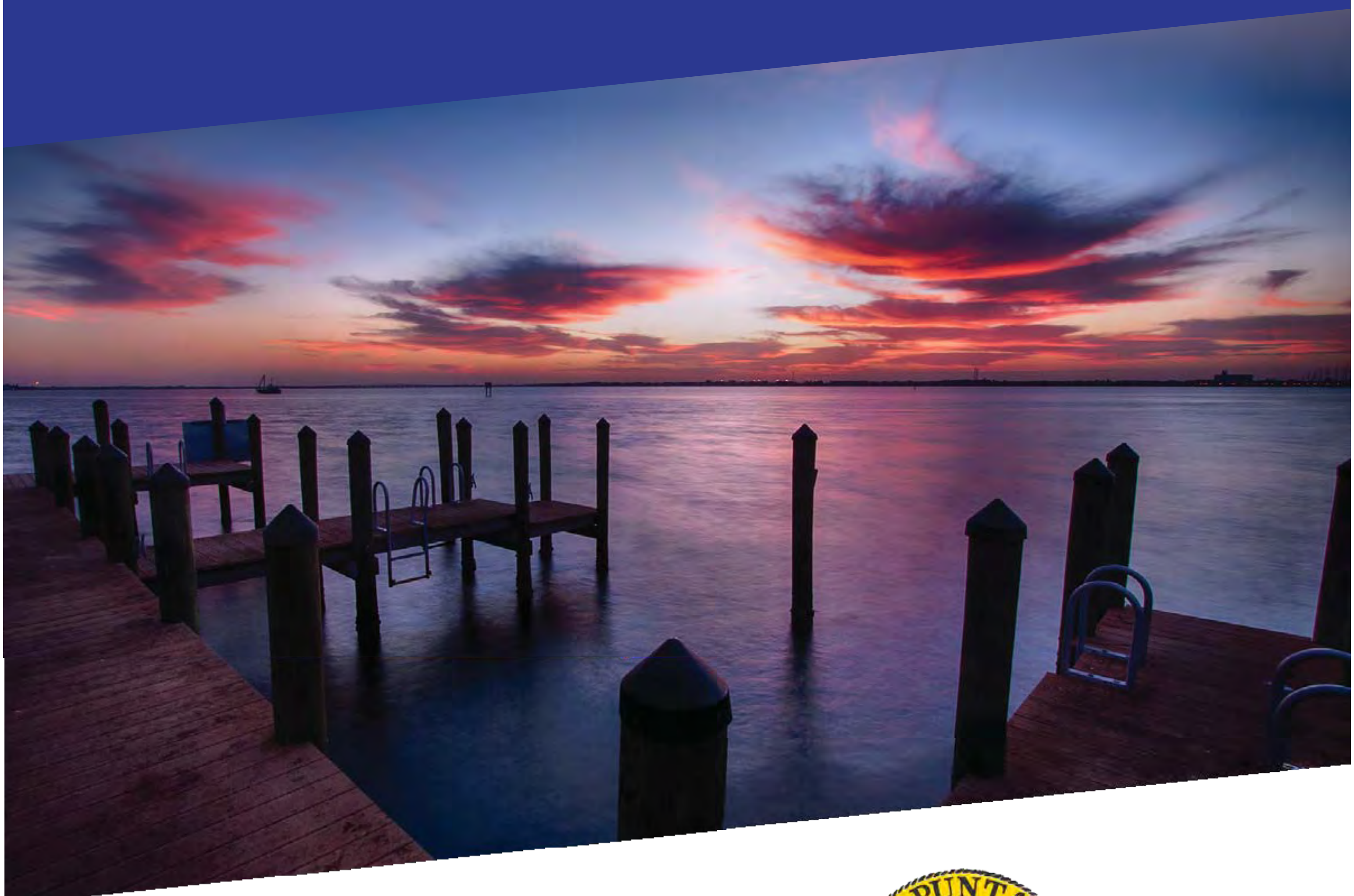
SEWER MASTER PLAN

City of Punta Gorda Utilities Department | 2018



PUNTA GORDA
SEWER MASTER PLAN

Prepared for:

City of Punta Gorda Utilities Department

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The preparation by Jones Edmunds & Associates Inc., 730 NE Waldo Road, Gainesville, Florida 32641, of the Fiscal Year (FY) 2017 Sewer Master Plan is authorized by Charlotte County, a political subdivision of the State of Florida, 18500 Murdock Circle, Port Charlotte, Florida 33948-1094, under an Amendment to Purchase Order No. 2016000218

CERTIFICATIONS AND SIGNATURE PAGE

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City of Punta Gorda Government

Punta Gorda City Council

Charlotte County Community Development

Charlotte County Economic Development

Charlotte County Property Appraiser

Charlotte County Tourisms Development

Charlotte County TV

Charlotte County Utilities and Public Works

Research and Environmental Institutions

Charlotte Harbor National Estuary Program

Charlotte Soil & Water Conservation District

FAU's Harbor Branch Oceanographic Institute

MOTE – Marine Laboratory & Aquarium

Sarasota Operations Coastal Oceans Observation Lab

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Regulatory Partners

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Florida Department of Health

FWS Fisheries Program

South Florida Water Management District

Southwest Florida Water Management District

Professional Associations

Charlotte DeSoto Building Industry Association

Charlotte Harbor Flatwoods Initiative

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LIST OF ACRONYMS AND ABBREVIATIONS

A	
AADF	Annual Average Daily Flow
B	
BCC	Board of County Commissioners
BEBR	Bureau of Economic and Business Research
BOD	Biochemical Oxygen Demand
C	
CAR	Capacity Analysis Report
CBOD	Carbonaceous Biochemical Oxygen Demand (5-day)
CCSMP	Charlotte County Sewer Master Plan
CCUD	Charlotte County Utilities Department
CIP	Capital Improvement Program
D	
DD	Directional Drill
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
E	
EOPCC	Engineer’s Opinion of Probable Construction Costs
EPA	US Environmental Protection Agency
ERC	Equivalent Residential Connection
ESS	Existing Sewersheds
F	
FAC	Florida Administrative Code
FAC	Florida Association of Counties
FDEP	Florida Department of Environmental Protection
FEMA	Federal Emergency Management Agency
FFWCC	Florida Fish and Wildlife Conservation Commission
FOG	Fats, Oils, and Grease
fps	Feet per Second
FS	Florida Statutes
G	
GIS	Geographical Information System
gpd	Gallons per Day
gph	Gallons per Hour
GST	Ground Storage Tank
H	
HAB	Harmful Algae Bloom
HDPE	High-Density Polyethylene

HMI	Human Machine Interface
HUD	US Department of Housing and Urban Development
I	
I&I	Infiltration and Inflow
L	
LF	Linear Feet
LS	Lift Station
M	
MADF	Monthly Average Daily Flow
MG	Million Gallons
MGD	Million Gallons per Day
mg/L	Milligrams per Liter
MHI	Median Household Income
MHP	Mobile Home Park
MMADF	Maximum Monthly Average Daily Flow
MTMADF	Maximum 3-Month Average Daily Flow
N	
N	Nitrogen
NH^4	Ammonia
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
O	
O^2	Oxygen
O.C.	Open Cut
O&M	Operation and Maintenance
P	
PER	Preliminary Engineering Report
PGU	Punta Gorda Utilities
PVC	Polyvinyl Chloride
R	
RCW	Reclaimed Water
S	
SCADA	Supervisory Control and Data Acquisition
SMP	Sewer Master Plan
SR	State Road
SRF	State Revolving Fund
STEP	Septic Tank Effluent Pumping
STP	Sewage Treatment Plant
SWFRPC	Southwest Florida Regional Planning Council
SWFWMD	Southwest Florida Water Management District
T	
TMADF	Three Month Average Daily Flow

TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TPY	Tons per Year
TSS	Total Suspended Solids
U	
μg/L	Micrograms per Liter
UIC	Underground Injection Control
USDA	US Department of Agriculture
V	
VFD	Variable-Frequency Drive
W	
WAS	Waste-Activated Sludge
WRF	Water Reclamation Facility
WWTP	Wastewater Treatment Plant

DEFINITIONS

A	
Activated Sludge	Wastewater treatment process that uses aeration to promote the growth and cultivation of aerobic microorganisms that are used to breakdown, convert and remove/reduce undesirable wastewater constituents.
Air Resources Management System (ARMS) Facilities	ARMS Facilities are point locations of the businesses or facilities in the State of Florida that have requested permitting from FDEP's Division of Air Resource Management. Permits are for major and minor stationary sources of air pollutants that specify emission limits and requirements for construction and operation.
B	
Backflow Prevention	A type of valve that is typically used to prevent liquid from backflowing into a pipe that supplies potable water potentially contaminating the water supply.
Biogas	Byproduct of wastewater treatment that can be used as fuel; similar to natural gas.
Biosolids	Organic byproduct of wastewater treatment; biosolids resemble dark soil and can be used as a nutrient-rich soil amendment.
Biological Oxygen Demand	The amount of dissolved oxygen utilized by aquatic microorganisms.
C	
Capital Cost	Cost of equipment and materials that exclude mark-ups of provided services such as permitting, mobilization, overhead and profit and administrative fees.
Capacity Analysis Report	A report that provides an evaluation and comparison of the current and future flows to a treatment plant (water and/or wastewater) permitted and rated capacities of the different components of the treatment plants to provide timely planning of future improvements or expansions to maintain compliance with the latest rules and regulations.
Cassette	A unit that contains several of the same components.
Centralized Sewer	Sewer conveyance system for transporting sewer from houses, commercial, industrial, and institutional buildings through pipes and pumps to facilities for treatment and disposal.
Certificated Area	An identified geographic area and boundary where an entity has exclusive rights to provide water and wastewater utility services.
Cogeneration	The process in which an internal combustion engine is used to produce heat and electrical power from biogas.
Collection System	A network of pipes used to convey sewage from homes to lift stations under pressure, vacuum, or gravity conditions.
Consumer Confidence Report	Economic indicator that measures the degree of optimism that consumers feel about the overall state of the economy and their personal financial situation.
D	
Dissolved Oxygen	The amount of oxygen gas dissolved in a given volume of water at a particular temperature and pressure, often expressed as a

	concentration in parts of oxygen per million parts of water.
Directional Drill	Also referred to as directional boring or HDD, a trenchless method of installing underground pipe, conduit, or cable in a shallow arc along a prescribed bore path by using a surface-launched drilling rig, with minimal impact on the surrounding area.
E	
Effluent	Flow exiting a specified process or location.
F	
Final Effluent	Treated water that is discharged out of the water reclamation facility.
Flood Irrigation	A method of irrigating in which water is conveyed through small trenches running through crops. Also called surface or furrow irrigation.
Flow	The volume of fluid moving at a continuous rate; commonly measured in millions of gallons per day (MGD) at water reclamation facilities or gallons per minute (gpm) at households.
Force Main	A pressure pipe conveying wastewater from the lift station to the water reclamation facility.
G	
Gravity Collection System	A type of collection system in which flow is conveyed by the energy of gravity. This type of system requires piping to be installed at a gradual incline (slope) to convey fluid to lift stations.
Grinder Pump Low-Pressure System	A grinder pump low-pressure system consists of conventional, drain, waste, and vent piping within the residence connected to the packaged grinder pump basin. The grinder pump basin is typically installed outdoors, below grade, and serves one residence. Grinder pumps discharge a finely ground slurry into small-diameter pressure piping. In a completely pressurized collection system, all the piping downstream from the grinder pump (including laterals and mains) will normally be under low pressure (60 psig or less).
H	
Headworks	Structure that is at the beginning of a water reclamation facility that contains equipment designed to mechanically or hydraulically remove influent solids larger than ½ inch and in some instances smaller than 1/2 inch.
Hypoxic	In ocean and freshwater environments, the term refers to low or depleted oxygen conditions in a water body. Hypoxic conditions occurs due to an imbalance of oxygen between oxygen consuming and producing biological and chemical processes. It is often associated with the overgrowth of certain species of algae, which can lead to oxygen depletion when they die, sink to the bottom, and decompose.
I	
Impaired Water	A waterbody or waterbody segment that does not meet its applicable water quality standards/use (e.g., drinking, fishing, swimming, shellfish harvesting) as set forth in Chapters 62-302 and 62-4, F.A.C., as determined by the methodology in Part IV of Chapter 62-303 of FS, due in whole or in part to discharges of pollutants from point or nonpoint sources.

Infiltration and Inflow (I&I)	Surface water or groundwater that enters the sewer collection system due to pipe age degredation.
L	
Lateral Line	A privately owned underground sewer pipe connecting a residence, business, industry, institution, etc., to a publicly owned **sewer** pipe.
Load	The mass of solids and organic material conveyed into the water reclamation facility as part of wastewater.
M	
Monthly Peaking Factor	The maximum monthly average daily flow divided by the annual average daily flow over the same 12-month period.
MSBU/MSTU	A geographic area within the County created by ordinance and defined by specific boundaries that provides a funding mechanism to provide capital improvements including sanitary sewer, potable water, roadways, and other services or capital improvements. Some examples of services that MSBUs/MSTUs may provide are road and drainage maintenance, waterway dredging, stormwater utility, fire protection, or sanitation service.
Monitoring Well	A pit or hole sunk into the earth to reach a water supply for the purposes of water level or water quality data collection. Monitoring wells are often used to assess groundwater contamination or flow patterns.
O	
Operation & Maintenance (O&M) Costs	The collective cost associated with the County to operate and maintain the wastewater system components including labor, repair, power, fuel, parts, cleaning, painting, monitoring. Typically measured on an annual basis.
Open Cut	Also referred to as open trench, an excavation in the ground that is open to the sky at its surface as opposed to a tunnel or bore hole that is trenchless
P	
Percent Capacity	The three-month average daily flow divided by the permitted capacity.
Pollutant	Generally any substance, such as a chemical or waste product, introduced into the environment that adversely affects the usefulness of a resource.
Preliminary Treatment	Initial treatment step, which removes larger material, like grit and paper, from wastewater.
Pressure Collection System	Sewer collection technology that transmits sewage from homes to a centralized location under positive pressure conditions. Common technologies include grinder pump and STEP sewer collection systems.
Primary Treatment	Gravity-settling step that removes solid material that floats or sinks.
Process Flow Diagram	A visual representation of the general flow of the water treatment facility operations and processes.
Lift station	A structure that receives sewage from the collection system and pumps it through a force main toward the water reclamation facility for treatment.

R	
Reclaimed Water	Wastewater that has been treated to acceptable standards for use as irrigation, decorative ponds for aesthetic purposes, and other non-potable uses.
S	
Secondary Treatment	Biological treatment step that removes organic matter.
Septic System	A sewage treatment system installed at the site of a residence/home. Septic systems usually include a septic tank to capture solids and a drain field that allows liquids to be absorbed in the soil.
Sewage	Refers to fluids that are produced at homes and conveyed to septic systems or a centralized sewer collection system.
Sewershed	A delineated area in which sewage is collected and conveyed to a single point or outlet.
STEP Sewer	STEP systems use conventional septic tank systems with automatic pumps and control devices to convey the liquid in the septic tank to a low-pressure collection system. CCUD refers the STEP systems as low-pressure systems. The term "low-pressure" will be used for this type of system in this report.
T	
Tertiary Treatment	Filtering, disinfecting, and dechlorinating the wastewater, making it clean for discharge
Train	A collection of different stages of treatment that progress through the water reclamation facility. Typically there are more than one in a water reclamation facility for redundant purposes.
Transmission System	A series of force mains that transmit sewage from the lift station to the water reclamation facilities.
Trunk Lines	Serve as the primary force mains that receive and convey sewage from other force mains to the water reclamation facilities.
V	
Vacuum Sewer Collection System	Sewer collection technology that transmits sewage from homes to a centralized location under vacuum (negative pressure) conditions. Vacuum sewers generally include a valve pit serving 2 to 3 homes, a collection system, and a lift station with vacuum pumps within the service area.
W	
Water Reclamation Facility	A facility where the wastewater from a collection/transmission system flow through a series of processes that remove contaminants from wastewater. It includes physical, chemical, and biological processes to remove these contaminants and produce environmentally safe treated wastewater (or treated **effluent**) including reclaimed water.
Wastewater	Refers to the influent fluid entering a water reclamation facility, comprised of residential sewage, industrial and commercial waste fluids, or water that has come into contact with these substances, i.e., groundwater/surface water entering the collection system from I&I.

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1 INTRODUCTION

1.1 OVERVIEW

Chapter 1 defines the purpose and objectives of the City of Punta Gorda Utilities (PGU) Sewer Master Plan (SMP). Creating an affordable, reliable, and efficient wastewater collection and treatment system is key to sustainable population growth, economic development, and the health of the City's and Charlotte County's natural resources and landscape.

Charlotte Harbor's rich historical and naturally beautiful features have been key to attracting businesses and residents to the area. Population surges and steady growth continue to impact water quality. This SMP is a local and regional collaborative effort to improve and protect the region's water quality in an affordable, sustainable, efficient, and reliable manner.

1.2 PURPOSE

The water quality in Charlotte Harbor, Peace River, and Myakka River has a significant impact on the surrounding communities. A regional effort is underway to improve and protect this crucial natural resource, which affects the ecosystems, fisheries, marine and wildlife habitats, beaches, coastal wetlands, tourism industry, home values, and overall quality of life. As a part of this effort, the PGU contracted Jones Edmunds & Associates, Inc. to prepare an SMP to reduce pollution to the Harbor by converting septic to sewer (S2S) within PGU's service area. These efforts will assist in sustaining the quality of Charlotte County's natural water resources, ensure a safe water supply, provide a recreational haven, and protect an environmental resource in accordance with the City's Comprehensive Plan and Charlotte County's Blue Water Strategy.

According to the City's Comprehensive Plan and the Charlotte County's Blue Water Strategy, the primary goal of this project is to collaboratively develop an initial 15-year plan to implement an affordable, reliable, and efficient wastewater collection and treatment system for a sustainable environment.

1.3 HISTORY AND GROWTH

The Charlotte Harbor area was originally explored by Ponce de Leon in 1515 and 1521. In 1565, Spanish explorers named the area Carlos Bay, after the Native American Calusa Tribe who inhabited Florida's southwest coast at the time. Early settlements on the outer islands failed due to confrontations with the local inhabitants, but Spanish and English settlements slowly developed along the banks of the Peace River.

English settlers renamed the bay "Charlotte" in 1775 as a tribute to Queen Charlotte Sophia. In 1819, Florida was ceded to the United States by the Spanish and 26 years later became the 27th state. Colonel Isaac Trabue purchased 30 acres on the east shore of Charlotte Harbor (Figure 1-1) and established the Town of Trabue in 1884. In 1887, the town was renamed and incorporated as the City of Punta Gorda.

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Figure 1-1 Charlotte Harbor

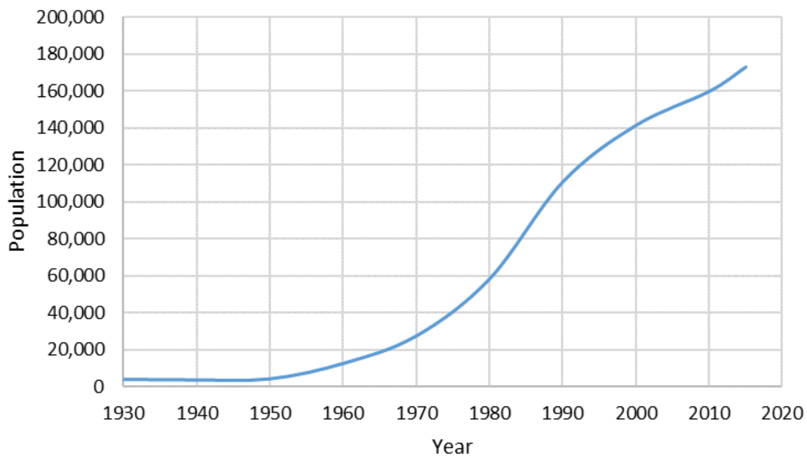
Real change started to occur in 1886 when the Florida Southern Railroad arrived, connecting the area to the rest of the state. As the century ended, Punta Gorda became an important port for Cuban cattle shipments, and the harbor served as a fishing resource for mullet, Spanish mackerel, and channel bass.

In April 1921, the State approved dividing the original DeSoto County into five counties including Glades, Hardee, Highlands, and Charlotte (which was named by the citizens of Punta Gorda after the bay). Today, Charlotte County covers 694 square miles with approximately 126 square miles of waterways.

Before 1950, a substantial portion of Charlotte County's population resided in the City of Punta Gorda. Growth took off throughout Charlotte County after the General Development

Corporation established the unincorporated community of Port Charlotte in the 1950s, offering affordable homes in Florida's paradise to the rapidly expanding middle class. Attracted by the beautiful rivers, beaches, estuaries, and resources of Charlotte Harbor, the population in Charlotte County grew rapidly and increased from fewer than 5,000 in 1950 to over 170,000 residents presently (Figure 1-2). The 2017 population estimate of the City of Punta Gorda is 18,838 (BEBR, 2017).

Figure 1-2 Charlotte County Population by Year



Population growth throughout the entire County has impacted water bodies and rivers in Charlotte County. The harbor's historically pristine waters and thriving ecology are being threatened by excess nutrients, bacteria, viruses, low dissolved oxygen, and toxic organic compounds; harmful algae blooms (HABs); and decreasing water clarity. The Peace and Myakka Rivers, which flow through Charlotte County and discharge into Upper Charlotte Harbor, and Charlotte Harbor are now listed as impaired by the US Environmental Protection Agency (EPA) for dissolved oxygen, chlorophyll-a, bacteria in shellfish, and mercury in fish tissue.

Coastal water quality degradation is not limited to Charlotte Harbor. Numerous cities and counties along the Florida coast are experiencing eutrophication and HABs due to nutrient pollution. In 2012, the Florida Department of Environmental Protection (FDEP) adopted specific Numeric Nutrient Criteria (NNC) to protect the State's estuaries and coastal areas from nutrient over-enrichment (Rule 62 302.532, Florida Administrative Code [FAC]). Table 1-1 lists the NNCs for Upper Charlotte Harbor and the contributing rivers. Similar coastal areas and estuaries including Tampa Bay, Sarasota Bay, the Florida Keys, and Martin County have already begun implementing sustainable practices to restore their natural water resources and meet NNCs with measureable improvement (Ayers, 1998; Lapointe and Herren, 2016).

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Table 1-1 Numeric Nutrient Criteria for Charlotte Harbor, Peace River, and Myakka River

Nutrient	Charlotte Harbor Proper	Tidal Peace River	Tidal Myakka River
Total Nitrogen (mg/L)	0.67	1.02	1.08
Total Phosphorus (mg/L)	0.19	0.31	0.50
Chlorophyll-*a* (µg/L)	6.10	11.7	12.6

Note: mg/L = milligrams per liter.
µg/L = micrograms per liter.
Data specified in Rule 62-302.530(47)(b), FAC.

1.4 Septic Tanks and Charlotte Harbor Water Quality

The deteriorating water quality in Charlotte County has been largely attributed to nutrient and bacteria loads originating from on-site treatment and disposal systems (OSTDSs), more commonly referred to as septic systems (CHEC, 2003; Tetra Tech, 2013; LaPointe et al., 2016).

