# *Report on Expansion of Beneficial Use of Reclaimed Water, Stormwater and Excess Surface Water (Senate Bill 536)*

**Office of Water Policy**
**Florida Department of Environmental Protection**
**December 1, 2015**

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## ACKNOWLEDGEMENTS

The Department would like to recognize and thank the staff of the Northwest Florida Water Management District, Suwannee River Water Management District, St. Johns River Water Management District, South Florida Water Management District, the Southwest Florida Water Management District, the Department of Transportation and the Department of Agriculture and Consumer Services, who were critical to the of development of this report. In addition, we appreciate the input received from water suppliers, water users and other interested stakeholders.

# EXECUTIVE SUMMARY

### PURPOSE AND GOALS OF THE STUDY

By 2030, Florida's population is estimated to reach 23,609,000 – almost a 26% increase over 2010. Fresh water demand is projected to reach 7.7 billion gallons per day by 2030, an additional 1.3 billion gallons over 2010 water use for the state. The Florida Legislature, recognizing the importance of sustainable water supplies to the state's economy, environment and quality of life, passed SB 536 in the 2014 Legislative Session (Appendix A).

Senate Bill 536 (SB 536) directs the Department of Environmental Protection (DEP) to conduct a comprehensive study to determine how the use of reclaimed water, stormwater and excess surface water could be expanded to assist in meeting future demands.

Specifically, the study report is required to identify:

- factors that prohibit or complicate the expansion of the beneficial use of reclaimed water, stormwater and excess surface water and recommend how those factors can be mitigated or eliminated (Chapters 2-4);
- measures that would lead to the efficient use of reclaimed water (section 2.7);
- environmental, engineering, public health, public perception and fiscal constraints of expansion, including utility rate structures for reclaimed water (Chapters 2-4); and,
- areas in the state where traditional water supply sources are limited and the use of reclaimed water, stormwater, or excess surface water for irrigation or other purposes is necessary (Chapter 6).

The report is to then recommend permit incentives for entities that substitute reclaimed water for traditional water sources and to determine the feasibility, benefit and cost estimate of the infrastructure needed to construct regional storage features on public or private lands for reclaimed water, stormwater and excess surface water. (Chapters 4 and 5).

### FINDINGS

The report includes a review and analysis of the historic development, regulatory framework, current status and potential for future expansion of reclaimed water (Chapter 2), stormwater (Chapter 3), excess surface water (Chapter 4) and storage (Chapter 5).

Impediments and constraints to increasing the use of reclaimed water (section 2.6), stormwater (section 3.3) and excess surface water (section 4.4) for water supply are identified. Recommendations to mitigate or eliminate impediments and provide incentives for increased beneficial use of these water sources are provided (Chapter 7).

## IMPEDIMENTS TO EXPANSION

Seven general categories of issues/impediments were identified that impact the expansion or the use or reclaimed, stormwater or excess surface water in the state. Addressing each of these issues will be necessary to expand the efficient use of reclaimed water.

- Cost and Funding - developing or expanding these waters for beneficial use can require a significant investment in water treatment, transmission and storage infrastructure.
- Matching Supplies and Demands - efficient utilization of supply is limited primarily by seasonal differences in the supply and demand and the availability of storage or supplemental sources.
- Regulatory - several regulatory impediments exist related to using these waters for aquifer recharge, indirect or direct potable reuse and other uses. For surface water withdrawals, the lack of established minimum flows and levels provide additional regulatory hurdles.
- Water Quality - concern for exacerbating nutrient enrichment of waters in some areas may constrain their use.
- Public Input and Involvement – public outreach and education is critical to public trust and acceptance of these waters, particularly for indirect or direct potable reuse.
- Long-Term Uncertainty – concerns about the reliability of the sources may dissuade users from relinquishing groundwater allocations and accepting alternatives.
- Scaling up to Regional Solutions – moving from localized service areas to regional water systems may present governance and funding challenges.
- Hydrogeologic Constraints – in areas where ground and surface waters are highly connected, surface water withdrawals may directly affect groundwater resources.

## WATER STORAGE

Three general methods of storage were studied as part of this report: reservoirs; aquifer storage and recovery (ASR) and aquifer recharge (AR); and dispersed water management. Large capacity reservoirs can respond to changes in water demands but can require the acquisition of large land areas and substantial investments in capacity that may not be required until well into the future. Storing water underground in ASR or AR facilities requires less land area and reduces evaporative losses compared to reservoirs, but can include greater uncertainties in project performance. Dispersed water management provides water quality and flood attenuation benefits.

The selection of the best storage mechanism for a water supply or water management system depends on a thorough case-by-case analysis considering the storage needs, hydrogeologic setting, land availability and other factors.

Impediments and constraints identified for reservoirs include:

- substantial suitable land area required;
- cost for land acquisition and operation and maintenance;
- substantial investment in capacity that may not be required until well into the future;

- public acceptance by surrounding neighborhoods;
- environmental/permitting limitations; and,
- construction and development time.

Impediments and constraints identified for aquifer storage and recovery and aquifer recharge include:

- hydrogeologic uncertainty – an inherent “investment risk” exists due to variability within the aquifer that cannot be fully assessed until the ASR or AR system is build and operated;
- ASR recovery efficiency – the volume of water that can be recovered is a key measure of success of an ASR facility and may take time to achieve acceptable levels;
- water quality issues – trace metals such as arsenic may be released from the rock matrix by the injected water; and,
- cost and funding – most ASR facilities to date have required cost share assistance.

## CONCLUSIONS AND RECOMMENDATIONS

### Regional Recommendations by Water Management District

Water use patterns and hydrogeologic conditions vary widely across the state and are frequently the controlling factors in determining the most appropriate alternative water supply development or water storage options. Therefore, in addition to the statewide analysis described above, regional analyses were conducted by each WMD to identify areas where traditional water supply sources are limited and to determine the appropriate regional focus for enhancing the use of reclaimed water, stormwater and excess surface water. These analyses were supported by the extensive work conducted as part of Regional Water Supply Plan development in each WMD, as well as graphical presentation of data related to water use and availability. The major conclusions are summarized below.

- Northwest Florida Water Management District
  - Investigate opportunities to match existing reclaimed water sources with golf courses, nurseries and power plants.
  - Proceed with implementation of new water supply development grant program.
- Suwannee River Water Management District
  - Explore the use of excess surface water from the Suwannee River to provide aquifer recharge for the recovery and support of natural systems and to support dispersed agricultural water uses.
- South Florida Water Management District
  - Continue to implement regional water resource development projects that address a range of water-related needs, including those of urban and agricultural water supply.
  - Continue Cooperative Funding Program to assist in the development of stormwater, alternative water supply and water conservation projects.
  - Continue implementation of storage reservoir projects as part of the Comprehensive Everglades Program (CERP).
- St. Johns River Water Management District

    - Investigate opportunities for increased use of reclaimed water in major water use areas in Orlando, Jacksonville and along the east coast.
    - Investigate opportunities for increased use of reclaimed water by large agricultural users in the southern part of the District.
    - Identify priority areas for aquifer recharge.
    - Consider additional cost share funding for reclaimed water ASR wells in coastal regions.
- Southwest Florida Water Management District
    - Continue assistance in implementation of the following projects:
        - The Tampa Electric Company (TECO) Lakeland/Mulberry/Polk Reclaimed Water Project, an industrial reuse system in southwest Polk County.
        - The Southern Hillsborough County Reclaimed Water Aquifer Recharge Project, a natural system enhancement reuse pilot project located in southern Hillsborough County.

<u>Statewide Recommendations</u>

The results of this study produced numerous statewide recommendations to increase the beneficial use of reclaimed water, stormwater and excess surface water.  In general, the recommendations fall into the following categories:

- DEP and WMD Regulatory Changes;
- Agency Actions;
- Water Supplier Actions;
- Funding; and,
- Education and Outreach.

A compilation of the recommendations by water source and storage is provided in Chapter 7.

# 1 INTRODUCTION

## 1.1 PURPOSE AND GOALS OF THE STUDY

By 2030, Florida's population is estimated to reach 23,609,000 – almost a 26% increase over 2010. Fresh water demand is projected to reach 7.7 billion gallons per day by 2030, an additional 1.3 billion gallons over 2010 water use for the state. The Florida Legislature, recognizing the importance of sustainable water supplies to the state's economy, environment and quality of life, passed SB 536 in the 2014 Legislative Session (Appendix A).

> *"DEP, in coordination with stakeholders shall conduct a comprehensive study and submit a report on the expansion of use of reclaimed water, stormwater and excess surface water in this state"*

Senate Bill 536 (SB 536) directs the Department of Environmental Protection (DEP) to conduct a comprehensive study to determine how the use of reclaimed water, stormwater and excess surface water could be expanded to assist in meeting future demands.

Three important terms – reclaimed water, stormwater and excess surface water – are defined as follows for the purposes of this study.

> **Reclaimed water:** Water that has received at least secondary treatment and basic disinfection and is reused after flowing out of a domestic wastewater treatment facility.
>
> **Stormwater:** The flow of water, which results from and which occurs immediately following, a rainfall event and which is normally captured in ponds, swales, or similar areas for water quality treatment or flood control.
>
> **Excess surface water:** Water that could be available for withdrawal from rivers, lakes or other water bodies that is in excess of the amount needed to sustain healthy ecological conditions in the water body and downstream waters and that otherwise meets the applicable consumptive use permitting criteria.

## 1.2 REQUIREMENTS OF SENATE BILL 536

Senate Bill 536 contains three procedural requirements for the comprehensive study:

- hold a minimum of two public meetings to gather input on the study;
- provide opportunity for the public to submit written comments before submitting the report; and,
- submit report to Governor, Senate President and Speaker of the House no later than December 1, 2015.

The study report is required to:

- identify factors that prohibit or complicate the expansion of the beneficial use of reclaimed water, stormwater and excess surface water and recommend how those factors can be mitigated or eliminated;
- identify measures that would lead to the efficient use of reclaimed water;
- Identify environmental, engineering, public health, public perception and fiscal constraints of expansion, including utility rate structures for reclaimed water;
- identify areas in the state where traditional water supply sources are limited and the use of reclaimed water, stormwater, or excess surface water for irrigation or other purposes is necessary;
- recommend permit incentives, such as extending current authorization for long-term consumptive use permits for all entities that substitute reclaimed water for traditional water sources that become unavailable or otherwise cost prohibitive; and,
- determine the feasibility, benefit and cost estimate of the infrastructure needed to construct regional storage features on public or private lands for reclaimed water, stormwater and excess surface water, including the collection and delivery mechanisms for beneficial uses such as agricultural irrigation, power generation, public water supply, wetland restoration, aquifer recharge and waterbody base flow augmentation.

## 1.3 STUDY PROCESS AND STAKEHOLDER INVOLVEMENT

To direct the work needed to carry out the charge in SB 536, DEP formed a multi-agency planning workgroup including representatives from DEP, the Department of Agriculture and Consumer Services (DACS), the Department of Transportation (DOT) and from the five water management districts (WMDs). In addition, technical teams of staff from these agencies were formed to collect and analyze information and assist in report preparation for the following topic areas.

- Reclaimed Water
- Stormwater
- Excess Surface Water
- Storage – Reservoirs
- Storage – Aquifer Storage and Recovery (ASR), Aquifer Recharge (AR) and Dispersed Water Management (DWM)

The Department used several tools to receive public input as part of the SB 536 Study, including:

- a web-based survey conducted from August 7 - August 24, 2014;
- five public workshops held in Panama City, Live Oak, Palatka, West Palm Beach and Brooksville in October-November 2014;
- individual stakeholder meetings;
- a webpage with study updates, workshop presentations and an e-mail address to submit comments;
- teleconference access to agency study working group meetings;
- a statewide webinar on the draft legislative report held on August 20, 2015;

- a public meeting on the draft legislative report held in Maitland on August 24, 2015; and,
- an FTP site where the public could access all submitted comments, raw survey data and a recording of the webinar.

A detailed description of the public input process and results is provided in Appendix C.

## 1.4 REPORT STRUCTURE

The three types of water sources considered in this study, Reclaimed Water, Stormwater and Excess Surface Water, are discussed individually in Chapters 2-4. Each chapter provides the background and current status of the use of the water source in the state, a discussion of issues, constraints and impediments specific to that source and recommendations for reducing impediments and increasing the beneficial use of the source.

Chapter 5 discusses Water Storage, which can be used in association with each of the water sources. Types of water storage techniques discussed in Chapter 5 include reservoirs, aquifer storage and recovery, aquifer recharge and dispersed water management. Recommendations for enhancing the use of these storage techniques are provided.

Chapter 6 provides a Regional Analysis by water management district to identify specific opportunities or areas of emphasis for enhancing the use of reclaimed water, stormwater and excess surface water based on regional conditions. This chapter identifies the areas where traditional sources are limited and opportunities exist to meet water needs with reclaimed water, stormwater or excess surface water. Finally, Chapter 7 contains a summary of the recommendations for increasing the beneficial use of reclaimed water, stormwater and excess surface water.

Additional detailed information is provided in Appendices A - F, including a list of acronyms used in the report in Appendix B.

# 2 RECLAIMED WATER

## 2.1 BACKGROUND

Reclaimed water is defined in Chapter 373, F.S. as "water that has received at least secondary treatment and basic disinfection and is reused after flowing out of a domestic wastewater treatment facility. The use of reclaimed water is an important component of both wastewater management and water resource management in Florida. Reclaimed water or "reuse" offers an environmentally sound means of managing wastewater that dramatically reduces environmental impacts associated with discharge of wastewater effluent to surface waters. In addition, use of reclaimed water currently provides an alternative water supply for many activities that do not require potable quality water (e.g. irrigation, industrial use, toilet flushing, aesthetic features, fire protection, etc.), which serves to conserve available supplies of potable quality water. Finally, some types of reuse offer the ability to recharge and augment available water supplies with high-quality reclaimed water.

The Earth's finite supply of water is continually recycled and reused through the hydrologic cycle. Although not often acknowledged, many communities indirectly use reclaimed water for part of their water supply. Environmental professionals have long used the example of "unplanned" reuse along the Mississippi River. Minneapolis, St. Louis, Memphis and many other cities use water from the Mississippi and its tributaries, treat the wastewater and discharge the treated wastewater back to the river. These domestic wastewater discharges along with industrial discharges, agricultural runoff and stormwater discharges are all components of the water withdrawn, treated and used by New Orleans and other downstream communities.

In Florida, groundwater is also recycled water. It is important to recognize that groundwater comes from the land's surface. Hence, the water percolating from the land's surface into the ground includes all of the inputs found in surface waters – agricultural runoff, urban stormwater and domestic and industrial wastewater inputs. In karstic areas of the state, entire rivers naturally flow underground through natural depressions or sinkholes, only to reappear via springflow. In addition, most reclaimed water land application projects (rapid infiltration basins, sprayfields, etc.) ultimately return water to groundwater, which may be available to down-gradient users. In Florida, groundwater accounts for about 90% of public and domestic water supply. Approximately 20% of Floridians safely consume groundwater without treatment or disinfection.

While Florida's freshwater resources are finite, the state faces continuing population growth which is projected to result in an additional 4.8 million Floridians through 2030 (DEP, 2014). With population growth the state will see increased demands for water and increased volumes of wastewater, which must be managed to prevent pollution. At the same time, many areas of the state are approaching, or have exceeded, the sustainable limits of traditional groundwater supplies.

Chapter 62-40, Florida Administrative Code (F.A.C.), the "Water Resource Implementation Rule" (formerly known as the "Water Policy Rule") requires the water management districts to assess their water resources and to designate "water resource caution areas." The designated water resource caution areas (areas having current or future critical water supply problems) are shown in **Figure 2.1**. These water resource caution areas generally represent areas in the state where traditional water sources may not be adequate to meet expected water needs. Within these areas, water conservation, reuse and other alternative resources will play critical roles in ensuring adequate water supply.

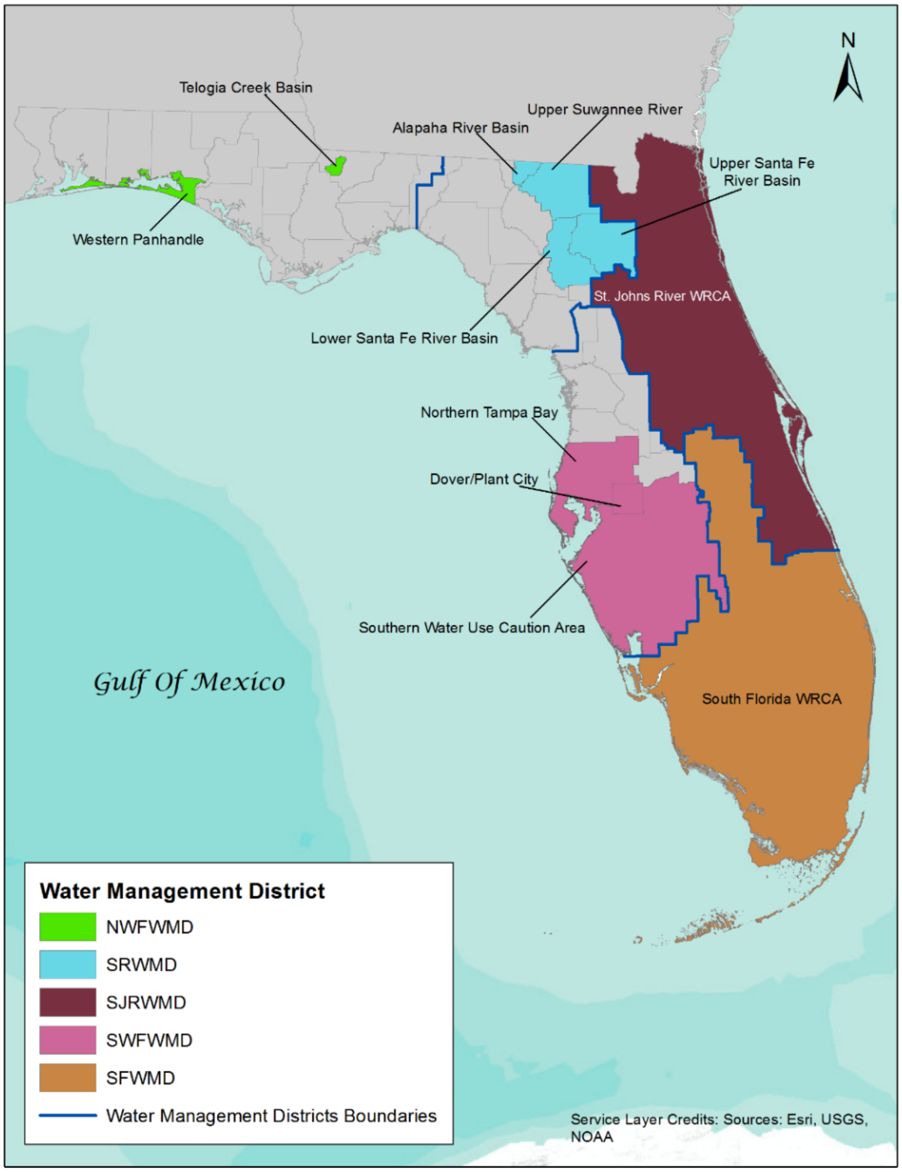



*Figure 2.1.1: Water Resource Caution Areas*

While Florida has been remarkably successful in implementing reuse - 45% of wastewater is currently reused - more can be done. As reported in the 2013 Reuse Inventory, Florida disposed of over 960 million gallons per day (MGD) of wastewater effluent using deep injection wells, ocean outfalls and surface water discharges. This represents a waste of a valuable resource. Where technically, environmentally and economically feasible, reclaimed water should be reused for beneficial purposes.

### 2.1.1 History of Reclaimed Water in Florida

Before the mid-1980s Florida had limited reuse activity and very little institutional framework related to reclaimed water. Wastewater management in Florida was dominated by effluent disposal practices – surface water discharges, ocean outfalls and deep well injection disposal. Rules governing reuse were limited to those that dealt primarily with slow-rate land application systems (sprayfields) and rapid-rate land application systems (percolation ponds). In fact, the term "reuse" did not even appear in Florida's rules.

As water quality constraints began to make it difficult to find suitable locations for new or expanded surface water discharges, some utilities began to look at various land application methods as a means for managing domestic wastewater. As a result, Florida saw the implementation of several notable reuse systems, including those in St. Petersburg, Gainesville and Orange County.

The lack of comprehensive rules governing reuse posed significant hurdles for the early reuse projects. Significant differences in permitting approaches and requirements between DEP district regulatory offices created permitting uncertainties that further impeded progress.

In the mid-1980s, DEP began development of a comprehensive reuse program in partnership with the WMDs. The Public Service Commission and the Department of Health became early partners reflecting their respective roles in dealing with investor-owned utilities and the protection of public health. The basic tenets of the reuse program have always been protection of public health and the environment.

In the late 1980s, Chapter 403, F.S., established the encouragement and promotion of reuse as a formal state objective. Mandatory consideration of reuse became part of the wastewater regulatory program; the reuse program was initiated; comprehensive rules governing reuse were established; and Florida began to experience rapid growth in use of reclaimed water. This growth continues today. Figure 2.2 presents a timeline of reuse in Florida showing landmark reuse systems and significant milestones in the development of Florida's reuse program.

## 2.2 REGULATORY STRUCTURE FOR RECLAIMED WATER

Over the last 30 years, Florida's regulatory structure has been specifically developed to encourage and promote the use of reclaimed water. Both DEP and the WMDs play a regulatory role in the use of reclaimed water. DEP regulations focus on water quality and ensure that reclaimed water is appropriately treated for its intended use in order to ensure protection of public health and the environment. The WMD regulations focus on water quantity, as reclaimed water is an alternative water supply source that can be used to meet the state's growing water demand. The WMDs do not regulate the use of reclaimed water through the consumptive use permitting program; however, regulations are in place to promote the development of reclaimed water supplies for use in lieu of higher quality sources where feasible.

### 2.2.1 Overview of Water Quality Statutes and Rules Related to Reclaimed Water

- **Chapter 403, F.S.,** authorizes DEP to regulate domestic wastewater facilities including the issuance of construction permits and operation permits for reuse facilities. Section 403.064, F.S., establishes that the promotion and encouragement of reuse is a formal state objective and requires certain applicants applying for wastewater permits in Water Resource Caution Areas to prepare reuse feasibility studies. Subsection 403.086(9), F.S., provides that by December 31, 2025 the six existing ocean outfalls located along the Southeast coast are required to reuse a minimum of 60% of the facility's baseline flow for beneficial purposes. This equates to 175 MGD of additional reuse by 2025. Sections 403.064 and 403.086(9), F.S., are provided in Appendix D-1.

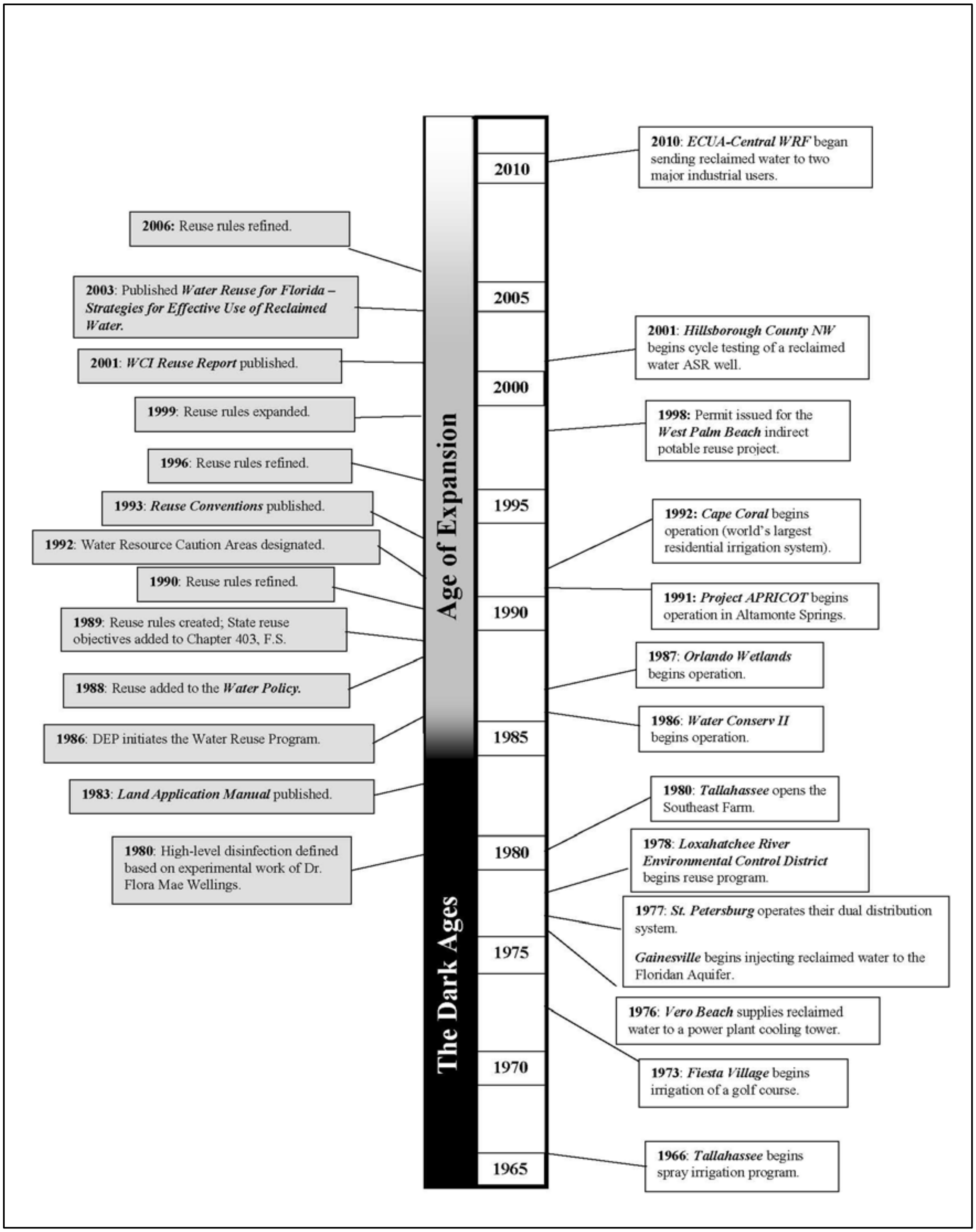



*Figure 2.2.1: Florida's Water Reuse Timeline*

- **Chapter 62-610, F.A.C.**, entitled "Reuse of Reclaimed Water and Land Application," contains detailed regulations governing reuse in Florida. Reuse is defined in Chapter 62-610, F.A.C., as the deliberate application of reclaimed water for a beneficial purpose. The rule identifies the most common types of reuse systems and establishes design, operation and maintenance requirements for these systems. These types of reuse systems are:
  - **Slow-rate land application; restricted public access –** the application of reclaimed water to a vegetated land surface, most often through spray irrigation, where public access is restricted. Treatment requirements for these systems include reclaimed water that has received at least secondary treatment and basic disinfection.
  - **Slow-rate land application; public access –** the irrigation of areas accessible to the public – golf courses, parks and similar areas – along with irrigation of residential properties and edible crops. A wide range of other activities also are addressed – toilet flushing, fire protection, street cleaning, decorative fountains, dust control and vehicle washing. These reuse systems feature reclaimed water that has received at least secondary treatment and high-level disinfection.
  - **Rapid-rate land application –** the deliberate application of reclaimed water at high rates to rapid infiltration basins (RIBs), percolation ponds, or absorption fields to recharge the groundwater. Treatment requirements for these systems include reclaimed water that has received at least secondary treatment, basic disinfection and meet the nitrate standard of 12 mg/L.
  - **Aquifer Storage and Recovery (ASR) –** the injection of reclaimed water into a subsurface formation for storage and recovery of the stored reclaimed water for beneficial purposes at a later date. It is only when reclaimed water, which has been stored in an aquifer, is recovered and used for beneficial purposes that the reclaimed water is considered to be "reused." Injected water must meet applicable groundwater requirements before injection. Recovered water must meet the performance standards for fecal coliforms as specified for high-level disinfection.
  - **Recharge of Class F-I, G-I and G-II groundwaters –** these types of systems include:
    - Injection of reclaimed water directly into those groundwaters;
    - Rapid-rate land application systems located over those groundwaters;
    - Use of reclaimed water to create salinity barriers to protect those groundwaters; and
    - Discharges to surface waters which are directly connected to those groundwaters.

    The treatment requirements depend on the type and class of groundwater into which the reclaimed water is injected. Groundwater recharge is also called Aquifer Recharge.
  - **Indirect Potable Reuse (IPR) –** This type of reuse system involves the planned use of reclaimed water to augment surface water resources which are used or will be used for public water supplies. IPR systems include discharges to Class I surface waters and discharges to other surface waters which are directly or indirectly connected to Class I surface waters. The treatment requirements depend on the class of surface waters to which the reclaimed water is discharged. While the injection of reclaimed water into a drinking water aquifer is also sometimes referred to as IPR, this is included as groundwater recharge in Chapter 62-610, F.A.C., as described above.

  - **Wetlands creation, restoration and enhancement –** Reclaimed water can be used to create, restore, or enhance man-made wetlands as well as hydrologically altered wetlands. Wastewater wetlands that discharge to Class I waters or contiguous to Class I waters must meet the same requirements as other discharges to surface water.
  - **Industrial Uses –** Industrial uses of reclaimed water involve the use of reclaimed water for cooling water, wash water, or process water at industrial facilities. Reclaimed water cannot be used in food or beverage processing facilities where the reclaimed water would come into contact with food or beverages being prepared for human consumption. For most applications, secondary treatment and basic disinfection are required. Some uses would involve additional site restrictions.
- **Chapters 62-620, 62-600 and 62-601, F.A.C.** These chapters establish permitting criteria and provide technical requirements for construction, operation and monitoring of all types of wastewater treatment facilities, including facilities that produce reclaimed water.

2.2.2 <u>Overview of the Water Quantity (Consumptive Use) Statutes and Rules related to Reclaimed Water</u>

- **Chapter 373, F.S.**, establishes the state's five WMDs and includes the authority for DEP and the WMDs to issue permits for the consumptive use of water. Similarly to section 403.064, F.S., section 373.250, F.S., finds that the "encouragement and promotion of water conservation and reuse of reclaimed water … are state objectives and considered to be in the public interest." This section provides that a permit may not be required for the use of reclaimed water. However, when a use includes surface water or groundwater, the permit for such sources may include conditions that govern the use of the permitted sources in relation to the feasibility or use of reclaimed water. An applicant may be required to use reclaimed water in lieu of a proposed use of surface water or groundwater when the use of reclaimed water is "available; is environmentally, economically and technically feasible; and is of such quality and reliability as is necessary to the user." Section 373.250, F.S., is provided in Appendix D-1.
- The WMDs implement these statutory provisions related to reclaimed water through their consumptive use permitting rules. The WMDs' rules are contained within Title 40 of the F.A.C.

## 2.3 CURRENT STATUS OF USE OF RECLAIMED WATER

2.3.1 <u>Florida</u>

Over the past 30 years, Florida has made great strides in the expansion of reclaimed water systems and today Florida is recognized as a national leader in water reuse. Reuse is now an integral part of wastewater management, water resource management and ecosystem management in Florida.

In 2013, Florida reused approximately 719 MGD of reclaimed water, which represents approximately 45% of the total domestic wastewater flow in the state (Figure 2.3). Figure 2.4 presents the amount of reclaimed water used within each water management district. A total of 482 domestic wastewater treatment facilities with permitted capacities of 0.1 MGD or above made reclaimed water available for reuse by 434 reuse systems. The total reuse capacity (total amount of water the facility is designed to treat) associated with these systems was 1,691 MGD. Figure 2.5 shows the percentage of reclaimed water utilization by flow for each reuse type.

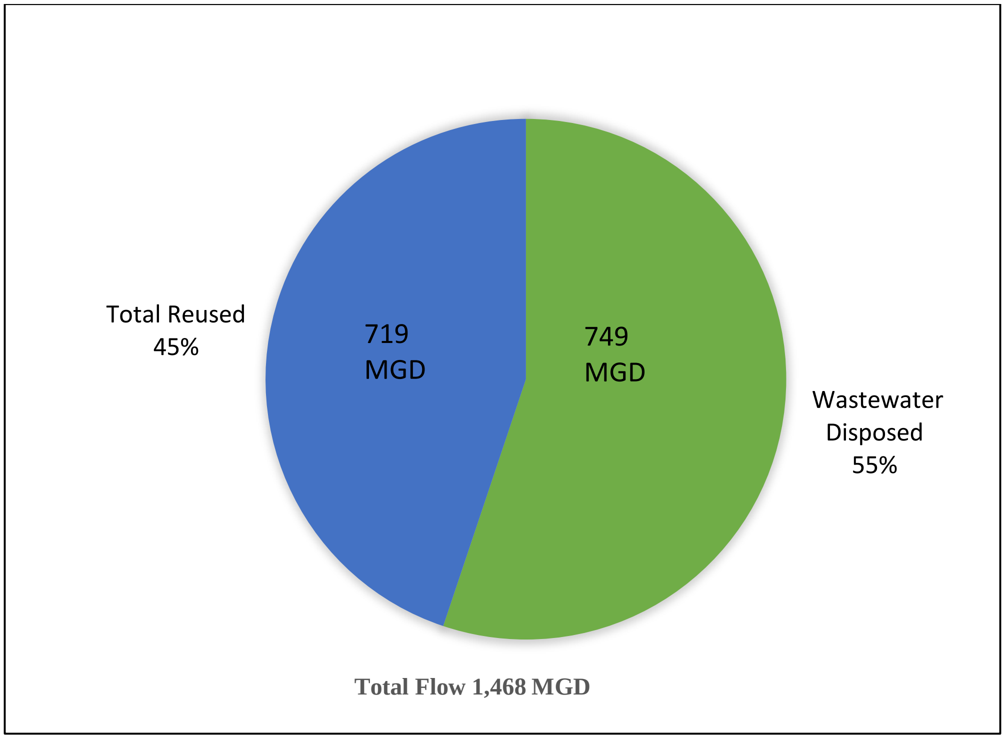
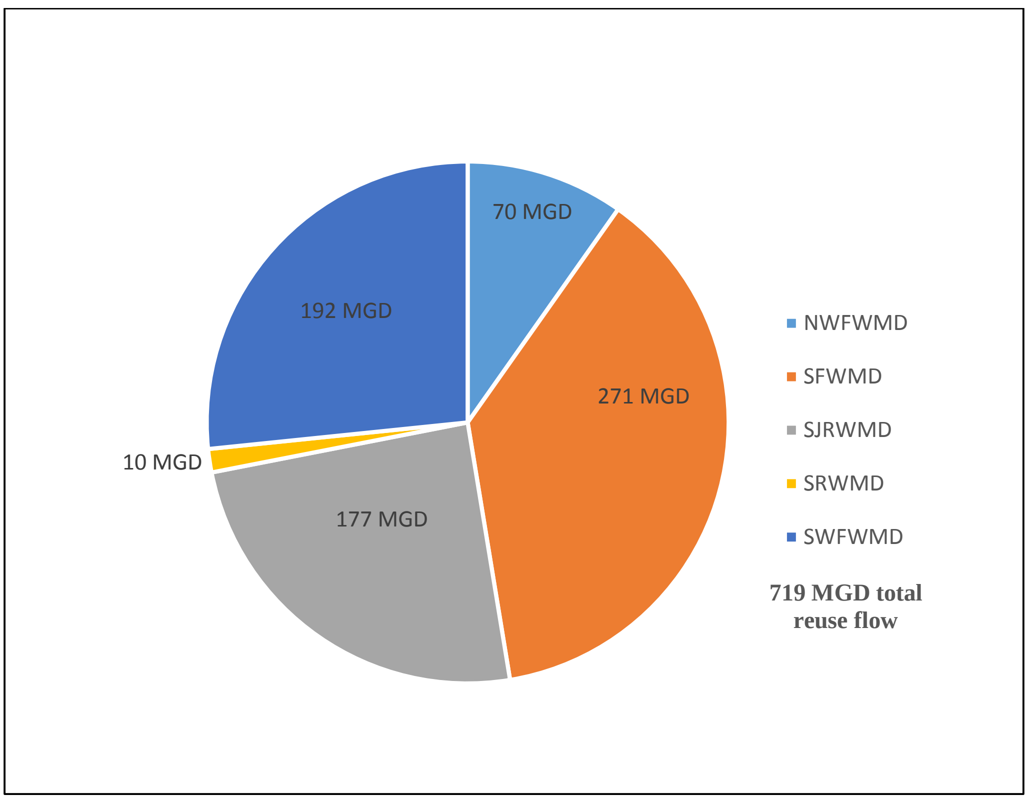
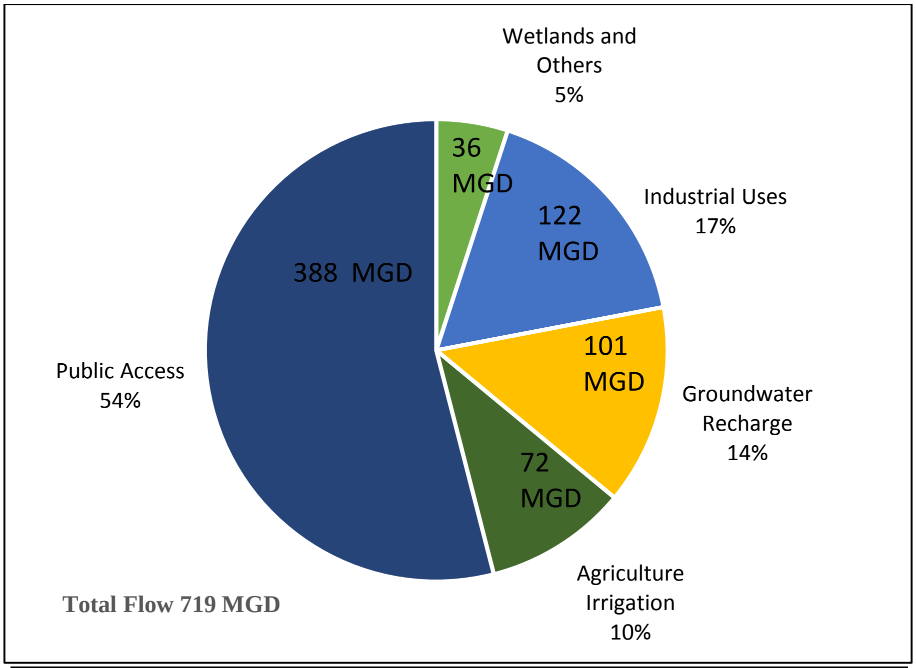



*Figure 2.3.1: Percentage of Reused Wastewater in Florida in 2013*




Data Source: (DEP, 2014)

*Figure 2.3.2: Quantity of Reclaimed Water (MGD) Used Within Each Water Management District in 2013*




Note: Agriculture irrigation includes edible crops (e.g., citrus) as well as feed and fodder crops (e.g., spray fields).

*Figure 2.3.3: Percentage of Reclaimed Water Utilization in Florida by Flow for Each Reuse Type*

About 49 active domestic wastewater treatment facilities having permitted capacities of 0.1 MGD or greater do not provide reuse of any kind. These facilities had a total permitted capacity of 209 MGD and a total flow of 135 MGD.

Not all reuse types are created equal in terms of benefitting water supply. That is, some types of reuse are more efficient than others at replacing the use of potable quality water withdrawn from ground or surface waters ("offsetting" potable water use"), or at recharging the aquifer. Therefore, from a pure efficiency standpoint, reuse that provides a 1:1 replacement of potable quality water, or a 1:1 recharge of the aquifer, is considered the most desirable from a water supply standpoint. Table 2.1 lists average Potable Quality Water Offsets and Recharge Fractions, which were developed as part of DEP's Water Conservation Initiative, for various reuse activities. However, the figures shown in Table 2.1 are generalizations. The desirability of individual reuse applications should be analyzed on a case-by-case basis as local conditions may result in differing levels of benefits. For example, reclaimed water may be more appropriate for aquifer recharge purposes in regions of the state where aquifer conditions enable the cost-effective use of rapid infiltration basins. Alternatively, the use of reclaimed water for wetlands restoration may achieve highly desirable local environmental goals.

Domestic wastewater facilities that have permitted capacities of 0.1 MGD or more are required to submit an annual reuse report to DEP. DEP uses the information contained in these annual reuse reports to produce and publish the Annual Reuse Inventory Report each May. The statistics included in this section of this report are based on the 2013 Annual Reuse Inventory Report (DEP, 2014). The statewide average reuse flow per capita in 2013 was 37 gallons per day**.** Figure 2.6 shows the map of Florida's counties color-coded by range of reuse flow per capita.

*Table 2.1: Relative Desirability of Reuse Activities*

| Desirability | Reuse Activity | Offset (a,c) | Recharge Fraction (b,c) |
|---|---|---|---|
| **High** | Indirect potable reuse | -- | 100 |
| **High** | Industrial uses | 100 | 0 |
| **High** | Toilet flushing | 100 | 0 |
| **High** | Rapid Infiltration Basins (where groundwater is used) | 0 | 90 |
| **High** | Efficient agricultural irrigation where irrigation is needed | 75 | 25 |
| **High** | Efficient landscape irrigation (golf courses, parks, etc.) | 75 | 10 |
| **High** | Efficient residential irrigation | 60 | 40 |
| **High** | Cooling towers | 100 | 0 |
| **High** | Vehicle washing | 100 | 0 |
| **High** | Commercial laundries | 100 | 0 |
| **High** | Cleaning of roads, sidewalks, & work areas | 100 | 10 |
| **High** | Fire protection | 100 | 10 |
| **High** | Construction dust control | 100 | 0 |
| **High** | Mixing of pesticides | 100 | 0 |
| **Moderate** | Inefficient landscape irrigation (parks and other landscaped areas) | 50 | 50 |
| **Moderate** | Inefficient agricultural irrigation | 50 | 50 |
| **Moderate** | Surface water with direct connection to groundwater (canals of SE Florida) | 0 | 75 |
| **Moderate** | Wetlands restoration (when additional water is needed) | 75 | 10 |
| **Moderate** | Inefficient residential irrigation | 25 | 50 |
| **Moderate** | Flushing & testing of sewers and reclaimed water lines | 50 | 0 |
| **Moderate** | Rapid Infiltration Basins where groundwater is currently not used | 0 | 25 |
| **Low** | Aesthetic features (ponds, fountains, etc.) | 75 | 10 |
| **Low** | Sprayfields (wastewater disposal on grass or other cover crop at irrigation rates higher than agronomically necessary; intended to provide some groundwater recharge) | 0 | 50 |
| **Low** | Wetlands (when additional water is not needed) | 0 | 10 |

(a) Percentage of reclaimed water that replaces potable water;
(b) Percentage of reclaimed water that augments potable groundwater or Class I surface water;
(c) Depending on local circumstances, the offset and recharge may not be of equal importance.
*Modified from:* (DEP, 2002) *page 151*

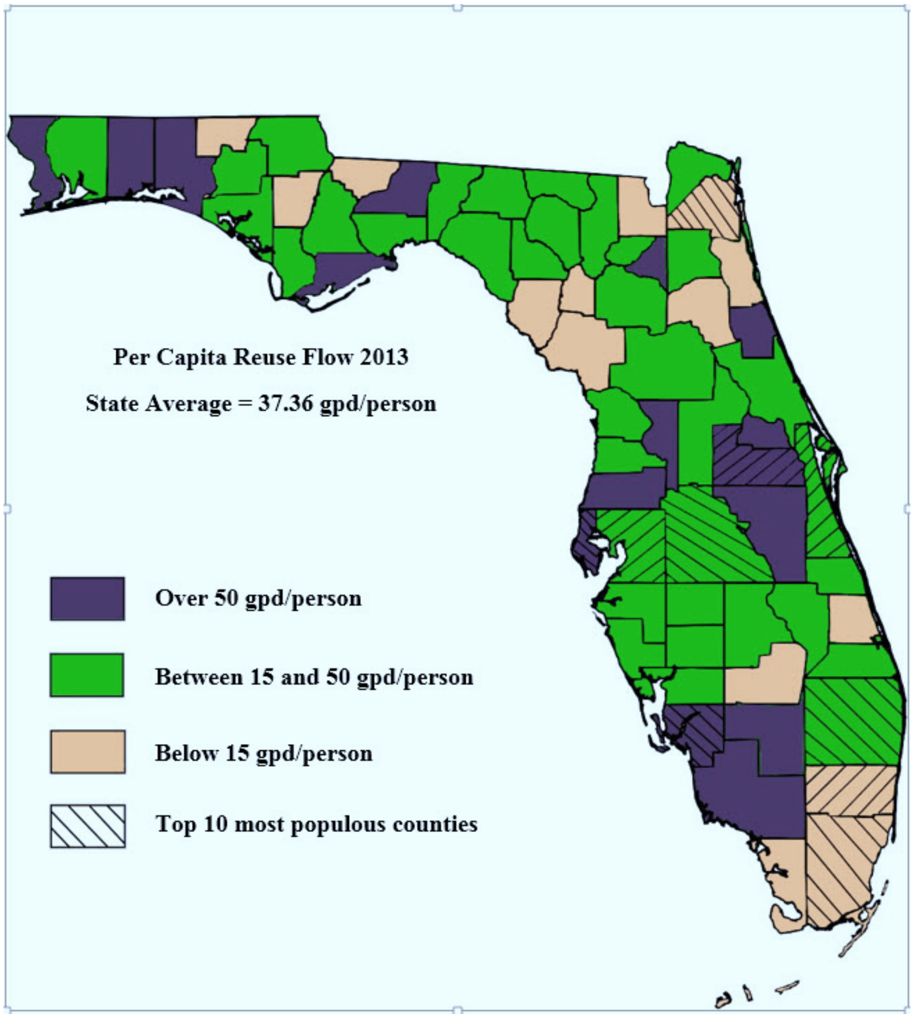



*Figure 2.3.4: Per Capita Reuse Flow 2013 (gallons per day per person)*

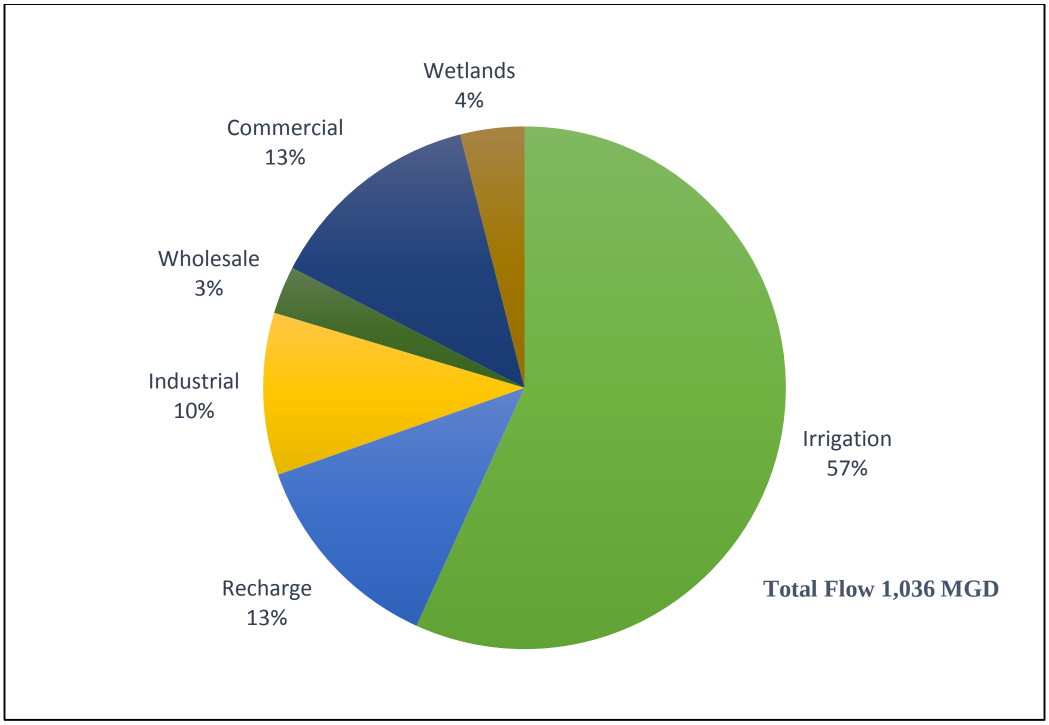
### 2.3.2 Nationwide

Water reuse in the United States has grown over time for multiple reasons. One reason has been the increasingly stringent discharge requirements for treated wastewater. This, combined with the decreasing availability of traditional water supplies, has resulted in the increased use of reclaimed water in some regions of the country. More recently, incentives have spurred the development of water reuse projects. One example is the Metropolitan Water District of Southern California, which serves approximately 19 million people. To meet long-term water demands, Metropolitan provides a regional financial incentive program to encourage development of reclaimed water and groundwater recovery projects that reduce demand on imported water supplies. These factors, along with the desire to reduce the use of potable water for irrigation and other non-potable uses, have increased public acceptance of water reuse.

Nationwide, treated municipal wastewater represents a significant potential source of alternative water supply. With the advent of stricter water treatment and discharge regulations in the 1970s, centralized wastewater treatment has become more commonplace in urban areas of the United States. With centralized treatment comes the ability to treat to acceptable standards and beneficially reuse the water.

Within the United States, the population generates an estimated 32,000 million gallons per day (MGD) of municipal wastewater (EPA, 2012). It has been estimated that a third of this amount could be reused (GWI, 2010) (Miller, 2011) (NRC, 2012). Currently only about 7 to 8 % of this water is reused in some way (as opposed to 45% in Florida), leaving an opportunity for expanding water reuse nationwide (GWI, 2010) (Miller, 2011). Continuing centralization of wastewater treatment will increase those opportunities into the future.

