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VOLUSIA COUNTY – GEMINI SPRINGS WASTEWATER TREATMENT FEASIBILITY ANALYSIS REPORT

Volusia County | August 2021

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VOLUSIA COUNTY – GEMINI SPRINGS WASTEWATER TREATMENT FEASIBILITY ANALYSIS REPORT

Prepared for

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ACRONYMS AND ABBREVIATIONS

Acronym	Definition
AADF	Annual Average Daily Flow
ADF	Average Daily Flow
AGM	Annual Geometric Mean
AWT	Advanced Wastewater Treatment
BEBR	University of Florida Bureau of Economic and Business Research
BMAP	Basin Management Action Plan
CIP	Capital Improvement Plan
CRA	Community Redevelopment Area
CWSRF	Clean Water State Revolving Funds
DWTS	Distributed Wastewater Treatment System
DWTU	Distributed Wastewater Treatment Units
ENR	Engineering News-Record
EOPCC	Engineer's Opinion of Probable Construction Costs
EPA	Environmental Protection Agency
ERC	Equivalent Residential Connection
ERU	Equivalent Residential Unit
FDEP	Florida Department of Environmental Protection
FDOH	Florida Department of Health
FLWMI	Florida Water Management Inventory
FM	Force Main
fps	Feet per second
GIS	Geographic Information System
GPCD	Gallons per Capita per Day
GPD	Gallons per Day
GPM	Gallons per Minute
GPSF	Gallons per Square Foot
lb-N/yr	Pounds of Nitrogen per Year
LF	Linear Feet
LS	Lift Station
MDF	Maximum Daily Flow
MFL	Minimum Flow and Level
mg/L	Milligrams per Liter
MGD	Million Gallons per Day
MHI	Median Household Income
MP	Master Plan
MPR	Master Plan Report
NSILT	Nitrogen Source Inventory and Loading Tool

Acronym	Definition
O&M	Operation and Maintenance
OFS	Outstanding Florida Spring
OSTDS	Onsite Sewage Treatment and Disposal Systems
PHF	Peak Hourly Flows
PFA	Priority Focus Area
PPA	Priority Project Area
PPH	Persons per Household
PUD	Planned Unit Development
RCW	Reclaimed Water
SCADA	Supervisory Control and Data Acquisition
SF	Square Foot
SJRWMD	St. Johns River Water Management District
SRF	State Revolving Funds
SRWRF	Southwest Regional Wastewater Reclamation Facility
STPO	Septic Tank Phase-Out
TMDL	Total Maximum Daily Load
UFA	Upper Florida Aquifer
USDA	US Department of Agriculture
USGS	US Geological Survey
WRF	Water Reclamation Facility
WRU	Volusia County Water Resources and Utilities
WWTF	Wastewater Treatment Facility
WWTP	Wastewater Treatment Plant

1 INTRODUCTION

1.1 PURPOSE

Under the 2016 Florida Springs and Aquifer Protection Act, the Florida Department of Environmental Protection (FDEP) is required to adopt septic system remediation plans for Outstanding Florida Springs (OFSs) where FDEP has determined that upgrading or eliminating septic systems is necessary to achieve nutrient water-quality objectives. Gemini Springs in southwest Volusia County is one of 30 OFSs established in 2016 and one of three established in Volusia County.

The Wastewater Treatment Feasibility Analysis Report (FAR) is a grant-funded project intended to accelerate development of information essential to implementing an effective septic system remediation plan. Key elements of the FAR are inventorying septic systems, assessing wastewater capacity and infrastructure, determining infrastructure upgrades, and evaluating cost-effective projects and financing options.

FDEP has adopted a basin management action plan (BMAP) for Gemini Springs based on the established total maximum daily load (TMDL) for nitrogen. This report does not intend to provide a path to satisfying the entire TMDL goal. As directed by the 2016 Florida Springs and Aquifer Protection Act, this report focuses on septic systems. The BMAP identifies several other significant sources of nitrogen loading to groundwater. Identifying, evaluating, and recommending alternatives for other sources is beyond the scope of this report.

1.2 OVERVIEW OF REGULATORY STUDIES

Gemini Springs is classified as a second magnitude spring and consists of two spring vents approximately 150 feet apart in the City of DeBary, Florida, wholly within Volusia County. Gemini Springs feeds into a man-made reservoir through two spring runs, then through Padgett Creek (also known as the Gemini Springs Run), and into Lake Monroe. A part of the St. Johns River system, Gemini Springs is a popular destination for walking, cycling, and ecotourism; thus, maintenance and protection of the springs are high priorities for the surrounding municipalities, Volusia County, and the St. Johns River Water Management District (SJRWMD).

Based on US Geological Survey (USGS) and SJRWMD data collected from 1995 to March 2015 and presented in SJRWMD Technical Publication SJ2017-5, the twin spring vents of Gemini Springs discharge approximately 9.8 cubic feet per second (cfs) or 6.333 million gallons per day (MGD). Initially, three spring vents were present, but one was historically referred to as a seep. The seep was at one time drilled out and converted to an uncased 8-inch-diameter free-flowing well. According to SJRWMD, this well was backfilled to a shallower depth in 1991 and completely abandoned in 2002. The remaining spring vents from west to east are referred to as Spring 1 and Spring 2. Spring 1 appears to flow from a horizontal limestone cavern approximately 6 feet high by 8 feet wide, resulting in a spring pool nearly 15 feet in diameter. Spring 2 is smaller, flowing from a small cavern under a rock ledge approximately 3 feet below the water surface. The run of Spring 1 converges with Spring 2 at the west end of the reservoir, impounded by an earthen dam and fixed weir structure. The primary water source into Gemini Springs is the Upper Florida Aquifer (UFA), which is a highly transmissive limestone aquifer.

Water throughout the springshed moves between the UFA, approximately 10 to 40 feet beneath land surface, and the surficial aquifer system but is slowed by an intermediate confining unit. The confining layer is perforated by sinkholes that allow the transmission of surface waters into the UFA at a rapid rate. Various modes of testing have indicated that water emanating from Gemini Springs is relatively young.

In 2017, SJRWMD adopted a minimum flow and level (MFL) regime for the springs, citing critical environmental values such as *water quality, aesthetic and scenic attributes, and fish and wildlife habitats*. The springs are currently meeting the MFL.

The earliest water-quality sample collected at Gemini Springs was by Volusia County in 2000; regular, near-monthly sampling has been conducted by the County since 2008. Based on collected data, FDEP determined that Gemini Springs had elevated nutrient concentrations that impaired the body of water. In 2017, FDEP determined the non-impaired limit on the TMDL threshold of nitrate-N to be 0.35 milligram per liter (mg/L).

FDEP adopted TMDL constraints in 2017 based on nitrate-nitrite impairment, citing targeted beneficial uses listed as *fish consumption, recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife*. Based on the TMDL, FDEP developed and adopted a BMAP in 2018, proposing a comprehensive set of strategies to achieve the required pollutant-load reduction. The BMAP also includes the designation of a Priority Focus Area (PFA), an area of the basin identified as most vulnerable to pollutant loading. Figure 1-1 presents the location of Gemini Springs and associated BMAP and PFA areas.

The water quality in Gemini Springs, Lake Monroe, and the UFA has a significant impact on the community. The springs and associated reservoir provide recreational and aesthetic benefits to residents and visitors, economic opportunities, and essential habitat for fish and other wildlife. This FAR is part of an effort to improve and protect this crucial natural resource, which impacts ecosystems, fisheries, marine and wildlife habitats, wetlands, the tourism industry, home values, and overall quality of life.

The Gemini Springs springshed and BMAP boundaries extend into Volusia and Seminole Counties. The portion of the Gemini Springs springshed within Volusia County has residential communities and commercial entities with a population of approximately 15,000. Within the PFA, most of these communities do not have central sewer-collection systems and instead use septic systems to treat and dispose of wastewater. To avoid additional damage to the springs created by the dense use of septic systems, the County is evaluating options for removing septic systems and providing centralized sewer collection with treatment at the County’s Southwest Regional Wastewater Reclamation Facility (SRWRF) or another municipal wastewater treatment facility.

The adopted TMDL requires a 76-percent reduction in nitrogen loading within 15 years. It proposed to meet the goal by achieving 30 percent of the reduction within 5 years, 80 percent of the reduction within 10 years, and 100 percent of the reduction within 15 years. The largest nitrogen loads to groundwater come from urban turfgrass fertilizer. Based on the BMAP, farm fertilizer accounts for 46 percent of the nitrogen load to fertilizer. The second largest contribution is from Onsite Sewage Treatment and Disposal Systems (OSTDS), which account for 41 percent of the total nitrogen loading to groundwater.

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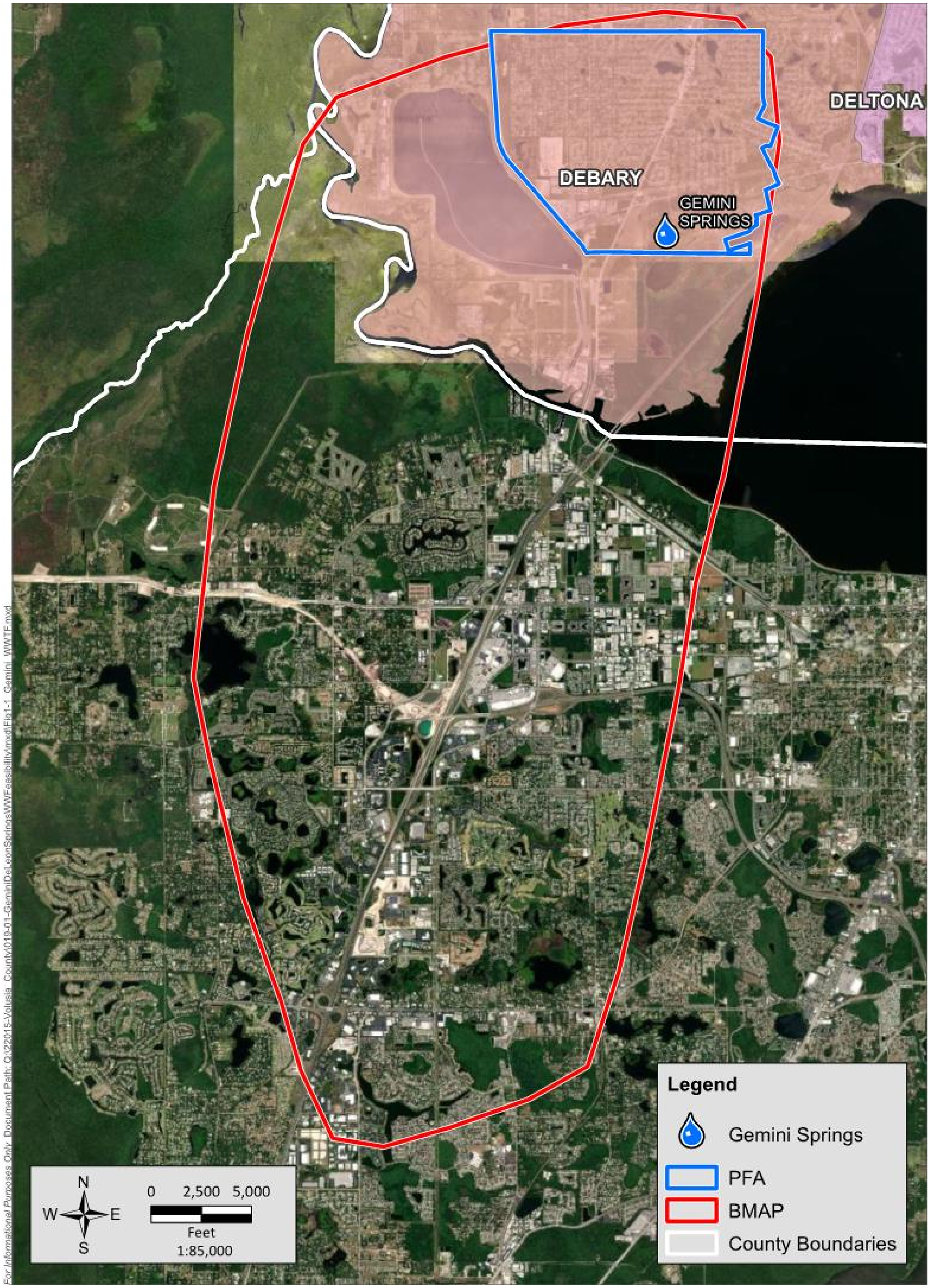
Figure 1-1 Gemini Springs BMAP and PFA Boundaries

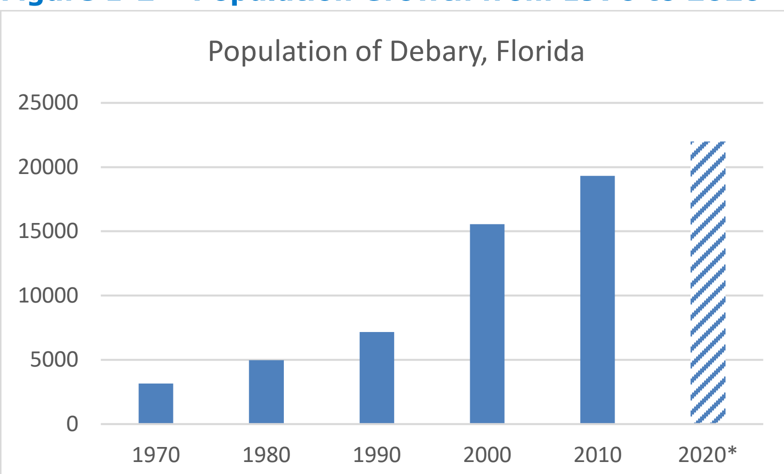


1.3 Background

Gemini Springs is approximately one mile northwest of the west shoreline of Lake Monroe within the 221-acre Gemini Springs Park. The park is operated and maintained by Volusia County and provides predominantly land-based recreation for residents and visitors and a critical habitat for fish and wildlife species. The springs were closed to swimming and boating in 2002 due to elevated levels of *Escherichia coli* (E. coli) bacteria. However, fishing is allowed from the designated fishing dock.