Figure 1-3 displays the number of septic systems installed from 1940 through 2014 within unsewered portions of the City's service area. The majority of the septic systems were installed in the 1970s with a second wave in 2005. Currently, there are approximately 2,700 septic systems within the City's service area and over 45,000 septic systems County-wide (Charlotte County Utilities Department [CCUD], 2010). Septic systems operate through a multi-step process that includes a septic tank and drainfield.

Figure 1-3 Number of Septic Systems Installed in the City's Unincorporated Service Area

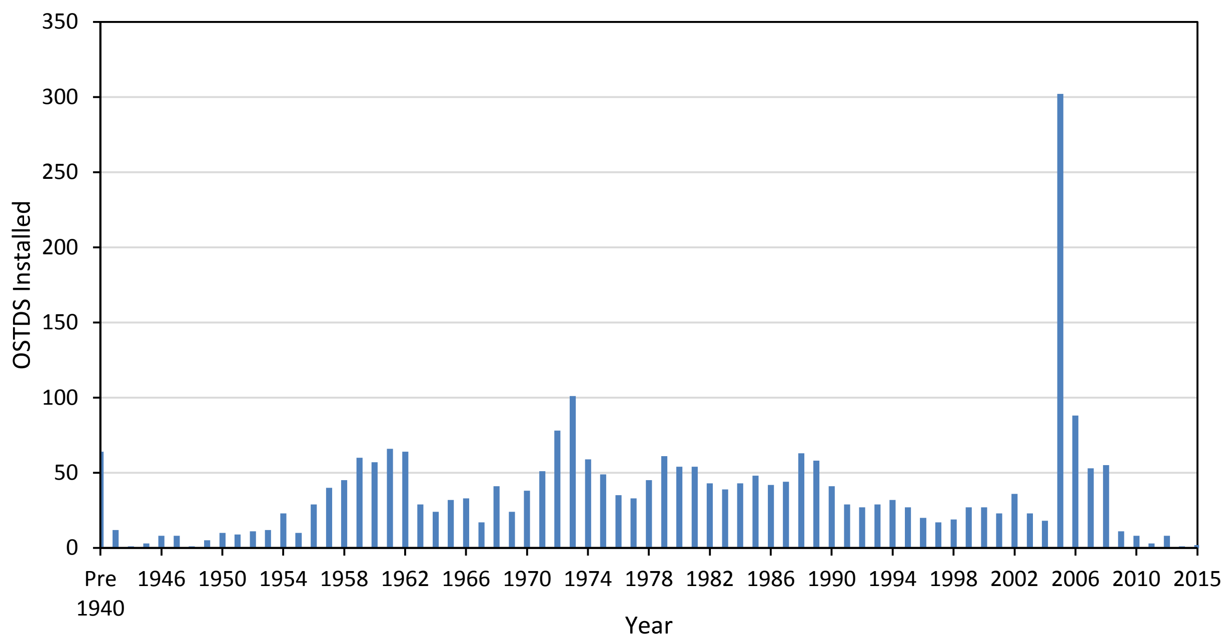

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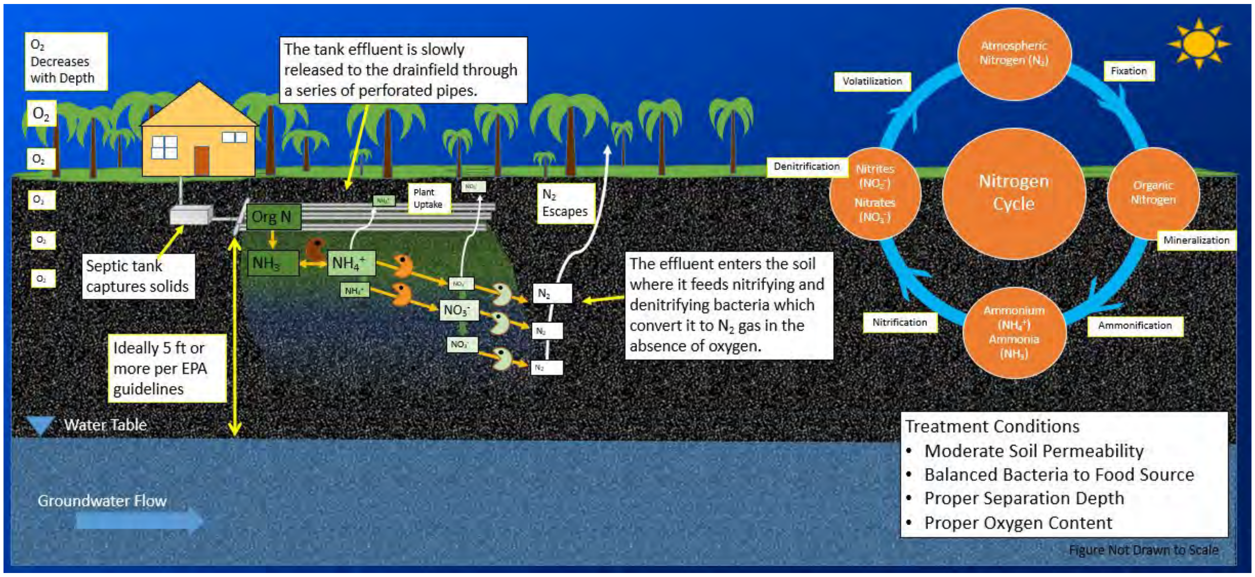
Figure 1-4 depicts how wastewater from the home is collected and conveyed to the septic system through drainpipes.

Figure 1-4 Typical Septic System and Drainfield with Ideal Treatment



In the septic tank, solids settle out while the effluent flows through a series of perforated pipes that are embedded in a drainfield generally located in the yard. The effluent percolates into the drainfield and through a deep layer of soil, allowing additional treatment to occur before entering the groundwater.

All septic systems release the nutrients of nitrogen (N) (primarily in the form of ammonia [NH_4^+]) and phosphorus (P) to the groundwater from the drainfield. In a properly operating system, nitrifying bacteria in the upper portions of the drainfield/soil convert NH_4^+ to nitrate (NO_3^-) in the presence of oxygen (O_2) in porous soils.

As the effluent percolates deeper in the ground, another group of bacteria – denitrifiers – convert the NO_3^- to nitrogen gas (N_2 gas), which escapes upward to the atmosphere. The denitrification process occurs under conditions without oxygen present.

1.5 Factors Contributing to Septic Failure

The soil type and separation depth relative to the groundwater table play significant roles in the septic systems' treatment effectiveness. High-porosity soils found in many coastal regions of Florida are saturated due to high groundwater and are typically unsuitable for providing the necessary treatment time since the effluent travels too quickly through the soil to neutralize bacteria and pollutants in the sewage.

Figure 1-5 shows a septic system with non-ideal treatment. The high groundwater floods soils, which reduces oxygen transfer and lowers oxygen levels, leading to incomplete nitrogen removal. The NH_4^+ does not fully nitrify to NO_3^-, and the denitrifying bacteria's ability to convert the NH_4^+ to N_2 gas is impeded, leaving the NH_4^+ to persist in the groundwater and ultimately impact surrounding surface waters.

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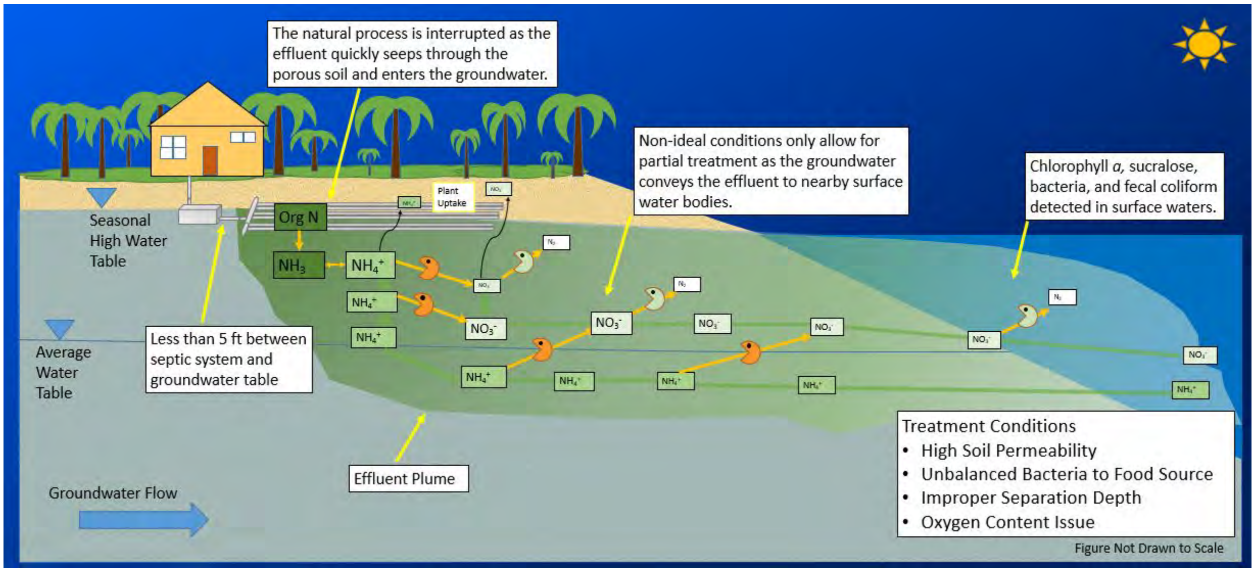
Figure 1-5 Typical Septic System and Drainfield with Non-Ideal Treatment



Fill soils are often required in Florida for the septic systems to function properly to meet design parameters and to increase the separation depth to seasonal high groundwater. To help protect groundwater, the State changed the septic system requirements in 1983, increasing the requirements from a 6-inch-minimum separation distance between the bottom of the septic tank drainfield and seasonal high water table to a 2-foot minimum. The EPA recommends a minimum 5-foot separation to seasonal high groundwater. Additionally, the distance from the septic system to surface waters was increased from a 25- to 50-foot setback to a 50- to 75-foot setback (64E-6.002, Florida Statutes [FS]).

The soil conditions in Charlotte County are classified as A/D, indicating high groundwater and drained conditions as discussed in the Charlotte County SMP. Figure 1-6 displays the groundwater flow patterns throughout Charlotte County. All surficial groundwater in the City and throughout the County flows into Charlotte Harbor. Therefore, nearly all septic tank effluents are ultimately conveyed to Charlotte Harbor once the groundwater flow reaches the surface water body.

Several researchers have shown correlations between the human population and nitrogen loadings through the use of sewage tracers such as fecal bacteria, nitrogen isotopes, and sucralose concentrations (Lapointe et al., 2016; Green et al., 2015; Risk et al., 2009; Ursin and Roeder, 2008; and Howarth et al., 2000). Recent studies conducted by the Harbor Branch Oceanographic Institute at Florida Atlantic University (FAU) Marine Ecosystem Health Program have shown that the presence of fecal coliform and concentrations of chlorophyll-a in Charlotte Harbor have increased over the years.

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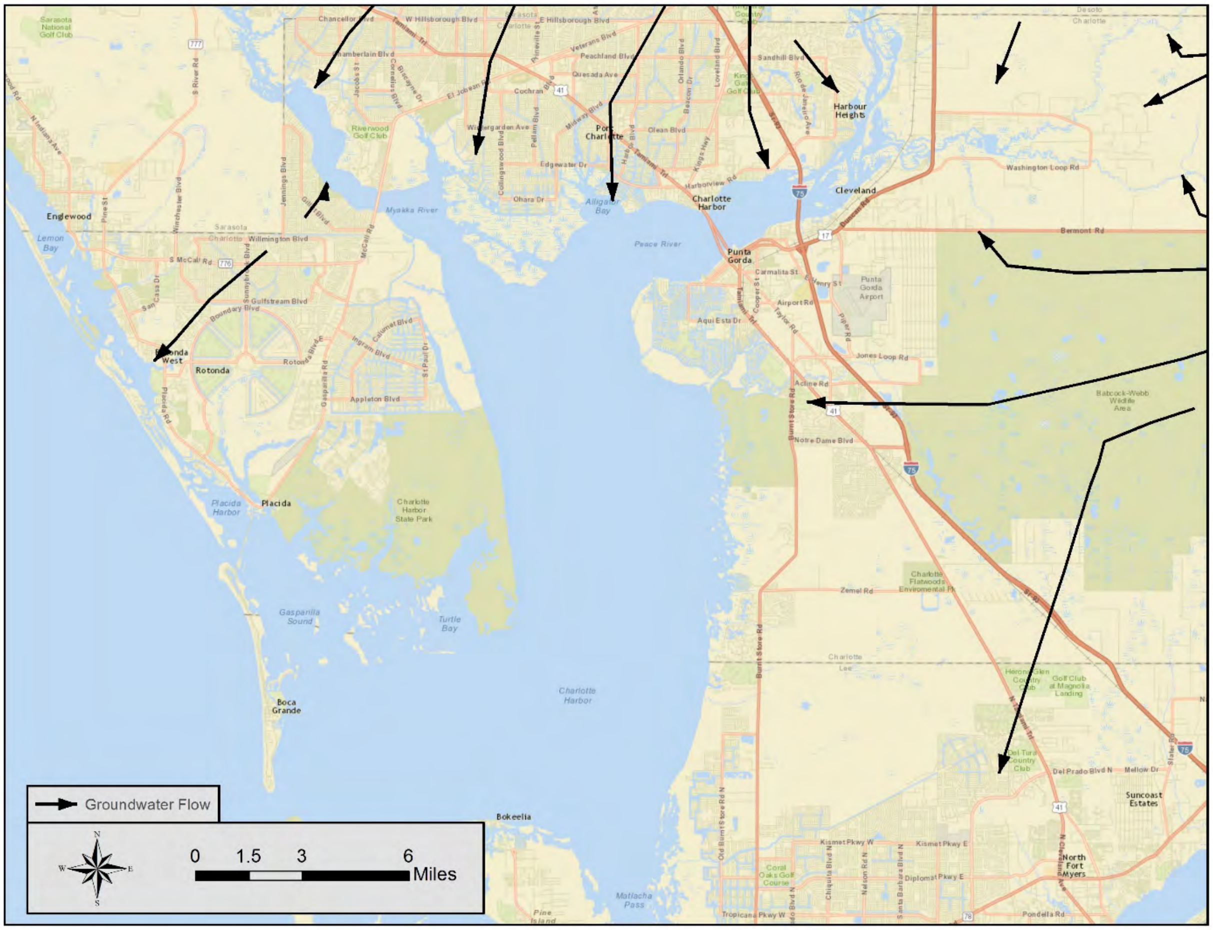
Figure 1-6 Groundwater Flow in Charlotte County and Punta Gorda



The increased levels of sewage tracers strongly correlate to the increases in population and septic system installations. The research found ammonia values were well above the macroalgae bloom threshold of 0.014 microgram per liter (µg/L), indicating favorable conditions for HABs. Figure 1-7A shows fecal coliform bacteria concentrations above the FDEP surface water quality criteria listed in the Florida Statutes, which were established to protect the health of swimmers and recreation. Figure 1-7B shows that chlorophyll-a has consistently increased over time and is well above the NNC value of 6.10 µg/L as shown in Table 1-1.

Note: Chlorophyll-a is used as an indicator of the level of algae growth and biomass within a water body.

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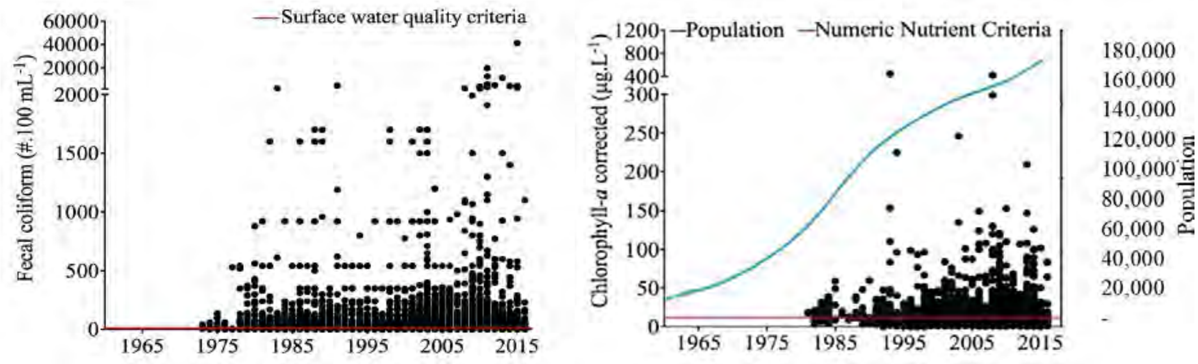
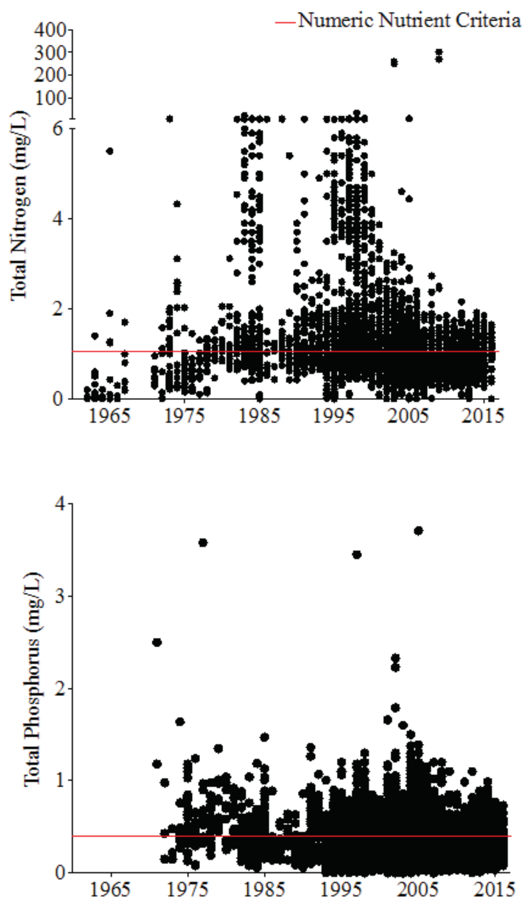
Figure 1-7 Wastewater Indicator Trends over Time in Charlotte County (Lapointe et al., 2016)



(A) (B)

Figure 1-7C summarizes Total Nitrogen (TN) and Total Phosphorus (TP) levels and the increasing trend in these parameters in Charlotte Harbor canals and estuary.



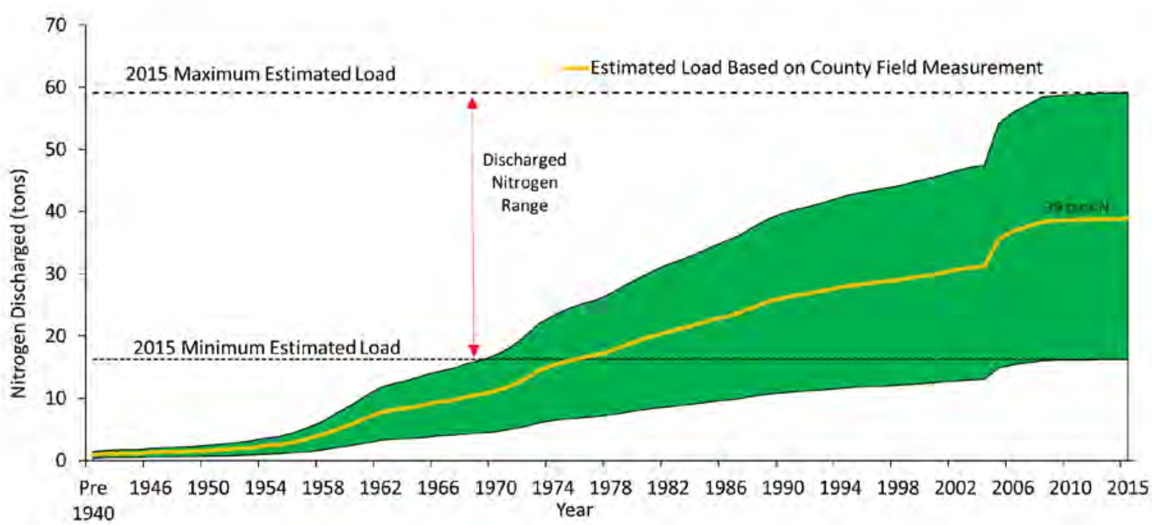
(C)

The increasing levels of nitrogen, fecal coliform, and chlorophyll-a reveal that the level of treatment provided by septic systems is not sufficient to protect the water quality of receiving water bodies. The combination of unsuitable soils, seasonally high groundwater tables, and aging septic systems allows minimally treated sewage to percolate through the soil and enter the groundwater where it is conveyed to canals, rivers, creeks, and estuarine shorelines. This results in high levels of nitrogen, phosphorus, fecal microbes, and organic wastewater contaminants being transported to the Harbor.

Researchers estimate nitrogen effluent loads originating from septic systems vary to between 4.8 and 17.5 pounds per person per year (Ursin and Roeder, 2008; EPA, 2002; and Crites et al., 1998). Based on US Census data, an average of 2.5 people per household contribute to each of the City's 2,700 septic systems. Figure 1-8 displays the range of TN loading in the City based on the number of septic systems within the City's service area. Based on nitrogen loading data and current septic system counts, a range of 16 tons (approximately 32,400 pounds) N to 59 tons (approximately 118,200 pounds) N was discharged from septic systems in 2015.

Since 2016, Charlotte County has conducted field measurements of nitrogen levels released from septic systems. The average TN effluent concentrations was found to be 70 milligrams per liter (mg/L), corresponding to a nitrogen load of 39 tons (approximately 77,700 pounds) N per year discharged to Charlotte Harbor. The excessive amount of nitrogen promotes excess algae growth within the water bodies, which sustains and contributes to the formation of HABs. HABs can lead to aquatic hypoxia, causing red tide events and significant ecological destruction (Gilbert P., 2009; Gulf of Mexico Coastal Ocean Observing System [GCOOS], 2013).

Figure 1-8 Range of Discharged Nitrogen from Septic Systems in Punta Gorda



Surface water quality in Charlotte Harbor varies between the wet and dry seasons. The rainy season and large tropical storms create increased surface water and groundwater flows into the Harbor. Increased groundwater and stormwater flows, contaminated with partially treated septic tank effluent, produce ammonia-nitrogen and fecal coliforms that flow into Charlotte Harbor. The nitrogen increase results in algal blooms as measured by an increase in chlorophyll-a. Figure 1-9A, B, C, and D show the variability of water quality in Charlotte Harbor during the dry seasons (April 2015 and April 2016) and wet seasons (August and September 2015) for chlorophyll-a, fecal coliform, and TN.