Figure 2.7 shows the nationwide percentage of reclaimed water utilization by flow for each reuse type.




Source: (WateReuse Research Foundation, 2008)

*Figure 2.3.5: Nationwide Percentage of Reclaimed Water Utilization by Flow and Reuse Type*

### 2.3.3 Global Trends

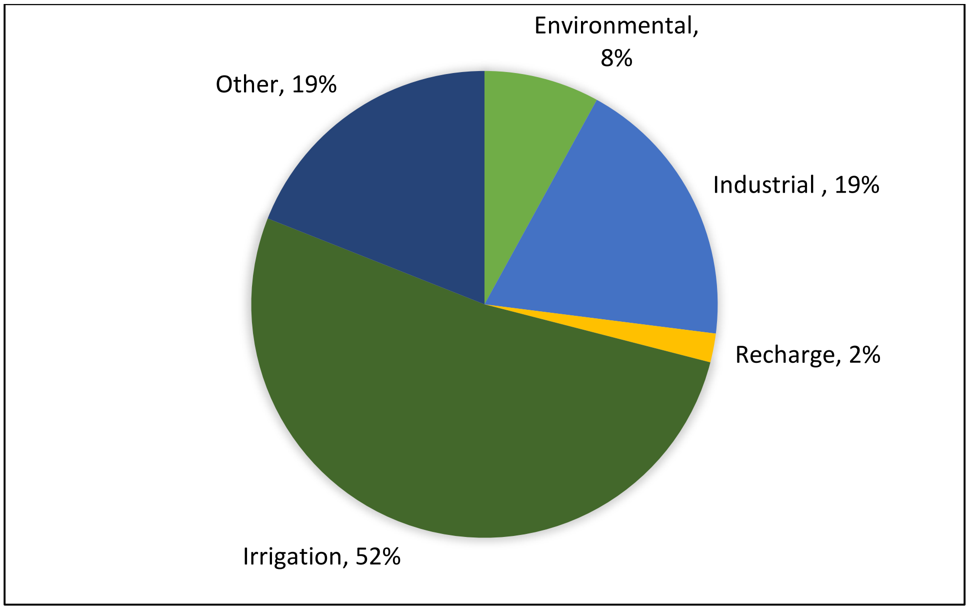
Globally, the sophistication of wastewater treatment practices varies widely and generalizations are difficult. In large parts of the world, the reuse of untreated, partially treated, or mixed wastewater, whether intentional or unintentional, is typically not practiced under a regulatory framework or protocol designed to ensure the safety of the resulting water for the intended use. Quite often it is in stark contrast to the practice in the United States, where wastewater treatment is ubiquitous. Alternatively, some international water reuse projects are sophisticated and trendsetting.

Wastewater reuse worldwide occurs mainly for agricultural irrigation, but is also used for aquaculture, industry, drinking water, non-potable household uses, landscape irrigation, recreation and aquifer recharge (EPA, 2012). The amount of direct potable reuse (DPR) (highly treated domestic wastewater introduced directly into a municipal water system) and planned indirect potable reuse (IPR) remains low worldwide, but it is growing (GWI, 2010). The first DPR system (without the use of an environmental buffer) was brought on-line in the late 1960’s in the city of Windhoek, Namibia. In this example of potable reuse, purified municipal wastewater is introduced into the water treatment plant intake (after treatment to at least near drinking water quality), or blended with conventionally-treated surface water directly into the water distribution system after meeting the drinking water standards (EPA, 2012).

Singapore provides an example where water reuse and potable reuse, has been made a national priority. Singapore is a small island city-state with no natural aquifers or groundwater and relies on rainfall and raw water imported from neighboring Malaysia. To achieve a sustainable and robust water supply to meet increasing water demand, Singapore diversified its water sources, including the establishment of the NEWater system. NEWater produces high-grade reclaimed water treated to drinking water standards, which is key to Singapore achieving its water sustainability.

There are a growing number of examples around the globe of potable reuse primarily driven by pressures on water supply, along with increased public acceptance because of successful records of performance demonstrated by notable installations in the United States, Australia, Namibia, South Africa and Singapore (GWI, 2010) (NRC, 2012).

Figure 2.3.6 illustrates the different uses of reclaimed water from advanced treatment facilities around the world.




Source: (EPA, 2012)

*Figure 2.3.6: Global Percentage of Reclaimed Water Utilization by Flow and Reuse Type*

*(Includes only flows from facilities that provide advanced (tertiary) treatment)*

## 2.4 State and WMD Investments in Reclaimed Water

Recognizing the legislative finding that the promotion and encouragement of reuse is a state objective, DEP and the WMDs have provided significant funding assistance for the planning, construction and implementation of projects that increase reuse. These projects help to achieve the dual goals of reducing the discharge of pollutants to the State's surface waters to help meet Total Maximum Daily Loads and providing an alternative source of water to meet growing water use needs.

A summary of DEP and the WMDs funding assistance for reclaimed water projects for the last ten years is provided in Table 2.2. Over $568 million was budgeted for reclaimed water projects between 2004 and 2014. Many Districts provide funding assistance in the form of cost-share assistance grants, which leverage additional funding from the cost-share partners.

The Southwest Florida Water Management District (SWFWMD) had the highest level of funding for reclaimed water projects, budgeting an average of approximately $21 million per year. From the inception of the SWFWMD Cooperative Funding Initiative Program in Fiscal Year (FY) 1987 through today (FY2015), the District has budgeted at total of $408 million towards 357 reclaimed water projects with total costs of $956 million. At completion, the 357 co-funded projects will result in more than 950 miles of reuse lines, 245 MGD of capacity and 116-131 MGD of benefits.

Over the past ten years, the South Florida Water Management District (SFWMD) has approved over $86 million for reclaimed water projects. That funding leveraged more than $400 million in construction costs of 192 reclaimed water projects. These projects had a combined increase in reclaimed water production capacity of 106 MGD.

DEP funding is provided through the Clean Water State Revolving Fund (SRF) program, which provides low interest loans for wastewater and stormwater infrastructure improvements that reduce or eliminate sources of water pollution. Over the last 10 years, DEP loans for reclaimed water projects totaled $198 million and averaged about $20 million per year or roughly 8% of the total clean water funding provided by DEP. In addition, over $18 million for reclaimed water projects was provided through the SRF Small Communities Wastewater Facilities Grants program.

## 2.5 Analysis of Types of Reuse

Previous sections of this report have identified the types of reuse that are currently implemented in Florida and are regulated by DEP under Chapter 62-610, F.A.C. An additional type of reuse, direct potable reuse, is implemented in other countries and is receiving increasing attention in the U.S. as a potentially viable reuse option. Each type of reuse has its own associated issues and considerations that may affect its potential contribution to expanding the state’s beneficial use of reclaimed water. The most feasible or beneficial type of reuse can vary significantly by region or reclaimed water utility depending on the specific geology, hydrology, development patterns, population served, or other factors. Appendix D-2 provides an in-depth discussion of each type of reuse, its associated constraints and opportunities and Appendix D-3 provides examples of existing projects, including:

- landscape irrigation/public-access reuse;
- agricultural irrigation;
- industrial reuse;
- aquifer recharge;
- environmental enhancement and restoration;
- indirect potable reuse; and,
- direct potable reuse.

*Table 2.2: Summary of Funding by the Water Management Districts and DEP for Reclaimed Water Projects over the Past Ten Years*

| Fiscal Year | Northwest Florida Water Management District | South Florida Water Management District | St. Johns River Water Management District | Southwest Florida Water Management District | Suwannee River Water Management District | Department of Environmental Protection Loans | Department of Environmental Protection Grants |
|---|---|---|---|---|---|---|---|
| **FY2004-05** | $0 | $2,940,000 | $1,774,557 | $18,441,017 | $0 | $11,815,184 | $150,000 |
| **FY2005-06** | $3,000,000 | $16,856,380 | $12,686,395 | $29,378,507 | $6,500,000 | $6,917,016 | $14,911,036 |
| **FY2006-07** | $4,850,000 | $16,526,600 | $5,063,529 | $19,862,511 | $2,500,000 | $35,539,971 | $201,865 |
| **FY2007-08** | $0 | $27,193,450 | $87,839 | $18,110,037 | $2,000,000 | $2,735,629 | $649,000 |
| **FY2008-09** | $0 | $11,995,983 | $640,000 | $25,751,413 | $1,500,000 | $37,322,527 | $0 |
| **FY2009-10** | $0 | $1,060,000 | $0 | $19,672,706 | $1,500,000 | $25,924,538 | $2,289,677 |
| **FY2010-11** | $0 | $3,704,700 | $0 | $17,088,388 | $125,000 | $24,412,699 | $0 |
| **FY2011-12** | $0 | $1,570,000 | $4,132,126 | $15,380,739 | $0 | $10,569,762 | $210,173 |
| **FY2012-13** | $0 | $2,500,000 | $3,500,000 | $19,294,703 | $0 | $14,294,378 | $0 |
| **FY2013-14** | $1,171,500 | $1,739,100 | $9,767,756 | $21,691,124 | $0 | $28,779,394 | $14,324 |
| **Total** | **$9,021,500** | **$86,086,213** | **$37,652,202** | **$204,671,145** | **$14,125,000** | **$198,311,098** | **$18,426,074** |

## 2.6 SUMMARY OF RECLAIMED WATER IMPEDIMENTS AND CONSTRAINTS

There are presently a number of issues which represent impediments to the expansion of water reuse in Florida. This study compiled a list of these impediments and constraints after seeking input and technical comment from various state agencies, environmental and water supply professionals, stakeholder groups, local governments and the general public. Many of these constraints are discussed in Appendix D-2 as they relate to the various distinct types of reuse. Seven general categories of issues were identified that drive the expansion of water reuse in the state.

- Cost and Funding
- Matching Supplies and Demands
- Regulatory
- Water Quality
- Public Input and Involvement
- Long-Term Uncertainty
- Scaling up to Regional Solutions

This section provides an overview of the key issues, impediments and constraints to the use of reclaimed water in Florida.

### 2.6.1 Costs and Funding

Lack of funding and the cost of developing or expanding water reuse systems are critical impediments to the development of reclaimed water supplies in Florida. During the course of this study, comments and input from agency staff, local governments, water industry professionals and members of the public frequently cited financial constraints as the primary factor impeding the expansion of water reuse.

Development or expansion of water reuse systems for beneficial use can require a significant investment in water treatment, transmission and storage infrastructure. Infrastructure costs can vary depending on the magnitude and complexity of the system. Capital construction costs of the 275 reclaimed water projects funded under the Water Protection and Sustainability Program averaged $6 million per MGD of water provided. Data from the 90 reclaimed water projects funded within the SWFWMD over the last five years averaged capital costs from $7-8 million per MGD provided.

In general, the less expensive projects, where users are located close to the source of the reclaimed water, are pursued early in a reclaimed water system's development. As a reclaimed water system matures, longer transmission distances between supplier and customers may lead to increased costs per MGD of benefit. Additionally, for projects involving ASR or AR, higher treatment requirements may lead to both increased infrastructure and operational costs. Table 2.3 shows comparative costs within the St. Johns River Water Management District (SJRWMD) for traditional water supplies and alternative water supplies other than reclaimed water and Table 2.4 shows different types of direct and indirect potable reuse (SJRWMD, 2014). Indirect recharge through the use of RIBs or wetland infiltration basins is generally cheaper than other forms of alternative water supply, while the increased treatment requirements for ASR or direct recharge significantly increase the final costs for these types of reuse. It is expected that the funding partnership between reclaimed water providers, WMDs and the State will continue to be essential to the expansion of the beneficial use of reclaimed water.

*Table 2.3: Comparative Costs within the SJRWMD for Traditional and Alternative Water Supplies*

| Water Supply Source | Avg. Daily Flow (MGD) | Unit Cost ($/1000 gal) | Type of Source | Total Unit Cost ($/1000 gal) |
|---|---|---|---|---|
| **Upper Floridan Aquifer** | 10 | $0.27 | Traditional | $0.27 |
| **Upper Floridan Aquifer** | 20 | $0.25 | Traditional | $0.25 |
| **Seawater** | 10 | $8.51 | Alternative | $8.51 |
| **Seawater** | 20 | $7.21 | Alternative | $7.21 |
| **Brackish Ground Water** | 10 | $2.55 | Alternative | $2.55 |
| **Brackish Ground Water** | 20 | $2.05 | Alternative | $2.05 |
| **Surface Water** | 10 | $2.43 | Alternative | $2.43 |
| **Surface Water** | 20 | $1.74 | Alternative | $1.74 |

Source: (SJRWMD, 2014)

*Table 2.4: Comparative Costs within the SJRWMD for Potable Reuse*.*

| Potable Reuse Water Supply Source | Avg. Daily Flow MGD | Unit Cost $/1000 gal | Unit Cost to Treat for GW Injection $/1000 gal | Unit Cost to Recover and Treat Recharged GW $/1000 gal | % Cost Adjustment for Losses and Net Benefit to Aquifer | Adjusted Yield MGD | Total Unit Cost $/1000 gal |
|---|---|---|---|---|---|---|---|
| **Saltwater Intrusion Barrier** | 10 | $0.55 | NA | $0.27 | 15% | 8.5 | $0.94 |
| **Saltwater Intrusion Barrier** | 20 | $0.49 | NA | $0.25 | 15% | 17 | $0.85 |
| **Rapid Infiltration Basin** | 10 | $0.60 | NA | $0.27 | 20% | 8 | $1.04 |
| **Rapid Infiltration Basin** | 20 | $0.59 | NA | $0.25 | 20% | 16 | $1.01 |
| **Created Wetland Infiltration Basin** | 10 | $0.45 | NA | $0.27 | 25% | 7.5 | $0.90 |

| Potable Reuse Water Supply Source | Avg. Daily Flow MGD | Unit Cost $/1000 gal | Unit Cost to Treat for GW Injection $/1000 gal | Unit Cost to Recover and Treat Recharged GW $/1000 gal | % Cost Adjustment for Losses and Net Benefit to Aquifer | Adjusted Yield MGD | Total Unit Cost $/1000 gal |
|---|---|---|---|---|---|---|---|
| **Created Wetland Infiltration Basin** | 20 | $0.44 | NA | $0.25 | 25% | 15 | $0.86 |
| **Direct Potable Aquifer Recharge** | 10 | $0.17 | $2.94 | $0.27 | 15% | 8.5 | $3.69 |
| **Direct Potable Aquifer Recharge** | 20 | $0.16 | $2.45 | $0.25 | 15% | 17 | $3.11 |
| **Aquifer Storage & Recovery** | 10 | $0.29 | $2.94 | $0.27 | 5% | 9.5 | $3.68 |
| **Aquifer Storage and Recovery** | 20 | $0.29 | $2.45 | $0.25 | 5% | 19 | $3.14 |
| **Direct Reuse** | 10 | $3.91 | NA | NA | NA | 10 | $3.91 |
| **Direct Reuse** | 20 | $3.85 | NA | NA | NA | 20 | $3.85 |

Source: (SJRWMD, 2014)
*Includes capital construction, operation and maintenance costs.

When funding support for infrastructure is unavailable, the costs of this infrastructure is passed on the end users through higher rates, which can reduce economic feasibility for end users. Typically, reclaimed water users (customers) are charged for the commodity by the provider. In some cases, less-expensive water alternatives are available to the user. During the Consumptive Use Permit (CUP) application process, the water management districts require that the feasibility of alternative sources, such as reclaimed water, is considered for non-potable uses. However, if the use of reclaimed water is determined not to be economically feasible, then the use of ground or surface water will be permitted if all other criteria are met.

### 2.6.2 Matching Supplies and Demands

The maturity of reclaimed water systems varies around the state. In areas where traditional, relatively cheap sources of water supply are available, there is little incentive for water utilities to invest in reclaimed water systems, particularly those types of reuse that provide potable water offsets. Financial and technical assistance from the WMDs or DEP is frequently needed to develop reclaimed water systems and to promote reclaimed water use in lieu of ground or surface water sources.

However, in areas where traditional water supplies are limited and reclaimed water is recognized as a valued resource, the main constraint in increasing the use of reclaimed water becomes the ability of a utility to match the available reclaimed water supplies with reclaimed water customer demands. The utilization rate (percentage of available reclaimed water used annually) of mature reclaimed water systems varies by utility.

In a mature reclaimed water system where traditional sources are limited, typically only 50% to 70% of treated wastewater flows go to reclaimed water customers. The highest utilization rates occur in areas where large industries and numerous residential customers can be supplied. Utilization is limited primarily by seasonal differences in the supply and demand of reclaimed water and the availability of storage or supplemental sources.

For an irrigation-based system, a utility typically commits to meeting peak demands of its customers, which occurs during dry periods when irrigation demand is the highest. During normal or wet periods, the utility disposes of the excess reclaimed water that is not used. Additional customers cannot be added unless the utility can meet their needs year round. For example, a reclaimed water system with a 1.0 MGD average annual flow normally is limited to supplying 0.5 MGD (50% utilization) on a yearly basis. This is because during the dry season, demand for reclaimed water for irrigation can more than double.

There are five main options to increase reclaimed water utilization beyond the typical 50% threshold. These include:

1. **Seasonal Storage** including reservoirs and ASR systems to increase the flexibility of a reclaimed water system to store excess reclaimed water during high supply and low demand times and retrieve stored water during peak demand times and seasons. Seasonal storage is:
    - Critical for irrigation based systems such as residential and golf courses who need year round supply through peaks and troughs in demand;
    - Not necessarily important for industrial, mining, power generation customers who have large storage on site and/or use water consistently throughout the year.
2. **System Interconnects** to enable the transfer of excess reclaimed water from one utility to an adjacent reuse utility that has un-met customer demands.
3. **Demand Management**
    - Interruptible customer base that can use other sources of water during peak demand times
    - Appropriate metered rates to discourage wasteful over-irrigation
    - Irrigation schedules to spread out irrigation demands
4. **Customer Selection and System Diversification** to provide reuse to a variety of customer types which have non-competing demand schedules. For instance, recharge customers can be served with excess reuse at any time or season without competing with other reuse customers and power plants typically have peak reuse demands during the summer months when irrigation demands are at their lowest.

5. **Supplementation** of reclaimed water supplies with other sources during short peak demands can enable the reuse utility to greatly increase its overall annual utilization rate.

### 2.6.3 Regulatory

Several regulatory impediments were identified during the course of the study that constrain the use of reclaimed water. These include:

- Underground Injection Control (UIC) Permitting. Obtaining a permit for ASR or AR with reclaimed water can be challenging. The cost of treating reclaimed water to drinking water standards as required prior to direct injection can be an impediment. The potential mobilization of arsenic into the groundwater from injection of reclaimed water adds uncertainties and cost into the permitting project and may jeopardize project success.
- Lack of Regulatory Framework for Direct Potable Reuse. While a regulatory framework exists for indirect potable reuse, no regulatory framework currently exists should a community wish to pursue direct potable reuse. Absent a clear process and criteria, communities may be hesitant to pursue DPR projects.
- Treatment Requirements for Supplementation of Reclaimed Water Systems. While the supplementation of reclaimed water systems can increase the beneficial use of reclaimed water, the treatment requirements for the supplemental water prior to comingling with the reclaimed water increases cost and are viewed by some as unnecessary.
- Restriction on Irrigation of Edible Crops. Direct irrigation with reclaimed water is not allowed on edible crops that are not peeled, skinned, cooked, or thermally processed before consumption. Stakeholders have expressed concerns that this restriction is not technically supported and adds to the public perception that reclaimed water is not safe.
- Local Regulation. Some local governments have adopted more stringent surface water and groundwater standards than the state standards, or instituted restrictions on the use of reclaimed water for landscape irrigation that otherwise meets DEP requirements. Such additional local restrictions can unduly limit the beneficial use of reclaimed water.
- Coordination of Regulatory Programs. Lack of coordination between DEP and WMD regulatory programs may result in missed opportunities to match producers and users of reclaimed water, or to identify appropriate supplementation sources for reclaimed water systems.
- Irrigation Wells. Landscape irrigators may install groundwater wells as a cheaper alternative to using available reclaimed water without adequate evaluation by the WMD of whether or not the use of reclaimed water is feasible and should be required as provided in s. 373.250(3), F.S.

## 2.6.4 Water Quality

### 2.6.4.1 *Nutrients*

There are a number of nutrient-impaired surface waters across Florida that are targeted for water quality improvement through existing or anticipated Basin Management Action Plans (BMAPs) (DEP, 2014). These efforts currently require the dedication of considerable local, regional, state and federal resources. While the process focuses on reducing nutrient inputs from all sources, one of the sources that is often identified in the BMAP process is wastewater effluent. In some cases, it is a significant source of nutrients to impaired waters.

While substantial progress in meeting water quality goals was made when point source discharges of wastewater to waterbodies were eliminated, the development of reclaimed water for reuse has the potential to create new, or contribute to existing, impairments. To avoid this problem, the nutrient content of reclaimed water should be recognized and incorporated into waterbody nutrient budgets. Specifically, where reclaimed water is used for turf or crop irrigation, the incorporation of reclaimed water derived nutrients needs to be included within fertilization regimes. This approach will allow a reduction in the amount of fertilizer applied and save the reuse customer money, while reducing, or at a minimum not increasing, nutrient inputs to the landscape.

### 2.6.4.2 *Environmental Substances of Concern*

In 2008, the conclusions of an internal DEP workgroup were published to evaluate strategies to effectively address a wide variety of potential contaminants, commonly referred to as Emerging Substances of Concern, or ESOC (DEP, 2008). These include organic contaminants, such as flame retardants, pharmaceuticals and personal care products, endocrine-modulating chemicals, nanoparticles and biological metabolites. It is almost inevitable that small amounts of these compounds, which are manufactured to protect human health, improve consumer goods, or optimize agricultural production, are unintentionally released into the environment. Relatively recent improvements in laboratory analytical methods have enabled the identification of these substances, which likely have been present in waters for decades. It is important to note that water is not the only exposure route. Measurable amounts of these types of compounds are also found in air and food. According to a national study on the Irrigation of Parks, Playgrounds and Schoolyards with Reclaimed Water (1600 sites) there have been "no incidences of illness or disease from either microbial pathogens or chemicals." (WateReuse Research Foundation, 2005).

The widespread use of reclaimed water can increase the number of pathways into the environment for ESOC in wastewater. This creates a challenge for governmental agencies, for the following reasons:

- environmental monitoring and chemical-specific regulation for millions of substances is impracticable due to the sheer number of compounds and potential monitoring costs; and,

- uncertainty associated with the environmental fate, transport and toxicological effects of ESOC.

2.6.4.3 *Salinity*

In some cases, reclaimed water can contain elevated salinity levels, most often in coastal areas where saline water seeps into the wastewater collection system. Elevated salinity in reclaimed water can affect its feasibility for certain types of reuse, particularly irrigation. In fact, the salinity of reclaimed water may be the single most important parameter in determining its suitability for irrigation (EPA, 2012). The salinity of particular reclaimed water can vary greatly from source to source. These salts in reclaimed water come from (Martinez & Clark, 2009):

- ions naturally found in the water (from the original source);
- ions remaining in dissolved form after separation of solids during treatment of the water;
- any salts added during the treatment process or home water softening; and,
- infiltration of saltwater into sanitary sewer lines prior to treatment (a possibility in coastal areas with high groundwater tables and older sewers in need of repair).

The amount of dissolved salts and plant salt sensitivity need to be considered when determining if irrigation is a viable use for a given reclaimed water system. In coastal areas, greater efforts to reduce infiltration of saltier groundwater into wastewater collection pipelines may be necessary to reduce the reclaimed water's salinity and thus be better suited for irrigation purposes.

2.6.5 Public Input and Involvement

Public input and involvement before and during the development and expansion of water reuse systems were identified as another important issue. The use of treated wastewater, even for non-potable uses, can elicit strong reactions from the public. As with other types of water projects, public support for reclaimed water projects can be critical to project success. The importance of involvement of elected officials and public education and participation, can be acute in the case of certain types of water reuse – especially indirect and direct potable reuse. The experiences of California and Texas in planning and implementing DPR projects clearly demonstrate that public education and involvement is key to project success.

2.6.6 Long-Term Uncertainty

In 2012, legislation was passed that addressed the extent of DEP and the WMDs' authority to regulate the use of reclaimed water through the CUP program. The legislation provides that reclaimed water is not subject to regulation under the CUP program until the reclaimed water has been discharged into "waters," including rivers, lakes, impoundments, wetlands and all other waters or bodies of water. Concerns have been raised by some providers and users about the lack of long-term commitments to serve and receive reclaimed water. Some reclaimed water providers are reluctant to spend money and extend services to customers without long-term commitments from those end users. In contrast, some end users have expressed concerns about taking reclaimed water without a long-term commitment by the provider (utility). The end user's

concern is that their existing CUP for a traditional source of water (e.g. groundwater) may be relinquished, only to have the provider re-direct reclaimed water elsewhere. In that case, their previous allocation of groundwater may no longer be available through the CUP process.
In contrast to the previous issue, where long-term commitments for reclaimed water are perceived to be a benefit, other stakeholders provided another perspective. In some cases, previous commitments by the utility may limit the ability to re-purpose that reclaimed water for more beneficial uses.

### 2.6.7 Scaling up to Regional Solutions

Water reuse is permitted by DEP on a facility-by-facility basis and reclaimed water is typically distributed within jurisdictional or service area boundaries. Collection of revenue from reclaimed water usage is also primarily focused within utility boundaries. Scaling up reuse programs to regional networks provides a challenge, given the local nature of reclaimed water production, distribution, billing and customer service. The successful transition to regional reuse will depend on selection of optimal collaborators, careful coordination and governance and funding.

## 2.7 RECOMMENDATIONS

The previous sections analyzed the types of water reuse and outlined the opportunities and constraints associated with expanding the beneficial use of reclaimed water. This section provides recommendations for reducing impediments and expanding the development of water reuse in Florida.

### 2.7.1 Funding/Cost Recommendations

Lack of funding was identified as a critical impediment to the expansion of reclaimed water. The need for additional funding support to develop water reuse systems was identified during the study by local governments and utilities, agency and water management district staff, industry professionals and members of the general public.

Reclaimed water can provide a cost-efficient, safe and sustainable water supply, but funding is needed to create the necessary infrastructure. Section 373.707(2)(c), F.S., provides that "funding for the development of alternative water supplies shall be a shared responsibility of water suppliers and users, the State of Florida and the water management districts." The funding partnerships are essential for the expansion of the use of reclaimed water and should be maintained. Increasing funding support can alleviate fiscal impediments and greatly increase the feasibility of developing the infrastructure to realize expanded reclaimed water supplies for beneficial use.

Priorities for funding should include reclaimed water projects that provide significant potable quality offsets or significant aquifer recharge that supports water supply goals or provides natural system restoration. The addition of significant storage facilities for reclaimed water, treatment upgrades to provide water quality suitable for aquifer recharge or indirect potable reuse, transmission facilities to supply reclaimed water to large users and infrastructure to interconnect reclaimed water supplies are the types of projects expected to provide significant benefits.

### 2.7.2 Regulatory/Agency Action Recommendations

During the development of this study, DEP and the WMDs received considerable feedback relating to the agency processes that might help expand the beneficial reuse of reclaimed water. Based on stakeholder input and building on lessons learned in previous reclaimed water efforts, DEP identified the following regulatory/agency action recommendations:

#### 2.7.2.1 *Reclaimed Water Aquifer Storage and Recovery and Aquifer Recharge*

Storing reclaimed water underground for future use and using reclaimed water to recharge aquifers affected by groundwater withdrawals, are both key elements to enhancing the beneficial use of reclaimed water and meeting future water supply needs. DEP should review the existing UIC rules applicable to reclaimed water and identify and pursue rule revisions that would streamline permitting of these systems while maintaining protection of groundwater resources and public health and safety.

#### 2.7.2.2 *Regulatory Framework for Potable Reuse*

Both indirect and direct potable reuse have promise for use in Florida to increase the beneficial use of reclaimed water and to ensure adequate water supplies for the future while sustaining natural systems. Chapter 62-610, F.A.C., currently provides a regulatory framework for indirect potable reuse involving the augmentation of surface waters with reclaimed water. Although not called IPR, the recharge of groundwater with reclaimed water is also addressed in the rule. DEP should review the existing rules that would apply to aquifer recharge for IPR to determine if changes or clarifications are needed to ensure that the rules provide adequate and clear guidance to applicants for IPR projects.

Unlike IPR, DEP rules do not provide a clear regulatory framework for the implementation of a direct potable reuse project, should a community wish to pursue that option. Such rules require consideration of both the wastewater and drinking aspects of the regulatory requirements. DEP should adopt rules to establish clear procedures and criteria for implementing direct potable reuse, including treatment plant operator requirements for wastewater treatment plants that will produce water for direct potable reuse.

#### 2.7.2.3 *Supplementation with Surface Water, Stormwater or Groundwater*

The use of surface water, stormwater or groundwater for supplementation of reclaimed water systems is a tool that allows a utility to serve more customers and reduce the need for reclaimed water disposal. Stakeholders have expressed concerns that the treatment required by rule 62-610.472, F.A.C., prior to augmentation of reclaimed water systems is unduly burdensome and not necessary in all cases. DEP should review the treatment requirements for supplementation of reclaimed systems to determine if changes can be made that would reduce treatment requirements while maintaining appropriate public health and safety protections.

2.7.2.4 *Irrigation of Edible Crops*

Direct irrigation with reclaimed water is not allowed on edible crops that are not peeled, skinned, cooked, or thermally processed before consumption. Stakeholders have expressed concerns that this restriction is not technically supported and adds to the public perception that reclaimed water is not safe. Direct irrigation has been safely and successfully practiced in other states for decades. DEP, with assistance from the Department of Health, should review the restriction on the direct use of reclaimed water on edible crops in Chapter 62-610, F.A.C., to determine if revision is appropriate.

2.7.2.5 *Nutrients in Reclaimed Water*

Increased levels of nutrients in surface waters have raised issues and concerns about the potential contribution of nutrient loads from irrigation or aquifer recharge with reclaimed water. Reducing the nutrients in reclaimed water where feasible, providing adequate education to reclaimed water users so that fertilizer use can be reduced when irrigating with reclaimed water and providing best management practices to ensure that reclaimed water runoff does not reach surface waters, will all contribute to addressing these water quality concerns and promote the expansion of the reuse of reclaimed water. Specific recommendations include:

- DEP should develop public education and outreach material on the nutrient content of reclaimed water, its value as a fertilizer, the need to balance use of commercial fertilizers in these areas so as not to exceed recommended overall nutrient application rates and cost savings associated with limiting commercial fertilizer application because of the nutrient value of the reclaimed water. The material should be distributed in areas where reclaimed water is provided to customers, with emphasis on BMAP areas. All information should be provided in the context of the harm associated with excess nutrient levels in surface waters and springs and should be made easily understandable to the average homeowner. The information should be disseminated by DEP, local governments, utilities and the University of Florida Institute of Food and Agricultural Sciences (IFAS) through Green Industries Best Management Practices training, local nutrient reduction programs such as Think about Personal Pollution, utility bills, public service announcements, nurseries, home improvement centers, garden clubs and other forums.
- DACS should implement fertilizer offset Best Management Practices (BMPs) for all growers irrigating with reclaimed water. For example, the BMP manual "Water Quality/Quantity Best Management Practices for Florida Vegetable and Agronomic Crops" was last updated in 2006. The current draft update includes the following new BMP #3 for growers in the springsheds of large springs: "Do not exceed the IFAS recommended fertilizer rate for N and P, including any contributions from irrigation sources."
- The BMP should be expanded beyond spring areas and the reference to "contributions from irrigation sources" should be more explicit about reclaimed water, including linking to information on the nutrient content of reclaimed water

being made available to agricultural areas. Similar information should be included in other BMPs where the use of reclaimed water is relevant.

- In order to make nutrient concentrations of reclaimed water used for irrigation easily available to the user, the nutrient content of reclaimed water provided to utility customers for irrigation should be included in DEP's Annual Reuse inventory on a facility-by facility basis (DEP, 2014).

#### 2.7.2.6 *More Restrictive Local Government Ordinances*

Some local governments have adopted more stringent surface water and groundwater standards than the state standards, or instituted restrictions on the use of reclaimed water for landscape irrigation that otherwise meets DEP requirements. Such additional local restrictions may unduly limit the beneficial use of reclaimed water. In these instances, the applicable WMDs and DEP should work cooperatively with local governments to develop mechanisms for exceptions to these local restrictions when all state requirements are met and water resources are not expected to be adversely impacted by the proposed reclaimed water use.

#### 2.7.2.7 *Coordination of DEP/WMD Programs*

Coordination between the water-related programs of DEP and the WMDs is critical to the timely identification of opportunities to increase the beneficial use of reclaimed water. In most WMDs, but not all, DEP wastewater permitting staff have periodic meetings with the WMD consumptive use permitting and water supply planning staff to allow the matching of potential users of waters with reclaimed water supply. DEP and the WMDs need to ensure that these coordination meetings take place at least bi-annually in each WMD to ensure that opportunities to match users and suppliers are identified.

The use of stormwater for supplementation of reclaimed water systems has also been identified as a potential method for increasing the beneficial use of reclaimed water. DEP and the WMDs should establish periodic meetings between DEP wastewater staff and WMD environmental resource permitting staff to identify opportunities for stormwater from new development to be used for supplementation of reclaimed water systems.

The program coordination processes discussed above may also serve to highlight projects for WMD reclaimed water cost share assistance.

#### 2.7.2.8 *Public Involvement and Participation Recommendations*

As Florida's water use regime shifts from traditional groundwater sources to alternative water supplies such as reclaimed water, public support will be essential to the success of expanding water reuse in the state. Public outreach by DEP and the water management districts is needed to inform and involve the public about the use of reclaimed water and build public support for the concept of water reuse – especially for newer concepts like potable reuse. The DEP, in coordination with the five WMDs, should establish a statewide education and outreach program for reclaimed water. The program should focus on educating the public on the treatment and uses of reclaimed water and building trust in current regulatory safeguards for all types of water reuse. Partnership with groups such as the WateReuse Association will be important in providing the necessary science, engineering and expertise. Outreach with stakeholder groups will continue to be essential during the discussion and development of individual water reuse initiatives.

### 2.7.3 Recommendations for Providers and Users of Reclaimed Water

In 2012, legislation was passed that addressed the extent of DEP and WMD authority to regulate the use of reclaimed water through the CUP process. The legislation provides that reclaimed water is not subject to regulation under the consumptive use permitting program until the reclaimed water has been discharged into “waters,” as defined in section 403.031(13), F.S. Given the unique status of reclaimed water, in comparison to surface water and groundwater, recommendations are included for the providers and the users of reclaimed water.

#### 2.7.3.1 *Implement Mandatory Reuse Zones*

Local governments that currently operate or are contemplating the addition of a reclaimed water system, should consider the establishment of Mandatory Reuse Zones. Such ordinances require the connection to a reclaimed water system where made available by the utility and prohibits the use of potable water provided by the utility for irrigation and other non-potable uses that could be met by reclaimed water. This approach would be especially effective in protecting water resources in Water Resource Caution Areas, where it would have the benefit of reducing otherwise stressed sources of water. The concept was outlined in the 2012 final report by the Reclaimed Water Policy Workgroup (FWEAUC, 2012).

#### 2.7.3.2 *Implement Tiered Reclaimed Water Rates*

The second recommendation for local governments is to consider the use of tiered reclaimed water residential rates, where appropriate, to encourage efficient use of this resource. In areas where traditional sources are limited and reclaimed water has fully transitioned from a disposal option to a valuable water resource, efficient use of reclaimed water should be promoted. Price signals are one of the most effective methods of curbing wasteful use by customers. It is recognized that more efficient use of reclaimed water prompted by tiered rates may have the unintentional side-effect of creating disposal problems for the reclaimed water utility unless adequate reclaimed water storage facilities are available. Tiered water rates should be examined most closely by systems with storage capabilities.

#### 2.7.3.3 *Focus on Industrial/Commercial/Institutional Users*

Utilities with water reuse systems, or plans to develop a water reuse system, should explore potential industrial, commercial and institutional (I/C/I) sector customers for reclaimed water. Increasing the use of reclaimed water by the I/C/I sector is highly recommended for a number of reasons. First, I/C/I uses are the most efficient reuse activities in terms of potable quality water offset (DEP, 2002). As such, continued expansion of I/C/I reuse will extend water supplies to a greater extent than other types of reuse. Also, I/C/I uses are usually more cost effective for installation and maintenance, avoid disruptive retrofitting of older communities, sends more volume of water to fewer customers and offers more stable seasonal demands. In addition, depending on the specific use, the nutrient concerns related to irrigation of landscaping may be avoided.

#### 2.7.3.4 *Long-Term Agreements between Users and Suppliers*

It is recommended that reclaimed water providers consider long-term agreements with end users. If cost-sharing with the state is involved, long-term agreements between reclaimed water providers and users should be required or strongly encouraged. Long-term agreements provide the utility with certainty of customers and recovery of costs and well as provide assurances to the end user that reclaimed water deliveries will not be redirected during the term of the agreement.

# 3 STORMWATER

## 3.1 BACKGROUND

The management of stormwater in Florida has changed markedly over several decades. The first stormwater management systems were primarily pipes, ditches and canals designed to address public health and flooding of roadways, homes and property. As water quality concerns associated with untreated stormwater became apparent, new BMPs were incorporated in the design of stormwater systems. Today, many Florida communities use stormwater management ponds as desirable open space amenities. The on-site storage of stormwater stands in direct contrast to the earlier management methods that drained stormwater quickly and efficiently away from communities.

The State of Florida receives a significant amount of rainfall, between 50 and 65 inches, per year. To deal with this large volume of water, stormwater management systems are currently designed to achieve three primary goals: 1) protect communities from flooding (safety and property); 2) improve water quality of runoff discharged to receiving water bodies or wetlands (stormwater treatment); and 3) protect the hydrology of natural systems. Nearly every BMP employed to achieve these goals involves on-site storage of stormwater runoff and the subsequent infiltration to groundwater or slow release of this volume to surface water.

Senate Bill (SB) 536 directed the Department of Environmental Protection (DEP), in coordination with stakeholders, to investigate options to expand the beneficial use of stormwater. Beneficial use of stormwater needs to be complementary to the existing goals of stormwater management. For the purpose of SB 536, stormwater refers to the flow of water which results from and which occurs immediately following, a rainfall event and which is normally captured in ponds, swales, or similar areas for water quality treatment or flood control.

The urbanization of Florida, including the conversion of agricultural lands to other uses, has resulted in significant changes in the timing of stormwater runoff. These changes have the potential to provide a substantial volume of stormwater that can be used for beneficial uses. Figure 3.1 shows example hydrographs from typical developed and undeveloped watersheds to illustrate the changes in stormwater flow caused by historic stormwater management practices.

Opportunities exist for expanding the beneficial use of stormwater for water quality, water supply and natural resource needs. As an example, increased stormwater infiltration can address both water quality concerns in the Total Maximum Daily Load (TMDL) program and extend groundwater resources for water supply. Stormwater projects can be used to provide aquifer recharge, address minimum flows and levels (MFLs) in surface waters, hydrate wetlands and irrigate residential, commercial and agricultural properties.

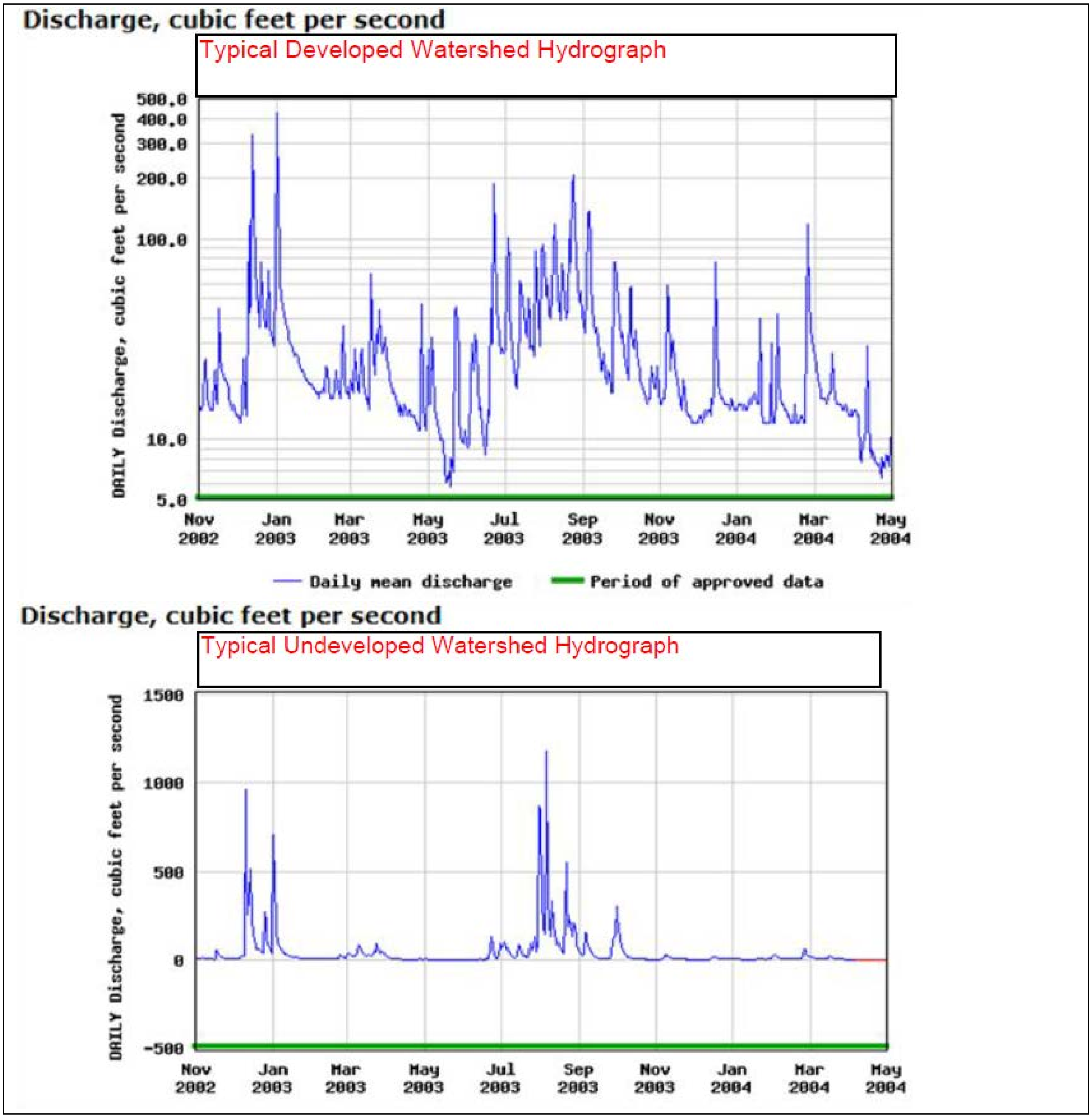



*Figure 3.1.1: Typical Developed and Undeveloped Watershed Hydrographs*

### 3.1.1 Traditional Uses of Stormwater

Stormwater has served as a water supply source when other sources of water were not readily available. On a small-scale, cisterns were historically used to supply domestic water for single family homes where public water was not readily available. Stormwater was collected from rooftops, stored in cisterns and used for various household purposes.

Medium-scale beneficial use has largely been limited to communities that use stormwater ponds as a source for turf or landscape irrigation. Typically, a pump is used with a screened intake pipe to withdraw pond water for use in irrigating lawns or green space within a development. The irrigated areas are typically within the contributing drainage area of the pond.

Historically, the use of stormwater for water supply purposes has been limited to stressed areas or as a cost savings measure. As traditional sources of water continue to become limited, the development of stormwater as an alternative source will evolve.

### 3.1.2 Regulatory Framework

There are numerous federal, state and local rules related to stormwater management. Almost without exception, rules developed in the late 1980s and 1990s were aimed at flood protection or water quality improvement. Little attention has been paid to the potential to beneficially use managed stormwater. Most federal and state stormwater management regulations are administered by DEP and the Water Management Districts (WMDs).

#### 3.1.2.1 *Federal*

Stormwater is regulated through the Clean Water Act under the National Pollutant Discharge Elimination Systems (NPDES). Within the NPDES stormwater program, local governments manage publicly operated stormwater management systems based on the provision outlined in the Municipal Separate Storm Sewer System (MS-4) regulations. It follows that any significant attempt to beneficially use water contained within an MS-4 may require reporting under the NPDES program. There is currently very little information or criteria related to using stormwater as a resource in the NPDES regulations. This program is administered by DEP with Environmental Protection Agency (EPA) oversight.

Floodplain management is primarily a function of the Federal Emergency Management Agency (FEMA). FEMA works in various levels of cooperation with WMDs and local governments in an effort to protect the public through mapping the floodplain. The current effort underway is FEMA's Multi-Hazard Flood Map Modernization Program. This information is used by the WMDs and local governments to reduce potential flood impacts for development.

#### 3.1.2.2 *State*

The WMDs and DEP, implement the water resource portions of Chapter 373, F.S. Stormwater management systems, dams and reservoirs are regulated under Part IV of Chapter 373, F.S., which includes flood and water quality protection criteria. Permitting of consumptive uses of water is regulated under Part II of Chapter 373, F.S., which includes criteria related to planning and permitting for the consumptive use of water. For the most part, there is little nexus between the Part II and Part IV programs to encourage the beneficial use of stormwater. In some cases, the programs can hinder rather than encourage the beneficial use of stormwater.

The human health aspect related to potable water (disinfection, public treatment and distribution systems, etc.) is largely the purview of DEP under provisions of Chapter 403, F.S. When stormwater is used for drinking water, it requires treatment similar to any surface water source. DEP also regulates the treatment and distribution of reclaimed water for a variety of uses. Rule

62-610.472, F.A.C., provides criteria for the use of stormwater to supplement reclaimed water systems.

There are related programs under Chapters 373 and 403, F.S., including TMDLs, MFLs and water reservations. The TMDL program is implemented through BMAPs adopted by DEP. MFLs and water reservations are generally adopted by the WMDs and used in water supply planning and regulation.

The use of stormwater within a building footprint is governed by the plumbing element of the 2010 Florida Building Code. This section of the building code does not address the appropriate non-potable uses of stormwater internal to a building. This code is administered by local governments.

DACS implements a program to address stormwater quality from agricultural activities. Rather than a “permitting program”, it is driven by an aggressive BMP program to conserve soil and water resources as they relate to farm practices. This program is administered under the provisions in Chapters 373 and 403, F.S.

The UIC program is outlined in Chapter 62-528, F.A.C. This rule governs the use of drainage wells due to their potential impact on the water quality of the receiving aquifer. The use of drainage wells are used as a cost effective tool in the management of stormwater for protection from flood impacts.

Local governments implement stormwater programs by ordinance and growth management rules to address specific areas and issues of concern. These rules vary widely and in some cases include receiving water protection and creative management of stormwater through local Low Impact Design (LID) criteria.

## 3.2 Stormwater for Water Supply

The use of stormwater as a water supply source has increased over the past ten to fifteen years. The increase has been primarily in areas where groundwater and surface water have limited availability. Typically, harvested stormwater has been used for irrigation throughout the state and as both an irrigation and potable source in the southern half of the state. Potable use of stormwater occurs in areas where the definition of stormwater and surface water are blurred due to the large contributing watershed area, flat terrain and shallow water table conditions. Stormwater has been a source for potable uses in communities near the coast that have large scale drainage systems with a network of freshwater canals like the City of North Port in Sarasota County or the Water Control Districts in southeast Florida established under Chapter 298, F.S.

The relative scale of the types of projects for the potential beneficial use of stormwater may be grouped into four general categories; Residential or Commercial (project areas less than 5 acres), Basin or Subdivision (project areas of 5 to 100 acres), Watershed or Regional (multi-basin areas greater than 100 acres) and Agricultural. The Florida Department of Transportation (DOT) could also be considered a separate category as DOT owns and operates a considerable number of unique stormwater management systems in Florida.

#### 3.2.1 Residential or Commercial

At the individual residential lot or small commercial scale, the use of cisterns, rain barrels and rain gardens to collect stormwater has enjoyed resurgence and has been advocated by many organizations as well as government entities through implementation of LID practices. While this has resulted in a limited quantifiable reduction of the use of potable water for landscape irrigation, property owners using these methods for outside watering may see a significant reduction in utility bills, especially where sewer billing is tied to potable water usage. The use of cisterns, rain barrels and rain gardens for yard watering and other similar scale uses is becoming more widespread through the "Master Gardener" program with the IFAS Extension Service and similar outreach efforts with local potable water utilities. Additionally, it is not uncommon for individual homeowners to tap into adjacent stormwater ponds and drainage canals for lawn irrigation.

#### 3.2.2 Basin or Subdivision

Basin or subdivision projects may be considered approximately 5 to 100 acres in size. These projects typically have a central stormwater management system (pond) allowing the use of stored stormwater runoff and the surrounding surficial aquifer for irrigation of common areas. Based on conversations with landscape irrigation contractors, thousands of these systems have been installed around the state as a low cost irrigation water source that is considered a community asset. Insufficient data exists to accurately quantify the amounts of water beneficially used from these systems.

#### 3.2.3 Watershed or Regional

Watershed or regional projects typically involve multiple basins with a combined acreage of greater than 100 acres, were constructed prior to existing rules (pre-1980s drainage systems) and would normally be managed by a local government, Chapter 298 District or a public/private partnership. Watershed or regional projects have a nearly continuous flow and are commonly designed to alleviate flooding. They usually do not provide a level of water quality treatment consistent with current rules or goals. Current watershed or regional projects are commonly designed with a water quality treatment element.

For example, Lake Hilaman is a surface water body located in the City of Tallahassee that is used to irrigate a City-owned 18-hole golf course surrounding the lake. The lake has a contributing area of approximately 600 acres from a heavily urbanized watershed. The project has significantly reduced the amount of groundwater used for irrigating the golf course.