Over the last 10 years, 112 water-quality samples were taken at Gemini Springs. According to the TMDL, the annual geometric mean (AGM) concentrations have ranged from 0.97 to 1.33 mg/L at the headsprings. The elevated nitrate concentrations are believed to be the result of the changing land uses throughout the springshed. The portion of the Gemini Springs springshed in Volusia County is wholly within the municipal limits of the City of DeBary. The land use in this part of the springshed has changed significantly from 1974 to present day. The City of DeBary has grown from 3,154 to nearly 22,000 people, which is a more than 500-percent growth over the last half century. Figure 1-2 presents population data collected by the US Census Bureau for DeBary from 1970 to 2010 with an estimated population in 2020 (University of Florida Bureau of Economic and Business Research [BEBR], 2020).

Figure 1-2 Population Growth from 1970 to 2020



Based on FDEP's Nitrogen Source Inventory and Loading Tool (NSILT) modeling conducted for the 2018 BMAP, 41 percent of nitrogen loading in Gemini Springs is attributable to septic systems. The Florida Department of Health's (FDOH) Florida Water Management Inventory (FLWMI), a centralized listing of OSTDS geographic information system (GIS) data, reports 2,749 septic systems within the Volusia County section of the Gemini Springs BMAP for that same year. Typically, septic tanks constructed from steel have a 20- to 30-year useful life. Septic tanks constructed from concrete or plastic may last 30 to 40 years. On average, FDOH data appears to indicate an overall 20- to 30-year lifespan for septic tanks, with differences stemming from amount of use, type of use, level of maintenance, and groundwater characteristics.

Figure 1-3 presents the number of new OSTDS construction permits issued by the Volusia County DOH between 1999 and 2019. FDOH OSTDS permit data show a steep downward trend in new OSTDS construction after 2006, with a gradual uptick beginning again in 2016. Section 6.1 identifies potential septic-to-sewer project areas and summarizes their numbers of lots and numbers of lots with septic systems; the identified areas are approximately 80% developed. If the permitting trend continues, new septic system construction will be on the rise once more and the nitrogen loading attributable to septic systems will increase as well.

Figure 1-3 New Septic System Permits Issued, 1999-2019

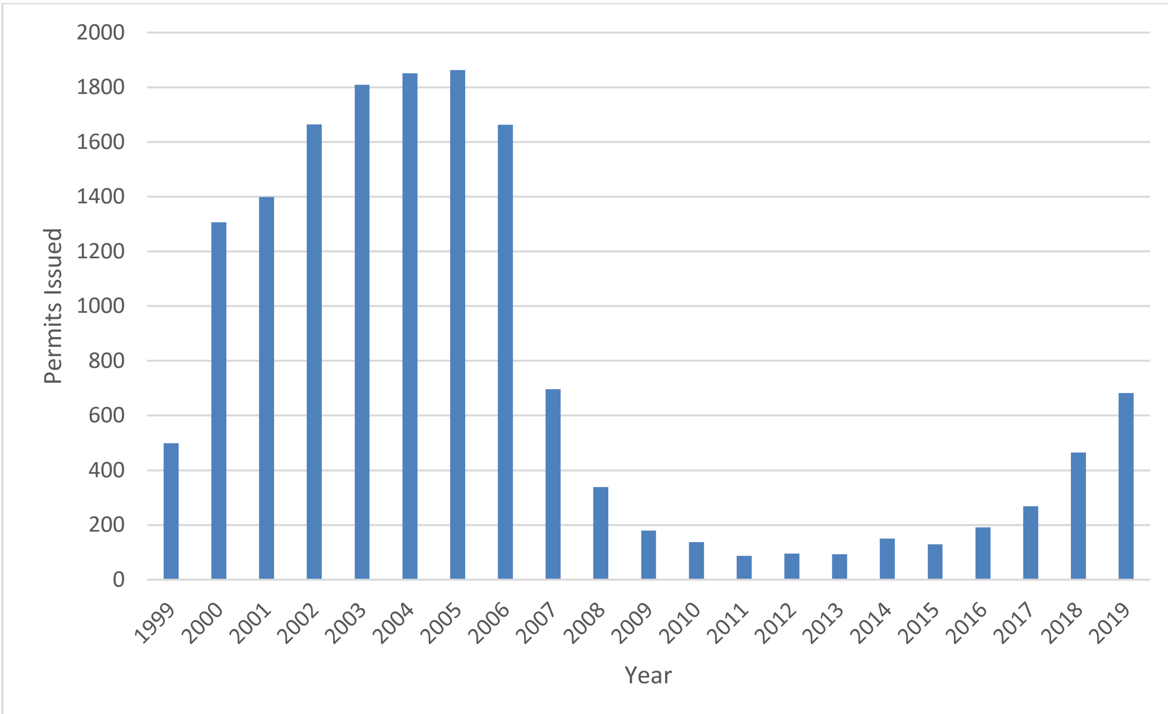


Figure 1-4 presents the comparative land uses in 1974 and in 2014.

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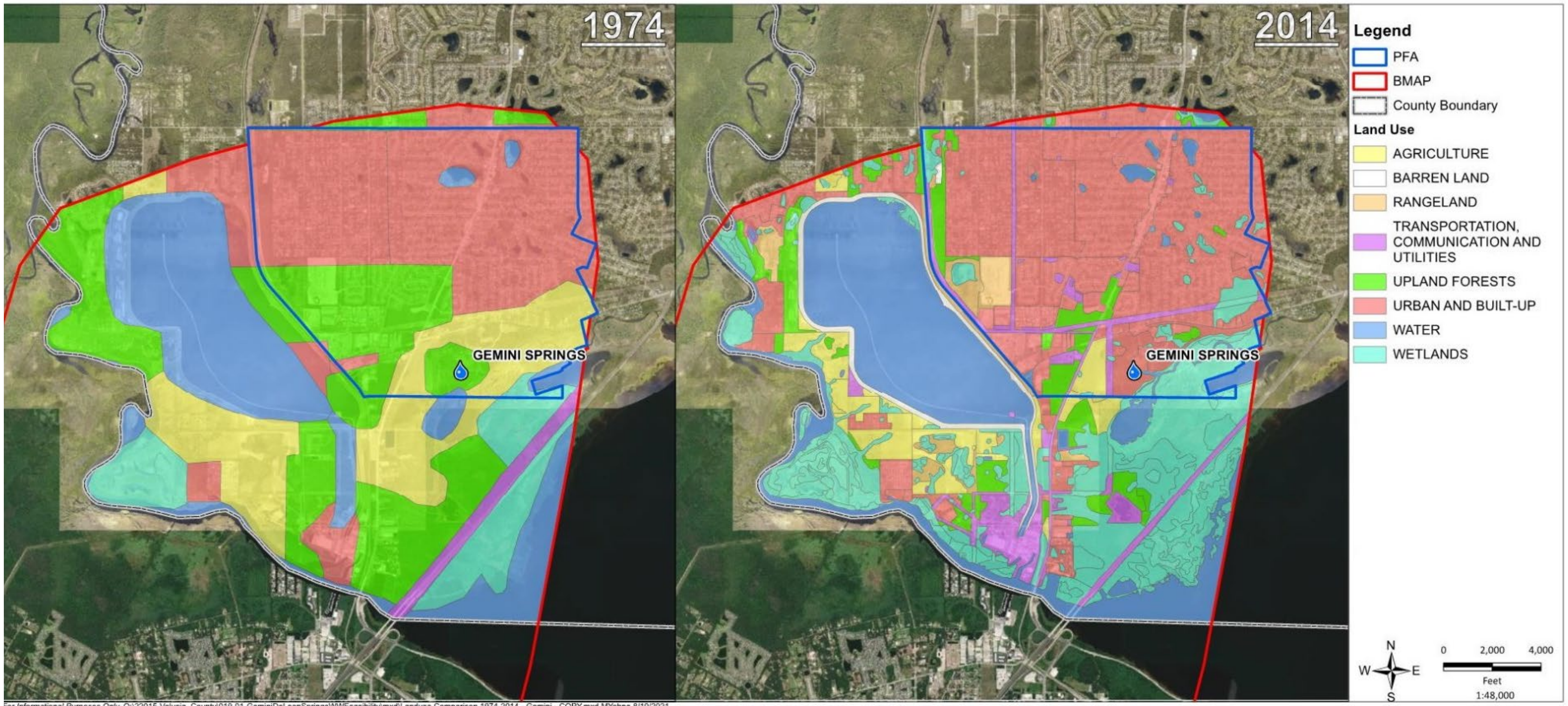
Figure 1-4 Land Use in the Volusia County Portion of the Gemini Springs BMAP, 1974 and 2014



For Informational Purposes Only Q:\22015-Volusia_County\019-01-GeminiDeLeonSpringsWWFeasibility\mxd\Landuse Comparison 1974-2014 - Gemini - COPY.mxd MYohpe 8/10/2021

1.4 The Science on Septic Nutrients Entering Groundwater

Septic systems operate through a multi-step process that includes a septic tank and drainfield (or leachfield). Figure 1-5 depicts how wastewater from the home is typically collected and conveyed to the septic system through drainpipes.

Once in the septic tank, solids settle out while the liquid effluent flows through a series of perforated pipes that are embedded in a drainfield. 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 (primarily in the form of ammonia-nitrogen [NH_4^+ -N]) and phosphorus to the groundwater from the drainfield. In a properly operating system, nitrifying bacteria in the upper portions of the drainfield naturally convert ammonia-nitrogen to nitrate-nitrogen (NO_3^- -N) in the presence of oxygen (O_2) in porous soils. As the effluent percolates deeper in the ground, denitrifying bacteria convert the nitrate-nitrogen to nitrogen gas ($N_{2\ gas}$), which escapes to the atmosphere. The denitrification process occurs with a carbon source under conditions without oxygen present.

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 regions of Florida are saturated due to high groundwater and are typically unsuitable for providing the necessary treatment time. Figure 1-6 shows a septic system with non-ideal treatment. High groundwater creates flooded soils, which reduce oxygen transfer and create low-oxygen levels leading to considerably less removal of nitrogen. In this situation, the conversion of ammonia to nitrate and nitrate to nitrogen gas are impeded, leaving a large percentage of nitrate to persist in the groundwater and ultimately impact surrounding surface waters.