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Figure 1-9A Surface Water Quality: April 2015 (2.1 inches of Rain)

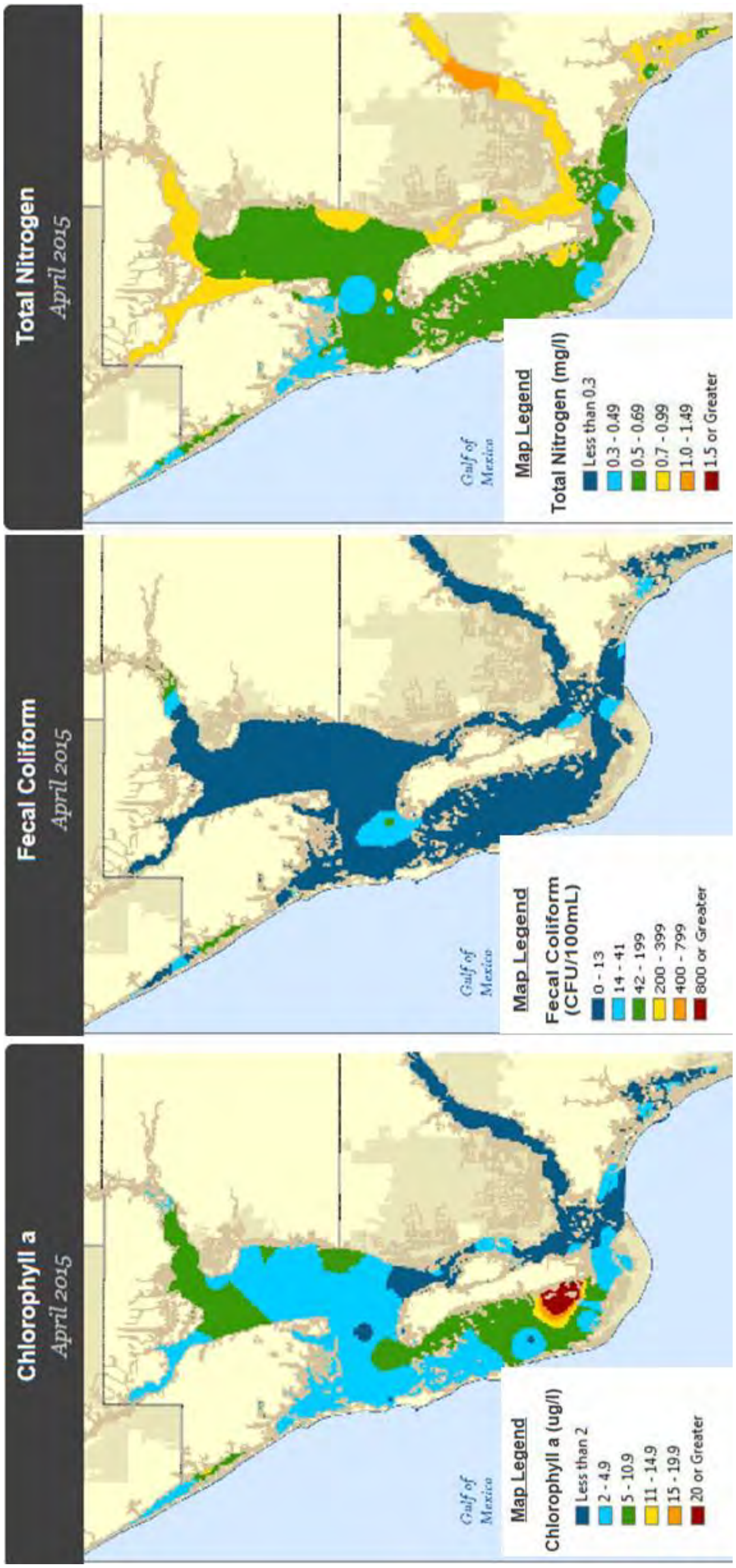

Figure1-9B Surface Water Quality: August 2015 (13.6 inches of Rain)

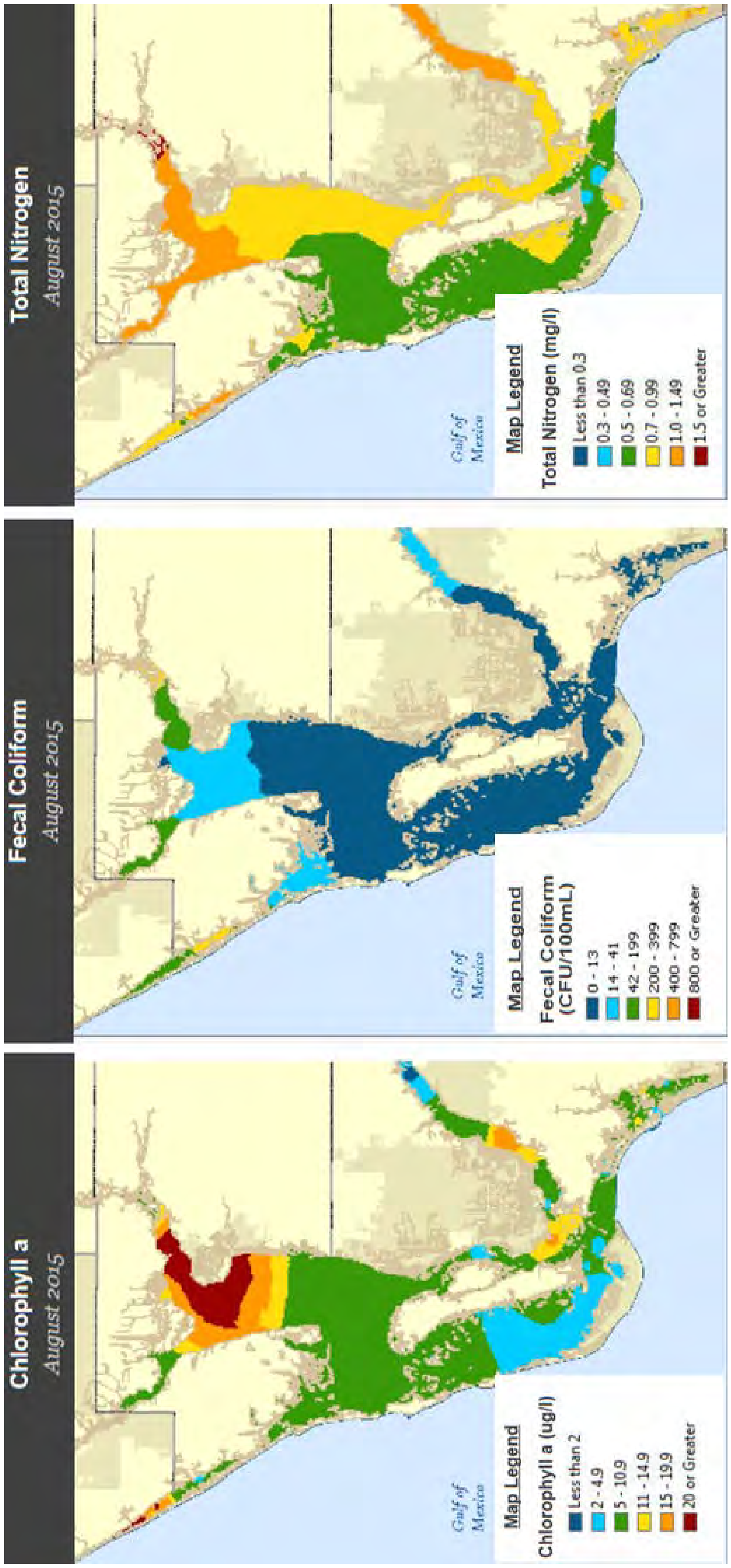

Figure 1-9C Surface Water Quality: September 2015 (8.2 inches of Rain)

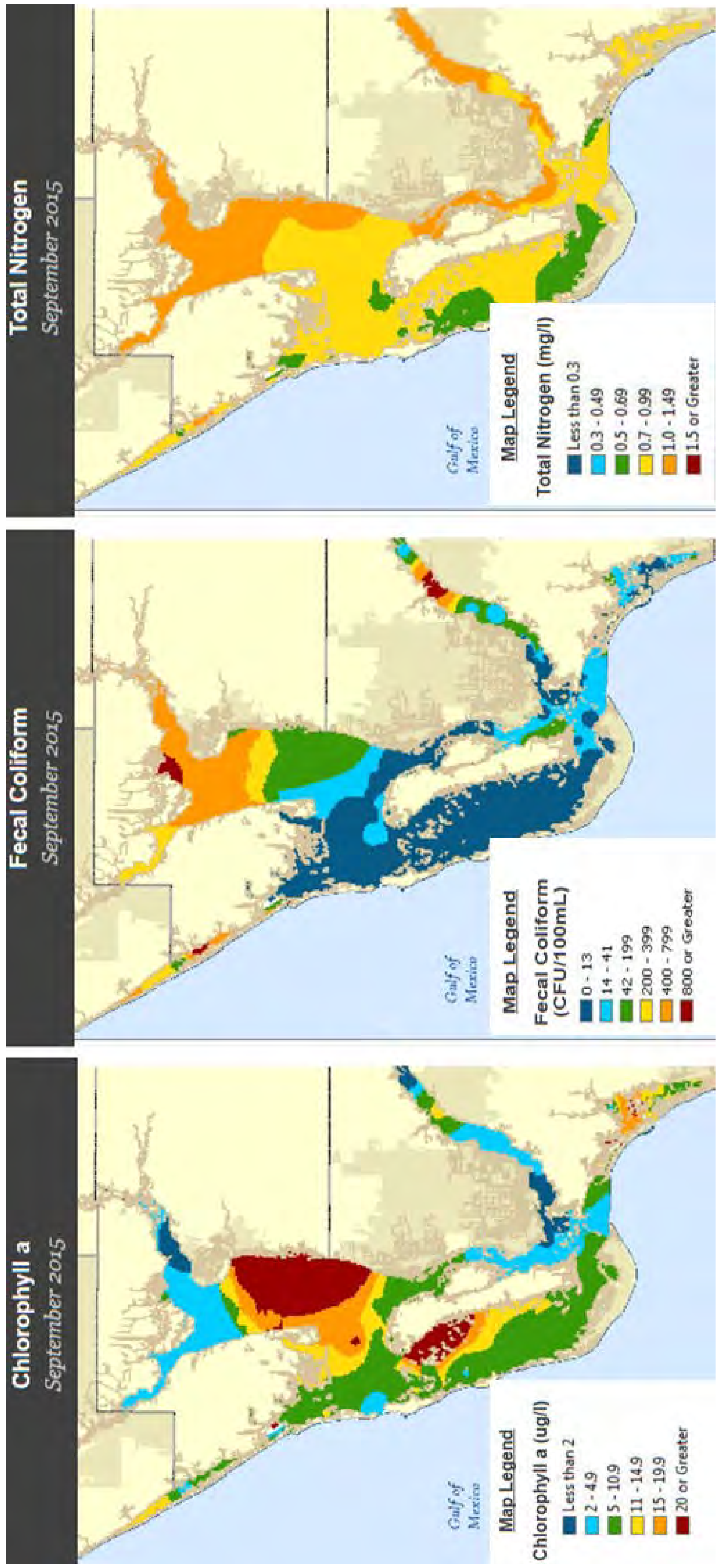

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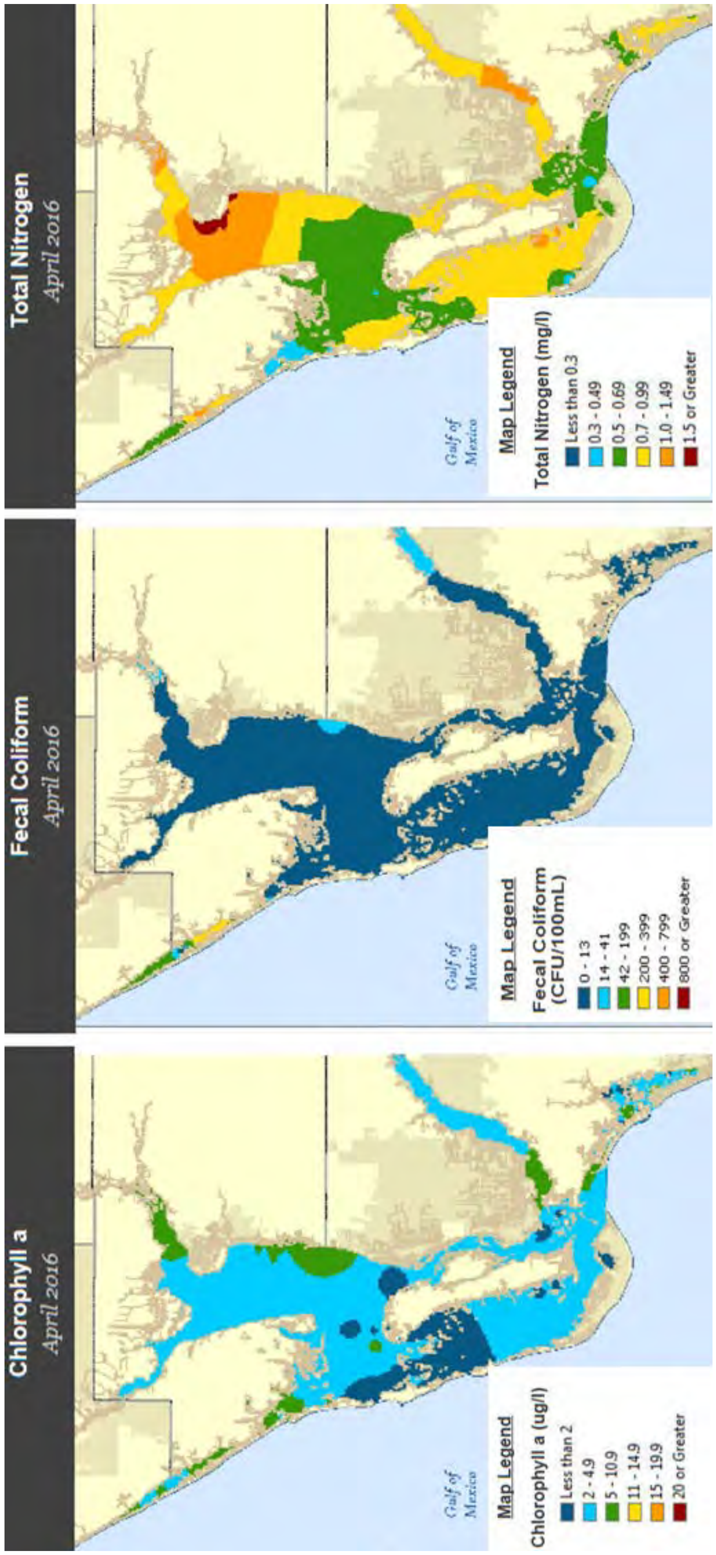
Figure 1-9D Surface Water Quality: April 2016 (1.4 inches of Rain)



Maintaining Charlotte Harbor's estuary water quality is critical to the future of the community. Charlotte Harbor is known as a world-class destination for recreational fishing. The Southwest Florida Regional Planning Council (SWFRPC) estimated that the fishing industry has a local economic impact in excess of $1 billion annually (Southwest Florida Water Management District [SWFWMD], 2006). The majority of the visitors drawn to the area come for the Harbor and local beaches and generate an estimated economic impact of $526 million at local restaurants, hotels, and attractions (Research Data Services, 2016). Reducing pollutants entering the water bodies translates into fewer beach closures and improved fishing and recreational opportunities, which improves the quality of life for residents and tourists to the County's shorelines.

The Harbor's health not only impacts fishing, retail, and travel industries, but also the real estate market and home values. Modeling studies have been used to estimate the impact of water quality on real estate values. Michael et al. (1996) found a 1-meter improvement in water clarity resulted in average property value increases ranging from $11 to $200 per foot of water frontage along Maine lakes. Considering total water frontage within the study area, this equates to tens of millions of dollars in improved property prices. Similar studies have correlated the effect of 1-mg/L changes in suspended solids and dissolved inorganic nitrogen concentrations, noting that the average price of both non-waterfront and waterfront Maryland properties are affected by 1 and 9 percent, respectively (Poor, 2006).

The average non-waterfront and waterfront property values in Charlotte County are $111,000 and $234,000, respectively (TBEP, 2014; Zillow, 2016). A 9-percent decrease in home values due to increases in nitrogen loadings could decrease home values by an average of $26,000 for non-waterfront property and up to $60,000 for waterfront property. To protect the land and home values, the community must commit to the future – the future of the Harbor, rivers, aquifer, beaches, and estuaries, as well as the groundwater under their properties.

Charlotte Harbor is Florida's second largest open-water estuary and is home to a large population of Snook, Tarpon, Redfish, and Spotted Seatrout, as well as numerous species of aquatic organisms, plants, birds, and wildlife. The Harbor is the focal point of the City; restoring the Harbor is a common goal of the local, state, and federal governments. Installing a centralized sewer system will benefit the environment by giving the community the ability to transport sewage to the City wastewater treatment plant (WWTP) which has been engineered to achieve a higher level of nutrient removal. Removing the existing septic systems and connecting residential and commercial units to the central sewer system will alleviate problems with the existing septic systems, protect the public health of the community, improve the water quality of surrounding water bodies, and promote economic growth within the community for current and future generations.

1.6 Objectives

Developing and implementing the SMP is a joint effort between the City of Punta Gorda City Council, Utility Advisor Board, and residents, the Charlotte County Board of County Commissioners (BOCC), and CCUD. This effort provides an affordable community solution that addresses the common goals of improving and restoring water quality in the Charlotte Harbor Estuary and enhancing the community's quality of life. The following SMP objectives support the City's and BOCC's goals:

- Summarize the need to reduce nutrient and bacteria discharges.
- Review and compile historical collection sewer system, WWTP, and flows and loading data.
- Summarize the private sewer utilities in the City service area.
- Model and estimate system growth due to S2S connections and infill in existing sewered areas.
- Develop detailed consumer and wastewater flow estimates through buildout.
- Review existing wastewater collection and transmission systems.
- Review the existing WWTP and prepare an infrastructure assessment.
- Develop capital improvement plan (CIP) recommendations based on existing infrastructure needs and guiding principles.

1.7 Guiding Criteria for Evaluating Septic To Sewer Conversions

The SMP addresses the local and regional community's goal of reducing nitrogen loading to Charlotte Harbor through septic to sewer conversions. The conversion area evaluations and prioritizations incorporate the guiding principles of affordability, sustainability, efficiency, and reliability.

- Affordability – Each project identified in the SMP focuses on developing affordable solutions for residents and business owners.
- Sustainability – The SMP incorporates a balanced approach to prioritize septic tank replacements to maximize environmental benefits and provide long-term reductions in nutrient loadings in a manner that is affordable to residents and business owners.
- Efficiency – The SMP considers existing utility infrastructure and implements efficient construction methods to decrease costs on road trenching and repair.
- Reliability – The SMP considers existing wastewater treatment and conveyance infrastructure and identifies which components will require updating to provide a reliable product to the City's residents and businesses.

1.8 Partners and Related Plans

Preparing the SMP is a goal of the City and is aligned with the existing local, regional, and non-profit cooperating partner goals and objectives.

Specifically, the SMP addresses goals and objectives outlined in:

- The City of Punta Gorda Comprehensive Plan
- The CCUD SMP (Revised 2017)
- The CCUD Strategic Plan (Revised 2016)
- The County's Smart Charlotte 2050 Comprehensive Plan (Charlotte County BOCC, 2010)
- The Priority Actions of the Charlotte Harbor National Estuary Program (CHNEP) Comprehensive Conservation and Management Plan (CCMP) (CHNEP, 2013)
- The Joint Florida Gulf National Estuary Programs Southwest Florida Regional Ecosystem Restoration Plan (SWFRERP, 2013)
- Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act (RESTORE) Council Initial Comprehensive Plan

- Charlotte County Area 1 Preliminary Engineering Report (CCUD, March 2010)
- Charlotte Harbor Environmental Center
- Charlotte County Manchester Waterway Boat Lock Removal Plan Net Ecosystem Benefits by FDEP and US Army Corps of Engineers (USACE) Permit Compliance Report
- The SWFWMD Charlotte Harbor Surface Water Improvement Management (SWIM) Plan

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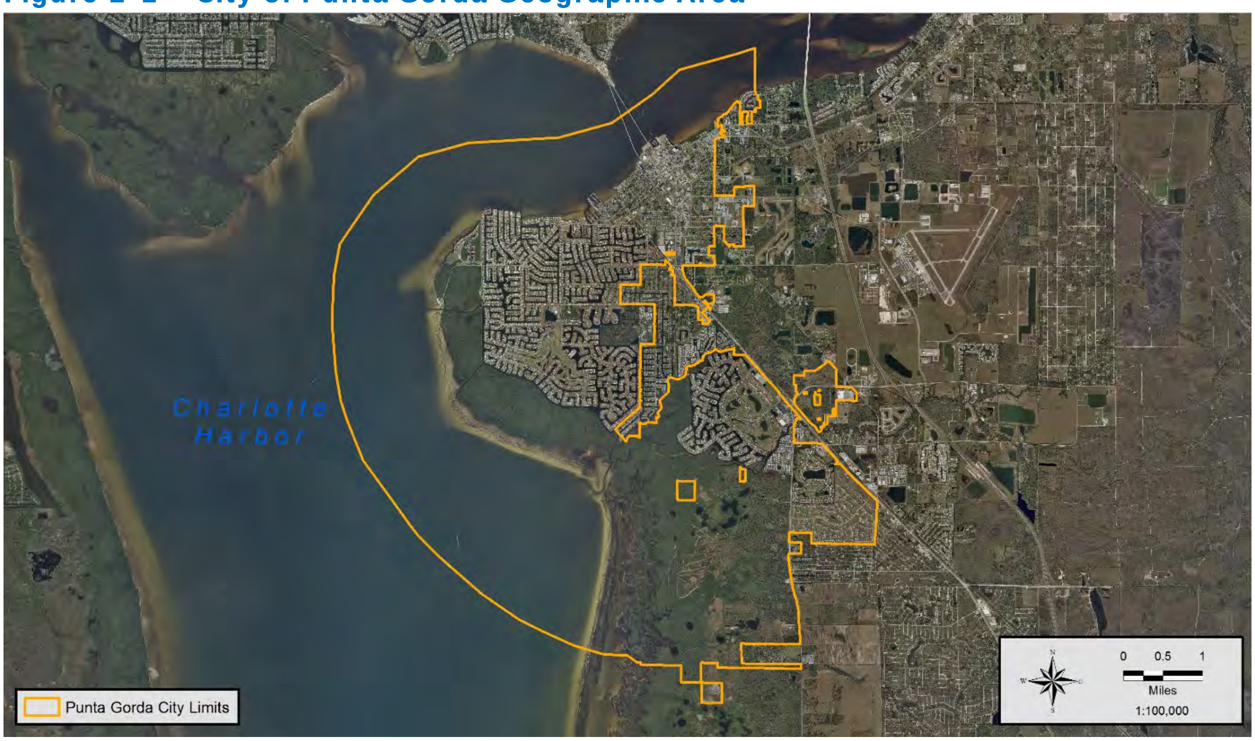
2 PAST & PRESENT – DEVELOPMENT OF A SEWER UTILITY

This chapter provides a historical perspective of the City's sewer system development, the formation of the City of Punta Gorda Utilities Department, a review of private utilities within the service area, and a summary of the present-day sewer system. This chapter also reviews the City's ongoing wastewater projects in the planning, design, and construction phases.

