Table 13: SWMU's Estimated Dates of Remediation

SWMU 60	**09/2014**
SWMU 59	**05/2014**
SWMU 74 Hill	**07/2015**
SWMU 74 Port	**07/2015**
SWMU 7/8	**01/2015**
AOC F 124	**After 2016**

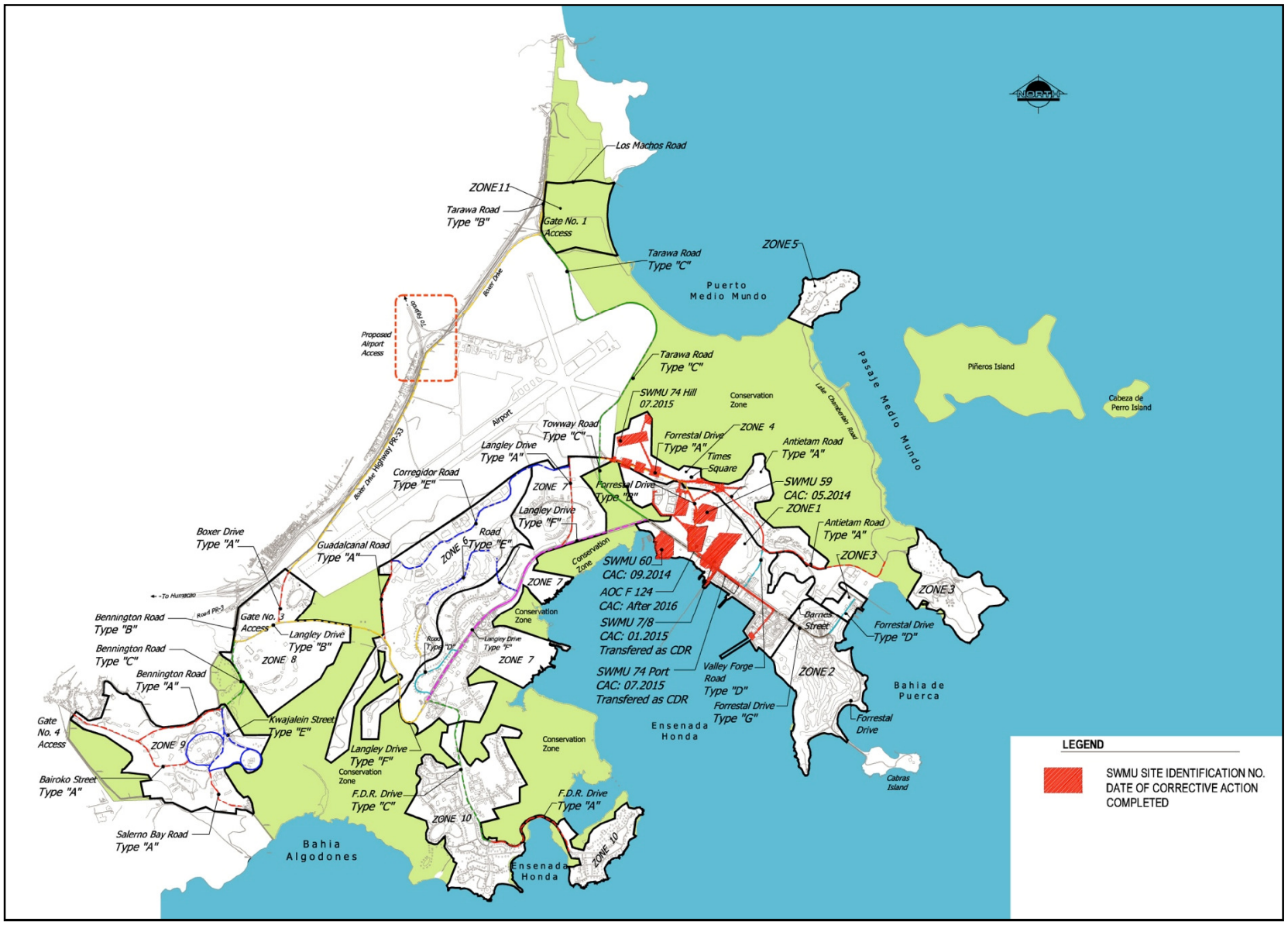


Figure 97: SWMU's Affecting Infrastructure Phasing

4.3 Phases Infrastructure Demand by Proposed Construction Phase

4.3.1 Infrastructure Demand Tables

Following are the demand schedules divided by utility and by proposed infrastructure development phase.

Table 14: Trip Generation by Proposed Development Phase

Zone	Location	Projected Use	Development Area (Gross Square Feet)	TRIP GENERATION (TPD)	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5
					49,797	41,895	26,583	9,865	732
1	Port Caribe	**Commercial Heart**							
		Retail/ Restaurants/ Entertainment District	200,000	8,000	8,000				
		Hospital	130,000	6,000	6,000				
		Office	50,000	518	518				
		Marina	25,000	1,180	1,180				
		International Cruise Terminal	150,000	900		900			
		Industrial/ Back of House	50,000	800		800			
		National Guard Boat Ramp	9,500	48	48				
		Homeland Security Boat Ramp	2,500	13	13				
		Ferry Terminal	50,000	1,250	1,250				
2	Caribbean Riviera	**Destination Anchor**							
		Casino	210,000	2,169	2,169				
		Casino Hotel	2,000,000	16,000	16,000				
		Retail/ Restaurants/ Entertainment	200,000	8,000	8,000				
		Cabras Island (Coast Guard)	2,000	10	10				
		Wastewater Treatment Plan	1,000	5	5				
3	El Yunque Grande	**Premier Eco-Tourism Resort**							
		Hotels- "Lodge"	120,000	1,200		1,200			
		Eco Museum/Visitor's Center	50,000	92		92			
		Office	30,000	310	310				
		Retail/ Restaurants/ Entertainment "Village"	100,000	4,000	4,000				
		Residential Villas - Ecolodge	450,000	1,800		1,800			
		Marina	25,000	590	590				
		US Army Reserve/ National Guard[1]	46,500	465	465				
		Armed Forces Reserve Center[1]	72,000	720	720				
		Water Taxi Terminal/ Pier	20,000	500	500				
4	Marsh Vista	**Golf/Country Club Amenity**							
		18 Hole Golf Course							
		Clubhouse and Dining	35,000	720		720			
		Residential	250,000	1,250		1,250			
5	Eco-Outpost Camp	**Environmental Retreat**							
		Dining/ Conference	25,000	250			250		
		Lodging	100,000	800			800		
		Office/ Research	25,000	258			258		

Table 15: Trip Generation by Proposed Development Phase (cont.)

Zone	Location	Projected Use	Development Area (Gross Square Feet)	TRIP GENERATION (TPD)	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5
					49,797	41,895	26,583	9,865	732
6	Airport Uplands	**Collateral Development**							
		Airport, Govermment, Military	250,000	2,000		2,000			
		Industrial/ Warehouse	250,000	2,000		2,000			
		Specialty Industrial	200,000	3,200		3,200			
		Office	75,000	775		775			
		Residential	250,000	9,000			9,000		
		18-hole Golf Course		720			720		
		Clubhouse	35,000	5			5		
		Radar Station	1,025	19		19			
		Potable Water treatment plan	3,800	19	19				
7	Main Street	**Town Center**							
		Educational Facilities/ Schools	80,000	1,537		1,537			
		Office	100,000	1,033		1,033			
		Retail, Restaurant, Entertainment	400,000	16,000		16,000			
		Residential	1,450,000	5,850			5,850		
		Industrial/ Back of House / Support Services	200,000	3,200		3,200			
		Hotel	320,000	3,200		3,200			
		Community College	200,000	2,080		2,080			
		Coast Guard Pier	8,910	89		89			
8	Sports Core	**Community Sports**							
		9 Hole Golf Course							
		Clubhouse	15,000	360				360	
		Retail, Restaurant, Entertainment	30,000	1,200				1,200	
		Industrial	50,000	400				400	
		Office	50,000	517				517	
		Sports Complex/ Recreation Fields	200,000	230				230	
		Residential	200,000	810				810	
9	Island Paradise	**Retreat, Conference, Learning**							
		Retail, Restaurant, Entertainment	50,000	2,000				2,000	
		Hotels	320,000	2,400				2,400	
		Back of House / Support Services	50,000	800				800	
		Conference/ Educational	500,000	1,148				1,148	
10	Capeheart	**Residential/ Corporate**							
		Corporate/ Institutional	500,000	5,000			5,000		
		Retail, Restaurant, Entertainment	50,000	2,000			2,000		
		Residential	650,000	2,700			2,700		
11	Ceiba Park	**Gateway**							
		Concessions	10,000	400					400
		Office	20,000	207					207
		Pier	25,000	125					125

Table 16: Water Demand by Proposed Development Phase

Zone	Location	Projected Use	Development Area (Gross Square Feet)	WATER DEMAND (GPD)	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5
					1,733,800	1,112,653	680,500	483,772	16,500
1	Port Caribe	**Commercial Heart**							
		Retail/ Restaurants/ Entertainment District	200,000	60,000	60,000				
		Hospital	130,000	29,750	29,750				
		Office	50,000	15,000	15,000				
		Marina	25,000	12,000	12,000				
		International Cruise Terminal	150,000	15,000		15,000			
		Industrial/ Back of House	50,000	17,500		17,500			
		National Guard Boat Ramp	9,500	2,850	2,850				
		Homeland Security Boat Ramp	2,500	750	750				
		Ferry Terminal	50,000	6,000	6,000				
2	Caribbean Riviera	**Destination Anchor**							
		Casino	210,000	63,000	63,000				
		Casino Hotel	2,000,000	1,400,000	1,400,000				
		Retail/ Restaurants/ Entertainment	200,000	60,000	60,000				
		Cabras Island (Coast Guard)	2,000	600	600				
		Waste Water Treatment Plan	1,000	300	300				
3	El Yunque Grande	**Premier Eco-Tourism Resort**							
		Hotels- "Lodge"	120,000	105,000		105,000			
		Eco Museum/Visitor's Center	50,000	8,500		8,500			
		Office	30,000	9,000	9,000				
		Retail/ Restaurants/ Entertainment "Village"	100,000	30,000	30,000				
		Residential Villas - Ecolodge	450,000	80,000		80,000			
		Marina	25,000	6,000	6,000				
		US Army Reserve/ National Guard[1]	46,500	13,950	13,950				
		Armed Forces Reserve Center[1]	72,000	21,600	21,600				
		Water Taxi Terminal/ Pier	20,000	3,000	3,000				
4	Marsh Vista	**Golf/Country Club Amenity**							
		18 Hole Golf Course				0			
		Clubhouse and Dining	35,000	10,500		10,500			
		Residential	250,000	50,000		50,000			
5	Eco-Outpost Camp	**Environmental Retreat**							
		Dining/ Conference	25,000	7,500			7,500		
		Lodging	100,000	70,000			70,000		
		Office/ Research	25,000	7,500			7,500		

Table 17: Water Demand by Proposed Development Phase (cont.)

Zone	Location	Projected Use	Development Area (Gross Square Feet)	WATER DEMAND (GPD)	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5
					1,733,800	1,112,653	680,500	483,772	16,500
6	Airport Uplands	**Collateral Development**							
		Airport, Govermment, Military	250,000	87,500		87,500			
		Industrial/ Warehouse	250,000	87,500		87,500			
		Specialty Industrial	200,000	70,000		70,000			
		Office	75,000	22,500		22,500			
		Residential	250,000	40,000			40,000		
		18-hole Golf Course					0		
		Clubhouse	35,000	10,500			10,500		
		Radar Station	1,025	308					
		Potable Water Treatment Plan	3,800	1,140		1,140			
7	Main Street	**Town Center**							
		Educational Facilities/ Schools	80,000	15,900		15,900			
		Office	100,000	30,000		30,000			
		Retail, Restaurant, Entertainment	400,000	120,000		120,000			
		Residential	1,450,000	260,000			260,000		
		Industrial/ Back of House / Support Services	200,000	70,000		70,000			
		Hotel	320,000	280,000		280,000			
		Community College	200,000	39,000		39,000			
		Coast Guard Pier	8,910	2,613		2,613			
8	Sports Core	**Community Sports**							
		9 Hole Golf Course						0	
		Clubhouse	15,000	4,500				4,500	
		Retail, Restaurant, Entertainment	30,000	9,000				9,000	
		Industrial	50,000	17,500				17,500	
		Office	50,000	15,000				15,000	
		Sports Complex/ Recreation Fields	200,000	9,272				9,272	
		Residential	200,000	36,000				36,000	
9	Island Paradise	**Retreat, Conference, Learning**							
		Retail, Restaurant, Entertainment	50,000	15,000				15,000	
		Hotels	320,000	210,000				210,000	
		Back of House / Support Services	50,000	17,500				17,500	
		Conference/ Educational	500,000	150,000				150,000	
10	Capeheart	**Residential/ Corporate**							
		Corporate/ Institutional	500,000	150,000			150,000		
		Retail, Restaurant, Entertainment	50,000	15,000			15,000		
		Residential	650,000	120,000			120,000		
11	Ceiba Park	**Gateway**							
		Concessions	10,000	3,000					3,000
		Office	20,000	6,000					6,000
		Pier	25,000	7,500					7,500

Table 18: Wastewater Discharge by Proposed Development Phase

Zone	Location	Projected Use	Development Area (Gross Square Feet)	WASTEWATER DESCHARGE (GPD)	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5
					1,355,690	755,936	608,000	412,199	16,500
1	Port Caribe	**Commercial Heart**							
		Retail/ Restaurants/ Entertainment District	200,000	50,000	50,000				
		Hospital	130,000	25,500	25,500				
		Office	50,000	15,000	15,000				
		Marina	25,000	12,000	12,000				
		International Cruise Terminal	150,000	7,500		7,500			
		Industrial/ Back of House	50,000	6,887		6,887			
		National Guard Boat Ramp	9,500	2,850	2,850				
		Homeland Security Boat Ramp	2,500	750	750				
		Ferry Terminal	50,000	6,000	6,000				
2	Caribbean Riviera	**Destination Anchor**							
		Casino	210,000	63,000	63,000				
		Casino Hotel	2,000,000	1,050,000	1,050,000				
		Retail/ Restaurants/ Entertainment	200,000	50,000	50,000				
		Cabras Island (Coast Guard)	2,000	600	600				
		Wastewater Treatment Plan	1,000	300	300				
3	El Yunque Grande	**Premier Eco-Tourism Resort**							
		Hotels- "Lodge"	120,000	78,750		78,750			
		Eco Museum/Visitor's Center	50,000	12,500		12,500			
		Office	30,000	9,000	9,000				
		Retail/ Restaurants/ Entertainment "Village"	100,000	25,000	25,000				
		Residential Villas - Ecolodge	450,000	70,000		70,000			
		Marina	25,000	6,000	6,000				
		US Army Reserve/ National Guard[1]	46,500	13,950	13,950				
		Armed Forces Reserve Center[1]	72,000	21,600	21,600				
		Water Taxi Terminal/ Pier	20,000	3,000	3,000				
4	Marsh Vista	**Golf/Country Club Amenity**							
		18 Hole Golf Course		0		0			
		Clubhouse and Dining	35,000	10,500		10,500			
		Residential	250,000	43,750		43,750			
5	Eco-Outpost Camp	**Environmental Retreat**							
		Dining/ Conference	25,000	7,500			7,500		
		Lodging	100,000	52,500			52,500		
		Office/ Research	25,000	7,500			7,500		

Table 19: Wastewater Discharge by Proposed Development Phase (cont.)

Zone	Location	Projected Use	Development Area (Gross Square Feet)	WASTEWATER DESCHARGE (GPD)	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5
					1,355,690	755,936	608,000	412,199	16,500
6	Airport Uplands	**Collateral Development**							
		Airport, Govermment, Military	250,000	34,436		34,436			
		Industrial/ Warehouse	250,000	34,436		34,436			
		Specialty Industrial	200,000	27,548		27,548			
		Office	75,000	22,500		22,500			
		Residential	250,000	35,000			35,000		
		18-hole Golf Course		0			0		
		Clubhouse	35,000	10,500			10,500		
		Radar Station	1,025	308		308			
		Potable Water treatment plan	3,800	1,140	1,140				
7	Main Street	**Town Center**							
		Educational Facilities/ Schools	80,000	10,600		10,600			
		Office	100,000	30,000		30,000			
		Retail, Restaurant, Entertainment	400,000	100,000		100,000			
		Residential	1,450,000	227,500			227,500		
		Industrial/ Back of House / Support Services	200,000	27,548		27,548			
		Hotel	320,000	210,000		210,000			
		Community College	2,000,000	26,000		26,000			
		Coast Guard Pier	8,910	2,673		2,673			
8	Sports Core	**Community Sports**							
		9 Hole Golf Course		0				0	
		Clubhouse	15,000	4,500				4,500	
		Retail, Restaurant, Entertainment	30,000	7,500				7,500	
		Industrial	50,000	6,887				6,887	
		Office	50,000	15,000				15,000	
		Sports Complex/ Recreation Fields	200,000	9,272				9,272	
		Residential	200,000	31,500				31,500	
9	Island Paradise	**Retreat, Conference, Learning**							
		Retail, Restaurant, Entertainment	50,000	2,500				2,500	
		Hotels	320,000	157,500				157,500	
		Back of House / Support Services	50,000	27,540				27,540	
		Conference/ Educational	500,000	150,000				150,000	
10	Capeheart	**Residential/ Corporate**							
		Corporate/ Institutional	500,000	150,000			150,000		
		Retail, Restaurant, Entertainment	50,000	12,500			12,500		
		Residential	650,000	105,000			105,000		
11	Ceiba Park	**Gateway**							
		Concessions	10,000	3,000					3,000
		Office	20,000	6,000					6,000
		Pier	25,000	7,500					7,500

Table 20: Electrical Load Demand by Proposed Development Phase

Zone	Location	Projected Use	Development Area (Gross Square Feet)	ELECTRICAL LOAD DEMAND(KVA)	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5
					39,838	29,908	15,641	12,414	424
1	Port Caribe	**Commercial Heart**							
		Retail/ Restaurants/ Entertainment District	200,000	2,700	2,700				
		Hospital	130,000	1,820	1,820				
		Office	50,000	690	690				
		Marina	25,000	13	13				
		International Cruise Terminal	150,000	1,425		1,425			
		Industrial/ Back of House	50,000	360		360			
		National Guard Boat Ramp	9,500	5	5				
		Homeland Security Boat Ramp	2,500	1	1				
		Ferry Terminal	50,000	375	375				
2	Caribbean Riviera	**Destination Anchor**							
		Casino	210,000	2,835	2,835				
		Casino Hotel	2,000,000	23,000	23,000				
		Retail/ Restaurants/ Entertainment	200,000	2,700	2,700				
		Cabras Island (Coast Guard)	2,000	27	27				
		Wastewater treatment plan	1,000	750	750				
3	El Yunque Grande	**Premier Eco-Tourism Resort**							
		Hotels- "Lodge"	120,000	960		960			
		Eco Museum/Visitor's Center	50,000	675		675			
		Office	30,000	414	414				
		Retail/ Restaurants/ Entertainment "Village"	100,000	1,350	1,350				
		Residential Villas - Ecolodge	450,000	2,048		2,048			
		Marina	25,000	13	13				
		US Army Reserve/ National Guard[1]	46,500	642	642				
		Armed Forces Reserve Center[1]	72,000	994	994				
		Water Taxi Terminal/ Pier	20,000	10	10				
4	Marsh Vista	**Golf/Country Club Amenity**							
		18 Hole Golf Course		300		300			
		Clubhouse and Dining	35,000	354		354			
		Residential	250,000	1,148		1,148			
5	Eco-Outpost Camp	**Environmental Retreat**							
		Dining/ Conference	25,000	253			253		
		Lodging	100,000	800			800		
		Office/ Research	25,000	345			345		

Table 21: Electrical Load Demand by Proposed Development Phase (cont.)

Zone	Location	Projected Use	Development Area (Gross Square Feet)	ELECTRICAL LOAD DEMAND(KVA)	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5
					39,838	29,908	15,641	12,414	424
6	Airport Uplands	**Collateral Development**							
		Airport, Govermment, Military	250,000	3,450		3,450			
		Industrial/ Warehouse	250,000	1,800		1,800			
		Specialty Industrial	200,000	2,340		2,340			
		Office	75,000	1,035		1,035			
		Residential	250,000	1,148			1,148		
		18-hole Golf Course		300			300		
		Clubhouse	35,000	354			354		
		Potable Water Treatment Plan		1,500	1,500				
		Radar Station	1,025	14		14			
		Zone Total	**1,061,025**						
7	Main Street	**Town Center**							
		Educational Facilities/ Schools	80,000	920		920			
		Office	100,000	1,380		1,380			
		Retail, Restaurant, Entertainment	400,000	5,400		5,400			
		Residential	1,450,000	6,548			6,548		
		Industrial/ Back of House / Support Services	200,000	1,440		1,440			
		Hotel	320,000	2,560		2,560			
		Community College	200,000	2,000		2,000			
		Coast Guard Pier	8,910	300		300			
8	Sports Core	**Community Sports**							
		9 Hole Golf Course		150				150	
		Clubhouse	15,000	152				152	
		Retail, Restaurant, Entertainment	30,000	405				405	
		Industrial	50,000	360				360	
		Office	50,000	690				690	
		Sports Complex/ Recreation Fields	200,000	600				600	
		Residential	200,000	923				923	
9	Island Paradise	**Retreat, Conference, Learning**							
		Retail, Restaurant, Entertainment	50,000	675				675	
		Hotels	320,000	2,560				2,560	
		Back of House / Support Services	50,000	150				150	
		Conference/ Educational	500,000	5,750				5,750	
10	Capeheart	**Residential/ Corporate**							
		Corporate/ Institutional	500,000	2,273			2,273		
		Retail, Restaurant, Entertainment	50,000	675			675		
		Residential	650,000	2,948			2,948		
11	Ceiba Park	**Gateway**							
		Concessions	10,000	135					135
		Office	20,000	276					276
		Pier	25,000	13					13

4.3.2 Phase 1 Proposed Infrastructure

Roads and Gates

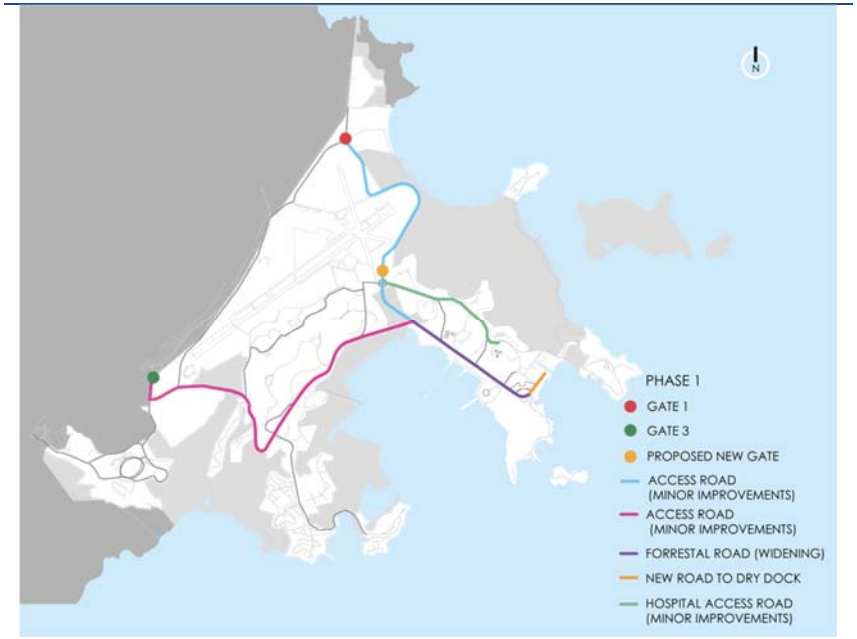


Figure 98: Phase 1 Road Improvements

Trips generated in Phase 1 are calculated in 50,000 Trips per Day approximately. Considering that traffic will be split between Gates 1 and 3 and leaning to increase the use Gate 3, the following improvements are proposed for roads and Gates in Phase 1:

- Improve access No. 1 and No. 3
- Construct a new Guard house on road to Gate 1
- Maintain and improve existing section on roads from Water Front to Gates 1 and 3 respectively
- Develop final full section on Zones 1 and 2 (Forrestal Drive)
- Construct a new 2-lane road on Zone 3 to the Dry Dock area
- Maintain and improve Existing Road to the Hospital.

The construction cost order of magnitude for roads and gates improvements in this phase is 3.8 million dollars approximately.