Large watershed-scale projects may have the greatest opportunity for beneficial uses of stormwater because the systems are typically controlled by a single entity or partnership, large volumes of water are managed and they provide an opportunity for low cost/high value water quality and natural systems improvements.

3.2.4 Agricultural

The agricultural applications that use tailwater recovery systems to harvest stormwater are similar in scale to the subdivision scale (10-100+ acres) in open-air applications. In tunnel (a low cost version of a standard greenhouse) and nursery operations, the area can be smaller. The hardware of pumps and telemetry systems is also somewhat similar but the intensity of management is greater than when irrigation water is used in landscape applications.

Tailwater recovery systems, designed to collect and use stormwater and irrigation runoff for irrigation, are excellent examples of the beneficial use of stormwater. Tailwater recovery system design typically consists of a pond constructed to a depth of about 5 feet below normal high groundwater. The area of the pond is generally about 5% to 10% of the land area to be irrigated. The pond is situated in a low topographic area so both stormwater and irrigated water can flow back into the pond. Special care in siting the pond is needed to stay away from wetlands that could be impacted by routine pumping operations. Further, management practices can be tailored to create a “cone of depression” in the surficial aquifer reducing off-site migration of nutrient rich surficial groundwater. Existing tailwater recovery systems have been implemented in partnership with the SWFWMD, SJRWMD and Suwannee River Water Management District (SRWMD). These types of systems hold promise for expanded future development in harvesting stormwater for beneficial agricultural use in areas where the groundwater levels are close to the ground surface.

In the SWFWMD, many tailwater recovery systems are being implemented through their Facilitating Agricultural Resource Management Systems (FARMS) Program. The purpose of the FARMS Program is to implement production-scale agricultural BMP projects that provide resource benefits that include water quality improvement, reduction of Upper Floridan aquifer withdrawals and/or conservation and restoration or augmentation of the area’s water resources and ecology. A goal for the FARMS Program is to reduce agricultural water use in the Southern Water Use Caution Area (SWUCA) by 40 MGD over the next 20 years. FARMS is designed to serve as an incentive to the agricultural community to install and maintain irrigation BMPs that will promote surface water and groundwater resource sustainability. As of May 2015, there are 172 approved FARMS projects that when fully implemented are estimated to offset 26.3 MGD of groundwater pumping and provide 43.8 MGD of frost-freeze protection.

The SRWMD is actively developing relationships with other agencies to create cooperative funding opportunities to stretch available financial resources. As of January 15, 2015, one tailwater recovery pond project has been approved. It will conserve 45 million gallons of groundwater per year. The concept involves installing drainage tiles over a 240-acre tract where stormwater is collected and piped to a downstream pond for future irrigation use. The SRWMD has also applied for additional grants from EPA to construct tailwater recovery projects on tracts ranging from four to 104 acres.

In the SJRWMD, St. Johns County and the agricultural farmers in the Deep Creek basin, a tributary to the St. Johns River, have partnered to develop the Masters Tract Regional Stormwater Treatment facility. The project, located within a 272-acre parcel, will collect stormwater runoff from upstream potato farms, convey the water through multiple treatment BMPs including a wet pond and finally distribute the water to sod farms for irrigation use. Excess discharge will continue to Deep Creek, but the nutrient pollutant load will be reduced to help meet TMDL goals.

#### 3.2.5 DOT Studies and Initiatives

Due to the often high cost of highway right-of-way acquisition, DOT has looked for opportunities to combine infrastructure with adjacent landowners to store and harvest highway stormwater runoff. When constructing roadway expansion improvements in certain highly developed urban areas, DOT has partnered with landowners, such as golf courses, to develop a stormwater harvesting design. Examples of these types of DOT/golf course partnerships are the Orange Brook Golf Course in Hollywood and the Dubsdread Golf Course in Orlando. These projects are possible because of the presence of a large irrigation need (golf course) coupled with a nearby source of stored stormwater.

DOT has also partnered with local governments to develop alternative water supplies. For these types of projects, captured stormwater is sent to a wastewater treatment plant to increase the reclaimed water volume or directly used as a non-potable irrigation source. The Altamonte Springs-DOT Integrated Reuse and Stormwater Treatment (A-FIRST) is an example of the beneficial use of stormwater on a regional scale and is the first partnership of its kind in Florida. The partnership includes DOT and the City of Altamonte Springs, along with DEP, the SJRWMD and the City of Apopka. Before A-FIRST, stormwater from I-4 would flow into drainage ponds/swales. Now, stormwater is captured, treated and redirected into the City's reclaimed water system and then used for irrigation. The City of Altamonte Springs sends any of its remaining reclaimed water to the City of Apopka, which is experiencing water shortages of its own. The project also reduces impacts to area springs and improves water quality in the Little Wekiva River. The project is being almost entirely funded by DOT through their savings from eliminating the need to build retention ponds for the expansion of the I-4 roadway. Current DOT policy requires designers to look for the above types of coordinated opportunities when designing stormwater management for their work program.

#### 3.2.6 Stormwater Management in Other States vs. State of Florida Practice

All states are required to respond to federal NPDES regulations, as promulgated by the 1972 Clean Water Act. NPDES regulations target investment in stormwater management infrastructure based on downstream water body health. In states where only NPDES requirements drive water quality investments, state transportation departments target regional stormwater treatment in areas of more valuable natural resources, reserving their limited funds to take advantage of opportunities to address priority water quality objectives. In contrast, state regulations in Florida require all development that exceeds certain thresholds to provide water quality treatment prior to discharge to downstream waters of the state and in general do not allow water quality treatment within waters of the state. In some cases, this restricts the collection of untreated stormwater in larger regional ponds that could serve as sources for the beneficial use of stormwater. Increased regulatory flexibility to consider regional stormwater treatments systems where the conveyances are of low ecological value, can increase opportunities for the beneficial use of stormwater and address more water resource management objectives in an area.

## 3.3 Challenges to Expanding Beneficial Uses

There are a number of challenges with expanding the beneficial use of stormwater to help meet existing and future water supply and natural resource needs. Primary constraints and impediments to the expansion were examined through the review of ongoing stormwater management programs, which included input from various state agencies, environmental and stormwater professionals, stakeholder groups, local governments and the public. This section provides an overview of the key constraints and impediments.

### 3.3.1 Reliability

Stormwater, by its nature, is available periodically as a result of rainfall. In order to ensure that supplies are available during times of need, sufficient transmission and storage facilities must be available to capture and store water during wet periods.

### 3.3.2 Funding

As with most alternative supplies, lack of funding and the cost related to treatment, storage and transmission infrastructure can be a significant impediment to the development of stormwater for water supply.

### 3.3.3 Regulatory

In preparing this study, several regulatory issues that have the potential to constrain or impede the use of stormwater runoff were identified. These regulatory issues are described below.

#### 3.3.3.1 *Water Management District Permitting*

As previously described, there are two primary regulatory branches of water management, consumptive use permitting (CUP) and environmental resource permitting (ERP). Stormwater harvesting within these permitting processes is not adequately addressed to encourage beneficial uses. Areas where significant strides have been made in the use of stormwater for water supply, such as in the SWUCA of the SWFWMD, have been prompted by restrictions on groundwater use and the lack of other feasible alternative sources.

#### 3.3.3.2 *State Wastewater Permitting*

Historically, wastewater discharges to Florida's waters added unwanted nutrients to surface waters. Reusing treated wastewater for irrigation helped to address this issue. This strategy not only reduced the impacts to downstream waters but also extended the use of higher quality groundwater. Stormwater may be harvested and used in a similar way, leading to a similar outcome.

Chapter 62-610, F.A.C., outlines the requirements for the use of reclaimed water, including for irrigation. Blended use of stormwater and reclaimed water, or using stormwater to supplement reclaimed water systems, can extend or offset the use of fresh traditional groundwater. Currently, Chapter 62-610, F.A.C., requires stormwater to be disinfected prior to blending with reclaimed water.

#### 3.3.3.3 *UIC Rules for Aquifer Recharge*

Aquifer recharge wells are included in the Class V, Group 2 wells as defined by Chapter 62-528, F.A.C. These wells are used for the storage or disposal of fluids into or above an Underground Source of Drinking Water (USDW). The current regulatory framework requires the injected water meet specified water quality criteria depending on the classification of the receiving aquifer. The costs associated with treating stormwater to meet drinking water quality criteria can be cost prohibitive. In some areas, the water quality standards for enhanced aquifer recharge using wells may be overly stringent compared to natural recharge processes.

#### 3.3.3.4 *The Food Safety Modernization Act (FSMA)*

The FSMA requires the Food and Drug Administration (FDA) to develop regulations aimed at improving the safety of produce. There are two components of the new regulations: standards for produce production and food safety measures for facilities that process food for human consumption. The proposed rules related to water quality of agricultural water are of particular interest from a stormwater harvesting perspective. Proposed standards include general water quality, water system inspection, water treatment and water testing requirements, requirements for water used in harvesting, packing and holding of produce and recordkeeping requirements. From the growers' perspective, the proposed agricultural water standards may have significant costs for testing, treatment and maintenance, particularly for harvested stormwater. Continued partnerships with DACS for cost share opportunities and improved BMPS are important in developing stormwater harvesting options such as tailwater recovery ponds.

### 3.3.4 Agricultural Operations

The agricultural industry has unique challenges in using stormwater as an irrigation water supply. Stormwater harvested for agricultural operations may be a potential source of pathogens that can contaminate produce. However, it may be a viable option for other agricultural uses such as irrigation of sod. In addition, tailwater recovery ponds take valuable agricultural land out of production potentially creating financial challenges. To date, this has been a barrier to more widespread use of this technology.

### 3.3.5 Public Perception

Although stormwater is used in the southern portion of the state, it has not been recognized as a significant alternative source of water to augment freshwater supply. Stakeholders provided varying concerns and opinions on this concept. Water quality concerns highlight public perception as one of the major challenges for stormwater harvesting. Additional concerns include impacts to recreational uses, wildlife, wetlands and downstream receiving waters.

In regards to water quality, the most common concerns are potential high nutrient loads and the potential presence of pathogens, microbes and blue green algae along with the potential health effects that could result from exposure and contact to stormwater.

#### 3.3.6 Timing

There are location specific concerns and management considerations regarding the timing of high and low flows to certain receiving water bodies. In contrast, at some locations a reduction in high flows could potentially have a positive effect on water quality and water levels for downstream natural resources.

#### 3.3.7 Technical

Although this study identified potential technical issues, lack of technical expertise is unlikely to be a significant impediment to the development and expansion of stormwater supplies. There is sufficient technical experience throughout the surface water and wastewater industry that would be relevant to advancing stormwater projects to meet water supply needs.

## 3.4 RECOMMENDATIONS

Stormwater is normally captured and/or conveyed by maintained ponds, swales, or similar features for water quality treatment or flood control. Capturing available stormwater for water supply, particularly to support conjunctive use projects, may be effective but can be expected to have varying levels of reliability, depending on storage and climatic conditions. Due to the variations in Florida's geology and water supply needs, developing regional approaches may be beneficial, particularly in areas of high surface water/groundwater interaction. This study identified the near-term actions that could help mitigate constraints to expanding beneficial use of stormwater.

#### 3.4.1 Regulatory

During the development of this study, DEP and the WMDs received considerable feedback relating to the regulatory process of the developing surface water supplies. Based on stakeholder input and building on lessons learned in previous efforts, the following regulatory actions are recommended.

##### 3.4.1.1 *Consumptive Use Permitting*

The CUP rules should be revised to include harvested stormwater runoff as a lower quality source that should be evaluated prior to permitting the use of surface or groundwater in a manner similar to reclaimed water.

Revisions should be considered to the CUP and ERP rules requiring the ERP and CUP permit applications to be jointly processed when both types of permits are required for a project/development.

### 3.4.1.2 *Environmental Resource Permitting Program*

Florida regulations require all development that exceeds certain thresholds to provide water quality treatment prior to discharge to downstream waters of the state. This includes discharges to manmade conveyance channels if these are classified as waters of the state. Mechanisms should be developed within the Environmental Permitting Program that would allow conveyance of untreated stormwater when the effect on environmental resources is minimal in order to allow stormwater harvesting from a single, large point of extraction rather than multiple smaller ponds. There is an opportunity to incorporate this approach in the BMAP process where stakeholders collectively agree to the highest and best outcomes.

The ERP stormwater rules should be revised to incentivize "direct recharge" systems (i.e. minimal pretreatment, sand chimneys, etc.) that receive runoff from landscapes with a very low risk for adverse pollutant loads.

The current stormwater rules allow for, but do not specifically promote, beneficial stormwater harvesting/reuse (e.g. capture and use of stormwater for irrigation). The rules should be evaluated to determine if incentives could be incorporated for certain types of stormwater capture and reuse.

### 3.4.1.3 *Reclaimed Water Permitting Rule 62-610, F.A.C.*

DEP should review the treatment requirements in Chapter 62-610, F.A.C., for the blending of harvested stormwater and treated wastewater to determine if changes can be made that would reduce treatment standards while maintaining appropriate public health and safety protections.

### 3.4.1.4 *Underground Injection Control Permitting Rule 62-528, F.A.C.*

Aquifer recharge and aquifer storage and recovery represent important strategies to address storage needs, but can be hampered by existing regulatory framework, particularly water quality requirements. DEP should reconsider the present UIC rules that regulate aquifer recharge and work to establish a regulatory framework that improves the viability of using harvested stormwater runoff for aquifer recharge, but also continue to provide the necessary protections for groundwater resources and public health and safety.

### 3.4.1.5 *Food Safety Modernization Act*

At the time of publication of this report, the FDA is promulgating new agricultural water use standards under the FSMA. As these standards will provide requirements for general water quality, water system inspection, water treatment and water testing, there is potential that the cost of compliance with the new requirements will create a disincentive for use of harvested stormwater in agricultural operations. DACS, IFAS and the WMDs should continue to work with the FDA on new agricultural water quality requirements to ensure that they are compatible with the use of harvested stormwater. Further, DACS, IFAS and the WMDs should conduct outreach with agricultural producers to support the use of harvested stormwater, where feasible, in light of future water use standards.

#### 3.4.1.6 *Florida Building Code*

The next time the Florida Building Code is "opened" for revision, the use of stormwater should be addressed in a manner similar to the use of reclaimed water to allow use for non-potable applications like toilet flushing or other industrial uses.

### 3.4.2 Partnering and Funding

Identifying and attracting partners and funding to invest in future stormwater harvesting project opportunities may require regional cooperation. Stormwater projects could provide nontraditional and alternative water supply to meet future water demands and natural resources needs. Since these projects will produce water at a higher cost than traditional fresh groundwater sources, support from other funding sources will be needed. Building on lessons learned in previous planning efforts, the following actions are recommended to potentially achieve a stakeholder buy-in and a greater return on investment for stormwater harvesting opportunities.

#### 3.4.2.1 *Regional Water Supply Planning*

Utilizing stormwater to meet existing and future water supply and natural resource needs is increasing, but stormwater is currently only given minimal consideration in the regional water supply planning process. The WMDs, as part of the regional water supply planning process, should establish a coordinated process for identifying opportunities to link stormwater supplies to water supply needs. Such a coordinated process could bring together, where appropriate, MFL recovery strategies, stormwater quality (BMAP), stormwater quantity (flood protection) and stormwater supply planning so each issue is synergistically addressed and potential funding partners identified.

#### 3.4.2.2 *Stormwater Coordinating Committee*

Following the successful model of the Reuse Coordinating Committee, which was established in 1992, the DEP should form a Stormwater Coordinating Committee including representatives of DEP, the WMDs and DOT to promote the beneficial use of stormwater, coordinate stormwater related activities and to promote communication between the member agencies. Potential additional members and partners include DACS, local governments in high population areas who are required to manage stormwater systems under DEP's MS-4 program, stormwater utilities and the Florida Stormwater Association.

#### 3.4.2.3 *Partnering with DOT*

DOT and the WMDs should coordinate to explore the potential use of existing and proposed public highway drainage infrastructure to convey stormwater to facilitate water supply or other environmental needs. Figure 3.2 shows current DOT Planning Projects and Figure 3.3 shows the current DOT Preliminary Design and Engineering Projects.

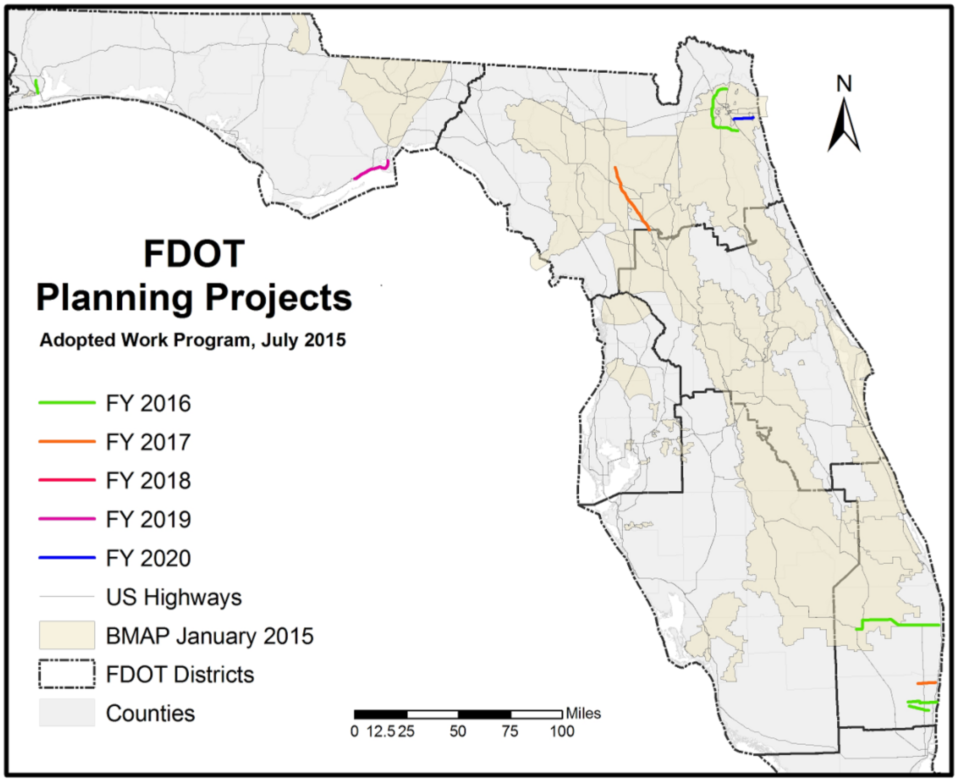



*Figure 3.4.1: DOT Planning Projects*

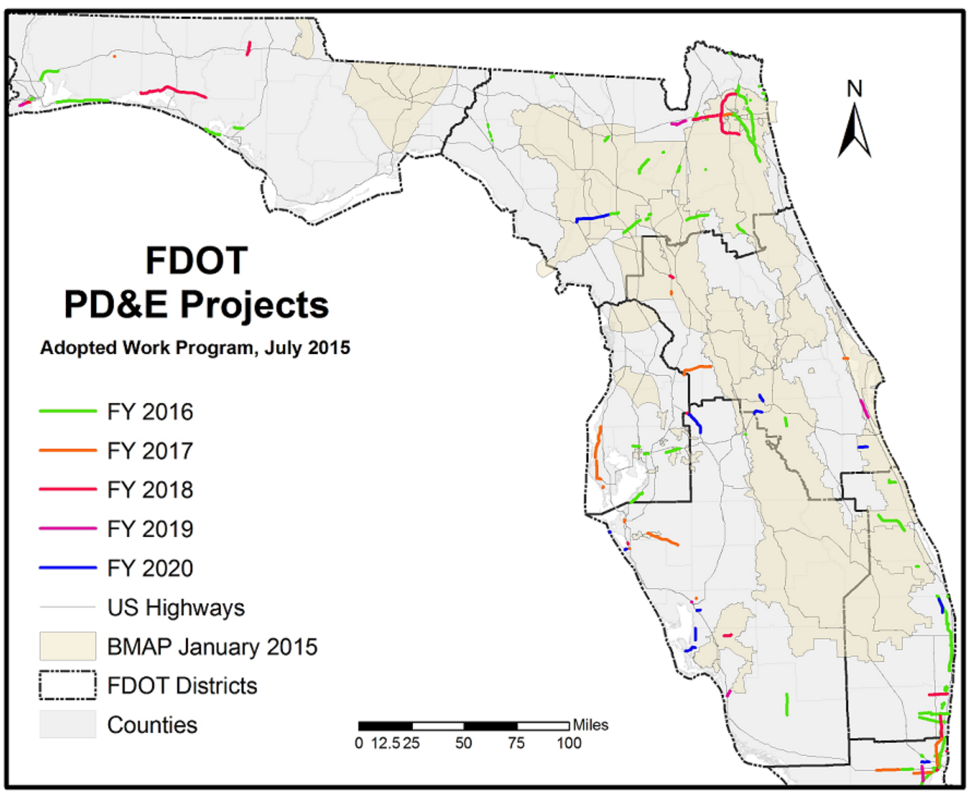



*Figure 3.4.2: DOT Preliminary Design and Engineering Projects*

#### 3.4.2.4 *Agricultural Operations*

DEP, DACS and the WMDS should consider the development of financial models or incentives to encourage farmers to increase the implementation of tailwater recovery projects and address the financial impact of taking some land out of production. This issue could be addressed in the development of partnerships with other water quality or water supply stakeholders.

#### 3.4.2.5 *Cooperative Funding*

DACS has a cooperative funding program that could be used as a framework to assist stormwater harvesting for tailwater recovery systems. DACS and the WMDs should continue to work together and could provide educational and technical support to program participants. In addition, statewide cooperative funding options should be considered.

Funding partnerships among the state, water management districts, water suppliers and water users should continue to be pursued for stormwater projects that benefit water supply.

### 3.4.3 <u>Public Perception and Support</u>

Stormwater harvesting is still in the early stages of development in the State of Florida; therefore, public education on the uses and implementation concepts of stormwater is crucial to the success of this water supply alternative. DEP, the WMDs, DACS and DOT need to educate the public and partner with stakeholder and special interests groups in order to build consensus support for stormwater as a viable water asset that can be used for multiple uses. Conducting public workshops with environmental groups, water supply users and providers would promote ideas and help determine how to best use excess stormwater in the future.

Most concerns raised by the public can be addressed by conducting demonstration and pilot projects at strategic locations throughout the state. These projects must include implementation of a data collection and monitoring protocol in order to evaluate pre and post conditions. Positive results from these pilot projects should help build public support and develop appropriate regulatory criteria for this alternative.

# 4 EXCESS SURFACE WATER

Withdrawals from surface waters currently account for approximately a third of freshwater withdrawn for use in Florida. Ensuring that such withdrawals do not harm the ecology of the state's rivers, lakes, springs and other water bodies is a focus of the water management districts' MFLs, water supply planning, water reservations and consumptive use permitting processes. This section provides an overview of the use of excess surface water in the State of Florida and a discussion of issues relating to the potential expansion of excess surface water use throughout the state.

For the purposes of this study, "excess surface water," as referenced in Senate Bill 536, is defined as water that could be available for withdrawal from rivers, lakes or other water bodies that is in excess of the amount needed to sustain healthy ecological conditions in the water body and downstream waters and that otherwise meets the applicable consumptive use permitting criteria. The establishment of minimum flows and levels or water reservations is a major tool used to determine, at a planning level, where additional quantities of water may be available for use.

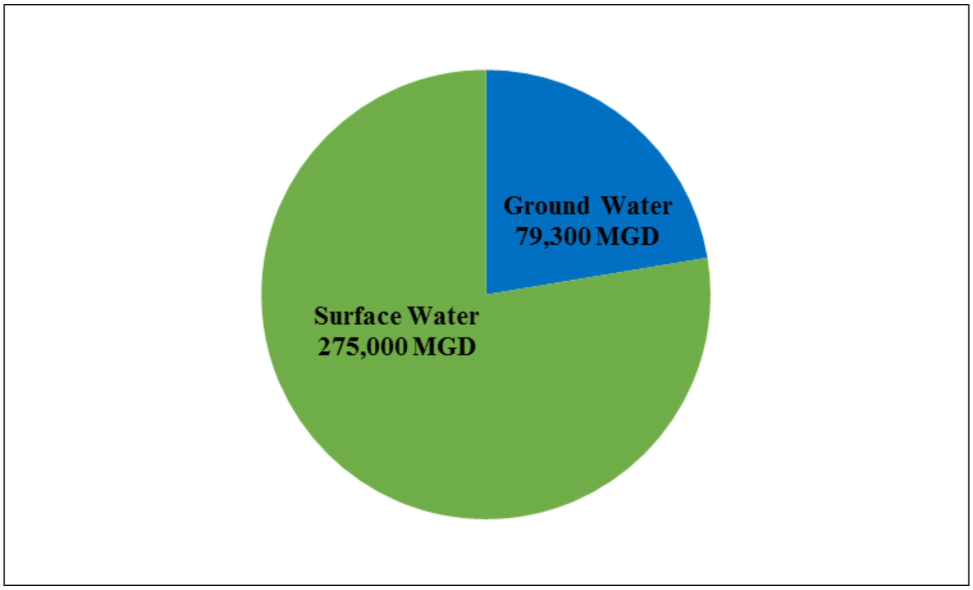
While stormwater can be considered a subset of surface waters, for the purposes of this study, "excess surface waters" refers to withdrawals directly from a water body. In contrast, stormwater resulting from rainfall that is captured in ponds, swales, or similar areas for water quality treatment or flood control is addressed in Section 3.

## 4.1 SUMMARY OF STATE AND NATIONAL TRENDS FOR SURFACE WATER USE

### 4.1.1 Nationwide Water Use Trends – 2010

Across the United States, surface water has been and continues to be, the predominant source of water for a variety of uses. The United States Geological Society (USGS) has been tracking and compiling water use data in the United States every five years since 1950. In the USGS' "Estimated Use of Water in the United States in 2010" report, the 2010 estimated water use nationwide was approximately 354,300 million gallons per day (MGD) which represents all withdrawals from all sources - fresh and saline groundwater and surface water – and for all use types (Maupin, Hutson, Lovelace, Barber, & Linsey, 2014). About 78% of the total nationwide withdrawals (fresh and saline) were from surface water while the remaining 22 % were from groundwater. On a total fresh water basis, fresh surface water accounted for 230,000 MGD of nationwide withdrawals, while fresh groundwater withdrawals were approximately 76,000 MGD.

The USGS collects and analyzes water use data for the following use types: public supply, self-supplied domestic, irrigation, livestock and aquaculture, self-supplied industrial, mining and thermoelectric power. Thermoelectric power generation and irrigation continue to be the largest uses of water, accounting for 45% and 32%, respectively, of total withdrawals for all uses. Public supply is the third largest user of water, representing approximately 13% of the total withdrawals. In general, more surface water than groundwater was withdrawn nationwide for all use types except self-supplied domestic, livestock and mining. Figure 4.1 provides a comparison of groundwater and surface water withdrawals in the United States.




Source: (Maupin, Hutson, Lovelace, Barber, & Linsey, 2014)

*Figure 4.1.1: Total Water Withdrawals in the United States, 2010*

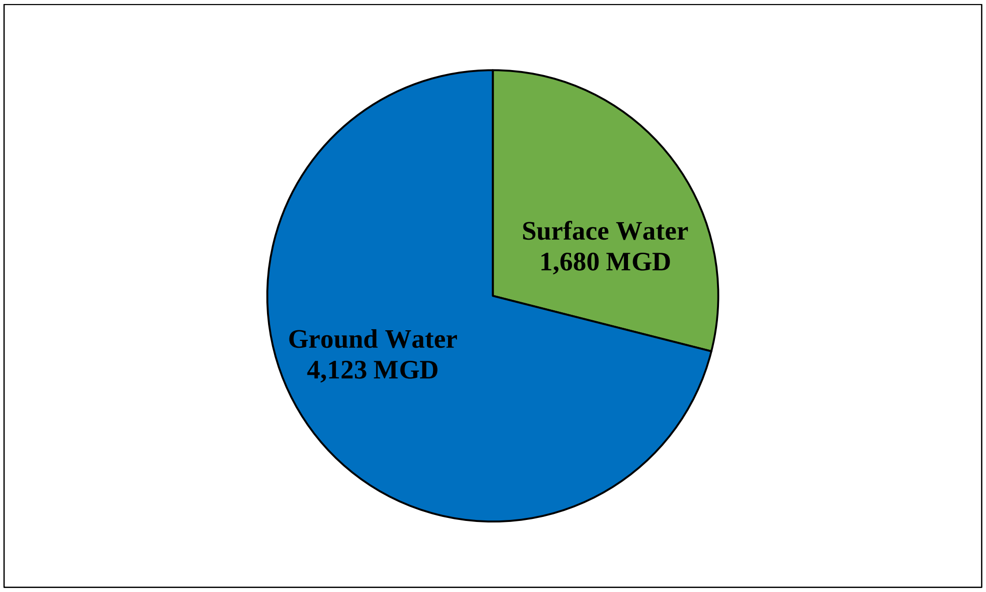
### 4.1.2 Florida Water Use Trends - 2010

Unlike most states throughout the United States, fresh groundwater has traditionally been the primary water supply source in many areas of Florida, making Florida the largest groundwater user east of the Mississippi River. In 2010, California, Florida and Texas represented 38% of total groundwater withdrawals for public supply. The following discussion is based on the USGS summary of water withdrawals in Florida for 2010 (Marella, 2014).

In 2010, the total amount of fresh water withdrawn in the State of Florida was approximately 6,400 million gallons per day (MGD). Ground water accounted for 65% of total freshwater withdrawals (4,166 MGD) in the State of Florida, while surface water accounted for the remaining 35% (2,233 MGD). The vast majority of Florida's population (92%) was supplied with drinking water that was derived from fresh groundwater and fresh surface water provided drinking water for only 8% of Florida's population. The majority of groundwater withdrawals (almost 62%) in 2010 were obtained from the Floridan aquifer system.

The majority of fresh surface-water withdrawals in Florida (56%) came from the Central and South Florida (C&SF) project including Lake Okeechobee and the canals in the Everglades agricultural areas of Glades, Hendry and Palm Beach Counties, the Caloosahatchee River and its tributaries in the agricultural areas of Collier, Glades, Hendry and Lee Counties and agricultural areas of Martin and St. Lucie Counties. Compared to other water use sectors in the state, agriculture utilizes significant quantities of fresh surface water. Approximately 45% of agricultural water use statewide comes from fresh surface water withdrawals; however, the use of fresh surface water for agriculture varies greatly around the state and is primarily concentrated within the South Florida Water Management District.

One water use sector that does utilize surface water for the majority of its water use is power generation. However, surface water used for thermoelectric power generation is typically used as either once-through cooling or recirculated during the process. The difference between what is withdrawn and what is discharged back to the surface water body is primarily evaporation. As a result power generation withdrawals are excluded from discussion in this section.




Note: Power generation withdrawals are excluded. Source: (Marella, 2014)

*Figure 4.1.2: Comparison of Fresh Surface Water and Ground Water Withdrawals in Florida: 2010*

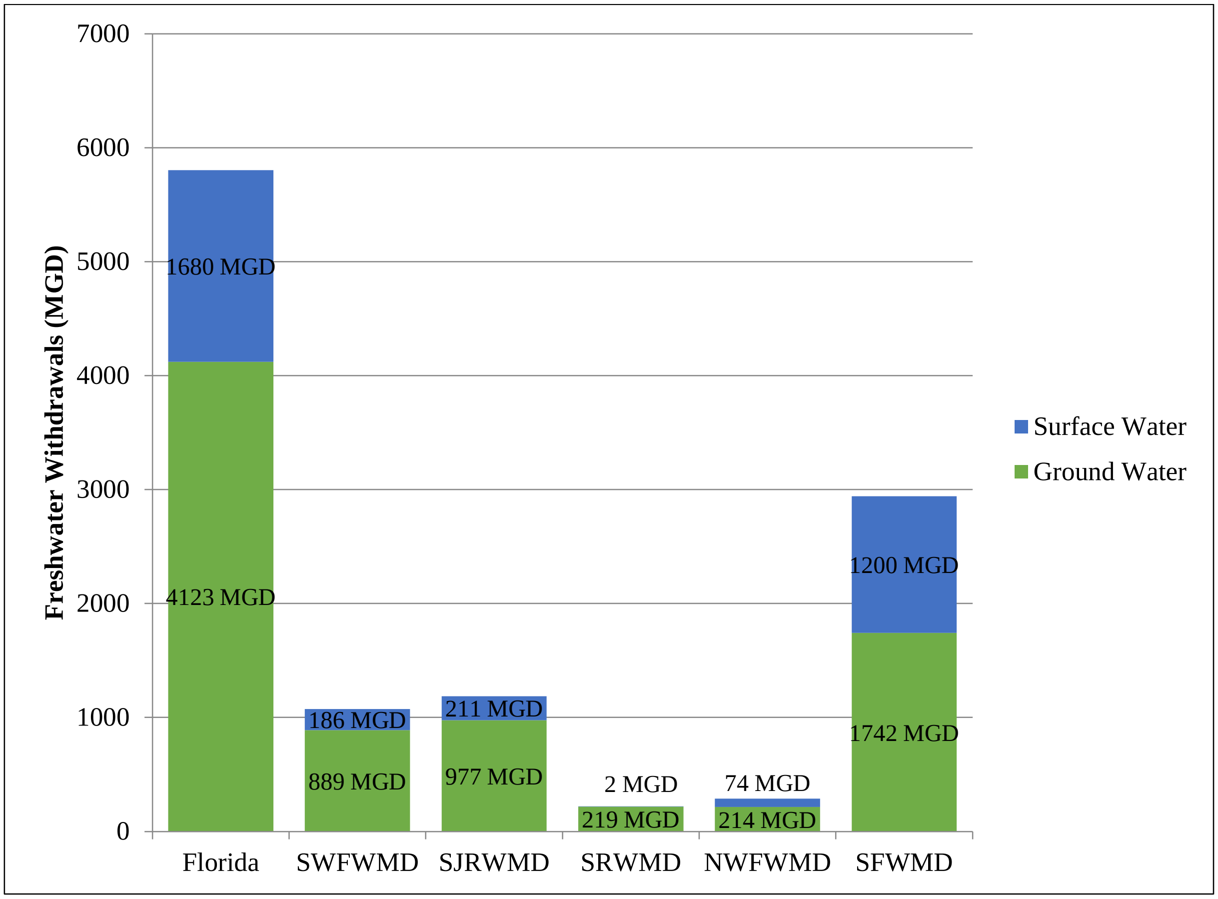
In summary, Florida is highly reliant on fresh groundwater to meet its water use needs relative to nationwide trends. When power generation withdrawals are excluded, fresh groundwater accounts for over 70% for fresh water withdrawals in the state and fresh surface water withdrawals make up the remaining 30%. Figure 4.1.2 provides a comparison of groundwater and fresh surface water withdrawals for the State of Florida (excluding power generation surface water use).

### 4.1.3 Water Management District Trends

The relative use of surface water and groundwater to meet water supply needs varies throughout the State of Florida. The following sections provide a brief overview of the use of both surface water and groundwater within each of the five water management districts. Figure 4.1.3, provides a regional comparison of the use of surface water and groundwater by water management district.

4.1.3.1 *Southwest Florida Water Management District (SWFWMD)*

Surface water has been a source of potable water in southwest Florida as far back as 1924. Surface water continues to provide an alternative source option in providing sustainable water supply.




Note: Power generation surface water withdrawals are excluded in statewide totals and for SWFWMD, SJRWMD, SRWMD and SFWMD. Statewide totals and totals for SRWMD and SFWMD provided from (Marella, 2014). SWFWMD and SJRWMD totals provided from 2010 SWFWMD and SJRWMD water use estimates. NWFWMD totals provided from 2013 NWFWMD district estimates and include consumptive uses for power generation. Total uses depicted for each WMD will not add up to statewide total depicted due to rounding and different reporting years and data sources.

*Figure 4.1.3: Comparison of Ground Water and Surface Water Withdrawals, Statewide and by WMD*

Average surface water use in the SWFWMD from 1995-2010 ranged from 14 to 24%. In 2010, the total amount of water withdrawn in the sixteen county SWFWMD area was 1,075 MGD. Surface water accounted for approximately 17% of the total quantities at 186 MGD and groundwater made up the remaining quantities of 889 MGD or 83% of total withdrawals.

The largest surface water withdrawals in the SWFWMD were for the public supply sector at 83% (155 MGD) with agriculture running a far second at 10% (19 MGD). The remaining 7%

fell within the industrial/commercial, mining and recreation/aesthetic uses. In comparison, the largest groundwater withdrawals were for the Agriculture sector at 50% of total groundwater use (448 MGD) with Public Supply running second at 35% of total groundwater use (313 MGD).

#### 4.1.3.2 *St. Johns River Water Management District (SJRWMD)*

Historically, surface water withdrawals in the SJRWMD have been small in comparison to groundwater use. Surface water withdrawals from 1995 to 2010 ranged from 15% to 25% of freshwater use, averaging about 19% of total freshwater use. In 2010, the total amount of water withdrawn in the SJRWMD was estimated at 1,287 MGD. Surface water and groundwater withdrawals accounted for 211 MGD (18%) and 977 MGD (82%) of total withdrawals, respectively.

The largest portion of surface water withdrawals in SJRWMD were for agricultural irrigation at 61% (128 MGD) of total surface water withdrawals, followed by landscape/recreational/aesthetic irrigation (20%), commercial/industrial/institutional/mining/dewatering (12%) and public supply (7%). The largest groundwater withdrawals were from public supply at 54% (523 MGD) and agriculture at 30% (285 MGD).

#### 4.1.3.3 *Suwannee River Water Management District (SRWMD)*

In 2010 total groundwater withdrawals in the SRWMD were approximately 219 MGD, with agricultural uses accounting for about 50% of groundwater withdrawals (111 MGD) (Marella, 2014). Surface water use, in contrast, made up only a tiny fraction of consumptive water use in the SRWMD. According to Marella, surface water withdrawals for consumptive uses in the SRWMD totaled less than 2 MGD in 2010 and were also primarily for agriculture (Marella 2014). It is noteworthy that in the past, surface water withdrawals for agriculture made up a larger portion of agricultural water use in the SRWMD. In the early 1980s, although overall agricultural water use was much lower, surface water withdrawals accounted for 20% of agricultural water use (approximately 6 MGD of a total of 29 MGD of agricultural use in 1980). Although agricultural water use in the SRWMD has increased significantly over the last thirty years, the use of surface water for agriculture has decreased over this timeframe.

#### 4.1.3.4 *Northwest Florida Water Management District (NWFWMD)*

Surface water withdrawals make up a significant portion of water use in the NWFWMD. A major reservoir and a fresh water canal are used for public supply. Streams and storage ponds are also used for agricultural, recreational and other nonpotable water uses. Surface water withdrawals reported to the NWFWMD for 2013 were 74 MGD, comprising 26% of total water production from all sources of 287 MGD (considering net consumption for power generation).

In the NWFWMD, surface water withdrawals account for 16 % of withdrawals for public supply, with the majority of use (22.9 MGD) originating in the Deer Point Lake Reservoir. Surface water use makes up a significant portion of industrial/commercial/institutional (I/C/I) use in NWFWMD. Surface withdrawals of 22.4 MGD were 35% of the total I/C/I withdrawals in 2013, nearly all from Deer Point Lake Reservoir. Surface water also made up a large portion (43% or

4.6 MGD) of the recreation use category, which includes landscape irrigation and 16% (2.9 MGD) of agricultural withdrawals.

4.1.3.5 *South Florida Water Management District (SFWMD)*

According to the USGS estimates, in 2010 total freshwater withdrawals in the SFWMD were 2,942 MGD with power generation demands excluded. Surface water withdrawals accounted for approximately 40% of freshwater use in the SFWMD (1,200 MGD) and agricultural uses made up about 80% of those withdrawals. Surface water withdrawals for agriculture in the SFWMD also account for over 40% of statewide fresh surface water use. Ground water use accounted for the remaining 60% of freshwater withdrawals (1,742 MGD, power generation excluded), with public supply uses making up about 59% of groundwater withdrawals (1,024 MGD). It should be noted that in significant portions of the SFWMD, such as Miami-Dade and Broward Counties, groundwater sources such as the Biscayne Aquifer are highly connected to surface water features. Ground water, stormwater and surface water supplies are closely intertwined, with surface water directly supporting aquifer levels and groundwater use.

## 4.2 Potential Future Surface Water Supply

4.2.1 Southwest Florida Water Management District - Potential Future Supply

The SWFWMD 2010 Regional Water Supply Plan (RWSP) was utilized to quantify potentially available excess surface water in the SWFWMD (SWFWMD, 2010). As described in the RWSP, the SWFWMD estimates of potential surface water availability take into account MFLs, consideration of existing legal users and planning level engineering limitations, among other considerations. The available yield for each river was calculated using its established minimum flow and/or hydrodynamic modeling; and in some cases a planning level minimum flow criteria was used. The potential yield for these rivers will ultimately be determined by their minimum flows once they are established. Estimated total surface water available is 299 MGD (Figure 6.5.4).

The southern region of the District includes Cow Pen Slough; the Braden, Manatee, Myakka Rivers and Myakkahatchee Creek; and Peace River and Shell Creek. A draft MFL for the lower Manatee and Braden rivers is close to completion, with updated information indicating no additional flow available in those rivers. No additional flow is available from Myakkahatchee Creek. Total estimated average flow available from Cow Pen Slough, Shell Creek and Myakka and Peace Rivers is 170 MGD. The SWFWMD is working on solutions to remove, for beneficial use, the excess flows from the Flatford Swamp, a 2,300-acre hardwood swamp in the Upper Myakka River Watershed. Average flow available is estimated at a maximum of 13 MGD.

Within the Heartland Planning Region, the major river/creek systems include the Peace River (see southern region) and Josephine Creek. An estimated average flow of 4 MGD is available from Josephine Creek. The Tampa Bay Planning Region major river systems include the Anclote, Hillsborough (including the Tampa Bypass Canal), Alafia and Little Manatee rivers. Currently the Anclote, Hillsborough and Alafia rivers have adopted MFLs. While no additional flow is available in the Hillsborough (including Tampa Bypass Canal) or Anclote Rivers, the amount of water available could change in the future as the Northern Tampa Bay Water Use Caution Area recovery strategies are re-evaluated by 2020. In the Northern Planning Region, available water from the Little Manatee River from the RWSP was estimated at 0.2 MGD (depicted in Figure 6.5.4 as 0 MGD). Total estimated average flow available from the Alafia River is 19 MGD. The Withlacoochee River is the only major river system in the northern part of the District. The potential yield of the Withlacoochee River for water supply will ultimately be constrained by its established MFLs. Total estimated average flow available from the Withlacoochee River is 93 MGD.

4.2.2 <u>St. Johns River Water Management District - Potential Future Supply</u>

Within the SJRWMD the St. Johns River has been identified as a potential source of surface water in many regions. The St. Johns River may supply a large quantity of raw water but water quality and quantity vary seasonally thereby requiring multiple treatment processes, significant amounts of storage and multiple sources of water to ensure a reliable supply. The lower Ocklawaha River at Rodman Dam has been identified as another potential source of surface water, with a preliminary yield estimate of 30 MGD. However, because the SJRWMD is currently adopting MFLs for the lower Ocklawaha River, potential withdrawals may be constrained.

Portions of the SJRWMD are part of the Central Florida Water Initiative (CFWI) area. The draft CFWI RWSP identifies 142 potential water supply development project options, which includes 15 surface water projects (CFWI, 2015). The primary surface water sources and their potential raw water withdrawals in Region 3 include: the St. Johns River at Yankee Lake (up to 50 MGD), St. Johns River at SR 46 (up to 50 MGD) and the St. Johns River/Taylor Creek Reservoir at SR 520 (up to 55 MGD). Yankee Lake and the Taylor Creek Reservoir are currently sources of water for public supply. The potential yields identified at these withdrawal locations were simulated as part of the St. Johns River Water Supply Impact Study (WSIS) (SJRWMD, 2012). The WSIS analyzed maximum annual cumulative withdrawals at these locations that meet the established MFLs for DeLand. The SJRWMD has adopted or proposed MFLs at the St. Johns River at SR 44 near DeLand, the St. Johns River at SR 50, the St. Johns River at SR 520 and Taylor Creek, which may constrain withdrawals.

4.2.3 <u>Suwannee River Water Management District - Potential Future Supply</u>

In 2010, the SRWMD conducted a Water Supply Assessment (WSA) that examined the impacts of water use in the SRWMD on its groundwater and surface water resources (SRWMD, 2010). This assessment indicated that declines in the Upper Floridan Aquifer have impacted a number of rivers and springs to the degree that they are not currently meeting, or will not meet during the 2030 planning period, their established minimum flows or planning level flow constraints. As a result, the SRWMD designated the following four basins as Water Resource Caution Areas (WRCAs): Upper Santa Fe, Lower Santa Fe, Alapaha River and Upper Suwannee River. Although further assessment is ongoing, the SRWMD anticipates that the potential for future year round surface water use from rivers in these WRCAs may be limited. However, as discussed below, seasonally available excess flows are available in many areas of the SRWMD. The SRWMD and SJRWMD are currently developing the North Florida Regional Water Supply Plan (NFRWSP) and will begin work on an updated RWSP/WSA in 2015, which will include information from the NFRWSP and include the remaining SRWMD counties. When complete, these studies will provide insight into potential year-round availability of surface water from the SRWMD's major rivers.

The SRWMD staff has conducted a preliminary analysis of potential seasonal availability of excess surface water from the district's major rivers. The SRWMD has not yet developed MFLs for several of these water bodies; therefore, simplifying assumptions were made based on previous work conducted for other MFL water bodies and previous water supply studies. The results presented here are a preliminary assessment for long-term planning; detailed study (including MFL development) would be required to produce more refined water availability estimates. As this assessment focuses on seasonally available surface water (i.e. seasonally high flows or flood flows), the potential surface water availability values are presented here as annual averages and are derived from long-term analysis of many years of streamflow data.

The SRWMD identified four major rivers where excess surface water from high river flows may be available (Figure 6.2.4): Aucilla, Steinhatchee, Withlacoochee and Suwannee Rivers. The greatest potential availability was from the Suwannee River, with an estimated average annual stream flow availability of approximately 156 MGD at the USGS Wilcox gage (near the City of Fanning Springs). Preliminary assessment indicates that the availability of water from the Suwannee River varies significantly on a year-to-year basis, but potentially large quantities of surface water may be available (greater than 100 MGD as an annual average) roughly 80% of calendar years. It is expected, however, that a majority of the potential supplies from the Suwannee River system will be available in the months of January through May. Little, if any, water would be considered excess during certain low flow periods or drought conditions. As a result significant storage capacity would be required to develop these potential surface water supplies.

The SRWMD planning-level assessment also indicated that smaller quantities of excess surface water may be available on the Aucilla and Steinhatchee Rivers, 18.4 and 10.5 MGD, respectively. Additionally, although part of the Suwannee River system, the Withlacoochee River may also represent a potential source of excess surface water, with approximately 45.5 MGD of average annual availability. These potential supplies also share significant seasonality constraints and storage requirements.

#### 4.2.4 Northwest Florida Water Management District - Potential Future Supply

The watersheds of the major rivers in northwest Florida extend north of Florida into Alabama or Georgia. There are significant surface water withdrawals occurring upstream from Florida and therefore outside the jurisdiction of the NWFWMD. These withdrawals complicate evaluation of unimpaired flows and mechanisms to ensure equitable allocations of water among the states do not exist. The NWFWMD MFL program was initiated in 2012 and includes expansion of the hydrologic monitoring network to provide the data needed for MFL development and resource assessments to further evaluate surface water availability. The NWFWMD anticipates adoption of its first MFLs in 2019.

At this time, available surface water resources in excess of those already permitted, if any, have not been identified in the NWFWMD. Until such time as MFLs are established and availability of surface water determined, the NWFWMD will continue to evaluate applications for consumptive uses of surface waters on a case-by-case basis to protect and sustain natural resources.

Although the NWFWMD has not yet adopted MFLs for its priority water bodies, the NWFWMD has established water reservations on two rivers under rule 40A-2.223, F.A.C. The magnitude, duration and frequency of observed flows of the Apalachicola and Chipola rivers are reserved for all seasons of the year for the protection of fish and wildlife of the rivers, associated floodplains and Apalachicola Bay (Figure 6.1.3). The rule states that, with certain exemptions, consumptive withdrawals of surface water from the main stem of these rivers and the Chipola Cutoff are not in the public interest. These reservations explicitly define that surface water from the main stem of Apalachicola and Chipola rivers is unavailable for consumptive use.

The 2012 Regional Water Supply Plan Update for Region II (Santa Rosa, Okaloosa and Walton counties) includes a potential surface water alternative water supply project for Okaloosa County (NWFWMD, 2012) The quantity of water available from the Shoal River for this project has not yet been determined.

4.2.5 <u>South Florida Water Management District - Potential Future Supply</u>

The SFWMD operates and maintains 2,060 miles of canals, 2,080 miles of levees and berms, 1,413 water control structures and 71 pump stations in the Congressionally authorized Central and Southern Florida (C&SF) Project. The canal system, depicted in Figure 6.4.2, provides an interconnected network of conveyance features to move water within the system. It is as a result of this interconnected system that the SFWMD can manage and deliver water from various regions. Unlike other watersheds in the State, rainfall within one watershed has the potential to be captured and stored for subsequent delivery to another watershed within the C&SF.

Due to adverse effects to the environment that were identified in the 1990s, the original C&SF system is now being modified under the Comprehensive Everglades Restoration Plan (CERP). CERP provides a framework and guide to restore, protect and preserve the water resources of central and southern Florida, including the Everglades. It covers sixteen counties and over 18,000 square miles. The CERP Plan was approved in the Water Resources Development Act of 2000 and is expected to take more than 30 years to construct.