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

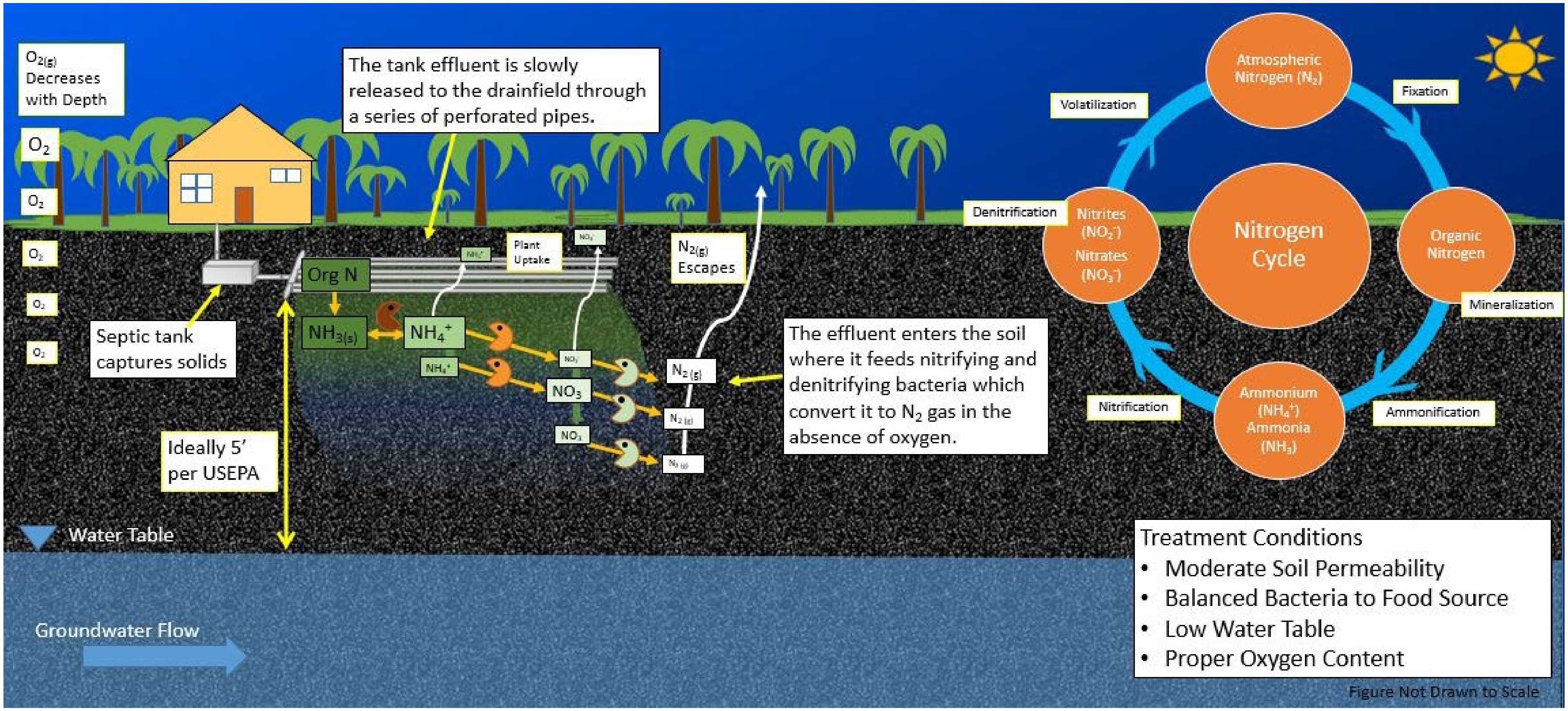

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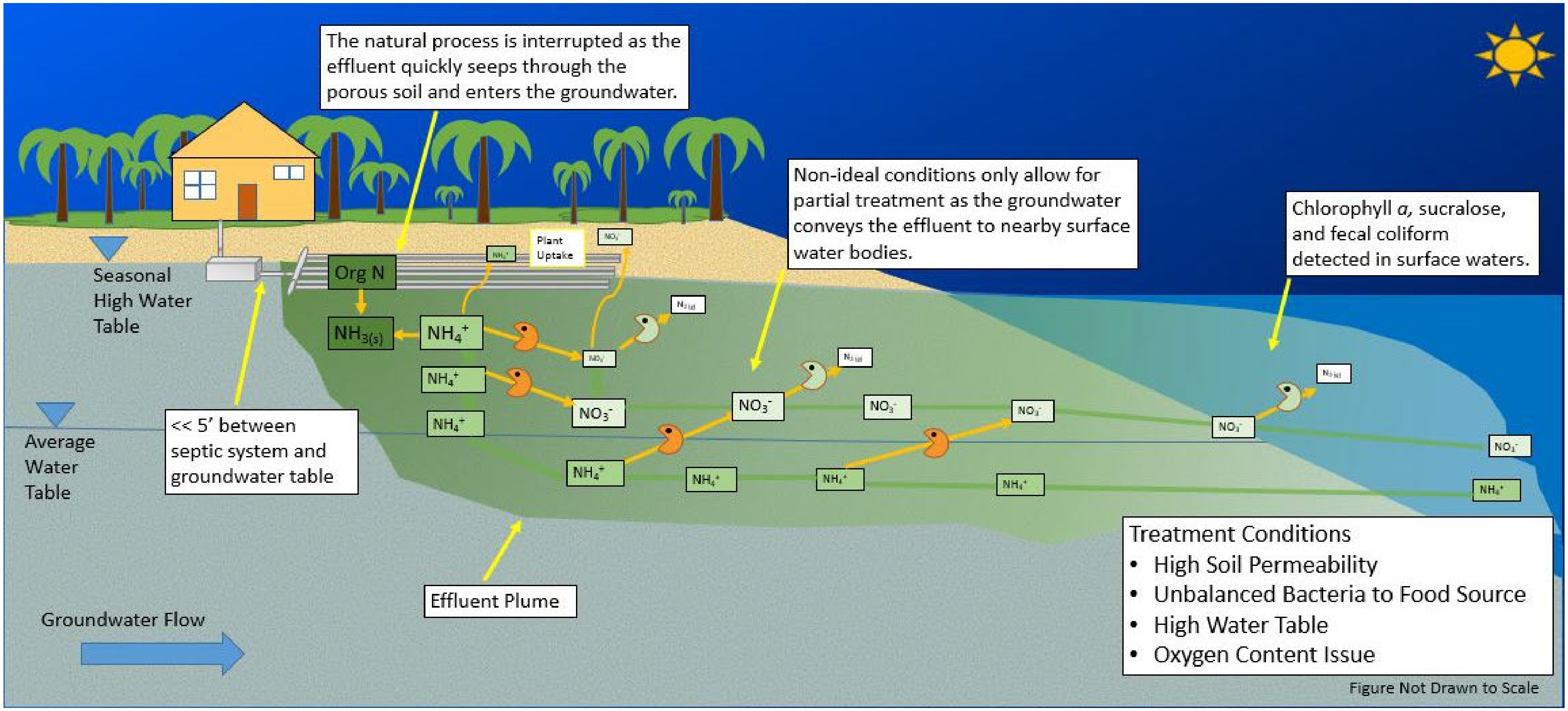
Figure 1-6 Typical Septic System and Drainfield with Non-Ideal Treatment



1.5 Wastewater Treatment FAR Objectives

Developing and implementing the FAR is a joint effort between the Volusia County Government and FDEP. Required under the 2016 Florida Springs and Aquifer Protection Act, this effort is based on the FDEP-adopted BMAP for Gemini Springs and is the first major step in converting the Gemini Springs area from predominantly using septic systems to using centralized sewer collection and treatment or enhanced onsite treatment. The FAR is intended to provide an affordable community solution that addresses the common goals of improving and restoring water quality in Gemini Springs, protecting crucial fish and wildlife habitat, and enhancing the community's quality of life. The following FAR objectives support these BMAP goals:

- Summarize the need to reduce nutrient and bacteria discharges.
- Review and compile historical sewer system and water reclamation facility (WRF) flows and loads data.
- Model and predict system growth.
- Develop detailed consumer and wastewater flow estimates through buildout.
- Review existing wastewater collection and transmission systems.
- Review existing WRFs and prepare infrastructure extension recommendations.
- Develop Capital Improvement Plan (CIP) recommendations based on existing infrastructure needs.

1.6 Guiding Criteria for Evaluating Septic-to-Sewer Conversions

The FAR addresses the local and regional community's goal of reducing nitrogen loading to Gemini Springs through septic-to-sewer conversions and reduced reliance on traditional septic systems. The conversion area evaluations and prioritizations incorporate the guiding principles of affordability, sustainability, efficiency, and reliability as described below:

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

2 PAST AND PRESENT – DEVELOPMENT OF A SEWER SYSTEM

This Chapter provides a historical perspective of the regional area's sewer system development, a review of private utilities within the service area, and a summary of the present-day sewer system. This Chapter also reviews the ongoing regional wastewater projects in the planning, design, and construction phases.

2.1 SEWER SYSTEM GROWTH AND DEVELOPMENT

Volusia County is in northeast Central Florida, bordered by the St. Johns River to the west and the Atlantic Ocean to the east (Figure 2-1). The County was officially formed in 1854 by the Florida Legislature through the division of Orange County; at that time, Volusia County had fewer than 1,000 residents and the common sewage disposal method consisted of outhouses or privies. The County population grew steadily over the next 100 years, reaching nearly 50,000 residents at the start of World War II. The post-war period was a time of significant growth for the County, with the population tripling between 1950 and 1970. Growth has yet to slow; the 2020 BEBR population estimate was 551,588.

Fifteen public utility providers serve the population of Volusia County – 14 cities and Volusia County Water Resources and Utilities (WRU). Of these providers, nine operate water and/or WWTFs. The remaining smaller cities receive wholesale water supply and wastewater treatment from other larger cities or have no centralized infrastructure. As the population continues to grow and the demand for services rises, widescale septic-to-sewer conversion efforts will be a collaborative effort shared between local municipality, County, and State resources.

A 1990 USGS survey of treated domestic wastewater in Volusia County identified 60,843 active septic systems, 25 domestic WWTFs, and three County-run WWTFs. By the end of 1999, despite County efforts to consolidate WWTFs and expand access to centralized sewer, the number of septic systems had grown to approximately 80,000. The most recent FLWMI estimates that 92,281 septic systems existed in Volusia County in 2018. Based on population growth in known unsewered areas, the number of septic systems is estimated to now be over 100,000.

Overall, WRU provides wastewater collection, treatment, and disposal services for approximately 7 to 8 percent of the countywide population. In 1986, Volusia County purchased a private utility serving the Southwest Volusia County area, and the population of southwest Volusia was expected to expand rapidly over the next 10 years. A master wastewater plan was prepared that recommended the County construct a new, regional WWTF and decommission one of the original private utility's smaller plants. In the ensuing 5 years, WRU completed construction of the new 0.75-MGD SRWRF. The new facility was designed so that it would be easily expandable and cost-effective to meet the continuously growing wastewater needs of the County.

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Figure 2-1 Volusia County Geographic Area

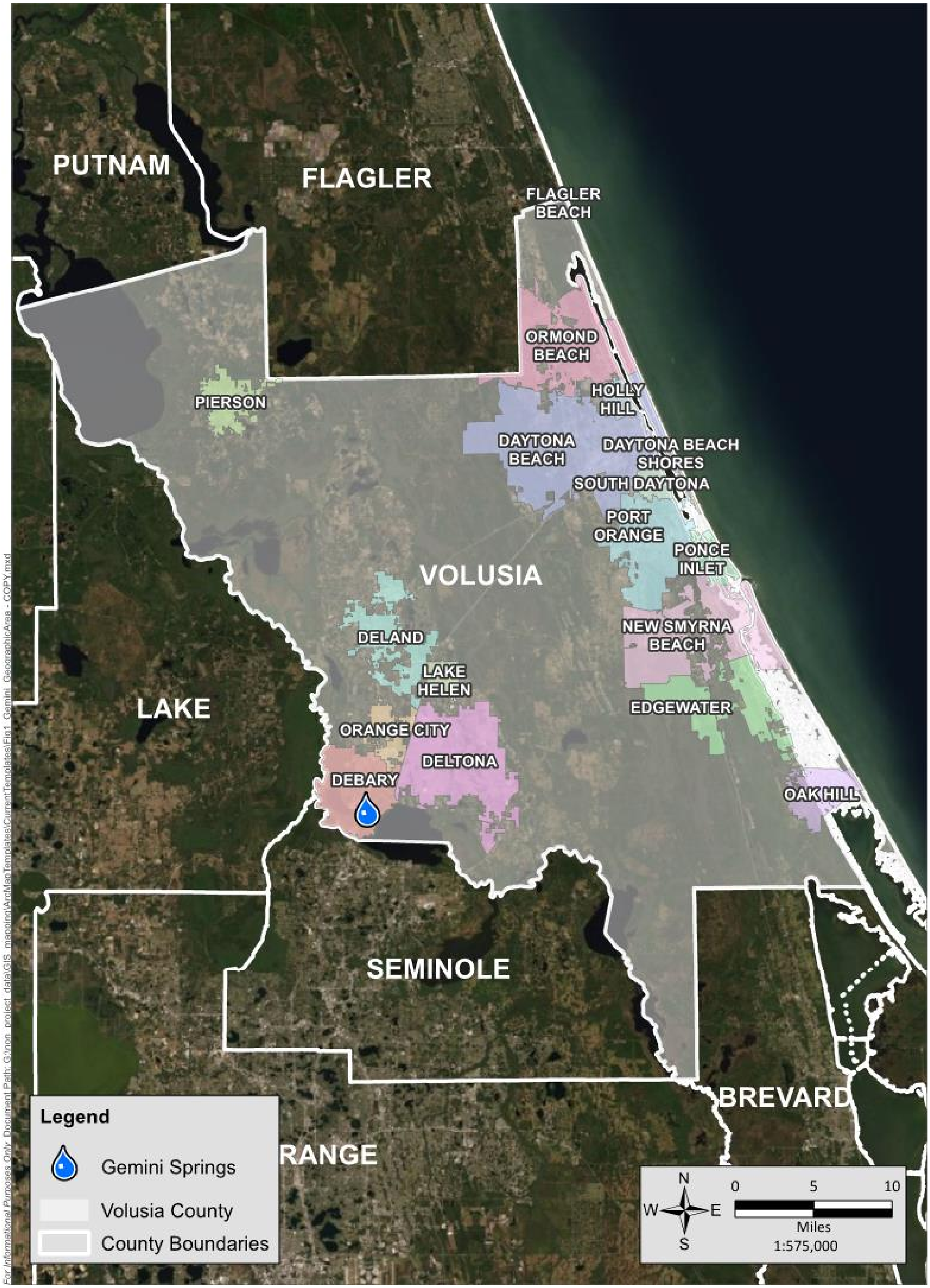
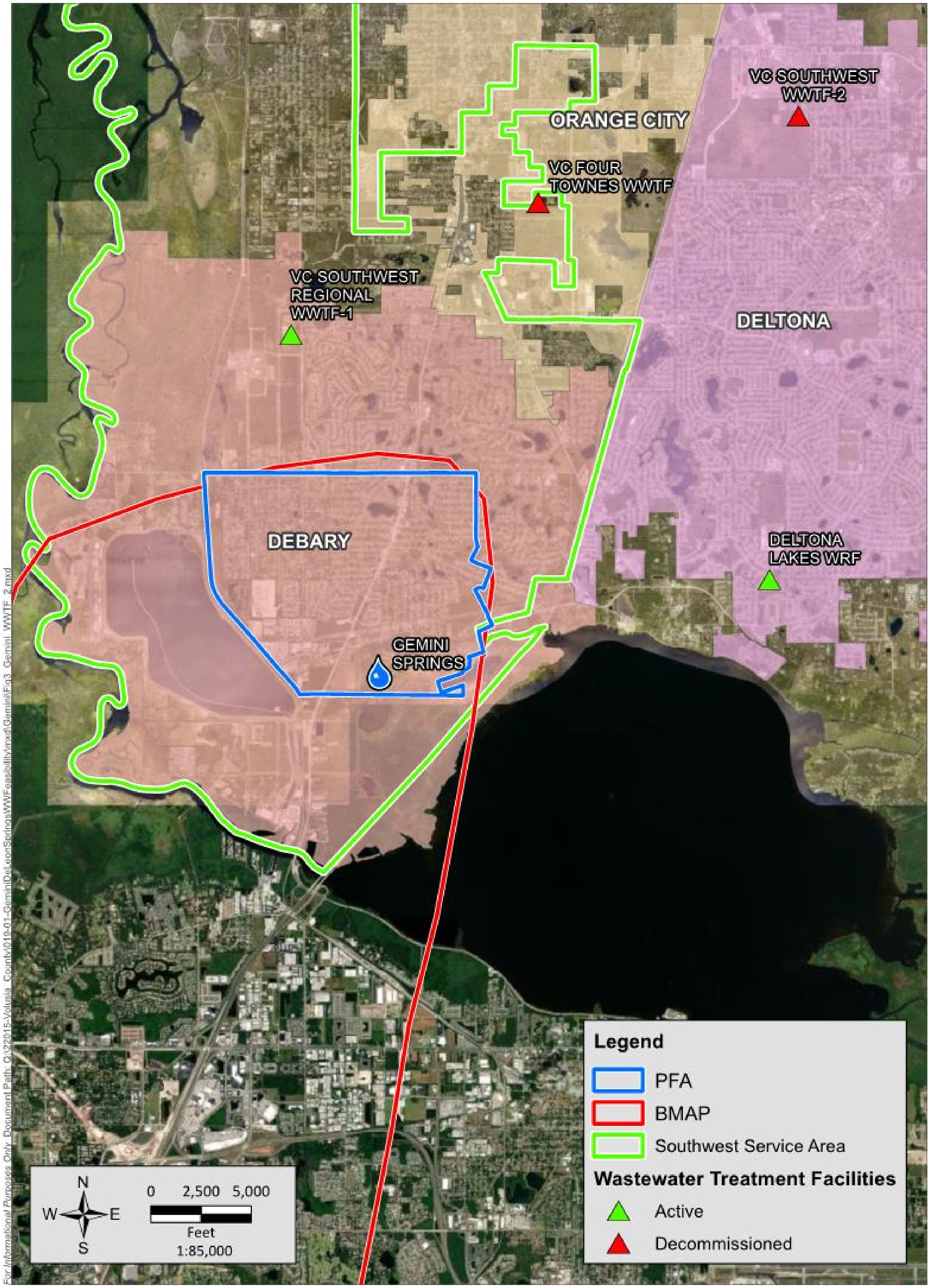


Figure 2-2 shows that according to FDEP's most up-to-date data, Volusia County owns and operates three WWTFs near the Gemini Springs springshed – SRWRF, Deltona North (Southwest #2), and Four Townes (decommissioned). In July 2014, new TMDL regulatory standards were adopted by FDEP for the Blue Springs basin in Volusia County. The new requirements necessitated the conversion of WWTFs treating over 100,000 gallons per day (GPD) from standard to advanced wastewater treatment (AWT). Rather than invest in facility upgrades at both plants near Blue Springs – SRWRF and Four Townes – the County decided to focus attention on expanding plant capacity and converting to AWT at SRWRF and reroute flows from the Four Townes plant, allowing for its eventual decommissioning.