Potable Water System

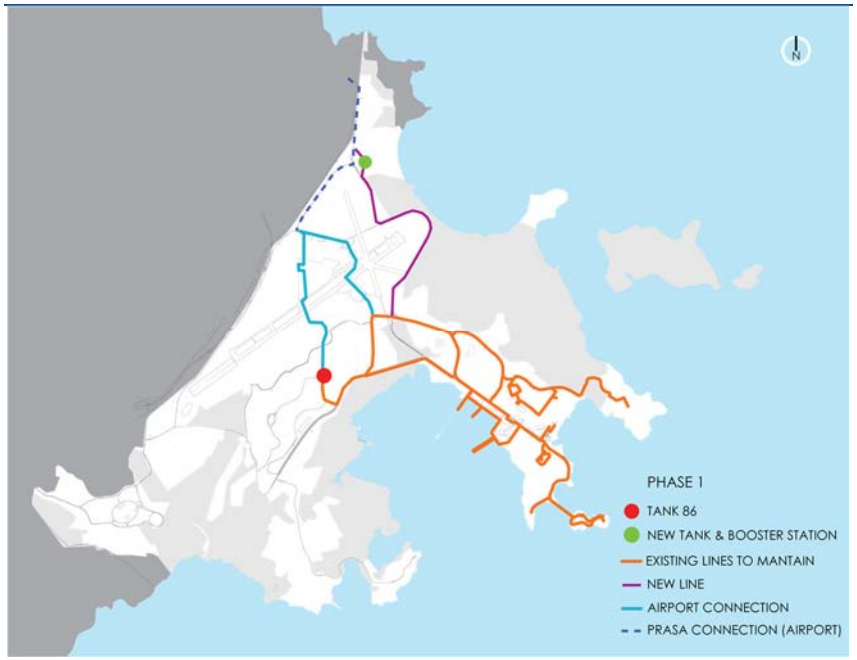


Figure 99: Phase 1 Potable Water System Improvements

Potable Water consumption in Phase 1 is estimated in 1.7 MGD approximately. Considering the lack of capacity of the water transmission line from Fajardo WTP is more expensive and less reliable, improvements to the Potable Water System in Phase 1 is summarized as follows:

- Identify and repair leaks in zones 1 and 2 of the existing system
- Shut down existing Potable Water Treatment Plan in use
- Maintain, as feasible as possible, existing lines
- Maintain and reopen existing airport connection
- Install 20" pipeline from Base system on Forrestal Drive up to PRASA's 12" connection (3.9 km) and develop new booster pump and tank near Gate 1
- Relocate valves and hydrants affected by road widening
- Improve Tank 86 to an adequate operational level
- Improve booster system on Zone 1 and 3

The construction cost order of magnitude for potable water system improvements in this phase is 5.65 million dollars approximately

Wastewater System

Wastewater discharge in Phase 1 is estimated in 1.35 MGD approximately. Taking into consideration the existing system, the proposed land use and construction cost, of the two considered alternatives (as previously described in chapter 2), the alternative that considers connecting to PRASA system through the system that is under construction by the Ports Authority to supply the project was considered as more suitable for Phases 1 and 2.

The selected alternative includes the following improvements:

- Improve Lift Station 39
- Eliminate existing gravity lines and construct a new gravity line in Forrestal Drive to lift station 39
- Construct a new 12" force line from lift station 39 to Airport connection
- Maintain truck collection in other areas
- Identify and repair clogs and infiltration in existing system

The construction cost order of magnitude for wastewater system improvements in this phase is 4.45 million dollars approximately.

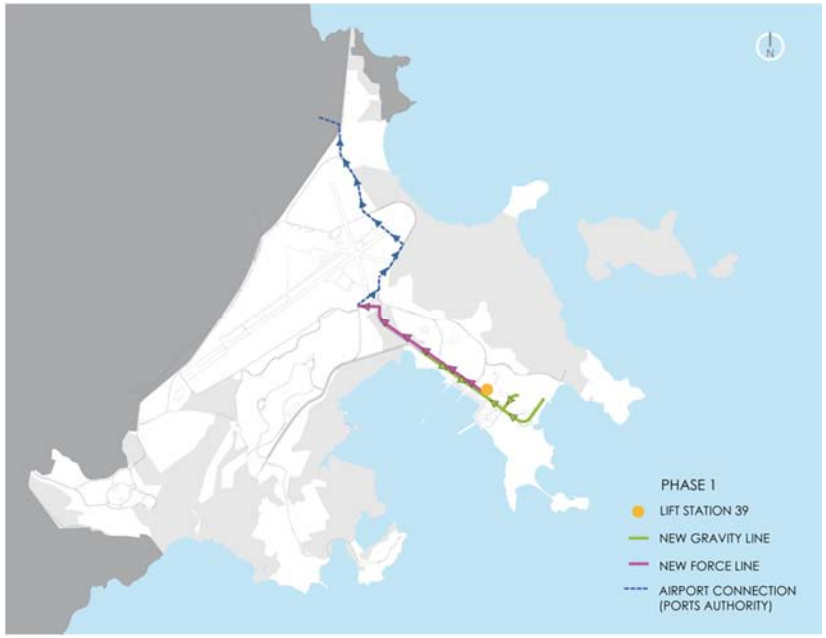


Figure 100: Phase 1 Wastewater System Improvements

Stormwater System

Although existing stormwater system is in fair condition, minor improvements are proposed to the system. In addition, mitigation areas are proposed for some zones that are in areas near to sensitive ecosystems.

Proposed improvements in phase 1 are:

- Repair and cleaning of existing pipelines and manholes
- Construct new pipelines, headwalls and Inlets
- And remove some existing pipelines

The construction cost order of magnitude for Stormwater system improvements in this phase is 870,000 dollars approximately.

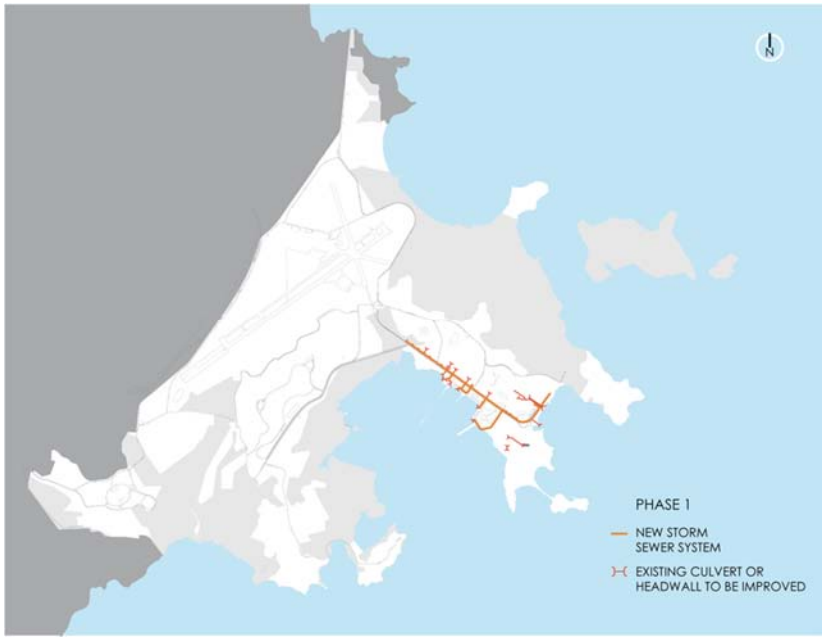


Figure 101 Phase 1 Stormwater System Improvements

Electrical System

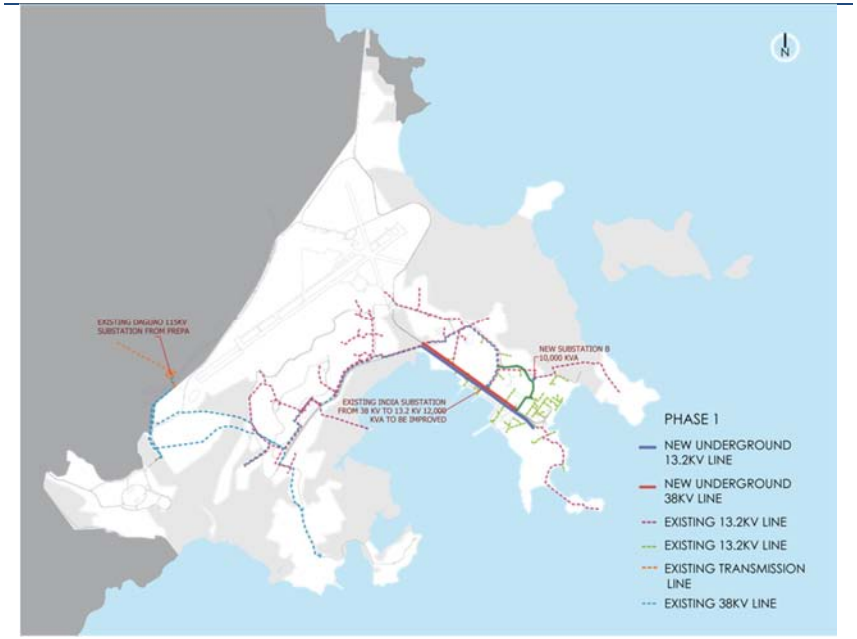


Figure 102: Phase 1 Electrical System Improvements

The estimated electrical load calculated for Phase 1 is 39,800 KVA approximately. The estimated load is divided between 13.2 KV (distribution voltage) and 38 KV (sub-transmission voltage). The improvements for this Phase 1 is summarized as follows:

- PREPA Improvements are needed to existing aerial lines and to existing India Substation (12,000 KVA). Substation lot size shall be increased to a minimum of 2,000 square meter
- A new Substation (10,000 KVA) 38KV to 13.2 KV is needed for the increase of electrical capacity of this phase
- In the Forrestal Drive “Type G” full section development, electrical underground of 13.2 KV and 38 KV was considered

The construction cost order of magnitude for Electrical system improvements in this phase is 16.6 million dollars approximately.

Telecommunications System

As per "Junta Reglamentadora de Telecomunicaciones de Puerto Rico" (JRTPR), the installation of a new fiber optics distribution system for all existing telephone and Cable TV providers in Puerto Rico is required. A main central distribution building of approximately 1,000 square feet in an approximately 2,000 square meter lot is required to support this operation.

Figure 103: Phase 1 Telecom System Improvements

The infrastructure improvements is summarized as fallow:

- Main Central Telecommunication Building
- From the main entrance of the Facilities 10 conduits of 4 inches and 8 conduits of 2 inches are needed up to the Main Central Building.

- From the Main Central Building the same quantity of conduits are run to five “mini-centrals” located strategically for future developments and Phase 1 development
- All telecommunication conduits must be underground

The construction cost order of magnitude for Telecommunication system improvements in this phase is 9.0 million dollars approximately.

4.3.3 Phase 2 Proposed Infrastructure

Roads and Gates

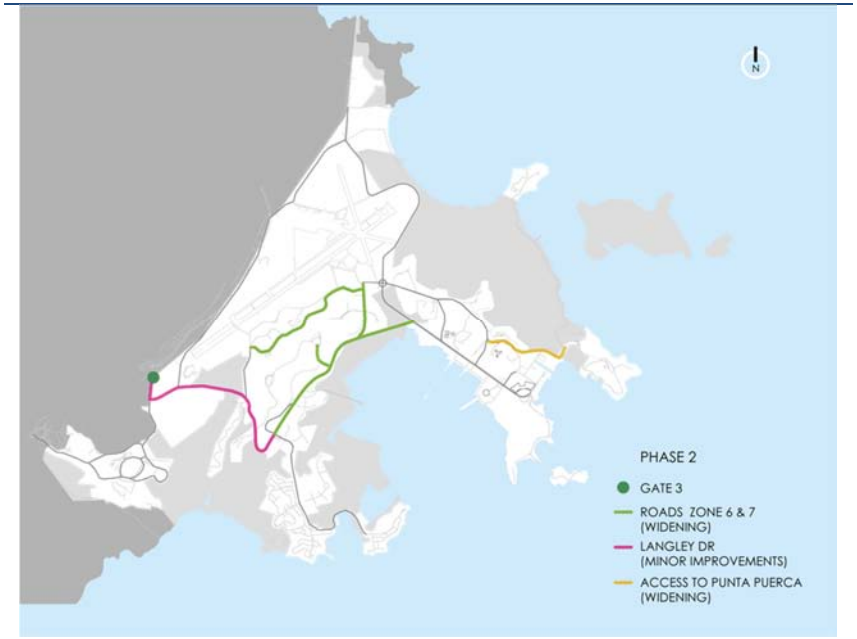


Figure 104: Phase 2 Roads

Trips generated in Phase 2 (accumulated Phase 1 and Phase 2) are total 92,000 Trips per Day approximately. We are considering that a major percentage of visitors will come through Gate 3. Proposed improvements for phase 2 are:

- Construct the full sections proposed in zones 6 and 7
- Widen from 2 lines to 4 lines access road from Water Front to Gate 3
- Widen Gate 3 to accordance with new road section
- Improve access road to Punta Puerca

The construction cost order of magnitude for roads and gates improvements in this phase is 5.0 million dollars approximately.

Potable Water System

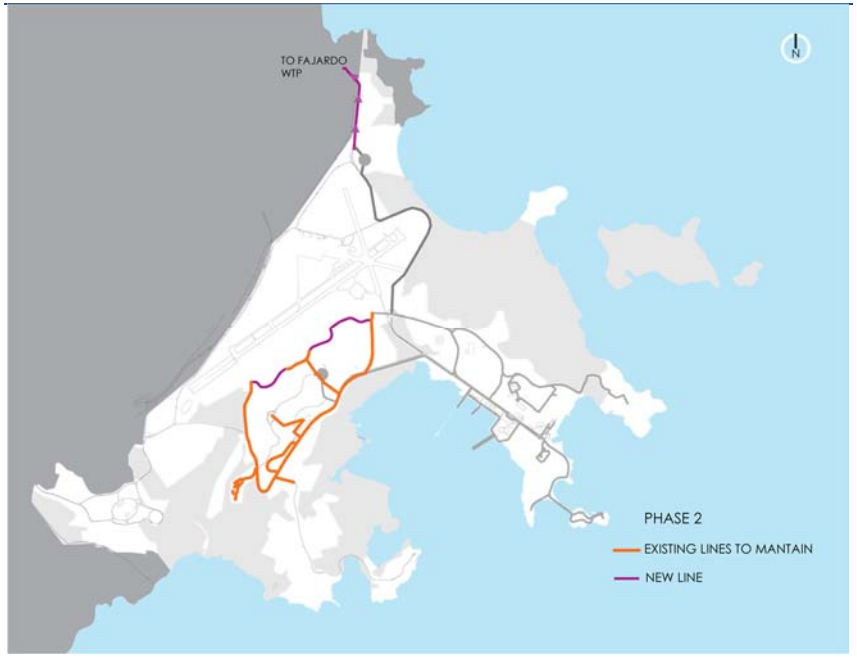


Figure 105 Phase 2: Water System Improvements

Potable Water consumption in Phase 2 is estimated in 2.8 MGD approximately. Improvements to the Potable Water System in phase 2 is summarized as follow:

- Install 20” pipeline from PRASA’s 12” connection up to Fajardo WTP (6.0 km)
- Maintain and use existing lines in zones 6 and 7
- Install a new line on zone 6 (Airport Industrial)
- Relocate Hydrants and valves affected by widening
- Repair leaks on system zones 3, 4, 6 and 7

The construction cost order of magnitude for potable water system improvements in this phase is 7.0 million dollars approximately.

Wastewater System

Wastewater discharge in Phase 2 is estimated in 2.1 MGD approximately. Airport system under construction will no have capacity to absorb all discharge, therefore an onsite WWTP will be needed by Phase 2.

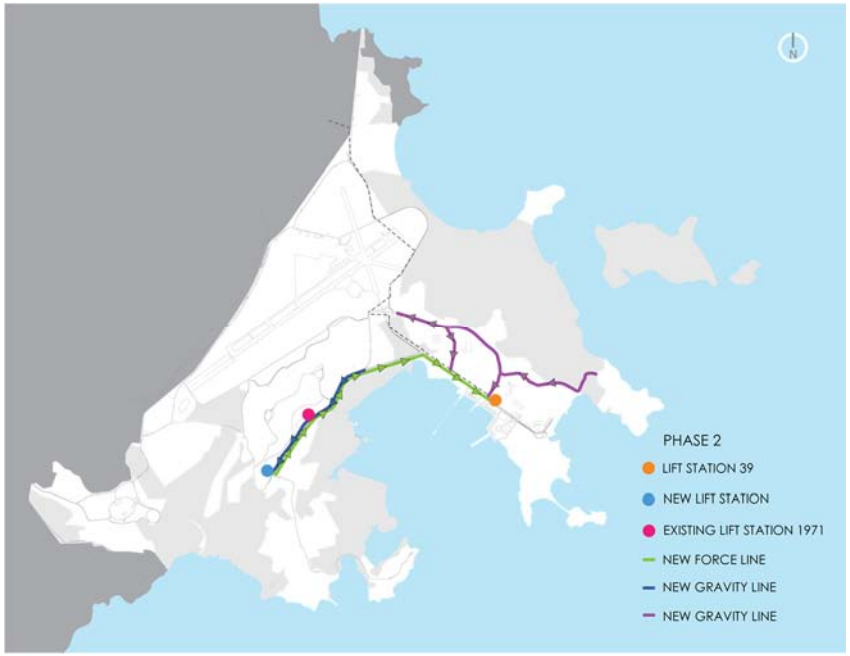


Figure 106: Phase 2 Wastewater System Improvements (Alt. 1)

Improvements to the Potable Water System in phase 2 is summarized as follow:

- Construct a new lift station in zone 7
- Construct a new force line from zone 7 to lift station 39
- Construct new gravity lines on zones 3, 4 and 6
- Construction of a new gravity line on Langley Drive to new lift station on zone 7

The construction cost order of magnitude for wastewater system improvements in this phase is 6.5 million dollars approximately.

Stormwater System

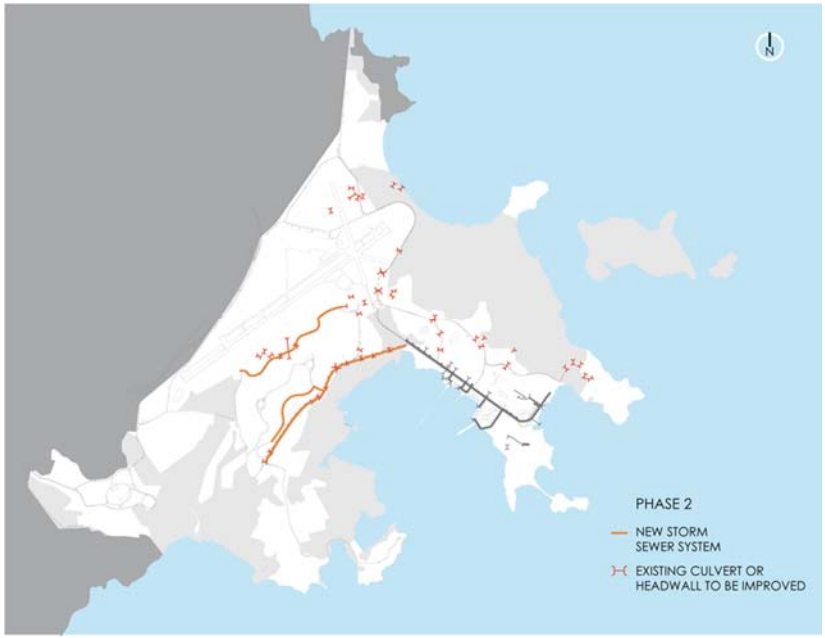


Figure 107 Phase 2 Stormwater System Improvements

Proposed improvements in stormwater system for phase 2 are:

- Repair and cleaning of existing pipelines and manholes.
- Construct a stormwater mitigation area
- Construct new pipelines, headwalls and Inlets
- And remove some existing pipelines.

The construction cost order of magnitude for stormwater system improvements in this phase is 970,000 dollars approximately.

Electrical System

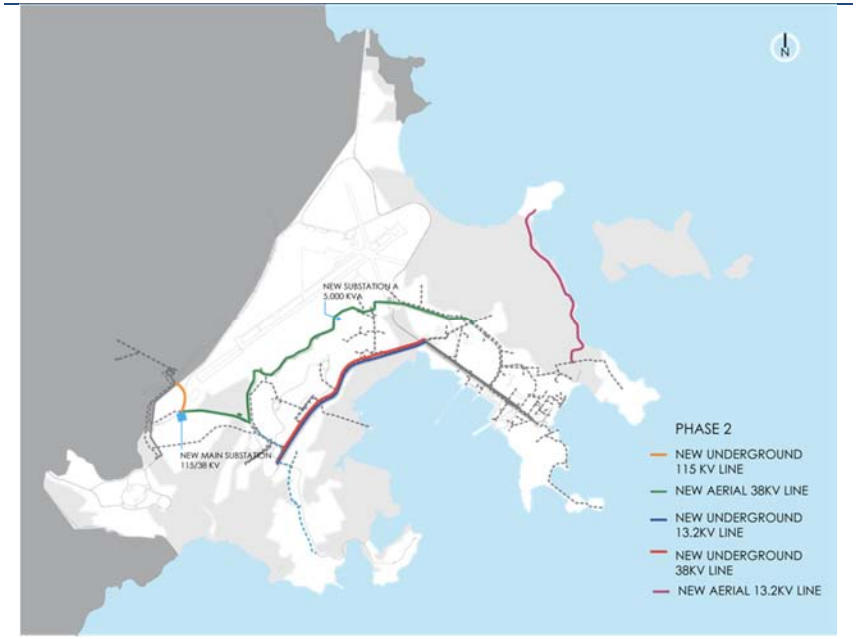


Figure 108: Phase 2 Electrical System Improvements

The estimated electrical load calculated for Phase 2 is 29,900 KVA approximately. With this additional new load it is required a new 115 KV substation of 100 MVA. The improvements for this Phase 2 include:

- New 115 KV Substation. Underground feeders serve from the Daguao 115 KV existing substation.
- Existing Charlie and Delta substations need improvement to 7,500 KVA and 12,000 KVA, respectively. Substation lot size shall be increased to a minimum of 2,000 square meter per substation.
- A new Substation (10,000 KVA) 38KV to 13.2 KV is needed for the increase of electrical capacity of this phase.
- In the Langley Drive “Type F” full section development, electrical underground of 13.2 KV and 38 KV was considered.

- New aerial 13.2 KV and 38 KV lines shall be constructed at the Corridor Road, Forrestal Drive Type “A” and Antietam Road Type “A”. This will create an electrical loop for PREPA meet their construction standards.

The construction cost order of magnitude for electrical system improvements in this phase is 33.6 million dollars approximately.

Telecommunication System

Figure 109: Phase 2 Telecommunications Improvements

In this Phase is important to create a telecommunication loop through the development of the Corridor Road, Forrestal Drive Type “A” and Antietam Road Type “A”. The infrastructure is the following:

- Two additional lots of at least 500 square meters are required.
- 10 conduits of 4 inches and 8 conduits of 2 inches are needed to close the telecommunication loop.
- All telecommunication conduits must be underground.

The construction cost order of magnitude for telecommunication system improvements in this phase is 6.8 million dollars approximately.

4.3.4 Phase 3 Proposed Infrastructure

Roads and Gates

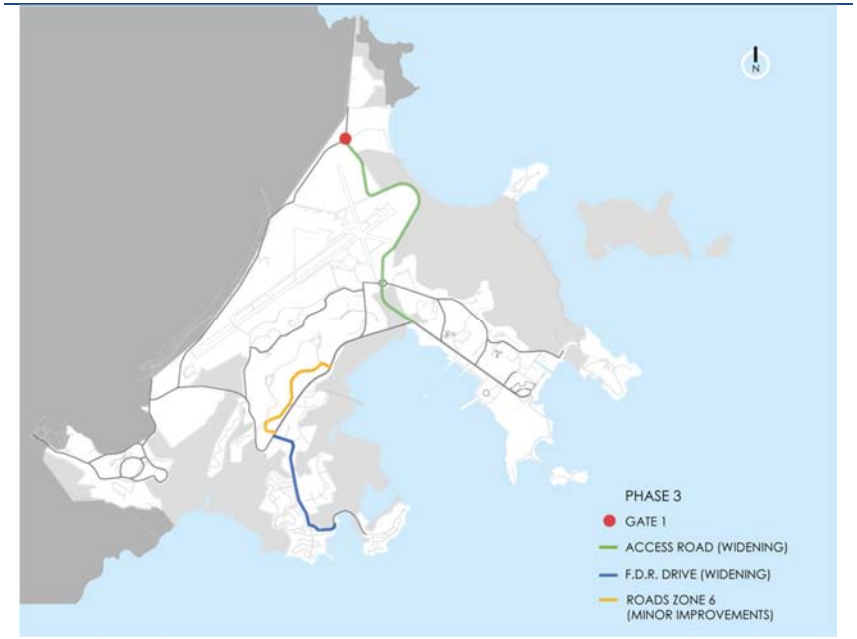


Figure 110: Phase 3 Roads Improvements

Trips generated in phase 3 are calculated to be around 118,000 Trips per Day. We are considering that a major percentage of visitors will come through Gate 3, but if the ROW of the access road to Gate 1 can be expanded; a widening of this road is proposed.