On average, approximately 3.5 million acre-feet of water is discharged to tide from the C&SF system each year (about 3,200 MGD). Figure 6.4.5 illustrates the major discharge locations in the C&SF system. The goal of CERP and other closely associated projects, is to capture fresh water that now flows unused to the ocean and the gulf (current "excess" surface water) and redirect it to areas that need it most. The majority of the water will be devoted to environmental restoration and reviving a dying ecosystem. The other captured water will benefit cities and farmers by enhancing water supplies for the south Florida economy. The implementation of the component projects of CERP will allow this goal of capturing these "excess" discharges to be achieved, providing environmental restoration and more sustainable water supply for south Florida.

## 4.3 Environmental Considerations

The following sections provide a brief overview of some of the environmental considerations that relate to the potential withdrawal of excess surface waters from large surface water bodies.

### 4.3.1 Minimum Flows and Levels

One of the primary environmental considerations to be recognized with regard to the use of excess surface water is the MFLs program. Section 373.042, F.S., requires the state water management districts or the Department of Environmental Protection to establish minimum flows and levels (MFLs) for aquifers, surface watercourses and other surface water bodies. By definition, adopted MFLs identify the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area. By establishing this limit, the MFLs provide a planning level benchmark to help establish excess quantities of surface waters that may be available from priority water bodies.

Surface water bodies which meet their MFLs may be identified as potential sources for the development of surface water supplies. Likewise, if it is determined that a surface water system is not meeting its established MFLs, its potential for withdrawals is limited.

### 4.3.2 Water Reservations

Another mechanism utilized by the WMDs for the protection of adequate quantities of water is a water reservation. As described in section 373.223(4), F.S., a water reservation is a legal mechanism to set aside water for the protection of fish and wildlife or public health and safety, making it unavailable for allocation to consumptive uses. Water reservation rules specify the locations, quantities, timing and distribution of the water being reserved for the natural system. Determining the necessary quantity, timing and distribution of the water is accomplished through evaluation of data and information linking the local hydrology to water needed for protection of fish and wildlife.

To date, water bodies subject to water reservations include the Apalachicola River in the NWFWMD and the North Fork of the Saint Lucie River in the SFWMD. Additionally, water reservations have been adopted or are planned for several component projects of the Comprehensive Everglades Restoration Plan, such as the C-43 Caloosahatchee River West Basin Storage Reservoir and for the Kissimmee River.

#### 4.3.3 Seasonality of Sources

The seasonality of surface water systems must also be considered when assessing the potential for development of surface water supplies. In general, Florida's rainfall patterns exhibit strong seasonality, with distinct dry and wet seasons. As would be expected, Florida's streamflow patterns also generally exhibit strong seasonality. In the southern portion of the state, the majority of rainfall and high water in surface water features tend to occur in the summer and early fall months, while the northern portion of the state tends to have a more mixed weather pattern, with significant rains and high streamflows in the spring in addition to the summer wet season. Thus, in the potential development of excess surface water supplies, consideration must be given to the seasonality of surface water availability and also to seasonality of water use. If surface water is only available during a portion of the year, but regional water use is steady year round, or peaks in a different time of the year, significant investment in storage capacity may be required to utilize the excess surface water for water supply purposes.

#### 4.3.4 Sea Level Rise

Water management concerns relating to sea level rise include potential impacts on future water supply, flood control, water quality and natural systems. The state's at-risk natural and cultural resources include its coastal wetlands and estuaries, as well as the unique Everglades ecosystem. With regard to surface water supplies, sea level rise is expected to accelerate the migration of the saltwater front upstream in coastal canals, streams and rivers directly connected to the open ocean. Over time, increased salinity may affect surface intakes of water supply systems. Development of surface water supplies in coastal areas should consider potential future impacts from sea level rise.

### 4.4 Impediments or Constraints to Expansion

There are presently a number of issues which represent impediments to the expansion of the use of surface water in Florida. This study examined these impediments via review of historical alternative water supply planning efforts and the input and technical comments from various state agencies, environmental and water supply professionals, stakeholder groups, local governments and the general public. Similarly, this study also examined some of the primary issues that may represent constraints on the development of excess surface water, both presently and into the future. This section provides an overview of the key impediments and constraints to the use of surface water in Florida.

#### 4.4.1 Financial Impediments

Lack of funding and the cost of developing new surface water supplies are a significant impediment to the development of excess surface water supplies in Florida. During the course of this study, comments and input from agency staff, local governments, water industry professionals and members of the public frequently cited financial constraints as the primary factor impeding the development of excess surface water supplies. This study identified three general issues which drive the financial constraints of developing new surface water supplies: 1) infrastructure needs; 2) high capital costs for regional scale projects; and 3) additional treatment costs compared to groundwater sources for public water supplies. These issues are discussed briefly below.

Infrastructure Needs: Developing excess surface water supplies for beneficial use requires a significant investment in new water treatment, transmission and storage infrastructure. Costs can vary depending on the magnitude and complexity of projects. Treatment of surface water for public supply generally requires different treatment processes than traditional groundwater supplies and can require a significant investment in water treatment plants. Adequate storage to insure reliability, varying water quality due to climatic or seasonal variations and transmission from source to users, all provide challenges when developing a surface water project and add to infrastructure costs. The development of surface water supplies to reduce dependence on groundwater sources and provide for future needs will require considerable investment in new and existing water infrastructure.

Capital Costs for Regional Scale Projects: In the development of excess surface water supplies, regional facilities offer economies of scale and often provide the best value from a cost-benefit standpoint. However, regional scale projects often have high capital costs for land acquisition and construction, which can impede implementation by local governments and water users. For example, the construction capital cost for a six billion gallon offline reservoir that was completed in 2009 for the Peace River Manasota Regional Water Supply Authority in DeSoto County was in excess of $60 million. The high capital costs for regional surface water solutions can be a particular impediment in rural areas, which often lack the large utilities to implement such projects and often have widely dispersed, self-supplied water uses. Many urban areas also face financial challenges to implementing regional solutions, as the need to expand or replace portions of existing water supply systems as they age competes for capital improvement dollars. Multi-cooperator partnerships among local governments and suppliers can help to spread high capital costs over several entities.

Treatment Requirements for Potable Use: The use of surface water generally requires higher levels of treatment than traditional groundwater supplies when used for public supply. Surface water is more susceptible to natural and anthropogenic pollutants than groundwater. A longer water treatment train (filtration, disinfection, etc.) is required to address all contaminants present in surface water sources. Water quality issues related to blending groundwater and surface water in public supply systems can also occur when more than one water supply source is used. The additional treatment requirements for surface water result in increased production costs over time compared to groundwater supplies. Surface water projects typically have unit production costs (which include capital costs and treatment and operation) in an approximate range from $2.00/1,000 gallons to $5.00/1,000 gallons for public supply, though higher costs are possible. The combination of higher treatment costs and the need for capital infrastructure investment for new surface water supplies can require increases in utility rates when surface water supplies are brought on line; however, financial support for capital costs such as land acquisition and construction can mitigate changes in utility rates.

In summary, the infrastructure needs and financial costs to develop excess surface water supplies can be considerable. Based on the findings of this study and much input from stakeholders, financial constraints and lack of funding availability represent the primary impediment to the development of excess surface water for beneficial use in Florida.

### 4.4.2 Regulatory Constraints and Impediments

Regulatory issues can have the potential to constrain or impede the use excess surface water. This study identified several such regulatory issues, which are described below.

#### 4.4.2.1 *UIC Rules for Aquifer Recharge*

Aquifer recharge wells are included in the Class V, Group 2 wells as defined by Chapter 62-528, F.A.C. These wells are used for the storage or disposal of fluids into or above an Underground Source of Drinking Water (USDW). The current regulatory framework requires the injected fluid meet specified water quality criteria depending on the classification of the receiving aquifer, currently, the drinking water standards in Chapter 62-550, F.A.C. The treatment costs associated with treating surface water to meet drinking water standards may be cost prohibitive and inhibit use of surface water for aquifer recharge. In areas with high surface water-groundwater interaction, such as the karstic areas of north Florida, primary drinking water standards can greatly exceed the water quality of surface waters that provide natural recharge via sink holes and sinking streams. In cases such as these, requiring treatment of surface water to primary drinking water standards for enhanced aquifer recharge may be overly restrictive compared to the natural recharge process.

#### 4.4.2.2 *Lack of Adopted MFLs*

Adopted minimum flow criteria are used in the WMDs' water use permitting programs to ensure that the timing and quantity of withdrawals do not cause significant harm to water resources or the environment. In the case where MFLs are not adopted and a surface water body has been identified as a potential source, there may be some level of uncertainty in availability of surface water quantities.

#### 4.4.2.3 *Agricultural Irrigation and the Food Safety Modernization Act (FSMA)*

Water used in agricultural operations is a potential source of pathogens that may contaminate produce. The FSMA requires the Food and Drug Administration (FDA) to develop regulations aimed at improving the safety of produce. There are two components of the proposed regulations: standards for produce production; and, food safety measures for facilities that process food for human consumption. The proposed rules related to water quality of agricultural water are of particular interest from a surface water use perspective. Agricultural water is water that is directly applied to the harvestable portion of a crop, water used for preparing crop sprays and water used for washing or cooling harvested produce. Proposed standards include: general water quality; water system inspection; water treatment and water testing requirements; requirements for water used in harvesting, packing and holding of produce; and recordkeeping requirements. From the growers' perspective, the proposed agricultural water standards for existing and future uses of surface water may have significant costs for testing, treatment and maintenance, particularly for surface water sources.

#### 4.4.2.4 *Transfers across County Boundaries*

Multi-jurisdictional, regional projects may propose transport and use of surface water across county boundaries. Such projects, with some exceptions, require consideration of additional statutory requirements. Section 373.223(3), F.S., (commonly known as the "local sources first" provisions) requires the WMDs to consider the factors listed in this statute in determining whether the proposed use is consistent with the public interest. The statute requires each WMD to use the information in its applicable regional water supply plan as the basis for its consideration of the special public interest criteria during its CUP review. A partial list of the considerations includes evaluating: proximity of the proposed water source to the area of use; water sources geographically closer to the area of use than the proposed source; all economically and technically feasible alternatives to the proposed source; and potential environmental impacts of transport and use of water from the proposed source. Any of these considerations could potentially limit transport and use across county boundaries.

#### 4.4.2.5 *Consumptive Use Permitting*

In the consumptive use permitting process, the WMDs require that the lowest acceptable quality water be used for a reasonable-beneficial water use. Some permittees with groundwater allocations and proposed alternative water supply projects using excess surface water are concerned about reductions in groundwater allocations. If lower quality sources are developed that essentially will replace higher quality, resource-limited sources such as fresh groundwater, the allocations are typically adjusted. Where appropriate, the WMDs support the conjunctive use of two or more sources of water, where the water source used may vary depending on the condition and availability of the water resources. The WMDs may adjust allocations based on operating protocol by source but typically do not issue permits with duplicate or redundant allocations from all sources. As such, permittees may resist the development of surface water sources as an alternative water supply.

### 4.4.3 Public Sentiment

Another important potential impediment to the development of excess surface water supplies is public sentiment. Public comments received during this study expressed concern by local stakeholders and advocacy groups regarding withdrawals from large water bodies. Concerns expressed include: negative effects on ecology, wildlife, or endangered species; potential impacts to recreational uses of water bodies (canoeing, fishing, etc.); and water quality concerns. Many of these comments expressed concerns that the MFL process or other water availability studies were inadequate and were not sufficiently protective of natural resources.

Some stakeholder groups expressed that all options relating to water conservation ought to be developed prior to developing additional surface water supplies. Finally, some respondents indicated an aversion to developing new surface water supplies for certain use types, particularly residential lawn or landscape irrigation, as well as reclaimed water system supplementation.

4.4.4 Hydrogeologic Constraints

Local and regional hydrogeology can also be an important constraint in the development of surface water supplies. In many portions of Florida, groundwater and surface water are highly connected, such as in the karstic recharge areas of north and central Florida. In areas where groundwater and surface water supplies are closely intertwined, the development of excess surface water supplies can directly affect groundwater resources. Likewise, surface water bodies in surficial aquifers can directly support aquifer levels and groundwater use via natural or induced recharge.

4.4.5 Issues Less Likely to be Significant Impediments and Constraints

Based on input from stakeholders and examination of the historical development of surface water supplies, this study also identified several potential issues which are unlikely to be significant impediments to the development of excess surface water supplies.

- Technology: A wide variety of public supply utilities, agricultural operations and industries successfully treat and utilize surface water supplies around the country. The technology to effectively treat, store and transmit surface water for various uses is well developed and continually improving and is not likely to constrain the expansion of surface water use in Florida.
- Lack of Regulatory Guidance: To date, a comprehensive regulatory structure for surface water use has been established throughout the U.S. by both the EPA and various states. At the foundation of this structure are the Clean Water Act and Safe Drinking Water Act which protect surface water supplies and establish criteria for the proper treatment of surface water supplies for human consumption.
- Lack of Local Technical Expertise: Although some local utilities or water users may not be familiar with surface water treatment processes and requirements, lack of technical expertise is not expected to be a significant impediment to the expansion of surface water supplies. There is sufficient technical experience throughout the water and wastewater industry to bring surface water projects to completion and local needs can be addressed via education and training. DEP and the WMDs can provide support to local users and suppliers when transitioning to surface water sources, particularly in rural areas.

## 4.5 CASE STUDY IN SURFACE WATER SOLUTIONS-TAMPA BAY WATER

Tampa Bay Water is a regional water supply authority created in 1998. The creation of Tampa Bay Water ended the greater Tampa Bay region's "water wars" and created a new alliance between six local governments in west-central Florida: Hillsborough County, Pasco County, Pinellas County, New Port Richey, St. Petersburg and Tampa.

The mission of Tampa Bay Water is to reliably provide clean, safe drinking water to the Tampa Bay region now and for future generations. After investigating a number of options, Tampa Bay Water's Board of Directors approved construction of the Master Water Plan Configuration I in

November, 1998. Configuration I created an expanded, interconnected regional water supply and kept pace with the region's growing water demands. The plan included a number of diverse, alternative water supply sources, key pipelines and interconnections.

Surface water was the first alternative drinking water source added by Tampa Bay Water beyond groundwater. Since late 2002, surface water has been treated at Tampa Bay Regional Surface Water Treatment Plant. The plant is the central point of the Enhanced Surface Water System, which is designed to take advantage of 47 to 50 inches of rain that typically falls in the Tampa Bay region annually.

When available, water is skimmed from the Alafia River, Hillsborough River and the Tampa Bypass Canal. Some is treated for immediate use at the Regional Surface Water Treatment Plant and surplus water is stored in the 15.5-billion gallon C.W. Bill Young Regional Reservoir to supply the water treatment plant during dry times. The reservoir was built on property purchased by the SWFWMD in cooperation with Tampa Bay Water. Tampa Bay Water purchased easements from the SWFWMD covering the cost of the land for the reservoir. Tampa Bay Water then used bonds and federal funds to construct the storage facility. Tampa Bay Water's permitted surface water withdrawals take into consideration available river flows to protect both low and high flows and withdrawals abide by established MFLs on the Alafia and Hillsborough Rivers.

Due to the addition of alternative source water such as surface water and seawater desalination to its traditional groundwater, Tampa Bay Water tested various blends of their raw water sources and determined member government distribution systems would benefit if treated water alkalinity levels were increased. A regional alkalinity adjustment facility was completed in 2003.

In late 2010, Tampa Bay Water expanded its Regional Surface Water Treatment Plant through bonds and state funding. The expansion increased the plant's average sustainable capacity to 85 to 90 MGD with a maximum rated treatment capacity of 120 MGD. This meets up to 50% of the region's drinking water needs.

Use of surface water varies from year to year based on customer demands and weather and river flow variability. In 2014, surface water accounted for 35% of Tampa Bay Water's 157 MGD of deliveries to their customers (Tampa Bay Water, 2015). Surface water expansion is listed as one of the future project concepts in Tampa Bay Water's 2013 Long-Term Master Water Plan. Tampa Bay Water represents a highly successful conjunctive use water supply system that demonstrates how the successful implementation of excess surface water use may be achieved in Florida.

## 4.6 RECOMMENDATIONS

As demonstrated in the previous case study, the successful implementation of excess surface water use requires a coordinated and concerted effort to achieve sustainable and effective water supply solutions. This section provides an overview of potential strategies for reducing impediments to the development of excess surface water supplies in Florida.

### 4.6.1 Financial Recommendations

Lack of funding and financial challenges were identified as the most critical impediments to the development of excess surface water supplies throughout the course of this study. The need for additional funding support to develop excess surface water supplies was cited by agency and WMD staff, industry professionals, water infrastructure trade groups, local governments and utilities and members of the general public. Surface water can provide affordable and sustainable water supply, but funding is needed to create the necessary infrastructure for regional solutions. Section 373.707(2)(c), F.S., provides that "funding for the development of alternative water supplies shall be a shared responsibility of water suppliers and users, the State of Florida and the water management districts." These funding partnership are essential to the expansion of excess surface water supplies.

In the past, the legislature has put in place guidelines encouraging the development of regional scale projects and regional water supply authorities. Regional scale projects can provide economies of scale that greatly increase project value and efficacy. Providing priority funding to regional projects and maintaining cooperative funding programs can greatly increase viability of excess surface water use.

#### 4.6.1.1 *Mitigating Infrastructure Costs*

The development of excess surface water supplies for beneficial use will require a significant investment in new and existing infrastructure. However, there are a number of strategies which the WMDs and DEP can utilize to mitigate some of these costs and maximize value in future surface water projects. In Florida, aquifers have historically provided the vast majority of our water storage and transmission needs. In some cases, the need for large surface storage features could be reduced by utilizing natural aquifers for storage via aquifer recharge and aquifer storage and recovery. Aquifer recharge may be particularly important in rural areas with highly seasonal use dispersed over a large area, where transmission to individual users would otherwise be cost-prohibitive and large utilities capable of constructing and managing a large storage system may not exist. Water resource development such as this would typically be implemented by the WMD. It should be also noted, however, that treatment requirements for aquifer recharge and ASR can also be significant and will vary for individual projects.

Establishing regional water cooperatives or authorities can help facilitate regional projects. As previously stated, regional scale projects can often achieve economies of scale that can improve cost-effectiveness, but have higher initial capital costs. The establishment of regional water cooperatives and water supply authorities provides a mechanism to spread costs to a larger pool of beneficiaries and improve project feasibility. This strategy has been successfully applied in the past in various locations throughout Florida.

Finally, the conjunctive use of surface water and groundwater can mitigate the need for storage when surface water is seasonally available. The principal of conjunctive use is simple: use surface water when it is available and use groundwater at other times. By allowing for some use of groundwater supplies when surface water is unavailable, such as during long-term droughts, the need for long-term storage of surface water can be reduced while maintaining water supply resiliency. Several successful conjunctive use projects have been implemented in Florida, most notably, the creation of Tampa Bay Water. In some areas, conjunctive use may represent a viable and cost-effective option for developing excess surface water supplies.

#### 4.6.1.2 *Mitigating Treatment Costs*

Maintaining natural buffer lands around surface water bodies can protect and cleanse the water quality of overland runoff to surface water supplies. Strategic land acquisition and sound management of sensitive areas of watersheds can reduce the potential for surface water supply degradation and reduce risks to surface water users. An example of this strategy that has been implemented for many years is the New York City's Watershed Protection Program. New York City relies extensively on surface water supplies from a system of reservoirs in mountainous watersheds upstate of the city. To protect this water supply, the city implemented a Watershed Protection Program that focuses on land acquisition and management, as well as cooperation with upstream stakeholders in contributing watersheds to maintain high source water quality and reduce the need for downstream treatment (NYCDEP, 2006). Similarly, in Manatee County, in 1984, voters approved issuance of bonds to support the purchase of lands in the Lake Manatee watershed to protect their source of drinking water.

### 4.6.2 Regulatory Recommendations

During the development of this study, DEP and the WMDs received considerable feedback relating to the regulatory process of the developing surface water supplies. Based on stakeholder input and building on lessons learned in previous surface water efforts, the DEP identified the following regulatory recommendations:

#### 4.6.2.1 *Conjunctive Water Use*

Conjunctive use projects, where excess surface waters are utilized seasonally and traditional groundwater supplies are used during drier periods, represent an important strategy for the development of excess surface water supplies. The WMDs should encourage the development of conjunctive use systems through their Regional Water Supply Plans and cooperative funding programs. Additionally, the WMDs should continue to ensure that their consumptive use permitting processes allow for the appropriate flexibility in permitting conjunctive use systems with diversified water sources.

#### 4.6.2.2 *Re-Examination of Aquifer Recharge Rules*

Addressing storage requirements for seasonally available surface water supplies is critical to the expansion of excess surface water use. Aquifer recharge and ASR represent important strategies to address storage needs, but can be hampered by the existing regulatory framework, particularly water quality requirements. DEP should re-examine the present Underground Injection Control rules which regulate aquifer recharge and work to establish a regulatory framework that improves the viability of using surface water for aquifer recharge, but also provides necessary protections for groundwater resources and public health and safety. Due to the variations in Florida's geology and water supply needs, developing regional approaches may be beneficial, particularly in areas of high surface water/groundwater interaction. For example, in highly karstic areas, monitoring-based standards in receiving groundwater may be more appropriate than treatment standards at the point of injection. DEP, the WMDs and DOT should work together to develop reasonable design standards for recharge projects using surface water sources.

#### 4.6.2.3 *Food Safety Modernization Act (FSMA)*

The potential cost to comply with the FDA's new standards under the FSMA will likely create a disincentive for surface water use in agricultural operations. DEP, DACS, IFAS and the WMDs should continue to work with the FDA on new agricultural water quality requirements to ensure that they are compatible with the use of excess surface water. Further, DEP, DACS, IFAS and the WMDs should conduct outreach with agricultural producers to support the use of excess surface water, where available, in light of the future water use standards.

### 4.6.3 Public Support Recommendations

As Florida's water use regime shifts from traditional groundwater sources to alternative water supplies such as excess surface water, public support will be essential to the success of surface water projects. Public education and outreach by DEP and the WMDs is needed to inform the public about the use of excess surface water and build public support for the development of surface water supplies. Future outreach efforts should focus on building public trust in current regulatory environmental safeguards and the science of water availability assessment. Partnership and outreach with stakeholder groups will continue to be essential in the water supply planning process.

### 4.6.4 Environmental Constraints

The water needs of Florida's surface water systems are a function of each water body's characteristics, natural drainage patterns and hydrologic conditions. The ecologies of these natural systems are adapted to local hydrologic regimes and may constrain the sustainable use of excess surface water. Likewise, environmental factors such as seasonality of rainfall and streamflow and variations in water quality, can similarly affect the availability of excess surface water for human uses. This section provides a brief overview of environmental factors that may constrain the expansion of the beneficial use of excess surface water.

#### 4.6.4.1 *Water Quality*

Clean water is essential not only for maintaining healthy natural systems, but also for maintaining water supplies for human use. The presence of undesirable chemical constituents in surface water bodies can impact its utility for various water uses and lead to increased treatment requirements and costs. For example, in some cases, utilizing excess surface water for wetland restoration may pose potential water quality impacts to those wetlands or the underlying aquifers if the source water contains increased or concentrated loads of nutrients and other undesirable chemical constituents.  Thus, depending on source water quality and wetland characteristics, utilizing surface water may not be feasible for certain uses or projects, or may require pretreatment.

Salinity levels in surface water bodies can also represent an important constraint on the use of excess surface water, particularly in coastal or estuarine areas.  Both the magnitude and location of surface water withdrawals can affect salinity levels in source water bodies and coastal receiving waters and may constrain available water in certain locations.  Both water quality and estuarine resources are considered in the MFL development process.

#### 4.6.4.2 *Ecological Constraints*

Capture or redirection of excess surface water from surface water bodies may affect the viability of local flora, fauna and fisheries, particularly on a seasonal basis when specific hydroperiods may be required.  Similarly, periodic flooding is needed to maintain the ecology of floodplains and wetlands and can constrain excess surface water availability even during flood events.  A particular constraint can be the presence of endangered or threatened species in or near a surface water body, with specific seasonal water condition requirements.  For example, the Everglades system has federally mandated constraints that affect the delivery of water during the nesting season for federally endangered snail kites and Cape Sable Seaside Sparrow.  Ecological constraints such as seasonal inundation of wetlands and endangered species requirements are generally considered in the development of MFLs for priority water bodies, but can also constrain availability from non-priority water bodies and managed systems.

#### 4.6.4.3 *Siting Constraints*

When a new surface storage facility is constructed, any wetlands within the physical footprint of the facility will be evaluated through the permitting process.  These wetlands would typically be considered directly impacted by the proposed project and act as a constraint due to mitigation requirements.  The federal permitting process also requires an alternative sites analysis.

#### 4.6.4.4 *Seasonality*

As previously discussed, Florida's rainfall patterns exhibit strong seasonality, with distinct dry and wet seasons.  Thus, when developing excess surface water supplies, a seasonal mismatch of surface water availability in comparison to water use demands can constrain the potential for excess surface water development.  This seasonal availability requires significant investment in storage capacity to utilize the excess surface water for water supply purposes.

# 5 WATER STORAGE

Florida has extensive aquifers which have long served as the primary basis for water storage and supply throughout the state. Florida also has a number of surface water bodies including large rivers and lakes used for water supply. In some areas, the aquifer and riverine systems have been developed to their practical capacity and additional traditional and alternative water supplies have been and are being developed to optimize the use of available water resources. Storing water is a commonly used technique for optimizing use of water supplies by collecting water during times of plenty for use during dry or peak use times.

This section discusses three general methods of water storage: reservoirs, aquifer storage and recovery (ASR) and aquifer recharge (AR); and, dispersed water management.

## 5.1 BACKGROUND

Water supplies developed using groundwater aquifers in Florida have historically relied on using the aquifer as the fundamental basis for water storage. Ground water is withdrawn from wells as needed to meet user demands. For public water supply, water pumped from wells or rivers is treated and commonly stored in tanks to balance differences between available water supply and water customer needs.

On the smallest scale, on-site wells constructed for single family homes and small commercial operations are equipped with small tanks to normalize water pressure and accommodate the relatively small differences between well pump capacity and the variations of household or business water uses. As water supply capacities increase to serve more homes and more and larger businesses, the numbers of wells and the sizes and types of storage tanks increase.

The elevated and ground level tanks seen in many cities and towns comprise the most common forms of water storage. Until the past 30 years, elevated tanks of fabricated steel construction were the most common types of water storage tanks. As pumps and control systems changed and need developed for higher pressure and increased storage, ground level, pre-stressed concrete tanks became much more common.

Where traditional storage tanks are inadequate to balance sources and demands, other alternative forms of storage are needed. Many factors must be considered when determining the method and capacity of storage appropriate for a water supply or water management system. These include the source and quantity of available water, local hydrogeological conditions, land availability, the water needs of natural systems and the seasonal and daily needs of water system customers.

### 5.1.1 Planning for Water Storage

Choosing the type and capacity of storage to include in a water supply system is dependent on extensive planning and the investment of land and money for system development. For example, determining whether a water supply should use a covered or uncovered tank, a lined or unlined pond, a large aboveground reservoir, or an aquifer storage and recovery system requires a detailed technical evaluation of water source availability and existing and future needs including an understanding of peak, average and minimum water use demand. Such an evaluation must also recognize available storage site conditions, the ability to maintain water quality during storage and subsequent delivery and the socio-economic impacts of water distribution systems.

Each type of storage has associated advantages and drawbacks. Elevated tanks can assist in improved distribution hydraulics but be more restricted in capacity as well as be considered less aesthetically acceptable. Uncovered tanks and unlined ponds and reservoirs can be less expensive to construct but more subject to water quality concerns. Large capacity reservoirs can respond to changes in water demands but can require that large land areas be acquired and reserved from other uses and require substantial investments in capacity that may not be required until well into the future. Storing water underground in ASR facilities requires less land area and reduces evaporative losses compared to reservoirs, but can include greater uncertainties in project performance.

The selection of the best storage mechanism for a water supply or water management system depends on a thorough case-by-case analysis, considering and balancing the factors discussed in this section.

## 5.2 RESERVOIRS

### 5.2.1 Current Use

In Florida, older fresh water reservoirs were constructed within the course of rivers, known as "in-stream" or "in-line" reservoirs. River-based reservoirs were constructed by widening and deepening a river's "natural" path and constructing a dam behind which surface water was impounded. The City of Tampa's Hillsborough River reservoir (1.4 billion gallon capacity for untreated river water) is an example of an older, in-line reservoir constructed within a natural river path. Another example of an in-stream reservoir is the Braden River Bill Evers Reservoir (1.5 billion gallons capacity) owned by the City of Bradenton.

More modern river-based reservoirs are constructed as "off-line" storage on sites some distance from a river's "natural" path. Off-line reservoirs commonly offer considerably more flexibility in reservoir siting and in responding to environmental and permitting concerns. Tampa Bay Water's C.W. Bill Young Reservoir (15.5 billion gallon capacity for untreated Alafia River water) is an example of a newer, off-line reservoir. Another example of a newer, off-stream reservoir is the Peace River Manasota Regional Water Supply Authority's reservoir, which stores water withdrawn from the Peace River.

The major existing and proposed surface water reservoirs in Florida are listed in Appendix E.

### 5.2.2 Reclaimed Water Reservoirs

Reclaimed water systems are also heavily dependent on matching daily and seasonal supplies with customer demands. Seasonal storage has been found to be the limiting factor for reclaimed water systems. Numerous tanks and ponds (lined and unlined) store reclaimed water on a daily basis to match daily fluctuations in customer needs. As the demand for and reliance on, reclaimed water has increased the need for expanded storage capacity, large reservoirs have become more common.

The City of Apopka has constructed a 120 million gallon reservoir to both store reclaimed water and to accumulate stormwater during wet weather. The reservoir was designed and constructed to store 83 million gallons within a lined reservoir and to allow 37 million gallons of unlined capacity to recharge the local aquifer. The existing reservoir has performed well and the City hopes to replicate it for expanded storage and service.

Two new reservoirs constructed for reclaimed water storage are situated in Pasco County. The County Utilities Department is completing construction of the Boyette Reservoir, a 512 million gallon single basin reservoir to serve as primary storage for its expanding reclaimed water system. Pasco County also has a 110 million gallon, single basin reservoir in operation. These combined reservoir capacities are intended to allow Pasco County to balance all reclaimed water generation with its reclaimed water customer demands, without reliance on effluent disposal.

Some wastewater reclamation systems rely on the use of wetlands, rather than open water reservoirs, for retention of their effluent prior to reuse or discharge. The City of Lakeland operates a 1,400 acre wetland treatment system, organized as seven cells, to achieve advanced quality effluent.

The major existing reclaimed water reservoirs in Florida are included in the listing in Appendix E.

### 5.2.3 Considerations for Reservoir Development

Planning, design, construction and operation of reservoirs are important aspects for an efficient and responsive water supply. Reservoirs can be used to store raw water prior to treatment at municipal water treatment facilities, to store treated water prior to distribution and use and to store water for power generation facilities and agricultural uses. They can also be used to store water for environmental enhancement including maintaining stream flows and lake levels, as well as to reduce the rates and volumes of freshwater discharges into estuaries. Reservoir designs vary according to the reservoir purpose.

Reservoir design requires substantial information to confirm site applicability and to form the basis for site design, site construction and subsequent operation and maintenance. Large reservoirs are commonly designed to have a long service life of 50 years or more (WODW, 2009). Design capacities depend on the confidence in projected water supply needs and sources, available funding, available land, the reservoir purpose and alternatives for constructing future capacity. Facilities with long service lives require careful planning and design that incorporates a variety of local considerations including:

- utility demand projections;
- proximity to water supply source(s);
- proximity to alternate sources of supply;
- protection of both source and stored water quality;
- surrounding property ownership and land use considerations;
- potential impacts on environmental, cultural, archeological and historic resources;
- proximity to other water distribution pumping and pipeline components;
- site access and public safety considerations during extreme weather and service conditions;
- geotechnical investigations to ensure that a site can be used to construct a safe and water-tight structure;
- topographic, surface water and groundwater evaluations to assess site suitability and to minimize impacts to surrounding areas;
- evaporative losses;
- sufficient land area for construction, maintenance and, expansion;
- access for power, personnel, equipment and chemical deliveries;
- compliance with pertinent regulatory requirements; and,
- governance, financing and cost sharing/recovery.

Reservoir design must address varying water levels related to excess stormwater, wave run-up, evaporation and extremes in water use demand. Storage facilities must also be designed to consider operational responses to changes in water quality related to weather, algal blooms and stratification.

#### 5.2.4 Costs

With access to conveniently located, large, undeveloped parcels of land, water storage in open reservoirs can be an attractive option due to their relative simplicity of design and low cost for construction, operation and maintenance. With an average cost of about $27,000 per million gallons of storage capacity, reservoirs can provide for relatively economical storage for optimization of available water supplies. The costs to construct surface reservoirs varies considerably with the required capacity, associated land costs and the other considerations discussed above. Table 5.1 provides the detailed costs for a number of major reservoirs with capacities ranging from 500 million gallons to over 50 billion gallons and with unit construction costs ranging from less than $10,000 to greater than $80,000 per million gallons of capacity. The substantial range in unit and total costs for reservoir construction illustrated in Table 5.1 reinforces the need to closely evaluate specific project conditions before attempting to establish a reservoir project budget.

*Table 5.1: Offline Surface Water Reservoir Costs and Land Requirements*

| Reservoir Project Name & Location | Construction Date | Storage Capacity, Acre Feet | Storage Capacity, MG | Estimated Construction Cost | Construction Cost per MG | Total Project Land Area (acres) | Data Source | Lined yes/no |
|---|---|---|---|---|---|---|---|---|
| **C-44, Martin County** | Ongoing | 50,200 | 16,357 | $344,356,990 | $21,052 | 12,657 | SFWMD, 2015 | no |
| **C-43, Caloosahatchee River, Hendry County** | Planning | 170,000 | 55,391 | $543,211,530 | $9,806 | 10,489 | SFWMD, 2015 | no |
| **Tampa Bay Water - C.W. Bill Young, Hillsborough County** | 2004 | 47,570 | 15,500 | $ 267,000,000* | $17,225 | 980 | ENR, 2013 | no |
| **A-1 FEB, Palm Beach County** | 2015 | 60,000 | 19,560 | $285,200,000 | $14,580 | 16,414 | SFWMD, 2015 | no |
| **Peace River Regional, Desoto County** | 2009 | 18,413 | 6,000 | $62,622,023 | $10,437 | 640 | Barnard Constr. Bid 7/1/2009 | yes |
| **Holder, Withlacoochee River, Marion County** | Planning | 9,207 | 3,000 | $93,081,000 | $31,027 | 461 | (WRA, 2010) | yes |
| **Boyette Reclaimed Water Reservoir, Pasco County** | March, 2013 | 1,534.50 | 512 | $42,000,000 | $84,000 | 97.4 | Pasco bid | yes |

* original construction plus costs for subsequent repairs (Engineering News Report, 2013)

### 5.2.5 Impediments or Constraints to Expansion

Although open water reservoir costs can be relatively low to design and construct, based on a unit cost per million gallons of capacity basis, they do require investment in a substantial land area. Locating and acquiring land suitable for reservoir construction and operation can be a significant impediment which substantially affects feasibility and cost. Once a suitable land area is identified, gaining public acceptance from landowners and communities in close proximity to a storage reservoir can also be challenging and requires extensive public outreach efforts.

As with most major public works projects, implementing major new storage facilities can require extended (5 to 10 years) periods of time from the identification of need to placing a facility in service. Locating and acquiring a site ranging in area from one to six square miles, with appropriate geotechnical and environmental conditions, can be a formidable task. Permitting through the state Environmental Resource Permitting program and the U.S. Army Corps of Engineers dredge and fill program and establishing funding for construction, operation and maintenance provide further challenges. Both the relatively new C. W. Bill Young Reservoir and the nearly complete Boyette reservoirs encountered considerable issues in the collective efforts to construct and place them into service.

Impediments and constraints can be summarized as follows:

- substantial suitable land area required;
- cost for land acquisition and operation and maintenance;
- substantial investment in capacity that may not be required until well into the future;
- public acceptance;
- environmental/permitting limitations; and,
- construction and development time.

### 5.2.6 Recommendations for Reducing Impediments

Recommendations for reducing impediments include:

- **Ensure advance planning and coordination with all interested stakeholders.** The single most important effort for ensuring success is early coordination and consensus building on:
  - The purpose and need for the reservoir.
  - The required location, capacity and service life of the reservoir.
  - Cost of construction, operation and maintenance of the reservoir as part of the total water supply system.
- **Form Partnerships for Regional Reservoir Construction**. Construction of regional reservoirs by Regional Water Supply Authorities or other multi-jurisdictional water supply entities can improve efficiencies and reduce the costs of large reservoir construction.

- **Continuation of state and WMD alternative water supply cost-share programs to incentivize reservoir construction.**

## 5.3 Aquifer Storage and Recovery / Aquifer Recharge

### 5.3.1 Introduction

**Aquifer storage and recovery (ASR)** is the underground injection and storage of water into a subsurface formation for withdrawal for beneficial purposes at a later date. ASR provides for storage of large quantities of water for both seasonal and long-term storage and ultimate recovery that would otherwise be unavailable due to land limitations, loss to tides, or evaporation. While ASR is not in itself a new supply source, it provides for system reliability allowing for increased development of other sources of water. ASR is used to store potable water, reclaimed water, surface water and groundwater. All recovered water is blended or treated as necessary to meet the requirements for its distribution or discharge. Some sources of supply, including many surface water systems, can be intermittent and therefore unreliable. Other supply options such as reclaimed water have variable seasonal demand but relatively consistent supply. Even groundwater, often thought of as immune to supply shortages, is subject to lowered water levels and deterioration of quality when subjected to heavy demand. In these instances, ASR systems play an important role in storing large quantities of water for later distribution during periods when the source or demand is variable. The ASR facilities in Florida are shown on Figure 5.1.

The first operational ASR well in Florida began operations in Manatee County in 1983. Since then, utilities throughout southeast and southwest Florida have installed ASR systems, often with the assistance of Alternative Water Supply grants from the water management districts and other state funding mechanisms. In 2014, there were approximately 26 active permitted ASR wellfields in Florida and an additional 13 projects under development. To date, there are several large multi-well systems at Marco Island, Tampa and the City of Cocoa. Presently, the Peace River ASR system is the largest ASR wellfield in Florida, comprised of 21 ASR wells with a combined recovery capacity of 10 to 20 MGD.

**Aquifer recharge (AR)** is similar to ASR with one important distinction: the water used to recharge the aquifer is not being stored for withdrawal from the same facility at a later date. While ASR is typically considered a water storage and supply strategy, AR is primarily considered a water resource development and conservation strategy that is used to preserve and enhance water resources and natural systems (e.g., sustain water levels, meet MFLs including river and spring flows and restore recharge) and to attenuate flooding. For both ASR and AR, the aquifer acts as an underground reservoir for the recharged water. Whereas ASR is most commonly developed near major population centers requiring storage to ensure system reliability (e.g., public supply and commercial/industrial/mining uses), AR is most effective as a water management strategy in rural areas with fairly sparse population containing water resources directly reliant upon stable regional aquifer levels. These water resources include streams and associated springs that are hydraulically connected to the Floridan aquifer system (FAS) and are primarily located where the FAS is semi-confined to unconfined.

Aquifer recharge can be implemented by either direct or indirect technologies. Direct recharge involves the injection, typically via a well system, of available water into the aquifer with the intent to raise aquifer levels and/or provide some measure of saltwater intrusion control. Indirect recharge involves recharge at the land surface through various percolation methods, but mostly through RIBs. Indirect recharge projects using RIBs are an effective reclaimed water recharge tool for the surficial aquifer system. Geological conditions favorable for recharge through RIBs are the primary constraint. Areas good for indirect recharge have a deep water table resulting from a thick unsaturated zone extending from land surface to the top of the water table.

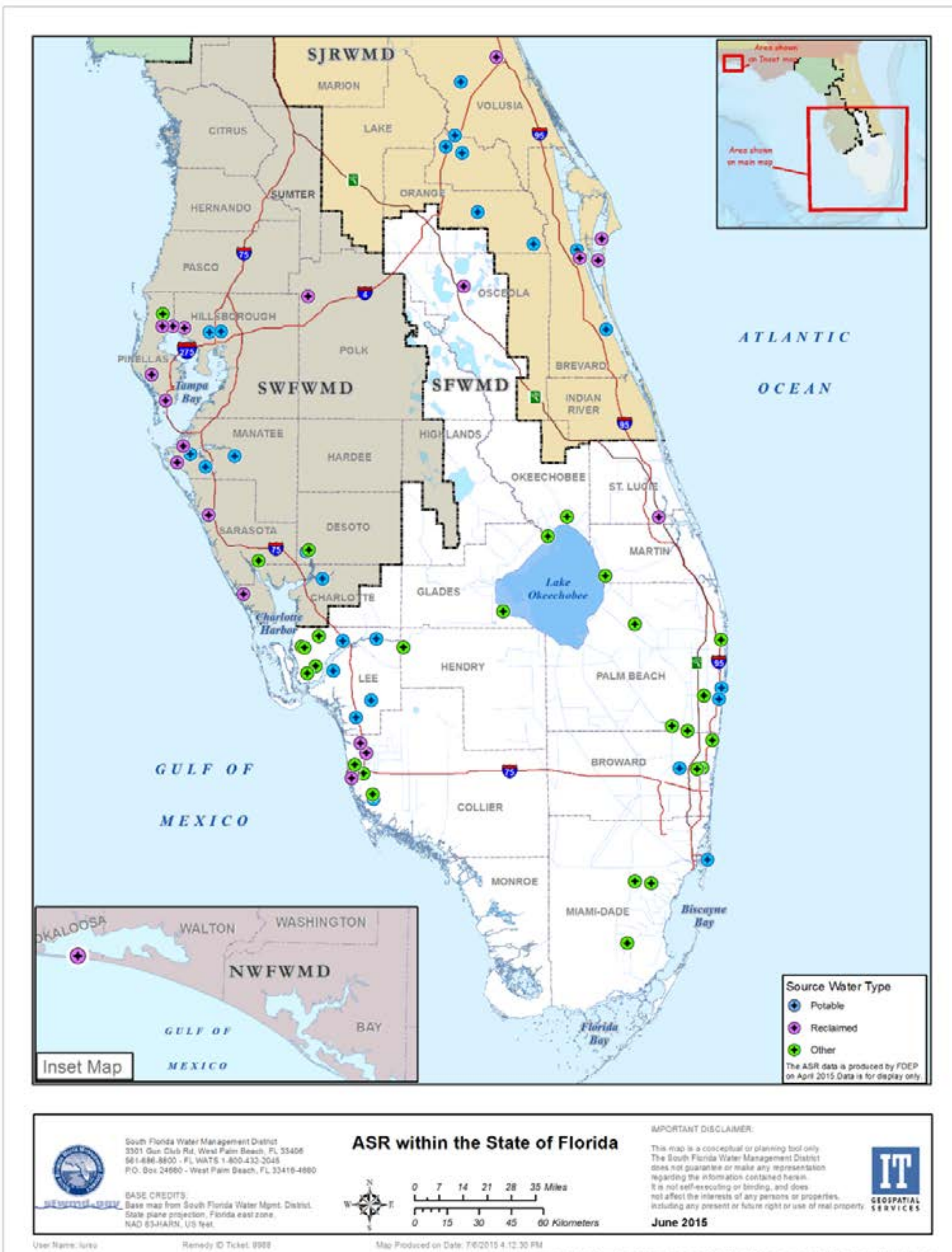



*Figure 5.3.1: ASR Facilities within the WMDs in Florida*

Indirect recharge projects are most feasible in areas where: 1) there is a nearby reliable surface water source (at least seasonally); 2) the watershed containing the source water is rural and primarily undeveloped; and, 3) natural recharge features (e.g., karst features or recharge ponds and lakes) exist in the recharge area and the source water that feeds the recharge system is the same as the natural features. Some exceptions to this do exist. For instance, in urbanized Orange County, the Water Conserv II (WCII) indirect aquifer recharge project uses a regional supply of highly treated reclaimed water to provide indirect recharge through constructed RIBs. WCII is the first project permitted in Florida for the use of reclaimed water as an irrigation source for crops for human consumption.

### 5.3.2 Considerations

#### 5.3.2.1 *Aquifer Characteristics*

In Florida, ASR and direct AR have been used to recharge and store potable water, reclaimed water, surface water and groundwater. Most ASR and AR wells inject into the limestone of the upper portion of the FAS, at depths of between 400 to 1,200 feet below land surface (BLS). Recharge works best where the FAS is transmissive, or allows water to flow freely through the rock and where the FAS is confined by overlying beds of less permeable materials. Notable exceptions include the shallow ASR system at Destin, completed near the base of the surficial aquifer system, at depths of between 100 and 200 feet BLS and the Polk County ASR system, completed in deeper portions of the Lower Floridan aquifer at a depth greater than 2,000 feet BLS.

Water quality within the receiving aquifer is also a consideration. Between depths of 1,500 and 2,000 feet BLS the FAS commonly contains brackish groundwater, exhibiting total dissolved solids (TDS) concentrations between 500 to 3,000 milligrams per liter (mg/L). Generally, the salinity of the water within the FAS increases with depth.

#### 5.3.2.2 *Source Water Quality*

An important component of any ASR or AR project is the quality and characteristics of the water that will be pumped into the aquifer. Water injected into a Class G-II groundwater, which include the aquifers used for AR and ASR, must meet Florida’s groundwater quality standards. Surface and reclaimed water is generally expected to contain some level of nutrients and microbiota, depending on the source water and may contain other constituents of concern. Stormwater from urban, industrial and residential areas has the potential for the presence of a wide variety of contaminants. Reduction of these constituents often requires filtration and disinfection of the water.

#### 5.3.2.3 *Funding*

To date, most aquifer recharge and storage projects in Florida have been constructed by municipal water utilities, seeking a means to store seasonally available water, during low-demand periods. Many of the systems were constructed, with funding assistance provided by the water management districts, as a means to encourage implementation of Alternative Water Supply technologies. Within the past decade, the CERP funded the construction of two pilot

ASR systems and exploratory wells throughout south Florida and is evaluating regional ASR implementation for ecosystem restoration.

#### 5.3.2.4 *Regulations*

In Florida, water that is used for direct recharge of an aquifer must meet the Florida Ground Water Standards as set forth in Chapter 62-520, F.A.C. The Ground Water Standards consist of narrative minimum criteria and the primary and secondary drinking water standards, except for the total coliform bacteria standard, which is set at 4 colonies per 100 ml. These standards must be met in the source water at the wellhead prior to recharge. Exemptions to the secondary drinking water standards may be given if warranted.

ASR and AR wells are classified as Class V injection wells in Chapter 62-528, F.A.C., the Florida Underground Injection Control rule. These are wells that inject non-hazardous fluids into or above formations that contain underground sources of drinking water. All owners or operators of Class V wells are required to obtain a permit from DEP. The initial permit allows for the construction of the injection well and monitoring system. Upon completion of the well construction, the well owner must certify that the completed injection system has been constructed according to the permit requirements. The authorization to use the well is issued by DEP upon receipt of the above certification and the construction and well testing data, demonstrating that the operation of the wells will not adversely impact an underground source of drinking water. After a period of successful injection testing, the owner may qualify for an operation permit. In addition to UIC permitting, implementation of an ASR or AR project often requires a consumptive use permit from the applicable water management district for withdrawal of the source water for injection and for recovery of the stored water.

### 5.3.3 <u>Issues, Impediments or Constraints</u>

#### 5.3.3.1 *Hydrogeologic Uncertainty*

The ultimate performance of an ASR or direct AR system relies heavily on conditions deep within the subsurface that can only be ascertained by indirect means such as geophysics and well testing techniques. Although these techniques are helpful, there can be structural and stratigraphic variability with the aquifer and geologic attributes that these techniques cannot fully assess. As a result, it is only after an ASR and AR system is built and operated for some period of time that the true efficiency and performance of the system can be realized. Hence, there is an inherent “investment risk” that exists in implementation of an ASR or AR project that is typically not encountered during construction of surface storage features.

#### 5.3.3.2 *ASR Recovery Efficiency*

Recovery efficiency is defined as the volume of water of acceptable quality that can be recovered during an individual ASR cycle, expressed as a percentage of the volume stored in that cycle. Recovery efficiency is an important operational “success” criterion since the recharge water to an ASR well typically has considerable economic value, having been treated to meet water quality standards. It is important for water utilities to recover a high percentage of the stored water. Similarly, it is important to achieve high recovery efficiency as early as possible so that the capital investment in ASR facilities can be recovered instead of spending months or years in a succession of test cycles to slowly achieve recovery efficiency goals.

Recovery efficiency in surface reservoirs in Florida is estimated at about 40% because of high evaporation, transpiration, seepage and conveyance losses. Recovery efficiency from an ASR system can therefore be less than 100% and still be of greater benefit to overall water management than a surface water reservoir.

5.3.3.3 *Water Quality Effects*

Minerals such as pyrite and iron oxides are present in the rock that comprises the FAS. When these minerals are exposed to water containing dissolved oxygen, such as during well construction or ASR cycle testing operations, geochemical and microbial changes occur in the subsurface that leach trace metals out of the minerals and into solution. Trace metals that have been noted or that have otherwise been a subject for concern at various ASR and well recharge and surface recharge sites have included arsenic, uranium, mercury, nickel, chromium, cobalt, zinc, antimony, vanadium and molybdenum. Florida Ground Water Standards have been established for arsenic, mercury, nickel, chromium and other trace metals. Based upon trace metal concentrations in ASR recovered waters in Florida from early stages of cycle testing, it appears that arsenic is the only trace metal that may frequently exceed the groundwater standards.