In 2018, the County completed the $12.7-million project at the SRWRF by upgrading to AWT, expanding treatment plant capacity, and expanding the reclaimed water system. The project was made possible through $7.5 million in grant funding provided by FDEP and SJRWMD. Projects are currently underway to begin transferring flow from the Deltona North WRF to SRWRF, thereby expanding reclaimed water availability and improving water quality by reducing nutrient pollutants within the springshed.

Figure 2-2 Volusia County WWTFs



2.2 Private Utilities Within the Service Area

Many small, private package plants continue to operate in Volusia County. Figure 2-3 shows three private facilities within the Gemini Springs BMAP area with wastewater program permits: two industrial and one power plant. Table 2-1 lists the package WWTFs that are currently maintained by private entities. These facilities are not likely to connect into the County's wastewater system in the future. Industrial discharges tend to have poor water quality for wastewater treatment as evidenced by low biological oxygen demand; treating this type of discharge at the SRWRF is not recommended without pretreatment. The power plant's wastewater is predominantly cooling water discharges that are also not recommended for general wastewater treatment. The economic feasibility of potential connections will need to be evaluated.

Table 2-1 Privately Operated Package WWTF Information

Facility ID	Name	Address	Permit Expiration Date
FL0001554	FPL Sanford Plant	950 South US Highway 17-92	9/2/2018
FLG110871	Preferred Materials CBP	300 Benson Junction Road	8/6/2024
FLA175951	Seminole Precast Recycle System	331 Benson Junction Road	12/6/2020

Source: FDEP Wastewater Facility List.

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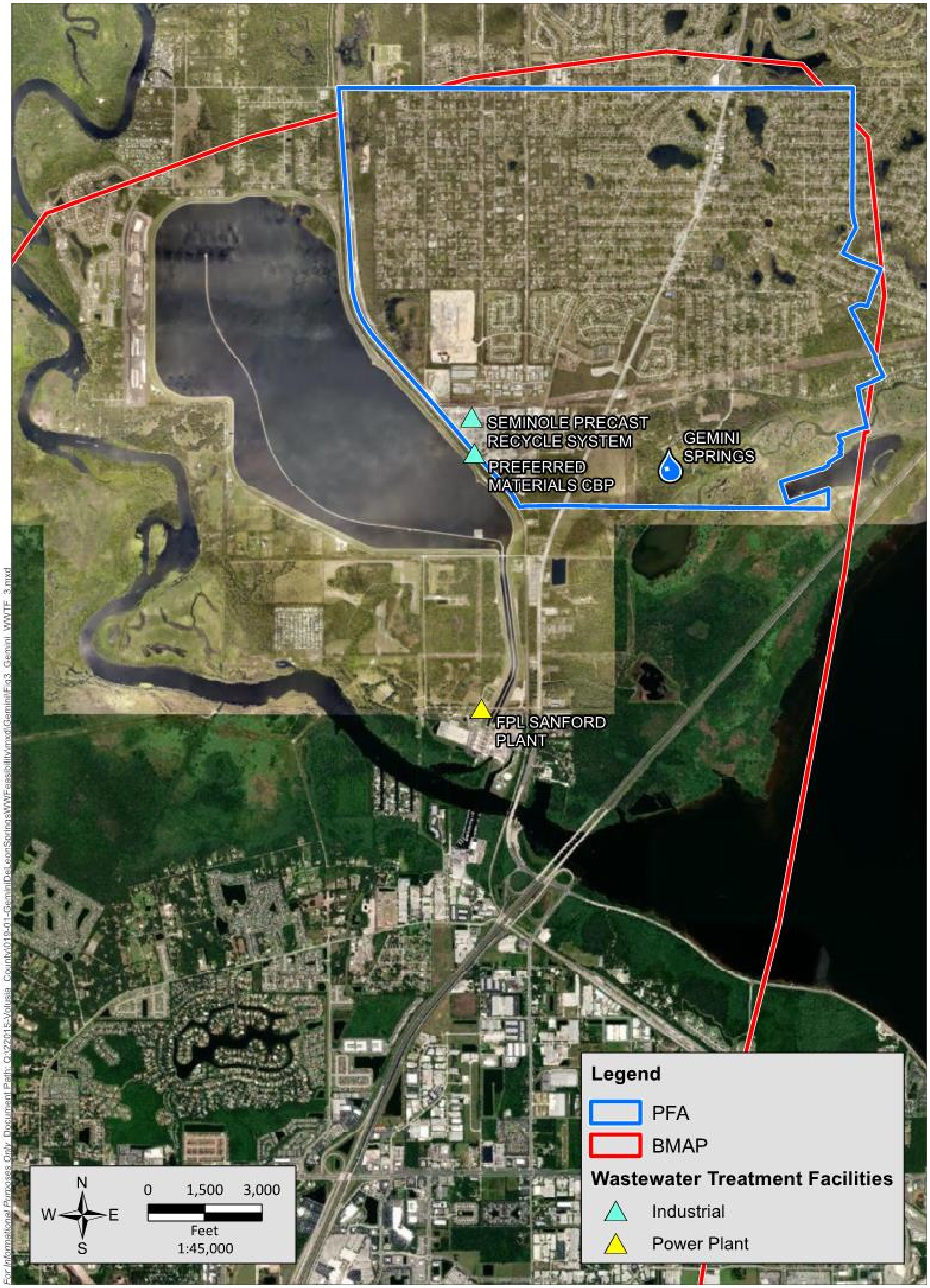
Figure 2-3 WWTFs in Gemini Springs BMAP



2.3 Ongoing Projects and Programs

Volusia County is committed to maintaining and, where feasible, expanding its program of effluent treatment, reuse, and disposal. The County is also committed to protecting and improving the springs and associated waterbodies, focusing on sustainable future development and environmental stewardship. In support of these goals, the County is managing several projects that will impact the sewer system.

2.3.1 Deltona North WWTP Lift Station and Force Main

Due to the low flows and relatively high effluent nutrient concentrations, the County desired to decommission the Deltona North WRF and send flows to the SRWRF. This is projected to achieve significantly lower effluent concentrations and result in significant savings in operation and maintenance expenses. This project is to construct a new lift station and force main to reroute the existing flows. The decommissioning of the Deltona North WWTF does not include taking the existing rapid infiltration basins (RIBs) out of service; they will remain as a backup reuse disposal site for the County's public access reuse (PAR) system during periods when reuse capacity exceeds demand. Construction was completed in mid-2021.

2.3.2 Deltona North RIB Rerate Study

The Deltona North (Southwest 2) WRF has four RIBs that receive reuse water from the County's PAR system. The PAR system is connected to the SRWRF and interconnected with the municipal Deltona Lakes and Deland/Wiley Nash WWTFs. The County is interested in increasing the disposal capacity of the RIBs to divert public access reuse from the interconnected reuse system when the quantity of reuse water significantly exceeds demand. The technical aspects of this project were completed in 2019. The County expects the permit rerate to occur in late 2021 or early 2022 following construction of the Deltona North Wastewater Treatment Plant (WWTP) Lift Station and Force Main project.

2.3.3 Volusia Blue Wetland Recharge Project

The B&H Excavation Site, about 0.5-mile northeast of Blue Spring, was identified as a potential recharge site by the West Volusia Water Suppliers (WVWS) and SJRWMD. The site is an active mine covering about 60 acres that was excavated to approximately 40 to 50 feet below natural grade. The west side of the property borders an existing 10-inch force main owned by Florida Department of Transportation that conveys stormwater discharge from Mill Lake to the St. Johns River. This first phase of this project, completed in December 2018, evaluated the water quality feasibility of using the B&H Excavation Site for recharging between 2 and 4 MGD of reclaimed water from the SRWRF to benefit Blue Spring. In 2020 and 2021 Volusia County led a hydraulic load testing study. The results of this test showed the site would not recharge as much water as anticipated. Despite the field data testing results, the County continues to believe a holistic water quality and water supply approach will be the most financially sustainable over generations. The County will continue to evaluate this site and consider other multi-beneficial projects as opportunities and challenges present themselves.

2.3.4 Fisher Plant Decommissioning

Volusia County and the City of Deltona are looking into joint planning to determine operational and financial feasibility of constructing a wastewater force main extension from the City of Deltona's Deltona Lakes WRF (the Fisher Road facility) along Dirksen Road to connect to the County system, thereby allowing for the decommissioning of the aging Fisher plant. The feasibility analysis would also include possible expansion of the County's SRWRF by 1 to 1.5 MGD. Ultimately, the project would produce measurable benefits for the Volusia Blue Spring and Gemini Springs TMDLs, as a new force main along Dirksen Road would provide necessary infrastructure to reach the communities nearest to the spring.

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3 RESTORATION OPTIONS

This Chapter reviews different centralized collection system and de-centralized enhanced nitrogen treatment septic remediation alternatives as restoration options for the project area. Chapter 6 presents the cost analyses conducted to determine affordable improvements and efficient implementation sequencing.

3.1 CENTRALIZED COLLECTION SYSTEM ALTERNATIVES

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 grinder pump, vacuum collection, and gravity collection systems.

3.1.1 LOW-PRESSURE (GRINDER PUMP SYSTEMS)

Figure 3-1 shows a typical grinder pump system.

Figure 3-1 Grinder Pump System

(Schematic from https://eone.com/sewer-systems/brochures.)

Grinder pump systems consist of conventional drain, waste, and vent piping within an individual residence connected to an existing conventional septic tank or a packaged grinder pump basin. The sewage gravity flows to the existing septic tank or basin. After a given volume of sewage accumulates, the sewage is pumped through a small-diameter force main to a transfer lift station or the WWTP for treatment.

Advantages

- Shallow excavation, which reduces the potential of encountering limerock and groundwater.
- Minimizes community disruptions to street, sidewalks, etc.
- Low infiltration potential.

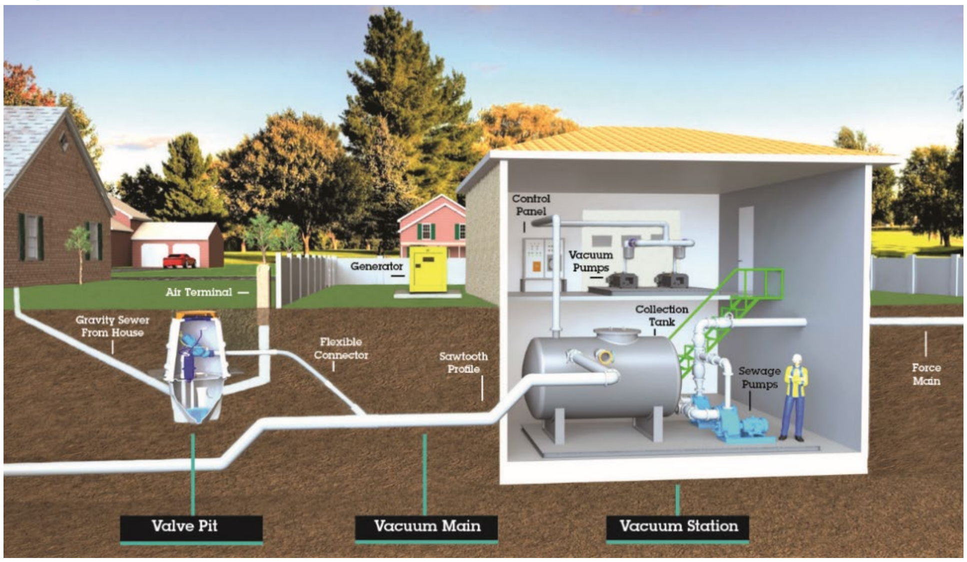
Disadvantages

- May require an easement.
- Requires new power supply to each resident and a dedicated control panel.
- Operation and maintenance (O&M) costs associated with pumps.

3.1.2 Vacuum Collection System

Figure 3-2 shows a typical vacuum sewer system.

Figure 3-2 Vacuum Sewer System



(Schematic from https://www.aqseptence.com/app/en/keybrands/airvac/.)

In a vacuum system, sewage flows by gravity from two to four homes/structures into a valve pit. The valve pit has 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. When the valve opens, the sewage in the pit is "vacuumed" into small-diameter gravity piping (minimum of 4 inches in diameter) to the vacuum collection station. The vacuum collection station collects, stores, and pumps the sewage via pressure through a force main to the WWTP.

Advantages

- Shallow excavation, which reduces the potential of encountering limerock and groundwater.
- Minimizes disruptions to street, sidewalks, etc.
- Valves operate pneumatically so power is not required.

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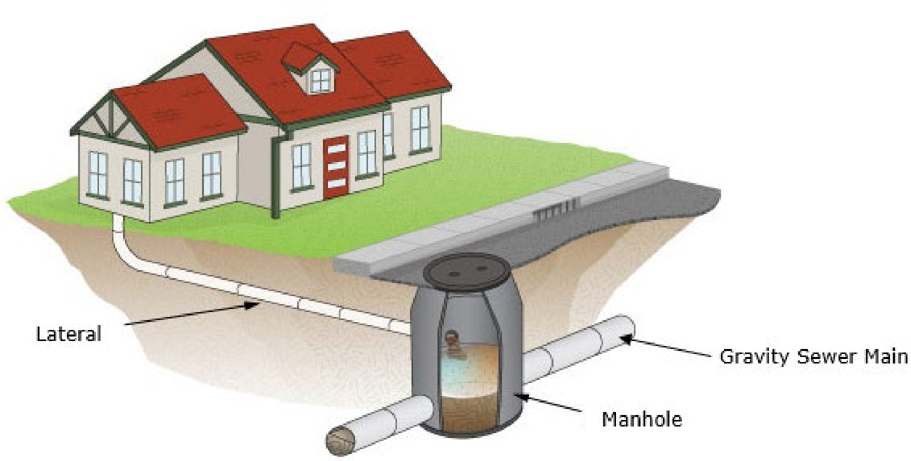
Disadvantages

- Higher O&M costs than gravity sewer.
- Moderate infiltration potential.
- High capital cost for smaller developments.
- More precise construction techniques (sawtooth pattern collection system piping) compared to low-pressure.