In general proposed improvements for phase 3 are:

- Minor improvements maintaining two lines on access road to zone 10 and portion on zone 6.
- Widen access road to gate 3 from 2 to 4 lines.

The construction cost order of magnitude for road system improvements in this phase is 6.1 million dollars approximately.

Potable Water System

Figure 111: Phase 3 Potable Water System Improvements

Potable Water consumption in Phase 3 is estimated in 3.6 MGD approximately. Improvements to the Potable Water System in phase 3 are summarized as follow:

- Improvements to water tank 535
- Relocate valves and hydrants affected by widening
- Repair leaks on system on zones 6 and 10

The construction cost order of magnitude for potable water system improvements in this phase is 0.62 million dollars approximately.

Wastewater System

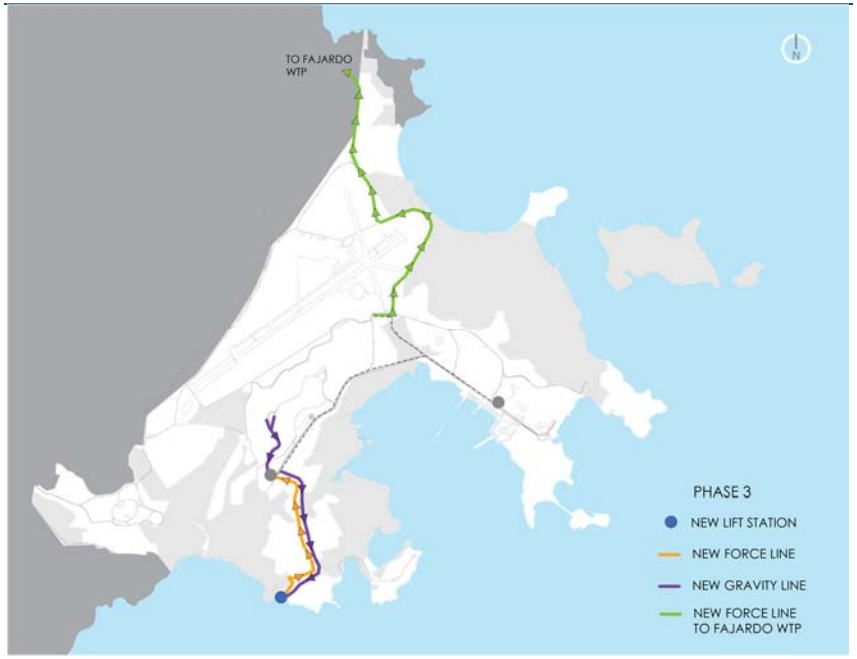


Figure 112: Phase 3 Wastewater System Improvements

Wastewater discharge in Phase 3 is estimated in 2.7 MGD approximately. Improvements proposed to the wastewater system in Phase 3 are summarized as follows:

- Construct a new lift station on zone 10
- Construct a new gravity line on zone 10
- Improve existing lift station on F.D.R. Drive
- Construct a new force line from F.D.R. Drive to the new lift station on zone 7
- Construct new gravity lines on zone 6
- Construct a new 12" force line from airport connection to PRASA connection point in Fajardo WWTP
- Improve lift station 39

The construction cost order of magnitude for potable water system improvements in this phase is 7.2 million dollars approximately.

Stormwater System

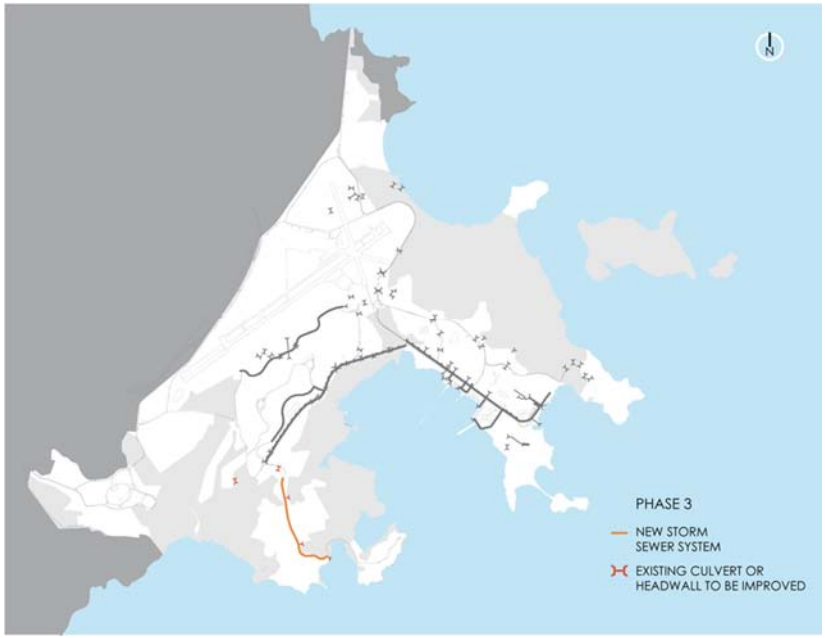


Figure 113 Phase 3 Stormwater System Improvements

Proposed improvements in stormwater system for phase 3 are:

- Repair and cleaning of existing pipelines and manholes.
- Construct a stormwater mitigation area
- Construct new pipelines, headwalls and Inlets
- And remove some existing pipelines.

The construction cost order of magnitude for stormwater system improvements in this phase is 400,000 dollars approximately.

Electrical System

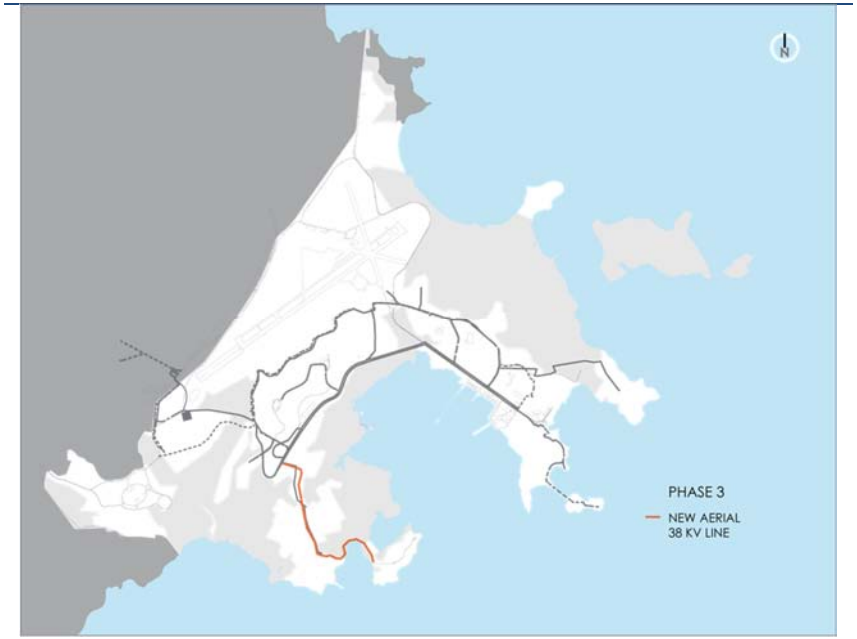


Figure 114: Phase 3 Electrical System Improvements

The estimated electrical load calculated for the Phase 3 is 15,600 KVA approximately. The developments for this phase are mostly residential, where the 13.2 KV distribution lines are needed extensively. The improvements for this Phase 3 are as follows:

- Existing Coral Sea substation need to be converted from 4.16 KV to 13.2 KV and a transformer of 7,500 KVA to cover Zone 10 exclusively. FDR Substations will not be used and shall be eliminated.
- New aerial 13.2 KV lines shall be install to cover zone 10, zone 5 and zone 6 developments.

The construction cost order of magnitude for electrical system improvements in this phase is 4.8 million dollars approximately.

Telecommunication System

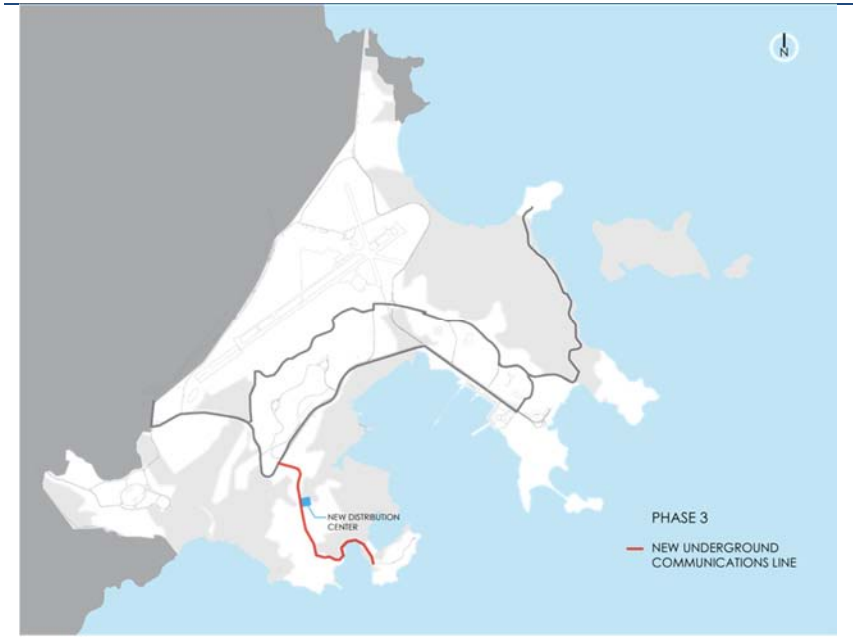


Figure 115: Phase 3 Telecommunications Systems Improvements

Basic telecommunication infrastructure is needed for this phase. The infrastructure is the following:

- Four additional mini central lot sizes of 500 square meters are required.
- 6 conduits of 4 inches and 4 conduits of 2 inches are needed.
- All telecommunication conduits must be underground.

The construction cost order of magnitude for telecommunication system improvements in this phase is 550,000 dollars approximately.

4.3.5 Phase 4 Proposed Infrastructure

Roads and Gates

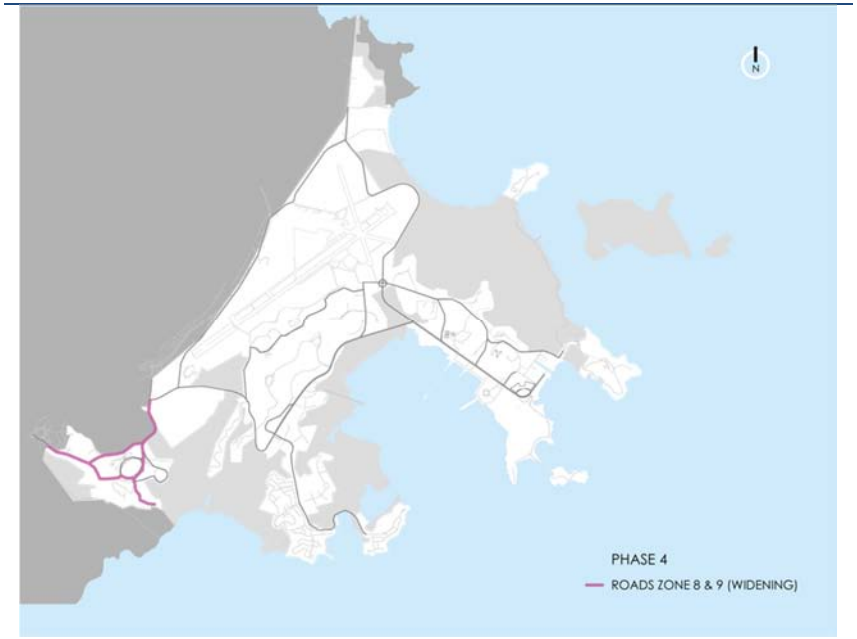


Figure 116: Phase 4 Roads

Trips generated in phase 43 are calculated as 128,000 Trips per Day approximately. Proposed roads improvements for phase 4 are as follow:

- Widening and Improvements to existing roads in zones 8 and 9.

The construction cost order of magnitude for roads system improvements in this phase is 3.1 million dollars approximately.

Potable Water System

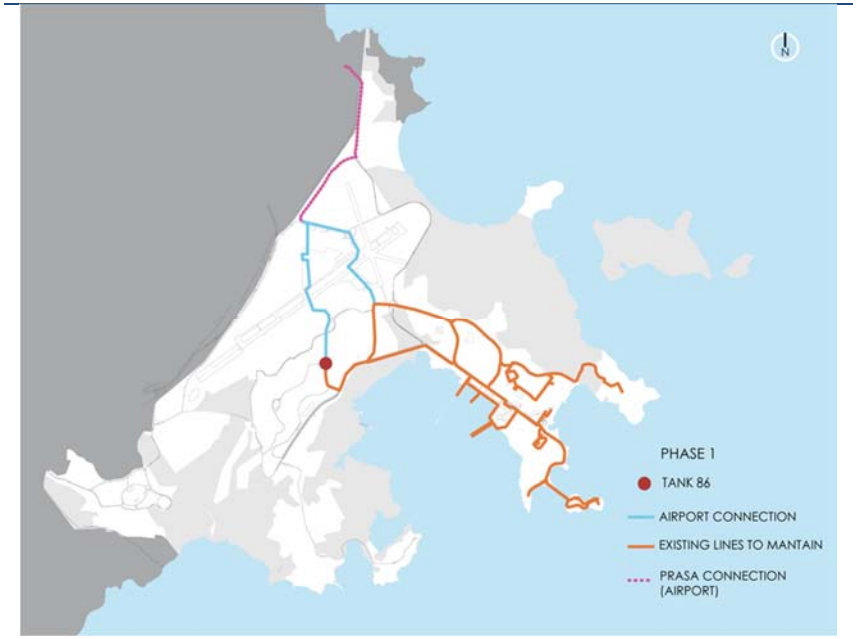


Figure 117: Phase 4 Potable Water System Improvements

Potable Water consumption in Phase 4 is estimated as 4.0 MGD approximately. Improvements to the Potable Water System in phase 4 are summarized as follows:

- Improve booster station on zones 8 and 9
- Install a smaller diameter pipe to zone 5
- Relocate valves and hydrants affected by widening
- Repair leaks on system on zones 8 and 9

The construction cost order of magnitude for potable water system improvements in this phase is 1.0 million dollars approximately.

Wastewater System

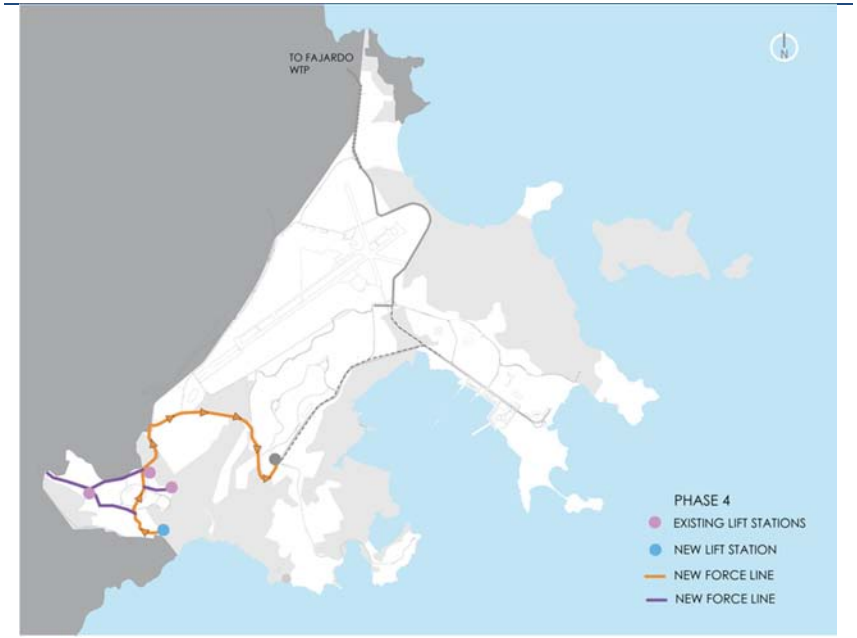


Figure 118: Phase 4 Wastewater System Improvements

Wastewater discharge in Phase 4 is estimated in 3.1 MGD approximately. Improvements proposed to wastewater system in Phase 4 are summarized as follows:

- Install new gravity lines on zones 8 and 9
- Improve existing lift station on zone 8 and 9
- Construct a new lift station on zone 9
- Construct a new force line from zone 9 to new Zone 7 lift station

The construction cost order of magnitude for wastewater system improvements in this phase is 4.1 million dollars approximately.

Stormwater System

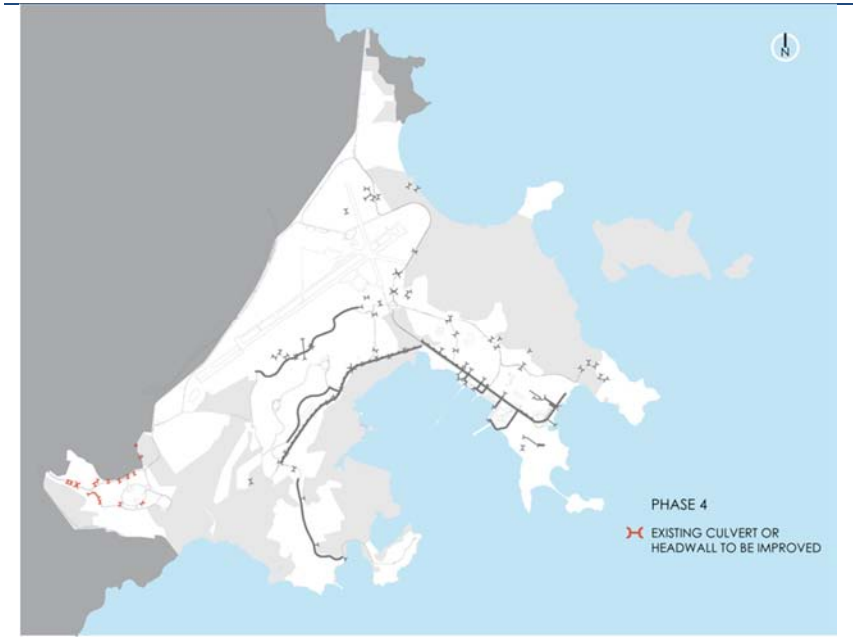


Figure 119 Phase 4 Stormwater System Improvements

Proposed improvements in stormwater system for phase 4 are:

- Repair and cleaning of existing pipelines and manholes.
- Construct a stormwater mitigation area

The construction cost order of magnitude for stormwater system improvements in this phase is 90,000 dollars approximately.

Electrical System

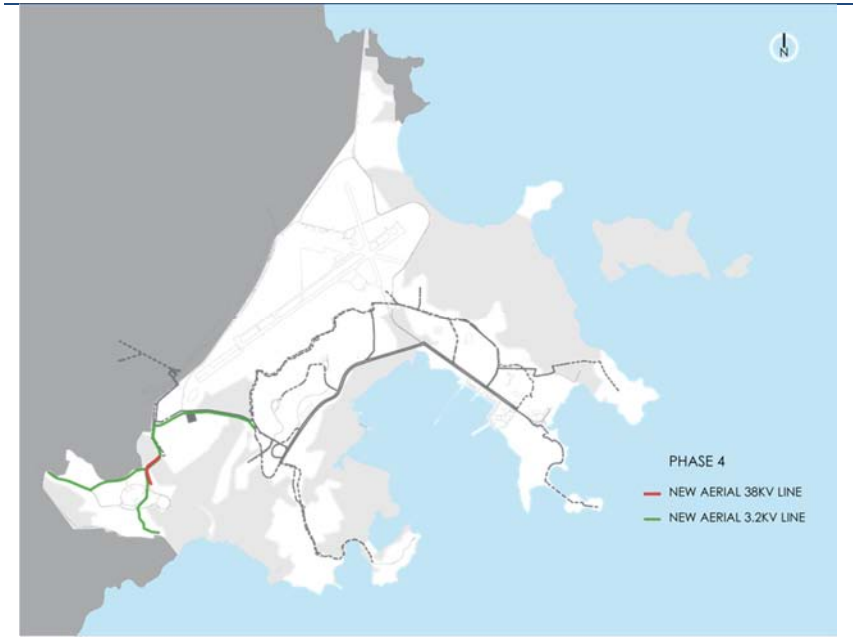


Figure 120: Phase 4 Electrical System Improvements

The estimated electrical load calculated for the Phase 4 is 12,400 KVA approximately. The major improvements to the electrical system have been done in previous phases. The need for this phase is the extension of the aerial 13.2 KV distribution to zone 8 and zone 9. The improvements for this Phase 4 are:

- Existing Bundy substation need to be converted from 4.16 KV to 13.2 KV and a transformer of 7,500 KVA to cover Zone 8 and zone 9.
- New aerial 13.2 KV lines shall be install to cover zone 8 and 9.

The construction cost order of magnitude for electrical system improvements in this phase is 4.3 million dollars approximately.

Telecommunication System

Figure 121: Phase 4 Telecommunications System Improvements

Basic telecommunication infrastructure is needed for this phase. The infrastructure is the following:

- One mini central lot size of 500 square meter is required.
- 6 conduits of 4 inches and 4 conduits of 2 inches are needed.
- All telecommunication conduits must be underground.

The construction cost order of magnitude for telecommunication system improvements in this phase is 550,000 dollars approximately.

5 Projected Capital Investment

ROOSEVELT ROADS REDEVELOPMENT
INFRASTRUCTURE MASTER PLAN

5.1 General Considerations and Costs

This study considered costs of infrastructure on general corridors and outside specific development areas. Each development area (ie. parcels for sale or lease) would be mandated to connect to these main utility corridors. All prices are based on present value and do not reflect inflation during time of development.

- Unit prices were obtained using various sources, among:
- Own database of Puerto Rico construction prices
- Current RS Means
- Public Agencies' unit prices
- Engineering judgment

After calculating the major dimensions of utility systems, quantities of items were calculated using the information collected (including CAD drawings, aerial photos, and site visit confirmations).

Total cost for upgrades to the utilities and infrastructure systems is in the range of $130 million to $140 million, depending of which alternative is selected.

The following tables include the total cost of upgrading infrastructure utilities per phase and considering development alternatives discussed in previous chapters. A more specific systems estimate is provided as well.