5.3.3.4 *Lack of Direct Aquifer Recharge Demonstration Projects*

Although it is generally recognized that direct aquifer recharge projects can result in substantial overall benefits to surface and groundwater resources, there have been relatively few projects that have been brought to completion in Florida.

5.3.4 Recommendations

The following are recommendations that should assist in overcoming some of the uncertainty, impediments and constraints that hinder the development ASR and AR projects.

**Recommendation 1: Revise current regulations to allow more permitting options for ASR and direct AR facilities**

ASR and AR wells are required to meet the Florida Ground Water Standards in Chapter 62-520, F.A.C., at the point of discharge. Exceptions available to other types of facilities that discharge into groundwater, such as the creation of a zone of discharge for a RIB or institutional controls on the use of groundwater near a hazardous waste remediation site, are difficult to use for injection facilities. Revision of the current UIC Rule (Chapter 62-528, F.A.C.) is needed to provide pathways for permitting of ASR and direct AR facilities, while also protecting groundwater resources and public health and safety.

Recent correspondence from EPA to DEP has provided some guidance on the permitting of potable water ASR wells in relation to the requirements of the federal UIC rules. The guidance references the use of monitoring, treatment technology and administrative controls that currently exist in Florida's regulatory framework. The guidance, recognizing the water resource benefits of ASR, provides flexibility in permitting ASR systems.

**Recommendation 2: Account for all costs and benefits in project economic analysis**
Underground storage projects can provide considerable water resource benefits at reasonable costs compared to other storage options such as reservoirs on large tracts of land which may be costly or not available. Failure to account for all benefits and costs, including ones that may not be reflected in market prices for water, can lead to underinvestment in aquifer recharge, overconsumption of water supplies, or both. An economic analysis of an ASR or AR project should capture the multiple benefits and costs of the project.

**Recommendation 3: Provide funding/institutional structure for regional recharge.**
Regionalization of water supplies has been recognized as a method to develop highly effective water supply projects that would be beyond the capabilities of individual utilities, agricultural interests and industry. Regionalization of ASR or AR in a similar manner would be equally beneficial and would overcome the same limitations experienced by public water supply development.

Regional recharge projects aimed at aquifer restoration may be particularly difficult to put into play in many areas of Florida because of the coordination needed among private and public partners to fund, construct and operate the system. However, in primarily rural regions with large, relatively undeveloped watersheds and available seasonal surface-water flows that recharge the aquifer through natural features (karst features and ponds and lakes) aquifer restoration projects can be relatively straightforward and cost effective to construct, operate and maintain. These types of areas exist in north-central and northwest peninsular Florida.

Regional recharge districts have been established in other parts of the country to organize and fund the construction and operation of projects. The WMDs should identify areas where regional recharge projects would be beneficial and work to form cooperative partnerships for implementation.

**Recommendation 4: Support research to address ASR/AR Water Quality Issues**
There is a substantial body of work documenting improvement in water quality that can occur during aquifer recharge and storage. The subsurface has, to a greater or lesser extent, the capacity to attenuate many chemical constituents and pathogens that might be present while at the surface, but are reacted upon underground through processes such as filtration, sorption and mineralogical, chemical, or microbial activity. With this in mind, the following investigations should be encouraged:

- Evaluation of the variability of chemical and microbial constituents in urban stormwater and reclaimed water and their behavior during infiltration and subsurface storage.

- Basic and applied research on emerging contaminants and their stability and persistence in the groundwater environment.
- A better understanding of the ambient microbial populations in groundwater and their ability to reduce concentrations of constituents of concern.
- Further study of the "reaction zone" in close proximity to ASR and AR wells, where changes in redox states, sorption-desorption reactions and microbiologic activity are very intense.
- Treatment technology alternatives should be explored to minimize issues associated with injection and recovery. Development of techniques that control dissolved oxygen or adjust water chemistry to be more compatible with aquifer conditions prior to injection could result in substantial reductions in operational costs.
- The benefits of emplacement of an initial, large "target storage volume" of fresh water, to establish a pre-conditioned area within the storage zone around the ASR well, prior to operational testing.

## 5.4 Dispersed Water Management

Dispersed water management (DWM) refers to the retention of stormwater runoff by private and public landowners, rather than allowing this water to drain off-site into rivers, lakes, or canals. Typically, this water is stored using relatively simple structures to hold water on the landscape in low-lying areas.

DWM projects are currently being implemented within the SFWMD and SRWMD (Fig. 5.2). In the SFWMD, DWM projects retain stormwater on private or public lands as a means of reducing potentially harmful discharges to downstream receiving waters. In the SRWMD, the general concept is similar with the additional benefit of providing additional surface water storage that is used to enhance wetlands and provide aquifer recharge opportunities. DWM projects in the SRWMD are typically constructed in rural and largely undeveloped, unfarmed watersheds so that stormwater runoff made available for recharge to the upper Florida Aquifer is of high quality.

In the SFWMD, DWM projects typically use simple, inexpensive structures (such as small berms and/or riser structures) to retain excess rainfall that would otherwise drain from the project site. In some cases, excess water from the regional system can be routed onto DWM sites and retained. DWM projects on private lands often include a contract between the landowner and the SFWMD whereby the landowner (or "service provider") is compensated for the "service" of storing water on their land. While the primary purpose of most DWM projects is discharge (water quantity) reduction, some projects also produce a water quality benefit by reducing nutrient loads to downstream waters. These projects also increase aquifer recharge opportunities and potentially enhance wildlife habitat.

As in the SFWMD, DWM in the SRWMD also utilizes simple and inexpensive structures. However, these structures are used to restore natural hydrologic conditions in watersheds that were altered by manmade ditching (constructed in order to drain large areas, typically for historical silviculture practices). These structures are most often placed within the manmade ditches and canals and consist of ditch blocks, flashboard risers and/or culverts. Once the pre-ditching hydrology is established, surface water flowpaths are re-established through wetland systems thereby enhancing the natural systems.

### 5.4.1 DWM in the South Florida Water Management District

The SFWMD initiated the DWM program to restore the health of surface waters within the Lake Okeechobee watershed and the watersheds of the St. Lucie and Caloosahatchee Rivers and their estuaries (collectively, the Northern Everglades) as a result of the passage of the Northern Everglades and Estuaries Protection Program by the Florida legislature. A pilot program, the Florida Ranchlands Environmental Services Project which commenced in 2005, established the framework for the SFWMD's Northern Everglades Payment for Environmental Services program, which pays private landowners for storing water on ranchlands. The SFWMD is currently undertaking another pilot program to evaluate the effectiveness of storing water on privately owned fallow citrus lands. In addition, the program includes storage and retention projects on public lands. DWM projects on public lands have focused on storing and retaining excess surface water on SFWMD project lands as an interim use. A brief history of the DWM Program on private lands within SFWMD follows.

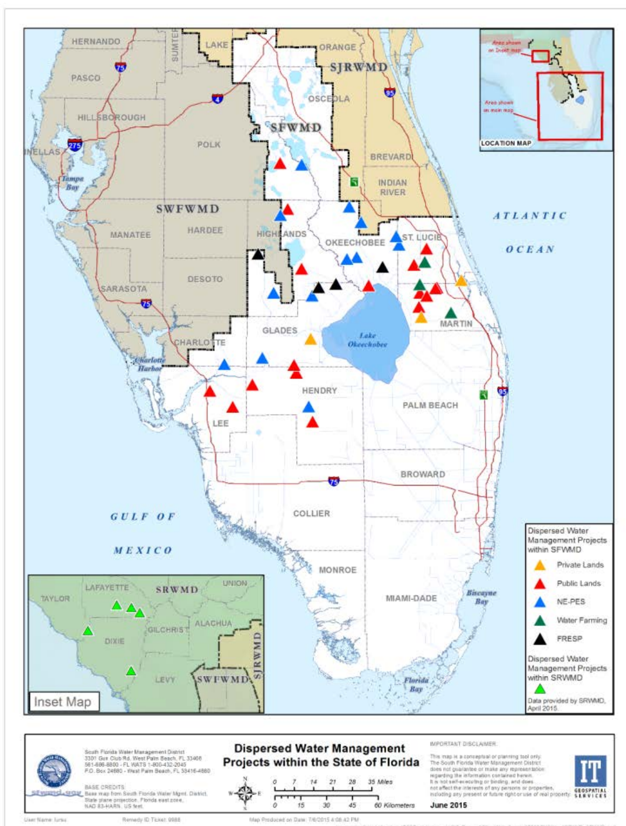



*Figure 5.4.1: Dispersed Water Management Projects*

### 5.4.1.1 *Florida Ranchlands Environmental Services Pilot*

The Florida Ranchlands Environmental Services Pilot (FRESP) Project was a five-year pilot project to field-test and develop a Payment for Environmental Services program. FRESP partners included eight ranchers, World Wildlife Fund, Florida Cattlemen's Association, Florida DACS, DEP, IFAS, United States Department of Agriculture Natural Resources Conservation Service, MacArthur Agro-ecology Research Center and SFWMD. These demonstration projects proved that on-ranch water management was a feasible and cost-effective way to achieve water retention and water quality improvement in these areas when compared to other options.

### 5.4.1.2 *Northern Everglades Payment for Environmental Services (NE-PES) Program*

Based on the success of the FRESP Project, SFWMD expanded opportunities for DWM in the Northern Everglades watersheds whereby private landowners manage water on parts of their property to provide two different water management services: water retention/storage or nutrient (TP or TN) load reduction. Solicitations released through this program allow for an innovative approach by offering eligible cattle ranchers the opportunity to compete for contracts for water and nutrient retention. The goal of the NE-PES Program is to establish contracts with private landowners to obtain the water management services of water retention and nutrient retention to reduce flows and nutrient loads to Lake Okeechobee and the downstream estuaries. The NE-PES Program keeps ranchers working and reduces pressure to convert ranchlands to development or other more intense agricultural uses. The SFWMD is responsible for administering this program in coordination with the DACS, DEP and U.S. Department of Agriculture Natural Resources Conservation Service.

NE-PES solicitations were released in January 2011 and December 2012. Eight water retention contracts were awarded for each solicitation. All eight projects awarded from the first solicitation are operational and provide a total estimated annual retention of 4,778 acre-feet. The second NE-PES solicitation resulted in eight contracts, one of which is currently operational. The remaining seven are in the design or construction phase. The total estimated annual retention from the second set of projects is 99,670 acre-feet.

### 5.4.1.3 *Water Farming Payment for Environmental Services Pilot Program*

An innovative approach to delivering environmental services, similar to NE-PES, is the Water Farming Payment for Environmental Services (WF-PES) pilot program. This concept seeks to field test the potential for retaining water on fallow citrus lands. Feasibility analyses were completed in April 2012 by the Indian River Citrus League and in October by the Gulf Citrus Growers Association, both under cooperative agreements with the SFWMD. The WF-PES pilot projects will help determine the cost-effectiveness and benefits associated with retaining water on fallow citrus lands. The pilot project has three participants and is partially funded through a Clean Water Act Section 319(h) grant agreement with DEP. The estimated total annual storage available is 11,285 acre-feet. The projects will be operated for two years to gather data for any future WF-PES projects.

5.4.2 DWM in the Suwannee River Water Management District

The Middle Suwannee River and Springs Restoration and Aquifer Recharge Project (Middle Suwannee Project) is an example of an ongoing DWM Project in the SRWMD. The Middle Suwannee Project is located along the southeast flank of the SRWMD-owned Mallory Swamp in southeast Lafayette County extending into northeast Dixie County. Cooperators in the project include the Florida Fish and Wildlife Conservation Commission (FWC), Dixie and Lafayette Counties and private landowners.

The SRWMD began hydrologic restoration efforts at Mallory Swamp in 2006. The initial restoration activities were completed in 2009 and re-established the natural drainage patterns and hydrology previously disturbed by silviculture activities (i.e., ditching of the Swamp) prior to the SRWMD ownership. The Middle Suwannee Project builds upon the Mallory Swamp restoration activities using similar methods. The project re-establishes natural drainage patterns by modifying hydraulic structures (culverts and flashboard risers) along the southeastern margin of Mallory Swamp; thereby optimizing available surface water for wetland hydration and aquifer recharge, enhancing springs restoration. Aquifer recharge to the upper Floridan Aquifer will be optimized by using natural recharge features (such as sand-bottom ponds and lakes) and passive aquifer recharge wells. Optimizing aquifer recharge is a key component of the Middle Suwannee Project since it will: 1) increase spring flows in the middle Suwannee River reach primarily between Branford and County Road 340 in Dixie County and 2) supplement water supplies for permitted water users in southeast Lafayette and northeast Dixie counties, including self-supplied agriculture. The amount of additional water made available for aquifer recharge is dependent on the frequency and duration of storm events; however, surface water modeling results indicate that up to 10 MGD may be achieved under significant wet weather events.

The SRWMD has received a Class V, Group 2 UIC permit from the DEP for a passive recharge well on FWC property in Lafayette County. The well is located adjacent to two connected sand-bottom lakes located down gradient and east of the St. Regis Canal (a manmade canal along the eastern perimeter of Mallory Swamp). The source water for the well originates in Mallory Swamp, which is an entirely undeveloped physiographic feature and watershed. Once the natural hydrology is re-established, surface water will flow slowly from Mallory Swamp through rehydrated wetlands following precipitation events; eventually reaching the sand-bottom lakes and recharging the upper Floridan Aquifer.

Under high-flow storm events, the recharge well will serve as a supplemental source of recharge to the upper Floridan Aquifer while maintaining the lake stage to prevent inundation of the surrounding upland landscape. Under such storm events, recharge flow into the passive recharge well is expected to range from 0.1 MGD to 0.5 MGD.

Additionally, testing of surface water and groundwater quality for the Middle Suwannee Project demonstrates improvement as stormwater runoff moves down gradient through the wetlands toward the sand-bottom lakes. Specifically, the water-quality in the sand-bottom lake adjacent to the proposed recharge well location is reflective of the groundwater quality in the upper Floridan Aquifer approximately 600 feet east of the lake.

The SRWMD is currently investigating other opportunities for DWM projects in order to maximize surface water storage, enhance natural systems and provide aquifer recharge. These potential sites share similar geomorphologic and hydrogeologic conditions to the Middle Suwannee Project. Examples of these conditions are: 1) relatively large, forested watersheds with gently sloping topography; 2) watersheds that have been altered by drainage ditches and canals; 3) a relatively high percentage of historic and existing wetlands; and 4) areas where hydrogeologic conditions allow for natural aquifer recharge following restoration of the natural hydrology.

### 5.4.3 Considerations for Dispersed Water Management

#### 5.4.3.1 *Seasonality*

As described, the primary goal of the DWM Program in the SFWMD is reduction of excess wet season flows to downstream waters (e.g., Lake Okeechobee, St. Lucie River and Caloosahatchee River). As such, there is limited applicability to dry season use or function. In some cases (such as projects that pump regional water on-site for retention), there is some opportunity for dry season operations. However, these opportunities are limited by water supply concerns.

Further, SFWMD DWM projects are typically shallow-storage projects (less than 2 feet deep for FRESP/NE-PES and less than 4 feet for Water Farming). Therefore, these projects experience rapid decline in water volume available early in the dry season due to losses to seepage and evapotranspiration. According to a feasibility study performed on the Water Farming concept for the Indian River Citrus League (Assessment of Water Farming on Agricultural Lands, AECOM, 2013), potential water supply benefits can only be realized in projects that pump regional water on-site and then only in wetter-than-average years.

#### 5.4.3.2 *Reliability*

DWM projects have the potential to augment local (or even regional) agricultural water supply needs. For instance, participants in SFWMD’s FRESP and NE-PES programs have noted the early dry season benefits of residual soil moisture caused by wet season retention efforts, lessening (or delaying) the need for pasture irrigation. The ongoing Water Farming Pilot Program will explore the potential to return water stored in the wet season back to the regional system during the early dry season for irrigation use.

However, the amount of water stored in DWM projects is highly dependent upon excess wet season flows. Water availability during drier-than-normal years will be greatly reduced. Further, stored water available during the dry season would likely be non-existent in a 1-in-10 drought year, which is the basis for permitted irrigation allocations.

5.4.4 Issues, Impediments or Constraints

DWM as practiced in the SFWMD is an effective program aimed at reducing harmful wet season flows, with observable benefits to aquifer recharge, wetland restoration and habitat enhancement. It is limited only by the number of willing participants and the availability of funding necessary to continue or expand the program. However, based on the considerations discussed above, DWM has limited use as a potential storage option for water supply. Therefore, its applicability to the "beneficial use" goals of SB 536 is limited.

Several of the above discussed considerations for DWM projects also translate into impediments and constraints; particularly lack of available water in the dry season and maximized benefit during wetter than normal wet seasons. Furthermore, limited funding for DWM projects is a factor. The goal of DWM projects in the SRWMD is to restore natural hydrologic conditions (i.e., wetland storage and enhancement and aquifer recharge benefits) and supplement water supply to local users (e.g., self-supplied agriculture). Notwithstanding impediments to expansion of DWM in many areas of the state, expansion in rural regions with high value water resources (such as springs) that rely on stable aquifer levels is viable when high quality source water is available. These areas are common in north-central Florida, in particular the SRWMD.

5.4.5 Recommendations for Reducing Impediments to DWM

- Continued Funding. As discussed above, the major impediment to expansion of DWM programs is largely related to funding limitations. To the extent that the program has secondary benefits of aquifer recharge, habitat restoration and others, additional funding sources should be sought in support of these programs.
- Continue coordination with the agricultural community on the use of fallow agricultural lands for Dispersed Water Management. The availability of fallow agricultural lands (such as citrus groves impacted by Citrus Greening) should be further developed as alternatives for near-term water storage and potential local/regional beneficial use. The WMDs should continue and enhance outreach to the agricultural community to further develop this concept.

# 6 REGIONAL ANALYSIS

Water use patterns and hydrogeologic conditions vary widely across the state and are frequently the controlling factors in determining the most appropriate alternative water supply development or water storage options. Therefore, this section contains regional analyses conducted by each WMD to determine the appropriate regional focus for enhancing the use of reclaimed water, stormwater and excess surface water. These analyses are supported by the extensive work conducted as part of regional water supply plan development in each WMD, as well as graphical presentation of data related to water use and availability.

## 6.1 NORTHWEST FLORIDA WATER MANAGEMENT DISTRICT (NWFWMD)

### 6.1.1 Water Use Overview

In 2010, water use in the NWFWMD was approximately 357 MGD (Figure 6.1.1). By 2035, the District expects water use to increase by almost 17% to over 417 MGD. Public water supply was the largest use sector in 2010, followed by commercial/industrial/institutional. Together these two sectors accounted for 63% of the water used. By 2035, the NWFWMD projects these will remain the two largest water use sectors, accounting for almost 64 % of the water use. Projections indicate that domestic use and small public supply will experience the largest growth rate at nearly 24%, followed closely by recreational use at over 23%.

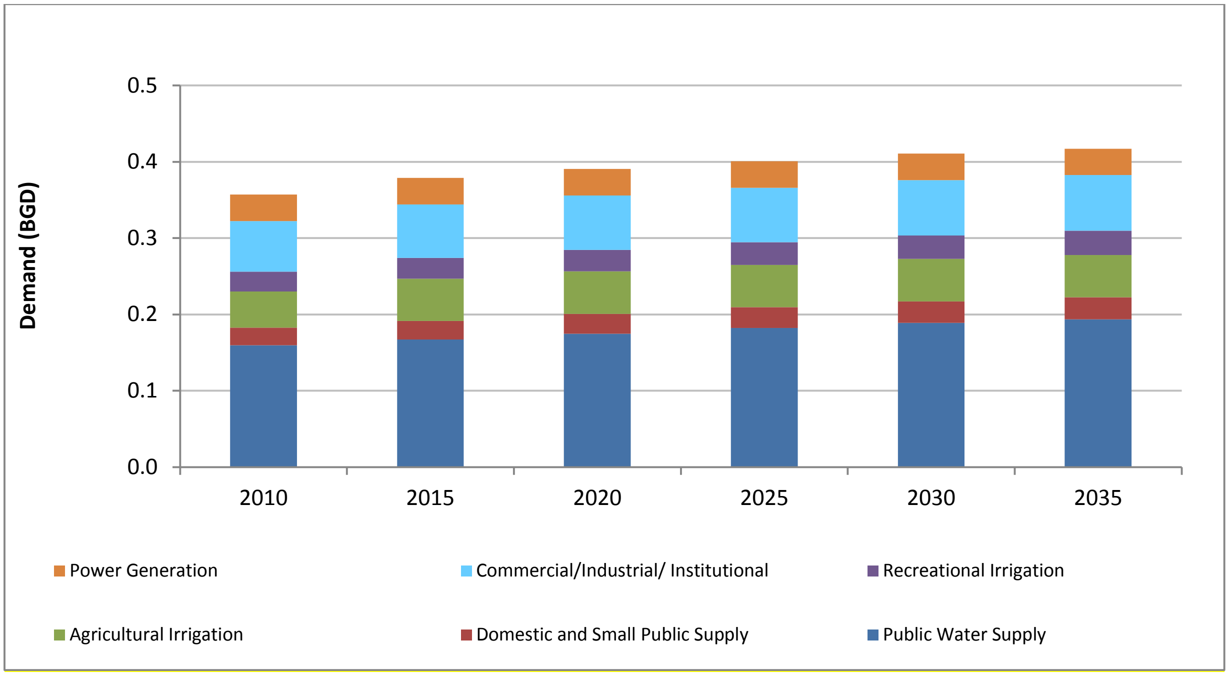



*Figure 6.1.1: Northwest Florida Districtwide Projected Demand*

### 6.1.2 Reclaimed Water Use and Availability

In 2013, there were 113 active domestic wastewater treatment plants (WWTPs) within the NWFWMD with a total wastewater flow of 96.2 MGD. Of these, 28 WWTPs with reuse programs distributed 24.7 MGD to offset potable uses (26% of total wastewater flow within NWFWMD). Six of these applied 100% of their treated effluent to uses that replaced or offset potable quality water. Of the other 107 WWTPs, effluent not used to offset potable use was managed in one or more ways, including: 18 discharged to surface waters, 7 to wetlands, 38 to RIBs, 15 to absorption fields and 34 to sprayfields. Reclaimed water availability, calculated as the amount not used to offset potable water uses, totaled 71.5 MGD in 2013 (74% of wastewater flow). Figure 6.1.2 shows sources of reclaimed water in NWFWMD.

Reclaimed water from 25% of these facilities was used to meet non-potable water needs, primarily for irrigation and industrial uses. Of the 66 operating golf courses in northwest Florida in 2013, 18 used 6.5 MGD of reclaimed water for irrigation. Irrigation of residences and other public access areas accounted for 3.7 and 2.0 MGD, respectively. Industrial reuse was 11.8 MGD, with most of this used for power generation cooling. Two WWTPs provided 0.7 MGD of reclaimed water to two wholesale plant nurseries for irrigation (one located in a WRCA] and one east of the NWFWMD boundary in the SRWMD).

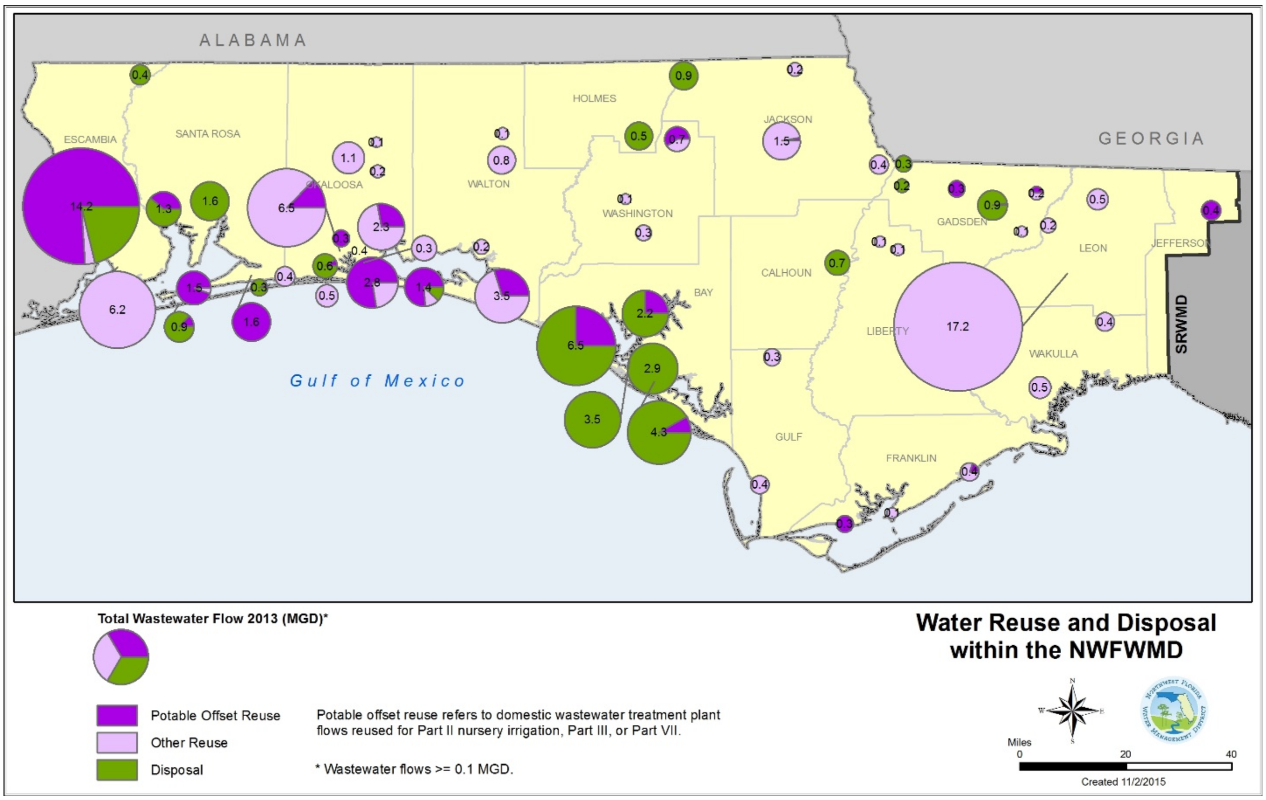



*Figure 6.1.2: Water Reuse and Disposal within the NWFWMD*

### 6.1.3 Surface Water Use and Availability

Surface water withdrawals reported to the NWFWMD for 2013 were 73.7 MGD, comprising 26% of total water production from all sources (considering net consumption for power generation). A wide range of surface water bodies are used within the district for water supply including Deer Point Lake Reservoir and the St. Joe Canal. Deer Point Lake Reservoir is the main water source for Bay County providing 22.9 MGD for public supply and 21.1 MGD for industrial use in 2013. The St. Joe Canal diverts 1.4 MGD from the Chipola River to the City of Port St. Joe in Gulf County for public supply.

The watersheds of the major rivers in northwest Florida extend north of Florida into Alabama or Georgia. There are significant surface water withdrawals occurring upstream from Florida and therefore outside the jurisdiction of the NWFWMD. These withdrawals complicate evaluation of unimpaired flows and mechanisms to ensure equitable allocations of water among the states do not exist. The NWFWMD, to provide an enhanced level of protection for the Apalachicola and Chipola rivers, has established water reservations under rule 40A-2.223, F.A.C. The magnitude, duration and frequency of observed flows are reserved for all seasons of the year for the protection of fish and wildlife of the rivers, associated floodplains and Apalachicola Bay (Figure 6.1.3). The rule states that, with certain limited exceptions, consumptive withdrawals of surface water from the main stem of these rivers and the Chipola Cutoff are not in the public interest.

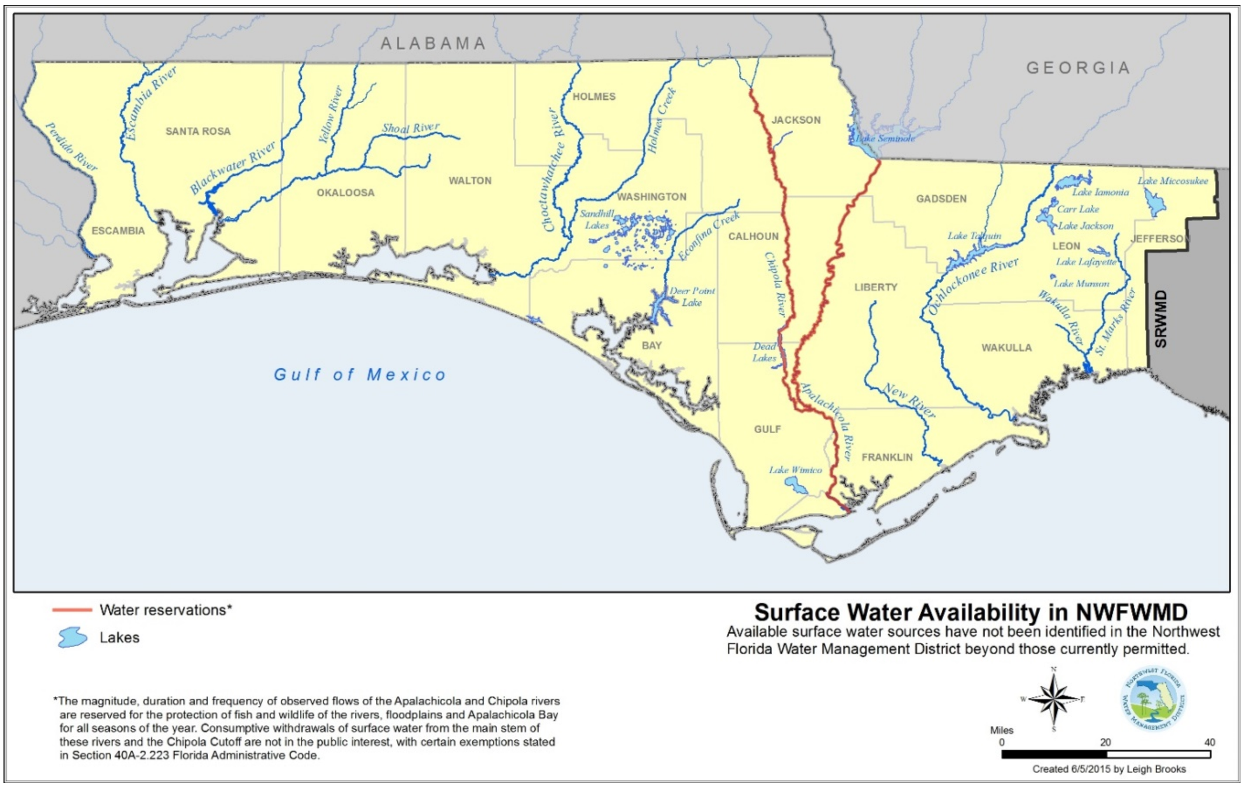



*Figure 6.1.3: Surface Water Availability in the NWFWMD*

The NWFWMD's MFL program was initiated in 2012 and includes expansion of the district's hydrologic monitoring network to provide the data needed for MFL development and resource assessments. Available surface water resources in excess of those already permitted, if any, have not been identified. The district's first MFL is expected to be adopted in 2019 for the St. Marks River Rise, a first-magnitude spring. Adoption of MFLs for the Wakulla Spring/Sally Ward

Spring system and for Jackson Blue Spring is anticipated in 2021 and 2023, respectively. Surface water bodies on the district's MFL Priority List are scheduled for MFL development in later years.

The 2012 Regional Water Supply Plan Update for Region II (Santa Rosa, Okaloosa and Walton counties) includes a potential surface water alternative water supply project for Okaloosa County (NWFWMD, 2012). The quantity of water available from the Shoal River for this project has not yet been determined.

### 6.1.4 Stormwater Use and Availability

There has been modest, but growing application of stormwater for non-potable uses in the NWFWMD. Many golf course irrigation systems withdraw water from ponds that collect stormwater. However, the availability of stormwater to offset potable demands across the NWFWMD has yet to be determined.

The district is currently funding a stormwater reuse pilot project with the City of Marianna for irrigation at Chipola College. The project is in the design stage and estimated to be completed in 2016.

### 6.1.5 Storage

#### 6.1.5.1 *Reservoirs*

There are numerous aboveground surface water storage facilities in the NWFWMD including reservoirs for public water supply, impoundments for irrigation and other uses, stormwater ponds and reclaimed water storage ponds and tanks. Primary or secondary purposes include: 16 dams for water supply; 64 dams for irrigation; and 7 dams for flood control and stormwater management (U.S.ACE, 2013). Other purposes include fish and wildlife, recreation, or fire protection, stock, or small farm use. The NWFWMD's database for management and storage of surface water contains records for 1,157 dam facilities; however, storage volume and purpose are not readily available. It is possible that existing storage facilities could be employed to store excess surface water.

Deer Point Lake Reservoir was created by damming the upper portion of North Bay in St. Andrew Bay, capturing flow mainly from Econfina Creek. Withdrawals are authorized up to 98 MGD but are currently less than half that amount. As noted previously, Okaloosa County is anticipating meeting future water needs with development of a reservoir located near the Shoal River. The reservoir would impound a tributary stream and be supplied with water pumped from the river or via river bank filtration. Figure 6.1.4 shows the location of surface water storage reservoirs in NWFWMD.

*Figure 6.1.4: 2013 Water Storage in the NWFWMD -- Surface Water Reservoirs*

Of the 66 operating golf courses in the NWFWMD, 22 rely primarily on surface water that is captured in ponds. Many also store reclaimed water until it is needed. There are numerous farm ponds in the Florida panhandle, many of which are in-stream impoundments used for agricultural irrigation or for fish or waterfowl.

In 2013, the total capacity of 34 permitted reclaimed water storage ponds was 397.8 million gallons and the total capacity of six permitted reclaimed storage tanks was 20.7 million gallons. Some of the larger storage ponds hold reclaimed water for use on sprayfields since potable offset reuse has not been optimized. Figure 6.1.5 shows regional reclaimed water storage in the NWFWMD.

### 6.1.5.2 *Aquifer Storage and Recovery*

There is one permitted ASR system in the NWFWMD (Figure 5.1). The George F. French Water Reclamation Facility in the City of Destin has seven injection/recovery wells that pump reclaimed water into the main producing zone of the sand-and-gravel aquifer system for later recovery and reuse. There may be potential for development of additional ASR systems in the NWFWMD in areas where hydrologic conditions are favorable.


*Figure 6.1.5: 2013 Water Storage in the NWFWMD -- Regional Reclaimed Storage*

6.1.5.3 *Aquifer Recharge and Dispersed Water Management*

In 2013, there were 38 domestic WWTPs that discharged to RIBs and 15 WWTPs that discharged to absorption fields within the NWFWMD. The quantity of water discharged using these methods was 8.5 and 0.4 MGD respectively. The volume recharging potable aquifers has not been determined but is likely less. In some areas, water discharged also contributes to surface waters through seepage streams and wetlands. Eleven WWTPs using these discharge methods are located in spring contribution areas and eight WWTPs are located in the upper Wakulla River and Wakulla Spring BMAP area. Many groundwater systems in northwest Florida are naturally low in nutrients and are not ideally suited for RIBs or sprayfields. Additional treatment may be warranted to reduce nutrients to achieve aquifer recharge and water protection goals.

There are no dispersed water management projects in the NWFWMD.

6.1.6 Uses and Needs

Water Resource Caution Areas (WRCAs) and Areas of Resource Concern (ARCs) have been identified in NWFWMD to address water needs and limitations. In the WRCA covering coastal Santa Rosa, Okaloosa, Walton counties, the coastal Floridan aquifer is still recovering from a decline in groundwater levels due to high coastal pumpage. A WRCA in the Upper Telogia Creek Drainage Basin in Gadsden County, where water withdrawals historically supported agricultural irrigation, was established due to reduction in supply and competition for available water. ARCs have been designated in southern Bay County and the central portion of Gadsden

County. In both of these areas there is concern for water availability and quality. Additional areas have substantial water demands but are not located in areas of limited water availability. Two large, urban population centers with high public supply demand include the cities of Pensacola (30 MGD in 2013) in Escambia County and Tallahassee (26 MGD in 2013) in Leon County. Figure 6.1.6 shows water WRCAs, ARCs and water demand in NWFWMD.

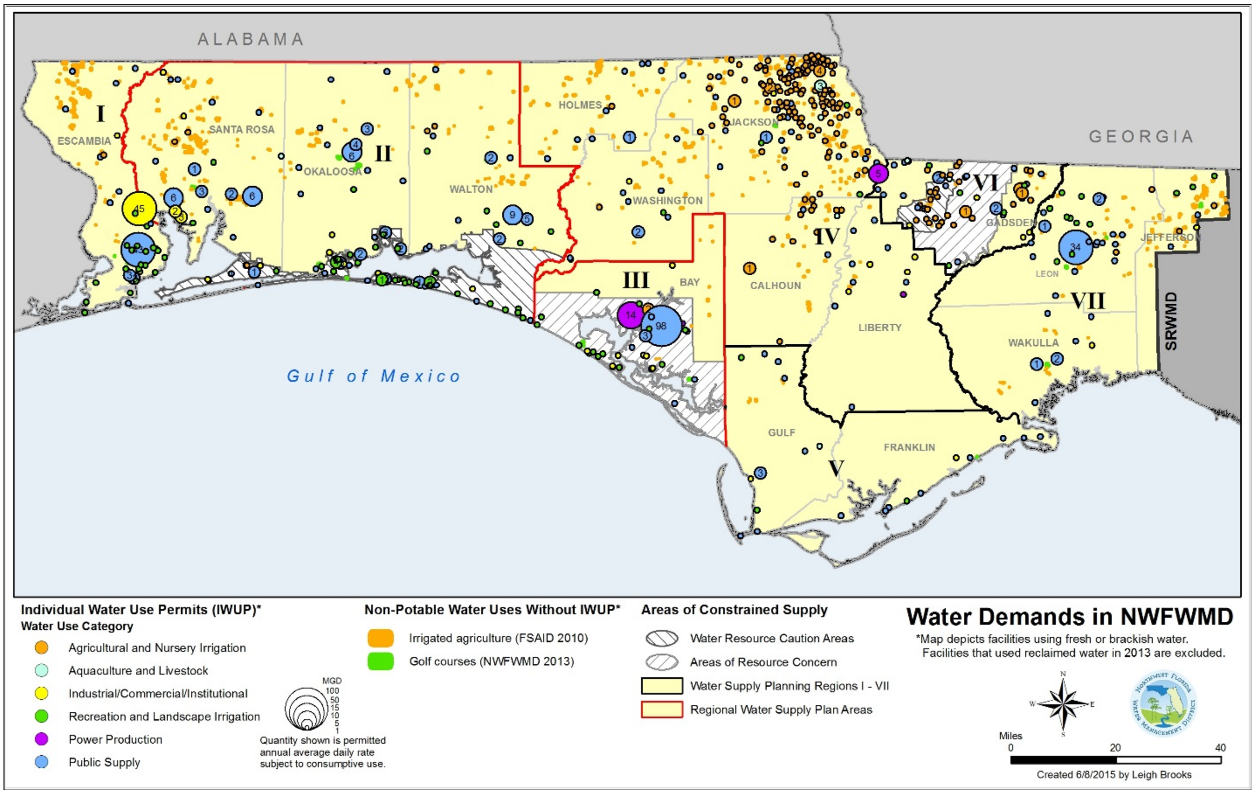



*Figure 6.1.6: Water Demands in the NWFWMD*

In northwest Florida, water demand for agriculture is highest in Jackson County at approximately 24 MGD with substantial demands in Gadsden County, 7 MGD and Santa Rosa County, 6 MGD (DACS, 2015). According to DACS Directory of Certified Nurseries, as of 2015 there are 249 nurseries within the NWFWMD. Of those, 57 are wholesale, 118 are retail, 53 are both wholesale and retail, 16 are for private use and five are government nurseries. Counties with the most nurseries are Santa Rosa (49), Escambia (38), Leon (36), Jefferson (23), Jackson (19), Gadsden (17), Okaloosa (15) and Bay (14). Only a few nurseries have large enough demands to require an individual water use permit. Most use utility-supplied potable water or self-supply wells for watering.

Power production typically uses large amounts of surface water for cooling and the use of reclaimed water is expanding for this purpose. Gulf Power has recently begun to use reclaimed water for cooling at its plant on the Escambia River, which had the largest power production withdrawal of freshwater in the NWFWMD. Gulf Power is interested in replacing the current once-through use of brackish surface water with reclaimed water at its plant in Bay County and is in discussions with local utilities to plan infrastructure development. A City of Tallahassee plant in Wakulla County is a closed loop system using reclaimed water from domestic and industrial wastewater discharge. There are cooling towers at six other Panhandle power plants and at industrial/commercial/institutional facilities where use of non-traditional water sources may be feasible. Industrial demands are heaviest in Escambia County (22 MGD in 2013) and Bay County (21 MGD from Deer Point Lake in 2013).

#### 6.1.7 Opportunities to Match Water Sources and Needs

Based upon the amount of unused wastewater that is readily accessible, there are opportunities for the expansion of reuse of reclaimed water. This is especially so in those areas where the availability of surface water has not yet been identified and stormwater reuse infrastructure has not yet been developed. Stormwater harvesting could potentially be developed in the future in those urban areas with stormwater management systems or in cooperation with DOT using transportation corridor stormwater facilities.

Increasing the amount of reuse can be achieved by maximizing utilization of existing reuse systems and/or by developing new ones where there are suitable matching opportunities. Potable offsets could be increased at 22 WWTPs with existing reuse programs. Development of new reuse systems should be focused on large WWTPs with sufficient reclaimed flows and nearby large, non-potable water demands. Many WWTPs in the NWFWMD are small facilities in rural areas where it is not cost effective or feasible to develop potable offset reuse programs. However, there may be opportunity for some small WWTPs to provide reclaimed water for agricultural water users.

Of the 27 golf courses in the NWFWMD that primarily use groundwater for irrigation, six are located within one mile of a WWTP with available reclaimed water. Fourteen are located within three miles of a WWTP with availability. The City of Crestview has applied for funding to develop reclaimed infrastructure to provide reuse for golf course and other public access uses. Likewise, the City of Gretna has applied for funding to expand plant capacity and distribution to provide reclaimed water to a golf course.

Like golf courses, plant nurseries provide an opportunity for using reclaimed water to replace potable water. There are 17 nurseries in the coastal Region II WRCA, 10 in the Bay County Area of Resource Concern and eight in the Gadsden County Area of Resource Concern. Currently, only one of these nurseries is using reclaimed water. Retail nursery use would require Part III reclaimed water suitable for public access, which is readily available in coastal Region II. There are 37 nurseries located in the City of Tallahassee and 32 located in the City of Pensacola that could potentially use reclaimed water in the future as reuse systems are further developed. Emerald Coast Utility Authority's Bayou Marcus plant serving Pensacola may need to upgrade to high-level disinfection to accommodate public access reuse, though its other plants (Pensacola Beach and Central Water Reclamation Facility) currently produce public access quality water.

Three large combustion power plants present potential future opportunities for converting to reclaimed water for cooling: Gulf Power Lansing Smith Electric Generating Plant (1001.5 MW, 10.1 MGD of brackish water in 2013) in Southport; Arvah B. Hopkins Generating Station (377.5 MW, on city water) in Tallahassee; and the Santa Rosa Energy Center (241 MW, 0.3 MGD reported in 2013) in Pace. Reclaimed water cooling may also be possible with three large industrial users in the district: Ascend Performance Materials LLC Pensacola Florida Plant (102 MW, 7.1 MGD in 2013); International Paper Co. Pensacola, which currently uses reclaimed water from Escambia County Utility Authority for plant processes (82.8 MW, 21.5 MGD); and Rock Tenn CP, LLC Panama City Mill (34 MW, 17.5 MGD). A more detailed analysis of proximity to WWTPs could identify other opportunities.

In springs contribution areas of the Dougherty Karst Plain (Holmes, Jackson and Washington counties) and the Woodville Karst Plain (Gadsden, Jefferson and Leon counties), there are opportunities to match reclaimed flows with nearby golf courses, nurseries or irrigated agricultural areas to offset potable water use. Nutrient control prior to land application, where not already required, may be a priority. Additional nutrient control could facilitate aquifer recharge while meeting groundwater protection goals.

The district has initiated a new water supply development grant program, which is funding reclaimed water projects for a number of communities, including Fort Walton Beach, Pace and Escambia County.

## 6.2 Suwannee River Water Management District (SRWMD)

### 6.2.1 Water Use Overview

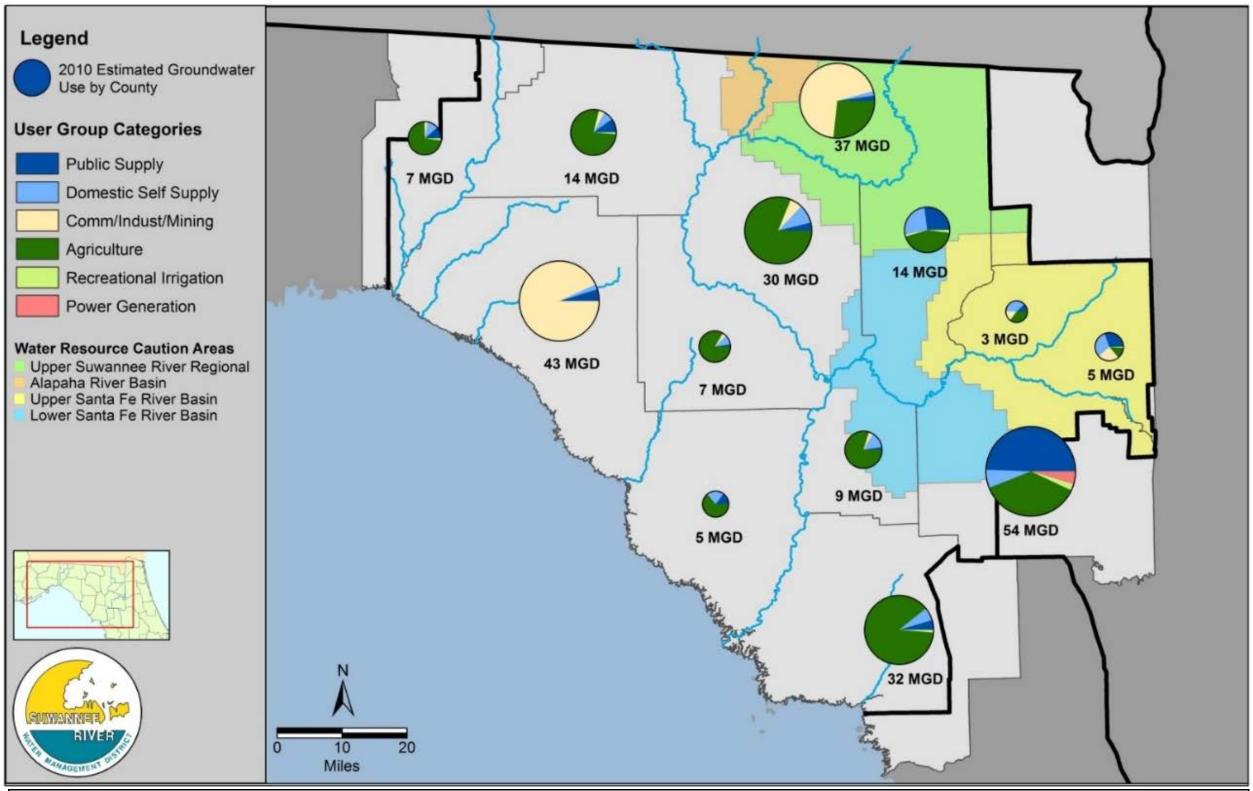
The SRWMD's overall water use is the lowest among the five water management districts. Presently, fresh groundwater is the primary source of water for consumption. With the exception of two large commercial and industrial operations and a large public utility located in Alachua County (primarily in the SJRWMD), water use in the SRWMD is highly dispersed, with many small users distributed over large rural areas. Figure 6.2.1 shows the distribution of water uses and needs, by county and user group categories, throughout the SRWMD.

Based on preliminary work conducted for the upcoming regional water supply plan, the SRWMD is expected to experience growth in water use across most sectors over the next twenty years. Agricultural water use is anticipated to continue to experience steady growth in many areas of the SRWMD and is expected to continue to be the largest water use sector in the SRWMD through the 2035 planning horizon. Additionally, current population projections indicate that the population of the SRWMD will grow by approximately 18% from 2010 to 2035, driving a moderate increase in the SRWMD's smaller Public Supply and Domestic Self-Supplied water use sectors.

### 6.2.2 Regional Water Supply Challenges

Declines in the Upper Floridan aquifer have impacted a number of rivers and springs within the SRWMD. As a result, the SRWMD established four WRCAs: Upper Santa Fe Basin, Lower

Santa Fe Basin, Alapaha River Basin and Upper Suwannee River Regional WRCAs. Additionally, the recently adopted MFLs for the Lower Santa Fe and Ichetucknee Rivers and springs are not being met and an MFL recovery strategy is currently in place for the Lower Santa Fe Basin. Assessment and study of these water resources indicate that regional groundwater withdrawals both within and outside of the SRWMD jurisdictional boundaries have impacted these water bodies, necessitating regional solutions. The successful development and implementation of significant regional aquifer recharge, water conservation and alternative water supply projects as part of the Lower Santa Fe Basin Recovery Strategy will be necessary to restore these water bodies and to meet current and future water supply needs across the North Florida region.




Note: Values provided are 2010 USGS groundwater withdrawal estimates by county and represent county-wide totals for groundwater withdrawals. Values are not subdivided in counties shared by two water management districts. Baker County water use is not depicted as very little water use occurs in Baker County within the SRWMD's jurisdiction.