3.1.3 Gravity Collection System

Figure 3-3 shows a typical gravity collection system.

Figure 3-3 Gravity Collection System



(Schematic from https://emedia.rmit.edu.au/dlsweb/Toolbox/plumbing/toolbox12_01/units/cpcpdr4001a_sanitary/00_groundwork/page_002.htm.)

Gravity collection systems are a common and traditional method to collect wastewater for public utilities. Sewage flows by gravity from the home through 4-inch sloped service lateral pipes to the gravity sewer mains. Gravity sewer mains are typically 8-inch diameter and larger. Manholes are typically required every 400 feet, at each main intersection, and at changes in flow direction. The network of gravity sewer mains and manholes is considered the gravity collection system. The gravity collection system typically conveys sewage to a transfer lift station that pumps the sewage under pressure to the WWTP for treatment.

Advantages

- Lowest O&M cost.
- Highest long-term reliability.
- Homeowner easements not needed.

Disadvantages

- High capital cost for retrofitting existing neighborhoods.
- Deeper excavations typically required.
- High community disruptions to streets, sidewalks, etc.
- Higher infiltration potential.

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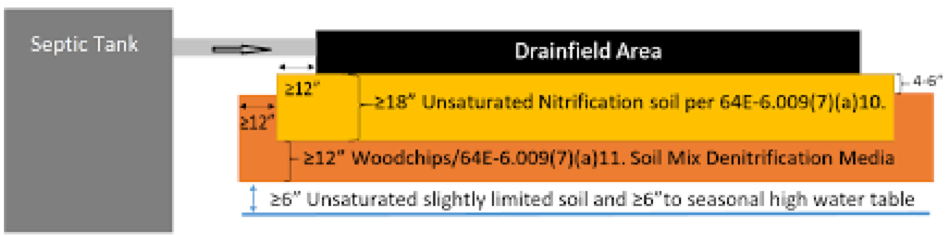
3.2 Enhanced Treatment of Nitrogen Onsite System Alternatives

FDOH has identified allowable enhancements to OSTDS/septic systems that will provide adequate nitrogen-removal rates in accordance with NSF/American National Standards Institute (ANSI) 245: Nitrogen Reduction. That standard covers residential wastewater treatment systems with rated capacities between 400 and 1,500 GPD. Minimum nitrogen reduction of 50 percent must be achieved. Options that provide for the repair, upgrade, or replacement of an existing OSTDS to meet nitrogen-removal requirements include in-ground nitrogen-reducing biofilters, nitrogen-reducing aerobic treatment units (ATUs), and performance-based treatment systems (PBTS).

3.2.1 In-Ground Nitrogen-Reducing Biofilter

Figure 3-4 shows an in-ground nitrogen-reducing biofilter.

Figure 3-4 In-Ground Nitrogen-Reducing Biofilter



(Schematic from https://www.flera.org.)

The in-ground nitrogen-reducing biofilter option is a passive system, which includes a denitrification layer under 18 inches of sand fill, all under the drainfield area. The denitrification layer is made up of a mixture of fine aggregate –coarse sandy loam, sandy loam, loamy sand, fine sandy loam, very fine sand, loamy fine sand, or loamy very fine sand and a lignocellulosic material, chips or shavings of untreated lumber, blended urban waste wood mulch, yellow pine sawdust, 2- to 3-inch wood chips, or other material demonstrated to be effective at denitrification. The denitrification layer is not less than 12 inches thick, extends 12 inches beyond the perimeter of the drainfield, and wraps 12 inches upward. Additionally, the denitrification layer bottom must be 6 inches above the seasonal high groundwater table. During construction, the denitrification layer must be inspected. The denitrification layer requires special repair and maintenance procedures. The denitrification layer must be tested for performance 10 years after installation to determine if media replacement is warranted. These systems are estimated to achieve 65-percent nitrogen removal.

Advantages

- Treatment occurs on site without the need for a centralized sewer.
- Can be used in conjunction with existing septic tank.
- Potential additional funding may be available.

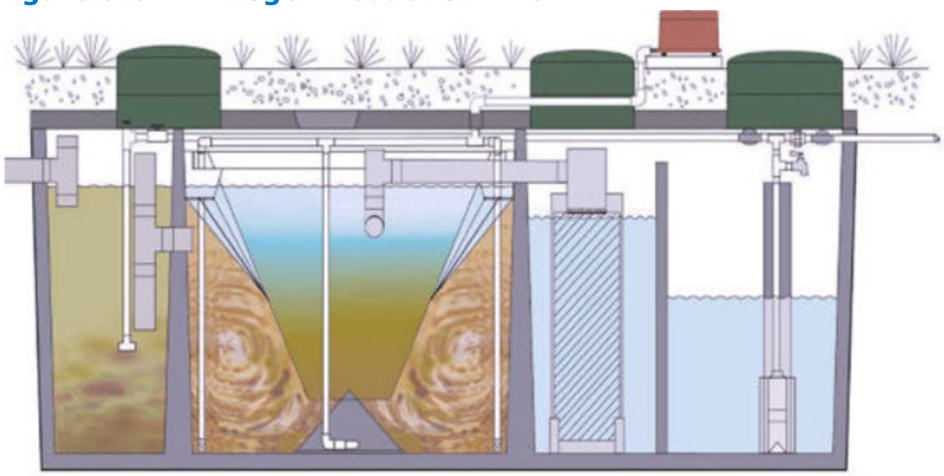
Disadvantages

- O&M requirements for homeowners.
- Limited application due to groundwater clearance requirements.
- Requires more space than a conventional septic system.

3.2.2 Nitrogen-Reducing ATU

Figure 3-5 shows a nitrogen reduction ATU.

Figure 3-5 Nitrogen Reduction ATU



(Schematic from https://floridaonsitesystemsanddesign.com/hoot-nitrogen-reduction/.)

The ATU system is more efficient at processing waste than a conventional septic tank and drainfield. It works by reducing the amount of biological material entering the drainfield. The nitrogen-reducing ATU systems typically involve biological denitrification processes such as mixed biomass using suspended growth, fixed film, or an unsaturated media filter or two-stage segregated biomass. In both processes, treatment is accomplished by bacteria respiration. In the mixed biomass process, recirculation with fresh incoming wastewater is essential for continuous denitrification. The two-stage segregated biomass process requires external carbon or chemical addition. All ATU systems typically consist of a pump, pipes, and diffusers. These systems require a maintenance contract and operating permit from the County health department. Effluent quality laboratory samples are required to be submitted by the maintenance entity every 6 months for residential systems and every 3 months for commercial systems, along with an inspection/maintenance report. FDOH annually inspects the maintenance and performance of the system. These systems are estimated to achieve 65-percent nitrogen removal.

Advantages

- Treatment occurs on site without the need for a centralized sewer.
- Potential additional funding may be available.

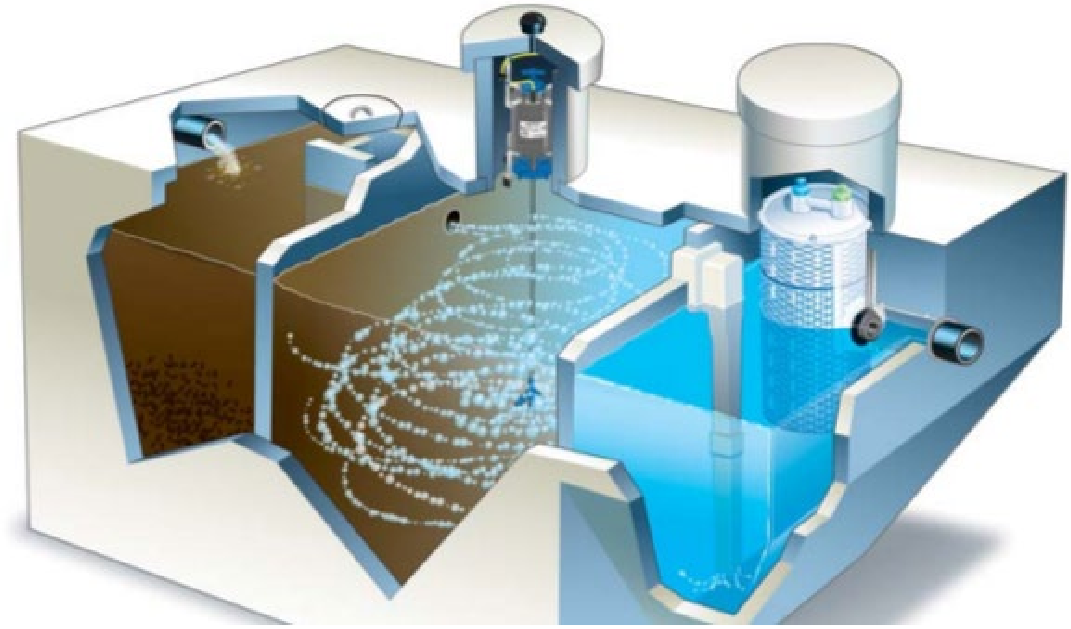
Disadvantages

- O&M requirements for homeowners.

3.2.3 Performance-Based Treatment System

Figure 3-6 shows a PBTS.

Figure 3-6 Performance-Based Treatment System



(Schematic from https://www.norweco.com/wp-content/uploads/2018/10/TNT_Flyer.pdf.)

The PBTS can include a nitrogen reducing ATU and other components. For example, they may include tanks that percolate effluent down through a medium such as peat moss or synthetic material or chlorinator/dechlorinators, ultraviolet (UV) lights, and/or effluent recirculation. They must be engineer-designed and require an approved maintenance contract and operating permit from the County health department. Effluent quality laboratory samples are required to be submitted by the maintenance entity every 6 months for residential systems and every 3 months for commercial systems, along with an inspection/maintenance report. Different sample levels are required based on the type of PBTS and the specific site conditions. The health department annually inspects the maintenance and performance of the system. These systems are estimated to achieve 65- to 90-percent or more nitrogen removal.

Advantages

- Treatment occurs on site without the need for a centralized sewer.
- Potential additional funding may be available.

Disadvantages

- O&M requirements for homeowners.

3.2.4 Distributed Wastewater Treatment System (DWTS)

Figure 3-7 shows an OnSyte DWTS.

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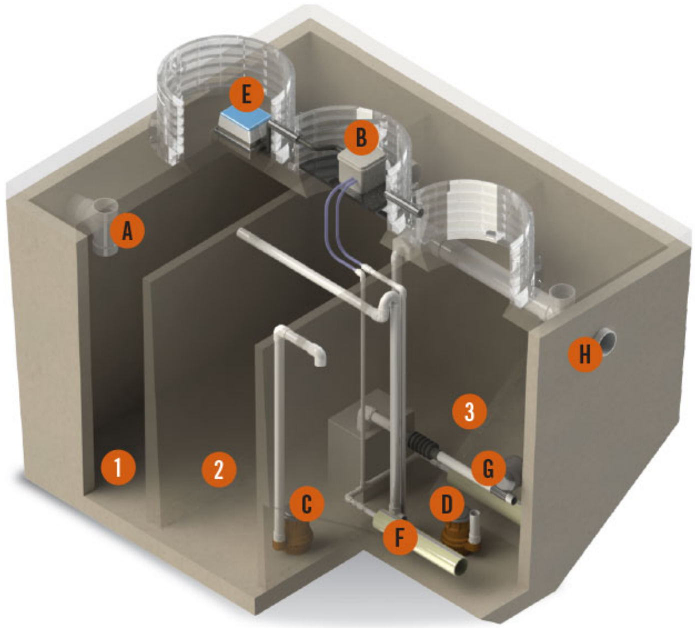
Figure 3-7 Distributed Wastewater Treatment System



1: Sewage enters the Separation Chamber **(1)** from the Inlet **(A)** – primary treatment occurs.

2: Sewage gravity flows into the Dosing Chamber **(2)** – secondary settling occurs.

3: The controller **(B)** determines an appropriate batch size and transfers the selected volume to the Reaction Chamber **(3)**, via a transfer pump **(C)** – Mix-Fill occurs.

4: The air blower **(E)** initiates aeration via twin fine air diffusers **(F)** – Reaction Occurs.

5: Following Settling, Decanting occurs **(G)** – discharging the supernatant through the outlet **(H).**

(Schematic from http://onsyte.com/residential-wastewater-treatment-system/.)

A DWTS is a new category of wastewater treatment system involving centrally managed, decentralized treatment technology that was recently approved by FDEP. Decentralized wastewater treatment is provided by individual distributed wastewater treatment units (DWTUs), which are installed at the point of generation (i.e., individual homes). These DWTUs are virtually connected to the utility using existing wireless data networks and a central management system such as a supervisory control and data acquisition [SCADA] system). In this configuration, the DWTS functions like a public wastewater collection and treatment system but without the physical sewer connection to each end user. These DWTS networks will be permittable for up to 100,000 GPD of total combined flow.

Advantages

- 80 to 90 percent removal of nitrogen (equivalent to secondary wastewater treatment processes).
- Treatment occurs on site without the need for a centralized sewer.
- Potential additional funding may be available.

Disadvantages

- Treatment and water-quality monitoring requirements for utility.
- Higher O&M costs for utility.

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4 PUBLIC EDUCATION PLAN AND PUBLIC INPUT

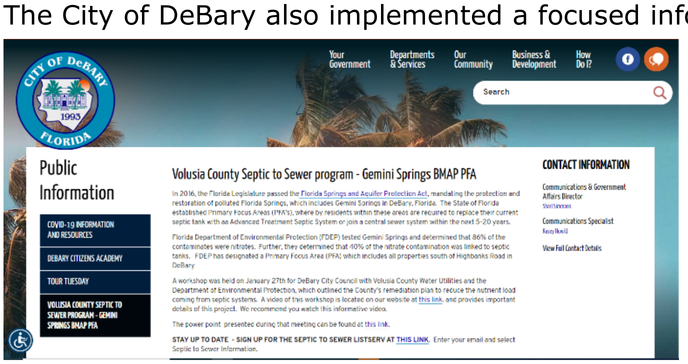
The public education plan for the Gemini Springs FAR, which was delayed due to the impact of COVID-19, included a series of meetings with elected officials and the public.