Table 22: Order of Magnitude Cost Summary by Phase

ORDER OF MAGNITUDE COST SUMMARY BY PHASE				
	Phase 1	**Phase 2**	**Phase 3**	**Phase 4**
Roads Improvements				
Gates	165,000	45,000		
Minor Improvements	861,343	72,000		240,000
sections	2,674,873	4,925,038	6,102,960	2,845,306
New Roads	97,464			
	3,798,681	**5,042,038**	**6,102,960**	**3,085,306**
Water				
WTP Shut down	150,000			
Tanks Improvements	75,000		30,000	
Booster Pumps Improvements	35,000		400,000	15,000
System General Improvements[1]	621,000	201,440	176,400	142,620
Relocation of Valves and Hydrants	125,000	25,000	15,000	10,000
New Booster Pump and Pit Tank	800,000			
New Lines (project interior and small diameter)		936,567		842,670
Connection to PRASA System at Airport	45,000			
New 20" Pipe to PRASA connection point[2]	3,806,400	5,859,000		
	5,657,400	**7,022,007**	**621,400**	**1,010,290**
Wastewater				
Improvements to Lift Stations	600,000	75,000	300,000	75,000
New Gravity Lines	3,836,888	4,965,227	928,798	2,263,866
New Force Lines		898,067	5,469,750	1,000,985
New Lift Station		500,000	500,000	750,000
	4,436,888	**6,438,293**	**7,198,548**	**4,089,850**
Stormwater System				
Pipes and Manholes Cleanning	18,840	15,390	31,290	9,210
New Pipes, manholes, Inlets and Headwalls	852,078	871,830	1,456,928	
Mitigation Areas		45,000	60,000	80,000
	870,918	**932,220**	**1,548,218**	**89,210**
Electrical System				
Improvements Required by PREPA[3]	6,400,000			
Improvements to Existing Substations	1,000,000	2,000,000	1,000,000	1,000,000
New Substations	2,750,000	9,750,000		
New Aerial Dist. Lines		5,046,020	3,783,290	3,334,940
New Underground Dist. Lines	6,437,902	16,865,222		
	16,587,902	**33,661,242**	**4,783,290**	**4,334,940**
Telecommunications System				
Telecommunications System	8,998,415	6,817,310	3,959,500	553,335
	8,998,415	**6,817,310**	**3,959,500**	**553,335**
Total per Phase for All Utilities	**$ 40,350,204.19**	**$ 59,913,110.91**	**$ 24,213,915.55**	**$ 13,162,930.85**

[1] Includes Piping and fittings and leak repairs
[2] This connection is divided in two phases, a first phase connecting toa 12" PRASA line and a second phase connecting to Fajardo WTP
[3] Excluding improvements related to substations

5.1.1 Roads Costs by Phase

Table 23: Roads Improvements Costs, Phase 1

ROADS IMPROVEMENTS CONSTRUCTION COST ORDER OF MAGNITUDE					
	Description	Qty	Unit	Unit Pric	Total
PHASE 1	Improvement to access gate 3	1	LS	40,000	40,000
	New guard house on road to gate 1	1	LS	125,000	125,000
	Maintain 2 lane on access road thru gate 1 (Minor Improvements)	5,286	LM	60	317,150
	Maintain 2 lane on access road thru gate 3 (Minor Improvements)	6,420	LM	60	385,193
	Develop full section on zone 1(Forrestal) "G"	3,139	LM	640	2,008,330
	Develop full section on zone 2 (Forrestal) "G"	1,042	LM	640	666,543
	New road to zone 3 (Dry dock area) "D"	262	LM	373	97,464
	Improvements to Forestal and Antietam (hospital)	2,650	lm	60	159,000
	Total Roads Improvements for these phase				**3,798,681**

Table 24: Phase 2 Roads Improvements Costs, Phase 2

ROADS IMPROVEMENTS CONSTRUCTION COST ORDER OF MAGNITUDE					
	Description	Qty	Unit	Unit Price	Total
PHASE 2	Develop full section on zone 6 "A"	2,000	LM	372.55	745,100
	Develop full section on zone 7 "A"	1,000	LM	372.55	372,550
	Develop full section on zone 7 "D"	870	LM	493.90	429,693
	Widen form 2 lane to 4 lane access road from gate 3 "F"	3,300	LM	623.55	2,057,715
	Widen form 2 lane to 4 lane access road from gate 3 "B"	3,100	LM	425.80	1,319,980
	Maintain 2 lane on access to zones 3 & 4 (Minor Improvements) (Punta Puerca) "A"	1,200	LM	60.00	72,000
	Improvements to gate access	1	LS	45,000.00	45,000
	Total Roads Improvements for these phase				**5,042,038**

Table 25 Roads Improvements Costs, Phase 3

ROADS IMPROVEMENTS CONSTRUCTION COST ORDER OF MAGNITUDE					
	Description	**Qty**	**Unit**	**Unit Price**	**Total**
PHASE 3	Widen from 2 lane to 4 lane access road from entrance to new gate 1 "B"	4,355.0	LM	425.80	1,854,359
	Widen from new gate 1 to Forestal Drive "C"	930.0		530.80	493,644
	Widen from 2 lane on access to zone 10 "C"	5,500.0	LM	530.80	2,919,400
	Widen from 2 lane on access to zone 6 "E"	1,340.0		623.55	835,557
	Total Roads Improvements for these phase				**6,102,960**

Table 26: Roads Improvements Costs, Phase 4

ROADS IMPROVEMENTS CONSTRUCTION COST ORDER OF MAGNITUDE					
	Description	**Qty**	**Unit**	**Unit Price**	**Total**
PASHE 4	Widen on zone 8 to section type"A"	580.0	LM	372.55	216,079
	Widen on zone 8 to section type "C"	880.0	LM	530.80	467,104
	Widen on zone 8 to section type "C"	1,880.0	LM	530.80	997,904
	Widen on zone 8 to section type "A"	3,125.0	LM	372.55	1,164,219
	Minor improvements to all other existing lines	4,000.0	LM	60.00	240,000
	Total Roads Improvements for these phase				**3,085,306**

5.1.2 Potable Water Costs by Phase

Table 27: Water System Costs, Phase 1

POTABLE WATER CONSTRUCTION COST ORDER OF MAGNITUDE					
	Description	**Qty**	**Unit**	**Unit Price**	**Total**
PHASE 1	Shut down existing WTP	1	LS	150,000.00	150,000
	Maintain existig lines and leaks repair	13,800	LM	45.00	621,000
	Relocate valves and hydrants affected by wedenings	1	LS	125,000.00	125,000
	Improvements to tank 86	1	LS	75,000.00	75,000
	Improvements to Booster Systems	1	LS	35,000.00	35,000
	New Booster Pump and Pit Tank	1	LS	800,000.00	800,000
	New 20" line to 12" PRASA line	3,900	LM	976.00	3,806,400
	Reopen Airport Connection (PRASA Service)	1	LS	45,000.00	45,000
	Total Roads Improvements for these phase				**5,657,400**

Table 28: Water System Costs, Phase 2

POTABLE WATER CONSTRUCTION COST ORDER OF MAGNITUDE					
	Description	**Qty**	**Unit**	**Unit Price**	**Total**
PHASE 2	New 20" Line from connection in previous phase to Fajardo \	6,000	LM	976.50	5,859,000
	Maintain and repair existing lines in zone 4 and 5	3,422	LM	20.00	68,440
	Maintain and repair existing lines in zone 6 and 7	6,650	LM	20.00	133,000
	Install new 10" line on zone 6 (Airport-Industrial)	1,622	LM	577.50	936,567
	Relocated valves and hydrants affected by widenings	1	LS	25,000.00	25,000
	Total Improvements for these phase				**7,022,007**

Table 29: Water System Costs, Phase 3

POTABLE WATER CONSTRUCTION COST ORDER OF MAGNITUDE					
	Description	**Qty**	**Unit**	**Unit Price**	**Total**
PHASE 3	Expand Booster Pump and Tank	1	LS	400,000.00	400,000
	Improvements to water tank 535	1	LS	30,000.00	30,000
	Repair leaks on system on zones 6 and 10	8,820	ML	20.00	176,400
	Relocated valves and hydrants affected by widenings	1	LS	15,000.00	15,000
	Total Improvements for these phase				**621,400**

Table 30: Water System Costs, Phase 4

POTABLE WATER CONSTRUCTION COST ORDER OF MAGNITUDE					
	Description	**Qty**	**Unit**	**Unit Price**	**Total**
PHASE 4	Install samall diameter pipe to Zone 5	3,121	ML	270.00	842,670
	Improvements to Booster Stations on zone 8	1	LS	15,000.00	15,000
	Repair leaks on system on Zones 8 and 9	7,131	ML	20.00	142,620
	Relocated valves and hydrants affected by widenings	1	LS	10,000.00	10,000
	Total Improvements for these phase				**1,010,290**

5.1.3 Wastewater System Costs by Phase

Table 31: Wastewater System Costs, Phase 1

WASTEWATER CONSTRUCTION COST ORDER OF MAGNITUDE					
	Description	**Qty**	**Units**	**Unit Price**	**Total**
Phase 1	Improvements to lift station 39	1	LS	600,000.00	600,000
	New 18" gravity line on Forrestal Drive to lift station 39	3,353	LM	800.00	2,682,198
	New 12" force line from lift station 39 to airport connection	2,692	LM	429.00	1,154,691
				Total Improvements for these phase	**4,436,888**

Table 32: Wastewater System Costs, Phase 2

WASTEWATER CONSTRUCTION COST ORDER OF MAGNITUDE					
	Description	**Qty**	**Units**	**Unit Price**	**Total**
Phase 2	New lift station on zone 7	1	LS	500,000.00	500,000
	New 6" force line from zone 7 to Lift Station 39	4,790	LM	187.50	898,067
	New 12" gravity line on Langley Drive to New lift station (zone 7)	1,764	LM	780.00	1,376,258
	Improve Lift Station 1971	1	LS	75,000.00	75,000
	New 12" gravity line on zone 3	1,096	LM	780.00	854,672
	New 12" gravity line on zone 4	1,662	LM	780.00	1,296,166
	New 8" gravity line on zone 6	2,131	LM	675.00	1,438,131
				Total Improvements for these phase	**6,438,293**

Table 33: Wastewater System Costs, Phase 3

WASTEWATER CONSTRUCTION COST ORDER OF MAGNITUDE					
	Description	**Qty**	**Units**	**Unit Price**	**Total**
PHASE 3	New 10" gravity line on zone 10	1,950	LM	121.51	236,923
	Improve existing lift stations on F.D.R. Drive	1	LS	300,000.00	300,000
	New lift stations in zone 10	1	LS	500,000.00	500,000
	New force line from zone 10 to new lift station at zone 7	2,650	LM	429.00	1,136,850
	New 8" gravity line on zone 6	1,025	LS	675.00	691,875
	Extend 12" force line from Airport to PRASA conn. point in Fajardo	10,100	ML	429	4,332,900
	Total Improvements for these phase				**7,198,548**

Table 34: Wastewater System Costs, Phase 4

WASTEWATER CONSTRUCTION COST ORDER OF MAGNITUDE					
	Description	**Qty**	**Units**	**Unit Price**	**Total**
Phase 4	New 8" gravity lines on zones 8 and 9	3,354	LM	675.00	2,263,866
	Improve existing lift station on zone 8 and 9	1	LS	75,000.00	75,000
	New lift station on zone 9	1	LS	750,000.00	750,000
	New 6" force line from zone 9 to new lift station on zone 7	5,339	LM	187.5	1,000,985
	Total Improvements for these phase				**4,089,850**

5.1.4 Stormwater System Costs by Phase

Table 35: Stormwater System Costs, Phase 1

STORM WATER CONSTRUCTION COST ORDER OF MAGNITUDE					
	Description	Qty	Unit	Unit Price	Total
PHASE 1	Pipe cleaning and repair	588.0000	LM	30.00	17,640
	Manholes claning and repair	4.0000	EA	300.00	1,200
	New pipe	3,141.0000	LM	208.00	653,328
	Pipe to be removed	250.0000	LM	75.00	18,750
	New headwall	1.0000	EA	5,000.00	5,000
	New inlets	35.0000	EA	5,000.00	175,000
					-
	Total Roads Improvements for these phase				**870,918**

Table 36: Stormwater System Costs, Phase 2

STORM WATER CONSTRUCTION COST ORDER OF MAGNITUDE					
	Description	Qty	Unit	Unit Price	Total
PHASE 2	Pipe cleaning and repair	513.0000	LM	30.00	15,390
	Stormwater mitigation area	3.0000	EA	15,000.00	45,000
	New pipe	3,260.0000	LM	208.00	678,080
	Pipe to be removed	50.0000	LM	75.00	3,750
	New headwall	3.0000	EA	5,000.00	15,000
	New inlets	35.0000	EA	5,000.00	175,000
	Total Improvements for these phase				**932,220**

Table 37: Stormwater System Costs, Phase 3

STORM WATER CONSTRUCTION COST ORDER OF MAGNITUDE					
	Description	**Qty**	**Unit**	**Unit Price**	**Total**
PHASE 3	Pipe cleaning and repair	1,043	LM	30.00	31,290
	Stormwater mitigation area	4	EA	15,000.00	60,000
	New pipe	7,706	LM	138.00	1,063,428
	Pipe to be removed	180	LM	75.00	13,500
	New headwall	2	EA	5,000.00	10,000
	New inlets	74	EA	5,000.00	370,000
	Total Improvements for these phase				**1,548,218**

Table 38: Wastewater System Costs, Phase 4

STORM WATER CONSTRUCTION COST ORDER OF MAGNITUDE					
	Description	**Qty**	**Unit**	**Unit Price**	**Total**
PHASE 4	Pipe cleaning and repair	307	LM	30.00	9,210
	Stormwater mitigation area	2	EA	40,000.00	80,000
	Total Improvements for these phase				**89,210**

5.1.5 Electrical System Costs by Phase

Table 39: Electrical System Costs, Phase 1

ELECTRICAL WORKS CONSTRUCTION COST ORDER OF MAGNITUDE					
	Description	**Qty**	**Unit**	**Unit Price**	**Total**
PHASE 1	New Substation A at 38kV	1	LS	2,750,000.00	2,750,000
	New Aerial 38kV Line (pole w/aerial line)	0	LM	560.00	-
	New 38kV Underground kV Line (LM one feeder)	2005	LM	1,886.00	3,781,430
	New Aerial 13.2kV Line (pole w/aerial line)	0	LM	490.00	-
	New 13.2kV Underground kV Line (LM one feeder)	2314	LM	1,148.00	2,656,472
	Improvements to India Substation	1	LS	1,000,000.00	1,000,000
	PREPA Improvements	1	LS	6,400,000.00	6,400,000
	Total Improvements for these phase				**16,587,902**

Table 40: Electrical System Works, Phase 2

ELECTRICAL WORKS CONSTRUCTION COST ORDER OF MAGNITUDE					
	Description	**Qty (Meter)**		**Unit Price**	**Total**
PHASE 2	New Substation B at 38kV	1	LS	2,750,000.00	2,750,000.00
	New Aerial 38kV Line (pole w/aerial line)	5208	LM	560.00	2,916,480.00
	New 38kV Underground kV Line (LM one feeder)	6333	LM	1,886.00	11,944,038.00
	New Aerial 13.2kV Line (pole w/aerial line)	4346	LM	490.00	2,129,540.00
	New 13.2kV Underground kV Line (LM one feeder)	3383	LM	1,148.00	3,883,684.00
	Improvements to Charlie and Delta Substations	2	LS	1,000,000.00	2,000,000.00
	New 115 KV Underground Line	415	LM	2,500.00	1,037,500.00
	Substation at 115kV	1	LS	7,000,000.00	7,000,000.00
	Total Improvements for these phase				**33,661,242**

Table 41: Electrical System Costs, Phase 3

ELECTRICAL WORKS CONSTRUCTION COST ORDER OF MAGNITUDE					
	Description	**Qty (Meter)**		**Unit Price**	**Total**
PHASE 3	Substation at 38kV (unt) (all new)	0	LS	2,750,000.00	-
	New Aerial 38kV Line (pole w/aerial line)	0	LM	560.00	-
	New 38kV Underground kV Line (LM one feeder)	0	LM	1,886.00	-
	New Aerial 13.2kV Line (pole w/aerial line)	7721	LM	490.00	3,783,290.00
	Improvements to Coral Sea Substation	1	LS	1,000,000.00	1,000,000.00
	New 13.2kV Underground kV Line (LM one feeder)	0	LS	1,148.00	-
	Total Improvements for these phase				**4,783,290**

Table 42: Electrical System Costs, Phase 4

ELECTRICAL WORKS CONSTRUCTION COST ORDER OF MAGNITUDE					
	Description	**Qty (Meter)**		**Unit Price**	**Total**
PHASE 4	Substation at 38kV (unt) (all new)	0	LS	2,750,000.00	-
	New Aerial 38kV Line (pole w/aerial line)	0	LM	560.00	-
	New 38kV Underground kV Line (LM one feeder)	0	LM	1,886.00	-
	New Aerial 13.2kV Line (pole w/aerial line)	6806	LM	490.00	3,334,940.00
	Improvements to Burndy Substation	1	LM	1,000,000.00	1,000,000.00
	New 13.2kV Underground kV Line (LM one feeder)	0	LS	1,148.00	-
	Total Improvements for these phase				**4,334,940**

5.1.6 Telecommunication System Costs by Phase

Table 43: Telecommunications System Costs, Phase 1

TELECOMMUNICATION WORKS CONSTRUCTION COST ORDER OF MAGNITUDE					
	Description	**Qty**	**Unit**	**Unit Price**	**Total**
PHASE 1	Main Central Station	1	LS	250,000.00	250,000
	Mini Central	5	LS	25,000.00	125,000
	New Underground 4" ø Conduit	94763	LM	55.00	5,211,965
	New Underground 2" ø Conduit	75810	LM	45.00	3,411,450
				Total Improvements for this phase	**8,998,415**

Table 44: Telecommunications System Costs, Phase 2

TELECOMMUNICATION WORKS CONSTRUCTION COST ORDER OF MAGNITUDE					
	Description	**Qty (Meter)**		**Unit Price**	**Total**
PHASE 2	Main Central Station	0	LS	250,000.00	-
	Mini Central	2	LS	25,000.00	50,000.00
	New Underground 4" ø Conduit	74370	LM	55.00	4,090,350.00
	New Underground 2" ø Conduit	59488	LM	45.00	2,676,960.00
				Total Improvements for this phase	**6,817,310**

Table 45: Telecommunications System Costs, Phase 3

TELECOMMUNICATION WORKS CONSTRUCTION COST ORDER OF MAGNITUDE					
	Description	**Qty (Meter)**		**Unit Price**	**Total**
PHASE 3	Main Central Station	0	LS	250,000.00	-
	Mini Central	4	LS	25,000.00	100,000.00
	New Underground 4" ø Conduit	45408	LM	55.00	2,497,440.00
	New Underground 2" ø Conduit	30268	LM	45.00	1,362,060.00
	Total Improvements for this phase				**3,959,500**

Table 46: Telecommunications System Costs, Phase 4

TELECOMMUNICATION WORKS CONSTRUCTION COST ORDER OF MAGNITUDE					
	Description	**Qty (Meter)**		**Unit Price**	**Total**
PHASE 4	Main Central Station	0	LS	250,000.00	-
	Mini Central	4	LS	25,000.00	100,000.00
	New Underground 4" ø Conduit	5333	LM	55.00	293,315.00
	New Underground 2" ø Conduit	3556	LM	45.00	160,020.00
	Total Improvements for this phase				**553,335**

6 Appendix

6.1 Index of Figures

Figure 1: Existing Road and Gates Network....2-19
Figure 2: Existing Conditions at Gate 1....2-20
Figure 3: Existing Conditions at Gate 1....2-20
Figure 4: Existing Conditions at Gate 3....2-21
Figure 5: Existing Conditions at Gate 4....2-21
Figure 6: Tarawa Road....2-22
Figure 7: Tarawa Road....2-22
Figure 8: Bennington Road....2-23
Figure 9: Forrestal Drive....2-23
Figure 10: Langley Drive....2-24
Figure 11: Langley Drive....2-24
Figure 12: Towway Drive....2-25
Figure 13: FDR Drive....2-25
Figure 14: Secondary Road in Capehart....2-26
Figure 15: Secondary Road around Capehart....2-26
Figure 16: Secondary Road (Bundy WWTP Access)....2-27
Figure 17: Secondary Road (Antenna Facility)....2-27
Figure 18: Bus Shelter in Langley Drive....2-28
Figure 19: Piers and Bulkheads at Ensenada Honda....2-30
Figure 20: Fueling Pier....2-31
Figure 21: Waterfront at Pier 2....2-31
Figure 22: Dry Dock Area....2-31
Figure 23: Pedestrian Crossing at Forrestal Dr.....2-32
Figure 24: Existing Water Distribution System....2-33
Figure 25: Raw Water Reservoir....2-34
Figure 26: Water Reservoir Outer Swale....2-34
Figure 27: Water Treatment Plant....2-35
Figure 28: Water Treatment Plant....2-35
Figure 29: Water Distribution Tank 86....2-37
Figure 30: Water Distribution Tank 535....2-38
Figure 31: Fire Protection Cistern....2-38
Figure 32: Fire Protection Cistern....2-39
Figure 33: Booster Pump 2360....2-41
Figure 34: Booster Pump 1977....2-41
Figure 35: Flooded Pressure Regulating Valve Box....2-42
Figure 36: Pressure Regulating Valve Box....2-42
Figure 37: Existing Sanitary Sewer System....2-44
Figure 38: Existing Sanitary Sewer Manhole....2-45
Figure 39: Existing Sanitary Sewer Lift Station....2-46
Figure 40: Forrestal WWTP....2-47
Figure 41: Forrestal WWTP....2-48
Figure 42: Capehart WWTP....2-48
Figure 43: Capehart WWTP....2-49
Figure 44: Bundy WWTP....2-49
Figure 45: Bundy WWTP....2-50
Figure 46: Exisitng Stormwater Sewer System Layout....2-51
Figure 47: Corrugated Metal Pipe Culvert....2-52
Figure 48: Concrete Box Culvert....2-53
Figure 49: FEMA 100 yr Flood Zones (West RR)....2-54
Figure 50: FEMA 100 yr Flood Map (East RR)....2-55
Figure 51: Existing 38KV Electrical Distribution Lines....2-58
Figure 52: Existing 13.2KV Electrical Distribution Lines....2-59
Figure 53: PREPA Daguao Main Electrical Substation....2-60
Figure 54: Substation Delta....2-61
Figure 55: Switchgear at Substation Delta (13.2KV)....2-61
Figure 56: Substation Charlie....2-62
Figure 57: Switchgear at Substation Charlie (13.2KV)....2-62
Figure 58: Substation India....2-63
Figure 59: Switchgear at Substation India (13.2KV)....2-63
Figure 60: Substation at Card Street....2-64
Figure 61: Substation at Breton Street....2-64
Figure 62: Substation Bundy....2-65
Figure 63: Substation Bundy....2-65
Figure 64: Substation FDR....2-66
Figure 65: Switchgear at FDR Substation (4.16KV)....2-66
Figure 66: Substation Coral Sea....2-67
Figure 67: Switchgear at Substation Coral Sea (4.16KV)....2-67
Figure 68: Existing Poles....2-68
Figure 69: Existing Poles....2-68
Figure 70: Existing IP Distribution....2-69
Figure 71: Existing Telecommunications Pull Box....2-69
Figure 72: Redevelopment Plan Zones....3-74
Figure 73: Proposed Roads Network....3-93
Figure 74: Gate 1 (Tarawa Road-Ceiba)....3-94
Figure 75: Gate 3 (Bennington Road- Ceiba)....3-95
Figure 76: Gate 4 (Bennington Road- Naguabo)....3-96
Figure 77: Proposed Highway Ramp at Airport....3-97
Figure 78: Proposed Water Distribution System....3-112
Figure 79: Proposed Wastewater System....3-129
Figure 80: Potential Stormwater Infrastructure....3-133
Figure 81: Proposed Electrical 38KV System....3-140

Figure 82: Proposed Electrical 13.2KV System 3-141
Figure 83: Proposed Electrical 13.2KV & 38KV Loop Systems 3-142
Figure 84: Subscriber Services & Bandwidth Demand (Bank of America) 3-143
Figure 85: Proposed Telecom Distribution Map 3-145
Figure 86: Vegetative Communities and Land Cover, Roosevelt Roads 3-148
Figure 87: View of Waterfront and Pier Area from Pier 3 3-152
Figure 88: Site Plan Showing Existing Piers and Bulkheads 3-153
Figure 89: Redevelopment Areas for Phase 1 4-157
Figure 90: Redevelopment Areas for Phase 2 4-157
Figure 91: Redevelopment Areas for Phase 3 4-158
Figure 92: Redevelopment Areas for Phase 4 4-158
Figure 93: Redevelopment Areas for Phase 5 4-159
Figure 94: Infrastructure Master Plan Phasing Summary 4-160
Figure 95: Infrastructure Phasing Timeline 4-161
Figure 96: SWMU's Affecting Infrastructure Phasing 4-163
Figure 97: Phase 1 Road Improvements 4-173
Figure 98: Phase 1 Potable Water System Improvements 4-174
Figure 99: Phase 1 Wastewater System Improvements 4-175
Figure 100 Phase 1 Stormwater System Improvements 4-176
Figure 101: Phase 1 Electrical System Improvements 4-176
Figure 102: Phase 1 Telecom System Improvements 4-177
Figure 103: Phase 2 Roads 4-180
Figure 104 Phase 2: Water System Improvements 4-180
Figure 105: Phase 2 Wastewater System Improvements (Alt. 1) 4-181
Figure 106 Phase 2 Stormwater System Improvements 4-182
Figure 107: Phase 2 Electrical System Improvements 4-182
Figure 108: Phase 2 Telecommunications Improvements 4-183
Figure 109: Phase 3 Roads Improvements 4-185
Figure 110: Phase 3 Potable Water System Improvements 4-185
Figure 111: Phase 3 Wastewater System Improvements 4-186
Figure 112 Phase 3 Stormwater System Improvements 4-187
Figure 113: Phase 3 Electrical System Improvements 4-187
Figure 114: Phase 3 Telecommunications Systems Improvements 4-188
Figure 115: Phase 4 Roads 4-190
Figure 116: Phase 4 Potable Water System Improvements 4-190
Figure 117: Phase 4 Wastewater System Improvements 4-191
Figure 118 Phase 4 Stormwater System Improvements 4-191
Figure 119: Phase 4 Electrical System Improvements 4-192
Figure 120: Phase 4 Telecommunications System Improvements 4-192