*Figure 6.2.1: Water Uses and Needs in the SRWMD*

### 6.2.3 Reclaimed Water

As much of the SRWMD is a high recharge area, the wastewater disposed via sprayfields and RIBs is recharged to the Upper Floridan aquifer, effectively offsetting demand. Where sprayfields are utilized, there may be potential to increase recharge rates by reducing evaporative losses. Presently, about 10% of wastewater flows in the SRWMD are utilized for reclaimed uses that directly offset or replace other consumptive water uses. Although reclaimed expansion in the SRWMD is limited in scale from a water supply standpoint, increased development of reclaimed water represents a potential tool for nutrient management purposes.

The wide-spread use of septic tanks within the SRWMD provides an opportunity to expand reuse. Many towns have relatively densely populated areas which rely upon septic tanks. While an expensive option, the connection of these areas to municipal sewer systems would generate greater reclaimed water volumes for beneficial reuse and would provide water quality benefits. Many small communities within the SRWMD, the majority of which are Rural Economic Development Initiative communities, do not have the financial resources to develop reuse systems beyond relatively low cost sprayfields or RIBs.

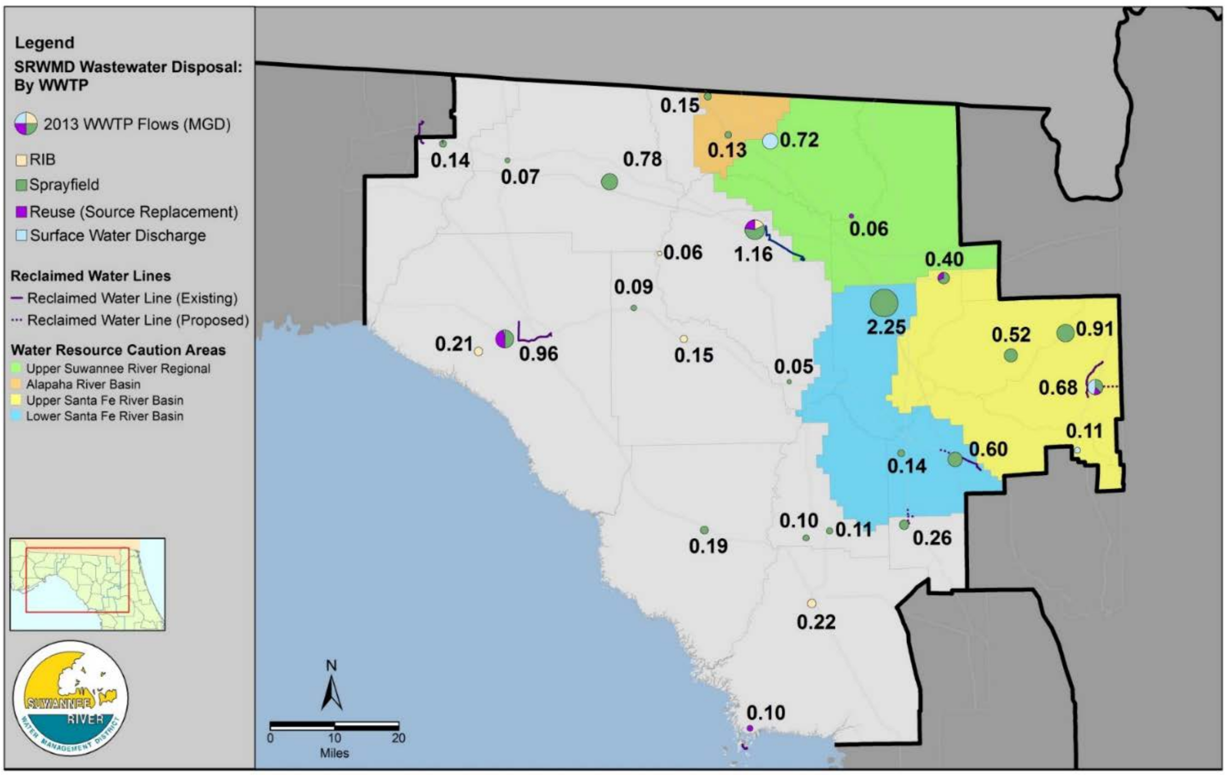
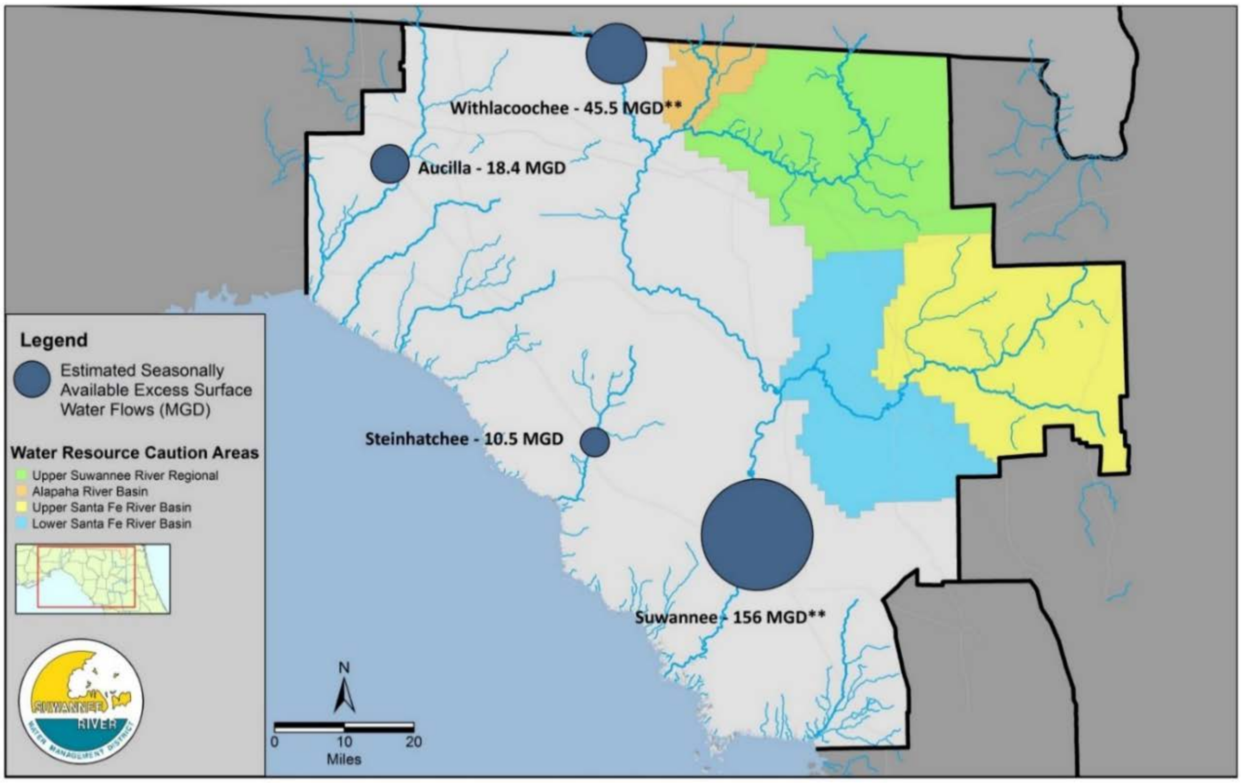



*Figure 6.2.2: 2013 Existing Reuse and Waste Water Disposal in the SRWMD*

## 6.2.4 Excess Surface Water

Planning level estimates indicate that significant quantities of seasonally available excess flows are available in several major river systems and represent a potential source of water for alternative water supply and water resource development projects. The SRWMD and SJRWMD are currently working on the development of the North Florida Regional Water Supply Plan, which will provide further insight into potential year-round availability of surface water from the area's major rivers. From a regional water supply perspective, the SRWMD anticipates that excess surface water flows from the Suwannee River system will represent a key potential source of water for regional aquifer recharge in the SRWMD in the future.

The SRWMD identified four major rivers where excess surface water from high river flows may be available (Figure 6.2.3): the Aucilla, Steinhatchee, (North) Withlacoochee and Suwannee Rivers. A preliminary assessment indicates that the availability of water from the Suwannee River varies significantly on a year-to-year basis, but greater than 100 MGD, annual average, may be available approximately 80% of the calendar years. Seasonal availability from rivers in the SRWMD would generally peak during North Florida's spring wet season (roughly February through May) and additional large water quantities could also be available in the summer and early fall in some years. Little, if any water would be considered excess during certain low flow periods or drought conditions. The seasonality of this system emphasizes that significant storage capacity would be required to develop these potential surface water supplies for beneficial use.




Note: The Withlacoochee River is a tributary of the Suwannee River. Available surface water flows presented for the Withlacoochee are a portion of the availability downstream on the Suwannee River. It is unlikely that the totals presented for these two rivers could be utilized simultaneously. Seasonally available streamflows presented are planning level estimates based on long-term multi-year averages. Values presented represent seasonal availability at a gaged location on each river. Availability will vary upstream and downstream of each gaged location.

*Figure 6.2.3: Estimated Seasonally Available Excess Surface Water Flows in the SRWMD*

This assessment also indicated that smaller quantities of excess surface water may be available on the Aucilla and Steinhatchee Rivers: 18.4 and 10.5 MGD, respectively. Additionally, although part of the Suwannee River system, the Withlacoochee River may also represent a potential source of excess surface water. These potential supplies also share similar seasonality constraints and storage requirements.

#### 6.2.4.1 *Regional Aquifer Recharge Potential*

Excess surface water from the Suwannee River system represents a key potential water source for regional aquifer recharge, MFL recovery efforts and alternative water supply in North Florida. Due to seasonal variation in availability, the rural and dispersed nature of the SRWMD's water users and the SRWMD's reliance on groundwater, aquifer recharge represents the greatest potential use of excess surface water in the SRWMD. Many of the major rivers in the SRWMD, including the Suwannee River itself, naturally recharge the Floridan aquifer, particularly during flood events. Enhancing this natural recharge process can provide a tool for meeting North Florida's water supply needs and supporting natural systems and springs. Utilizing excess surface water for regional scale aquifer recharge projects in the SRMWD would allow for the use of the Floridan aquifer for both storage and transmission purposes, reducing the need for costly surface storage and regional transmission infrastructure. The SRWMD has been investigating the potential use of excess surface water from the Suwannee River for regional aquifer recharge projects since shortly after the 2010 water supply assessment was completed. At this time, additional concept development is needed to identify, locate and develop strategic, regionally impactful aquifer recharge projects.

#### 6.2.4.2 *Impediments*

Due to the rural nature of the SRWMD, lack of capital funding is a critical impediment to the development of surface water as an alternative water supply. The SRWMD's water use is dominated by many small and highly dispersed water users and small municipalities, which generally do not have the financial resources to develop surface water systems. Depending on the use, the water quality of the SRWMD's surface waters sources would necessitate treatment, adding to capital and operational costs.

### 6.2.5 <u>Stormwater</u>

The primary areas where urban stormwater may be developed for beneficial use are small municipalities in the eastern, more confined areas of the SRWMD, such as Lake City, Starke, portions of Alachua County and along major highway corridors. Aquifer recharge represents an important potential use for stormwater and in many cases can provide both local flood mitigation benefits and support groundwater resources.

As was the case in much of rural Florida, historical ditching and draining programs and practices have altered natural drainage patterns in several areas of the SRWMD. These historical drainage networks provide opportunities for wetlands restoration and dispersed water storage projects that can provide environmental enhancement, flood mitigation and aquifer recharge opportunities. The SRWMD's Middle Suwannee River and Springs Restoration and Aquifer Recharge Project (Middle Suwannee Project) and Brooks Sink Restoration Project provide focus on restoring the natural hydrology of historically drained natural areas and reestablishing flows to natural recharge features.

Finally, tailwater recovery from agricultural operations also represents a potential opportunity. In early 2015, the SRWMD approved a cost share grant to build a new tailwater recovery pond project for an agricultural operation. Preliminary estimates indicate that this project may be able conserve up to 45 million gallons of groundwater per year, while also providing nutrient management benefits. The SRWMD is actively working to implement additional tailwater recovery opportunities.

### 6.2.6 Water Storage

#### 6.2.6.1 *Reservoirs*

At the time of the publication of this report, there are no regionally significant water supply reservoirs in the SRWMD. Future alternative water supply project concepts developed in the NFRWSP will likely identify water storage components, potentially including surface reservoirs.

#### 6.2.6.2 *Regional Aquifer Recharge*

Due to the SRWMD's unique hydrogeology and dispersed water use regime, aquifer recharge represents the primary solution to the SRWMD's water storage needs. As excess surface water is a highly seasonal water source, storage will be a key feature of future development projects. Aquifer recharge provides a storage mechanism that utilizes the natural storage capacity of the Floridan aquifer system and can reduce the need for costly surface storage features and distribution systems. To date, the SRWMD has been actively implementing several projects that include aquifer recharge components, including the previously mentioned Middle Suwannee Project and the Brooks Sink Restoration Project.

#### 6.2.6.3 *Dispersed Water Management*

DWM projects retain stormwater on private or public lands as a means of reducing discharges to downstream receiving waters from historical man-made drainage systems. The Middle Suwannee Project is also an example of an ongoing DWM Project and is fully described in Chapter 5. The SRWMD is currently investigating other opportunities for DWM projects for sites sharing similar geomorphologic and hydrogeologic conditions to the Middle Suwannee Project, such as: 1) large, forested watersheds with gently sloping topography, 2) altered watersheds, typically resulting from silvicultural practices, 3) high percentage of historic and existing wetlands, and 4) hydrogeologic conditions allowing for natural aquifer recharge.

### 6.2.7 Opportunities for Enhanced Use of Reclaimed Water, Stormwater and Excess Surface Water

The preliminary assessment indicates that the Suwannee River system and particularly the Suwannee River itself, can offer significant seasonally available quantities of fresh surface water to meet water supply needs and for the recovery and support of natural systems and springs. Within the SRWMD, the most promising potential use of excess surface water from the Suwannee River system is for regional aquifer recharge. Utilizing excess surface water quantities for Floridan aquifer recharge would provide a means to use available excess surface water to support dispersed agricultural water uses and also augment and restore groundwater levels which support the region's springs and rivers. Utilizing the Floridan aquifer for storage and transmission via aquifer recharge can reduce the need for surface storage infrastructure and distribution systems to a dispersed group of water users. Developing regional water supply solutions can be capital intensive and presently, fiscal constraints represent the primary impediment to developing excess surface water for regional aquifer recharge in the SRWMD.

Due to the rural nature of the SRWMD, reclaimed water use within the SRWMD will play a limited role in meeting future alternative water supply needs. Improvements in wastewater disposal methods and the expansion of reclaimed water access provide opportunities for improved nutrient management in sensitive recharge areas. Agricultural reclaimed use may represent a potential area for increased reclaimed water utilization. Additionally, on a regional level, expansion of the beneficial use of reclaimed water in the large urban centers of the North Florida Region could have significant regional benefits to water supply and natural systems in the SRWMD.

Although opportunities for large, regional stormwater projects may be limited by the rural nature of the SRWMD, the expanded use of stormwater represents a potential opportunity on a local level. The primary opportunity for the enhanced use of stormwater in the SRWMD is the hydrologic restoration of historically ditched and drained rural or natural areas for dispersed water storage, natural system enhancement and enhanced aquifer recharge. Agricultural tailwater recovery projects and local scale urban stormwater recharge projects in small communities provide opportunities for aquifer recharge, nutrient management and local flood mitigation.

## 6.3 St. Johns River Water Management District (SJRWMD)

### 6.3.1 Water Use Overview

In 2010, total water use in the SJRWMD was approximately 1,200 MGD (Figure 6.3.1). By 2035, water use is expected to increase by approximately 26% to over 1,500 MGD. Public water supply was the largest use sector in 2010, followed by agricultural irrigation. Together these two sectors accounted for about 81% of the water consumed. By 2035, it is estimated that public supply and agricultural irrigation will remain the two largest use sectors, though agricultural irrigation is predicted to decrease by 8%. Together these two sectors will account for nearly 78% of the projected use.

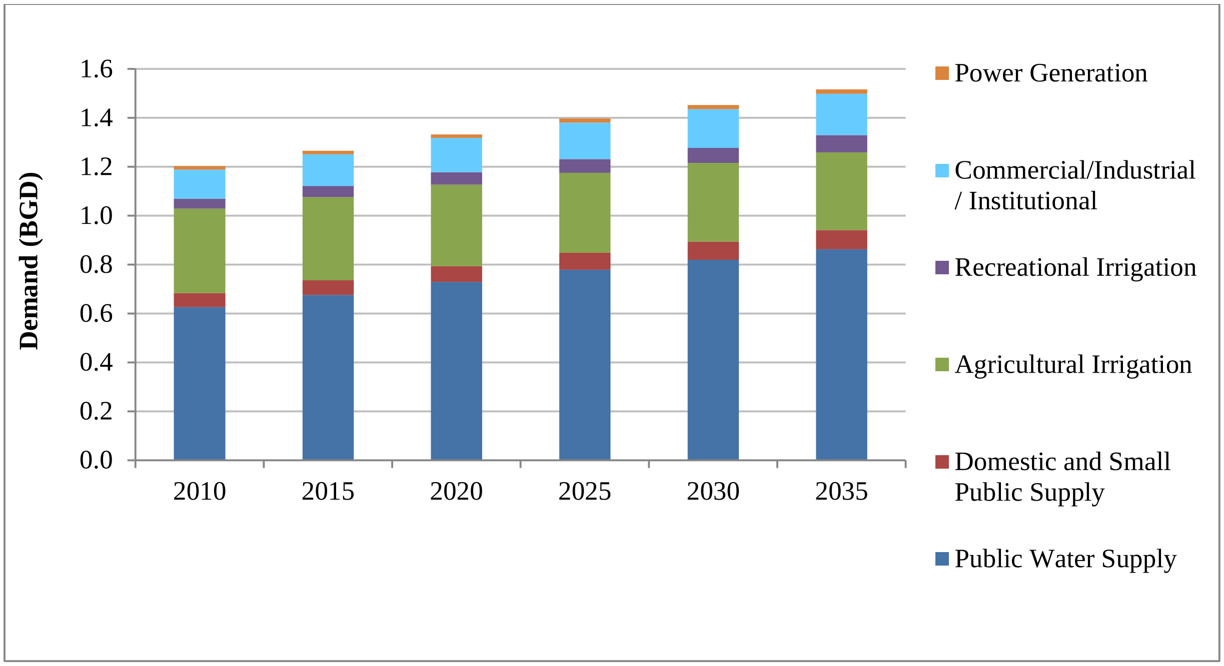
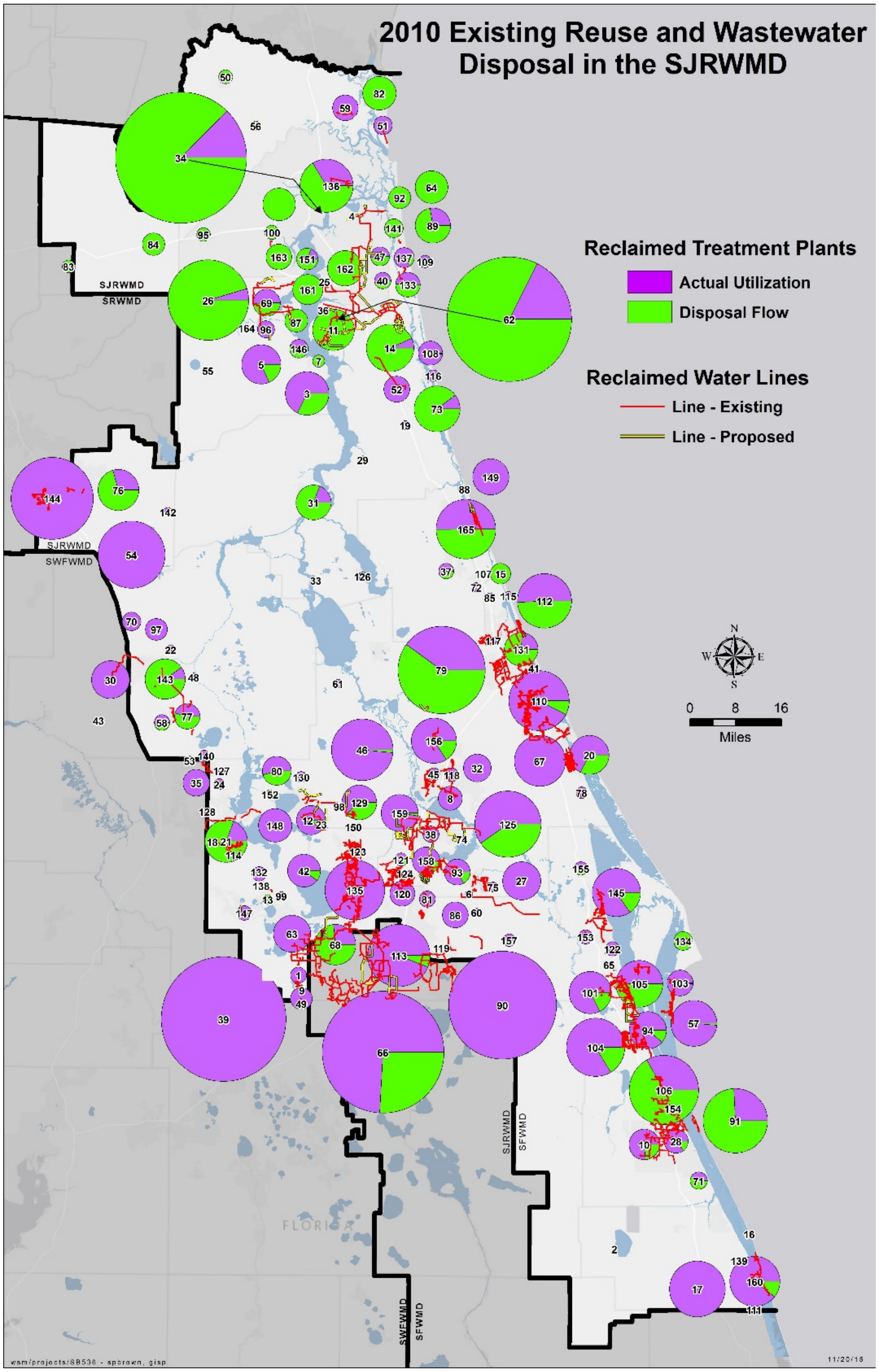



*Figure 6.3.1: SJRWMD Districtwide Projected Demand*

6.3.2 Reclaimed Water Use and Availability

According to the 2013 Florida Department of Environmental Protection Annual Reuse Inventory report, the total amount of reclaimed water used in the SJRWMD was 176.47 MGD. The totals by reuse types are: 103.80 MGD public access reuse, 9.06 MGD agricultural irrigation, 16.16 MGD aquifer recharge, 21.69 MGD industrial and 25.76 MGD other (includes wetlands, fire protection, toilet flushing and all other uses). The total estimated available reuse and wastewater treatment plant flow capacities in the SJRWMD are 439.30 MGD and 538.48 MGD, respectively. Figure 6.3.2 shows 2010 reuse utilization and disposal flow in the SJRWMD. Figure 6.3.3 shows the increases in reuse flow and capacity (constructed and permitted infrastructure) in the District. Figure 6.3.3 shows countywide increases in both reuse utilization and reuse capacity from 2000 to 2014.




Note: The numbers shown in this figure provide a general overview of locations and quantities of used and disposed reclaimed water. They should not be used as a basis for comparing reuse between regions, but instead demonstrate how hydrogeology and development patterns dramatically affect the feasibility of reuse.

*Figure 6.3.2: Reclaimed Water Facilities and Reuse in the SJRWMD*

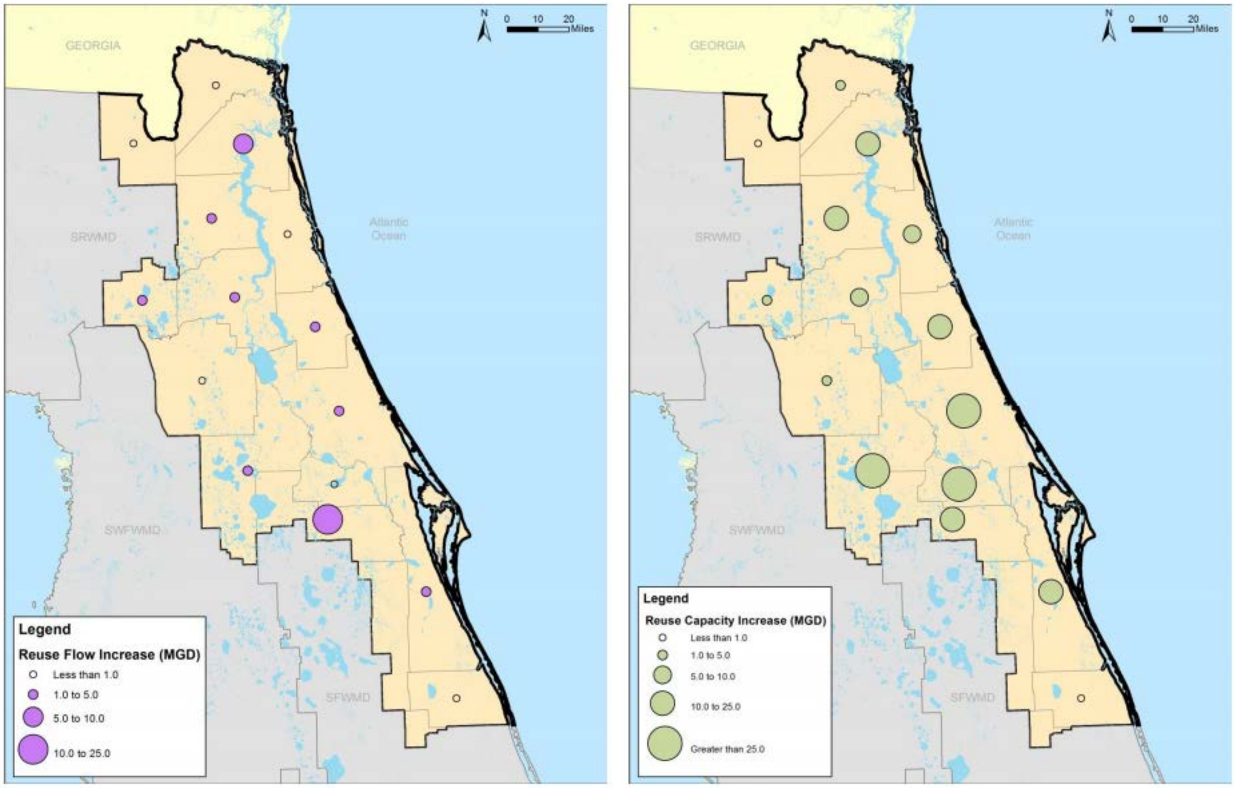



*Figure 6.3.3: Increases in Reuse Flow and Reuse Capacity in the SJRWMD by County from 2000 to 2014*

6.3.3 Surface Water Use and Availability

Surface water withdrawals in the SJRWMD are small in comparison to groundwater use. Average surface water withdrawals from 1995 to 2010 ranged from 15 to 25% of the total withdrawals. The average surface water withdrawal over the 16-year period was about 19% of total withdrawals. The largest surface water withdrawals in 2010 were for agricultural irrigation at 61% (128.10 MGD), followed by landscape/recreational/aesthetic irrigation (20%), commercial/industrial/institutional/mining (12%) and public supply (7%).

The SJRWMD has several permitted surface water withdrawals on the St. Johns River including Lake Washington (16.4 MGD), Taylor Creek (8.8 MGD), Lake Monroe (2.6 MGD), City of DeLand (2.0 MGD) and Yankee Lake (5.5 MGD). All of these withdrawals are for public supply use as potable water or reclaimed water augmentation. Additional potential surface water supplies are discussed below.

To consider the potential environmental effects of withdrawals from the St. Johns River and its major tributary, the Ocklawaha River, the district conducted the St. Johns River Water Supply Impact Study (WSIS) (Publication SJ2012-1) from 2007 to 2012. The WSIS concluded that annual average withdrawals from the St. Johns and Ocklawaha Rivers could be as high as 155 MGD and 107 MGD, respectively, without unacceptable ecologic and hydrologic impacts.

The lower Ocklawaha River at Rodman Dam has been identified as a potential source of surface water, with a preliminary yield estimate of 30 MGD. The following potential yields from the St. Johns River have also been identified: Yankee Lake (up to 50 MGD); SR 46 (up to 50 MGD); Taylor Creek Reservoir at SR 520 (up to 60 MGD); and, DeLand (64.2 MGD).

The SJRWMD is currently adopting MFLs for portions of the Ocklawaha and St. Johns Rivers that may affect these estimates. While the St. Johns River may supply a large quantity of raw water, water quality and quantity vary seasonally, which will require multiple treatment processes, significant amounts of storage and multiple sources of water to ensure a reliable supply.

6.3.4 <u>Stormwater Use and Availability</u>

Within the SJRWMD, stormwater harvesting is an integral component for the Altamonte Springs-Florida Department of Transportation Integrated Reuse and Stormwater Treatment (A-FIRST) project, the Masters Tract Regional Stormwater Treatment facility and multiple golf courses. In addition, Clay County Utility Authority is proposing a stormwater harvesting project on the First Coast Expressway in Clay County.

Potential opportunities for additional stormwater harvesting in the SJRWMD include:

- recharge basins located in the western region that promote infiltration/aquifer recharge;
- expansion of the current use of tailwater recovery ponds by agricultural operations where the groundwater table is at or close to the ground surface;
- partnerships between public and private entities to supplement irrigation supplies; and,
- strategically located basins or modification of existing basins that can provide storage and recharge for nearby wetlands and lakes, especially when part of an MFL prevention and recovery strategy.

6.3.5 <u>Water Storage for Future Use</u>

Existing and proposed reclaimed water storage facilities in the SJRWMD consists of reservoirs and aquifer storage and recovery (ASR) systems. These facilities are shown on Figure 6.3.4 and discussed separately below.

6.3.5.1 *Reservoir Storage*

SJRWMD's existing reservoirs were constructed for flood protection, water quality treatment, recreation and water storage. These existing reservoirs include the 13,000-acre Rodman Reservoir located in Marion and Putnam Counties, the 10.4 billion gallon in-line Taylor Creek Reservoir and the 120 million gallon City of Apopka Reservoir in Orange County. The Apopka Reservoir is for reclaimed water and stormwater storage, as well as aquifer recharge of water not used for irrigation. Rodman Reservoir is used primarily for recreational purposes and Taylor Creek Reservoir is for both flood protection and a water supply source. Additional reservoir storage capacity for surface or groundwater is being evaluated as part of the St. Johns River/Taylor Creek Reservoir surface water project.

Other projects currently under construction or development include the Fellsmere Water Management Area. This 10,000-acre wetland reservoir, currently under construction, will provide water supply for irrigation and will increase water storage in the Blue Cypress Lake watershed. In addition, it will consist of restored wetlands, providing significant environmental benefits. The Grove Land Reservoir & Stormwater Treatment Area is a proposed 5,000-acre reservoir and 2,000-acre stormwater treatment area to be located in Okeechobee and Indian River Counties. The reservoir water would be supplied from excess stormwater captured from the C-25, C-24 and C-23 basins that currently discharge to the Indian River lagoon. Similarly, the proposed C-10 Reservoir, a 1300-acre reservoir, will divert water from the C-1 canal through the Sawgrass Lake Water Management Area for water quality improvement. The reservoir will also serve to supplement the potential surface water supply in this region. Finally, the Mid-Clay Water Storage Project will consist of storage and recovery of reclaimed water at a land application and recovery site.

#### 6.3.5.2 *Aquifer Storage and Recovery*

ASR wellfields have operated successfully within the SJRWMD since 1987, beginning with the City of Cocoa system at the Dyal Water Treatment Plant. Currently, there are twelve ASR facilities in the SJRWMD, six of which are actively operated. The City of Cocoa Beach ASR is the only facility that stores and recovers reclaimed water. Figure 6.3.4 depicts the location of the ASR facilities within the SJRWMD.

ASR projects are most feasible in the counties of St. Johns, Flagler, Volusia, Seminole, Orange and Brevard as these counties have population centers generating wastewater with unused reclaimed water volumes (Figure 6.3.5). Many of these population centers also have public water supplies that are experiencing the effects of saltwater intrusion. Strategically located areas can be used to store excess reclaimed water for use during the dry season as an irrigation source to offset groundwater use. Aquifer recharge wells can also be used as saltwater intrusion barriers by storing relatively fresh reclaimed water in saltier aquifers. Similar saltwater intrusion barriers are used in other coastal areas such as California and South Carolina.

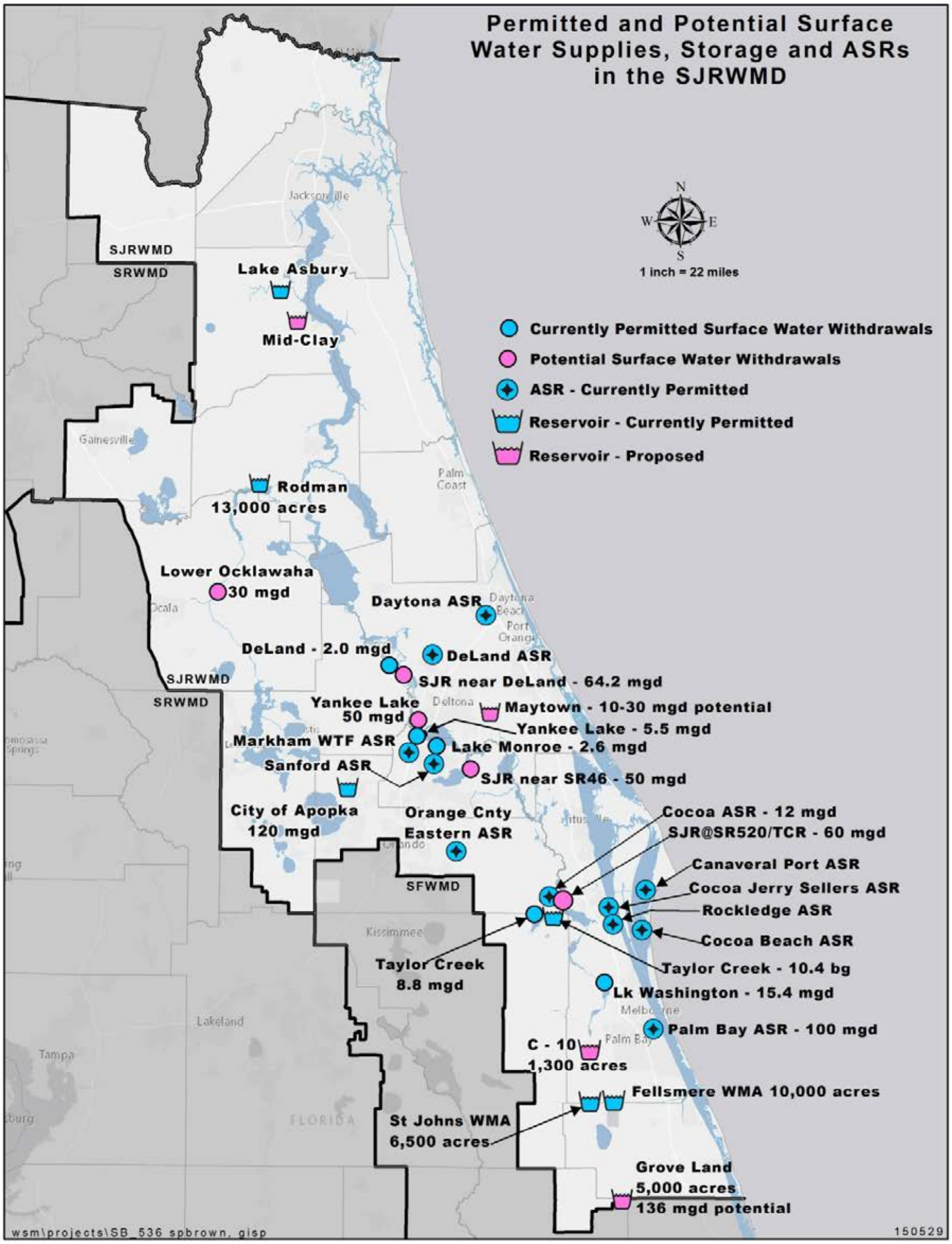
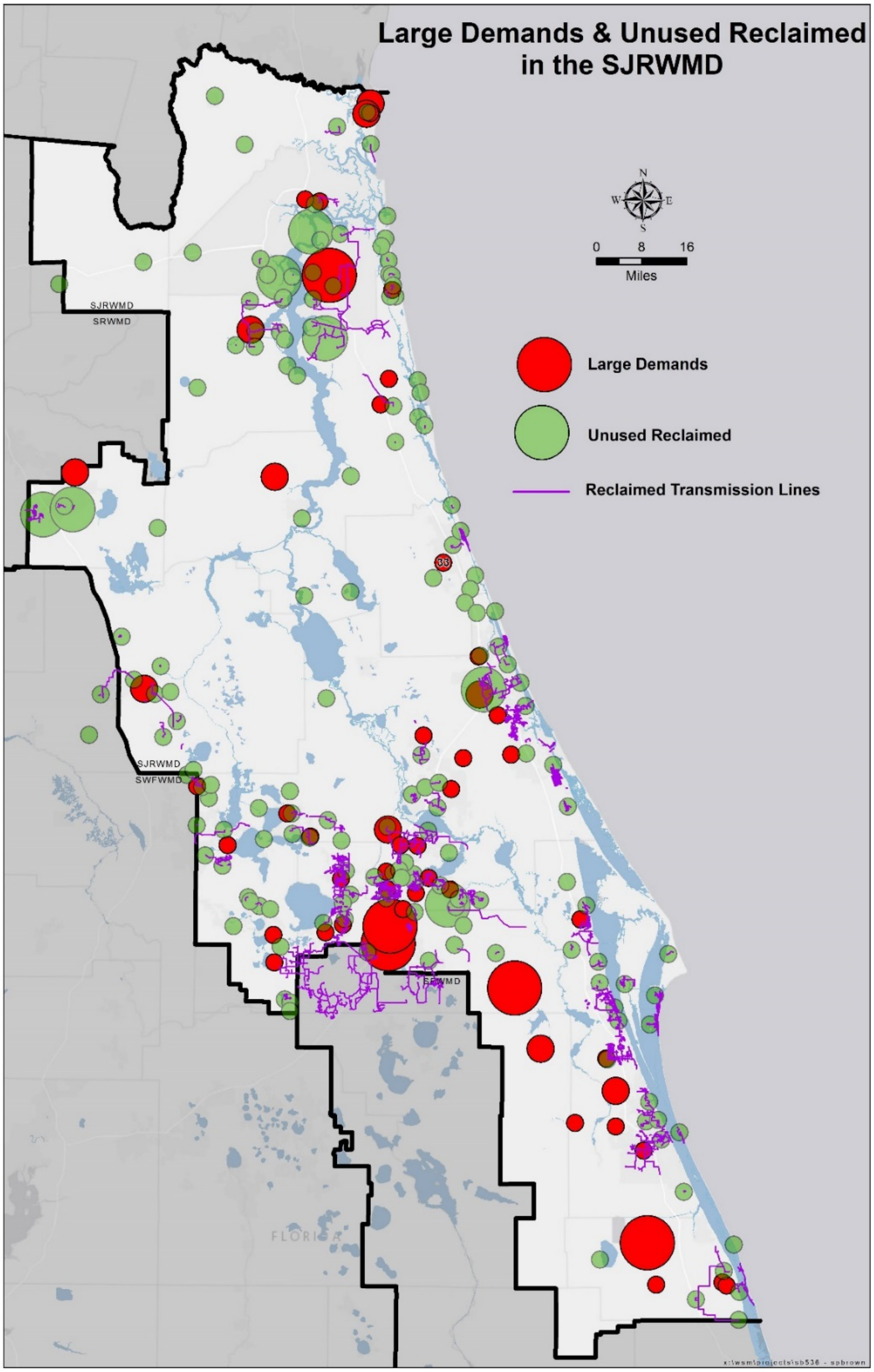



*Figure 6.3.4: Permitted and Potential Surface Water Supplies, Reservoirs and ASR Systems in the SJRWMD*




Note: The numbers shown in this figure provide a general overview of locations and quantities of used and disposed reclaimed water. They should not be used as a basis for comparing reuse between regions, but instead demonstrate how hydrogeology and development patterns dramatically affect the feasibility of reuse.

*Figure 6.3.5: Large Demands and Unused Reclaimed in the SJRWMD*

### 6.3.6 Aquifer Recharge and Dispersed Water Management

The most common aquifer recharge projects are through RIBs and treatment wetlands. While there are no existing or proposed dispersed water management projects in the SJRWMD, the district is exploring partnerships to incentivize storage of excess surface water on private property.

The Water Conserv II (WCII) Aquifer Recharge project is an indirect aquifer recharge project capable of supplying up to 28 MGD. The project is situated within the SJRWMD and SFWMD and is jointly owned and operated by the City of Orlando and Orange County. Highly treated reclaimed water is reused by a combination of agricultural and residential irrigation users and aquifer recharge through RIBs. The project was the first DEP permitted use of reclaimed water for reuse to irrigate crops for human consumption. The daily flows of reclaimed water not needed for irrigation are diverted to RIBs for indirect recharge to the Floridan aquifer.

Gainesville Regional Utilities (GRU) owns and operates the Kanapaha Water Reclamation Facility that serves the western portion of the Gainesville urban area. The facility is permitted for a flow rate of 14.9 MGD and produces advanced treatment quality reclaimed wastewater. GRU currently has approximately 3.0 MGD of residential and golf course irrigation and aquifer recharge by treatment wetlands.

### 6.3.7 Uses and Needs

Identification of areas that may have the potential to deliver reclaimed water for reuse are identified by mapping reclaimed wastewater treatment facilities and comparing their disposal flows with the actual reuse utilization (Figure 6.3.2). Large public water supply users are concentrated in the Orlando and Jacksonville areas and along the east coast. Large agricultural water users are predominate in the southern portion of the SJRWMD. Reclaimed water availability and the location of large water use demands are shown in Figure 6.3.4, demonstrating several areas that have the potential to supply unused reclaimed water as a water supply source.

### 6.3.8 Opportunities to match water sources and needs

An analysis of the wastewater plants that under-utilize reclaimed water should be made to prioritize funding to those plants with the highest potential to offset nearby demands. The SJRWMD has identified areas that may have the potential to deliver reclaimed water for reuse by mapping reclaimed wastewater treatment facilities and comparing their disposal flows with the actual reuse utilization (Figure 6.3.2). Region I, the northernmost water supply planning region in the District, stands out as having not only large un-used wastewater flows, but also areas of concentrated water demand that are among the highest in the SJRWMD. These unused wastewater flows could be strategically used in a regional-scale aquifer replenishment project. In addition, large public water supply users are concentrated in the Orlando and Jacksonville areas and along the east coast (Figure 6.3.4). Large agricultural water users are predominately in the southern portion of the SJRWMD. By cross-referencing the two figures showing available reclaimed water and water supply demand, several areas appear to have the potential to supply unused reclaimed water as a water supply source.

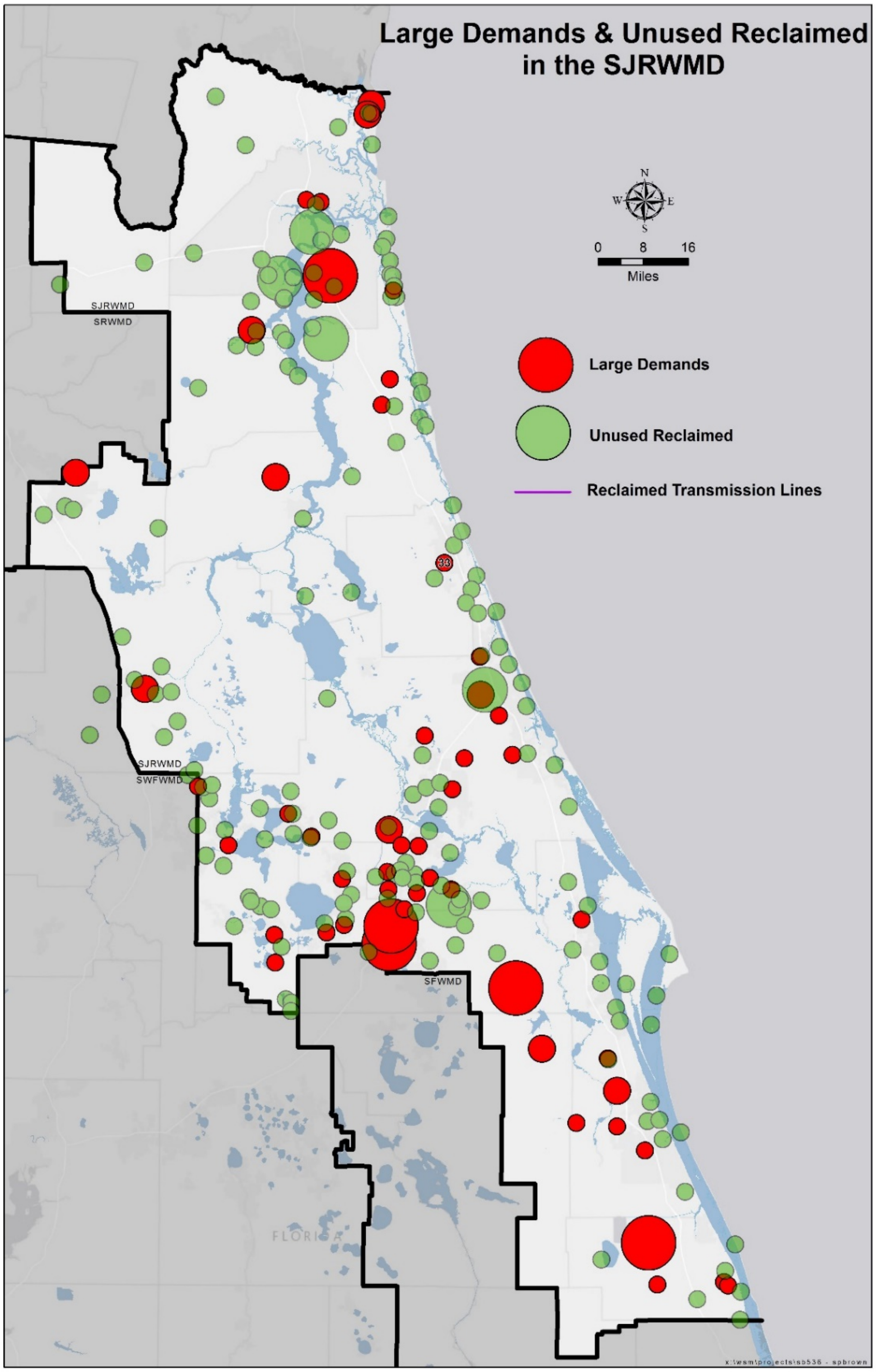



*Figure 6.3.3: Large Demands and Unused Reclaimed in the SJRWMD*

To increase the potential uses of reclaimed water, the SJRWMD encourages the pilot testing of the water purification process for identified reclaimed water sources that would facilitate regional recharge or indirect/direct potable reuse. Such pilot projects should be incentivized through cooperative funding by the District.

Indirect aquifer recharge should be investigated to identify priority areas where the geologic units of the Floridan aquifer are mostly unconfined. In SJRWMD, these areas are mostly on the western boundaries of the District in water supply planning Regions 1 and 2. In areas of the unconfined Floridan aquifer, construction of treatment wetlands could be funded to improve the water quality of stormwater prior to indirect aquifer recharge. Other areas in the SJRWMD, where the Floridan aquifer is semi-confined, could be used for direct injection of highly treated reclaimed water and stormwater.

Non-potable reuse is already widely implemented within the SJRWMD, but there is also potential for potable reuse in areas of the SJRWMD where additional reclaimed water supplies are available. The SJRWMD is cooperating with water utilities to investigate the feasibility of potable reuse and assembling an inventory of potential opportunities. More detailed feasibility investigations could include design and operation of small-scale demonstration projects to develop performance data to be used by cooperating utilities for project design and permitting.

In order to increase the reclaimed water supply available for reuse, cost share funding should be considered for additional ASR wells in coastal regions for storing excess wet weather volumes of reclaimed water for later recovery and use during periods of seasonal high demands.

## 6.4 South Florida Water Management District (SFWMD)

### 6.4.1 Water Use Overview

In 2010, total water use in the SFWMD was almost 3,300 MGD (Figure 6.4.1). By 2030, the SFWMD expects water use to increase by almost 23% to 4,050 MGD. Agricultural irrigation was the largest use sector in 2010, followed by public water supply. Together these two sectors accounted for 84% of the water used. By 2030, the SFWMD estimates that agricultural irrigation and public supply will remain the two largest use sectors, accounting for almost 82% of the estimated water use. Projections indicate that water quantities needed for power generation will more than triple and this sector will experience the largest growth rate at 258%.

The primary sources of water used to meet these needs are fresh traditional ground and surface water, brackish groundwater and reclaimed water. In many areas of the SFWMD, the primary fresh groundwater source is surficial aquifer systems such as the Biscayne Aquifer in the Lower East Coast and the Lower Tamiami Aquifer in Collier County. These aquifer systems are locally recharged from rainfall, stormwater ponds and regional and local canals. Surface water from local and regional canals and stormwater management systems are a significant water supply source for landscape and agricultural irrigation. Three public water utilities use surface water as a source in the SFWMD: the City of West Palm Beach, Okeechobee Utilities Authority and Lee County.