The PFA for Gemini Springs is entirely within the city limits of the City of DeBary. WRU worked closely with the DeBary City Manager to engage the DeBary City Council and residents of the impacted area to provide information and education sessions regarding the requirements of the 2016 Florida Springs and Aquifer Protection Act.

On January 27, 2021, a presentation was made to the DeBary City Council to provide an overview of the requirements of the 2016 Florida Springs and Aquifer Protection Act and FDEP’s expectations associated with the Gemini Springs FAR. Participants presenting to the Council included representatives from WRU, the County’s Consultant (Jones Edmunds), and virtual participation from Moira Hamann and Kevin Coyne from FDEP. Appendix A includes a copy of the presentation. This meeting was also publicly broadcast. City Council members came to a greater understanding of the potential financial impact of the advanced septic systems and provided direction to evaluate all lots of less than 1 acre in the PFA for connection to the County’s centralized wastewater system as the City does not have a utility.

On February 24, 2021, two socially distanced public outreach sessions were conducted to provide information and education to the public. Impacted residents were noticed of these meetings through direct mail, and meeting notices were published on the City’s website. Members of the public were asked to pre-register for the event to maintain a safe environment. The presentation to the public included representatives from the City, WRU, Jones Edmunds, and the Volusia County Department of Health. Once the members of the public had the opportunity to hear the presentation and ask questions, they were invited to fill out a survey to obtain feedback on the issues, concerns, and questions they had about the project. A recording of the public presentation, the presentation document, and the survey are all available on the City’s website for additional input by anyone not able to attend the meetings in person. Seventeen surveys were received.

The City of DeBary also implemented a focused information campaign to make sure residents were aware of the public meeting opportunities and to keep the community up to date on the plans for septic-to-sewer projects. The City website includes a dedicated page that allows residents to sign up for notifications on septic-to-sewer information and provides easy access to



the TMDL and BMAP reports. A map is also available that residents can view, which lets them determine if they are in an impacted project area. Additionally, the City maintains a page of answers to frequently asked questions concerning this program and a dedicated email (sewer@debary.org).

Surveys were available for public feedback at in-person meetings and online. The survey consisted of nine questions and a comment section. The intent of the survey was to gain insight into the public's knowledge and concerns relating to the requirements associated with the 2016 Florida Springs and Aquifer Protection Act and OSTDSs. Generally, the public surveyed thought that:

- Septic systems are a problem, as well as other sources of nutrient loading such as farm and lawn/turf grass fertilizer.
- Centralized sewer was preferable to decentralized sewer.
- More information is desired about which homes will be impacted and the associated costs.
- Cost is the biggest concern in progressing.

Appendix A provides a copy of the survey, a summary of the survey results, and a copy of all surveys submitted.

The final public outreach events were presentations of the results of the study (including the public outreach activities) to the DeBary City Council and separately to the Volusia County Council. Members of the public were given an opportunity to speak on this subject. Appendix A also includes minutes from the meetings.

76%

76% of respondents feel very or somewhat strongly about protecting the water quality of Gemini Springs

93%

Over 93% of respondents preferred centralized wastewater treatment systems over decentralized wastewater treatment systems

5 POPULATION, WASTEWATER FLOW, AND NUTRIENT LOADING ESTIMATES

This Chapter presents a review of current and projected population growth over a 20-year period of interest, estimated flow projections over the period of interest, and the modeling results of septic tank nutrient discharges in the PFA. Population growth and nutrient loading metrics are presented for the PFA, which represents the area of the Gemini Springs basin where the aquifer is most vulnerable to inputs and where the most connections exist between groundwater and the springs.

Available data from the US Census Bureau, the Volusia County Property Appraiser, SJRWMD, FDEP, and the University of Florida's BEBR were used to develop detailed population estimates, wastewater flow estimates, and nitrogen discharges for present day and buildout scenarios. Septic tank nitrate discharges were estimated using the FDEP NSILT tool.

5.1 Current Population, Wastewater Flow, and Septic Tank-Based Nitrogen-Loading Estimates

Current population estimates were based on a combination of US Census Bureau and BEBR population data. The closest US Census Bureau data are available for the City of DeBary, a city of approximately 20,000 people; the Gemini Springs PFA is wholly within the city limits of DeBary. To further refine the Gemini Springs PFA population, 2,976 residential units within the PFA boundary were identified through the Volusia County Property Appraiser and multiplied by the BEBR estimate of average persons per household (PPH) in Volusia County (2.38). This yielded a current estimated residential population of 7,083 people in the Gemini Springs PFA.

Wastewater flows from the current residential population were estimated based on a combination of existing potable water use data, tax parcel data, and average household size to be 164 GPD average daily flow (ADF) per equivalent residential unit. This amount equates to 68.91 gallons per capita per day (GPCD) and a total projected residential wastewater flow of 0.488 MGD.

Current non-residential wastewater flows were estimated based on parcel data from the Volusia County Property Appraiser and provisions of FDOH Chapter 64-E6, Florida Administrative Code, *Standards for Onsite Sewage Treatment and Disposal Systems*. Non-vacant commercial, industrial, and institutional parcels were identified and based on Department of Revenue use code estimated wastewater flows from each parcel were calculated on a maximum daily flow (MDF) basis. Based on known daily wastewater flow data at the SRWRF, an MDF:ADF factor of 1.3 was applied to the flow to achieve ADF for consistency with residential flow estimates. The total current non-residential wastewater flows within the Gemini Spring PFA were estimated to be 164,000 GPD ADF. Appendix B contains detailed non-residential wastewater flow assumptions.

Nitrogen loads from OSTDSs within Gemini PFA and BMAP were calculated using FDEP's GIS- and spreadsheet-based NSILT tool and the following formula:

$$L = N * P * I * (1 - D) * R$$

Where:

- L is the total nitrogen load reaching the UFA.
- N is the number of OSTDSs in the springshed.
- P is the number of PPH.
- I is the per capita nitrogen load.
- D is the soil attenuation rate.
- R is the Floridan aquifer recharge factor.

The number of OSTDSs were obtained from the FLWMI database for Volusia County. The FLWMI database provides information on which parcels have known septic or sewer, are likely or somewhat likely to have septic or sewer, or their status is unknown. Only those parcels with known, likely, or somewhat likely septic designations were considered and the N for those parcels was 1. If residential properties, those with DOR codes 001-008, were identified by the Volusia County Property Appraiser as having multiple residential units, then those N values were multiplied by the number of residential units to account for larger potential wastewater flows.

The PPH was obtained from BEBR estimates for Volusia County and is estimated to be 2.38. However, the FDEP February 2017 report, *Nitrogen Source Inventory and Loading Estimates for the Volusia Blue Spring and Volusia Blue Spring Run Contributing Area,* notes that many people with a home septic system most likely have access to a facility connected to a sewer system or non-residential septic system during their weekly routine (i.e., work, school, etc.), which thereby reduces nitrogen inputs to their home septic system. To account for this difference, population age information was obtained for the Volusia Blue report from the 2010 census; in Volusia County, 61.1 percent of the population is of school or working age and, according to the Bureau of Labor Statistics, spend 43.5 hours (or 25.9 percent) of the week away from home. Applying these values, the effective household population in Volusia County is reduced by 15.8 percent, yielding an adjusted P of 2.00 for all residential parcels.

An equivalent PPH was also calculated for non-residential properties. Wastewater flow estimates for each non-residential parcel were calculated above and divided by the per capita wastewater estimate for Volusia County, 68.91 GPCD ADF, to achieve an equivalency. These values were used as P for non-residential properties.

Multiple literature sources, including the US Environmental Protection Agency, have reported the per capita nitrogen load to OSTDS as 9.012 pounds of nitrogen per year. This value was used for I.

The soil attenuation rate accounts for natural nitrogen removal in the soil profile and varies throughout Volusia County, with literature values ranging from 10 to 50 percent. The value used by FDEP for all NSILT analyses is 50 percent; therefore, a value of 0.5 was used for D.

The Floridan aquifer recharge factor is based on the recharge rates at each septic tank location, accounting for reactive nitrogen losses along the travel path to and from the

OSTDS to the UFA. SJRWMD developed a UFA Recharge assessment in 2015, detailed in *Publication No. SJ2016-FSI*, which identifies areas of high, medium, and low recharge and discharge. High recharge, greater than or equal to 10 inches per year, would indicate low nitrogen attenuation and is assigned an R factor of 0.9. Medium recharge, 3 to 10 inches per year, is assigned an R factor of 0.5, and low recharge, 0 to 3 inches per year, is assigned an R factor of 0.1. Areas identified as discharge zones are presumed to be areas where the UFA is artesian (upward potentiometric gradient), indicating no net nitrogen loading to the aquifer; these were assigned an R factor of 0. Over 300 parcels reviewed for this assessment fit into multiple recharge zones, but the FLWMI data do not indicate the location of an OSTDS, just the parcel it is on. Therefore, R factors for these parcels were calculated based on a weighted average – using area of parcel within each area of recharge – to achieve a single R factor for each.

Each value was input into the above formula to achieve a final L. The estimated nitrogen loading from all OSTDS in the Gemini Springs PFA is 20,177 pounds of nitrogen per year.

5.2 Buildout Population and Wastewater Flow

Projected population growth was calculated in 5-year increments from 2020 to 2040. Table 5-1 shows low, medium, and high BEBR estimated growth rates for overall Volusia County population growth through 2045. The medium growth rate was selected for use in this assessment because it most closely resembles historic growth rates in Volusia County.

Table 5-1 BEBR Population Growth Projections for Volusia County

Volusia County[1]	2020	2025	2030	2035	2040	2045
Low	527,100	542,000	552,400	559,900	565,000	568,200
Medium	544,100	571,700	594,300	613,600	629,900	644,600
High	559,700	602,500	642,900	680,600	715,800	748,800

[1]Growth projections based on Volusia County 2019 population estimate of 531,062.

Table 5-2 shows residential population growth projected through 2040 based on the selected medium BEBR growth rate. The table includes projected potential wastewater flows from the population estimates based on 68.91 GPCD.

Table 5-2 Projected Residential Population and Wastewater Flows

Gemini PFA	2019 Estimate	2020 Projection	2025 Projection	2030 Projection	2035 Projection	2040 Projection
Residential Population	7,083	7,168	7,514	7,800	8,045	8,253
Wastewater Flows (MGD)	0.488	0.494	0.518	0.538	0.554	0.569

Non-residential wastewater flows were projected based on the same presumed rate of growth as the residential wastewater flows. Table 5-3 shows, for ease of calculations, that non-residential demand was converted to an equivalency based on GPCD. This equivalency was projected at the selected BEBR growth rate through 2040 and projected wastewater flows were calculated based on the equivalency and the established GPCD.

Table 5-3 Projected Non-Residential Population and Wastewater Flows

Gemini PFA	2019 Estimate	2020 Projection	2025 Projection	2030 Projection	2035 Projection	2040 Projection
Population Equivalency	2,380	2,409	2,525	2,621	2,703	2,773
Wastewater Flows (MGD)	0.164	0.166	0.174	0.181	0.186	0.191

6 RESTORATION PROJECT IDENTIFICATION, PRIORITIZATION, AND IMPLEMENTATION

This Chapter details the development of OSTDS remediation priority project areas (PPAs), PPA prioritization, and project implementation. Initial project recommendations, nutrient load reduction estimates, and construction cost estimates are provided for each PPA to facilitate project prioritization.

6.1 PROJECT AREA IDENTIFICATION

Figure 6-1 shows three PPAs, which have been identified as the primary areas of focus for specific OSTDS remediation projects. These areas were developed based on OSTDS density, proximity to existing infrastructure, development potential, and stakeholder input. Table 6-1 lists the PPA name, total number of lots, estimated number of lots with septic systems, and recommended OSTDS remediation project. The number of lots is from the Volusia County Property Appraiser and the number of septic systems is from the FLWMI database based on parcel attributes of *known septic*, *likely septic*, and *somewhat likely septic*.

Within each project area, multiple OSTDS remediation strategies were evaluated: gravity sewer, low pressure, vacuum sewer, and enhanced OSTDS. Evaluation of these options was based on proximity to existing centralized sewer, average lot sizes, lot elevations, and project costs. The recommended OSTDS remediation strategy for all three PPAs is vacuum sewer. The community made it clear that it preferred a centralized approach instead of requiring each resident to tackle this challenge alone. Based on the estimated construction costs and lower resident impacts during construction, vacuum sewer was selected as the preferred retrofit option.

Jones Edmunds developed an Engineer's Opinion of Probable Construction Cost (EOPCC) for each PPA based on a conceptual layout of the proposed wastewater infrastructure. This cost opinion includes sitework, mobilization/demobilization, maintenance of traffic, dewatering, and performance bonding. EOPCCs also include the costs of abandoning the existing septic tanks and constructing on-lot connections. These cost opinions do not include the use of capitalized interest, inflation, or contingencies.

The EOPCC's accuracy range depends on the level of design completed according to the Association for the Advancement of Cost Engineering International's *Cost Estimate Classification System (Recommended Practice No. 18R-97)*. The classifications depend on the level of project definition, with Class 1 being the highest level of definition and Class 5 being the lowest level of definition. A conceptual design for each project is defined as Class 5, with a range of accuracy of -30 to +50 percent. Table 6-2 presents the EOPCC, which was developed as a budgetary opinion of probable cost for each option.

An NSILT analysis was also performed for the PPAs to determine the estimated nitrogen loading to be removed. The total nitrogen load reduction through the implementation of all three PPAs is expected to be roughly 18,482 pounds TN per year.