6.2 Index of Tables

Table 1: Existing Water Tanks Summary....2-40
Table 2: Existing Pump Station Summary....2-40
Table 3: Main Electrical Substations....2-60
Table 4: Trip Generation by Zone....3-87
Table 5: Trip Generation by Zone (cont.)....3-88
Table 6: Water Demand By Zone....3-109
Table 7: Water Demand by Zone (cont.)....3-110
Table 8: Wastewater Generation by Zone....3-123
Table 9: Wastewater Generation by Zone (cont.)....3-124
Table 10: Electrical Load Demand by Zone....3-135
Table 11: Electrical Load Demand by Zone (Cont.)....3-136
Table 12: Total Electrical Load Per Zone....3-138
Table 13: SWMU's Estimated Dates of Remediation....4-162
Table 14: Trip Generation by Proposed Development Phase....4-164
Table 15: Trip Generation by Proposed Development Phase (cont.)....4-165
Table 16: Water Demand by Proposed Development Phase....4-166
Table 17: Water Demand by Proposed Development Phase (cont.)....4-167
Table 18: Wastewater Discharge by Proposed Development Phase....4-168
Table 19: Wastewater Discharge by Proposed Development Phase (cont.)....4-169
Table 20: Electrical Load Demand by Proposed Development Phase....4-170
Table 21: Electrical Load Demand by Proposed Development Phase (cont.)....4-171
Table 22: Order of Magnitude Cost Summary by Phase....5-196
Table 23: Roads Improvements Costs, Phase 1....5-197
Table 24: Phase 2 Roads Improvements Costs, Phase 2....5-197
Table 25 Roads Improvements Costs, Phase 3....5-198
Table 26: Roads Improvements Costs, Phase 4....5-198
Table 27: Water System Costs, Phase 1....5-199
Table 28: Water System Costs, Phase 2....5-199
Table 29: Water System Costs, Phase 3....5-200
Table 30: Water System Costs, Phase 4....5-200
Table 31: Wastewater System Costs, Phase 1....5-201
Table 32: Wastewater System Costs, Phase 2....5-201
Table 33: Wastewater System Costs, Phase 3....5-202
Table 34: Wastewater System Costs, Phase 4....5-202
Table 35: Stormwater System Costs, Phase 1....5-203
Table 36: Stormwater System Costs, Phase 2....5-203
Table 37: Stormwater System Costs, Phase 3....5-204
Table 38: Wastewater System Costs, Phase 4....5-204
Table 39: Electrical System Costs, Phase 1....5-205
Table 40: Electrical System Works, Phase 2....5-205
Table 41: Electrical System Costs, Phase 3....5-206
Table 42: Electrical System Costs, Phase 4....5-206
Table 43: Telecommunications System Costs, Phase 1....5-207
Table 44: Telecommunications System Costs, Phase 2....5-207
Table 45: Telecommunications System Costs, Phase 3....5-208
Table 46: Telecommunications System Costs, Phase 4....5-208

6.3 Support Documents

Phasing and Cost Summary

Construction Schedule

ROOSEVELT ROADS REDEVELOPMENT

INFRASTRUCTURE MASTER PLAN

Construction Phasing and Cost Proposal

PHASE 1

Roads ($3.8 mill)
-Improvements to access gate 3
-New guard house on road to gate 1
-Improvements to 2 lanes on access road thru gate 1
-Improvements to 2 lanes on access road thru gate 3
-Develop full section on zones 1 & 2 main corridor (Forrestal)
-New road to zone 3 (dry dock area)

Water ($5.65 mill)
-Shut down WTP
-Maintain existing lines
-Re-open airport connection (PRASA Service)
-Install new 20" pipeline from PRASA`s 12" connection (3.9 km) and construct new booster pump and tank
-Relocate valves and hydrants affected by widenings on zones 1 & 2
-Improvements to tank 86
-Repair leaks on system on zones 1 & 2

Wastewater ($4.45 mill)
-Improvements to lift station 39
-New gravity lines on Forrestal Drive and main corridors to lift station 39
-New 12" force line from lift station 39 to -airport connection (PRASA Service) (2.7km)

Electric System ($16.6 mill)
-PREPAs improvements on zones 1 & 2
-Maintain 38KVA connection from Daguao
-Install underground 38KVA & 13.2 KV on Pier area (Forrestal Drive)
-Upgrade subastations on zones 1 & 2
-Maintain existing aerial lines on other zones

Telecommunications ($8.9 mill)
-New central station
-New distribution station on zone 2
-New underground conduits on zones 1 & 2

Stormwater ($0.9 mill)
-New storm sewer system on Forrestal Drive
-Repairs and cleaning of existing culverts on zones 1 & 2
-New mitigation areas on zones 1 & 2

PHASE 2

Roads ($5.0 mill)
-Develop full section on zones 6 & 7 main corridors
-Widen from 2 lanes to 4 lanes access roads from gate 3
-Improvements to 2 lanes on access to zone 4 and zone 3 (Punta Puerca)

Water ($7.0 mill)
-Maintain existing lines in zones 6 & 7
-Install new line on zone 6 (Aiport-Industrial)
-Relocate valves and hydrants affected by widenings on zones 3, 4 ,6 & 7
-Repair leaks on system zones 3,4 6 & 7
-Install new 20" pipeline from PRASA`s 12" connection to Fajardo WTP (6.0 km)

Wastewater ($6.4 mill)
-New lift station on zone 7
-New force line to lift station 39
-New gravity line on Langley Drive to new lift station (zone 7)
-New gravity line on zones 3, 4 & 6 main corridors

Electric System ($33.0 mill)
-PREPAs improvements on zones 4, 6 & 7
-Install new underground 115KVA connection from Daguao
-New main substation 115KV/38KV transmision center on zone 7
-Install underground 38KVA & 13.2KV on zone 7
-Upgrade substation on zones 7
-Install new substations on zones 4 & 6
-New aerial 38KV & 13.2KV on zone 6

Telecommunications ($6.8 mill)
-New distribution center on zone 7
-New underground conduits on zones 3, 4, 6, 7 & 8

Stormwater ($0.9 mill)
-New storm sewer system on Langley Drive
-Repairs and cleaning of existing culverts on zones 3, 4, 6 & 7
-New mitigation areas on zones 3, 4, 6 & 7

PHASE 3

Roads ($6.1 mill)
-Widen from 2 lanes to 4 lanes access road from gate 1
-Improvements to 2 lanes on access to zone 10 & portion of zone 6

Water ($0.62 mill)
-Improvements to water tank 535
-Relocate valves and hydrants affected by widenings on zones 6 & 10
-Repair leaks on system on zones 6 & 10

Wastewater ($7.2 mill)
-New gravity line on zone 10
-Improve existing lift stations on F.D.R Drive
-New lift station on zone 10
-New force line from F.D.R. Drive to new lift station on zone 7
-New gravity line on zone 6
-New 12" force line from Airport Connection to Fajardo WWTP (10.1 km)

Electric System ($4.8 mill)
-PREPAs improvements on zone 10
-New loops for 38 KV and 13.2 KV on zone 10
-New 13.2KV aerial on zone 10
-Upgrade substations on zone 10

Telecommunications ($3.9 mill)
-New distribution center on zone 10
-New underground conduits on zone 10

Stormwater ($1.5 mill)
-New storm sewer system on F.D.R. Drive
-Repairs and cleaning of existing culverts on zones 6 & 10
-New mitigation areas on zones 6 & 10

PHASE 4

Roads ($3.1 mill)
-Improvements on zones 8 & 9 main corridors

Water ($1.0 mill)
-Improvements to Booster Stations on zones 8 & 9
-Relocate valves and hydrants affected by widenings
-Install small diameter pipe to zone 5
-Repair leaks on system on zones 8 & 9

Wastewater ($4.1 mill)
-New gravity lines on zones 8 & 9
-Improve Existing lift station on zone 8 & 9
-New lift station on zone 9
-New force line from zone 9 to new lift station on zone 7

Electric System ($4.3 mill)
-PREPAs improvements on zone 8 & 9
-New 13.2KV aerial on zone 8 & 9
-Upgrade substations on zone 8 & 9

Telecommunications ($0.6 mill)
-New distribution center on zone 8
-New underground conduits on zone 8 & 9

Stormwater ($0.1 mill)
-Repairs and cleaning of existing culverts on zones 8 & 9
-New mitigation areas on zones 8 & 9

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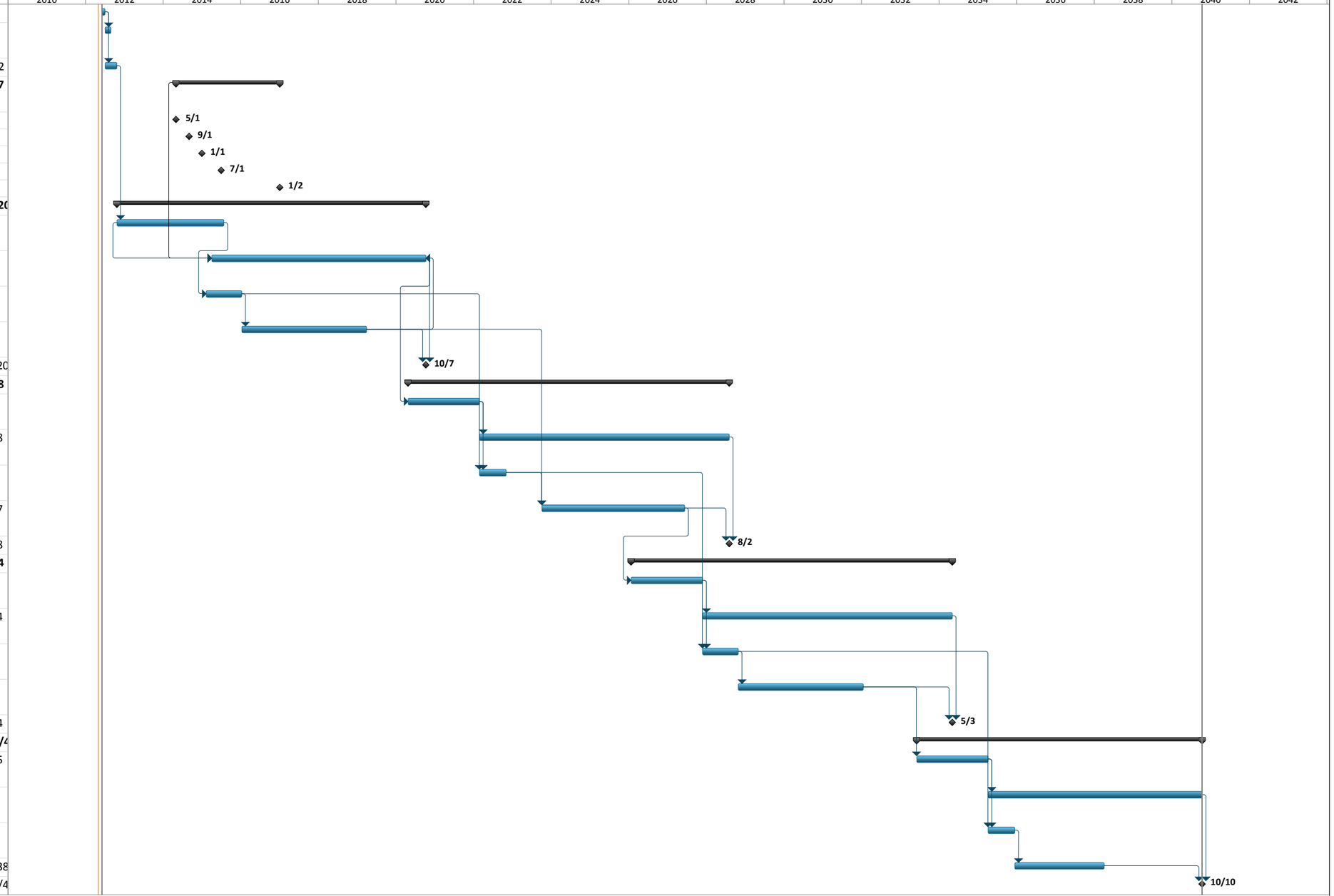
P.O. Box 195488 San Juan, P.R. 00919-5488

PROJECT PLANNING AND CONSTRUCTION SCHEDULE

ID	Task Name	Duration	Start	Finish
1	Review and Approval of Master Plan	1 mon	Mon 6/4/12	Fri 6/29/12
2	Intergency MOU with Infrastructure Government Agencies	2 mons	Mon 7/2/12	Fri 8/24/12
3	Parcelization Process	4 mons	Mon 7/2/12	Fri 10/19/12
4	**SWMU's cleaning of affected development areas**	**697 days**	**Thu 5/1/14**	**Mon 1/2/17**
5	SWMU 59	0 days	Thu 5/1/14	Thu 5/1/14
6	SWMU 60	0 days	Mon 9/1/14	Mon 9/1/14
7	SWMU 7/8	0 days	Thu 1/1/15	Thu 1/1/15
8	SWMU 74 (Hill and Port)	0 days	Wed 7/1/15	Wed 7/1/15
9	AOC F 124	0 days	Mon 1/2/17	Mon 1/2/17
10	**Phase 1**	**2078 days**	**Mon 10/22/1**	**Wed 10/7/20**
11	RFP Bidding & Negociation of Phase 1 Parcels & Projects	36 mons	Mon 10/22/12	Fri 7/24/15
12	Phase 1 Development Design and Construction	72 mons	Thu 4/2/15	Wed 10/7/20
13	Phase 1 Infrastructure Design and Permits	12 mons	Mon 2/9/15	Fri 1/8/16
14	Phase 1 Infrastructure Construction	42 mons	Mon 1/11/16	Fri 3/29/19
15	Phase 1 Completion	0 days	Wed 10/7/20	Wed 10/7/20
16	**Phase 2**	**2160 days**	**Thu 4/23/20**	**Wed 8/2/28**
17	RFP Bidding & Negociation of Phase 2 Parcels & Projects	24 mons	Thu 4/23/20	Wed 2/23/22
18	Phase 2 Development Design and Construction	84 mons	Thu 2/24/22	Wed 8/2/28
19	Phase 2 Infrastructure Design and Permits	9 mons	Thu 2/24/22	Wed 11/2/22
20	Phase 2 Infrastructure Construction	48 mons	Thu 10/5/23	Wed 6/9/27
21	Phase 2 Completion	0 days	Wed 8/2/28	Wed 8/2/28
22	**Phase 3**	**2160 days**	**Thu 1/22/26**	**Wed 5/3/34**
23	RFP Bidding & Negociation of Phase 3 Parcels & Projects	24 mons	Thu 1/22/26	Wed 11/24/27
24	Phase 3 Development Design and Construction	84 mons	Thu 11/25/27	Wed 5/3/34
25	Phase 3 Infrastructure Design and Permits	12 mons	Thu 11/25/27	Wed 10/25/28
26	Phase 3 Infrastructure Construction	42 mons	Thu 10/26/28	Wed 1/14/32
27	Phase 3 Completion	0 days	Wed 5/3/34	Wed 5/3/34
28	**Phase 4**	**1920 days**	**Thu 6/2/33**	**Wed 10/10/4**
29	RFP Bidding & Negociation of Phase 4 Parcels & Projects	24 mons	Thu 6/2/33	Wed 4/4/35
30	Phase 4 Development Design and Construction	72 mons	Thu 4/5/35	Wed 10/10/40
31	Phase 4 Infrastructure Design and Permits	9 mons	Thu 4/5/35	Wed 12/12/35
32	Phase 4 Infrastructure Constructio	30 mons	Thu 12/13/3	Wed 3/31/38
33	Phase 4 Completion	0 days	Wed 10/10/4	Wed 10/10/4



Project: Infrastructure Proposed S
Date: Mon 4/30/12

Task — Summary — External Milestone — Inactive Summary — Manual Summary Rollup — Finish-only
Split — Project Summary — Inactive Task — Manual Task — Manual Summary — Deadline
Milestone — External Tasks — Inactive Milestone — Duration-only — Start-only — Progress

Note:
TIme frame is estimate and is based on the construction and developement of land

Figures

ROOSEVELT ROADS REDEVELOPMENT

INFRASTRUCTURE MASTER PLAN

LOCAL REDEVELOPMENT AUTHORITY
ROOSEVELT ROADS - PUERTO RICO
COMMONWEALTH OF PUERTO RICO

NORTH

To Road PR-3

Los Machos Road

Tarawa Road

Gate No. 1 Access

Tarawa Road

Boxer Drive

To Fajardo

Puerto Medio Mundo

Tarawa Road

Conservation Zone

Lake Chamberlain Road

Pasaje Medio Mundo

Piñeros Island

Cabeza de Perro Island

Airport

Highway PR-53

Boxer Drive

Forrestal Drive

Towway Road

Times Square

Antietam Road

Langley Drive

Corregidor Road

Langley Drive

Forrestal Drive

Antietam Road

Conservation Zone

Forrestal Drive

Valley Forge Road

Barnes Street

To Humacao

Road PR-3

Boxer Drive

Guadalcanal Road

Gate No. 3 Access

Bennington Road

Langley Drive

Conservation Zone

Langley Drive

Forrestal Drive

Bahia de Puerca

Bennington Road

Bennington Road

Kwajalein Street

Gate No. 4 Access

Langley Drive

F.D.R. Drive

Conservation Zone

Ensenada Honda

Forrestal Drive

Cabras Island

Bairoko Street

Salerno Bay Road

Conservation Zone

F.D.R. Drive

Bahia Algodones

Ensenada Honda

FIGURE RO-1: EXISTING ROAD SYSTEM

1:40,000

FIG. RO-1

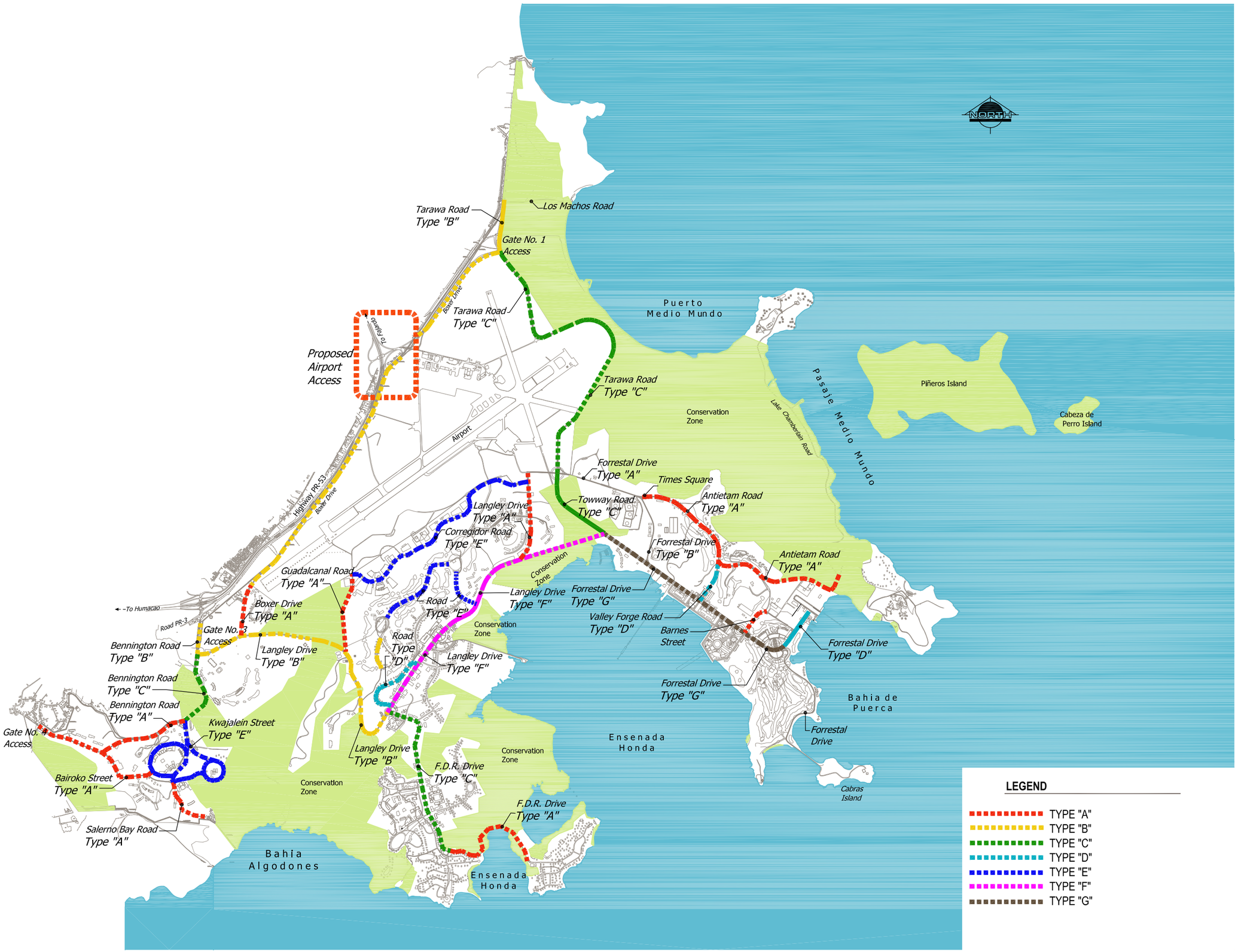


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FIGURE RO-2: PROPOSED ROAD SYSTEM

1:40,000

FIG. RO-2

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FIGURE WA-1: EXISTING WATER DISTRIBUTION SYSTEM

1:40,000

FIG. WA-1

NORTH

Puerto Medio Mundo

Pasaje Medio Mundo

Piñeros Island

Cabeza de Perro Island

Conservation Zone

Airport

Highway PR-53

BOOSTER PUMP 460 (FIRE)

POTABLE WATER STORAGE TANK 86 (TACAN)

BOOSTER PUMP 1977 (FIRE)

PRV

BOOSTER PUMP & FIRE SUPRESSION TANK 421

BOOSTER PUMP 2360

BOOSTER PUMP 244

FIRE SUPRESSION TANK 298

POTABLE WATER STORAGE TANK 535 (BUNDY)