2.1 Sewer System Development

The City of Punta Gorda is located in Charlotte County, south of the Peace River along the east side of Charlotte Harbor (see Figure 2-1). As mentioned in Chapter 1, Colonel Trabue platted the Town of Trabue in 1884, spurring growth to the area by attracting railroads and development to the region. By 1887, the local government was established and control of the region was passed to the citizens, thus the incorporation of the City of Punta Gorda. At that time, the common sewage disposal method in Florida consisted of outhouses or privies. Therefore, in the early 1900s the citizens implemented a scavenger tax to pay for routine collection of wastes and privy cleaning (CCMIN, 1909). The original price was 50 cents per month for a resident and a $1 per month for businesses. The waste was collected via cart and mule and transported to a cesspit west of the City for dewatering. The solids were then land applied on sand flats to dry and merge with the soil.

Figure 2-1 City of Punta Gorda Geographic Area



The City's scavenger tax served as a continuous funding source for wastewater and water maintenance. The City marshal was responsible for collecting the tax, which averaged $75 per month by 1911. Incremental improvements were made to convey sewage and stormwater away from the City over the years, which improved the health of the community (Harper, 2012).

In 1913, the City contracted Hiram McElroy to survey the water and sewer systems. Over the next few years, the City began installing cast-iron gravity sewer lines on portions of Virginia, Charlotte, Olympia, Gill, and Cross Streets and a detention tank on Sullivan Street. After 1915, the City routinely installed gravity sewer lines. The sewers were used to convey the City's sewage to settling tanks for solids removal before the effluent was discharged to the Bay. Around 1925, the first lift stations (LSs) (No. 1 and No. 2) (located at Conhran/Patty and West Olympia/Harvey Streets) were installed to extend the collection system.

The sewer collection expansion continued over the years as growth brought more residences to the area. By the 1940s, the City became concerned with the amount of waste entering the Harbor. In the 1950s, the State Board of Health prohibited swimming along the Punta Gorda Bay front due to possible pollution. At that time, the City Council began to discuss building a sewage plant to stop pollution and devaluation of the Charlotte Harbor. Eventually, the City decided to construct a new sewage plant and rehabilitate the out-of-service Army sewage plant at the airport.

The force mains serving LSs 1 and 2 were rerouted and connected to form the initial sewer network. The City added a new LS (No. 3) and force mains to connect the system to the airport sewage plant. Flows from LSs 1 and 2 were combined and rerouted through the LS 3 force main, which became the critical link in the system. In January 1956, the rehabilitated airport WWTP was operational, and sewage flows were no longer discharged directly to Charlotte Harbor.

2.2 Formation of the City's Utility Department

With increasing infrastructure maintenance and sewer-related projects occurring, the City Council created the Board of Sewer and Water Works Trustees of the City of Punta Gorda in 1955. Larger developments such as Punta Gorda Isles (PGI) opened the door for additional expansion. By 1961, the City had eight LSs in operation. In 1966, the City sewage plant had a design capacity of 260,000 gallons per day (gpd), an estimated 1,000 connections, and 490 mobile home connections.

In the 1970s, a sewer system study was conducted to locate, plot, and document all the City's sanitary and storm sewer lines. The study found that the City's system contained 74,010 feet of cast-iron and vitrified clay gravity sewer lines, ranging from 6 to 12 inches in diameter, with approximately 262 manholes (Rogers, 1969). One of the significant recommendations of this study was to restructure the City budget and organization to include a Director of Utilities and establish specific crews responsible for the sanitary systems. Although this recommendation was not fully implemented until 1995, the recommendation ultimately led to the development of the City's Utility Department.

Aging infrastructure and increasing population necessitated expansion of the City's treatment capacity. In 1971, the City broke ground on its new 1.0-million-gallon-per-day (MGD) WWTP on West Henry Street. Construction was completed in 1972, and the plant was publicized as the most modern advanced WWTP in the State.

Around the same time, State legislation (Wilson-Grizzle Act, Grizzle-Figg Act) was passed that created more stringent discharge requirements. This new legislation passed as the West Henry Street plant construction was completed and, unfortunately, prevented the new plant from receiving an operating permit. The plant operated under temporary permits for the next 12 years and was constantly violating the Department of Environmental Regulation's (successively, FDEP) and EPA's National Pollutant Discharge Elimination System (NPDES) requirements. These violations prevented the City from extending the system by adding connections to the plant; as a result, a number of package WWTPs were constructed by private developers to treat sewage from new homes.

The Federal Water Pollution Control Act of 1972 and its revisions required wastewater facilities planning to delineate cost-effective systems, treatment works, and disposal methods to meet more stringent discharge requirements. Along with the new Federal legislation came regional funding programs to encourage appropriate treatment. In 1975, the Punta Gorda Board of Sewer and Water Works Trustees suggested participating in Charlotte County's 201 Facilities Planning in an effort to meet regulatory requirements and obtain regional funding assistance.

The County-wide 201 Plan recommended a regional City plant with secondary treatment and land spreading be established at the Cecil Webb 884-acre site 7 miles east of Punta Gorda. Funding for the Cecil Webb project was provided under EPA grant number C120711040. The project was divided into four contracts.

- The first contract converted the West Henry Street plant to a master pumping facility and added two storage tanks for flow equalization and an odor-control system. Mixers were later installed to prevent sewage from becoming septic. The remaining portion of the West Henry Street plant was remodeled for use as the Public Works complex.
- The second contract included design and construction of a force main to connect the West Henry Street site to the Cecil Webb site.
- The third contract encompassed the design and construction of a 2.0-MGD wastewater treatment plant at the Cecil Webb site.
- The fourth contract covered land application and facilities for residuals management.

The four construction projects were completed in August 1984, ending the process of planning and regulatory involvement that occurred over the prior decade. That same year, the City adopted a wastewater service area that included incorporated Punta Gorda and a neighboring unincorporated area of the County as agreed upon in the 1978 Agreement with Charlotte County Regional Wastewater Authorities District.

The interlocal agreement established responsibilities for construction and maintenance of new wastewater facilities in the region, construction and maintenance of collection and transmission systems, and an implementation plan for phasing out local package WWTPs.

The implementation plan included removing 18 package WWTPs from service and connecting them to the regional system (Harper, 2012):

- Alligator Park
- Bay Palms Trailer Park
- Charlotte City Development Authority
- Charlotte City Public Safety
- Eagle Park Mobile Home Park (MHP)
- East Elementary School
- KAO Campgrounds
- Lazy Lagoon MHP
- Palm and Pines MHP
- Two within the Parkhill Manor area
- Pelican Harbor MHP
- Pine Terrace Trailer Park
- Punta Gorda Country Club
- River Forest MHP
- River Haven MHP
- Sea Cove Motel
- Windmill Village

In the late 1980s, the system required expansion to handle additional connections from the added package WWTPs and infill. The expansion required three separate contracts. The first converted the airport treatment facility to a master LS to send sewage to the Cecil Webb WWTP. The project included installing a generator, two storage tanks for equalization, and submersible mixers for continuous circulation of waste. The second contract increased the Cecil Webb WWTP capacity to 4.0 MGD, and the third expanded the residuals management fields and agricultural operations at the Webb WWTP site.

Over the years, growth in the service area increased, but outside the City limits was sparse and package WWTPs continued to be the most cost-effective option for developers. In 1988, the City obtained a federally funded grant (C120711080) to install new transmission mains in the unincorporated south portion of the service area. As part of the grant requirements, a number of package WWTPs must be connected to the regional system by the end of 1990.

With growth came the challenge of effluent disposal. In 1996, the City received funds through the State Revolving Fund (SRF) program to build a deep injection well system to address disposal. This project is discussed in greater detail in Chapter 5, but connecting package WWTPs to the City's centralized system continued to be a requirement for obtaining funding. As of 1996, eight package WWTPs within the Punta Gorda service area were still not connected to the City's system.

Today, all package WWTPs within the City's incorporated service area are connected to the City system. The remaining package WWTPs that are not connected to the City's system are located throughout the unincorporated portion of the PGU service area as shown in Figure 2-2.

Table 2-1 lists the package WWTPs that are currently maintained by private entities. These facilities may connect into the City's wastewater system in the future, but the economic feasibility of connection would need to be evaluated.

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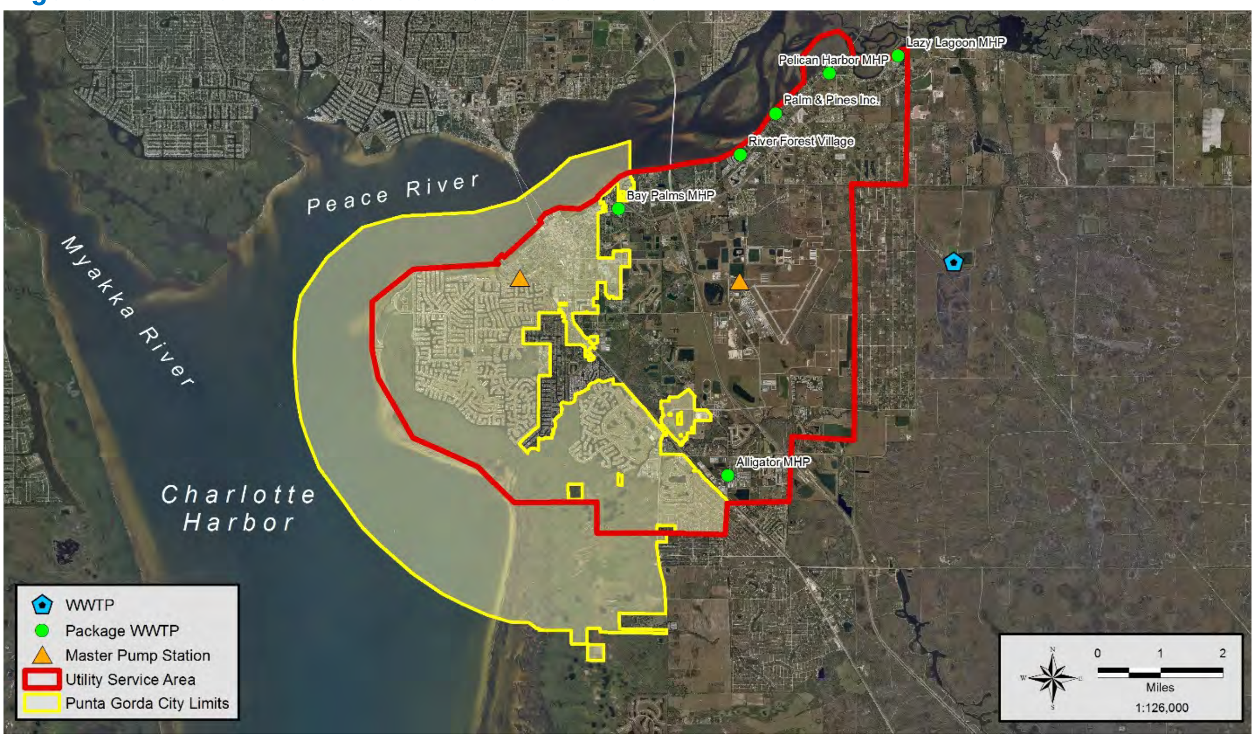
Table 2-1 Privately Operated Package WWTP Information

Facility ID	Name	Address	Capacity (gpd)	Permit Expiration Date
FLA014121	Alligator MHP	6400 Taylor Road	60,000	2/23/2021
FLA014067	Bay Palms MHP	25163 Marion Avenue	10,000	12/20/2020
FLA014070	Lazy Lagoon MHP	8320 Riverside Drive	70,000	10/18/2018
FLA014088	Palm & Pines Inc.	5400 Riverside Drive	15,000	12/23/2019
FLA014105	Pelican Harbor MHP	6720 Riverside Drive	20,000	3/29/2021
FLA014122	River Forest Village	4300 Riverside Drive	35,000	10/7/2017

Source: FDEP Wastewater Facility List.

Figure 2-2 Punta Gorda Service Area in 2017



2.3 PRESENT-DAY SEWER SYSTEM

The City's service area currently covers 30 square miles and includes a network of pipes, LSs, manholes, and a WWTP serving nearly 16,667 residents. The primary sewer facilities owned and managed by the City are shown on Figure 2-2 and consist of the following:

- Cecil Webb WWTP at 30999 Bermont Rd., Punta Gorda, FL 33982.

- Master LS at 4255 Henry St., Punta Gorda, FL 33982 (previously the Army/Airport WWTP).
- Master LS at 900 W Henry St., Punta Gorda, FL 33950 (previously the Henry St. WWTP).
- 129 miles of gravity sewer mains.
- 118 sewage LSs and 21 privately owned LSs.
- 2,543 manholes.
- 5,777 sewer customer connections.

FDEP regulates WWTPs through the issuance of Operating and Construction Permits. Table 2-2 provides the permit reference information for the City's Cecil Webb WWTP. The City's wastewater treatment and disposal facilities are on an 860-acre tract of land, 7 miles east of the City in the Cecil Webb Wildlife Management Area. The land is under a 99-year lease from the State of Florida. The City's WWTP was originally constructed in 1984 and was expanded in 1990 as previously described. The WWTP is currently rated at a capacity of 4 MGD based on an annual average daily flow (AADF) by FDEP (Permit No. FLA118371). The existing permit expires on September 21, 2019. The WWTP is permitted to dispose of effluent in an underground injection control well and uses land application for biosolids disposal.

Table 2-2 Cecil Web WWTP Permit Information

FDEP Operating Permit No.	Permitted Treatment Capacity (MGD)	Permitted Disposal Capacity (gpm)	Permit Expiration Date
FLA118371	4.0	8,333	9/21/19

2.4 Ongoing Projects and Programs

The primary focus of the Punta Gorda SMP is S2S conversion within the City's service area. The City's ongoing system operations and maintenance (O&M) projects include televising gravity mains, installing cured-in-place-pipe (CIPP) lining, repairing LS, preventing inflow and infiltration (I&I), and renewing and replacing pipe (R&R). City staff continually provides service to residents under a number of wastewater projects and programs including:

- WWTP Expansion
- The Loop Force Main Extension
- Sewer Feasibility Study
- Reuse Feasibility Study

Today, the City no longer uses the scavenger tax but does use an Infrastructure Surtax, a local option 1-cent ($0.01) sales tax, Utility Funds, and Utility Impact Fees for financing, planning, and construction of infrastructure. The Fiscal Year 2017-2021 CIP specifies the budget for wastewater infrastructure improvements and includes projects related to:

- Wastewater Gravity Sewer Replacement Projects
- Wastewater LS Renewal/Replacement Projects
- Wastewater Inflow Abatement – Rehabilitation Structures
- Wastewater Force Main Renewal/Replacement Projects

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3 SEWER IMPROVEMENTS AND COST ASSESSMENT

This Chapter discusses the methodology used to identify project areas for septic to sewer conversions. Each area was evaluated using environmental and economic scoring criteria to maximize environmental benefits that provide reduced long-term nutrient loading to Charlotte Harbor while being fiscally responsible. In the sections below the methodology used for developing project areas, completing environmental assessments and costs assessments is presented.

3.1 PROJECT AREA DEVELOPMENT

As discussed in Chapter 2, the PGU service area includes the City and a portion of unincorporated Charlotte County. Since the area inside the City limits has already been sewered, the focus for septic to sewer conversions was on the unincorporated PGU service area. Various meetings and workshops were held to select septic to sewer project areas within the unincorporated portion of the PGU service area. Participants included staff from City of Punta Gorda government, PGU, and Jones Edmunds. The meetings/workshops culminated in selecting 147 potential areas in need of septic to sewer conversions.

The 147 project areas were delineated by performing geospatial analysis by simultaneously considering the following items:

- PGU service area boundary – parcels must be located within the service area.
- Current sewer system infrastructure – parcels are predominantly served by septic tanks.
- Topography – areas groundwater flows to Charlotte Harbor or other surface water bodies.
- Dwelling unit density – number of equivalent dwelling units per acre.
- LS capacity – impact of project area location on existing LS capacity.
- Information gathered in City workshops – includes average people per household, flow rate per equivalent residential connection, and nitrogen loading per capita.
- Flows projections – For vacant parcels within the service area.

Figure 3-1 presents the City limits, PGU service area, and the 147 potential project areas (blue shading) identified throughout the unincorporated PGU service area boundary. Once identified, the potential project areas were evaluated for environmental and cost implications.

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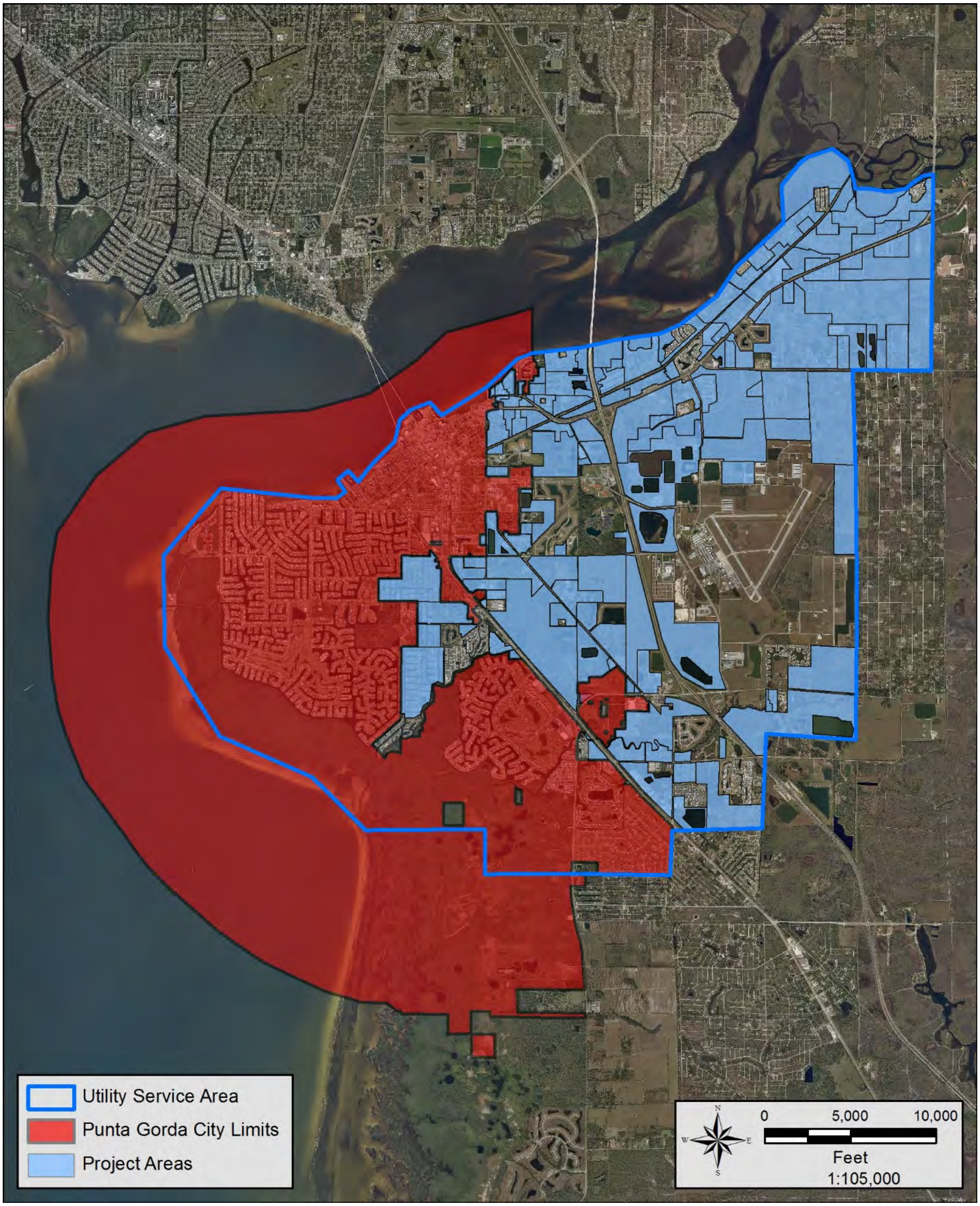
Figure 3-1 City of Punta Gorda Existing City Limits and Project Areas



3.2 Environmental Assessments

As presented in Section 1.5, the combination of unsuitable soils, seasonally high groundwater tables, and aging septic systems allow minimally treated sewage to percolate through the soil and enter the groundwater before flowing to surface water bodies. With over 2,700 existing septic systems generating tens of tons of Nitrogen loading throughout the City service area, there is the need to identify severely impacted areas and prioritize project phases.

Environmental scoring criteria were developed to evaluate the impact of converting septic tanks to sewer for each identified project area. The environmental scoring criteria include the proximity to surface waters, age of septic tanks, and nitrogen loading. Individual impact maps were developed to display the environmental scoring results for the project areas. The individual impact maps were used to develop an overall average environmental score for each project area throughout the unincorporated PGU service area for 2016.

3.2.1 Proximity to Surface Waters

Numerous studies have indicated that nutrients from septic tank effluents enter the groundwater supply if conditions are not sufficient for septic tank treatment. As described in Chapter 1, the groundwater throughout Charlotte County flows directly to Charlotte Harbor or indirectly through contributing streams, canals, and rivers. Therefore, project areas were ranked from 1 to 5 based on the distance from the project area to a surface water body that directly drains to Charlotte Harbor as follows:

- 1 = > 900 ft to surface water body (least impact).
- 2 = 601 to 900 ft to surface water body.
- 3 = 301 to 600 ft to surface water body.
- 4 = 101 to 300 ft to surface water body.
- 5 = ≤ 100 ft to surface water body (greatest impact).

Distances were measured relative to water bodies identified in the SWFWMD hydrography data.

Figure 3-2 is an impact map depicting the project area proximities to surface waters throughout the PGU service area. Red project areas represent areas that have most impact on surrounding surface water bodies while the blue coloration shows areas with the least impact. Essentially, majority of the project areas within the PGU service area are within 100 feet of a surface water body and received a score of 5.