Figure 6-1 Gemini Springs PPAs

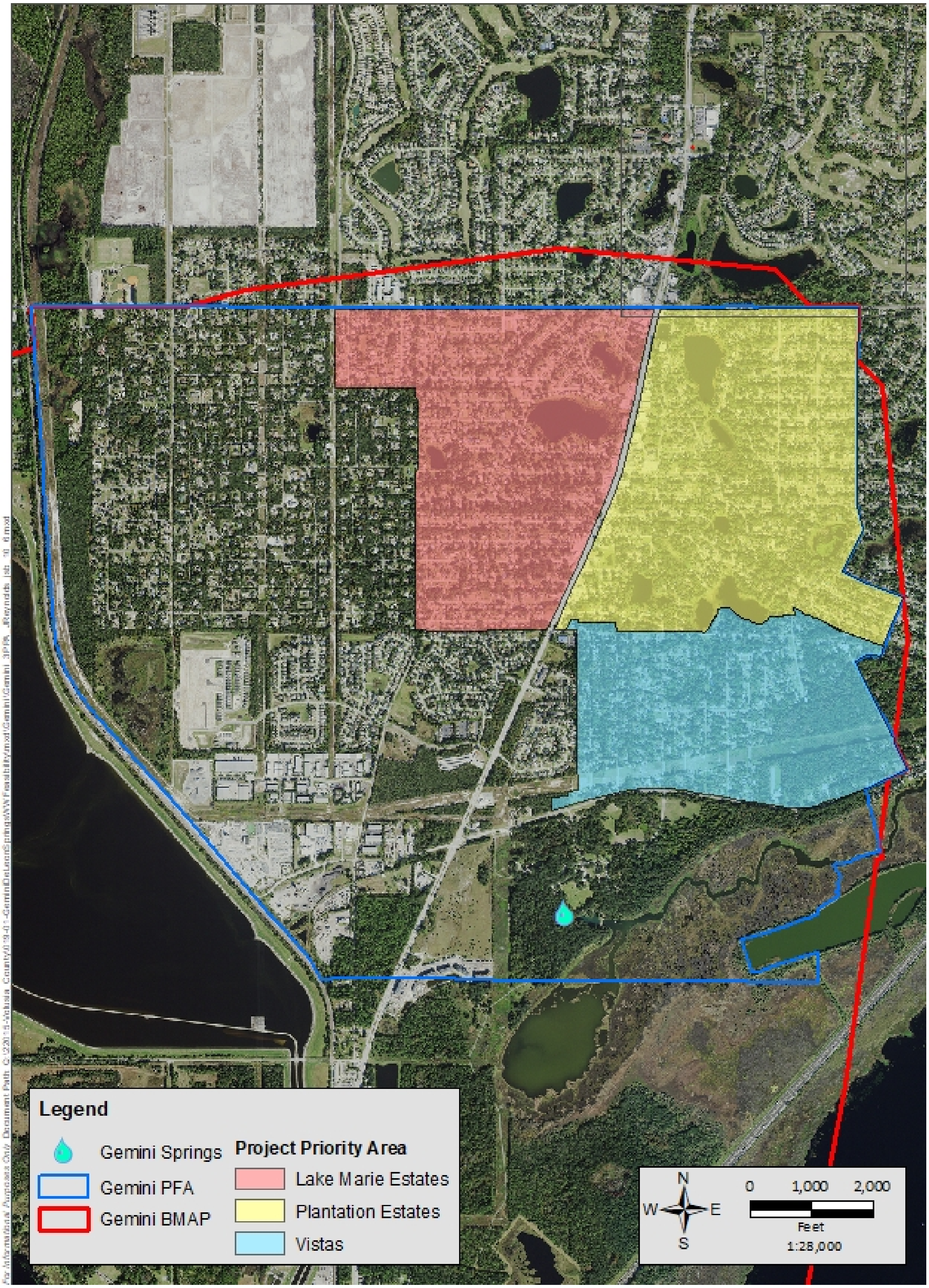


Table 6-1 Priority Project Areas

Project Area	# Lots	# Septic Lots	Recommended System Type
Lake Marie Estates	863	788	Vacuum
Plantation Estates	949	796	Vacuum
Vistas	695	396	Vacuum

Table 6-2 EOPCC

Project Area	# Lots	# Septic Lots	Cost/Lot ($)	Cost/Septic ($)	Total Project Cost ($)	-30% ($)	50% ($)
Lake Marie Estates	863	788	22,596	24,746	19,500,000	13,650,000	29,250,000
Plantation Estates	949	796	21,075	25,126	20,000,000	14,000,000	30,000,000
Vistas	695	396	20,863	36,616	14,500,000	10,150,000	21,750,000

6.2 Project Area Prioritization

Based on discussions during the community workshops and meetings with both City of DeBary and Volusia County staff, we understand that the community's goal is to introduce a centralized sewer system for all parcels less than 1 acre currently served by septic tanks inside the PFA. The community is ready to initiate this project as quickly as it can be funded to mitigate residents investing in septic tank upgrades or maintenance projects only to have their tank abandoned within several years. Based on this guidance, we are recommending all the lots be placed into a rolling 5-year plan. The rolling 5-year plan will allow the community to complete this project in an efficient manner in the first 5 years that grant or legislative funding is available.

The community is pleased that this project will satisfy the septic tank nitrogen loading reduction requirements in the BMAP and provide the residents with a sustainable long-term wastewater system. In coordination with County staff and City leadership, we concluded the Lake Marie Estates PPA should be the top-ranked area since this PPA is located nearest to the County's existing wastewater transmission system.

7 FUNDING AND FINANCE (PROVIDED BY RAFTELIS)

One objective of the Gemini Springs FAR is to develop a realistic funding strategy that apportions just, equitable, and affordable costs to property owners while not having an adverse effect on existing WRU ratepayers. This Chapter develops a funding plan and roadmap based on the County's service area characteristics. The constraints of this goal include uncertainty of outside funding sources, construction cost schedules, and public acceptance.

7.1 AFFORDABILITY

The water industry has made various attempts to define the concept of affordability. The industry literature generally links water and sewer bills to median household income (MHI). Although this is an imperfect method, a framework is provided from which judging the cost of providing water and sewer service can begin. When discussing affordability, other factors to be considered are income, property value, local cost of living, and economic conditions.

The industry literature on affordability has historically calculated the water and sewer bill as a percentage of local MHI statistics. This methodology standardizes affordability comparisons across regions and gauges a utility's "all-in" costs to ratepayers. The all-in utility payments described herein include monthly water and sewer service bills, property assessments, and other methods used to collect utility revenues. For water and sewer services, the benchmark for affordability has historically been set at 4.5 percent of MHI. For Gemini Springs, various MHI geographic measures could be used including the City of DeBary, the entire Volusia County, or census tract data more local to Gemini Springs. Table 7-1 summarizes the 2019 MHI for these various geographic areas:

Table 7-1 2019 Median Household Income Statistics

Description[1]	Volusia County	City of DeBary	Census Tract 909.02	Census Tract 909.04
Median Household Income	$49,494	$65,316	$59,575	$69,590

[1] 2019 data obtained from US Census Bureau's data.census.gov

As indicated above, at least two census tracts include properties within Gemini Springs: Census Tracts 909.02 and 909.04. The MHI for these two areas varies substantially, ranging from $59,575 and $69,590. Both census tract MHI's exceed the overall County MHI of $49,494; therefore, the County amounts were used for the affordability analysis to be conservative.

Applying the affordability benchmark of 4.5 percent to the County MHI yields $186 in monthly payments ($2,227 annually) as an upper limit affordability target. The water and sewer monthly utility bill, under the County's unsoftened rates, of $74 (approximately $26 for water and $48 for sewer) assuming a residential customer using 5,000 gallons, results in a maximum of $112 per month remaining for sewer assessments and other direct property owner contribution. As noted further in this Chapter, the prospective assessment to property owners is well below this maximum target.

Other factors that should be considered in this affordability discussion include:

- **Property Value:** Central sewer adds value not only to developed properties but to undeveloped properties as well. In certain situations, septic tank development within neighborhoods can be limited based on proximity to potable drinking water wells on adjacent lots. These limitations inhibit the ability to construct on these lots and can essentially render them undevelopable, severely reducing the properties' values. Central sewer eliminates these limitations, and property values across the neighborhood are increased.
- **Septic Tank Maintenance:** Another consideration is the cost avoidance from owning and operating a septic tank and alleviating risks associated with a septic tank failure. Septic tanks have a limited lifespan and can be costly to repair or replace, especially when compared to the MHI levels established above.
- **Environmental Implications:** One other primary factor to consider is the future environmental implications from the current level of septic tanks and the additional septic tanks from future development. With a growing population and an already strained natural waterway system, WRU will only be able to manage growth and future wastewater treatment by making central sewer available.

7.2 Sewer System Costs

This section summarizes the current value costs of constructing sewer systems for the three PPAs recommended for the Gemini Springs PFA. The cost to develop the new sewer collection system in 2021 dollars is approximately $54 million (excluding transmission system costs). As shown below, the analysis of these three PPAs include 2,508 lots. The analysis assumes 77 percent, or 1,935 of those lots, have OSTDS. Table 7-2 provides the cost and lot breakdown for the three recommended PFAs.

Table 7-2 Recommended PPAs and Project Costs

PPA	Lots	OSTDS	Project Costs (w/out Transmission)
Lake Marie Estates	864	787	$19,500,000
Plantation Estates	950	755	$20,000,000
Vistas	694	393	$14,500,000
Totals	**2,508**	**1,935**	**$54,000,000**

7.3 Funding Options

Funding for central sewer includes two elements: 1) the funding of infrastructure improvements and associated planning, design, and project management, and 2) the methods by which any borrowed funds for such infrastructure are repaid by property owners, end users, and/or other future revenue streams. The funding sources for the former include loans, bonds, grants, taxes, etc., and the latter includes the assessments, loan installments, and rates that support the repayment of debt obligations. This section discusses several funding sources starting with the infrastructure funding and followed by the future revenue streams to support debt repayment.

7.3.1 State Appropriation Funds and Grants

The State Legislature and the Governor's Office have had significant interest in the impact of septic tanks on the State's sensitive water bodies such as Gemini Springs. FDEP recognizes the financial magnitude of the septic-to-sewer need in Florida and the support that will be required to address this issue throughout the State. To assist local government in progressing septic-to-sewer programs, the State has dedicated funding from state and federal resources toward the elimination of septic tanks. With proactive lobbying efforts, the City of DeBary and Volusia County could take advantage of grant dollars to mitigate the cost of septic-to-sewer projects.

State and federal bodies such as water management districts, FDEP, the US Environmental Protection Agency (EPA), the US Department of Agriculture (USDA), and other agencies will often sponsor programs that include grants or loan forgiveness elements that do not require repayment. Although repayment is not required with grant programs, the City and County may still experience a certain level of administrative and other costs pursuing and executing grants.

7.3.2 State Revolving Fund (SRF) Loans

FDEP administers the Clean Water State Revolving Fund (CWSRF) loan program for financing public sewer utility infrastructure projects. The SRF financing rate for clean water projects is determined using a formula that includes the Bond Buyer 20-Bond GO Index average market rate[1]. In June 2021, the CWSRF annual average rate was as low as 0.02 percent, depending on census tract and other SRF affordability indices. This current level of interest is almost cost-free, but SRF loan repayment terms are typically limited to 20 years or less. Also, the principal and interest payments cannot be tailored around the issuer's existing debt service structure to level overall debt payments. SRF loan agreements require that rates be sufficient to provide for at least a 1.15 annual debt service coverage.

7.3.3 Bonds

The traditional method for utilities to finance infrastructure programs is to issue revenue bonds. Public utilities typically issue tax-exempt revenue bonds that provide tax savings for investors and thus attract lower interest rates than conventional bonds that are subject to income taxes from the investor. The term *revenue bond* is used since the primary pledge of repayment is a revenue stream associated with the infrastructure improvements. The interest rate on revenue bonds can vary depending on the issuer's credit rating, bond maturity structure, economic conditions, and other factors. Since the interest rate is typically substantially higher than SRF loans, the advantage to revenue bonds is the

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[1] FDEP. 2021. CWSRF Program. Accessed at: https://floridadep.gov/wra/srf/content/cwsrf-program. The clean water SRF Financing Rate Formula is:

$$FR = MR - 4 + (4/(1+(100/AI)3)) - 1/Log(P)$$

Where: FR = Financing Rate.
MR = Market Rate.
AI = Affordability Index.
P = Population served or to be served by the sponsor.

repayment structure can be tailored to meet the utilities' short- and long-term needs and existing debt repayment structure. A drawback of revenues bonds are the issuance costs associated with the bonds. Management, legal, financial, consulting, and engineering fees, along with other issuance costs inherent in this type of debt, generally increase the issuer's costs. Unlike SRF loans, which are 2-percent of the total loan amount, issuance costs on revenue bonds can vary depending on the costs mentioned above.

7.3.4 Sales Tax

Pursuant to Section 212.055 of the Florida Statute (FS), the governing authority in each Florida county may levy a discretionary sales surtax of 0.5 or 1 percent to fund infrastructure projects, contingent on a successful referendum. Proceeds from the discretionary sales tax may be used toward capital outlays associated with construction, reconstruction, or improvement of public facilities that have a life expectancy of 5 years or more; any related land acquisition, land improvement, design, and engineering costs; and all other professional and related costs required to bring the public facilities into service. In Florida, discretionary sales tax revenue has been used toward utility infrastructure in Sarasota, Hillsborough, Monroe, and Brevard Counties. To date, Volusia County voters have not approved an infrastructure sales tax surcharge; therefore, these funds are not available for the Gemini Springs program.

7.3.5 MSBU/Assessment on Septic-to-Sewer Properties

Due to the localized nature of the costs and benefits of central sewer installation, local governing bodies often impose special assessments on the property and typically collect such assessments through the annual tax bill administered through the tax collector's office. The procedure for imposing special assessments in Florida are set forth in Chapter 197, FS. In addition to public hearing, notification, and other procedural matters, special assessments imposed on a property must meet a two-pronged test: 1) the property must receive a special benefit from the improvement, and 2) the costs of such improvements must be fairly and reasonably apportioned among benefitting properties. Counties typically will establish Municipal Service Benefit Units (MSBU) if special assessments apply to only portions of the county area. The advantages to this approach are that it complies with Florida Statutes as well as it involves an established collection procedure through the local tax collector. Since taxes have the highest priority of payment relative to liens and other claims, the collection rate is significantly high. Offsetting these benefits are the administrative costs of administering the program, developing assessment resolutions, public hearings, and related procedural matters. Statutory early pay discounts of up to 4 percent to property owners are available and need to be built into the assessment calculation so that revenues adequately fund the extension program.