BOOSTER PUMP 2380

WATER TREATMENT PLANT

WATER RESERVOIR

BOOSTER PUMP

FIRE SUPRESSION TANK 771

Bahia Algodones

Ensenada Honda

Bahia de Puerca

Cabras Island

LEGEND

EXISTING WATER DISTRIBUTION PIPE

EXISTING RAW WATER INTAKE

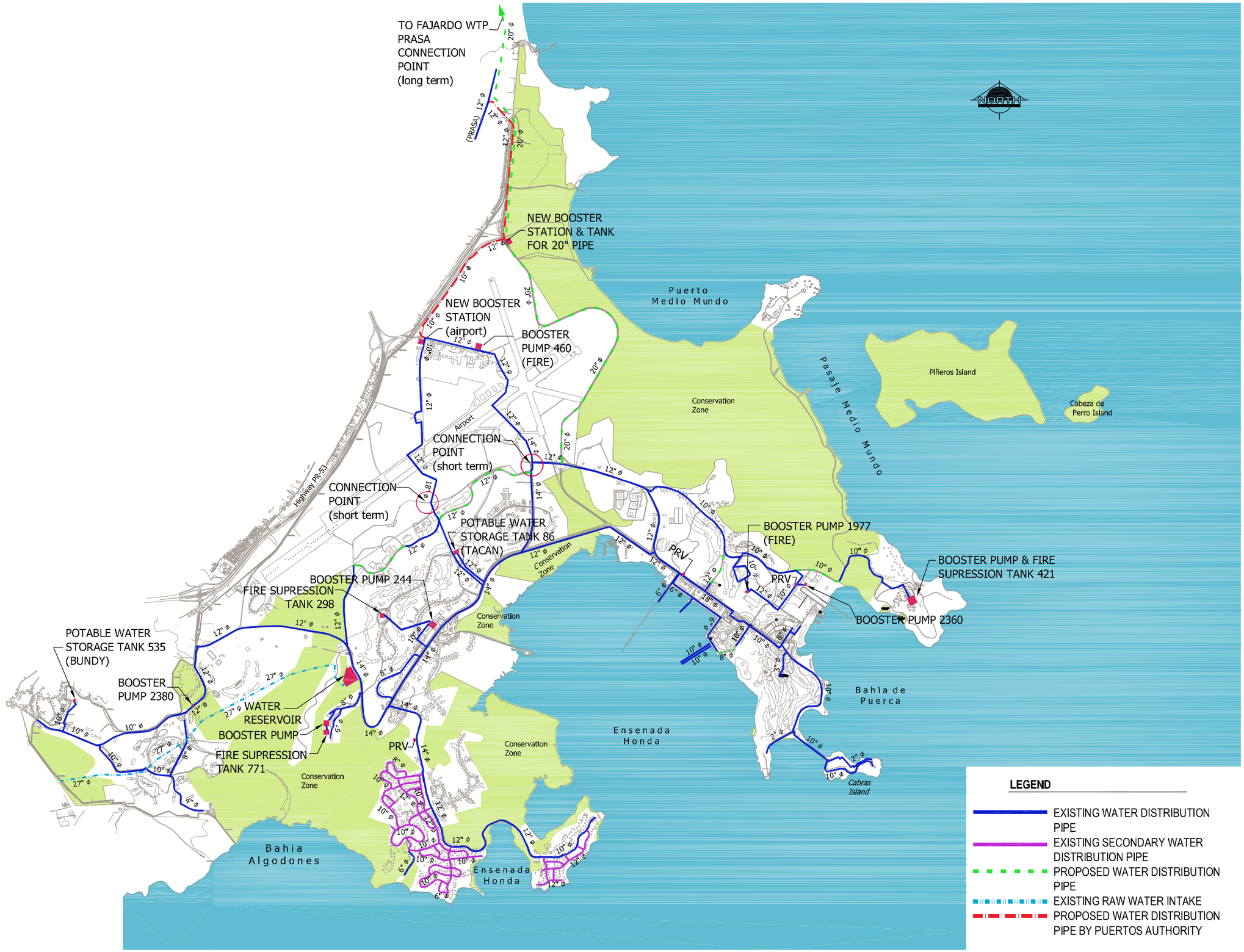

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FIGURE WA-2: PROPOSED WATER DISTRIBUTION SYSTEM

1:40,000

FIG. WA-2

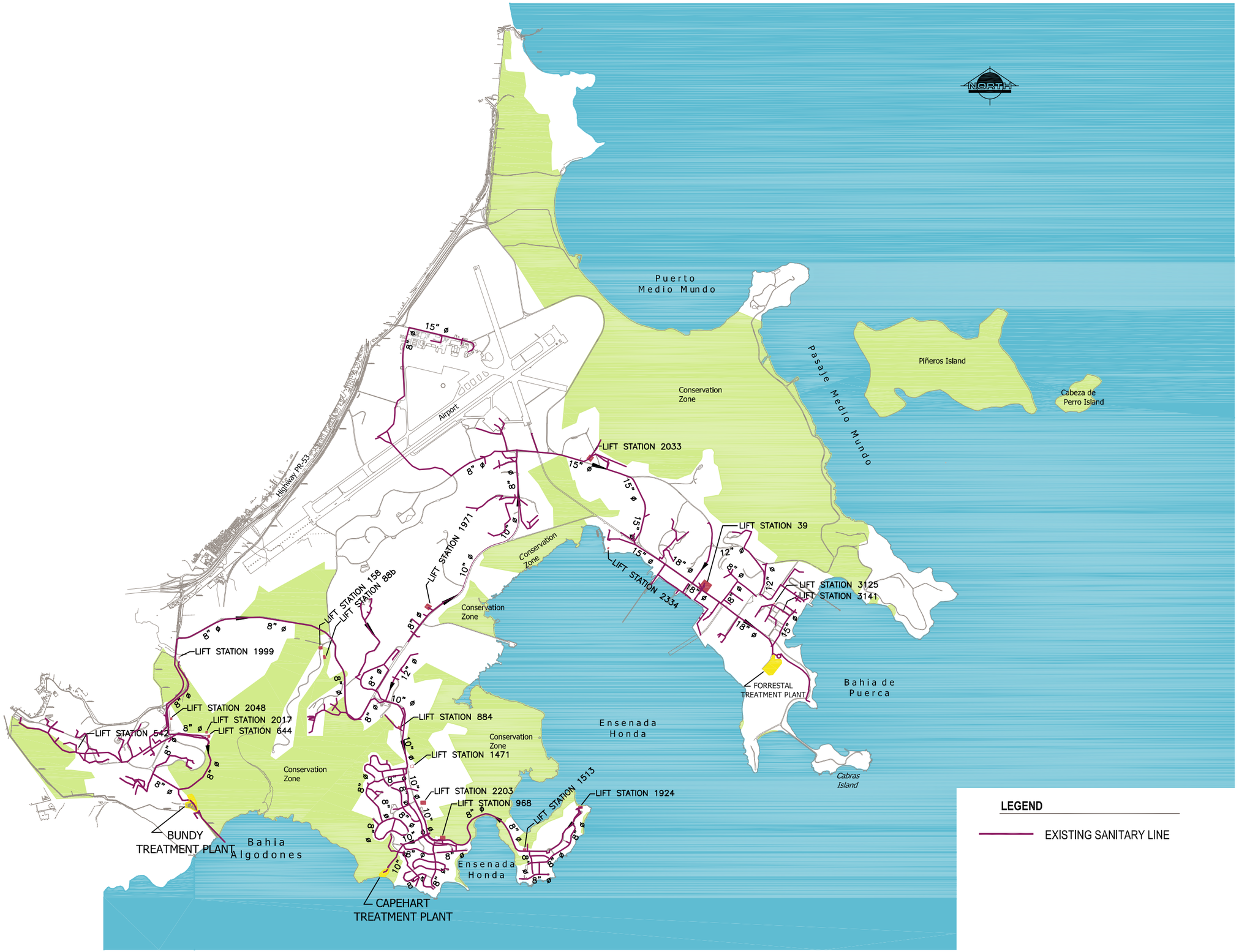

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FIGURE SA-1: EXISTING SANITARY SEWER SYSTEM

1:40,000

FIG. SA-1

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FIGURE SA-2: PROPOSED SANITARY SEWER SYSTEM