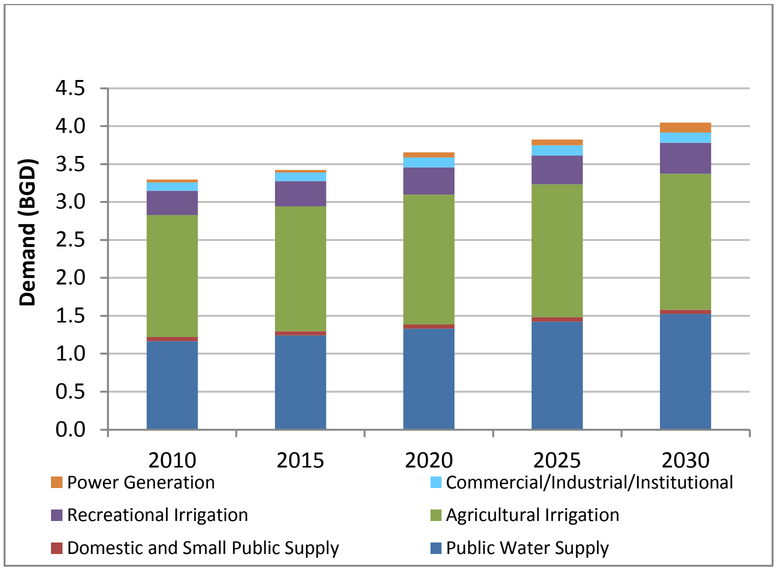



*Figure 6.4.1: SFWMD Districtwide Projected Demand*

However, in many areas, development of the surficial aquifer system and surface water has been maximized and limitations on increased withdrawals have been put in place. The entire SFWMD is designated as a Water Resource Caution Area, as defined in rule 62-40.210, F.A.C. Other areas of water supply concern, such as restricted allocation areas, minimum flows and levels recovery and prevention water bodies and water reservation water bodies, are shown on Figure 6.4.2. As a result, the Floridan Aquifer, which is brackish in most of south Florida south of Lake Okeechobee has been developed by public water supply utilities, golf courses and agricultural to meet all or a portion of their needs. Brackish water from the Floridan Aquifer requires desalination treatment prior to use for potable purposes. Forty utilities have constructed 270 MGD of reverse osmosis capacity. In addition, five golf courses have constructed reverse osmosis treatment facilities to use water from the Floridan Aquifer for irrigation. Agriculture, primarily citrus in Martin and St. Lucie counties, blends brackish water from the Floridan Aquifer with surface water to meet their needs, when surface water availability is limited. In addition, 270 MGD of reclaimed water is being reused in the SFWMD primarily for irrigation of residential lots, golf courses and other green space.

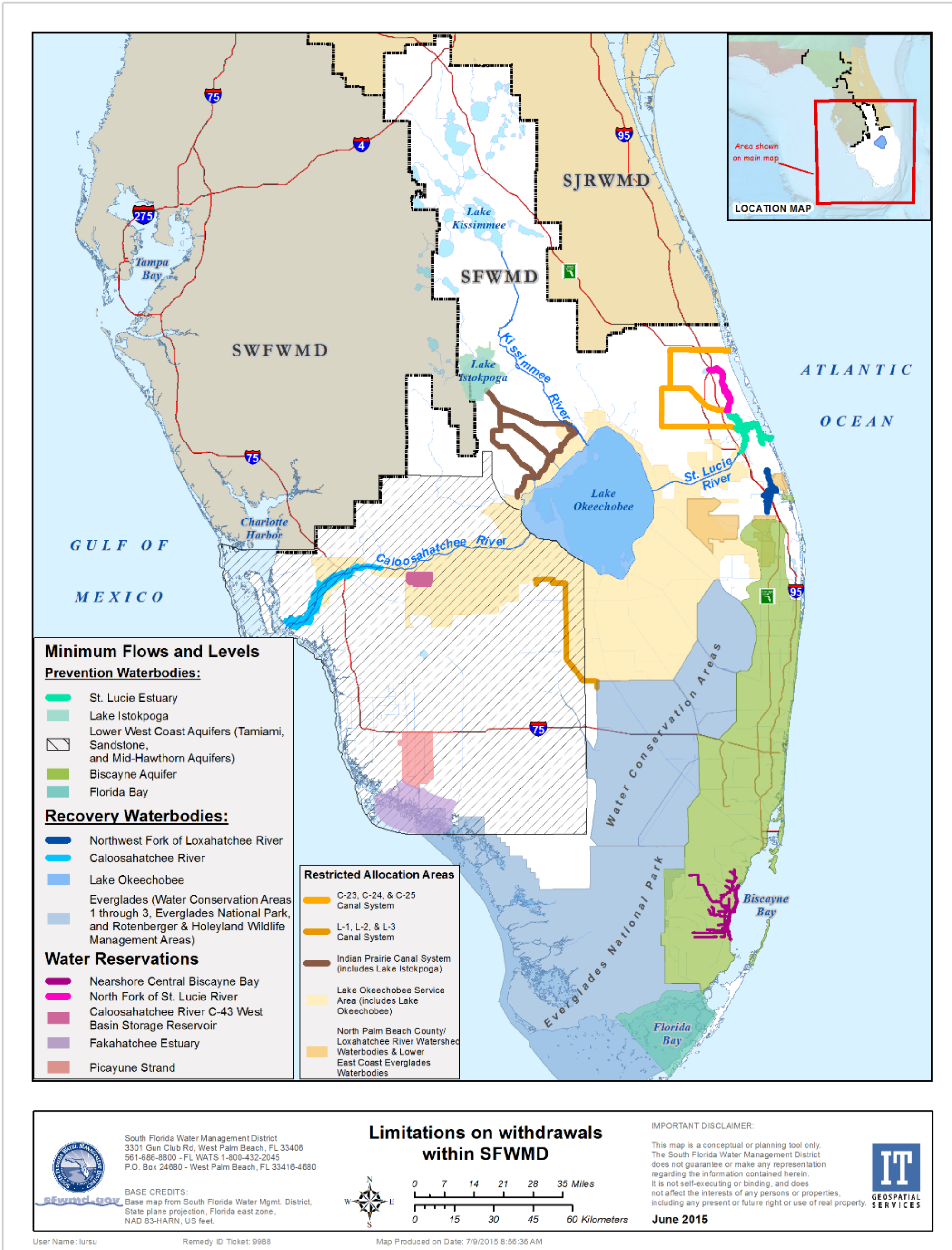



*Figure 6.4.2: Limitations on Withdrawals within the SFWMD*

### 6.4.2 <u>Reclaimed Water Use and Availability</u>

In 2013, 844 MGD of wastewater was treated in the SFWMD. Of this, 270 MGD (32%) was reused primarily for irrigation of residential lots, golf courses and other green space. The remaining 574 MGD was disposed of through deep well injection and ocean outfalls. The ways in which water reuse has evolved and how reclaimed water is used vary significantly across the Water Supply Planning Regions of the SFWMD (Figure 6.4.3).

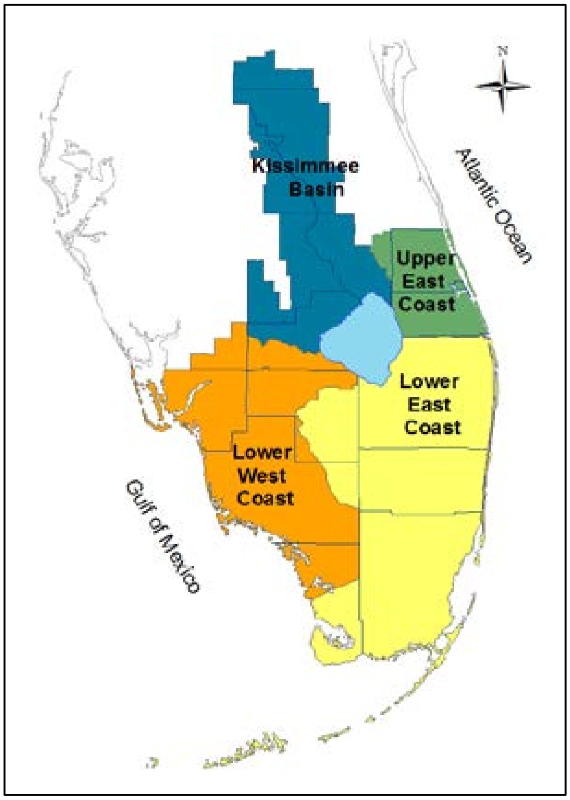



*Figure 6.4.3: SFWMD Water Supply Planning Regions*

The seasonality of rain and resulting water demands have limited the expansion of irrigation-based reuse systems in some areas. To overcome this, utilities have either constructed storage systems for excess reclaimed water or developed supplemental sources such as stormwater or groundwater. Several utilities have implemented, or are evaluating, storage of excess reclaimed water and surface water through aquifer storage and recovery because of the land requirements and costs of aboveground storage.

Water quality is an important consideration in expanding the use of reclaimed water. In coastal areas, infiltration of saline water into wastewater collection systems has resulted in elevated salinity in the wastewater, limiting the reuse potential of this water without desalination treatment. Nutrients in the reclaimed water are also a concern for existing and expanding reuse systems, given the low-nutrient targets in many areas of the SFWMD. The costs for treatment necessary to remove nutrients is an issue that often affects water reuse in the SFWMD.

Figure 6.4.4 shows existing (2013) wastewater reuse and disposal in the SFWMD. Each circle represents a permitted water reuse system; the magnitude of the wastewater treated reflected by the size of the circle. The purple “slices” of each circle represent the amount of wastewater reused. The green slices represent the amount of treated wastewater disposed. Therefore, the green slices indicate the opportunities to expand water reuse in the SFWMD.

Beginning in the early 1980s, the greater Orlando area began to transition from wastewater disposal to reuse. Wastewater discharges were eliminated from Shingle Creek and Lake Tohopekaliga. Without any other feasible options for wastewater disposal, the focus turned to reuse, such as the Water Conserv II project. With this early transition, water reuse systems in Orange and Osceola counties are among the most mature in the State. The percentage of reuse in Kissimmee Basin Area approaches 100%, reusing 96 MGD in 2013. Residential irrigation is the primary use of the reclaimed water, with many facilities using RIBs during low reclaimed water demand periods.

The Upper East Coast region of the SFWMD has a relatively small population with its reuse systems mostly in a transitional stage. As many areas develop, the original package treatment plants have been transitioning to larger, regional systems. These regional water reclamation facilities are installing infrastructure to grow their reuse systems. In 2013, this region reused about 35% (8 MGD) of the wastewater flow. The remaining 65% (14 MGD) was disposed of through deep injection wells. Reclaimed water is primarily used for irrigation of golf courses, parks, residential lots and other green space. Agricultural irrigation with reclaimed water, as with the other regions, is a challenge due to the distance between the treatment facilities and the agricultural areas.

In the Lower West Coast region, a significant driver for water reuse was water supply and reducing the demands on the fresh water sources. Development of fresh water sources in this area have been maximized, requiring development of alternative water supplies. As a result, approximately 90% (71 MGD) of the wastewater treated is reused while the remainder (8 MGD) is disposed of through deep injection wells or surface water discharge.

To maximize the use of reclaimed water, several utilities have supplemented their reclaimed with other sources, primarily excess surface water stored through ASR or surface water management systems. Aquifer recharge opportunities exist through either surface application or wells. Given the water supply challenges identified, potable reuse is also a viable option.

The Lower East Coast region contains all six of the State's wastewater ocean outfalls. In 2013, 14% (93 MGD) of the treated wastewater was reused. Palm Beach County reused 49% while Broward and Miami-Dade counties reused 6%, primarily for landscape irrigation and process water at wastewater treatment facilities. The remaining 86% (553 MGD) of the wastewater in these counties is disposed of either through deep injection wells or ocean outfalls.

Industrial use and environmental restoration provide future opportunities for expanded reclaimed water use in this area. Environmental uses for reclaimed water exist; however, most of the environmental areas either are too far from the sources of reclaimed water, or have water quality constraints. The feasibility of using reclaimed water from Miami-Dade's South District Wastewater Treatment Plant to supply additional water to the Biscayne Bay Coastal Wetlands Project was evaluated as part of the Comprehensive Everglades Restoration Plan (CERP). Due to the water quality concerns associated with discharging reclaimed water into Biscayne National

Park, an Outstanding Florida Water and costs for treatment, it was concluded other sources of water should be investigated. If more appropriate sources are not available, the reuse project may be initiated by determining the parameters of concern, the necessary wastewater treatment requirements and the appropriate treatment technology to be implemented.

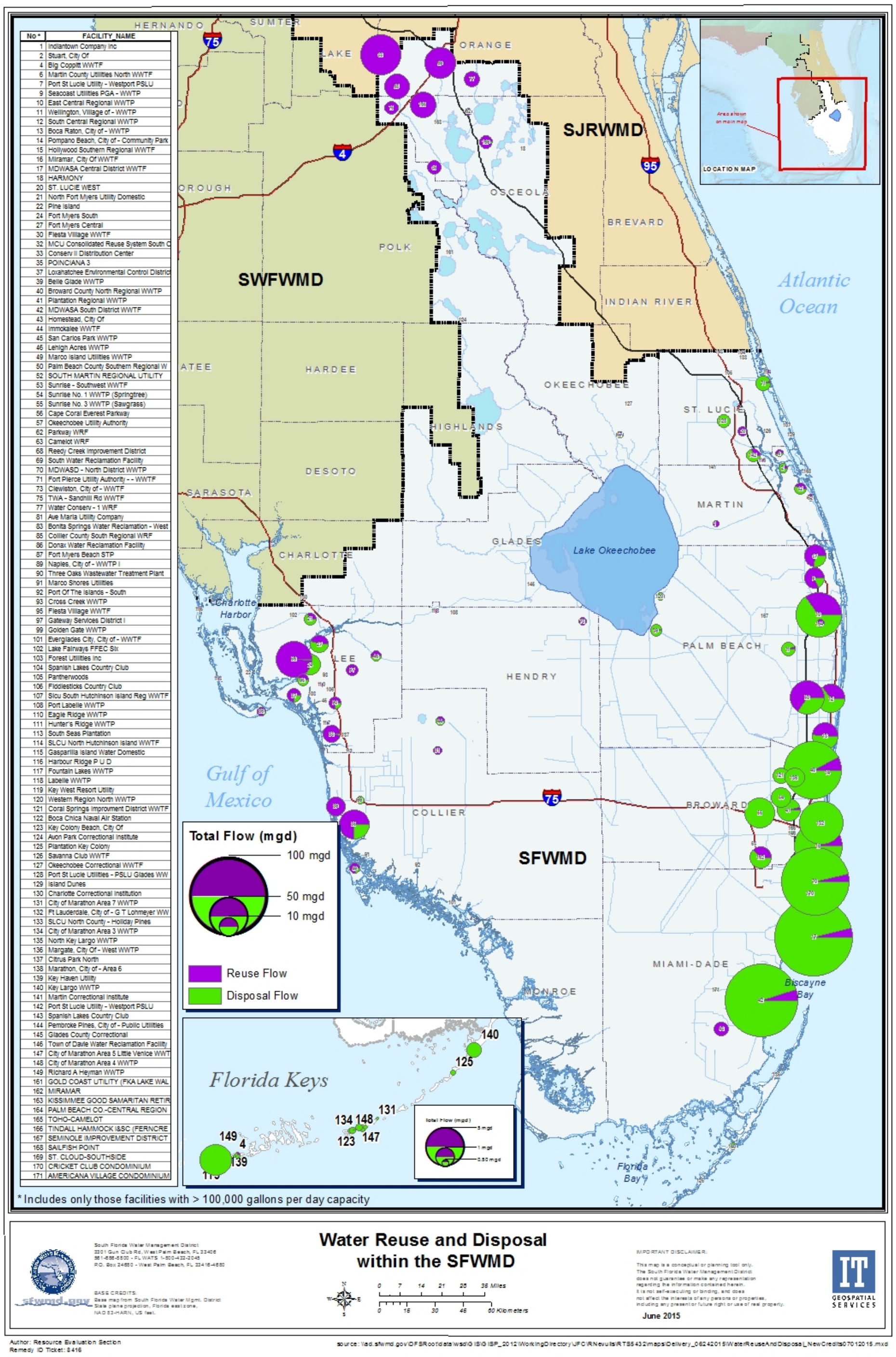



*Figure 6.4.4: Wastewater Reuse and Disposal within the SFWMD*

In 2008, legislation was passed requiring that at least 60% of the effluent previously discharged through ocean outfalls be beneficially reused. The two ocean outfalls in Palm Beach County (Boca Raton, Delray Beach/Boynton Beach) have largely addressed their reuse requirements through increased irrigation. Broward County Utilities is coordinating with Palm Beach utilities to provide reclaimed water for irrigation to southern Palm Beach County. Miami-Dade's reuse requirement is 117 MGD. Their current plan is to reuse up to 90 MGD of reclaimed water at FP&L's Turkey Point facility. Recharge of the Floridan Aquifer and other options are under consideration to meet the remaining obligation under the legislation. The City of Hollywood faces some persistent challenges in reusing their reclaimed water. First, being a low-lying coastal area, the facility's wastewater stream is brackish, thus making it difficult to use the reclaimed water for traditional irrigation purposes. Second, low land elevations and the high water table makes it difficult to use reclaimed water for aquifer recharge or a saltwater barrier without causing increased potential for flooding.

#### 6.4.3 Surface Water Use and Availability

The SFWMD operates and maintains 2,060 miles of canals, 2,080 miles of levees and berms, 1,413 water control structures and 71 pump stations as a part of the Central and South Florida System (C&SF). Lake Okeechobee is the major surface water storage feature in the SFWMD and is a central component of the interconnected regional system. It serves multiple functions including flood control, agricultural and urban water supply, fulfillment of Seminole Tribe of Florida water rights, navigation, recreation and fish and wildlife preservation and enhancement.

As a result of this interconnected system the SFWMD can manage and deliver water to and from various areas. Unlike other areas of the State, rainfall within one watershed has the potential to be captured and stored for subsequent delivery to another watershed. On average, approximately two million acre-feet of water (650 trillion gallons) is discharged to tide from the system each year. Figure 6.4.5 shows the regional inflows and outflows of surface water within the system.

Due to adverse effects to the environment that were identified in the 1990s, the original C&SF system is now being modified under CERP. The goal of CERP is to capture fresh water that now flows unused to the ocean and the gulf and redirect it to areas where it is needed. The majority of the water will be devoted to environmental and ecosystem restoration. The remaining water will benefit cities and farmers by enhancing water supplies for the south Florida economy. The C-23, C-24, C-25 and C-44 (St. Lucie) canals are important sources of irrigation water within their respective drainage basins. Surface water bodies in the lower west coast region include rivers and canals that provide storage and conveyance of surface water.

#### 6.4.4 Stormwater Use and Availability

In the Orlando area, the existing drainage system, constructed by both public and private entities, provides an excellent opportunity for the capture of stormwater. While the large amount of impervious area in the region significantly alters the natural flow patterns in the basin, if managed properly, the produced stormwater provides a resource for natural systems enhancement, water quality improvement, supplementation of reclaimed water and aquifer recharge.

Throughout the upper east coast region, special districts that provide drainage and other services, harvest stormwater for irrigation, including agricultural and landscape. The lower east coast region has both some of the highest agricultural uses and some of the highest rates of surface/stormwater use. However, the use of individual tail water recovery systems or ponds are not as typical as in other portions of the state.

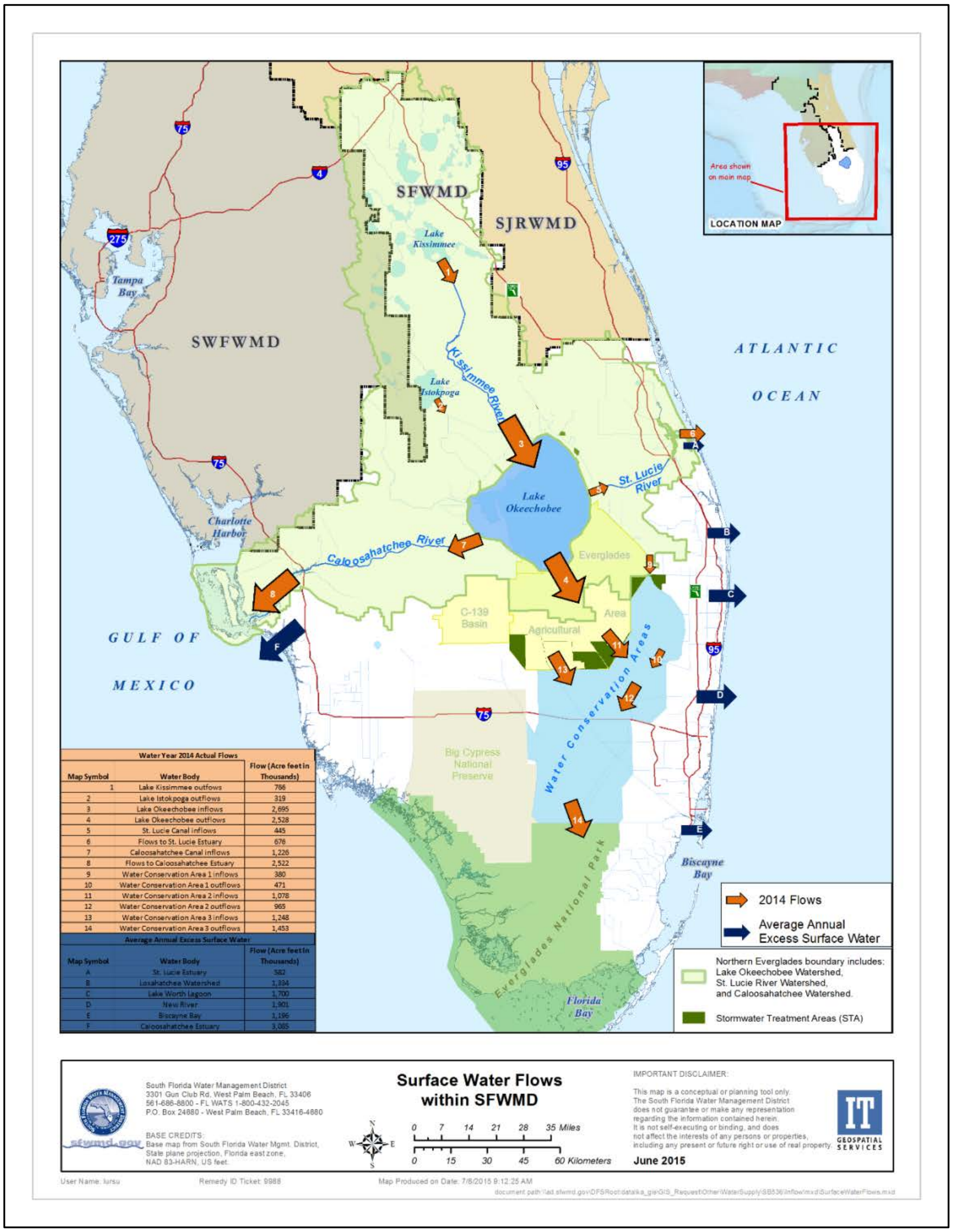



*Figure 6.4.5: Surface Water Flows within the SFWMD*

### 6.4.5 Storage - Surface Reservoirs

Increasing the storage of fresh water that now flows to the ocean and redirecting flow to areas that need it most, or for release during dry times, is the foundation of CERP and the Northern Everglades and Estuaries Protection Program (NEEPP). Many of the regional surface water storage components in the NEEPP were drawn from projects recommended in the CERP. Figure 6.4.6 shows major existing and proposed environmental restoration projects within the SFWMD, many of which are aboveground water storage reservoirs. Due to the magnitude and timing of flows throughout the south Florida landscape, large aboveground reservoirs are often considered as a first option for capturing water from the canals and lakes during wet periods.

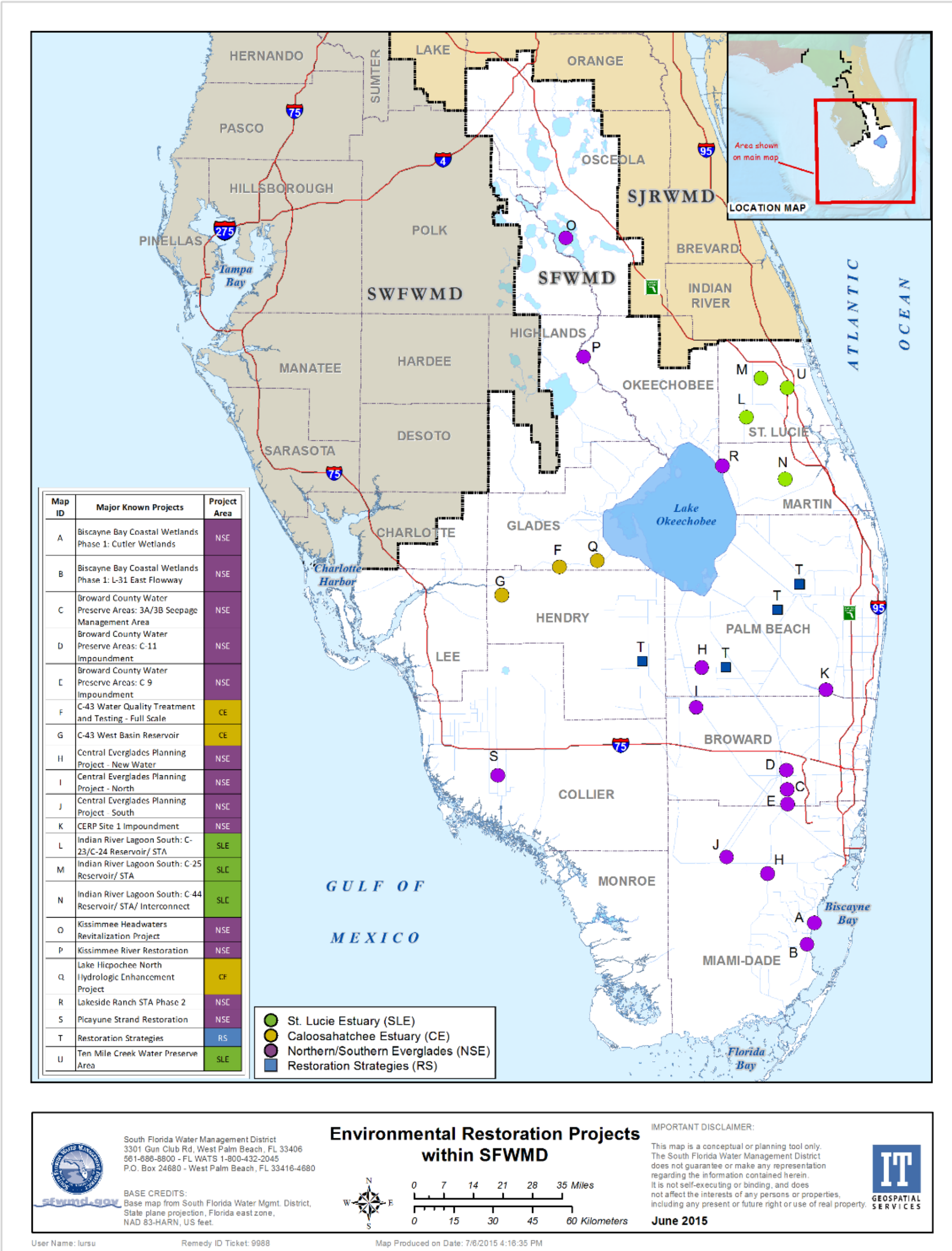
The NEEPP recognized the importance of managing the quantity, timing and distribution of water from the three Northern Everglades watersheds to achieve the integrated and comprehensive environmental restoration of Lake Okeechobee and the Caloosahatchee and St. Lucie estuaries. As a result, an analysis has been conducted for each of the three protection plans to determine the amount of water that needs to be stored in each watershed to achieve these objectives. The Caloosahatchee River Watershed Protection Plan and St. Lucie River Watershed Protection Plan indicated that storage was needed in each of these watersheds in order to address local basin runoff, while the magnitude of storage needed in the Lake Okeechobee/Kissimmee watershed varies depending on assumptions regarding delivery and storage volumes south of Lake Okeechobee.

In partnership with the State of Florida, the SFWMD is implementing the Restoration Strategies Plan, a regional water quality improvement and storage plan to complete 10 projects between Lake Okeechobee and the Greater Everglades. The plan calls for water storage with three large reservoirs, also referred to as Flow Equalization Basins (FEBs) and new stormwater treatment areas. Two of the FEBs are currently under construction.

Since 2006, Broward and Palm Beach County water providers have been collaborating in the development of a large public water supply reservoir project known as the C-51 Reservoir. This reservoir is conceptualized to provide public water supply that would otherwise be discharged to the Lake Worth Lagoon. While still in the planning, permitting and design phase, this project represents a constructive collaboration of public water supply entities.

### 6.4.6 Storage - Aquifer Storage and Recovery

The concept of storing and recovering fresh water within the Floridan Aquifer System in south Florida was initially tested in the Town of Jupiter during the mid-1970. Subsequent ASR demonstration projects were successfully conducted by the SFWMD in St. Lucie and Okeechobee Counties. The rapid expansion of ASR technology throughout the 1990’s, primarily by municipal water utilities, was supported by funding through alternative water supply grant programs. The majority of these systems were constructed with the intention of storing potable or treated surface or groundwater during periods of low seasonal demand for later recovery during high usage.




| Map ID | Major Known Projects | Project Area |
|---|---|---|
| A | Biscayne Bay Coastal Wetlands Phase 1: Cutler Wetlands | NSE |
| B | Biscayne Bay Coastal Wetlands Phase 1: L-31 East Flowway | NSE |
| C | Broward County Water Preserve Areas: 3A/3B Seepage Management Area | NSE |
| D | Broward County Water Preserve Areas: C-11 Impoundment | NSE |
| E | Broward County Water Preserve Areas: C 9 Impoundment | NSE |
| F | C-43 Water Quality Treatment and Testing - Full Scale | CE |
| G | C-43 West Basin Reservoir | CE |
| H | Central Everglades Planning Project - New Water | NSE |
| I | Central Everglades Planning Project - North | NSE |
| J | Central Everglades Planning Project - South | NSE |
| K | CERP Site 1 Impoundment | NSE |
| L | Indian River Lagoon South: C-23/C-24 Reservoir/ STA | SLE |
| M | Indian River Lagoon South: C-25 Reservoir/ STA | SLE |
| N | Indian River Lagoon South: C-44 Reservoir/ STA/ Interconnect | SLE |
| O | Kissimmee Headwaters Revitalization Project | NSE |
| P | Kissimmee River Restoration | NSE |
| Q | Lake Hicpochee North Hydrologic Enhancement Project | CE |
| R | Lakeside Ranch STA Phase 2 | NSE |
| S | Picayune Strand Restoration | NSE |
| T | Restoration Strategies | RS |
| U | Ten Mile Creek Water Preserve Area | SLE |

*Figure 6.4.6: Major Existing and Proposed Environmental Restoration Projects in the SFWMD*

To date, there have been 30 ASR systems constructed throughout the SFWMD. Of these systems, 22 are still active and available for operation, although several are currently not in use due to operational, financial, or regulatory constraints. The majority of the ASR systems are located in lower portions of the SFWMD. ASR continues to remain a viable alternative for storing large quantities of water, particularly in areas where aboveground storage options are unavailable or not economically viable.

The CERP envisioned construction of up to 333 ASR wells associated with environmental restoration of the greater Everglades ecosystem, subject to completion of an ASR Regional Study. The findings of the ASR Regional Study were that there were no "fatal flaws" uncovered that would prohibit the implementation of ASR for CERP, although the overall number of wells were reduced from those previously planned. The study has recently been completed and the study findings were largely supported by a National Research Council review, although phased construction and continued testing was warranted and proposed.

### 6.4.7 Aquifer Recharge and Dispersed Water Management

#### 6.4.7.1 *Direct Aquifer Recharge*

Direct aquifer recharge, involving injection of water directly into the aquifer, currently occurs in the greater Orlando area (shared by the SFWMD and the SJRWMD) where approximately 400 recharge wells divert stormwater flow from the surface to the Floridan aquifer. These wells were constructed between 1904 and the late 1960's to alleviate local flooding and predate the regulations that would otherwise require extensive pretreatment prior to directly recharging the aquifer.

In response to the 2008 legislation requiring the reduction then elimination of ocean outfalls, two utilities (Hollywood and Miami-Dade) are conducting feasibility and pilot assessments to recharge the Floridan aquifer with reclaimed water.

#### 6.4.7.2 *Indirect Aquifer Recharge*

Within the SFWMD, indirect aquifer recharge is occurring through RIBs and the SFWMD's regional canal system. Suitable geologic conditions exist for the use of RIBs along the eastern slope of the Lake Wales Ridge and the upper Kissimmee Basin. In the metro-Orlando area alone approximately 45 MGD of reclaimed water was delivered to local RIBs for aquifer recharge during 2010. Water Conserv II in Orange County provides reclaimed water for irrigation to golf courses, landscape and foliage, nurseries, tree farms, a fernery, six residential neighborhoods and 3,200 acres of citrus groves. It also provides reclaimed water to 3,725 acres of RIBs for recharge of the Floridan Aquifer.

The SFWMD regional canal system provides recharge to the shallow groundwater system. The degree of connection between the canals and the aquifers provides beneficial recharge to the shallow groundwater system, which is used by most of public water supply wellfields. During the wet season, rainfall provides sufficient water to maintain canal levels and recharge. When rainfall is not sufficient, water can be delivered from the regional system to maintain canal levels and aquifer recharge. In addition to canals, the Water Conservation Areas, spanning 846,387 acres, provide surface water storage, flood protection and aquifer recharge supply to urban and natural areas in the Lower East Coast Area.

6.4.7.3 *Dispersed Water Management*

Since 2005, the SFWMD has been working with a coalition of agencies, environmental organizations, ranchers and researchers to enhance opportunities for storing excess surface water on private and public lands. The Dispersed Water Management Program encourages property owners to retain water on their land, accept and detain regional runoff, or both. Through cooperative agreements, use of interim lands or environmental services projects, approximately 89,200 acre-feet of water retention and storage has been made available in the greater Everglades system on public and private lands. An additional 71,000 acre-feet of storage has been created through other regional public restoration projects and stormwater treatment areas.

The potential for expanding the current Dispersed Water Management Program is limited primarily by the number of willing landowner participants and available funding. The program is expected to grow and continue to be utilized as a valuable tool in managing wet season flows and reducing harmful discharges to downstream receiving bodies within the greater Everglades region, including Lake Okeechobee and the St. Lucie and Caloosahatchee River estuaries. However, due to the constraints such as seasonality and reliability, dispersed water management has limited use as a potential source for water supply.

6.4.8 Opportunities to Match Water Sources and Needs

Many opportunities exist within the SFWMD to match water needs to the available sources. Potential needs are shown on Figure 6.4.7. The map shows locations of existing consumptive use permits, as well as other potential water needs such as utilities of concern or risk that might benefit from aquifer recharge and the extent of saline intrusion along the coast that could benefit from strategic recharge of the aquifer in those locations. As shown in Figure 6.4.7, the interior of the SFWMD is predominated by agricultural demands whereas the coastal and northern boundaries are locations of intense public water demands.

The SFWMD has a number of Water Resource Development Projects that address a range of water-related needs, including those of urban and agricultural water supply. In addition to meeting environmental needs, these projects enhance water supply by increasing water availability, mitigate man-made impacts as a result of development and/or water use and contribute to the overall water resources. To support local alternative water supply development, conservation and stormwater initiatives, the SFWMD provides cost-share funding to entities for stormwater, alternative water supply and water conservation projects that are consistent with the district’s core mission through the Cooperative Funding Program. This program provides financial incentives to promote local projects that complement ongoing regional restoration, flood control, water quality and water supply efforts.

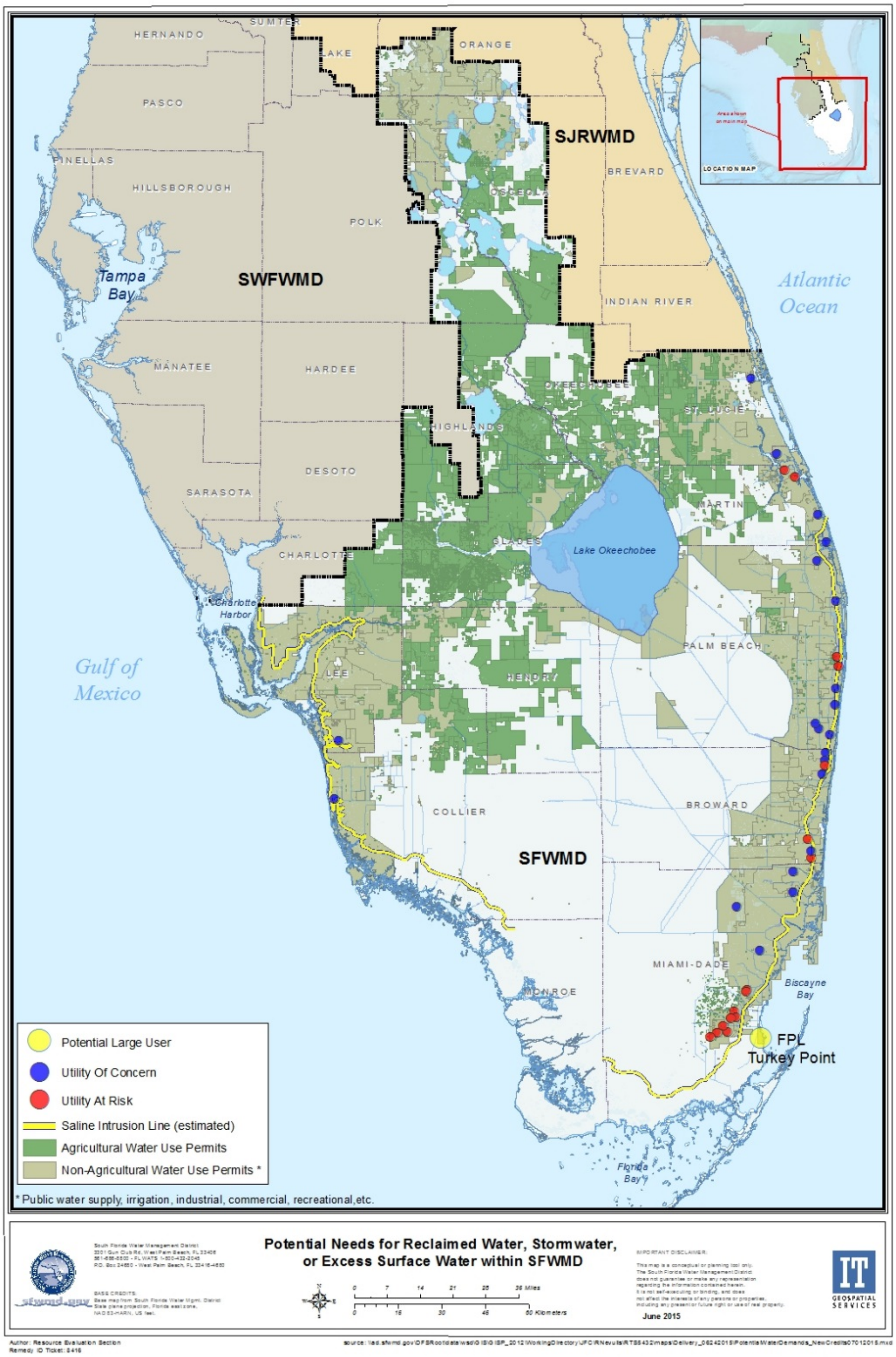



*Figure 6.4.7: Potential Needs for Reclaimed Water Stormwater, or Excess Surface Water within the SFWMD*

Additional storage is needed in the Lake Okeechobee Watershed to help manage the lake's levels. While the primary purpose of this storage is to manage levels and flows into Lake Okeechobee, the St. Lucie and the Caloosahatchee estuaries, it will also provide significant water supply benefits for human uses. The primary storage options include aboveground reservoirs, ASR, increased recharge and dispersed water management.

The CERP recommended a series of aboveground surface water reservoirs with STAs in the C-23, 24 & 25 Basins. These features collectively are referred to as the Indian River Lagoon South Phase I and Phase II Components and provide storage capacity for the basins. In addition to reducing harmful discharges, these projects will enhance surface water availability, the primary source of water for agriculture.

Reclaimed water is currently being used in landscape irrigation (medians, residential lots and golf courses). Aquifer recharge projects, either directly through wells or indirectly using RIBs, provide opportunities to beneficially reuse reclaimed water or use it as a saline-intrusion barrier along the coast. The use of supplemental surface water and storm water may enable utilities to maximize use of reclaimed water resources, if storage for these supplemental sources can be made available.

The basic premise of CERP was to build additional storage into the system in order to capture excess surface/storm water, attenuate flows to tide and use that water for environmental and human needs. The plan recommended many surface/storm water storage facilities in the form of deep and shallow impoundments and ASR systems. These efforts are listed in the Governor's Commitment to Everglades Restoration.

An opportunity exists to provide dry season flows to Biscayne Bay and Biscayne National Park through the use of reclaimed water, stormwater, or excess surface water. Dry season surface water flows would be introduced and distributed into surface waters or groundwater and allowed to flow to Biscayne Bay. The use of ASR technology for storage of excess surface water or reclaimed water is included in the project options.

In 2008, the Florida Legislature enacted an ocean outfall statute requiring the elimination of the use of six ocean outfalls as the primary means for disposal of treated wastewater. In addition, the affected wastewater utilities are required to reuse at least 60% of the outfall flows by 2025. One objective of this statute is to achieve the more efficient use of treated wastewater for beneficial purposes. Two notable projects are evolving from the legislation. Miami-Dade County is planning to supply reclaimed water to the FPL Turkey Point power plant for cooling. In addition, Broward and Palm Beach counties are cooperating on a project to bring reclaimed water from Broward County into southern Palm Beach County to help meet water demands and meet the reuse requirement.

## 6.5 Southwest Florida Water Management District (SWFWMD)

### 6.5.1 <u>Water Use Overview</u>

In 2010, total water use in the SWFWMD was about 1,303 MGD (Figure 6.5.1). By 2030, the SWFWMD expects water use to increase by more than 19% to 1,556 MGD. Public water supply was and is expected to remain the largest use sector followed by agricultural irrigation. There are four Water Supply Planning Areas in the SWFWMD (Figure 6.5.2). Water use in the Tampa Bay Planning region is projected to remain the highest of the four SWFWMD planning regions and water use in the Heartland Planning Region is projected to increase significantly. With careful resource management and development, the SWFWMD estimates that area water resources will meet area water demands through the year 2035.

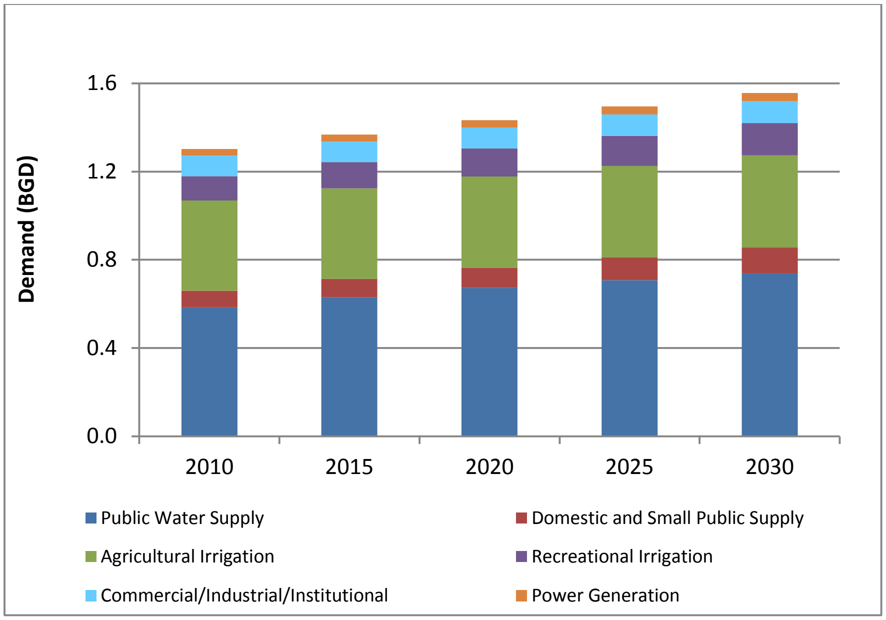



*Figure 6.5.1: SWFWMD Projected Water Demands*

Water demands in the SWFWMD are mostly met by reliance on a blend of groundwater, surface water and reclaimed water supplies. Several water suppliers, including Tampa Bay Water, the City of Tampa, the Peace River/Manasota Regional Water Supply Authority, the City of Bradenton and Manatee County, have developed and rely either heavily or entirely on surface water supplies. Other large water suppliers rely on the Upper Floridan groundwater supplies. Most water suppliers have developed reclaimed water systems to offset some of their customer's water needs.

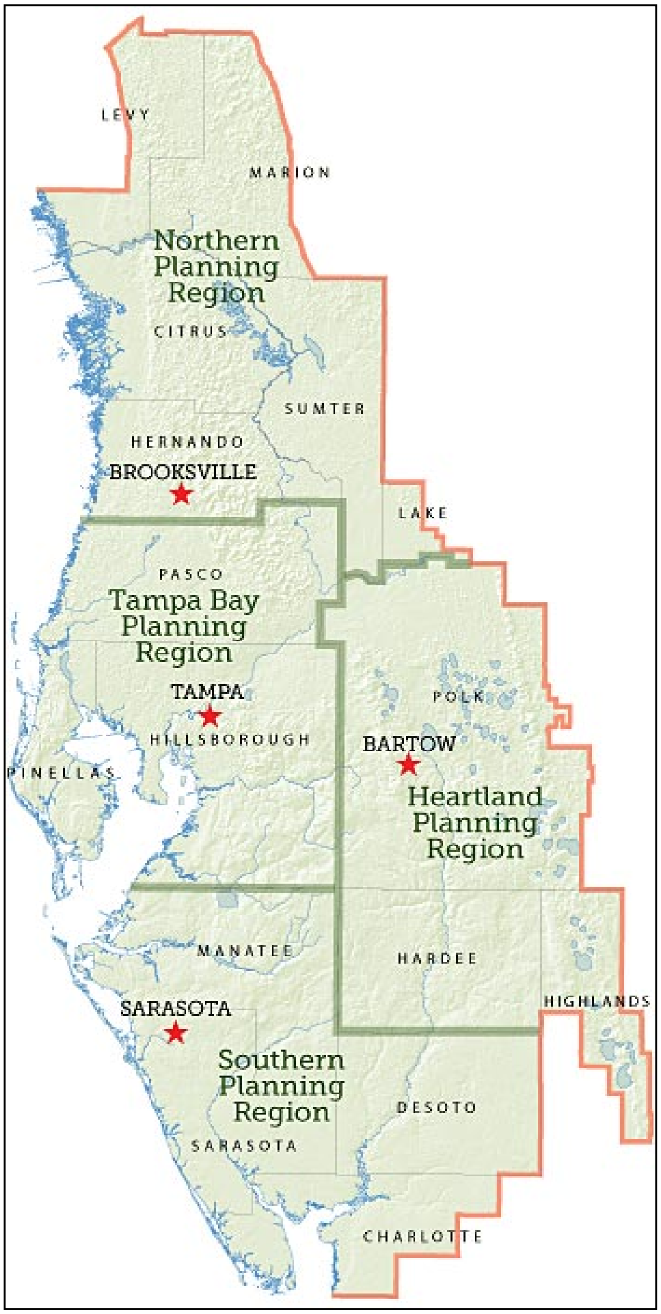



Figure 6.5.2: SWFWMD Planning Regions

6.5.2 Reclaimed Water Use and Availability

For decades, the beneficial use of reclaimed water has been a key component of water resource management within the SWFWMD. The SWFWMD has played a pivotal role in encouraging utilities to develop reclaimed water resources through its cooperative funding of more than $400 million in grants for over 350 reclaimed water projects. Approximately 55% (190 MGD) of the total 340 MGD of wastewater flow in the SWFWMD is currently reused for non-potable purposes such as landscape irrigation, agricultural irrigation, aesthetic and recreational uses, aquifer recharge, industrial uses, environmental enhancement and fire protection.

Figure 6.5.3 shows the location of existing reclaimed water supplies as well as those under construction. For each location, the amount of reclaimed water being used and disposed is represented. While great strides in the use of reclaimed water have been made, 150 MGD of reclaimed water is currently disposed of primarily through surface water discharges or deep well injection. The quantity of excess (unused) reclaimed water is projected to increase to over 220 MGD by 2035.

Several significant efforts are underway or in the planning stages to maximize use of the available reclaimed water supplies for beneficial purposes:

- Pasco County has constructed sufficient reuse storage capacity to reuse, by landscape irrigation, essentially all wastewater generated in the County.
- The City of Clearwater is proceeding with construction of treatment facilities to purify reclaimed water for recharge of the local groundwater supplies. The recharge and subsequent recovery of that purified water will be among the first Florida projects for IPR.
- The South Hillsborough Aquifer Recharge Program will assess the effects of using reclaimed water to directly recharge a non-potable zone of the Upper Floridan Aquifer to improve water levels in the Southern Water Use Caution Area and potentially provide a salinity barrier against saltwater intrusion.
- The Pasco County Wetlands and Aquifer Recharge Program will create treatment wetlands and rapid infiltration basins as part of a reclaimed water recharge facility in central Pasco County to restore natural surface water systems and contribute to recovery in the Northern Tampa Bay Water Use Caution Area.
- The Winter Haven Feasibility Study for Aquifer Recharge has resulted in early planning for a project to use reclaimed water for aquifer recharge and surface water augmentation.
- The Tampa Electric Company Lakeland/Mulberry/Polk Southwest Reclaimed Water Project is currently under construction to utilize all excess reclaimed water from the City of Lakeland, the City of Mulberry and Southwest Polk County wastewater treatment facilities beyond 2045.