7.3.6 New Septic-to-Sewer Rate Margins

Another funding source from new septic-to-sewer properties is the rate margin. At current rates, the sewer monthly bill is approximately $48, assuming a residential customer using 5,000 gallons. The marginal cost to WRU to serve these customers can be expected to be much lower than this amount. This financial margin could be earmarked to benefit the septic-to-sewer program and support a portion of debt service on septic-to-sewer debt. For example, if the additional operating cost for maintenance and operations for each new septic-to-sewer customer is only $38 per month, then $10 per month of margin would be available for WRU to support the septic-to-sewer program.[2] Financial Forecast and Funding Strategies

A comprehensive septic-to-sewer financing model was developed assuming County ownership and operation of the Gemini sewer projects. This funding model is to evaluate the financial viability of various sewer expansion segments within the County utility system. The financial model provides for input assumptions and projections in terms of level of self-sufficiency under various scenarios. After reviewing a variety of funding strategies, a 5-year plan has been developed based on achievable funding levels that balance property owner affordability with funding sources that match well with the infrastructure costs.

The sewer expansion plan was viewed from WRU's perspective and from the property owner's viewpoint. The major cost to the homeowner is the property owner assessment of $5,000. The proposed assessment amount may be paid up-front, or the fee may be assessed for up to 20 years at a 2.0-percent interest rate. Assuming the property owner takes advantage of the 4-percent early-pay discount, this equates to $317 per year or approximately $26 per month. The cost to vacant lots would defer to such time that development occurs. The County's existing wastewater development fee of $2,936 per equivalent residential connection (ERC) is assumed to be waived and not be charged to the property owner. WRU is exploring grant opportunities to be able to waive these fees.

7.3.7 Five-Year Improvement Plan

The total cost to develop the sewer collection system for the three PFAs at current costs is approximately $54 million (excluding transmission system costs) over the 5-year planning period. To account for inflation, an annual factor of 2.7 percent is applied to the project costs after Year 1. This factor is based on the 5-year historical average annual increase in the Engineering News-Record (ENR) Construction Cost Index. In addition, a 1.0-percent administrative allowance is included to account for WRU staff time on the PFAs. Table 7-3 provides the 5-year project costs for the septic-to-sewer program.

Table 7-3 Five-Year Inflated Project Costs

Year	Collection System Costs			Administrative Costs	Total Project Costs
	Current Dollars	Inflation	Total		
1	$2,400,000	$0	$2,300,000	$23,000	$2,423,000
2	11,600,000	313,200	11,913,200	119,100	12,032,300
3	16,200,000	886,600	17,086,600	170,900	17,257,500
4	16,000,000	1,331,300	17,331,300	173,300	17,504,600
5	7,800,000	877,100	8,677,100	86,800	8,763,900
Total	**$54,000,000**	**$3,408,200**	**$57,308,200**	**$573,100**	**$57,981,300**

[2] For 5,000 gallons, an incremental cost of $38 equates to $7.60 per 1,000 gallons. This incremental cost allowance would include additional electric for pumping and treatment, maintenance, labor, renewal, and replacement reserves. This allowance for incremental cost is above industry experience and therefore allows for a large contingency.

Table 7-3 shows that the total costs for the three PPAs over the 5-year period, including inflation and an administrative cost allowance, are approximately $58 million. The costs associated with the regional transmission system improvements necessary to connect the septic-to-sewer conversion area to the County's WWTP are assumed to be covered by grants and other utility funding sources.

Multiple funding strategies were reviewed for the 5-year sewer improvement plan. The strategy aims to assign just, equitable, and affordable costs to property owners and find an achievable level of outside funding while having no adverse effect on existing WRU ratepayers. The sources of outside funding proposed in the plan include SRF low-interest loans and grants. The proposed plan assumes that grants and/or legislative appropriations will cover 75 percent of the project costs. The remaining amount not funded from grants is funded through SRF loan proceeds administered by FDEP. The SRF loan program would be advantageous to WRU because of the low interest rates currently offered and the program being firmly established in Florida for utilities infrastructure improvements. Table 7-4 summarizes the annual project costs and funding sources for the 5-year sewer improvement plan:

Table 7-4 Five-Year Funding Summary

Description[1]	Year 1	Year 2	Year 3	Year 4	Year 5	Years 1-5 Total
Project Costs	$2.4 M	$12.0 M	$17.3 M	$17.5 M	$8.8 M	$58.0 M
Funding Sources						
Grants	$1.8 M	$9.0 M	$12.9 M	$13.1 M	$6.6 M	$43.5 M
SRF Loan Project Funds	$0.6 M	$3.0 M	$4.3 M	$4.4 M	$2.2 M	$14.5 M
Total	**$2.4 M**	**$12.0 M**	**$17.3 M**	**$17.5 M**	**$8.8 M**	**$58.0 M**

[1] All amounts shown in millions.

Table 7-4 shows that a portion of the project costs are expected to be funded through two SRF loans assumed to be issued by Volusia County.[3] The total new debt borrowed over the 5-year period for the sewer improvement plan is approximately $15 million. Table 7-5 provides the assumptions used for the SRF loan issuances. Each loan covers the remaining project costs (after grants) for a 3-year period.

[3] SRF loans are shown since they are low interest cost; other financing mechanisms such as revenue bonds, Water Infrastructure Finance and Innovation Act, etc. could be substituted for SRF loans with certain adjustments to assumptions regarding interest rates, duration, debt structure, etc. The SRF loan issuances are designed to illustrate the relative timing and sizing of debt.

Table 7-5 Five-Year SRF Loan Issuances

Description	SRF Loan 1 (Years 1 to 3)	SRF Loan 2 (Years 4 to 5)
Construction Reimbursement	$7,903,800	$6,567,500
Loan Costs [1]	162,800	133,900
Capitalized Interest [2]	234,900	127,400
Total Loan Amount	**$8,301,500**	**$6,828,800**
Term (years)	20	20
Interest Rate	2.00%	2.00%
Annual Debt Service	$505,700	$416,000

[1] Loan issuance costs assumed at 2.0 percent of project costs.

[2] SRF Loan 1 reflects 3 years of capitalized interest and SRF Loan 2 reflects 2 years of capitalized interest.

The annual debt service associated with the projected SRF loans is assumed to be repaid through a combination of the financial margin generated from new septic-to-sewer customers and the proposed assessment on septic-to-sewer properties. As discussed above, $10 per month of margin would be available for WRU to support the septic-to-sewer program. In addition, the financial model assumes a non-ad valorem assessment of $5,000 per single-family property. Table 7-6 and Table 7-7 provide the net cash flows to WRU associated with this analysis, considering the annual debt service and revenues generated to support the debt service.

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Table 7-6 Years 1 through 10 Cash Flow and Debt Service Coverage

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Assessment Revenue	$0	$73,500	$290,900	$477,900	$719,000	$719,000	$719,000	$719,000	$719,000	$719,000
Rate Margin	0	0	28,100	109,100	176,900	262,000	262,000	262,000	262,000	262,000
Total Revenue Available for Debt Repayment	$0	$73,500	$319,000	$587,000	$895,900	$981,000	$981,000	$981,000	$981,000	$981,000
SRF Debt Service Payments	$0	$0	$0	$505,700	$505,700	$921,700	$921,700	$921,700	$921,700	$921,700
Surplus/(Deficiency)	$0	$73,500	$319,000	$81,300	$390,200	$59,300	$59,300	$59,300	$59,300	$59,300
Debt Service Coverage	N/A	N/A	N/A	1.16	1.77	1.06	1.06	1.06	1.06	1.06
Available Reserves	$0	$73,500	$392,500	$473,800	$864,000	$923,300	$982,600	$1,041,900	$1,101,200	$1,160,500

Table 7-7 Years 11 through 20 Cash Flow and Debt Service Coverage

Description	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Assessment Revenue	$719,000	$719,000	$719,000	$719,000	$719,000	$719,000	$719,000	$719,000	$719,000	$719,000
Rate Margin	262,000	262,000	262,000	262,000	262,000	262,000	262,000	262,000	262,000	262,000
Total Revenue Available for Debt Repayment	$981,000	$981,000	$981,000	$981,000	$981,000	$981,000	$981,000	$981,000	$981,000	$981,000
SRF Debt Service Payments	$921,700	$921,700	$921,700	$921,700	$921,700	$921,700	$921,700	$921,700	$921,700	$921,700
Surplus/ (Deficiency)	$59,300	$59,300	$59,300	$59,300	$59,300	$59,300	$59,300	$59,300	$59,300	$59,300
Debt Service Coverage	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
Available Reserves	$1,219,800	$1,279,100	$1,338,400	$1,397,700	$1,457,000	$1,516,300	$1,575,600	$1,634,900	$1,694,200	$1,753,500

The financial forecast is based on the following wastewater availability schedule assuming mandatory connections with associated assessments and monthly wastewater charges:

Table 7-8 Five-Year Central Sewer Conversions

Year	New Connections[1]	Cumulative Connections
1	0	0
2	234	234
3	675	909
4	565	1,474
5	709	2,183

[1] Analysis assumes new connections begin paying monthly wastewater charges 1 year after connection (i.e., Year 2 connections pay the monthly wastewater charges in Year 3).

Appendix A

Public Education Plan Materials

(Will be populated following final Council meetings)

Appendix B

Detailed Non-Residential Wastewater Flow Assumptions

Table B-1 Detailed Non-Residential Wastewater Flow Assumptions

DOR UC	Description	Data	Flow Rate	Conversion Factor
10	Vacant Commercial – with/without extra features			
11	Stores, one story	Sum of TOT_LVG_AR	200 per bathroom	2 bathrooms/1,500 square feet (SF)
12	Mixed use – store and office or store and residential combination	Sum of TOT_LVG_AR	200 per bathroom	2 bathrooms/1,500 SF
13	Department Stores	Sum of TOT_LVG_AR	200 per bathroom	2 bathrooms/1,500 SF
16	Community Shopping Centers	Sum of TOT_LVG_AR	0.1 gallons per SF (GPSF)	N/A
17	Office buildings, non-professional service buildings, one story	Sum of TOT_LVG_AR	15 gallons per 100 SF	N/A
18	Office buildings, non-professional service buildings, multi-story	Sum of TOT_LVG_AR	15 gallons per 100 SF	N/A
19	Professional service buildings	Sum of TOT_LVG_AR	15 gallons per 100 SF	N/A
20	Airports (private or commercial), bus terminals, marine terminals, piers, marinas	COUNT_DOR_UC	3 gallons per passenger	N/A
21	Restaurants, cafeterias	Sum of TOT_LVG_AR	40 to 60 gallons per seat	11 to 15 SF/seat
22	Drive-in Restaurants	Sum of TOT_LVG_AR	40 to 60 gallons per seat	11 to 15 SF/seat
23	Financial institutions (banks, saving and loan companies, mortgage companies, credit services)	Sum of TOT_LVG_AR	15 gallons per 100 SF	N/A
25	Repair service shops (excluding automotive), radio and TV repair, refrigeration service, electric repair, laundries, Laundromats	Sum of TOT_LVG_AR	10 gallons per 100 SF	N/A
26	Service stations	COUNT_DOR_UC	200 per bathroom	2 bathrooms
27	Auto sales, auto repair and storage, auto service shops, body and fender shops, commercial garages, farm and machinery sales and services, auto rental, marine equipment, trailers and related equipment, mobile home sales, motorcycles, construction vehicle sales	Sum of TOT_LVG_AR	10 gallons per 100 SF	N/A
30	Florists, greenhouses	Sum of TOT_LVG_AR	15 gallons per 100 SF	N/A
33	Drive-in theaters, open stadiums	Sum of TOT_LVG_AR	4 gallons per seat	1 seat/10 SF
39	Hotels, motels	Sum of TOT_LVG_AR	100 gallons per room	1 room/500 SF
40	Vacant Industrial – with/without extra features	0	average current commercial rate	average of current flows/ LND_SQFOOT

DOR UC	Description	Data	Flow Rate	Conversion Factor
41	Light manufacturing, small equipment manufacturing plants, small machine shops, instrument manufacturing, printing plants	Sum of TOT_LVG_AR	5 gallons per 100 SF	N/A
42	Heavy industrial, heavy equipment manufacturing, large machine shops, foundries, steel fabricating plants, auto or aircraft plants	Sum of TOT_LVG_AR	5 gallons per 100 SF	N/A
44	Packing plants, fruit and vegetable packing plants, meat packing plants	Sum of TOT_LVG_AR	15 gallons per 100 SF	N/A
48	Warehousing, distribution terminals, trucking terminals, van and storage warehousing	Sum of TOT_LVG_AR	10 gallons per 100 SF	N/A
70	Vacant Institutional, with or without extra features			
71	Churches	Sum of TOT_LVG_AR	4 gallons per seat	1 seat/10 SF
72	Private schools and colleges	Sum of TOT_LVG_AR	10 gallons per student	1 student/30 SF
74	Homes for the aged	Sum of TOT_LVG_AR	100 per hospital bed	225 SF/hospital bed
76	Mortuaries, cemeteries, crematoriums	Sum of TOT_LVG_AR	5 gallons per 100 SF	N/A
77	Clubs, lodges, union halls	Sum of TOT_LVG_AR	5 gallons per 100 SF	N/A
80	Vacant Governmental – with/without extra features for municipal, counties, state, federal properties, and water management district (including DOT/State of Florida retention and/or detention areas)	0		
82	Forest, parks, recreational areas	Sum of TOT_LVG_AR	5 gallons per 100 SF	N/A
83	Public county schools – including all property of Board of Public Instruction	Sum of TOT_LVG_AR	10 gallons per student	1 student/30 SF
86	Counties (other than public schools, colleges, hospitals) including non-municipal government	Sum of TOT_LVG_AR	5 gallons per 100 SF	N/A
87	State, other than military, forests, parks, recreational areas, colleges, hospitals	Sum of TOT_LVG_AR	5 gallons per 100 SF	N/A
88	Federal, other than military, forests, parks, recreational areas, hospitals, colleges	Sum of TOT_LVG_AR	5 gallons per 100 SF	N/A
89	Municipal, other than parks, recreational areas, colleges, hospitals	Sum of TOT_LVG_AR	5 gallons per 100 SF	N/A