1:40,000

FIG. SA-2

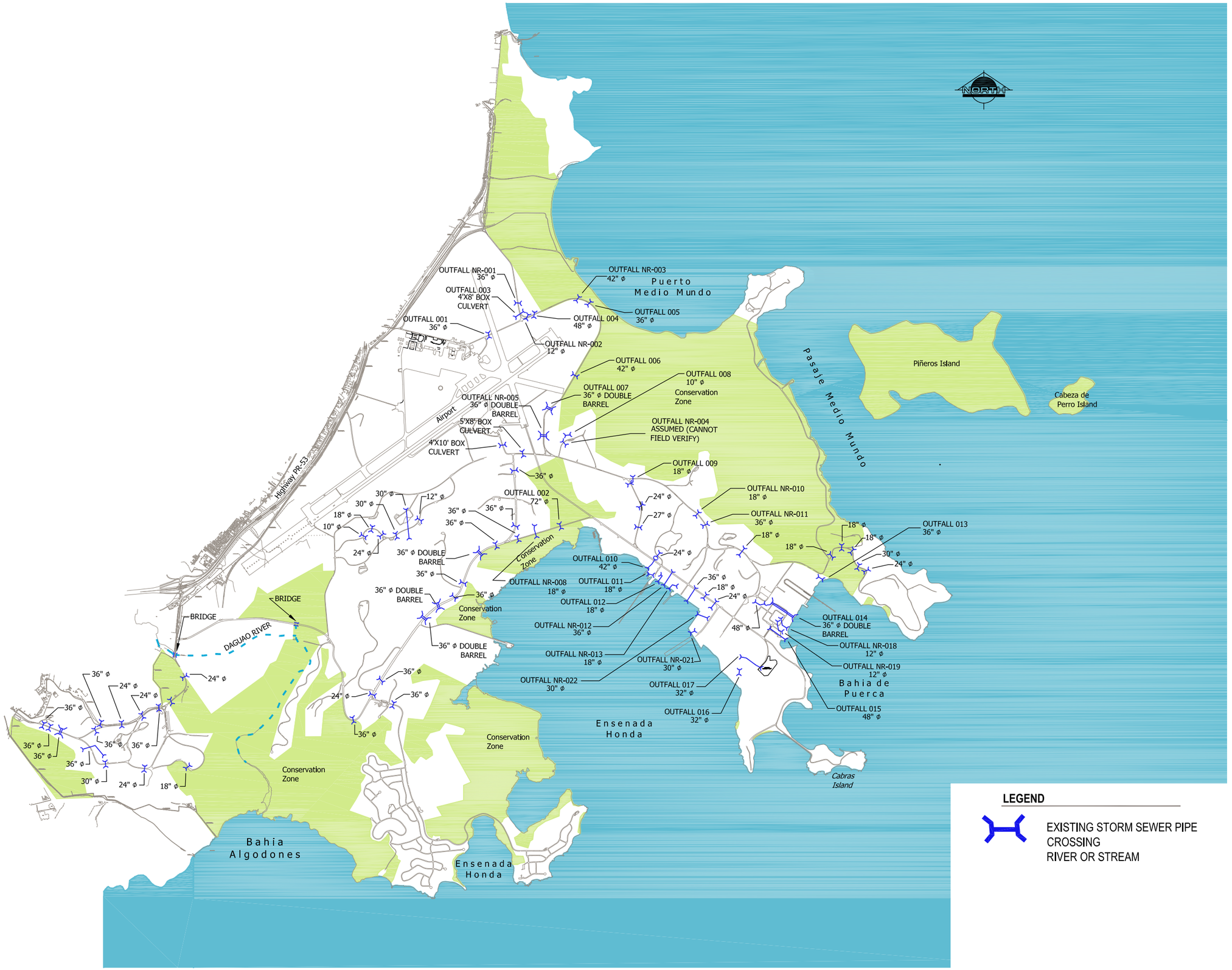

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FIGURE SS-1: EXISTING STORM SEWER DISTRIBUTION SYSTEM

1:40,000

FIG. SS-1

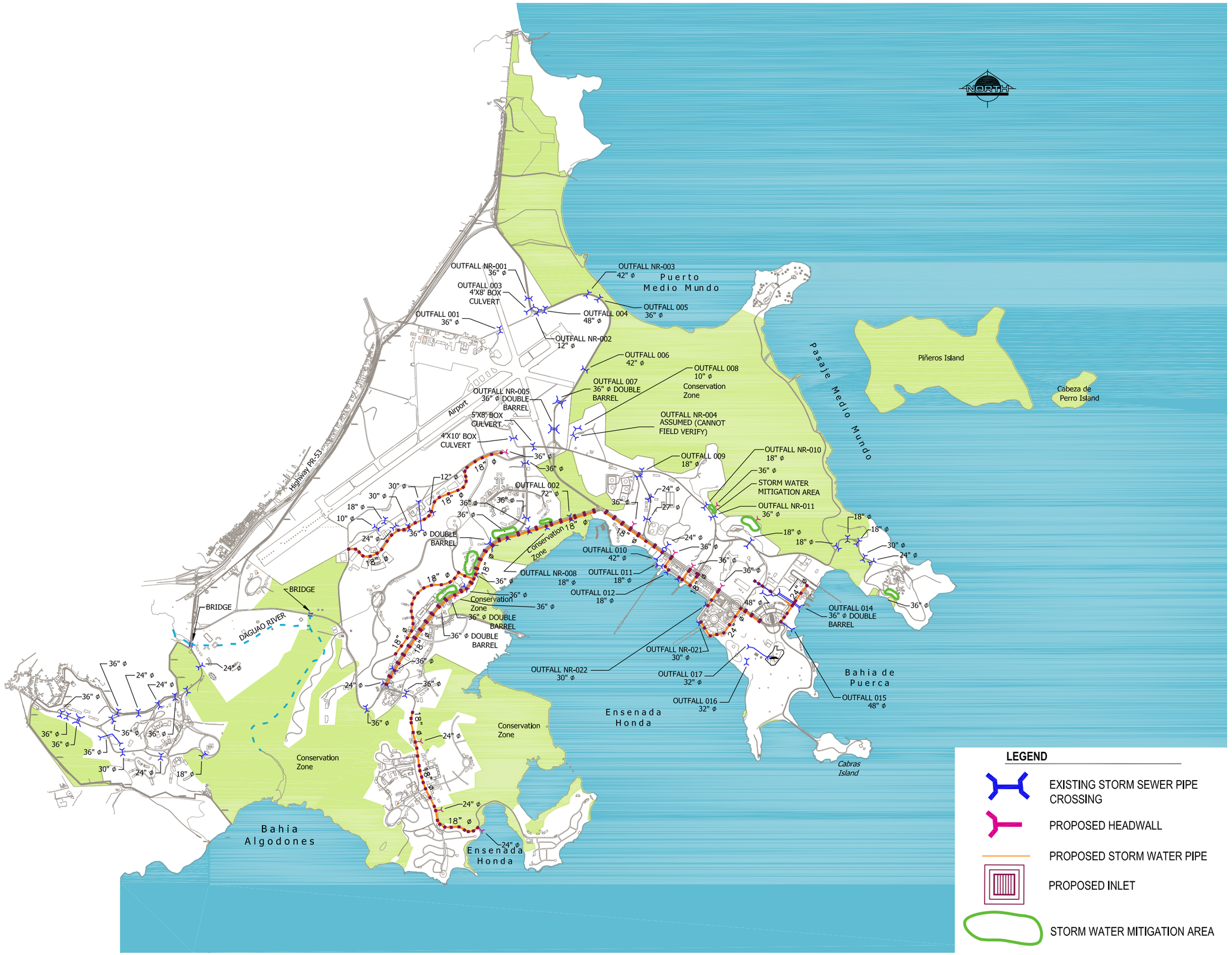

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FIGURE SS-2: PROPOSED STORM SEWER DISTRIBUTION SYSTEM

1:40,000

FIG. SS-2

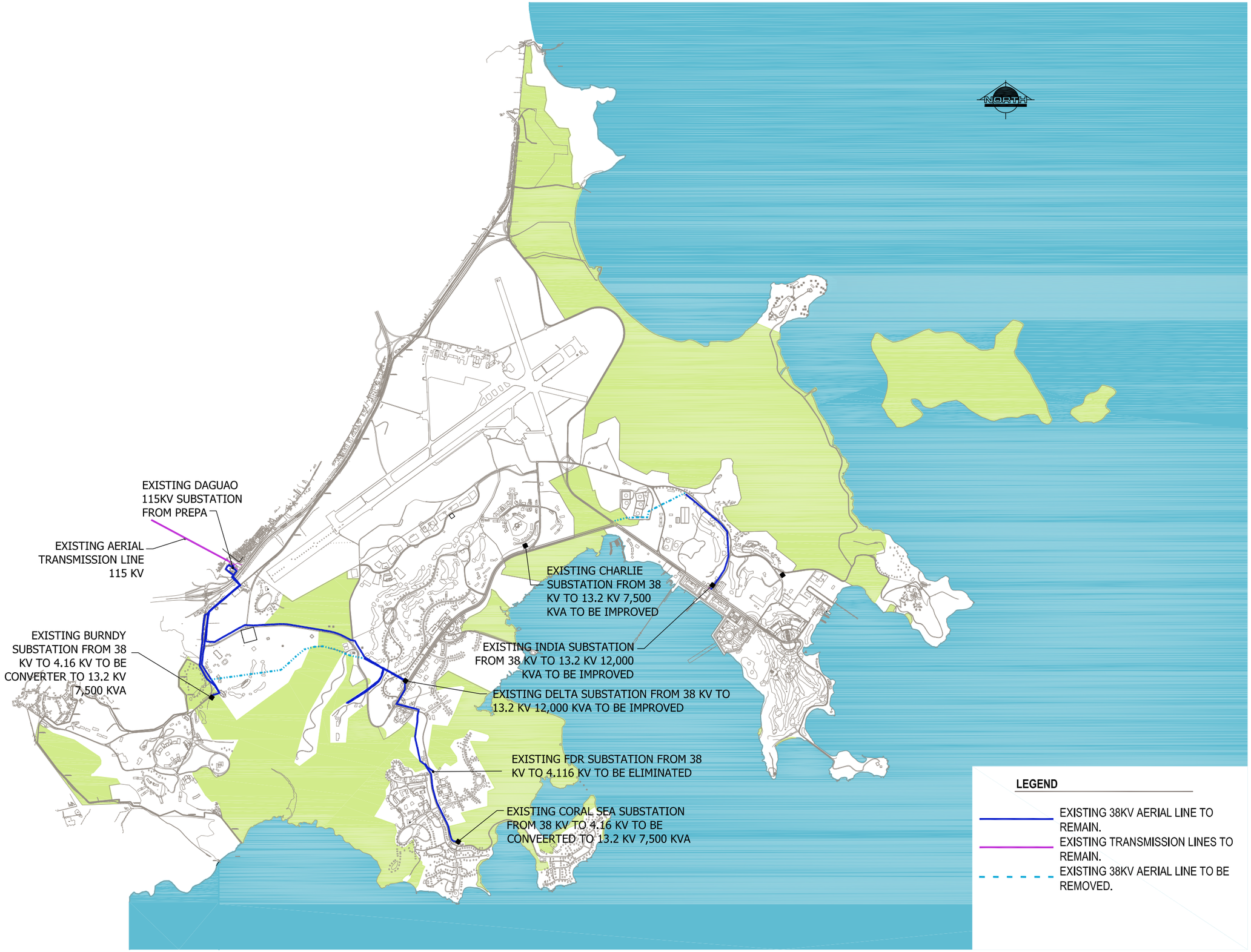

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FIGURE E-1 EXISTING 38KV ELECTRICAL LINE SYSTEM

1:40,000

FIG. E-1

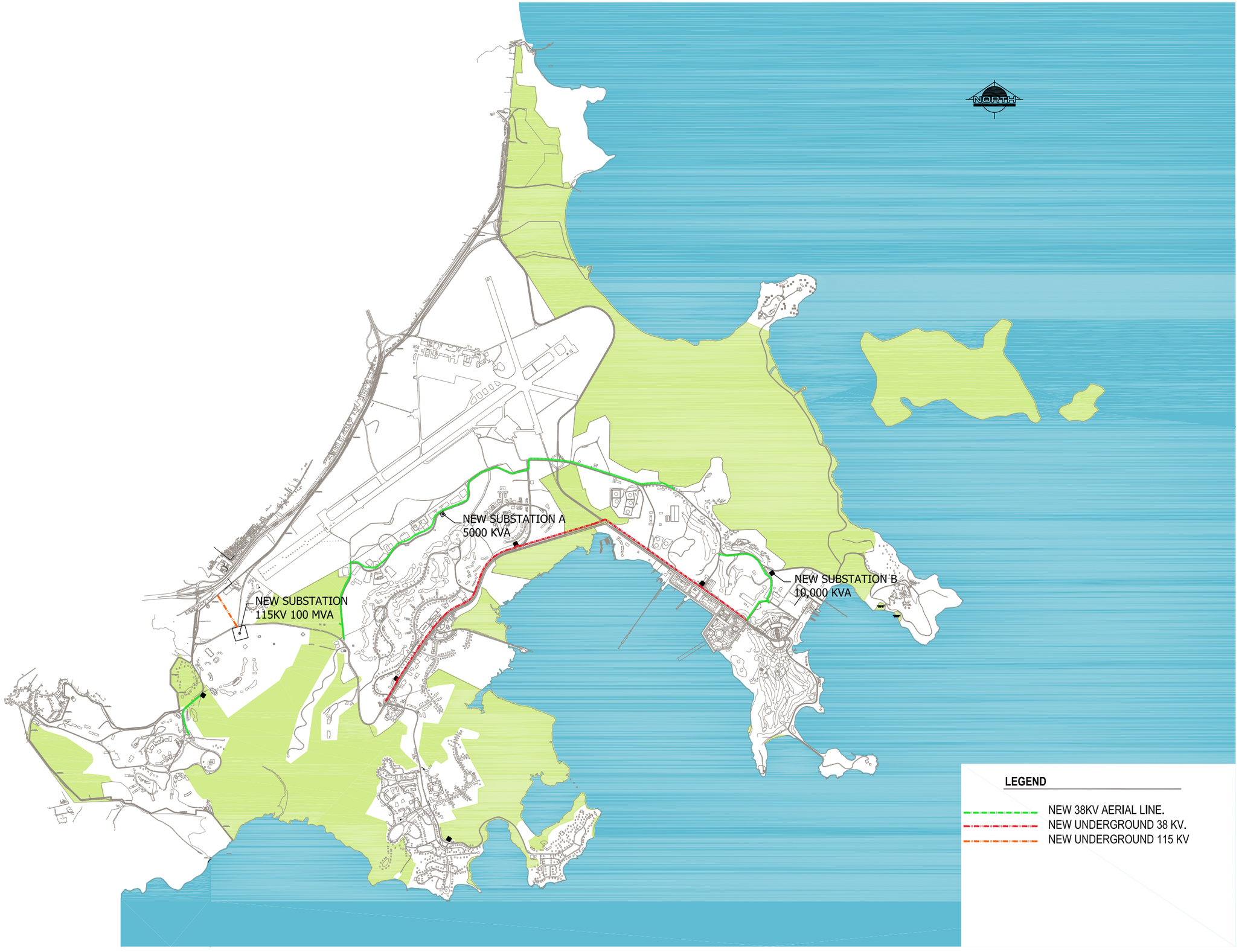

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FIGURE E-2 PROPOSED 38KV ELECTRICAL LINE SYSTEM

1:40,000

FIG. E-2

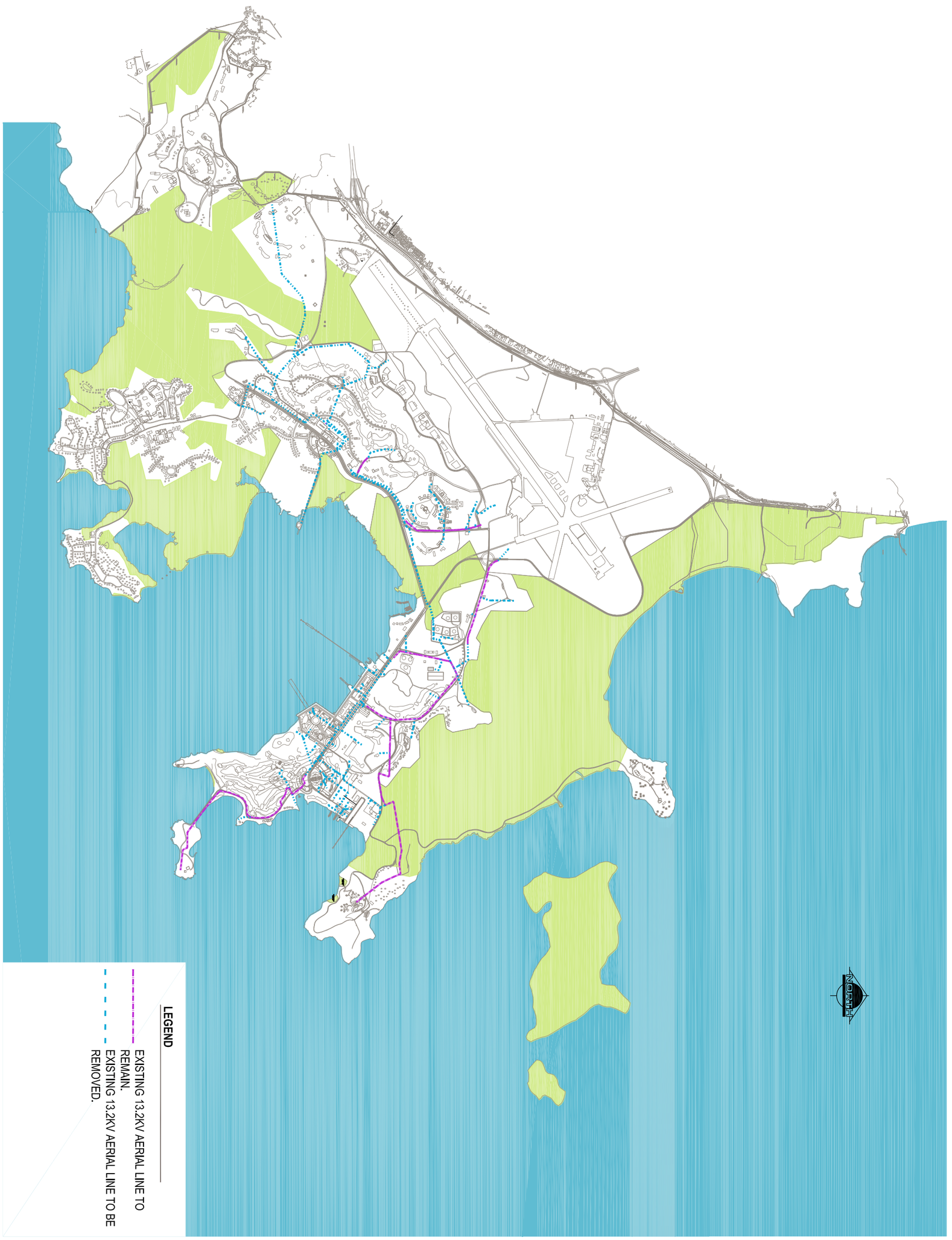

FIG. E-3

FIGURE E-3 EXISTING 13.2KV ELECTRICAL LINE SYSTEM

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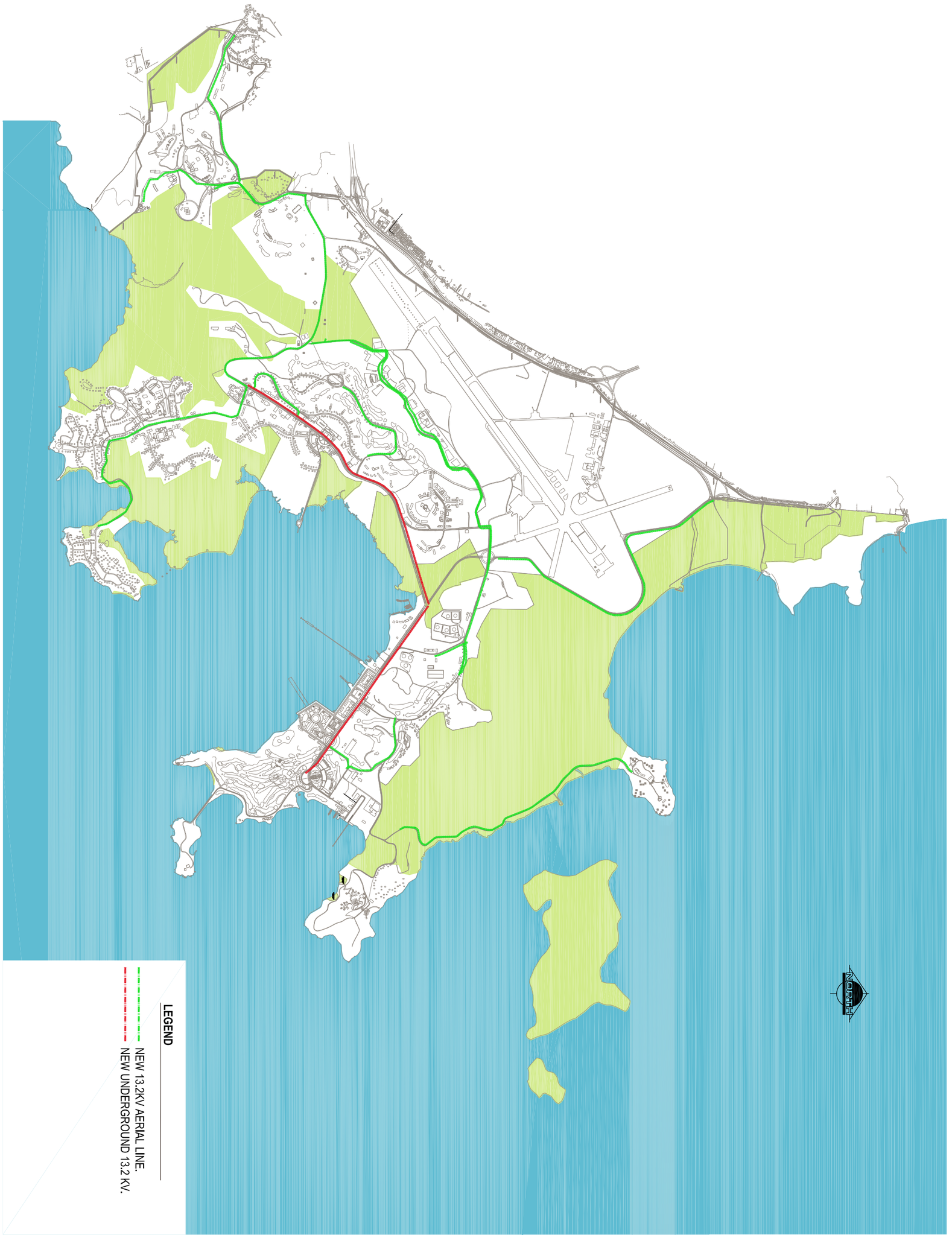

FIG. E-4

FIGURE E-4 PROPOSED 13.2KV ELECTRICAL LINE SYSTEM

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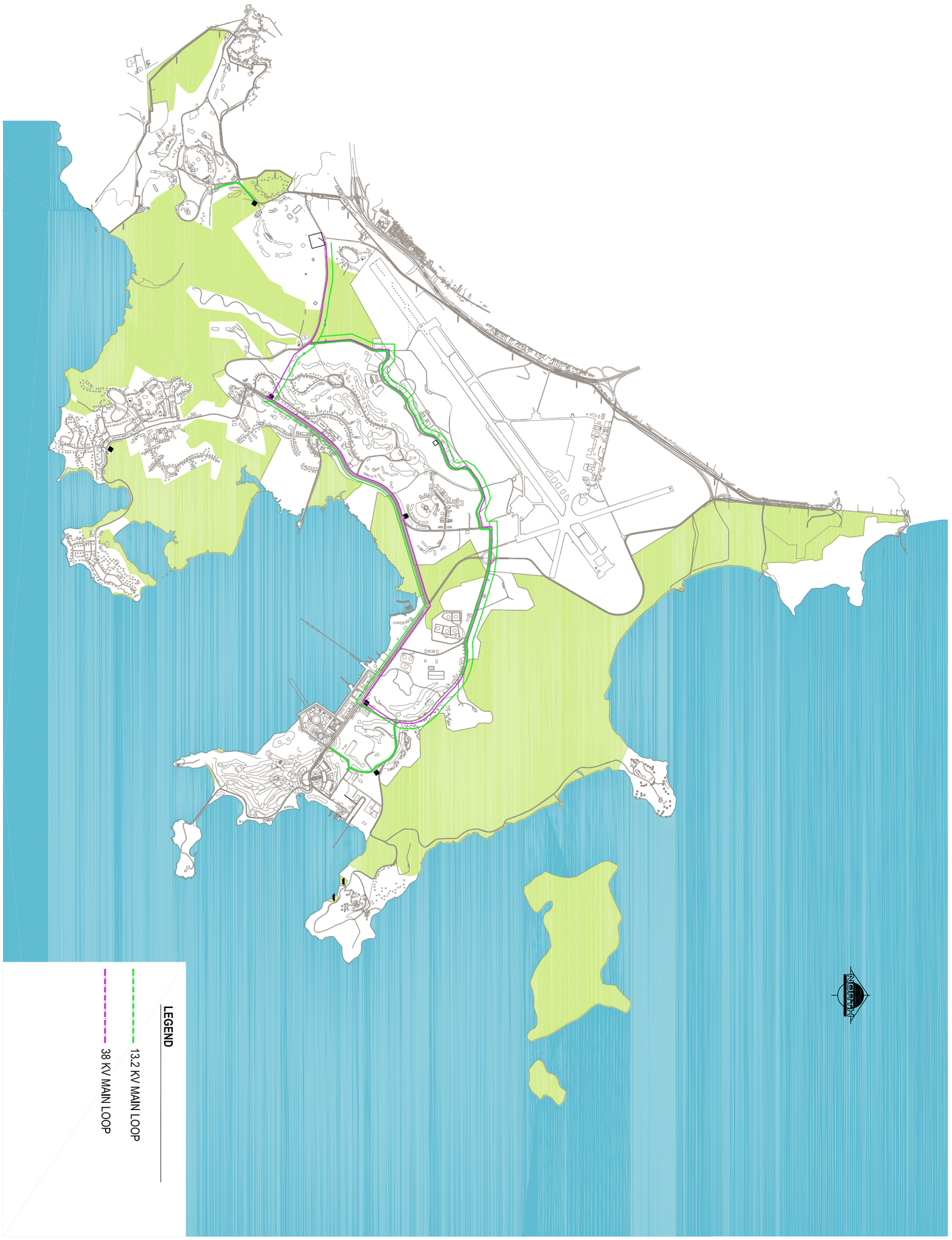

FIG. E-5

FIGURE E-5 PROP. 13.2- 38KV ELEC. MAIN LOOP SYSTEM

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COMMONWEALTH OF PUERTO RICO

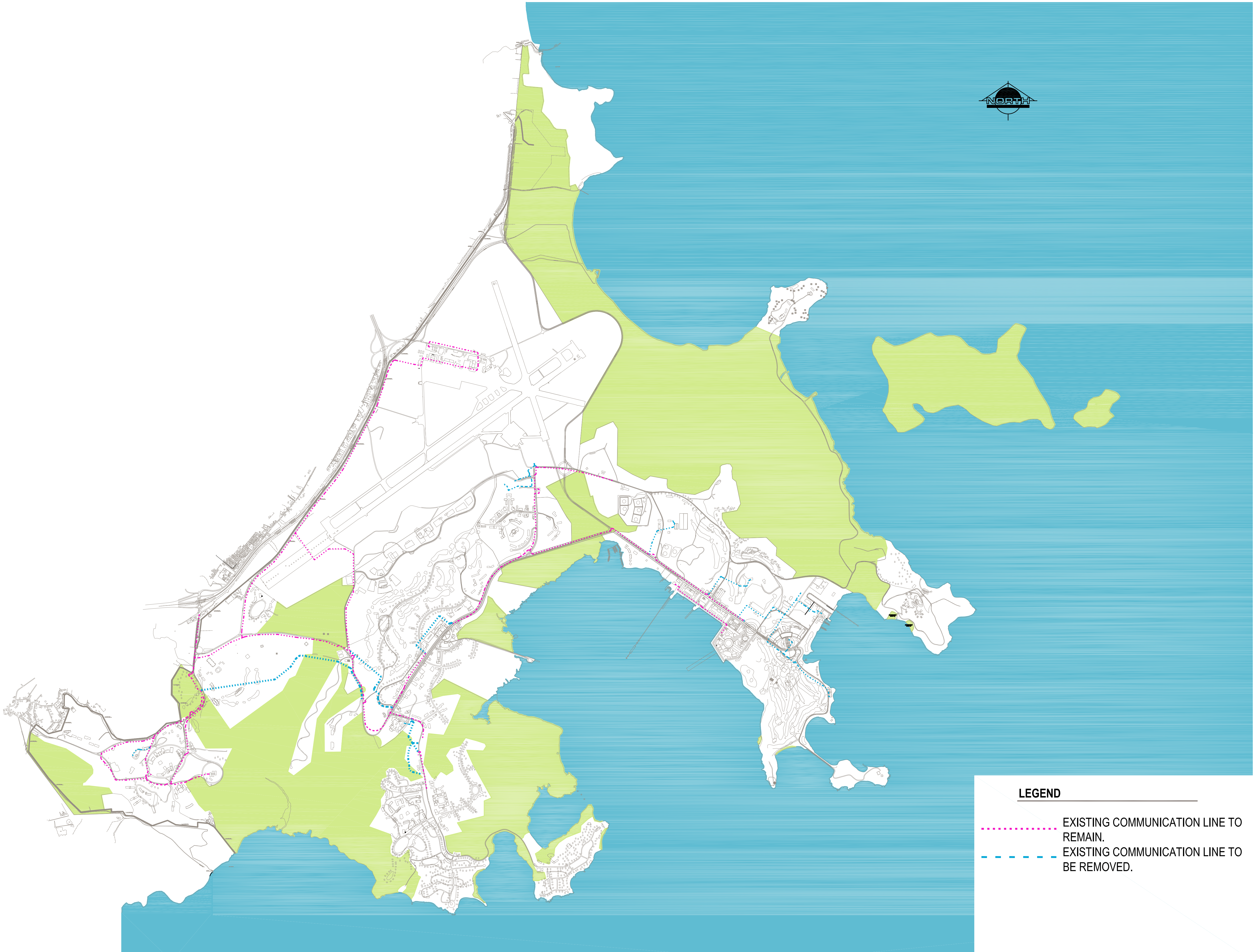

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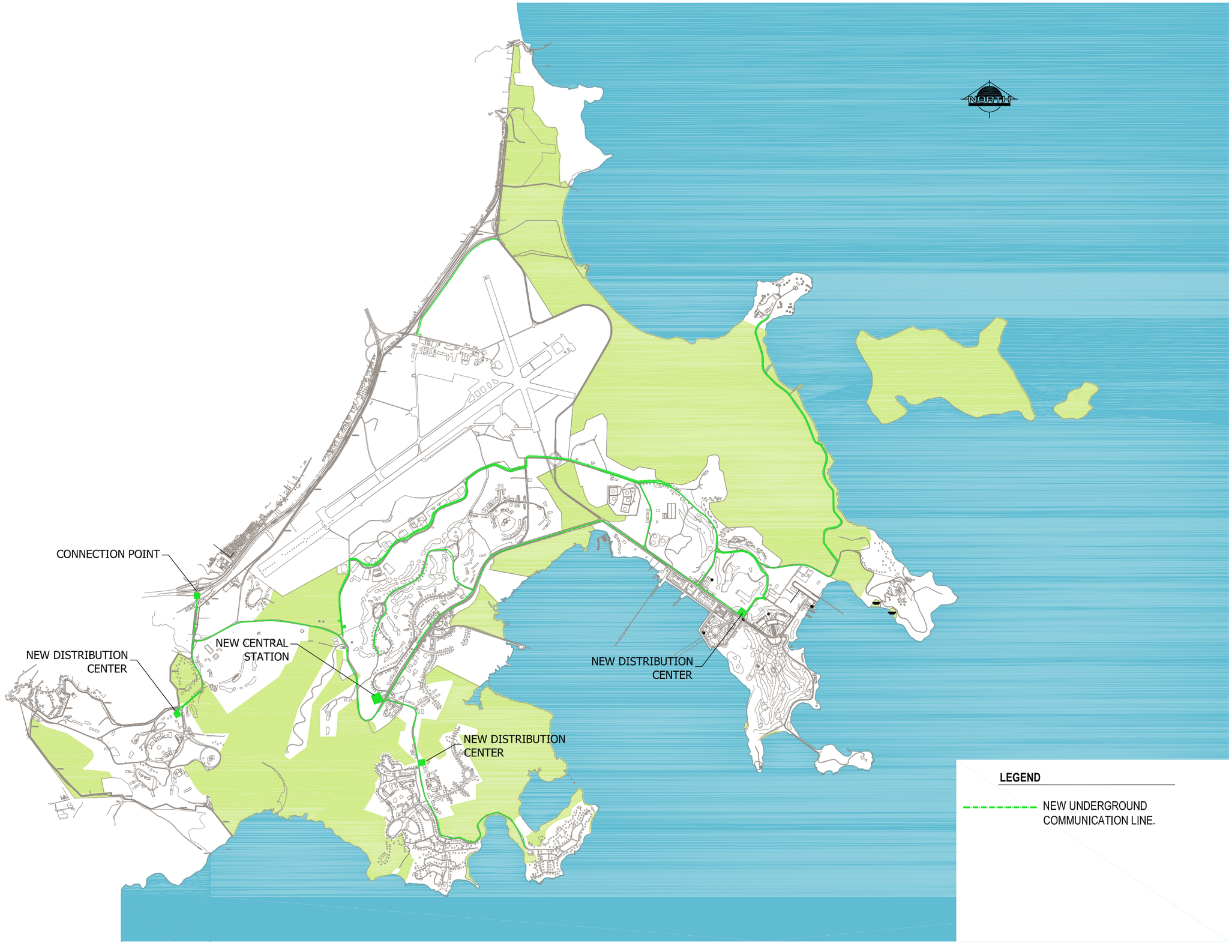
FIGURE E-6 EXISTING TELECOMMUNICATION SYSTEM

1:40,000

FIG. E-6



LOCAL REDEVELOPMENT AUTHORITY
ROOSEVELT ROADS - PUERTO RICO
COMMONWEALTH OF PUERTO RICO

INTEGRA architects & engineers

FIGURE E-7 PROPOSED TELECOMMUNICATION SYSTEM

1:40,000

FIG. E-7

NORTH

Los Machos Road

ZONE11

Tarawa Road
Type "B"

Gate No. 1
Access

Tarawa Road
Type "C"

ZONE5

Puerto
Medio Mundo

Proposed
Airport
Access

To Fajardo

Boxer Drive

Tarawa Road
Type "C"

SWMU 74 Hill
07.2015

Conservation
Zone

Lake Chamberlain Road

pasaje Medio Mundo

Piñeros Island

Cabeza de
Perro Island

Airport

Towway Road
Type "C"

Langley Drive
Type "A"

ZONE 4

Forrestal Drive
Type "A"

Times
Square

Antietam Road
Type "A"

Boxer Drive Highway PR-53

Corregidor Road
Type "E"

ZONE 7

Forrestal Drive
Type "B"

SWMU 59
CAC: 05.2014

ZONE1

Langley Drive
Type "F"

Boxer Drive
Type "A"

Road
Type "E"

Antietam Road
Type "A"

Guadalcanal Road
Type "A"

ZONE 6

Conservation
Zone

SWMU 60
CAC: 09.2014

ZONE3

ZONE 7

AOC F 124
CAC: After 2016

To Humacao

Road PR-3

Conservation
Zone

SWMU 7/8
CAC: 01.2015
Transfered as CDR

Barnes
Street

Forrestal Drive
Type "D"

Bennington Road
Type "B"

Gate No. 3
Access

Langley Drive
Type "B"

Road
Type "D"

Langley Drive
Type "F"

ZONE 7

Bennington Road
Type "C"

ZONE 8

Bennington Road
Type "A"

SWMU 74 Port
CAC: 07.2015
Transfered as CDR

Valley Forge
Road
Type "D"

ZONE2

Bahia de
Puerca

Gate
No. 4
Access

Kwajalein Street
Type "E"

ZONE 9

Forrestal Drive
Type "G"

Ensenada
Honda

Forrestal
Drive

Conservation
Zone

Langley Drive
Type "F"

Conservation
Zone

Bairoko Street
Type "A"

F.D.R. Drive
Type "C"

F.D.R. Drive
Type "A"

Cabras
Island

ZONE 10

ZONE 10

Salerno Bay Road
Type "A"

Bahia
Algodones

Ensenada
Honda

LEGEND

SWMU SITE IDENTIFICATION NO.
DATE OF CORRECTIVE ACTION
COMPLETED

LOCAL REDEVELOPMENT AUTHORITY
ROOSEVELT ROADS - PUERTO RICO
COMMONWEALTH OF PUERTO RICO

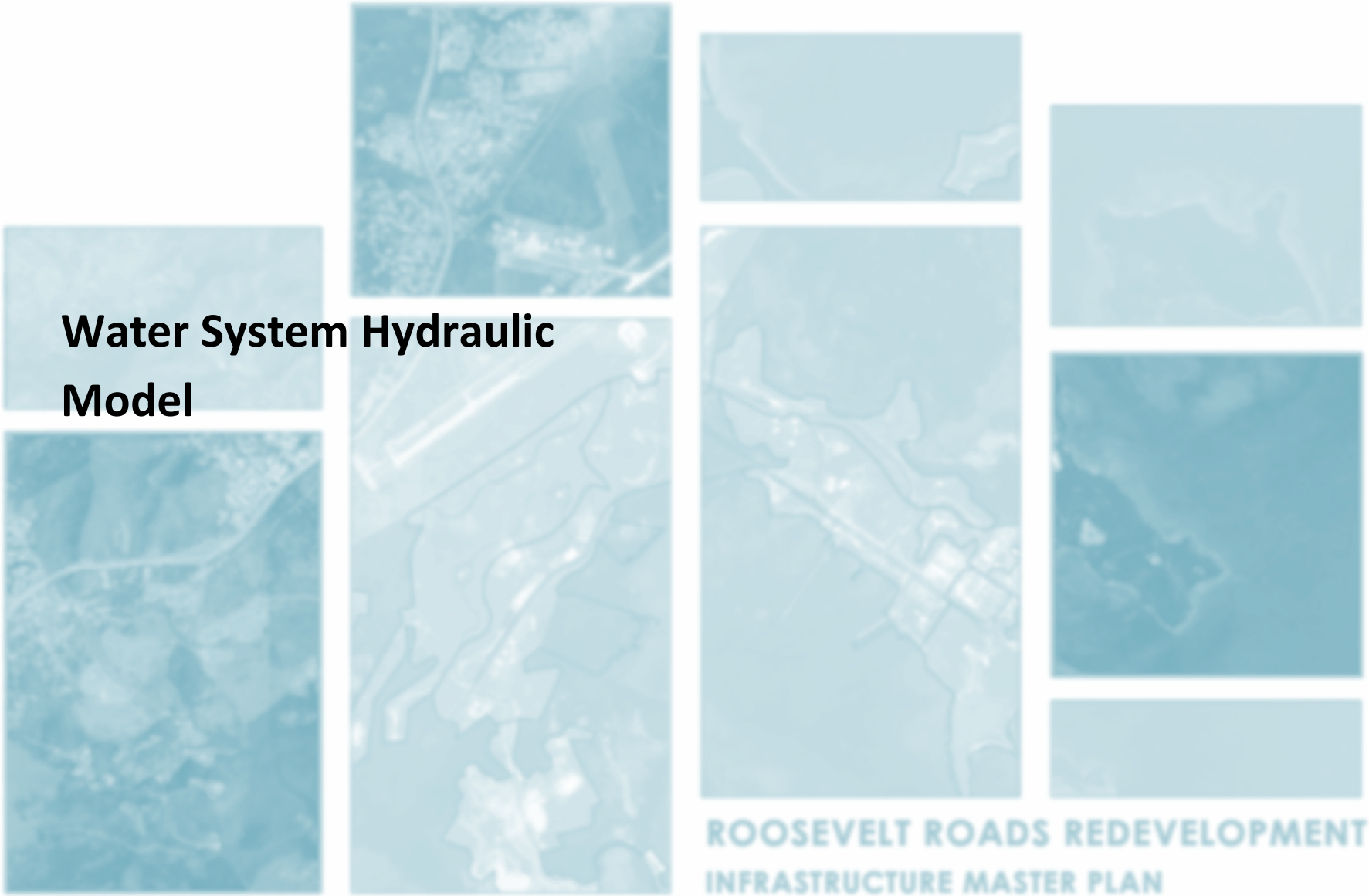
INTEGRA architects & engineers

FIGURE SWMU-1: SWMU's IN CONFLICT W/ PROPOSED ROAD

1:40,000

FIG. SR-1

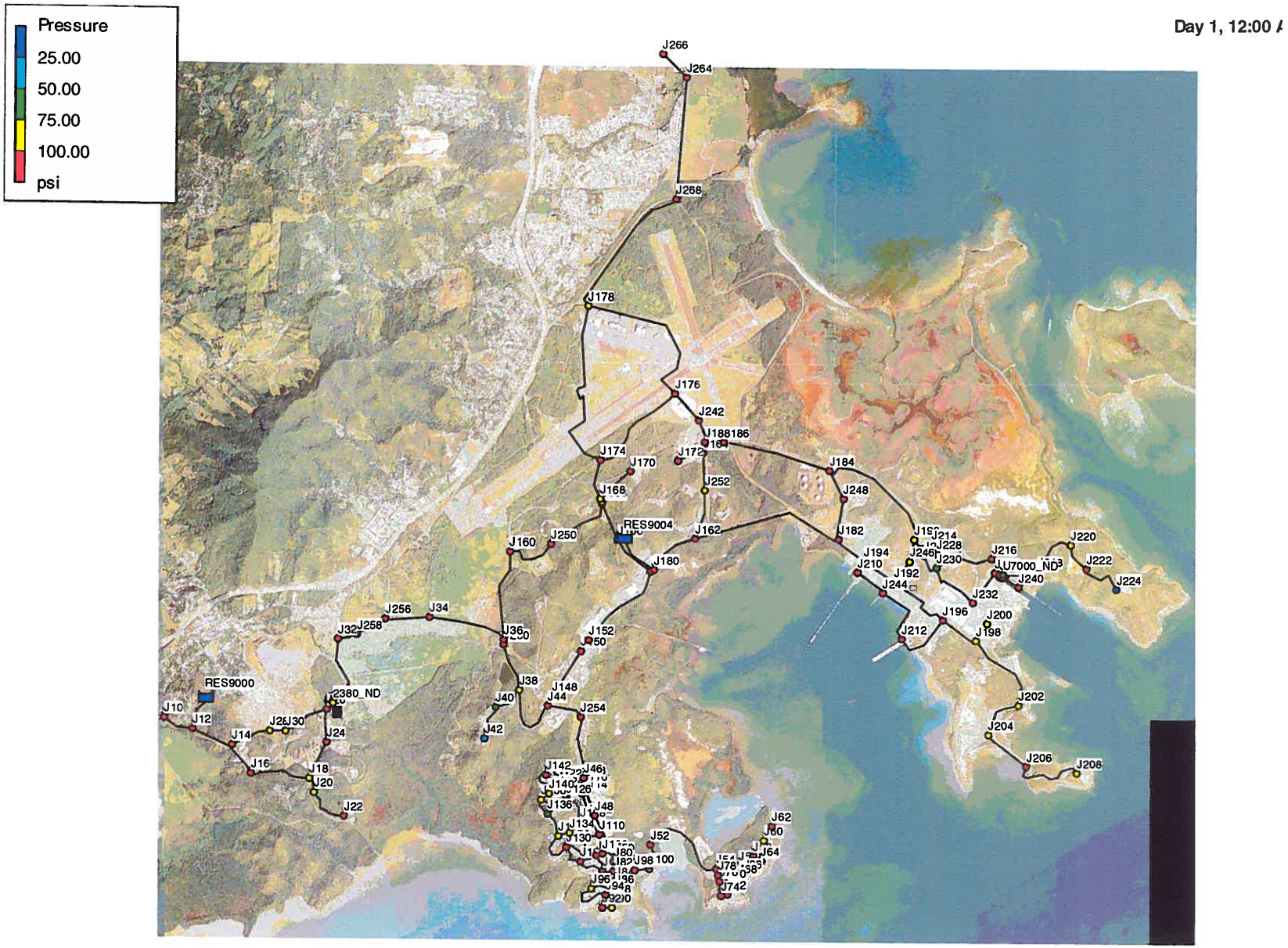
Water System Hydraulic Model



ROOSEVELT ROADS REDEVELOPMENT

INFRASTRUCTURE MASTER PLAN

ROOSEVELT ROADS WATER SYSTEM HYDRAULIC MODEL



Network Table - Nodes at 0:00 Hrs

Node ID	Elevation ft	Demand GPM	Head ft	Pressure psi
Junc J10	31.000000	0.00	289.12	111.84
Junc J100	20.000000	1.95	282.08	113.56
Junc J102	10.000000	1.95	282.08	117.89
Junc J104	30.000000	1.95	282.08	109.23
Junc J106	32.000000	1.95	282.08	108.36
Junc J108	24.000000	1.95	282.09	111.83
Junc J110	18.000000	1.95	282.09	114.43
Junc J112	18.000000	0.00	282.09	114.43
Junc J114	15.000000	0.00	282.08	115.72
Junc J116	12.000000	0.00	282.08	117.02
Junc J118	8.300000	0.00	282.08	118.63
Junc J12	21.000000	0.00	289.12	116.18
Junc J120	12.500000	0.00	282.07	116.81
Junc J122	25.000000	0.00	282.07	111.39
Junc J124	40.000000	50.00	282.07	104.89
Junc J126	44.000000	0.00	282.08	103.16
Junc J128	26.600000	1.95	282.09	110.70
Junc J130	38.000000	1.95	282.08	105.76
Junc J132	88.000000	1.95	282.08	84.10
Junc J134	71.000000	1.95	282.08	91.46
Junc J136	135.000000	54.00	282.07	63.72
Junc J138	90.000000	0.00	282.07	83.22
Junc J14	19.000000	0.00	289.25	117.10
Junc J140	64.000000	0.00	282.07	94.49
Junc J142	29.000000	0.00	282.07	109.66