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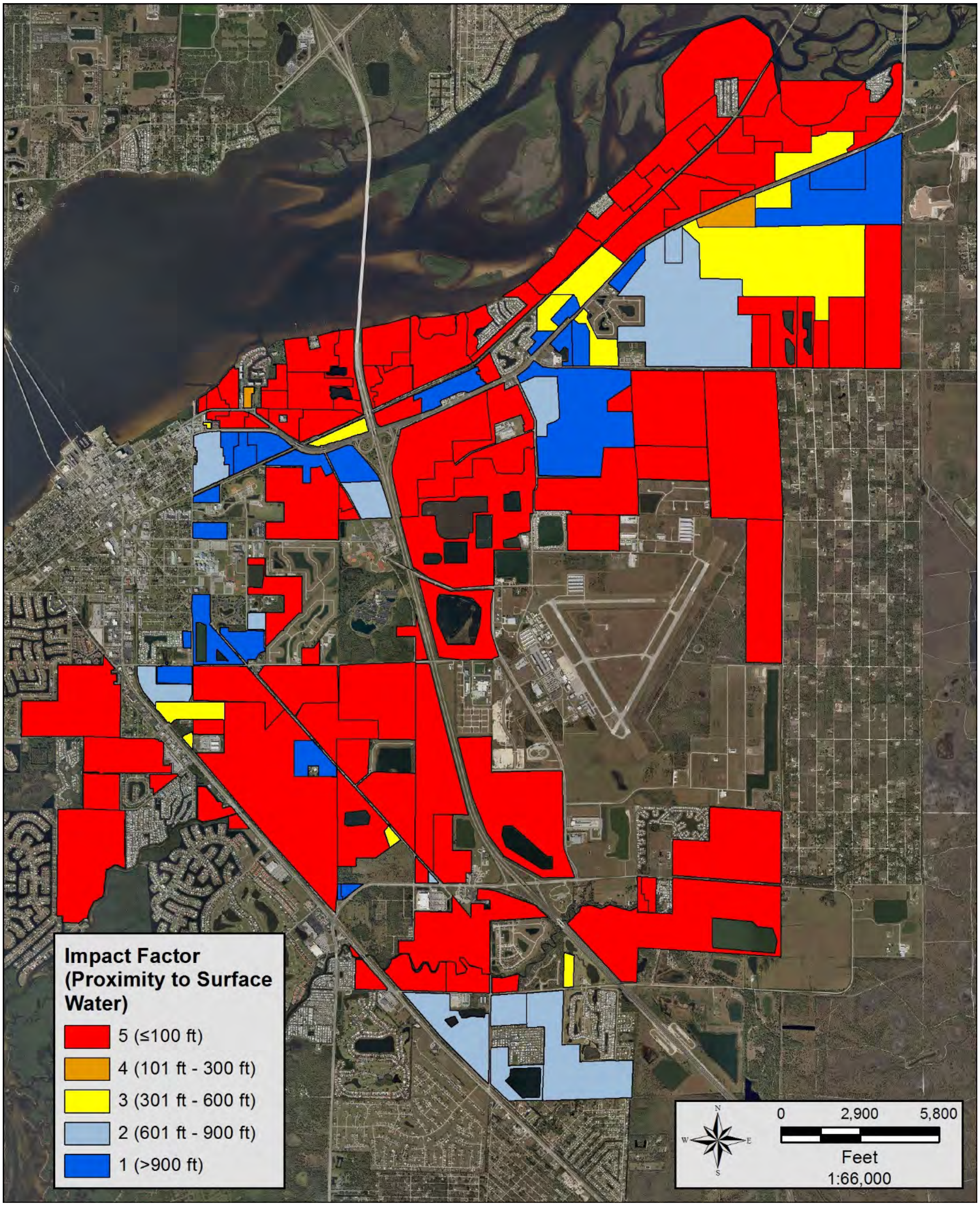
Figure 3-2 Current Priority Map – Proximity to Surface Water



3.2.2 AGE OF SEPTIC TANKS

The septic tank age provides an estimate of its functionality, likelihood of failure, and design criteria. For instance, septic tanks built before 1983 did not have to meet the current State requirements regarding groundwater separation and surface water setback distances. The age of the septic tanks were determined using SWFWMD GIS data, property appraisal data, sewer/potable water laterals, and building permit data. The septic tank age for each project area was calculated as the average septic tank age for lots within the project area.

The basis for the scoring criteria was derived from a number of sources. EPA reports that the average drainfield life is 15 years with a typical maximum drainfield life of 20 to 25 years (EPA, 1999; EPA, 2000). Additional research suggests the maximum life of a septic tank is 40 years (NewTechBio 2012; InspectApedia.com, 2017a; InspectApedia.com, 2017b). Each project area was assigned a septic tank age impact factor between 1 and 5, based on the following scoring criteria:

- 1 = Average age 0 to 15 years (least impact).
- 2 = Average age 16 to 20 years.
- 3 = Average age 21 to 25 years.
- 4 = Average age 26 to 40 years.
- 5 = Average age greater than 40 years (greatest impact).

Figure 3-3 displays the average septic tank age for each project area and its corresponding impact factor. The blue regions refer to areas where septic systems were installed less than 15 year ago which is when more stringent State regulations went into effect. The red areas represent areas where septic tanks are more than 40 years old. The results indicate that the majority of the septic tanks in the project areas were installed more than 26 years ago, making them susceptible to failure, questionable functionality, and more likely to leach partially treated sewage to groundwater and eventually to surface water bodies.

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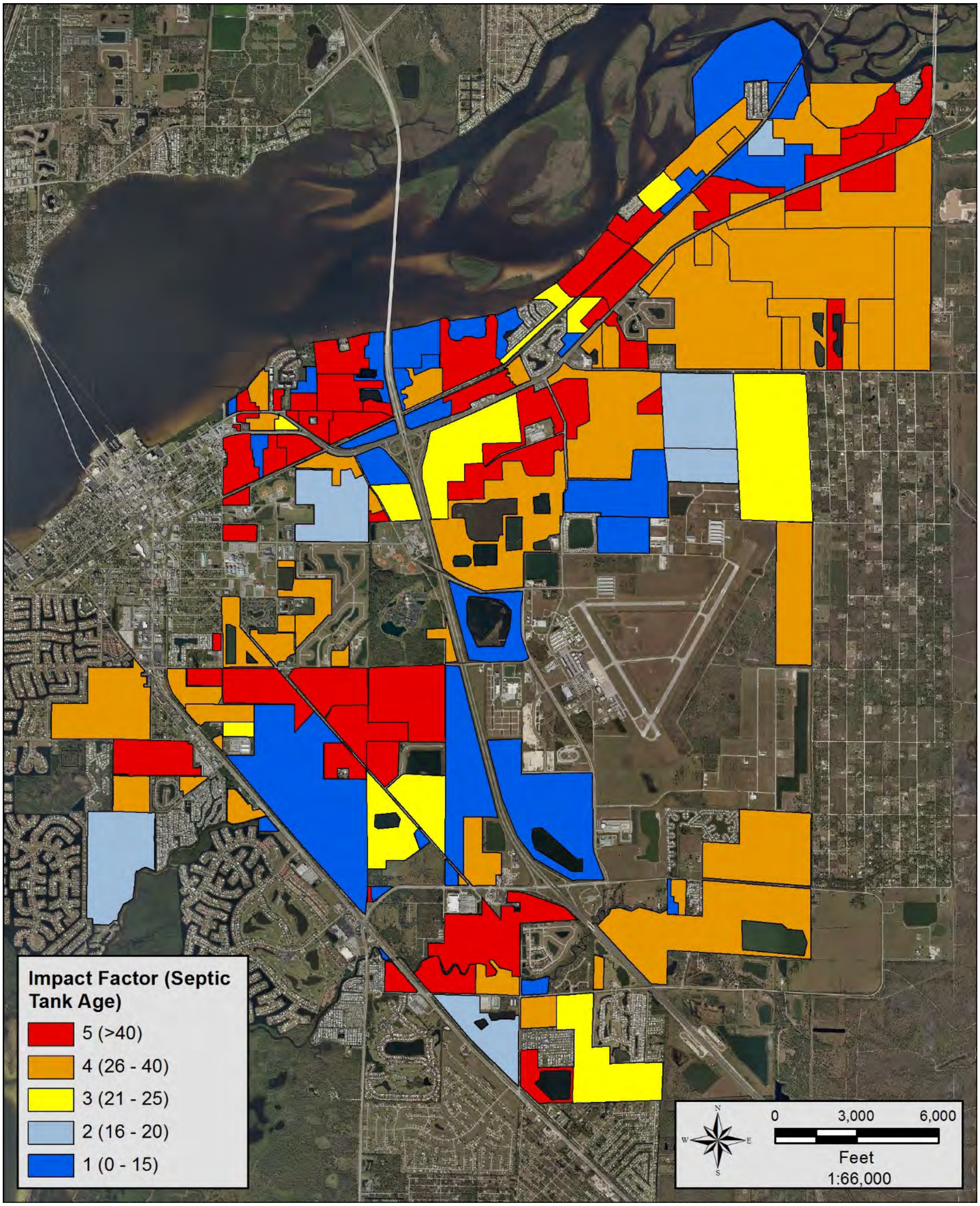
Figure 3-3 Current Priority Map – Estimated Average Age of Septic Tanks



3.2.3 NITROGEN LOADING

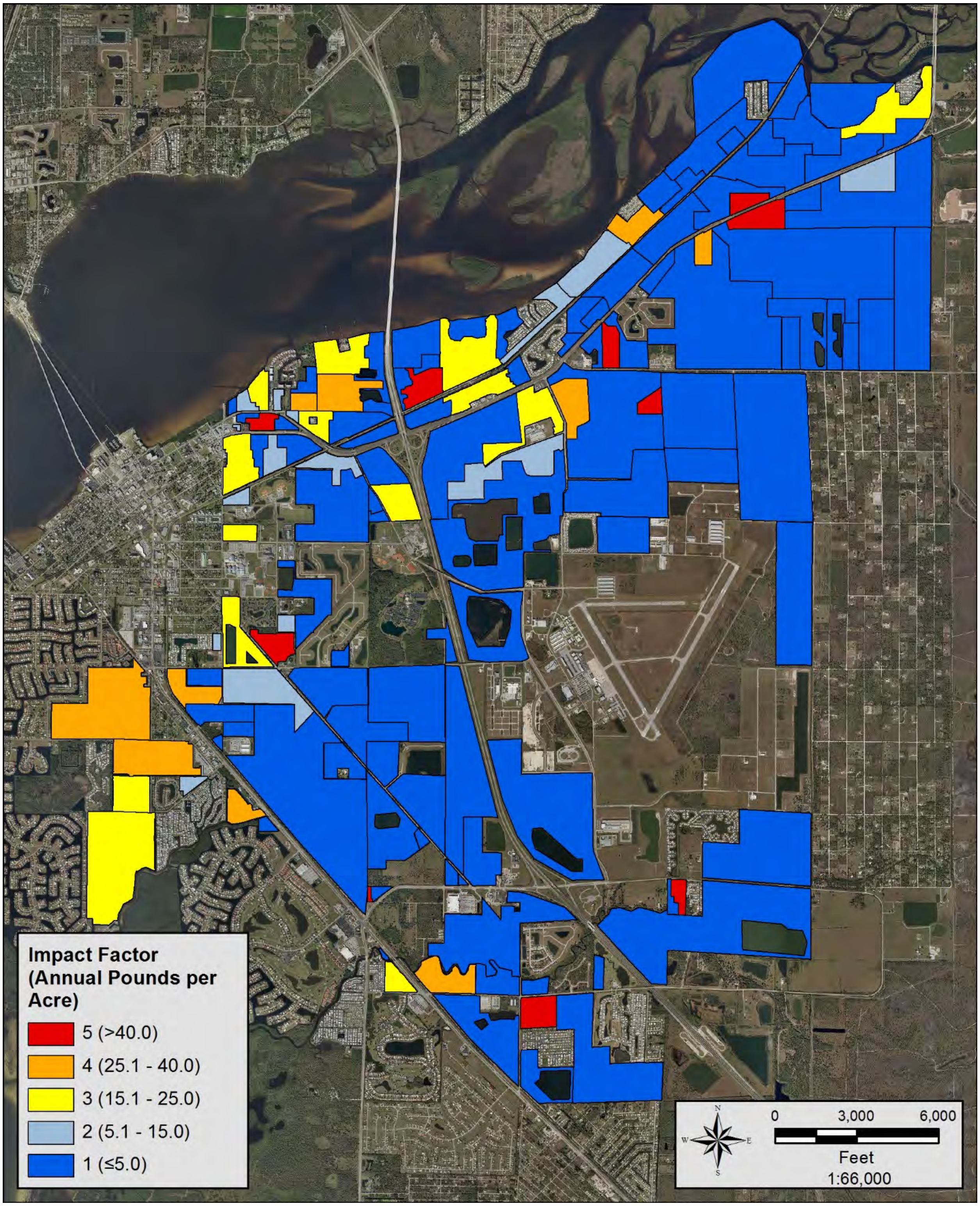
The number of septic tanks within Punta Gorda was determined using SWFWMD GIS data and property appraisal data. The number of septic tanks in the unincorporated portion of PGU's service area is approximately 2,700.

For each potential project area a nitrogen-removal-impact factor was calculated to quantify the reduction in nitrogen entering surface water when septic tanks are removed. The factor was based on average local nitrogen loading of 10 pounds of nitrogen per person per year that was determined from field test results and a review of typical nitrogen effluent estimates as presented in various publications (Ursin and Roeder, 2008; EPA, 2002; and Crites et al., 1998). Using the nitrogen loading value, an average of 2.5 people per household, and the residential density the nitrogen loading from each potential project area was estimated. The nitrogen-removal-impact factors assigned to the areas are based on the following:

- 1 = <5 pounds nitrogen removed per acre per year.
- 2 = 5.1 to 15 pounds nitrogen removed per acre per year.
- 3 = 15.1 to 25 pounds nitrogen removed per acre per year.
- 4 = 25.1 to 40 pounds nitrogen removed per acre per year.
- 5 = 40.1 to 65 pounds nitrogen removed per acre per year.

Figure 3-4 shows the nitrogen-removal-impact factor associated with converting each project area within the unincorporated PGU service area from septic to sewer. The project areas depicted in red are estimated to contribute between 40 and 65 pounds of nitrogen per acre per year and correspond to the area with the highest dwelling unit density. The analysis indicates that by converting all prospective project areas from septic to sewer, nitrogen loadings could be reduced by approximately 68,000 pounds per year in the unincorporated PGU service area based on 2.5 persons per household, 2,700 septic tanks, and an average 10 pounds per person local nitrogen loading.

Figure 3-4 Current Priority Map – Nitrogen Loading



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3.2.4 OVERALL IMPACT SCORE

Using the three environmental scoring criteria (proximity to surface waters, age of septic tanks, and nitrogen loading), the overall impact scores for each project area were developed by averaging the scores for each project area, assuming each criteria is equally-weighted. After evaluating the distribution of the weighted scores, PGU and Jones Edmund developed an overall impact classification scheme as follows:

- < 2.5 = slight environmental impact
- 2.5 – 2.9 = more of an environmental impact
- 3.0 – 3.4 = significant environmental impact
- 3.5 – 3.9 = higher environmental impact
- > 4.0 = greatest environmental impact

Figure 3-5 displays the overall impact score for each project area in Punta Gorda. The deep blue regions (overall impact score less than 2.5) represent project areas with least impact to surface water bodies. In terms of project prioritization, these blue areas may be ranked low unless incorporated through an overarching project goal. Thirty-nine project areas had average impact scores above 3. The red areas signify lots impacting surface water bodies the most based on the environmental scoring parameters. The majority of the project areas with the greatest impact (scores greater than 4) were near Aqui Esta and Solana where population density is high. Table 3-1 lists the number of project areas and their associated averaged impact scores for the unincorporated PGU service area.

Table 3-1 Project Area Impact Scores

Impact Score	Total Project Areas
4.0–5.0	15
3.5–3.9	13
3.0–3.4	11
2.5–2.9	38
<2.4	70
TOTAL	147

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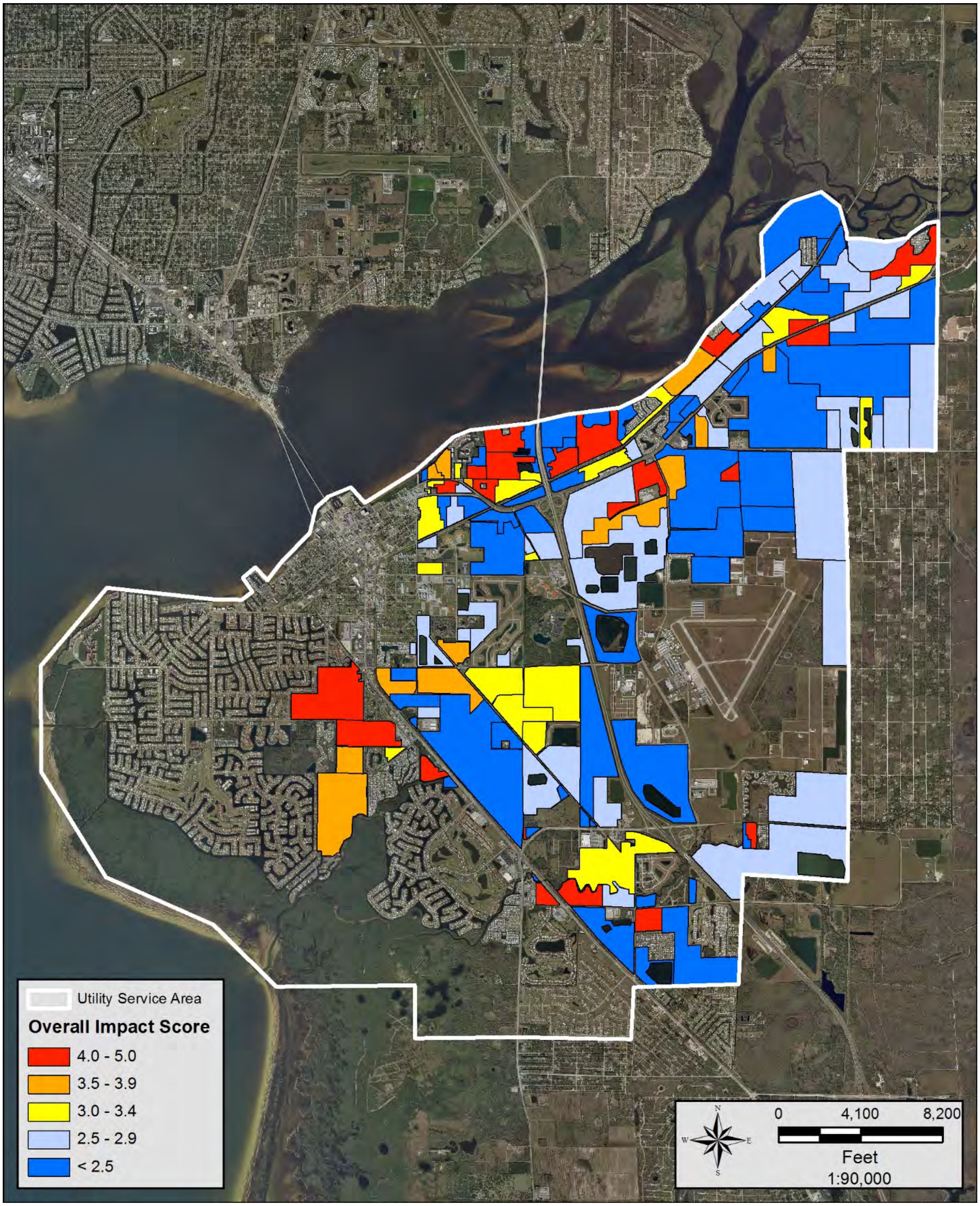
Figure 3-5 Current Priority Map – Overall Impact Score



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3.3 Collection Systems Cost Assessments

This section presents review of different centralized collection system alternatives to determine the type of collection system for each project area. Cost analyses were conducted to determine affordable improvements and efficient implementation sequencing.

Sewer collection systems are generally categorized by their transport mechanism, which include pressure, vacuum, and gravity. The most common types of collection systems currently implemented in Florida include low-pressure STEP, low-pressure grinder pump, vacuum collection, and gravity collection systems. These four collection system types were evaluated to develop an economical centralized collection system for the PGU service areas. The following factors were used to evaluate the wastewater collection system alternatives for the project areas:

- Constructability – ease and efficiency with which the system can be built to reduce or prevent errors, delays, and cost overruns.
- Reliability – ability of the selected wastewater collection system alternative to function properly over specified period of time without experiencing failures or incur excessive operation and maintenance (O&M) costs.
- Ease of Maintenance – collection system components are commonly available and not overly complicated to repair.
- Capital Costs –initial expenses the property owners and the City will incur to implement the collection system type.
- O&M Costs –costs associated with operating and maintaining the collection system.

3.3.1 Low-Pressure STEP System

Low-pressure STEP systems use conventional septic tank systems with automatic pumps and control devices to convey the liquid in the septic tank to a pressurized collection system. The system consists of a tank located at each home on private property and connected to the collection system by a small-diameter (typically 2 inches) pressurized pipe.

The collection system piping is typically composed of small-diameter-pressure mains that can be laid along existing roadways with minimum disruption to streets, sidewalks, lawns, driveways, and underground utilities. Surface restoration costs are similarly minimized.

The sewage travels from the house into the septic tank, where the solids in the sewage settle out and remain in the tank. A pump conveys the liquid from the septic tank to a local LS where it is transported to the WWTP through transmission force mains. In collection systems that contain a significant number of STEP systems, BOD augmentation at the WWTP becomes necessary to maintain proper carbon-to-nitrogen ratios since the majority of the carbon-based solids remain in the septic tank. The costs for BOD augmentation can be substantial.

Some communities are able to realize cost savings by retrofitting existing septic tanks with effluent pumps. However, the majority of the existing septic tanks in the City's service area are beyond the useful life or cannot be modified for a STEP system. A new septic tank with the effluent pump would need to be installed for each home. In addition, each pump installation requires a power connection to the resident's power supply and a dedicated control panel. A considerable amount of O&M costs are associated with maintaining the effluent pumps.

Table 3-2 summarizes the costs per equivalent residential connection (ERC) for Low Pressure STEP Systems as a function of the size of the project area (i.e., number of ERCs). ERC is a factor used to convert a given AADF to the equivalent number of units required for connection to the City system. For residential purposes, a single family residence constitutes one ERC. For all non-residential uses, one ERC equals 220 gpd (AADF).

On-lot and collection system costs are total project costs inclusive of construction and professional services. Annual O&M costs include replacement of parts, repairs, labor, and biochemical oxygen demand (BOD) augmentation at the WWTP.

Table 3-2 Capital and O&M Costs for Low Pressure STEP System

Item	100 to 350 ERCs	350 to 700 ERCs
On-Lot	$7,675	$7,675
Collection System Including On-Lot	$14,250–$17,700	$13,200–$14,250
Annual O&M	$980–$1,370	$870–$980
40-Year Present Worth	$33,700 – $44,800	$30,400 – $33,700

3.3.2 Low-Pressure Grinder Pump System

A grinder pump low-pressure system consists of conventional drain, waste, and vent piping within the residence connected to the packaged grinder pump basin. The grinder pump basin is typically installed outdoors, below grade, and serves one residence. Sewage from the residence enters the basin and grinder pumps discharge a finely ground slurry into small-diameter pressure piping. In a completely pressurized collection system, all piping downstream from the grinder pump (including laterals and mains) will normally be under low pressure (60 pounds per square inch gauge [psig] or less).

The system is composed of a grinder pump basin located at each home on private property and connected to the collection system by a small (typically 1.25 inches) pressurized pipe. Pipe sizes used in the collection system are typically similar to the small-diameter piping used for STEP systems. Small-diameter pipe pressure mains can be laid along existing roadways with minimum disruption to streets, sidewalks, lawns, driveways, and underground utilities. Surface restoration costs are similarly minimized. A considerable amount of O&M costs are associated with maintaining the grinder pumps.

Table 3-3 summarizes the costs per equivalent residential connection (ERC) for Low Pressure Grinder Pump Systems as a function of the size of the project area (i.e., number of ERCs). On-lot and collection system costs are total project costs inclusive of construction and professional services. Annual O&M costs include replacement of parts, repairs, and labor.