Node ID	Elevation ft	Demand GPM	Head ft	Pressure psi
Junc J144	10.000000	0.00	290.01	121.33
Junc J146	10.000000	0.00	290.09	121.36
Junc J148	40.000000	49.00	281.40	104.60
Junc J150	39.000000	256.00	277.38	103.29
Junc J152	33.000000	83.00	276.76	105.62
Junc J154	15.000000	61.00	273.19	111.87
Junc J156	254.000000	28.00	273.23	8.33
Junc J158	69.500000	61.00	273.24	88.28
Junc J16	23.000000	0.00	289.24	115.36
Junc J160	12.000000	0.00	286.86	119.09
Junc J162	10.000000	0.00	267.19	111.44
Junc J164	13.000000	0.00	266.87	110.00
Junc J166	69.500000	0.00	273.23	88.28
Junc J168	62.000000	0.00	273.18	91.50
Junc J170	32.000000	0.00	273.18	104.50
Junc J172	35.000000	0.00	266.87	100.47
Junc J174	39.000000	76.00	270.21	100.18
Junc J176	15.000000	0.00	269.52	110.28
Junc J178	67.000000	0.00	269.66	87.81
Junc J18	78.000000	116.00	289.20	91.51
Junc J180	15.000000	0.00	272.88	111.74
Junc J182	10.000000	0.00	255.74	106.48
Junc J184	23.000000	24.00	256.65	101.24
Junc J186	11.000000	0.00	265.43	110.25
Junc J188	15.000000	0.00	266.85	109.12
Junc J190	44.000000	0.00	247.53	88.19

Node ID	Elevation ft	Demand GPM	Head ft	Pressure psi
Junc J192	9.000000	0.00	247.34	103.27
Junc J194	12.000000	0.00	251.15	103.62
Junc J196	7.000000	42.00	245.95	103.54
Junc J198	9.000000	972.00	239.19	99.74
Junc J20	65.000000	146.00	289.14	97.12
Junc J200	12.000000	44.00	238.94	98.33
Junc J202	14.000000	0.00	239.11	97.54
Junc J204	16.500000	42.00	239.06	96.44
Junc J206	6.000000	0.00	239.06	100.99
Junc J208	26.000000	0.60	239.06	92.32
Junc J210	8.000000	0.00	250.34	105.01
Junc J212	10.000000	0.00	246.13	102.31
Junc J214	63.000000	18.00	246.92	79.69
Junc J216	7.000000	0.00	246.63	103.83
Junc J218	10.000000	25.00	246.46	102.46
Junc J22	36.000000	0.00	289.14	109.69
Junc J220	17.000000	56.00	246.01	99.23
Junc J222	3.000000	12.00	245.91	105.25
Junc J224	199.000000	73.00	245.79	20.27
Junc J226	80.000000	0.00	246.85	72.29
Junc J228	114.000000	0.00	246.83	57.56
Junc J230	101.000000	73.00	246.81	63.18
Junc J232	9.000000	0.00	246.70	103.00
Junc J234	8.000000	21.00	246.63	103.40
Junc J236	8.000000	0.00	246.61	103.39
Junc J238	7.000000	0.00	246.60	103.82

Node ID	Elevation ft	Demand GPM	Head ft	Pressure psi
Junc J24	13.000000	10.00	289.53	119.82
Junc J240	7.000000	6.00	246.54	103.79
Junc J242	16.000000	0.00	267.50	108.97
Junc J244	8.000000	25.00	248.48	104.20
Junc J246	20.000000	10.00	247.43	98.55
Junc J248	15.000000	12.00	256.24	104.53
Junc J250	0.000000	49.00	280.68	121.62
Junc J252	62.000000	38.00	266.97	88.81
Junc J254	7.000000	21.00	282.82	119.51
Junc J256	17.000000	22.00	293.41	119.77
Junc J258	18.000000	12.00	292.48	118.93
Junc J26	12.000000	0.00	289.82	120.38
Junc J260	30.000000	-2800.00	298.01	116.13
Junc J264	10.000000	0.00	269.66	112.51
Junc J266	16.000000	0.00	269.66	109.91
Junc J268	9.000000	11.00	269.66	112.94
Junc J28	72.000000	0.00	289.47	94.23
Junc J30	67.000000	0.00	289.56	96.43
Junc J32	27.000000	25.00	291.93	114.79
Junc J34	6.000000	0.00	294.87	125.17
Junc J36	31.000000	16.00	297.40	115.43
Junc J38	92.000000	0.00	291.93	86.63
Junc J40	162.000000	0.00	291.93	56.30
Junc J42	209.000000	0.00	291.93	35.93
Junc J44	8.000000	60.00	283.11	119.21
Junc J46	8.000000	0.00	282.38	118.89

Node ID	Elevation ft	Demand GPM	Head ft	Pressure psi
Junc J48	9.000000	10.00	282.12	118.34
Junc J50	2.700000	1.95	282.09	121.06
Junc J52	2.000000	1.95	282.06	121.35
Junc J54	9.000000	3.08	282.03	118.30
Junc J56	12.000000	3.08	282.03	117.00
Junc J58	32.000000	3.08	282.03	108.34
Junc J60	57.000000	3.08	282.03	97.50
Junc J62	40.000000	3.08	282.03	104.87
Junc J64	30.000000	3.08	282.03	109.20
Junc J66	30.000000	3.08	282.03	109.20
Junc J68	28.000000	3.08	282.03	110.07
Junc J70	13.000000	3.08	282.03	116.57
Junc J72	25.000000	3.08	282.03	111.37
Junc J74	30.000000	3.08	282.03	109.20
Junc J76	1.000000	3.08	282.03	121.77
Junc J78	10.000000	3.08	282.03	117.87
Junc J80	18.000000	1.95	282.08	114.43
Junc J82	37.000000	1.95	282.08	106.20
Junc J84	46.000000	1.95	282.08	102.30
Junc J86	40.000000	1.95	282.08	104.89
Junc J88	41.000000	1.95	282.08	104.46
Junc J90	61.000000	1.95	282.08	95.80
Junc J92	46.000000	1.95	282.08	102.30
Junc J94	36.000000	1.95	282.08	106.63
Junc J96	85.000000	1.95	282.08	85.40
Junc J98	20.000000	1.95	282.08	113.56

Node ID	Elevation ft	Demand GPM	Head ft	Pressure psi
Junc 2380_NU	100.000000	0.00	290.09	82.36
Junc 2380_ND	100.000000	0.00	290.01	82.33
Junc U7000_NU	100.000000	0.00	246.61	63.53
Junc U7000_ND	100.000000	0.00	246.60	63.52
Resvr RES9000	289.000000	127.74	289.00	0.00
Resvr RES9004	273.000000	-120.28	273.00	0.00

PREPA Transference
Summary Report

ROOSEVELT ROADS REDEVELOPMENT
INFRASTRUCTURE MASTER PLAN

GOVERNMENT OF PUERTO RICO
PUERTO RICO ELECTRIC POWER AUTHORITY
SAN JUAN, PUERTO RICO

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Roosevelt Roads Naval Base Facilities Transference Summary Report

I. Introduction

The United States NAVY (USN) is interested in transferring the electrical facilities and various fuel storage tanks of the former Roosevelt Roads Naval Base (Base) to the Puerto Rico Electric Power Authority (PREPA). This report presents a summary of the most relevant details regarding this transference and its progress. It is important to consider all these aspects so the transference can be done in an orderly manner and diligently.

This report was prepared by the Generation, Transmission and Distribution Directorate, which includes information provided by the Planning and Environmental Protection Directorate.

II. Electrical Facilities Transference

The Base has the following electrical facilities on-site:

- 4 – 38/13.2 kV substations: Alpha, Charlie, Delta, and India
- 3 – 38/4.16 kV substations: Bundy, FDR, and Coral Sea
- 38 kV sub-transmission electrical lines
- 13.2 kV and 4.16 kV distribution electrical lines or feeders

Assessing the possible transfer of these electrical facilities, it was found that PREPA has no use for the 4.16 kV substations, because the standard voltage for the electrical distribution system expansion is 13.2 kV. In fact, PREPA has a public policy for electrical distribution loads conversion from 4.16 kV to 13.2 kV in order to eliminate the voltage of 4.16 kV from Puerto Rico's electrical system. On the other hand, the three 4.16 kV substations are of limited capacity, so they cannot serve new developments: Bundy has two transformers of 1.68 MVA each, and FDR and Coral Sea have transformers of 5.6 MVA each. Furthermore, Bundy and Coral Sea transformers do not have a voltage regulator tap-changer, which affects the operation of these substations and the feeders that derive from them.

Bundy substation serves exclusively the federal agencies facilities and consequently we understand it can be maintained as a private substation. Regarding the FDR and Coral Sea

substations, we recommend that the USN removes them from their location. The USN suggested us that PREPA should receive these two substations, but we would have to invest funds to remove them and clean the land, with the uncertainty that it is contaminated with any pollutant. The cost estimate to remove both substations structures with their components, transformers, switchgear, breakers, fencing, poles, and concrete bases **is about $97,000** (see Table 1 attached). This estimate does not include the removal of the grounding mat, tubing, and any other underground equipment. Nor does it include the associated costs of removing any contaminants found during the work.

As per the previous explanation, PREPA should not accept the 4.16 kV substations. Any new development or load request on the Base's land will be connected to the 13.2 kV distribution system, according to PREPA's procedures. Therefore, PREPA may accept the transfer of the Base's 13.2 kV substations. Of these, the USN already transferred the Alpha substation to the Puerto Rico Ports Authority, because it serves exclusively the Base's airport. Given this situation, PREPA notified the USN and the Department of Economic and Commerce Development (DECD) that we may accept the 13.2 kV substations Charlie, Delta, and India, the 38 kV sub-transmission lines, and the 13.2 kV feeders, with their respective lots and easements. In assessing the conditions of this electrical infrastructure transfer, different technical areas of PREPA evaluated it. Among other things, Carolina Region Mapping personnel digitalized the Base's electrical system and the Transmission System Office personnel performed thermovision studies of the substations and electrical lines.

Personnel from the Planning and Environmental Protection Directorate, Generation, Transmission and Distribution Directorate, and Occupational Safety Department evaluated the substations and identified their deficiencies. In general, it was found that these substations do not comply with actual standards and regulations, especially with established safety clearances. Consequently, these installations require immediate improvements to meet these standards and regulations, before PREPA could energize and operate them according to good electrical industry practices. In addition, it is required that the lot where the substations are located have a minimum area of 2,000 m^2, so PREPA can comply with the spacing required for the proper maintenance and repair works and safety clearances. Substations lots of this size will also permit to increase the capacity of the 13.2 kV substations for serving new projects that can be developed on the Base's land. The required investment to put these 13.2 kV substations in compliance with the standards and regulations is **approximately about $2.2 million** (see Table 2 attached).

Personnel from Carolina Region performed a visual inspection of the sub-transmission lines and feeders. It was found that the sub-transmission lines gauges have a limited capacity for the projected load and, therefore, they need to be increased. The design and construction standards of these lines do not comply with PREPA'S construction regulations and their structures have no capacity for a wire gauge increase. Consequently, it is required to reconstruct these lines. On the other hand, some sub-transmission lines and feeders sections need to be relocated to improve the access and facilitate repairs and maintenance. The sub-transmission lines improvements will cost **approximately $2.7 million**. This estimate includes primary lines reconstruction, capacity increase to 556.5 kcmil ACSR, structural changes, and pole replacements with 65 feet concrete poles. The 13.2 kV feeder improvements will cost **approximately $4 million**. This estimate includes main lines reconstruction, capacity increase to 556.5 kcmil ACSR, structural changes, and pole replacements with 45 feet concrete poles. The investment of withdrawing poles, structures, and other materials of the existing sub-transmission lines and feeders is **approximately $350,000**.

The total investment to improve the Base's 13.2 kV substations Charlie, Delta, and India, the 38 kV sub-transmission lines, and the 13.2 kV feeders is about $9.2 million. It is important to indicate that there are no funds assigned for these works in PREPA's Capital Improvements Program. The costs detailed before do not include public lighting on roads and other structures, nor do they include surveillance costs to avoid vandalism (copper and other equipment robbery) on substations and electrical lines, once these facilities would be transferred to PREPA.

In addition to the sub-transmission lines and feeders improvements described above, it is necessary to make the easement constitution process for these lines on behalf of PREPA. This process includes, among other things, the elaboration of easement plans certified by a licensed and collegiate land surveyor, the making of deeds that describe the easement and its obligations notarized by a licensed lawyer, and submitting these plans and deeds in the Puerto Rico Property Registry. The land surveyor and lawyer that elaborate these plans and deeds shall be licensed and collegiate in Puerto Rico. The cost of performing the easement constitution process is additional to the cost detailed in the previous paragraph.

Due to the high costs that PREPA would incur to improve the electrical facilities and put them in service according to the electric industry standards, regulations, and good engineering practices, the cost of these assets should be minimal under the transfer method that is finally determined. Since PREPA does not require nor need the Base's electrical infrastructure and

can keep the existing wholesale electrical service, we recommend that PREPA may receive these electrical facilities only if all and each of the following conditions are met:

A. There shall be a fund allocation for making the improvements mentioned before. These funds are not included in PREPA's Capital Improvements Program, nor is it possible to include them in the future, due to the utility's fiscal situation.

B. All equipment, electrical installations, and land shall have a negative pollutants certification.

C. The USN shall make the electrical lines easement process in favor of PREPA.

D. The USN shall submit the following documents to PREPA:

1. Oil spill history for each substation.
2. Administrative Orders of the Environmental Protection Agency (EPA) in force and expired, if any.
3. Negative PCB (Polychlorinated Biphenyls), asbestos, and lead certification for equipments installed (substations, pad-mounted and pole-mounted transformers, etc.).
4. Any federal agency or court restriction for the electrical installations operations, if any.

E. The Roosevelt Roads Local Re-Development Authority (LRA) shall present to PREPA a master development plan for the Base land, which indicates the type of project to be developed (residential, commercial, industrial, etc.), location, and its estimated electric load in kVA. This information will enable PREPA to evaluate the projects electrical connection to the power system and determine which existent infrastructure could be used and which should be modified. Without this information, PREPA can not emit any endorsement for projects developing on the Base's land.

Transference method and related agreements should be final and firm before PREPA begins to make the electrical lines and substations improvements. The USN shall present a transference agreement draft to PREPA's Opinions, Legislations, and Contracts Division for evaluation. This agreement shall include, among other things, a clear and precise description of all electrical facilities to be transferred, the transference terms and conditions, associated costs, transference phases, and the strategy for maintaining the existing electrical service to the USN and Federal Government buildings still in use. It is necessary to provide the adequate metering devices and installations for keeping the electrical service of these buildings.

On the other hand, considering the possible construction developments and the Base Reuse Plan, the construction of a 115/38 kV transmission center will be needed. This construction requires the cession of a lot to PREPA with an area of approximately 5 acres and an easement of 200 feet wide for the 115 kV transmission lines. PREPA has evaluated several lots and the most adequate is the one near Bundy Substation (see attached map).

III. Fuel Storage Tanks Transference

PREPA began the evaluation of the possible transfer of the following Base's facilities:

- Five JP5 fuel storage tanks: 2270, 2271, 2272, 2273, and 2274
- Three DMF fuel storage tanks: 1995, 1996, and 2436
- Wharf and the tubing running along it

Before PREPA accepts the transference of these assets, it was agreed that a thorough inspection must be performed. Also, if there are deficiencies found during the inspection, it is required to make an estimate of the costs of the deficiencies correction. PREPA will use the results of this evaluation as criteria for deciding whether or not to accept the transfer of the facilities described above.

In the case of the fuel storage tanks, PREPA awarded the purchase order number O-053226 to Mechanical Integrity Solutions (MIS) for making the work of internal and external visual inspections and non-destructive testing of the tanks, in order to determine their condition, mechanical and structural integrity, and remaining useful life. MIS is a local contractor and is ready to begin the works as soon as authorization is granted to PREPA for performing them within the Base. PREPA's Risks Management Office obtained the certificate of liability insurance for the proposed scope of work, as required by the USN and LRA. The certificate is valid until August 29, 2011.

PREPA would receive the tanks, the wharf, and the fuel lines running along the wharf only if all and each of the following conditions are met:

A. These facilities condition, mechanical and structural integrity, and remaining useful life provide a safe, reliable, and efficient performance. These conditions shall be such that there is no need to make major improvements or a major replacement of the installations.

B. The facilities acquisition costs are not onerous, which shall consider the remaining useful life and the actual mechanical and structural conditions of these installations.

C. The USN shall conduct and pay for any environmental remediation work necessary to operate the installations to be transferred.

D. The USN shall make the easement process in favor of PREPA for the installation of fuel lines between the wharf and tanks.

E. The USN shall submit the following documents to PREPA:

1. Oil spill history for each tank.
2. Administrative Orders of the Environmental Protection Agency (EPA) in force and expired, if any.
3. Negative certification of asbestos, lead, and any other contaminant in the tanks, wharf, and the land where the fuel lines would be installed between the wharf and tanks.
4. Any federal agency or court restriction for the tanks and wharf operations, if any.

Transference method and related agreements should be final and firm before PREPA can begin to make any possible improvement or conditioning the tanks and wharf and install the fuel lines between them. The USN shall present a transference agreement draft to PREPA's Opinions, Legislations, and Contracts Division for evaluation. This agreement shall include, among other things, a clear and precise description of all facilities to be transferred, the transference terms and conditions, associated costs, and transference phases.

IV. Transference Progress

Regarding the electrical facilities transference, a meeting took place at the Base on August 18, 2010 at 9:00 a.m. It was coordinated with Mr. Erwin Kiess, Executive Director of Local Re-Development Authority (LRA). During the first part of the meeting, the Base land development master plan was presented. PREPA's personnel informed LRA that they shall submit a table showing the breakdown of the areas for development (residential, commercial, industrial, etc.), proposed use, and electrical load estimate, according to their development plan. Also, they shall present the possible development schedule for each area. LRA staff indicated that they would submit this information to PREPA.

During the second part of the meeting, we discuss various issues related to the electrical infrastructure transference, provided such installations comply with the electrical industry standards and regulations. The USN informed that they have several facilities operating at a voltage of 4.16 kV, which have to be kept with the electrical service. It was agreed that the USN personnel will provide the necessary information related to these installations and PREPA will perform field studies and give them the evaluation results. It was also agreed that the USN will present PREPA the environmental studies conducted on the facilities to be transferred.

Regarding the possible transference of the fuel storage tanks and wharf, PREPA is waiting for the USN permission for entering the Base to perform the tanks inspection and testing.

Report prepared by:

Luis Aponte Zayas, Executive Advisor
Generation, Transmission and Distribution Directorate

Date: September 1, 2010

Puerto Rico Electric Power Authority

Table 1
Cost and Construction Time Estimates for the Removal of the 4.16 kV Electrical Substations
in Roosevelt Roads Naval Base*

Substation	Structure (including lighting arresters and air switches)	Transformer and Switchgear	Substation Fence, Incoming Transmission Line Pole, and Transformer Concrete Base	Equipment Disposal	Total Cost	Removal Time Estimate
FDR	$12,342.00	$10,285.00	$32,912.00	$1,210.00	$56,749.00	4 weeks
Coral Sea	$12,342.00	$10,285.00	$16,456.00	$1,210.00	$40,293.00	3 weeks
Total	**$24,684.00**	**$20,570.00**	**$49,368.00**	**$2,420.00**	**$97,042.00**	**7 weeks**

*Additional costs may arise after a thorough evaluation of the substations. The costs in the table do not include the removal of the substation's grounding mat, underground equipment or contaminants.

Table 2
Cost and Construction Time Estimates for the Improvements of the 13.2 kV Electrical Substations in Roosevelt Roads Naval Base*

Substation	Structure Conditioning and Repairs	Grounding Mat Reconstruction and Gravel Cover	Fence	Driveways	SCADA	Commissioning	Secondary Oil Contention Structure	Substation Lot Area[1] (m^2)	Total Cost	Construction Time Estimate	Commissioning Time Estimate
Charlie	$9,161.50	$45,807.51	$31,043.11	$298,316.74	360,163.23	$58,492.93	$36,000.00	2,000	$838,985.03	12 weeks	6 weeks
Delta	$114,518.80	$45,807.51	$43,460.35	$29,528.82	360,163.23	$58,492.93	$36,000.00	2,000	$687,971.65	21 weeks	6 weeks
India	$19,086.47	$45,807.51	$36,444.61	$68,143.42	360,163.23	$58,492.93	$36,000.00	2,000	$624,138.17	16 weeks	6 weeks
Totals	**$142,766.77**	**$137,422.54**	**$110,948.08**	**$395,988.97**	**1,080,489.69**	**$175,478.79**	**$108,000.00**	**6,000**	**$2,151,094.85**	**49 weeks**	**18 weeks**

*Additional costs may arise after a thorough evaluation of the substations.

[1]The area of the lot may vary depending on the availability of existing facilities adjacent space.