Table 3-3 Capital and O&M Costs for Low Pressure Grinder Pump System

Item	100 to 350 ERCs	350 to 700 ERCs
On-Lot	$10,390	$10,390
Collection System Including On-Lot	$18,500-$22,000	$17,500-$18,500
Annual O&M	$770-$1,150	$650-$750
40-Year Present Worth	$33,800-$44,900	$30,500-$33,800

3.3.3 Vacuum Collection System

The vacuum sewer system includes a valve pit serving two to four homes, a vacuum collection system, and a vacuum collection station with pumps (vacuum and pressure). In a vacuum system, sewage flows by gravity from the homes/structures into a valve pit. Small-diameter gravity piping (minimum of 4 inches in diameter) are installed at relatively shallow depths of 4 to 6 feet at a minimum slope. The valve pits have a pneumatic valve that operates by pressure (no electrical power is required). The valve pit pneumatic valve opens automatically when a given quantity of sewage accumulates in the valve pit.

The vacuum collection system operates under a negative pressure/vacuum. The sewage is transported by vacuum until it ultimately discharges into a vacuum collection station. The vacuum collection station takes the place of a conventional LS by collecting, storing, and pumping the sewage via pressure through a force main to the WWTP. Disturbance to developed land resulting from construction is less than the disturbance from constructing a gravity collection system.

Table 3-4 summarizes the costs per equivalent residential connection (ERC) for Vacuum Collection Systems as a function of the size of the project area (i.e., number of ERCs). On-lot and collection system costs are total project costs inclusive of construction and professional services. Annual O&M costs include replacement of parts, repairs, and labor.

Table 3-4 Capital and O&M Costs for Vacuum Collection System

Item	100 to 350 ERCs	350 to 700 ERCs
On-Lot	$2,258	$2,258
Collection System Including On-Lot	$15,000–$23,800	$13,200–$15,000
Annual O&M	$540–$950	$420–$540
40-Year Present Worth	$25,500 – $42,600	$21,100 – $25,500

3.3.4 Gravity Collection System

Gravity collection systems are a common and traditional method to collect wastewater for public utilities. Sewage exits the home through pipes installed at an angle so the sewage flows by gravity. These service laterals connect each home to the gravity sewer mains. The gravity system then flows to localized LSs in the area. Manholes are typically required every 400 feet or at each bend. The LSs pump the sewage into force mains that transport the collected wastewater to other LSs or to WWTPs for treatment.

Construction of a gravity system results in a greater disturbance to the developed land (e.g., roadway, sidewalks, and other utilities). In addition, due to the high groundwater table in the area and depth of construction associated with gravity sewer, a significant amount of dewatering may be required. Gravity systems are typically more reliable than other systems since the mechanical and electrical components are only at the LSs. The maintenance of the service lateral from the property line or up to the right-of-way is the residence's responsibility, which can reduce the long-term overall operation and maintenance costs for the utility.

Gravity systems are the primary sewer collection technology implemented throughout the City. However, the City is continually evaluating alternative sewer technologies and considers the most current technologies when designing a collection system for a particular area.

Table 3-5 summarizes the costs per equivalent residential connection (ERC) for Gravity Sewer Systems as a function of the size of the project area (i.e., number of ERCs). On-lot and collection system costs are total project costs inclusive of construction and professional services. Annual O&M costs include replacement of parts, repairs, and labor.

Table 3-5 Capital and O&M Costs for Gravity Sewer System

Item	100 to 350 ERCs	350 to 700 ERCs
On-Lot	$2,258	$2,258
Collection System Including On-Lot	$23,300–$26,000	$20,000–$23,300
Annual O&M	$380–$760	$270–$380
40-Year Present Worth	$30,900 – $41,200	$27,600 – $30,900

3.3.5 Sewer System Selection

For the project area sizes proposed in this SMP, the initial capital costs associated with gravity collection systems remain significant. However, the O&M costs associated with gravity systems are much less than other collection systems. Consequently, the 40-year present worth of the gravity and vacuum systems become the most cost-effective collection system alternative.

Table 3-6 summarizes the 40-year present worth costs per equivalent residential connection (ERC) for each collection system as a function of the size of the project area (i.e., number of ERCs). The present worth cost comparison includes the on-lot and collection system costs for construction and professional services, and annual O&M costs including replacement parts, repairs, labor, and biochemical oxygen demand (BOD) augmentation at the WWTP if applicable. As shown the two most cost effective systems are vacuum and gravity collection systems.

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Table 3-6 Cost Comparison Summary of 40-Year Present Worth

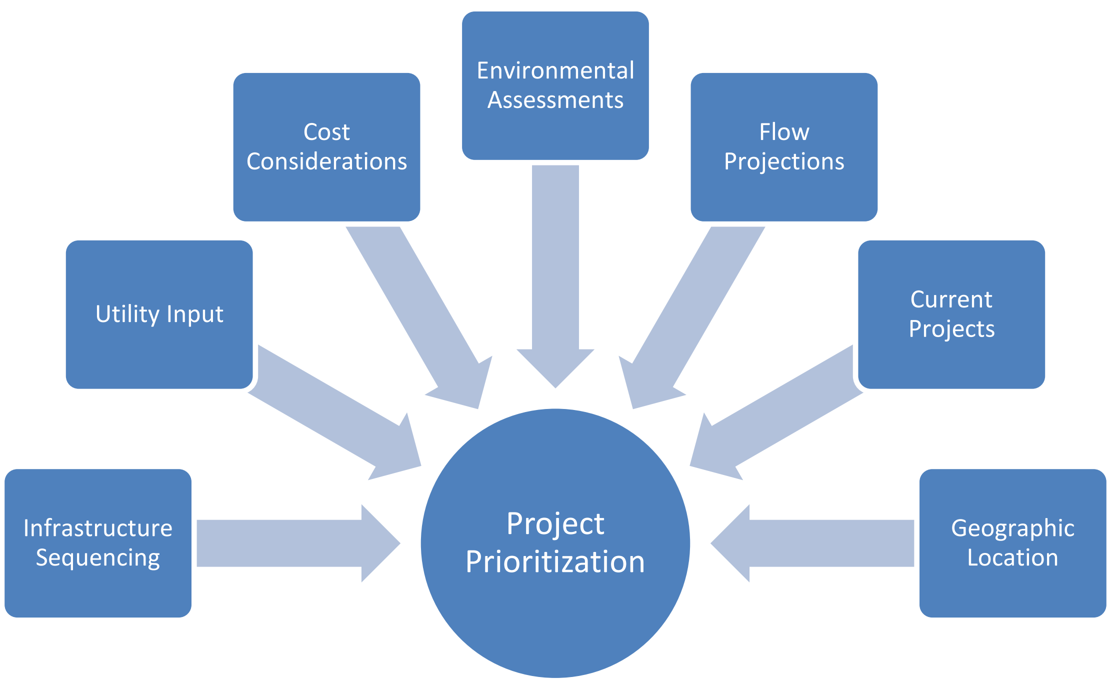
Sewer Collection System Technology	100 to 350 ERCs	350 to 700 ERCs
Low-Pressure/STEP	$33,700 – $44,800	$30,400 – $33,700
Low-Pressure/Grinder	$33,800 - $44,900	$30,500 - $33,800
Vacuum Collection	$25,500 – $42,600	$21,100 – $25,500
Gravity Collection	$30,900 – $41,200	$27,600 – $30,900

After considering the four main options for replacing septic tanks, the City decided that in most situations the gravity collection systems were the most feasible alternative for the majority of the PGU project areas based on the collection system evaluation and cost comparison. For the purposes of this SMP, it is assumed that gravity systems will be the dominant collection system installed in the future improvement areas.

3.4 Projects Implementation Plan

3.4.1 Project Area Prioritization

After applying the environmental and cost assessments to the 147 project areas, staff from City of Punta Gorda government, Charlotte County government, PGU, Charlotte Harbor National Estuary Program (CHNEP), and Jones Edmunds met to develop a project area prioritization plan that is flexible and provides a practical implementation sequence. The following inputs were considered in developing the project prioritization:



The project prioritizations were used to identify and develop the PGU improvement plan presented in Table 3-7. The table also includes the project area name, corresponding subarea identifier, and the total (including vacant) number of lots for the improvement plan.

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The plan includes converting 1,379 septic systems to sewer in 31 project areas within the PGU service area. The specific infrastructure improvements including collection systems, transmission lines, and LSs for the project areas under each plan are discussed in detail in Chapter 4.

Figure 3-6 graphically depicts the improvement plan by displaying the location of the project areas.

Table 3-7 Improvement Plan Project Area Details

Project Area	Sub-Area	Lots	Project Area	Sub-Area	Lots
1	—	481	4	4k	13
2	2a	249	5	5a	13
2	2b	113	5	5b	6
2	2c	9	5	5c	50
2	2d	71	5	5e	23
3		417	5	5f	92
4	4a	10	5	5g	9
4	4b	12	5	5h	4
4	4c	48	5	5i	22
4	4d	10	5	5j	14
4	4e	4	6	6a	98
4	4f	65	6	6b	179
4	4g	4	6	6c	27
4	4h	101	7	7a	118
4	4i	2	7	7b	35
4	4j	15		**Total**	**2,314**

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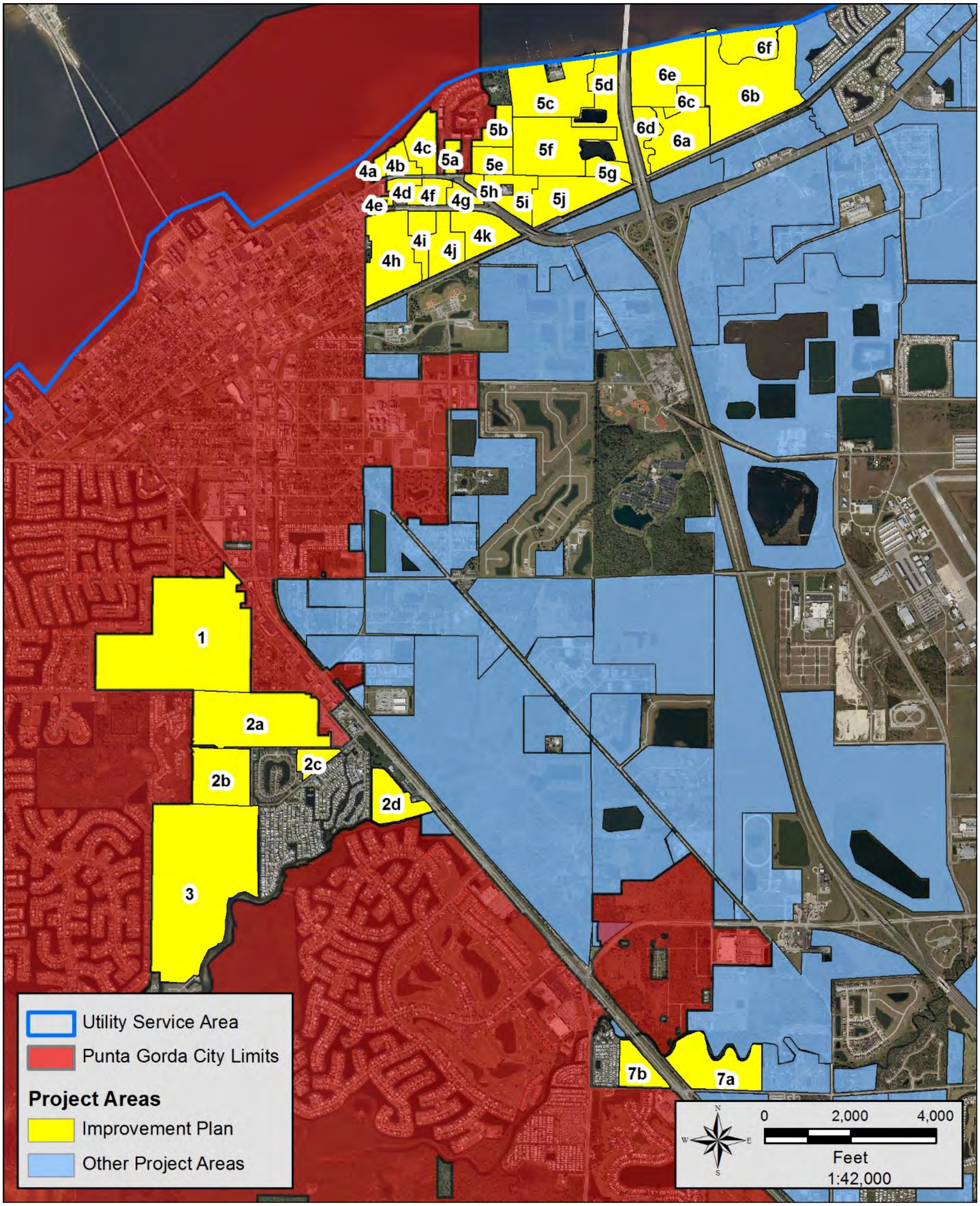
Figure 3-6 Detailed Improvement Plan Project Areas



3.4.2 Project Areas Consolidation

As part of the public- and private-stakeholders meeting/workshop held to discuss project area prioritization and improvement plan, the sub-areas were consolidated to produce seven major project areas and ranked in the order of proposed project execution sequence. Table 3-8 shows the consolidated project areas and associated lots. Figure 3-7 presents the seven consolidated project areas. The color ramp depicts project priority ranking, with red indicating high priority project area and deep green showing lowest priority area.

Table 3-8 Major Project Areas

Project Area	Lots
1	481
2	442
3	417
4	284
5	233
6	304
7	153
TOTAL	2314

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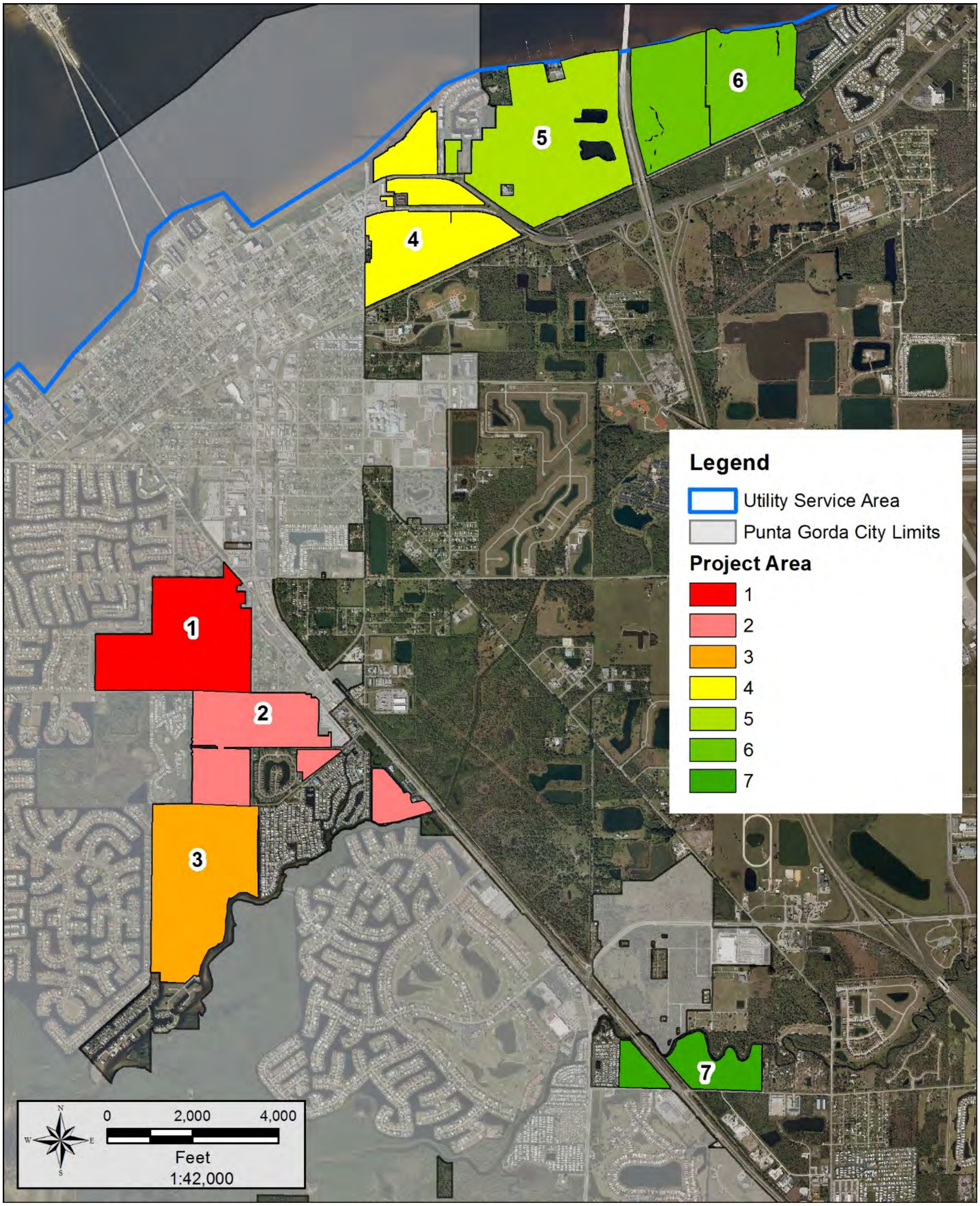
Figure 3-7 Overall Improvement Plan Project Areas and Priority Ranking



4 CAPITAL IMPROVEMENT PROJECTS

This Chapter provides an overview of the City's existing centralized wastewater collection and transmission systems, and details of CIPs required to convey wastewater flows from the Improvement Plan Project Areas to the existing collection system. The CIPs are composed of collection system improvements related to the conversion of septic to sewer.

The collection system CIPs include project duration and cost for a gravity collection system. Costs such as State Revolving Fund (SRF) origination fees, administrative fees, capitalized interest, and inflation are not included in this Chapter. The costs were determined on a per-connection basis using the unit cost for a gravity collection system. The preliminary opinion of probable project cost for each project area was estimated in fiscal year 2018 dollars and includes:

- On-Lot Connections
- Laterals
- Collection Piping
- Land
- Restoration (Included in Unit Costs for the Above)
- Mobilization and General Conditions (8%)
- Construction Contingency (20%)
- Professional Services (20%)

LSs required for connecting the septic to sewer conversion areas to the overall collection system are not included in the cost estimates and will be constructed using PGU Wastewater Capacity Fees.

4.1 Existing Collection and Transmission Systems

The City of Punta Gorda provides wastewater service to about 16,667 customers. The City's existing wastewater collection system conveys wastewater from homes and businesses through 188 miles of pipe to the City's WWTP. The collection systems include over 133 miles of gravity mains. Pipes range from 2 to 20 inches in diameter. LSs and force mains (over 55 miles) are used to pump flows to another gravity collection system, to a master LS, or directly to the WWTP. Figure 4-1 shows the current collection system, the transmission system including LSs and master LSs, and the WWTP that serves the City within the PGU service area.

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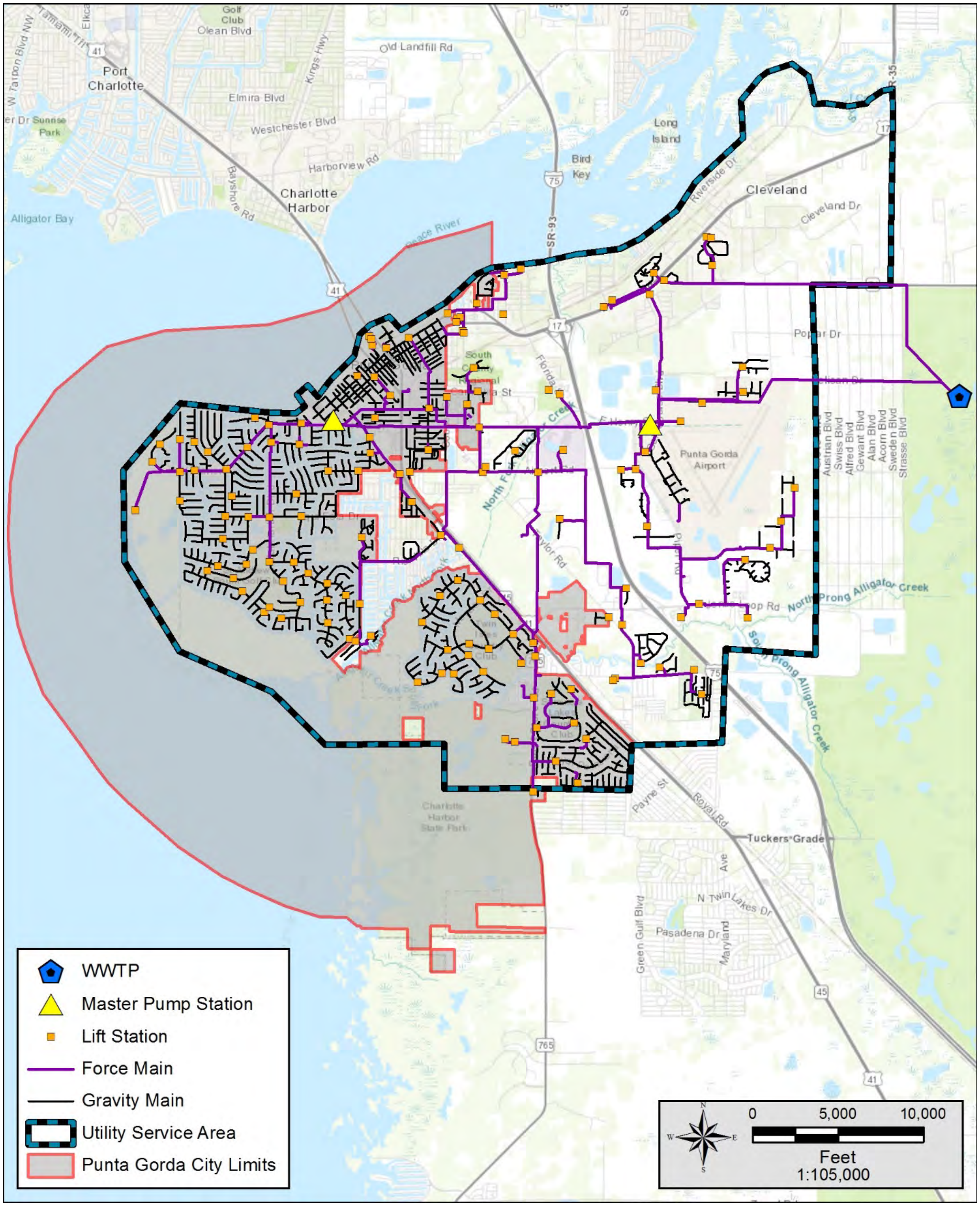
Figure 4-1 Existing Collection, Transmission, and Treatment Systems Map



4.2 Improvement Plan – Project Areas

The Improvement Plan includes seven overall project areas in the City's unincorporated service area as discussed in Section 3.4.2 and shown in Figure 4-2. Details regarding each project area are presented below:

- **Project Area 1** is the area bordered by Aqui Esta Drive, Magdalina Drive, and Vasco Street. The lots within the project area and information related to the proposed collection system are presented below:

  - Total lots: 481
  - Length of gravity mains: 30,692 linear feet (LF)
  - Quantity of LSs: 3

  Transmission system improvements will be required to convey wastewater from this Project Area to an existing LS and then to the WWTP. Based on coordination with the City, the wastewater from this Project Area is expected to be conveyed to LS 64. Determination of the transmission system improvements as discussed previously will require hydraulic modeling.

- **Project Area 2** is within the Aqui Esta area. The lots within the project area and information related to the proposed collection system are presented below:

  - Total lots: 442
  - Length of gravity mains: 27,571 LF
  - Quantity of LSs: 3

  Transmission system improvements will be required to convey wastewater from this service area to an existing LS and then to the WWTP. Based on coordination with the City, the wastewater from this Project Area is expected to be conveyed to LS 64. Determination of the transmission system improvements as discussed previously will require hydraulic modeling.

- **Project Area 3** is bordered by Almar Drive, Rio Villa Drive, and Vasco Street. The lots within the project area and information related to the proposed collection system are presented below:

  - Total lots: 417
  - Length of gravity mains: 24,887 LF
  - Quantity of LSs: 3

  Transmission system improvements will be required to convey wastewater from this service area to an existing LS and then to the WWTP. Based on coordination with the City, the wastewater from this Project Area is expected to be conveyed to LS 64. Determination of the transmission system improvements as discussed previously will require hydraulic modeling.

- **Project Area 4** is north of Dundee Road, boarded westerly by Copper Street and easterly by Duncan Road and Orchid Drive. The lots within the project area and information related to the proposed collection system are presented below:

  - Total lots: 284
  - Length of gravity mains: 31,820 LF
  - Quantity of LSs: 4

  Transmission system improvements will be required to convey wastewater from this service area to an existing LS and then to the WWTP. Based on coordination with the City, the wastewater from this Project Area is expected to be conveyed to LS 113. Determination of the transmission system improvements as discussed previously will require hydraulic modeling.

- **Project Area 5** includes the developments north of Duncan Road between I-75 and Orchid Drive. Sub-area 5d (See Figure 3-6) is not likely to be developed because of the extent of wetlands within its borders. For this reason, information and data related to sub-area 5d are excluded from the presentation below. The lots within the project area and information related to the proposed collection system are presented below:

  - Total lots: 233
  - Length of gravity mains: 33,660 LF
  - Quantity of LSs: 4

  Transmission system improvements will be required to convey wastewater from this service area to an existing LS and then to the WWTP. Based on coordination with the City, the wastewater from this Project Area is expected to be conveyed to LS 66. Determination of the transmission system improvements as discussed previously will require hydraulic modeling.

- **Project Area 6** includes the developments north of Riverside Drive between I-75 and Darst Avenue. Sub-areas 6d, 6e, and 6f (See Figure 3-6) are not likely to be developed because of the extent of wetlands within their borders. For this reason, information and data related these sub-areas are excluded from the presentation below. The lots within the project area and information related to the proposed collection system are presented below:

  - Total lots: 304
  - Length of gravity mains: 22,576 LF
  - Quantity of LSs: 3

  In addition, transmission system improvements will be required to convey wastewater from this service area to a new transmission LS and then to the WWTP. Determination of the transmission system improvements as discussed previously will require hydraulic modeling.

- **Project area 7** includes areas north of Acline Road and south of the Alligator Creek. The project sub-areas are intersected by Tamiami Trail (SR-41). The connection year for these areas depends on the schedule of the planned development north of Alligator Creek. The lots within the project area and information related to the proposed collection system are presented below:
  - Total lots: 153
  - Length of gravity mains: 11,753 LF
  - Quantity of LSs: 2

  Transmission system improvements will be required to convey wastewater from this service area to an existing LS and then to the WWTP. Based on coordination with the City, the wastewater from this Project Area is expected to be conveyed to LS 60. Determination of the transmission system improvements as discussed previously will require hydraulic modeling.

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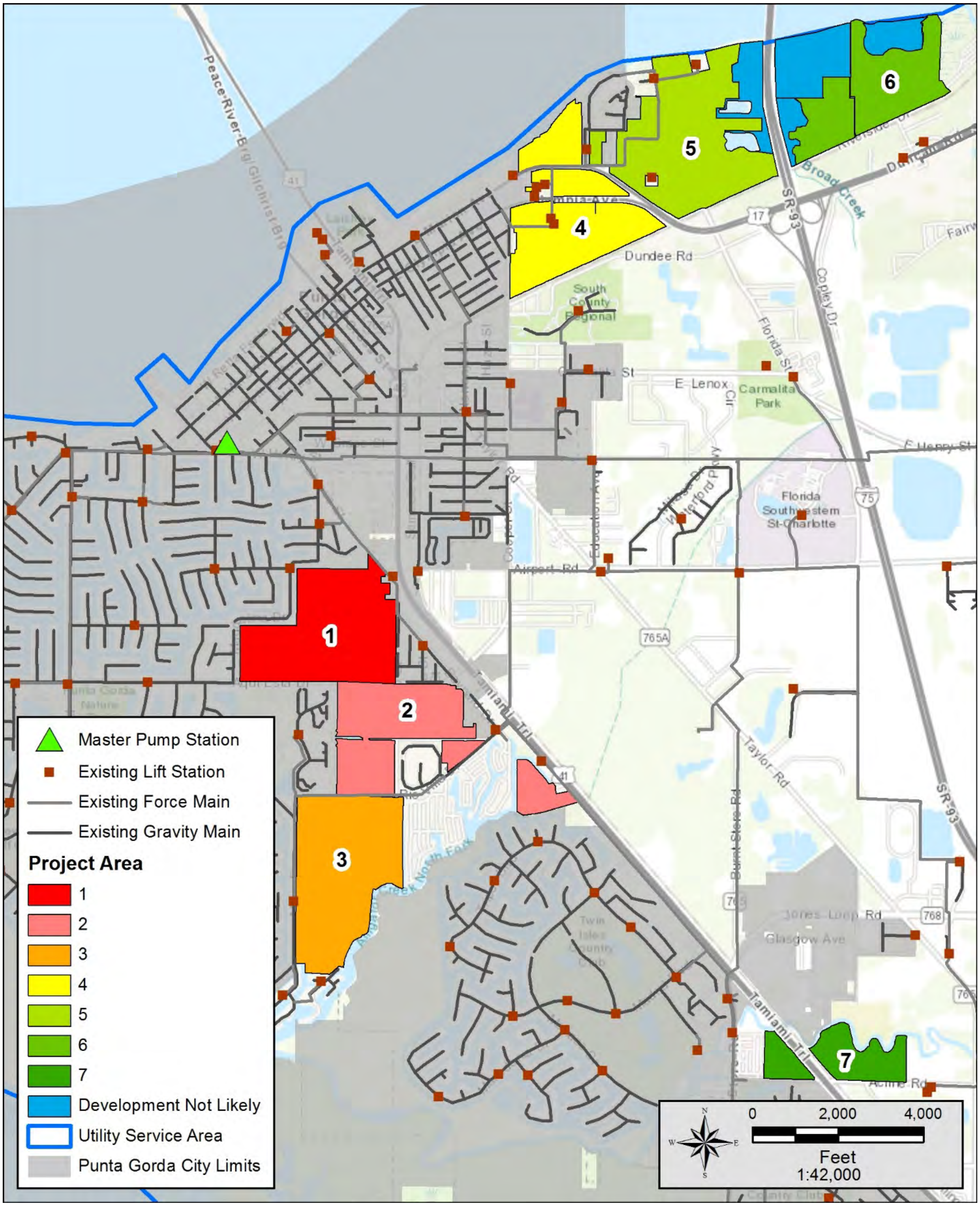
Figure 4-2 Improvement Plan



4.3 CAPITAL COSTS

Table 4-1 provides the capital costs for the Improvement Plan collection systems. Phase 1 of the improvement projects that include Project Areas 1, 2, and 3 will span 9 years. The duration of the subsequent projects are subject to change. Each project area is estimated to be completed in a 3-year period, with planning and design being conducted the first year and construction occurring in Years 2 and 3. Some projects are expected to be completed in 2 years, but larger projects may require additional time and their schedules should be adjusted during the project preliminary design phase.

The entire improvement project is estimated to cost $82,200,000, with the 9-year Phase 1 improvement projects comprising areas 1, 2, and 3 costing $39,100,000.

Additional transmission system improvements are expected to be required to serve these project areas. The costs associated with the transmission system improvements including LSs and force mains will be covered by PGU's Wastewater Capacity Fees. Hydraulic analysis and additional planning will be required to determine the detailed transmission system improvements and associated costs.

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Table 4-1 Capital Improvement Plan

Project Area	Years 1 – 3	Years 4 – 6	Years 7 – 9	Years 10 – 12	Years 13 – 15	Years 16 – 18	Years 19 – 21
1	$11,028,000	$ -	$ -	$ -	$ -	$ -	$ -
2	$ -	$9,952,000	$ -	$ -	$ -	$ -	$ -
3	$ -	$ -	$9,065,000	$ -	$ -	$ -	$ -
4	$ -	$ -	$ -	$10,455,000	$ -	$ -	$ -
5	$ -	$ -	$ -	$ -	$10,754,000	$ -	$ -
6	$ -	$ -		$ -	$ -	$7,885,000	$ -
7	$ -	$ -	$ -		$ -	$ -	$4,081,000
Total Collection System Costs	$11,028,000	$9,952,000	$9,065,000	$10,455,000	$10,754,000	$7,885,000	$4,081,000
Total Transmission System Costs	$3,308,400	$2,985,600	$2,719,500	$3,136,500	$3,226,200	$2,365,500	$1,224,300
Total S2S Costs	$14,336,400	$12,937,600	$11,784,500	$13,591,500	$13,980,200	$10,250,500	$5,305,300
Total Capital Cost				$82,186,000			

5 WASTEWATER TREATMENT PLANTS

The complexity and importance of WWTPs are often overlooked; therefore, the Chapter briefly discusses their purpose, monitoring requirements, and planning protocols. This Chapter also provides an overview of the current WWTP processes and operations, reviews historical flows and treated effluent water characteristics, lists ongoing improvements and challenges, and presents flow projections under low-, medium-, and high-growth conditions.

5.1 WWTP Treatment, Monitoring, and Planning Overview

WWTPs are designed to treat wastewater collected throughout the community and return the treated water to the environment. The treatment methods implemented at WWTPs include a number of physical and biological processes designed to provide optimal conditions for removing solids, breaking down organic material, and in some situations removing nutrients. The level and method of treatment depend on local conditions, disposal options, and regulations set forth to protect the health and safety of the public and our natural resources. FDEP is the state agency that issues WWTP permits and requires Utilities to record and submit discharge monitoring reports (DMRs) of flows and water quality characteristics to maintain compliance with the regulations.

The City of Punta Gorda currently owns and operates the Cecil Webb WWTP (see Figure 5-1). The WWTP serves the City of Punta Gorda and Charlotte County residents within the PGU service area. The WWTP is designed and permitted to treat 4 MGD of wastewater, expressed on an AADF basis. In addition, the WWTP has to meet effluent water quality requirements for constituents such as total suspended solids (TSS), carbonaceous biological oxygen demand (CBOD), and fecal coliform before safely injecting the water underground.

As local populations grow and infrastructure ages, the WWTP flows increase and eventually require the WWTP to be expanded. The timing for expansions and infrastructure improvements can be estimated using historical patterns and flow projections.

As part of the master planning effort, population-based flow projections were developed to estimate the future expansion timeline for the Cecil Webb WWTP and delineate the project areas through buildout.

SWFWMD developed spatially located population projections by combining the Bureau of Economic and Business Research (BEBR) growth data with Property Appraiser GIS parcel data. Flow projections for the WWTP involved combining SWFWMD's data with census data, DMR data, City planning data, and commercial water use data. The flow projections were modeled under medium-growth conditions, and low- and high-growth factors were used to determine the early and late start dates for each WWTP improvement.

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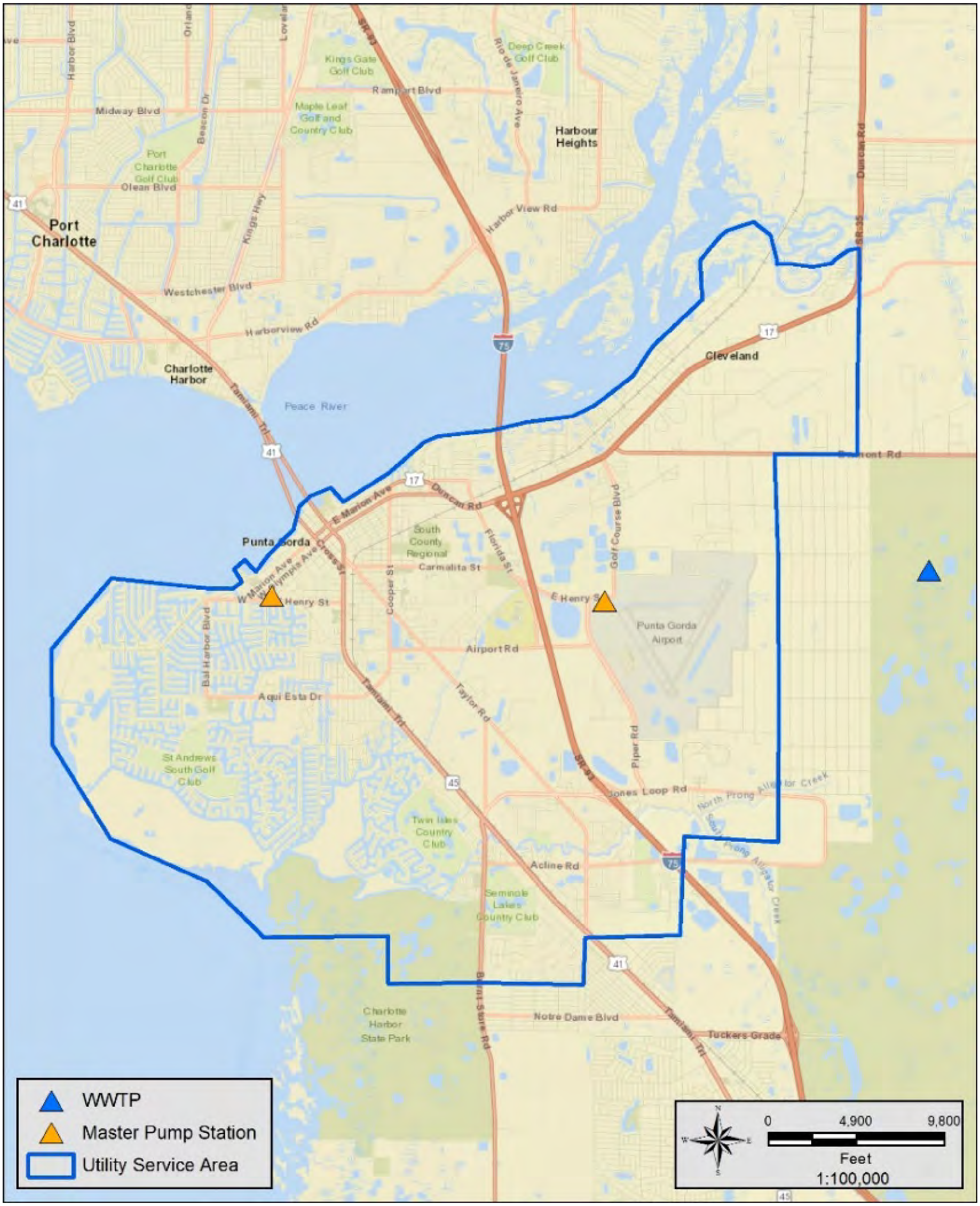
Figure 5-1 Location of City of Punta Gorda WWTP



The timing of the WWTP expansions presented in this Chapter are based on flow projections and Rule 62-600.405, FAC, *Planning for Wastewater Facilities Expansion*. This rule specifies when an owner of a WWTP is required to prepare and implement a capacity analysis report (CAR) or an update to one, preliminary design, final design, and an FDEP permit application for construction of the expansion based on the historical flows recorded in DMRs.

The criteria established in Rule 62-600.405, FAC, include:

- A CAR is submitted to FDEP when the 3-month annual daily flow (TMADF) of the most recent 3 consecutive months exceeds 50 percent of the permitted capacity of the WWTP or reclaimed water and disposal systems.
- If the permitted capacity will not be equaled or exceeded in at least 10 years, then a CAR is submitted every 5 years.
- If the permitted capacity will be equaled or exceeded in 10 years, then a CAR is submitted annually.
- If the latest CAR concludes that the permitted capacity will be equaled or exceeded:
  - In the next 5 years: Planning and preliminary design of a WWTP expansion needs to be prepared.
  - In the next 4 years: Final design documents (drawings and specifications) need to be prepared.
  - In the next 3 years: An FDEP permit application for expansion needs to be prepared.

Initiation of the construction of an expansion depends on the complexity of the expansion, the growth rate of the WWTP service area, the availability of funding, and other operational factors. For this reason, City staff and outside consultants routinely conduct facility assessments to identify improvements to optimize the operation and aesthetics of the WWTPs.

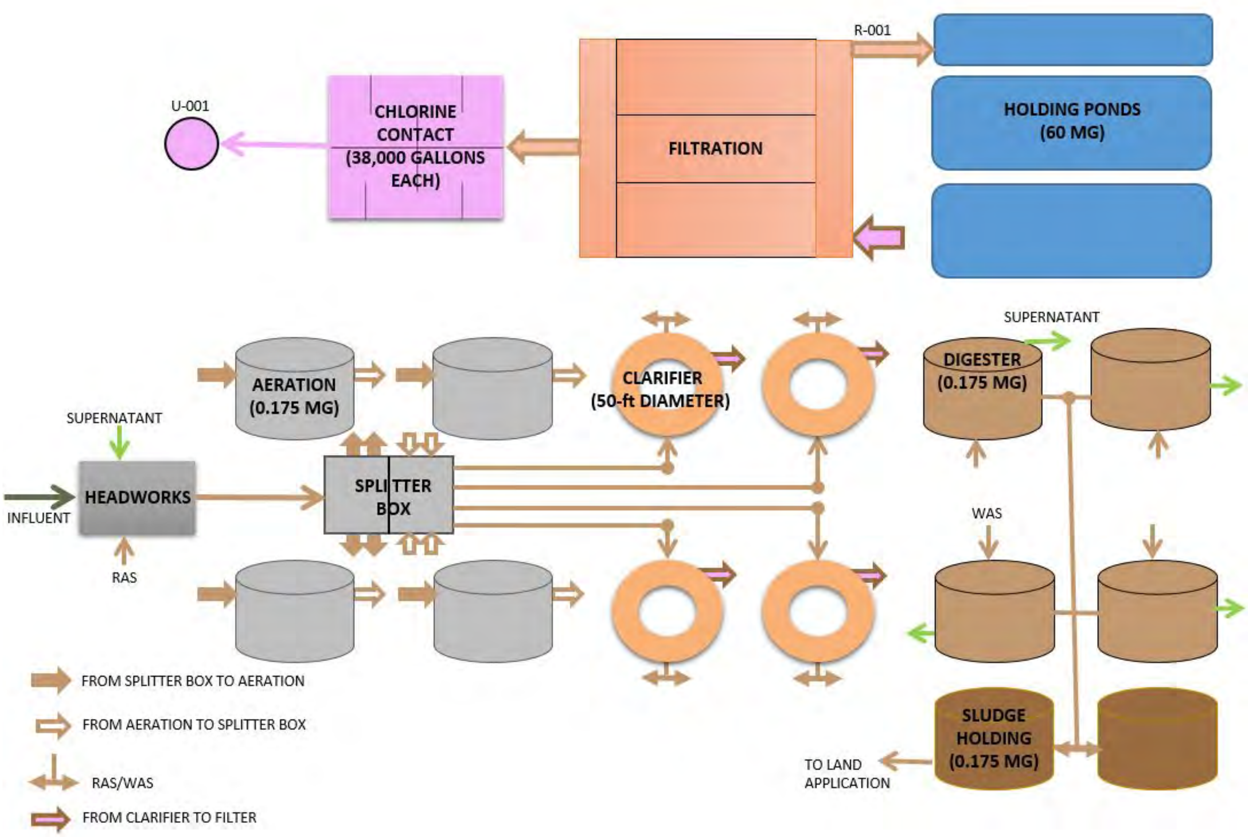
5.2 Overview of City of Punta Gorda's Cecil Webb WWTP

The Cecil Webb WWTP was constructed at 30999 Bermont Road on an 860-acre tract of land using an EPA grant. The land is under a 99-year lease from the State of Florida. In 1984, the 2.0-MGD AADF facility began treating wastewater under FDEP Permit No. FLA118371. Originally, the treated effluent from the WWTP was used for agricultural reuse to irrigate under-drained hay fields on the WWTP site, and local farmers harvested the hay. Because of connectivity to surface water through site runoff that ultimately entered Charlotte Harbor, the plant required an NPDES permit. Following an expansion in 1992, the permitted capacity doubled to 4.0 MGD AADF.

As regulations changed and discharge-monitoring requirements intensified, the City worked through several consent orders and explored other effluent disposal options. By 1999, the path toward using underground injection for effluent disposal began, and in October 2000 the injection well was fully operational. The City currently disposes of treated effluent by injection into a Class 1 injection well with a permitted capacity of 12 MGD. The injection well permit is renewed every 5 years. Residuals are disposed of by land application on the WWTP site.

The plant provides secondary treatment of wastewater and aerobic digestion of waste biosolids. The treatment units at the plant include two mechanical bar screens, aerated grit removal, four aeration tanks, four clarifiers, two chlorine contact tanks, six aerobic digesters, one lined supernatant holding basin, and three lined effluent storage basins with 60 million gallons (MG) of total storage volume. The current permit expires in September 2019. Figure 5-2 shows the City of Punta Gorda WWTP process flow diagram.

Figure 5-2 Punta Gorda Wastewater Treatment Plant



A.) Headworks: Raw wastewater enters the WWTP headworks structure where screening and grit removal take place. Two mechanical screens remove larger non-biodegradable material, and a manual bar screen is available for bypass purposes. After screening, the wastewater flows into a vortex-type grit removal unit for grit separation. Compacted screening and separated grit are dewatered and discharged to dumpsters for disposal. Internal plant flows from the on-site LS, supernatant from the aerobic digesters, and return-activated sludge (RAS) from the clarifiers combine with raw wastewater. Figure 5-3 shows the WWTP headworks.

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Figure 5-3 Punta Gorda WWTP – Headworks

B) Biological Treatment for Organics Removal: Wastewater from the headworks splits equally into four 50-foot-diameter, 175,000-gallon circular tanks where aeration and microorganisms treat biodegradable material. Blowers aerate the wastewater through two jet aeration devices per aeration tank. Figure 5-4 shows the WWTP aeration tanks.

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Figure 5-4 Punta Gorda WWTP – Aeration Tanks

C) Secondary Treatment: Flow from the biological treatment process splits between four 50-foot-diameter secondary clarifiers for solids separation. The clarifiers are skimmed to remove floatables and scum before the effluent flows over a circumferential weir. RAS pumps, located in the main control building, convey RAS to the headworks to replenish the microbial community or to the aerobic digestion tanks as waste-activated sludge (WAS).

D) Tertiary Treatment – Filtration: Clarified water is pumped to three deep-bed Tetra filters for tertiary filtration to remove the remaining solids. The filters are regularly cleaned using water from the clearwell and airbursts. Backwash water flows to the mudwell and is sent back through the plant for treatment. When flows exceed the filter's capacity, the clarified water is diverted to one of three holding ponds.

Figure 5-5 shows the WWTP Filter Feed Pumps.

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Figure 5-5 Punta Gorda WWTP – Filter Feed Pumps with the Clearwell and Filters in the Background

E) <u>Tertiary Treatment – Disinfection:</u> The filter effluent enters two 38,000-gallon chlorine contact tanks where chlorine gas is dosed for disinfection. The tanks are covered to reduce chlorine demand.

F) <u>Effluent Disposal Facilities:</u> Treated effluent is pumped into an underground injection well with a maximum injection rate of 8,333 gpm. Three permanently installed centrifugal pumps are not currently connected to the plant’s emergency generator; when power outages occur, a diesel-operated bypass pump is used for injection.

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Figure 5-6 shows the WWTP injection wellhead, and Figure 5-7 shows the injection well pumps and diesel-powered pump.

Figure 5-6 Punta Gorda WWTP – Injection Wellhead

Figure 5-7 Punta Gorda WWTP – Injection Well Pumps and Diesel-Powered Pump

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G) Holding Ponds: Effluent not meeting permit requirements or excess flows during extreme weather events can be diverted to three on-site holding ponds that provide approximately 60 MG of storage. Figure 5-8 shows the WWTP holding pond

Figure 5-8 Punta Gorda WWTP – Holding Pond

H) Aerobic Digestion: WAS is pumped from the clarifiers to one of four 50-foot-diameter tanks for aerobic digestion. The biosolids are held in the tank for 40 days to meet pathogen-reduction requirements and to reduce the mass for easier disposal. Digested biosolids at approximately 2-percent solids are land-applied on site. When the groundwater table is too high, the biosolids can temporarily be stored in the digested sludge-holding tanks.

Figure 5-9 shows the WWTP land application site.

Figure 5-9 Punta Gorda WWTP – Tractor Mowing the Land Application Site Field

5.3 WWTP Historical Flow and Characteristics Summary

Table 5-1 summarizes the historical flows from January 2011 to September 2017 for the Punta Gorda WWTP. The WWTP operated at a capacity between 53 and 64 percent of the AADF, and 58 and 75 percent of the maximum 3-month average daily flow (MTMADF) with the maximum monthly average daily flow (MMADF) peaking factors varying from 1.9 to 2.8. The MMADF from 2011 through September 2017 occurred in August 2017 at 6.7 MGD and corresponded with Hurricane Irma.

Table 5-1 WWTP Historical Influent Flow Summary

Year	AADF[1] (MGD)	MMADF (MGD)	MTMADF (MGD)	Percent Capacity (AADF/Permit)	Monthly Peaking Factor (MMADF/AADF)
2011	2.15	4.01	2.32	54%	1.87
2012	2.13	5.06	2.52	53%	2.37
2013	2.27	6.28	2.66	57%	2.77
2014	2.34	4.97	2.51	59%	2.12
2015	2.40	4.59	2.58	60%	1.91
2016	2.56	5.49	3.01	64%	2.14
2017[2]	2.42	6.75	2.87	61%	2.78

[1]Values based on 12 months from January to December DMR data.
[2]Values based on 9 months from January to September DMR data.

Figure 5-10 presents the monthly average daily flow (MADF), TMADF, and AADF reported to FDEP for the WWTP. MADFs vary from 1.6 MGD in June 2011 to 3.2 MGD in January 2016. TMADFs vary from 1.9 to 3.0 MGD. The AADFs were approximately 58 percent of the WWTP permit capacity with AADF values ranging from 2.1 to 2.6 MGD.

Figure 5-10 WWTP Historical Wastewater Influent Flows

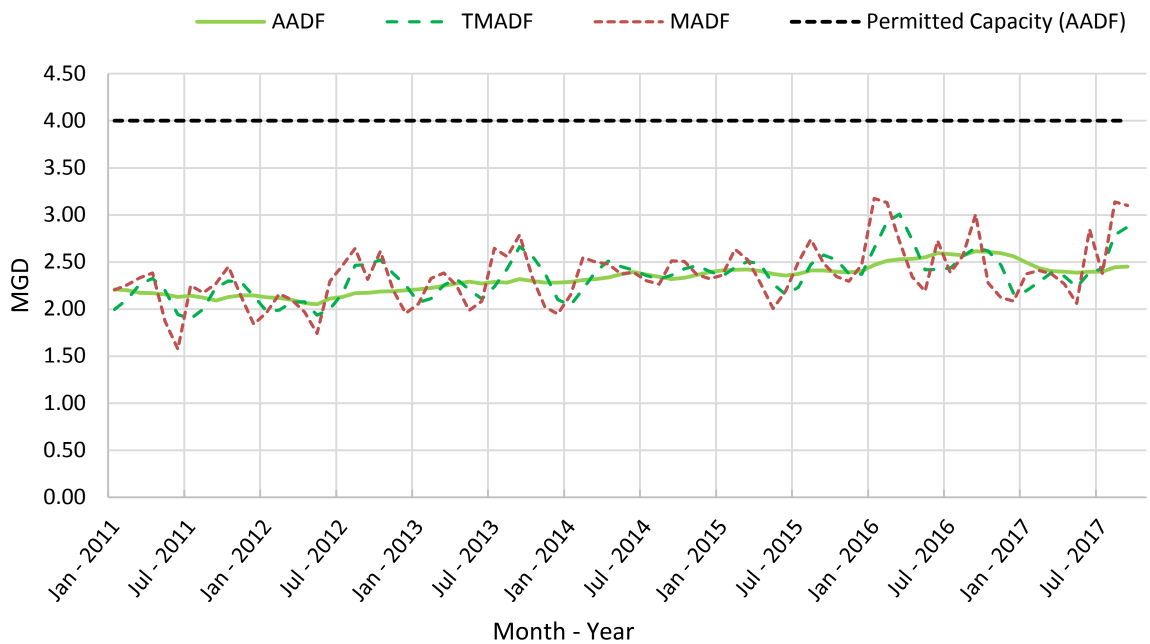

Table 5-2 summarizes the historical influent flow patterns from January 2011 through September 2017 for the WWTP. Weekly influent water samples for CBOD and TSS are collected as required by the permit. An analysis of the data from January 2011 to September 2017 showed the monthly average CBOD values varied from 137 to 175 milligrams per liter (mg/L) (2,600 to 3,500 pounds per day [lb/day]) and the monthly average TSS concentrations varied between 149 and 197 mg/L, equating to approximately 2,900 to 3,700 lb/day.

Table 5-2 WWTP Historical Influent Flow Characteristics Summary

Year	AADF (MGD)	CBOD (mg/L)	CBOD (lb/day)	TSS (mg/L)	TSS (lb/day)
2011	2.15	151	2,710	178	3,200
2012	2.13	140	2,490	192	3,420
2013	2.27	137	2,590	197	3,730
2014	2.34	141	2,750	149	2,920
2015	2.40	175	3,500	156	3,110
2016	2.56	200	4,260	185	3,950
2017	2.43	185	3,740	180	3,640

Note: Typical municipal wastewater CBOD range is between 120 and 380 mg/L.
Typical municipal wastewater TSS range is between 120 and 370 mg/L.

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Figure 5-11displays the average monthly influent CBOD and TSS concentrations for the WWTP and the typical months when winter residents are contributing to loads. The CBOD and TSS concentrations fluctuate seasonally, with higher concentrations during the winter months when seasonal residents are present and decrease to lower than the typical municipal wastewater range of 120 to 380 mg/L during the rainy season.

Figure 5-11 WWTP Historical CBOD and TSS Concentrations

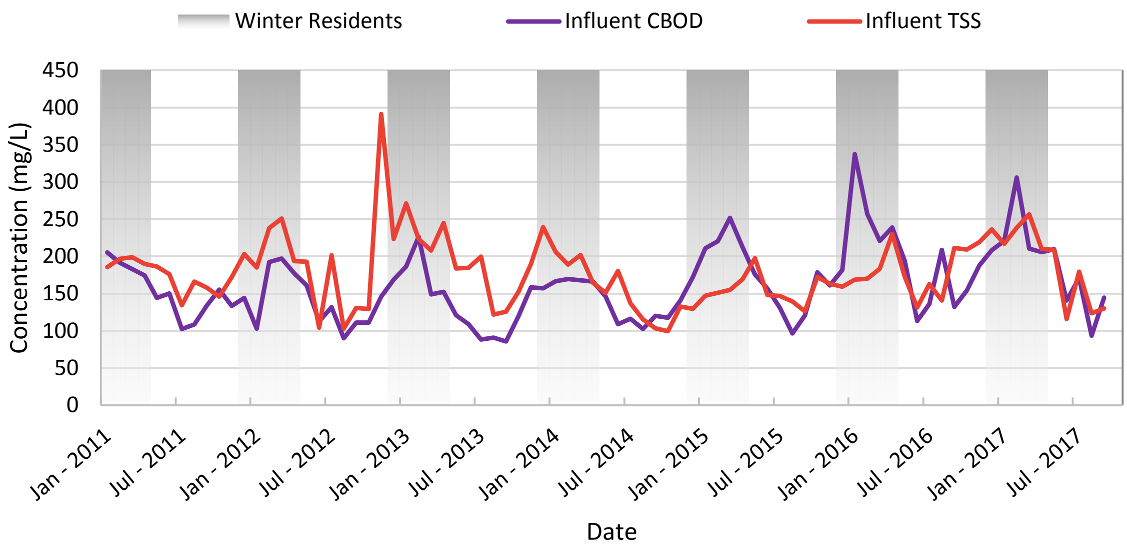
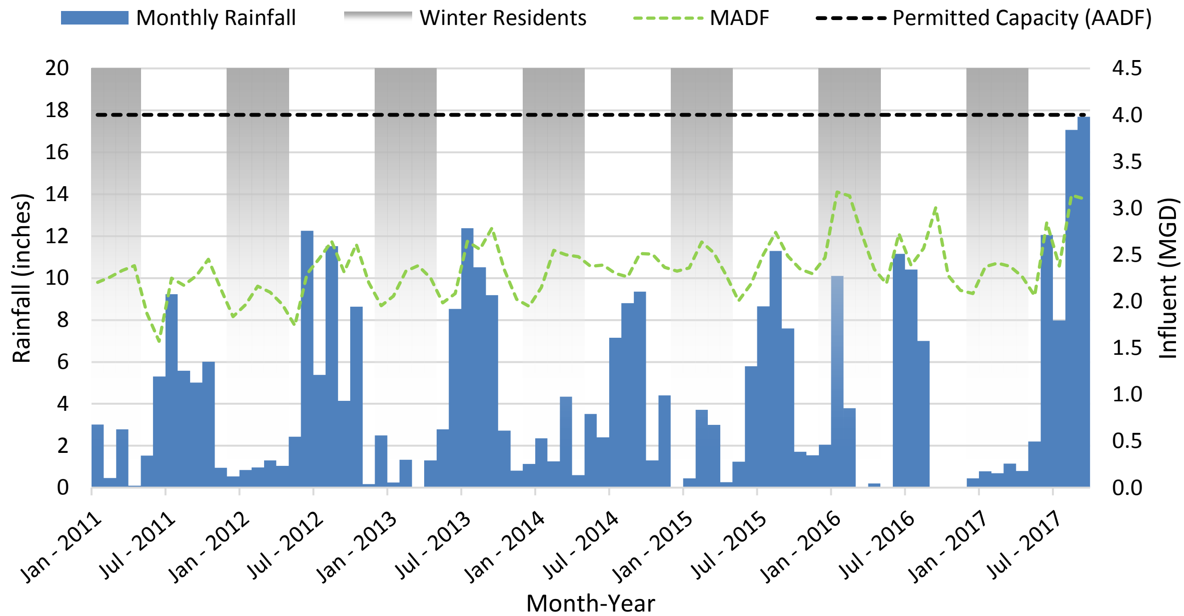


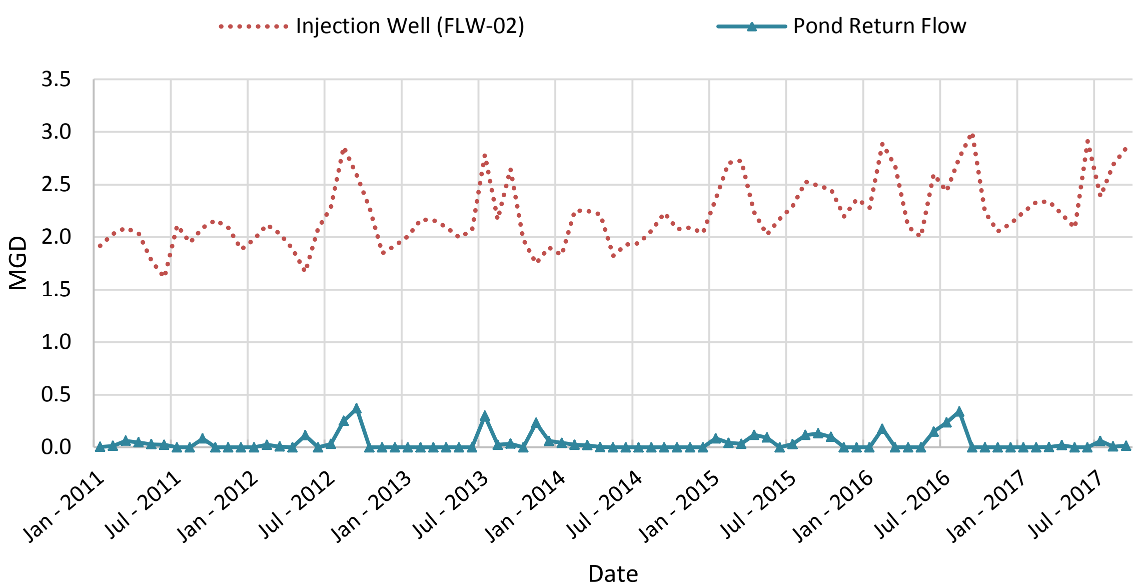
Figure 5-12 displays the total monthly rainfall and MADF from January 2011 to September 2017 for the WWTP. The total rainfall per year varied from 40.4 inches in 2011 to over 60.4 inches in 2017 (excluding October through December). The higher MADFs appear to correlate with the increased population of the area during January through April. Additional flow peaks occur during the summer months of 2011 through 2017, which is likely due to inflow and infiltration (I&I).

Figure 5-12 WWTP Historical Rainfall and Influent Wastewater Flows



The Cecil Webb WWTP permit allows treated effluent disposal into a deep injection well (U-001) or to an on-site holding pond (R-001). The deep injection well is permitted for an instantaneous maximum of 8,333 gpm or 12 MGD. Figure 5-13 displays the monthly average effluent flows from the WWTP from 2011 through September 2017.

Figure 5-13 WWTP Historical Wastewater Effluent Flows



Monthly effluent flows for the deep injection well peaked at 3.0 MGD. Although the well has a 12-MGD capacity, the filters are hydraulically limited, causing flows to be diverted to the holding ponds. This is most common in the rainy seasons when peak flows increase as a result of heavy rain events.

5.4 Ongoing WWTP Improvements

The City's WWTP staff takes pride in maintaining the facility and planning future improvements. This is evident in the recently refurbished Operations Control Room. The recently completed and scheduled improvements include:

A) Completed:

- Purchase of Belt Press Thickeners for Biosolids Processing
- Construction of Aerator and Clarifier Flow Splitter Box (Emergency Repair)
- Installation of Deep-Bed Filters (Required for Injection Well operation)

B) Scheduled for 2017 through 2021:

- WWTP Master Plan to Assess WWTP Facilities
- WWTP Permit Renewal (Renewal due to FDEP by March 2019)
- Wastewater Deep Injection Well Permit Renewal (Renewal due to FDEP by June 2019)
- Deep Injection Well Mechanical Integrity Test (MIT) (Complete by September 2020)
- Injection Well Pump Replacement
- WWTP Tank Coating
- WWTP Clear Well Filters
- WWTP DSSU Motor Replacement
- WWTP Reline Sludge Pond

5.5 WWTP Flow Projections and Expansion

Figure 5-14 shows the historical and projected AADFs for the WWTP. The flow projections for the Punta Gorda service area include infill growth from existing sewersheds and flows from S2S conversions. The flow projections indicate that the permitted capacity will not be exceeded until after 2040 under medium-growth conditions. The FDEP guidelines indicate that planning and preliminary design should be prepared in 2036, the final design should be prepared in 2037, and the construction should begin by 2038.

The low-growth scenario indicates that the WWTP AADF reaches 3.2 MGD by 2040 but will not be exceeded in the 20-year plan. Under high-growth conditions, the WWTP flows are projected to reach the permitted capacity by 2033. The preliminary and final expansion design plans would be prepared in 2028 and 2029, respectively. The construction start year is estimated to be in 2030 under high-growth conditions. Table 5-3 summarizes when planning, design, and permitting will need to be implemented based on the population projections and increases in flows.

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Figure 5-14 WWTP Historical and Projected AADFs

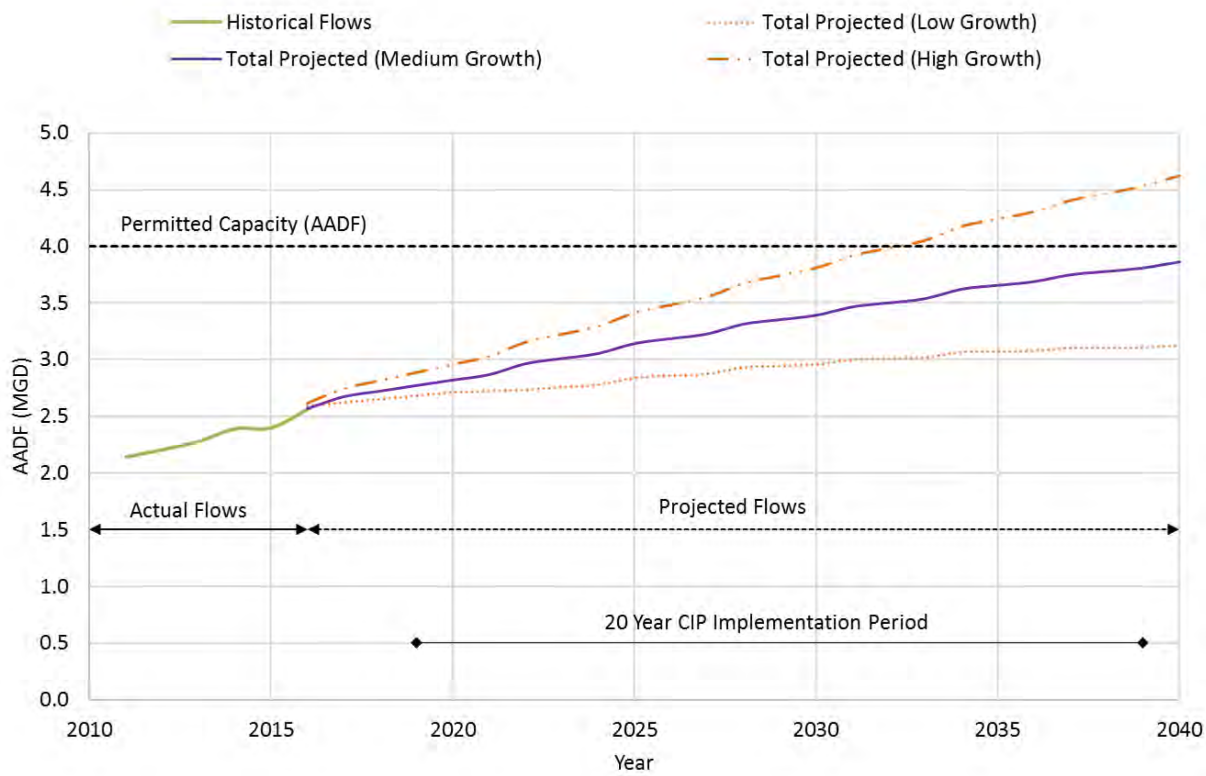

Table 5-3 WWTP Expansion Planning Summary Based on Population Projections

Projection Type	WWTP at Capacity (Year)	Planning and Preliminary Design (Year)	Final Design Documents (Year)	FDEP Permit Application for Expansion (Year)
Medium Growth	2042	2037	2038	2039
High Growth	2033	2028	2029	2030

A detailed assessment of the WWTP will be completed as part of the Wastewater Treatment Works Improvement project (ENG-WWTPEXP/1718) and will include a planning study to determine a multi-year plan for improvements necessary to meet future capacity and regulatory requirements. In totality, converting the selected project areas septics to sewer systems would not have an immediate impact on the WWTP. Notwithstanding, there will be ample time to address the increased plant inflows.

6 CONCLUSION

The PGU SMP presents an improvement plan aimed at reducing pollution by converting Septic to Sewer within the PGU service area. This SMP represents a local and regional collaborative effort to improve and sustain the quality of Charlotte County's natural water resources, ensure a safe water supply, provide a recreational haven, and protect an environmental resource in accordance with the City's Comprehensive Plan and Charlotte County's Blue Water Strategy.

The SMP includes methodology to identify septic to sewer project areas based on environmental and fiscal assessments to develop economical sewer improvements.

- Environmental scoring criteria were employed to identify project areas that maximize environmental benefits and provide reduced long-term nutrient loading to Charlotte Harbor. In addition, the environmental scoring criteria provided a mechanism to prioritize the level of importance of converting septic tanks to sewer for each project area. The criteria included the proximity of lots to surface waters, age of septic tanks, and nitrogen loading. Individual impact maps were developed to display the environmental scoring criteria for the project areas. The individual impact maps were used to develop an overall average environmental score for the project areas throughout the unincorporated PGU service area. This resulted in identifying potential priority service areas that offer the greatest benefit to the environment at a reduced cost. Sequencing of the priority project areas will allow the City to implement an orderly growth plan that extends from existing developed areas and expands outward.
- Cost analyses were conducted to determine the most economical and efficient centralized collection system improvement. Four collection system alternatives considered are low-pressure STEP, low-pressure grinder pump, vacuum collection, and gravity collection systems. The collection system types were evaluated based their constructability, reliability, ease of maintenance, capital costs and O&M costs.

After considering the four main sewer collection options for replacing septic tanks, the City decided that in most situations the gravity collection systems were the most feasible alternative for the majority of the PGU project areas based on the collection system evaluation and cost comparison.

Overall, seven project areas were identified, with Areas 1, 2 and 3 classified as high priority due to their impact on the environment. Implementation of the collection system improvement plan is in two phases. Phase 1 of the improvement projects that include Project Areas 1, 2, and 3 will span 9 years. The duration of the subsequent projects are subject to change. Each project area is estimated to be completed in a 3-year period, with planning and design being conducted the first year and construction occurring in Years 2 and 3. Some projects are expected to be completed in 2 years, but larger projects may require additional time and their schedules should be adjusted during the project preliminary design phase.

The entire improvement project is estimated to cost $82,200,000, with the 9-year Phase 1 improvement projects comprising areas 1, 2, and 3 costing $39,100,000. Additional transmission system improvements are expected to be required to serve these project areas. The costs associated with the transmission system improvements including lift stations and force mains will be covered by PGU's Wastewater Capacity Fees. Hydraulic analysis and additional planning will be required to determine the detailed transmission system improvements and associated costs.

Ultimately, selection of an implementation scenario is left to the City's discretion. All scenarios will accomplish the City's S2S goals. Selection of a more or less aggressive Implementation Plan depends on the City's funds and development plans.

Appendix A

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APPENDIX A – REFERENCES

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