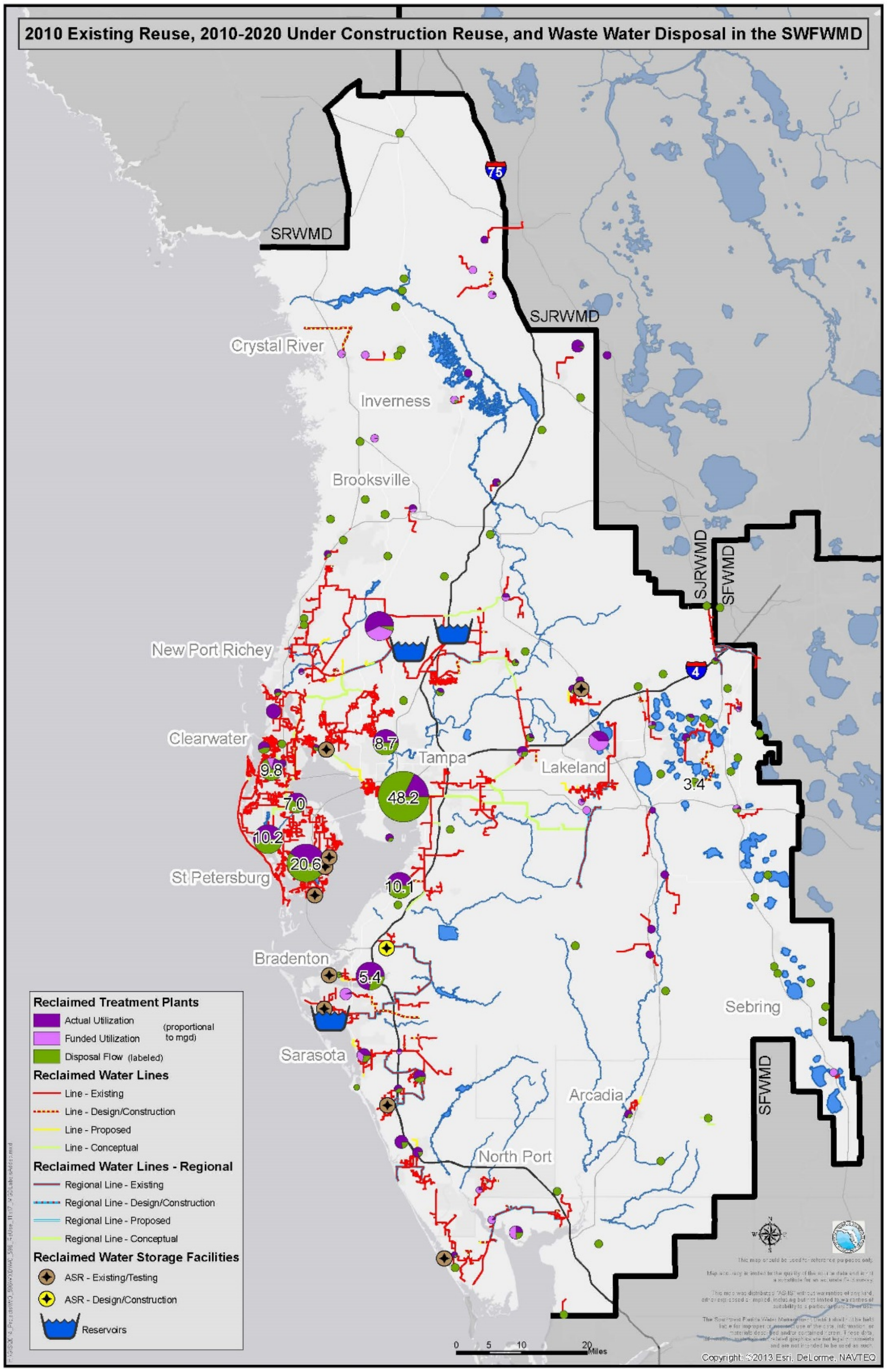



*Figure 6.5.3: 2010 Existing Reuse, 2010-2020 under Construction Reuse and Wastewater Disposal in the SWFWMD*

### 6.5.3 Surface Water Use and Availability

Water suppliers within the SWFWMD have developed and relied on surface water supplies to support the continued development of major urban areas and supply small local systems primarily for local irrigation needs. Surface waters are currently being used as a significant public water supply source by the City of Tampa (Hillsborough River and the Tampa Bypass Canal), Tampa Bay Water (the Tampa Bypass Canal and Alafia River), the Peace River/Manasota Regional Water Supply Authority (Peace River), Manatee County (Manatee River), the City of Bradenton (Braden River), the City of Northport (Myakkahatchee Creek) and the City of Punta Gorda (Shell Creek). Use of these sources involves operations of significant storage facilities including both on-line and off-line reservoirs and ASR components.

As discussed in Chapter 4, a total of 299 MGD of additional surface water is estimated to be available within the SWFWMD to meet future needs while sustaining natural systems (Figure 6.5.4).

### 6.5.4 Agricultural Conservation and Alternative Water Supply Best Management Practices

The SWFWMD has focused on the use of surface water/tailwater recovery as an alternative to groundwater supplies for agricultural uses as well as other water conservation BMPs. The SWFWMD's FARMS (Facilitating Agricultural Resource Management Systems) Program is an agricultural cost-share reimbursement program with goals aimed at reducing groundwater withdrawals from the Upper Floridan aquifer through conservation and alternative water supply BMPs. Surface water/tail water recovery pump stations, filtration systems and mainline pipe are examples of BMPs cost-shared through the SWFWMD's FARMS Program. Other water conservation BMPs cost-shares include water control structures, electronic controls including remote irrigation zone and start/stop controls, soil moisture and weather station climate sensor telemetry and cold protection BMPs in the Dover Plant City Water Use Caution Area (DPCWUCA).

As of the May 19, 2015 SWFWMD Governing Board meeting, there are 172 Governing Board approved FARMS projects located in the SWUCA, the DPCWUCA and in the area north of the SWUCA. The projected offset of groundwater pumping for the 172 projects is an estimated annual average of 26.3 million gallons per day (MGD) and estimated DPCWUCA frost-freeze protection of 43.8 MGD, respectively, with 144 operational projects totaling 19.5 MGD of actual annual average offset over the period of record.

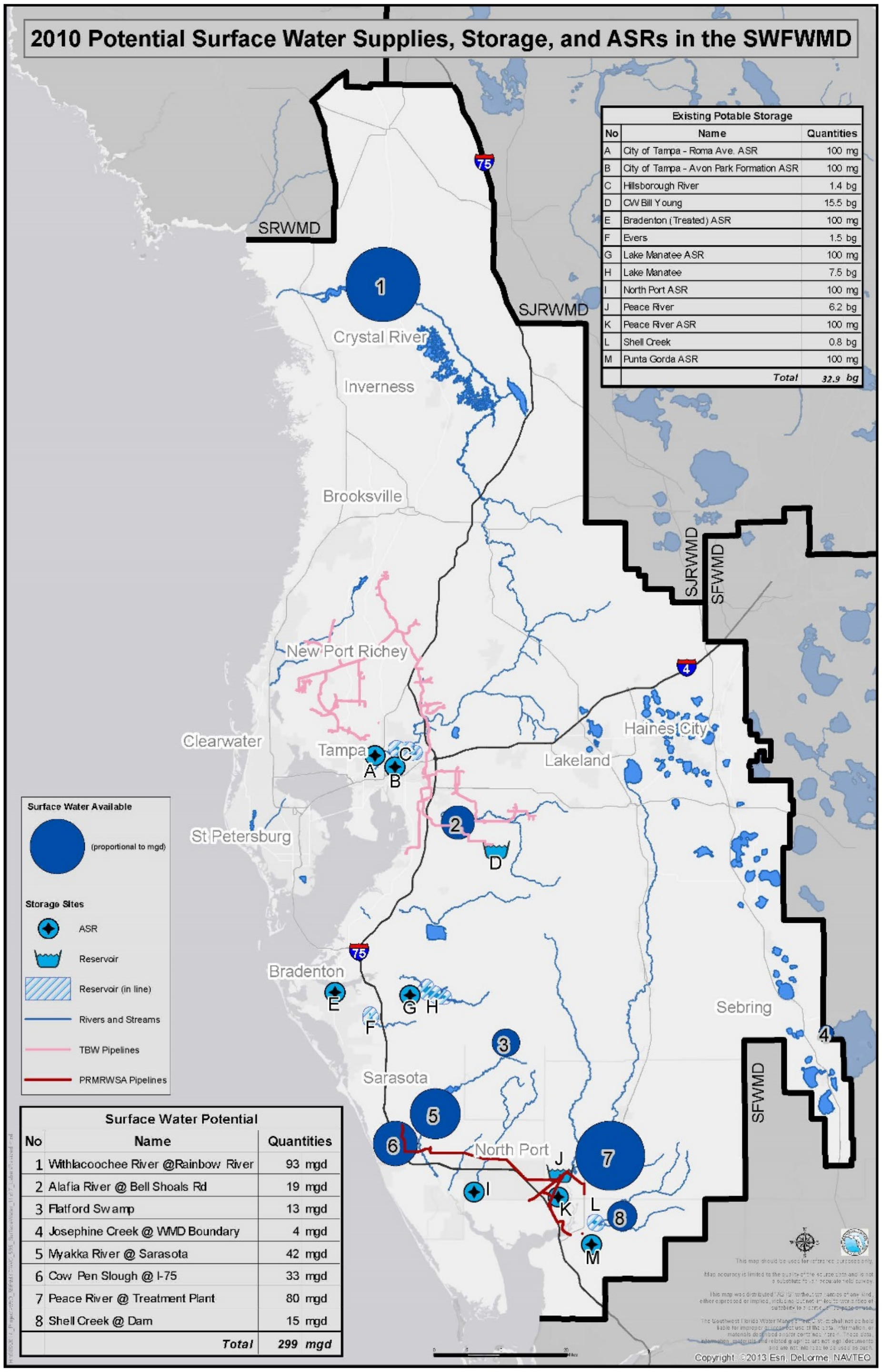



*Figure 6.5.4: 2010 Potential Surface Water Supplies, Storage and ASRs in the SWFWMD*

### 6.5.5 Storage

As indicated in Chapter 5, there are several large, off-line surface reservoirs in the Tampa Bay and Southern Planning Regions used to store excess river flows for subsequent treatment and delivery of potable water supplies (Figure 6.5.4). Tampa Bay Water recently completed its C.W.

Bill Young Reservoir and is considering construction of a second major reservoir as an option to further optimize the collection and use of surface water supplies in eastern Hillsborough County. The Peace River/Manasota Regional Water Supply Authority and its member governments are planning for additional storage capacity including possible reservoir sites in the southern SWFWMD region near Cow Pen Slough.

No large surface reservoirs are currently used in the SWFWMD's Northern Planning Region to store excess flows to meet potable water supply demands. Although the Withlacoochee River Water Supply Authority has not identified a need for new surface water storage facilities within the next 20-year planning horizon, there is consideration of reliance on surface waters as one of several options for future water supply.

Pasco County recently completed the construction of two large surface water reservoirs to store reclaimed water prior to delivery, primarily for landscape irrigation.

In the SWFWMD, there are currently five potable water and two reclaimed water ASR facilities that are fully permitted for operational use and have been supplying potable and reclaimed water for more than twenty years (Figure 5.1). The Peace River/Manasota Regional Water Supply Authority has a 21 well potable water ASR system that has received an operational permit. This facility has been supplying water for more than twenty years, but within just the last few years it received its operation permit.

The City of Tampa has an eight well potable surface water system that stores approximately one billion gallons per year that is capable of providing up to 10 MGD during the dry season. The Manatee County potable water ASR system consists of five wells and stores potable surface water. This system was the first to be installed in the state and has been in operation to meet emergency demands since the mid-1980s. The City of Punta Gorda has a four well ASR potable surface water system. Water recovery at this facility is more complicated by a variable and high TDS concentration due to both the surface water source and the elevated TDS in the storage zone. Finally, the City of Bradenton has a single well potable surface water ASR site located in downtown Bradenton. The site is capable of supplying up to 160 mg per year.

In addition to the above facilities, there are two additional potable water (Bradenton and North Port) and four additional reclaimed water (Oldsmar, Sarasota County, Polk County and Palmetto) ASR projects currently under development (Figure 5.1). Solutions to several key issues such as management of metals mobilization, attenuation of disinfection-by-products during storage, deterioration of injection rate and die off of microorganisms are being explored at these sites.

ASR development can be problematic because of the high initial investment and the uncertainty of success until the project wells undergo extensive field evaluation. In the SWFWMD, there are several facilities that have been abandoned. The Northwest Hillsborough County reclaimed water site was abandoned due to arsenic mobilization and very poor recovery efficiency. Pinellas County's proposed Lake Tarpon facility was abandoned because of rapid fouling of a lake water system and because other sources of water were available at lower costs. In addition, Pinellas County's attempt to convert several existing Class I injection wells, originally constructed for wastewater effluent disposal, into Class V ASR wells for reclaimed water storage and recovery was stopped because of low water recovery rates.

### 6.5.6 Aquifer Recharge and Dispersed Water Management

Excessive groundwater withdrawals have impacted much of the Tampa Bay region especially in the Dover/Plant City and Southern Water Use Caution Areas. Ground water withdrawals have impacted wetlands and surface water levels. Saltwater intrusion is also a major issue in the SWUCA. In cooperation with area governments and water suppliers, the SWFWMD has developed extensive programs to address the impacts of excessive groundwater withdrawals. The SWFWMD has developed alternative water supplies and methods for aquifer recharge using an extensive series of ASR and saltwater intrusion recharge wells. SWFWMD staff are working to develop a management and MFL recovery plan for ASR/Recharge well systems. Local governments and water suppliers in the Tampa Bay region are developing expanded programs for use and reuse of reclaimed water supplies.

The dispersed water management methods as practiced in the SFWMD have been limited within the SWFWMD to several agricultural operations that have incorporated the use of localized recovery of surface waters in on-site irrigation ditches. The City of Winter Haven is considering a concept of using private property for stormwater storage intended to accomplish enhanced aquifer recharge and stormwater management in addition to wetlands restoration.

### 6.5.7 Uses and Needs

The SWFWMD's Regional Water Supply Plan provides projected water demands through 2035 and contains an extensive discussion of potential water source options to meet the projected water demands. The plan also identifies recovery and prevention strategies for water bodies with established MFLs.

Figure 6.5.5 shows existing water use permits in the SWFWMD that exceed 3 MGD and areas that are currently experiencing water supply problems reflected by their designation as water use caution areas, or locations where MFLs area not being met. The figure illustrates where existing water use is most intense and where additional water sources will be needed for additional water supply, or to offset the effects of existing water supply on natural systems.

As shown in Figure 6.5.6, high water supply demands occur in the Tampa Bay metropolitan area that includes portions of Pasco and Polk counties. Available sources of excess surface water that could be used to meet these projected demands are located in the relatively remote northern and southern planning regions of the SWFWMD. However, transferring unused surface water supplies from these regions to address Tampa Bay area water demands is unlikely to be cost effective. Fortunately, substantial reclaimed water is available for use in the Tampa Bay area (Figure 6.5.6). Developing additional facilities for expanded irrigation, indirect or direct potable reuse, reclaimed water ASR and reclaimed water aquifer recharge would likely be more cost effective.

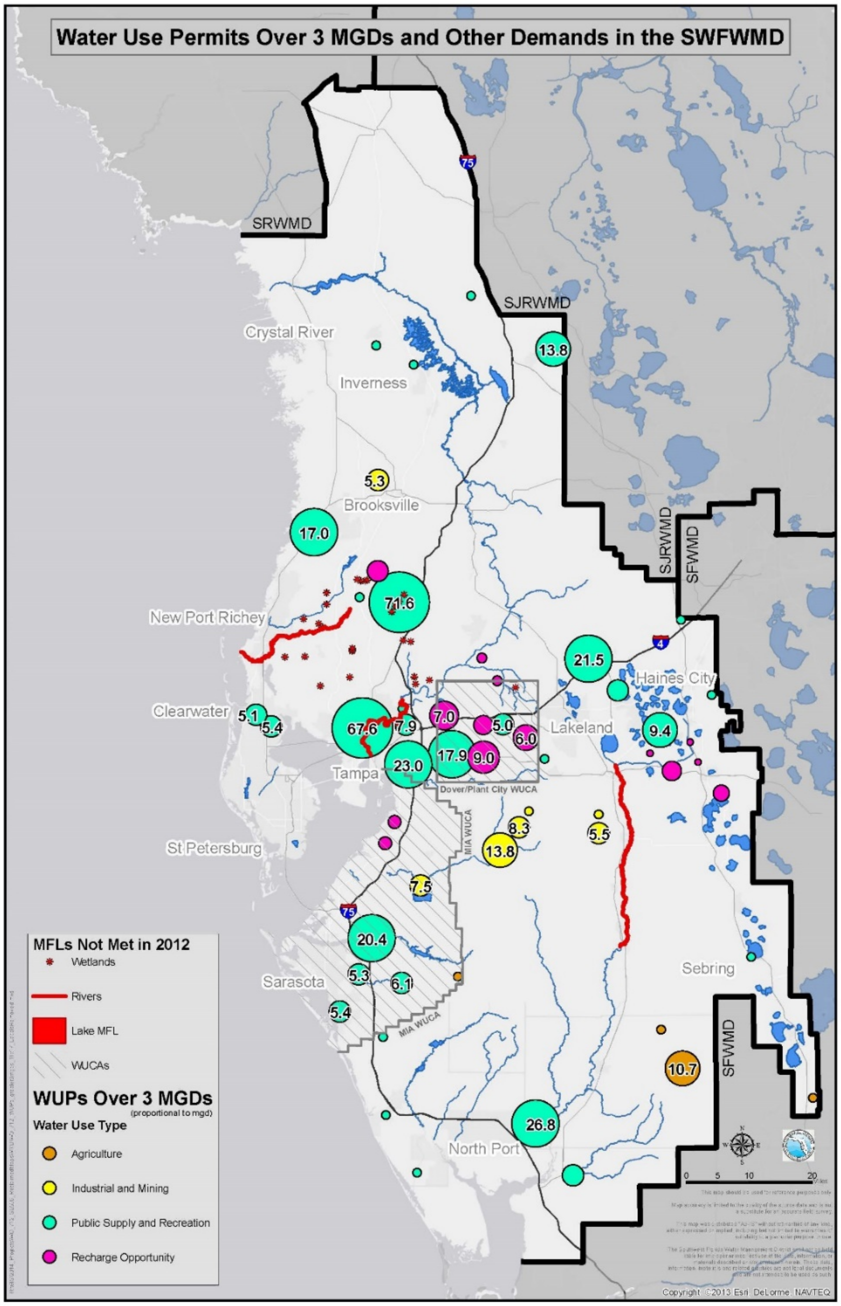



*Figure 6.5.5: Water Use Permits over 3 MGD and Other Demands in the SWFWMD*

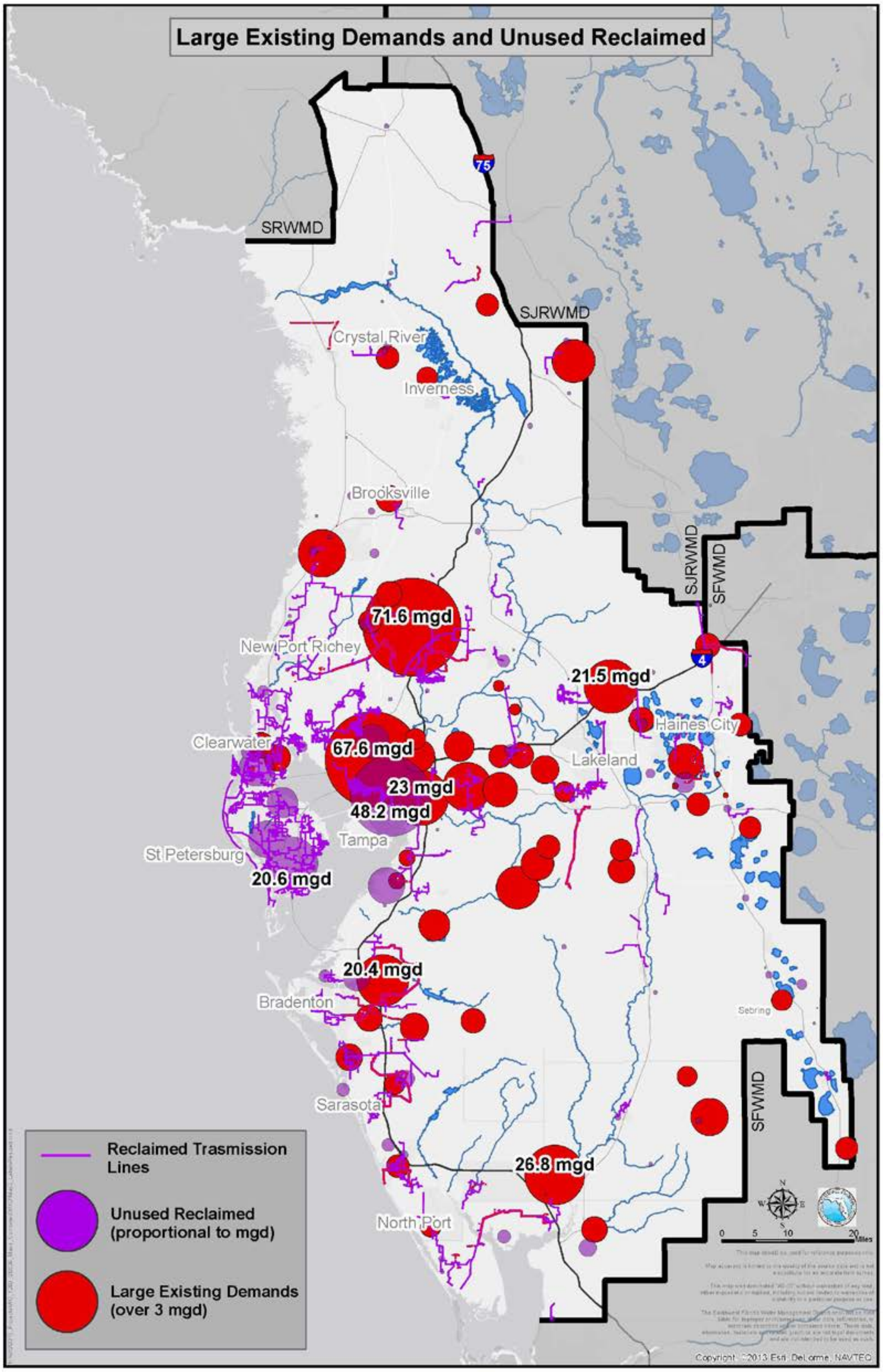



*Figure 6.5.6: Large Existing Demands and Unused Reclaimed*

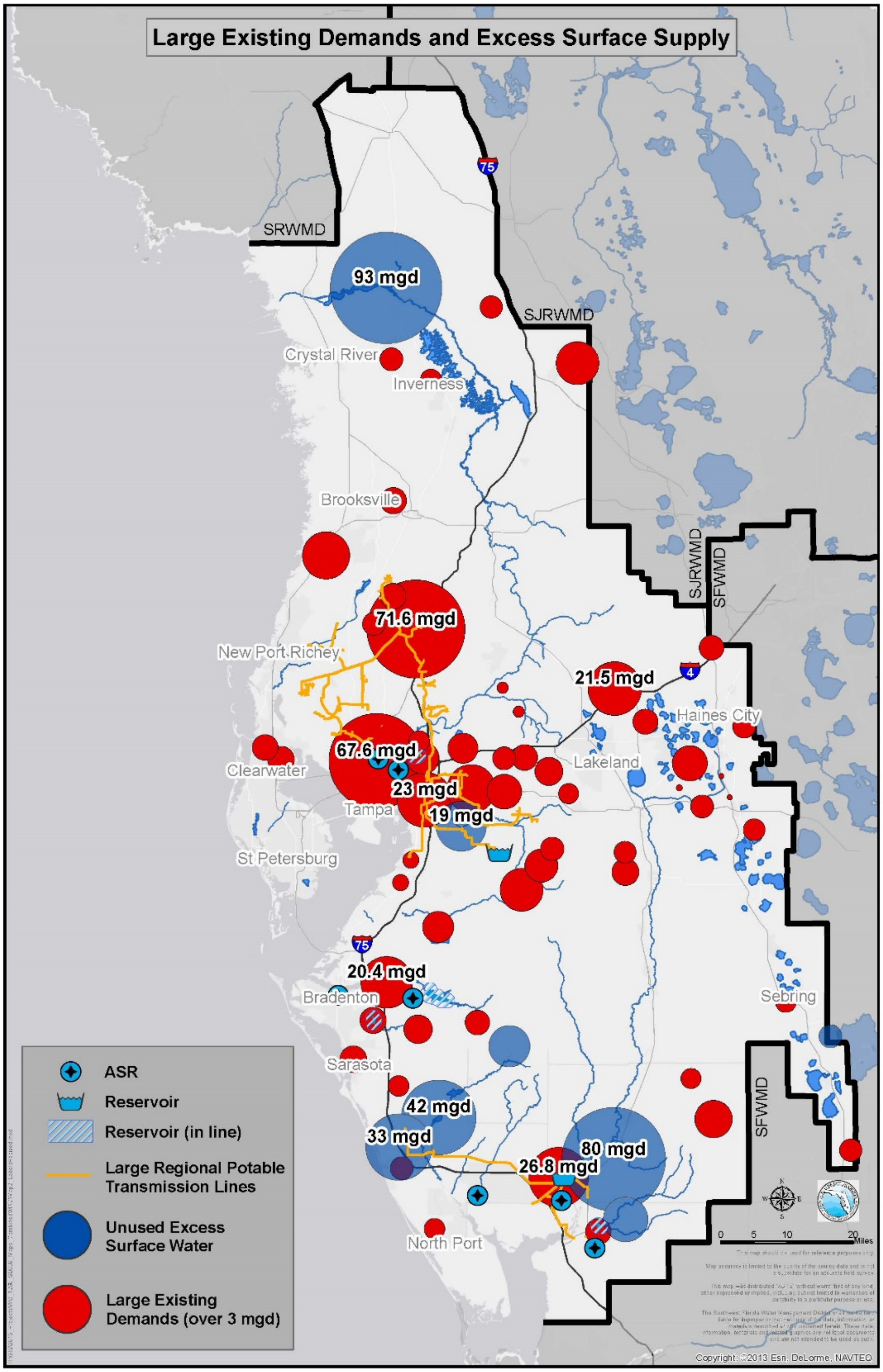



*Figure 6.5.7: Large Existing Demands and Excess Surface Supply*

6.5.8 Opportunities to match water sources and needs

The technologies and expertise to treat, store and reuse reclaimed water for expanded irrigation, aquifer recharge and indirect and direct potable reuse are reasonably well established and available to respond to project water needs in the Tampa metropolitan area. The Tampa Electric Company (TECO) Lakeland/Mulberry/Polk Reclaimed Water Project is an industrial reuse system in southwest Polk County. The project includes approximately 20 miles of reclaimed water transmission mains, pumping infrastructure, advanced treatment, a storage tank and a concentrate deep disposal well to utilize over 10 MGD of effluent from the City of Lakeland, Polk County and the City of Mulberry at TECO's Polk Power Station. The project is sized to a 2045 build-out capacity of 17 MGD. The City of Clearwater Ground Water Replenishment Project is an IPR system in central Pinellas County. The project is includes an advanced purification plant, an aquifer injection system and all monitoring infrastructure necessary to recharge 2.4 MGD of effluent from the City of Clearwater. Both of these projects are currently under development.

The Southern Hillsborough County Reclaimed Water Aquifer Recharge Project is a natural system enhancement reuse pilot project located in southern Hillsborough County that utilizes 2 MGD of reclaimed water from Hillsborough County's South-Central Reuse System to recharge the upper Floridan aquifer. The ongoing project is being evaluated to assist in meeting MFLs and creating a saltwater intrusion barrier. The project can be expanded or replicated to an additional build-out capacity of 20 MGD.

Other proposed projects within the SWFWMD include:

- The City of Winter Haven Recharge and Surface Water Augmentation Option, a natural system enhancement reuse system to recharge up to 4 MGD of reclaimed water from the City of Winter Haven to assist in meeting MFLs;
- The City of Tampa Reclaimed Water Augmentation Option, a natural system enhancement reuse system to utilize up to 40 MGD of reclaimed water from the City of Tampa for recharge and augmentation of water resources adjacent to and north of the Tampa By-Pass Canal and the Hillsborough River system;
- The Tampa Bay Water Reclaimed Water Recharge Option, a natural system enhancement reuse system to utilize up to 22 MGD of reclaimed water from a variety of Tampa Bay Area utilities to recharge the upper Floridan aquifer; and,
- The Tampa Bay Reclaimed Water Purification Option, a direct potable reuse system to utilize up to 5.0 MGD of reclaimed water from one of the Tampa Bay area utilities as a supply source for an advanced purification and professional training facility.

# 7 SUMMARY OF RECOMMENDATIONS AND CONCLUSIONS

This study examined impediments and opportunities related to expanding the use of three water sources: reclaimed water, stormwater and excess surface water, as well as storage options for these sources. It is clear that meeting the state's future water supply needs while sustaining our valuable water resources will not be accomplished through reliance on a single water supply source or storage method. Rather, increasing diversification of water supply sources and storage techniques will be the key to cost effective, sustainable water use into the future.
Florida has a well-established program to support the use of reclaimed water and is currently the national leader, reusing 45% of treated wastewater flows. This report focuses on actions needed to take the state's reuse program to the next level and achieve significant progress in beneficially reusing the remaining 55% of wastewater flows currently discharged to surface waters or injected deep underground.

In contrast to reclaimed water, stormwater is only beginning to be widely recognized as a potential supplemental source for water needs. The recommendations in this report are intended to ensure that water managers appropriately recognize and consider opportunities to use stormwater to help achieve water supply and natural system objectives.

Surface water sources are heavily used for water supply in some parts of the state, but are relatively untapped in other regions. The use of excess surface water has great potential to assist in solving the state's water supply challenges, particularly in areas where groundwater use has or will exceed sustainable levels. However, care must be taken to ensure that the flows and levels needed to sustain the ecological health of the water bodies are protected.

## 7.1 STATEWIDE RECOMMENDATIONS

The results of this study produced numerous statewide recommendations to increase the beneficial use of reclaimed water, stormwater and excess surface water. A compilation of the recommendations from Chapters 2 through 5, by water source and storage, is provided in Table 7.1. In general, the recommendations fall into the following categories:

- DEP and WMD Regulatory Changes
- Agency Actions
- Water Supplier Actions
- Funding
- Education and Outreach

*Table 7.1: Recommendations by Water Source and Storage*

| Recommendation | Chapter | DEP/WMD Regulatory Changes | Agency Actions | Water Supplier Actions | Funding | Education, Outreach |
|---|---|---|---|---|---|---|
| Maintain funding partnerships among the state, water management districts, water suppliers and water users for reclaimed water projects. | Reclaimed Water | | | | ✓ | |
| DEP should review the existing UIC rules applicable to reclaimed water and identify and pursue rule revisions that would streamline permitting of these systems while maintaining protection of groundwater resources and public health and safety. | Reclaimed Water | ✓ | | | | |
| DEP should review the existing rules that would apply to aquifer recharge for IPR to determine if changes or clarifications are needed to ensure that it provides adequate and clear guidance to applicants for IPR projects. | Reclaimed Water | ✓ | | | | |
| DEP should adopt rules to establish clear procedures and criteria for implementing direct potable reuse, including treatment plant operator requirements for wastewater treatment plants that will produce water for direct potable reuse. | Reclaimed Water | ✓ | | | | |
| DEP should review the treatment requirements for supplementation of reclaimed systems to determine if changes can be made that would reduce treatment requirements while maintaining appropriate public health and safety protections | Reclaimed Water | ✓ | | | | |

*Table 7.1 Recommendations by Water Source and Storage, continued*

| Recommendation | Chapter | DEP/WMD Regulatory Changes | Agency Actions | Water Supplier Actions | Funding | Education, Outreach |
|---|---|---|---|---|---|---|
| DEP, with assistance from the Department of Health, should review the restriction on the direct use of reclaimed water on edible crops in Rule 62-610 F.A.C. to determine if revisions are appropriate. | Reclaimed Water | ✓ | | | | |
| DEP should develop public education and outreach material on the nutrient content of reclaimed water, its value as a fertilizer, the need to balance use of commercial fertilizers so as not to exceed recommended overall nutrient application rates and promote cost savings associated with limiting commercial fertilizer application because of the nutrient value of the reclaimed water. | Reclaimed Water | | | | | ✓ |
| DACS should implement fertilizer offset Best Management Practices (BMP) for all growers irrigating with reclaimed water. | Reclaimed Water | | ✓ | | | |
| DEP should include in its Annual Reuse inventory the nutrient content of reclaimed water provided to utility customers for irrigation in order to make nutrient concentrations of reclaimed water used for irrigation easily available to users. | Reclaimed Water | | ✓ | | | |

*Table 7.1 Recommendations by Water Source and Storage, continued*

| Recommendation | Chapter | DEP/WMD Regulatory Changes | Agency Actions | Water Supplier Actions | Funding | Education, Outreach |
|---|---|---|---|---|---|---|
| Some local governments have adopted more stringent surface water and groundwater standards than the state standards, or restricted the application of reclaimed water which otherwise meets state requirements. The applicable WMDs and DEP should work cooperatively with local governments to develop mechanisms for exceptions and/or consistency. | Reclaimed Water | | ✓ | | | |
| DEP and the WMDs need to ensure that coordination meetings among DEP wastewater permitting staff, WMD consumptive use permitting staff and WMD water supply planning staff take place at least bi-annually to ensure that opportunities to match users and suppliers are identified. | Reclaimed Water | | ✓ | | | |
| DEP and the WMDs should establish periodic meetings between DEP wastewater staff and WMD environmental resource permitting staff to identify opportunities for stormwater from new development to be used for supplementation of reclaimed water systems. | Reclaimed Water | | ✓ | | | |
| DEP, in coordination with the five WMDs, should conduct statewide education and outreach related to reclaimed water. | Reclaimed Water | | | | | ✓ |
| Local governments that currently operate or are contemplating the addition of a reclaimed water system, should consider the establishment of Mandatory Reuse Zones. | Reclaimed Water | | | ✓ | | |

*Table 7.1 Recommendations by Water Source and Storage, continued*

| Recommendation | Chapter | DEP/WMD Regulatory Changes | Agency Actions | Water Supplier Actions | Funding | Education, Outreach |
|---|---|---|---|---|---|---|
| Utilities should consider the use of tiered reclaimed water rates, where appropriate, to encourage efficient use of the resource. | Reclaimed Water | | | ✓ | | |
| Utilities with water reuse systems, or plans to develop a water reuse system, should explore potential industrial, commercial and institutional (I/C/I) sector customers for reclaimed water. | Reclaimed Water | | | ✓ | | |
| Reclaimed water providers should consider entering into long-term agreements with end users. | Reclaimed Water | | | ✓ | | |
| The CUP rules should be revised to include harvested stormwater runoff as a lower quality source that should be evaluated prior to permitting the use of surface or groundwater in a manner similar to reclaimed water. | Stormwater | ✓ | | | | |
| Revisions should be considered to the CUP and ERP rules requiring the ERP and CUP permit applications be jointly processed when both types of permits are required for a project/development. | Stormwater | ✓ | | | | |
| Mechanisms should be developed within the ERP Program that would allow conveyance of untreated stormwater when the effect on environmental resources is minimal in order to allow stormwater harvesting from a single, large point of extraction. | Stormwater | ✓ | | | | |
| The ERP stormwater rules should be revised to incentivize "direct recharge" systems (i.e. minimal pretreatment, sand chimneys, etc.) that receive runoff from landscapes with low pollutant loads. | Stormwater | ✓ | | | | |

*Table 7.1 Recommendations by Water Source and Storage, continued*

| Recommendation | Chapter | DEP/WMD Regulatory Changes | Agency Actions | Water Supplier Actions | Funding | Education, Outreach |
|---|---|---|---|---|---|---|
| The stormwater rules should be evaluated to determine if incentives could be incorporated for certain types of stormwater capture and reuse. | Stormwater | ✓ | | | | |
| Revisions should be considered to amend Chapter 62-610, F.A.C., to address disinfection requirements to facilitate the blending of harvested stormwater and treated wastewater. | Stormwater | ✓ | | | | |
| DEP should reconsider the present UIC rules that regulate aquifer recharge and work to establish a regulatory framework that improves the viability of using harvested stormwater runoff for aquifer recharge, but also continues to provide the necessary protections for groundwater resources and public health and safety. | Stormwater | ✓ | | | | |
| DACS, IFAS and the WMDs should continue to work with the FDA on new agricultural water quality requirements to ensure that they are compatible with the use of harvested stormwater. | Stormwater | | ✓ | | | |
| DACS, IFAS and the WMDs should support and promote the agricultural use of harvested stormwater by providing technical and financial support to incentivize tailwater recovery as an alternative water supply source focusing on areas where it is most likely to be successful. | Stormwater | | | | | ✓ |

*Table 7.1 Recommendations by Water Source and Storage, continued*

| Recommendation | Chapter | DEP/WMD Regulatory Changes | Agency Actions | Water Supplier Actions | Funding | Education, Outreach |
|---|---|---|---|---|---|---|
| DEP should work with the Florida Building Commission to consider revisions to the Florida Building Code to address the use of stormwater for non-potable applications like toilet flushing or industrial uses. | Stormwater | | ✓ | | | |
| The WMDs, as part of the regional water supply planning process, should establish a coordinated process for identifying opportunities to link stormwater supplies to water supply needs. | Stormwater | | ✓ | | | |
| DEP should form a Stormwater Coordinating Committee including representatives of DEP, the WMDs and DOT. | Stormwater | | ✓ | | | |
| DOT and the WMDs should coordinate to explore the potential of using existing public highway drainage infrastructure to convey stormwater to facilitate water supply or other environmental needs. | Stormwater | | ✓ | | | |
| DEP, DACS and the WMDs should consider the development of financial models or incentives to encourage farmers to increase the implementation of tailwater recovery projects and address the financial impact of taking some land out of production. | Stormwater | | ✓ | | | |
| DEP, WMDs, DACS and DOT need to educate the public and collaborate with stakeholder and special interests groups in order to build consensus support for stormwater as a viable water asset that can be used for multiple purposes. | Stormwater | | | | | ✓ |

*Table 7.1 Recommendations by Water Source and Storage, continued*

| Recommendation | Chapter | DEP/WMD Regulatory Changes | Agency Actions | Water Supplier Actions | Funding | Education, Outreach |
|---|---|---|---|---|---|---|
| Funding partnerships among the state, water management districts, water suppliers and water users should continue to be pursued for stormwater projects that benefit water supply. | Stormwater | | | | ✓ | |
| Maintain funding partnerships among the state, water management districts, water suppliers and water users for regional surface water projects. | Excess Surface Water | | | | ✓ | |
| The WMDs should encourage the development of conjunctive use systems through their Regional Water Supply Plans. | Excess Surface Water | | ✓ | | | |
| The WMDs should ensure that the consumptive use permitting process continues to allow appropriate flexibility in permitting conjunctive use systems with diversified water sources. | Excess Surface Water | ✓ | | | | |
| DEP should re-examine the present UIC rules that regulate aquifer recharge and work to establish a regulatory framework that improves the viability of using surface water for aquifer recharge, but also provides necessary protections for groundwater resources and public health and safety. | Excess Surface Water | ✓ | | | | |
| DEP, DACS, IFAS and the WMDs should continue to work with the FDA on new agricultural water quality requirements to ensure that they are compatible with the use of excess surface water. | Excess Surface Water | | ✓ | | | |

*Table 7.1 Recommendations by Water Source and Storage, continued*

| Recommendation | Chapter | DEP/WMD Regulatory Changes | Agency Actions | Water Supplier Actions | Funding | Education, Outreach |
|---|---|---|---|---|---|---|
| DEP, DACS, IFAS and the WMDs should conduct outreach with agricultural producers to support the use of excess surface water, where available, in light of the future water use standards. | | | | | | ✓ |
| Public education and outreach by DEP and the WMDs are needed to inform the public about the use of excess surface water and build public support for the development of surface water supplies where available and consistent with natural system protection. | Excess Surface Water | | | | | ✓ |
| Ensure advance planning and coordination with all interested stakeholders. | Storage | | | | | ✓ |
| Form partnerships for regional reservoir construction. | Storage | | ✓ | | | |
| Continue State and WMD alternative water supply cost-share programs to incentivize reservoir construction. | Storage | | | | ✓ | |
| Revise current regulations to allow more permitting options for ASR and direct AR facilities. | Storage | ✓ | | | | |
| Account for all costs and benefits in project economic analysis. | Storage | | ✓ | | | |
| Provide an institutional structure for regional recharge. | Storage | | ✓ | | | |
| Provide funding for regional recharge. | Storage | | | | ✓ | |

*Table 7.1 Recommendations by Water Source and Storage, continued*

| Recommendation | Chapter | DEP/WMD Regulatory Changes | Agency Actions | Water Supplier Actions | Funding | Education, Outreach |
|---|---|---|---|---|---|---|
| Support research to address ASR/AR water quality issues. | Storage | | | | ✓ | |
| Continue funding for Dispersed Water Management programs. | Storage | | | | ✓ | |
| Continue coordination with the agricultural community on the use of fallow agricultural lands for Dispersed Water Management. | Storage | | | | | ✓ |

### 7.1.1 DEP and WMD Regulatory Changes

The regulatory recommendations include potential changes to the Underground Injection Control Program, Environmental Resource Permitting, Consumptive Use Permitting and Reuse (Wastewater) Permitting programs. Many of these recommendations focus on reducing impediments to, or promoting, the use of reclaimed water, stormwater and surface water for aquifer storage and recovery and aquifer recharge. These recommendations recognize that Florida's aquifer system can provide a natural water storage and transmission mechanism that avoids the need for large aboveground reservoirs and extensive pipeline infrastructure. Storing water in the aquifer can provide dual benefits of ensuring water supplies for human use, but also enhancing aquifer levels to support healthy springs, wetlands, lakes and rivers.

Another focus of the regulatory recommendations is ensuring that the proper regulatory structure exists for indirect and direct potable reuse. Several communities around the state are considering potable reuse projects as a way to promote a dependable water supply and reduce nutrient discharges to surface waters. Clear regulatory standards and procedures are needed to facilitate such projects.

Several of the recommendations call for a review of specific reuse treatment standards, such as the disinfection requirements for stormwater used to supplement reclaimed water systems. If it is determined that the best available science no longer supports the need for these requirements, changes may be warranted to reduce impediments to increasing reclaimed water use.

### 7.1.2 Agency Actions

While water quality and water quantity, by necessity, are regulated and managed under a variety of separate programs, a more holistic view of the water resource is needed for effective management. Many of the recommendations for agency action reflect the need to enhance coordination between agencies and permitting, planning and funding programs to ensure that opportunities to match water sources and water needs are identified and acted on in a timely manner. The establishment of a Stormwater Coordinating Committee, including DEP, DOT and the WMDs is recommended to promote the beneficial use of stormwater, following the example of the successful Reuse Coordinating Committee that has been in place since the early 1990's. Recommended agency actions also include measures to help prevent conflicts between water quality and water quantity objectives that may hinder the use of reclaimed water, including the establishment of fertilizer offset Best Management Practices by DACS for growers irrigating with reclaimed water.

### 7.1.3 Water Supplier Actions

These recommendations recognize the usefulness of tools such as Mandatory Reuse Zones and tiered reclaimed water rates in the effective operation of reclaimed water systems. Reclaimed water providers are encouraged to explore potential industrial/commercial/institutional customers, who need large quantities of reclaimed water, ideally on a year-round basis. These types of uses may provide for more cost-effective expansion of the use of reclaimed water in some areas than additional public access irrigation. In addition, long-term agreements between reclaimed water suppliers and users are recommended to address concerns related to reliability of water supply.

#### 7.1.4 Funding

The cost of developing alternative water supplies and storage systems was consistently raised by stakeholders as an impediment. Continued cost sharing partnerships among state, water management districts and local water suppliers will be critical to the expansion of reclaimed water, stormwater and excess surface water.

#### 7.1.5 Education and Outreach

DEP, DACS and the WMDs currently engage in significant education and outreach activities related to water treatment and use. However, the recommendations highlight areas where additional focus and effort is needed. DEP, in coordination with the five WMDs, should conduct statewide education and outreach related to reclaimed water. This will be particularly important for reclaimed water uses, such as large scale reclaimed water aquifer recharge, or direct and IPR, with which the public is less familiar.

Other outreach activities recommended include the production by DEP of educational materials on the nutrient content of reclaimed water to assist reclaimed water customers in understanding the proper application of commercial fertilizers in conjunction with reclaimed water irrigation.

## 7.2 Regional Analysis by Water Management District

Water use patterns and hydrogeologic conditions vary widely across the state and are frequently the controlling factors in determining the most appropriate alternative water supply development or water storage options. Therefore, in addition to statewide recommendations, regional analyses were conducted by each WMD (Chapter 6) to determine the appropriate regional focus for enhancing the use of reclaimed water, stormwater and excess surface water. These analyses were supported by the extensive work conducted as part of Regional Water Supply Plan development in each WMD, as well as graphical presentation of data related to water use and availability.

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# *Report on Expansion of Beneficial Use of Reclaimed Water, Stormwater, and Excess Surface Water (Senate Bill 536)*

# *Appendices*

**Office of Water Policy**
**Florida Department of Environmental Protection**
**December 1, 2015**

3900 Commonwealth Boulevard, MS 41
Tallahassee, Florida 32399-3000
www.dep.state.fl.us

# APPENDIX A: SENATE BILL 536

An act relating to reclaimed water; requiring the Department of Environmental Protection to conduct a study in coordination with the stakeholders on the expansion of the beneficial use of reclaimed water, stormwater, and excess surface water and to submit a report based upon such study; providing requirements for the report; requiring the department to provide the public an opportunity for input and for public comment; requiring that the report be submitted to the Governor and the Legislature by a specified date; providing an effective date.

Be It Enacted by the Legislature of the State of Florida:

Section 1. Use of reclaimed water, stormwater, and excess surface water.—

(1) The Department of Environmental Protection, in coordination with the stakeholders, shall conduct a comprehensive study and submit a report on the expansion of the beneficial use of reclaimed water, stormwater, and excess surface water in this state.

(2) The report must:

(a) Identify factors that prohibit or complicate the expansion of the beneficial use of reclaimed water, stormwater, and excess surface water and recommend how those factors can be mitigated or eliminated.

(b) Identify measures that would lead to the efficient use of reclaimed water.

(c) Identify the environmental, engineering, public health, public perception, and fiscal constraints of such an expansion, including utility rate structures for reclaimed water.

(d) Identify areas in the state where traditional water supply sources are limited and the use of reclaimed water, stormwater, or excess surface water for irrigation or other purposes is necessary.

(e) Recommend permit incentives, such as extending current authorizations for long-term consumptive use permits for all entities that substitute reclaimed water for traditional water sources that become unavailable or otherwise cost prohibitive.

(f) Determine the feasibility, benefit, and cost estimate of the infrastructure needed to construct regional storage features on public or private lands for reclaimed water, stormwater, and excess surface water, including the collection and delivery mechanisms for beneficial uses such as agricultural irrigation, power generation, public water supply, wetland restoration, groundwater recharge, and waterbody base flow augmentation.

(3) The department shall:

(a) Hold two public meetings, at a minimum, to gather input on the study.

(b) Provide an opportunity for the public to submit written comments before submitting the report.

(4) The report shall be submitted to the Governor, the President of the Senate, and the Speaker of the House of Representatives no later than December 1, 2015.

Section 2. This act shall take effect July 1, 2014.

# APPENDIX B: ACRONYMS

This list of acronyms provides information for terms used within the text of this report.

| Acronym | Explanation |
|---|---|
| **AR** | Aquifer Recharge |
| **ARCs** | Areas of Resource Concern |
| **ASR** | Aquifer Storage and Recovery |
| **BLS** | Below land surface |
| **BMAP** | Basin Management Action Plan |
| **BMP** | Best Management Practice |
| **C&SF** | Central and Southern Florida |
| **CAT** | Complete Advanced Treatment |
| **CERP** | Comprehensive Everglades Restoration Plan |
| **CFWI** | Central Florida Water Initiative |
| **CUP** | Consumptive Use Permit |
| **DACS** | Florida Department of Agriculture and Consumer Services |
| **DEP** | Florida Department of Environmental Protection |
| **DOT** | Florida Department of Transportation |
| **DPCWUCA** | Dover Plant City Water Use Caution Area (in SWFWMD) |
| **DPR** | Direct Potable Reuse |
| **DWM** | Dispersed Water Management |
| **EPA** | United States Environmental Protection Agency |
| **ERP** | Environmental Resource Permitting |
| **ESOC** | Emerging Substances of Concern |
| **F.A.C.** | Florida Administrative Code |
| **F.S.** | Florida Statutes |
| **FARMS** | Facilitating Agricultural Resource Management Systems |
| **FAS** | Florida Aquifer System |
| **FDA** | Food and Drug Administration |
| **FEB** | Flow Equalization Basins |
| **FRESP** | Florida Ranchlands Environmental Services Pilot |
| **FSMA** | Food Safety and Modernization Act |
| **FY** | Fiscal Year |
| **GRU** | Gainesville Regional Utilities |
| **I/C/I** | Institutional/Commercial/Industrial water uses |
| **IFAS** | University of Florida Institute of Food and Agricultural Sciences |

| Acronym | Explanation |
|---|---|
| **IGR** | Indirect Groundwater Recharge |
| **IPR** | Indirect Potable Reuse |
| **LID** | Low Impact Design |
| **MFL** | Minimum flows and levels |
| **mg/L** | Milligrams per liter |
| **MGD** | Million Gallons per day |
| **MRZ** | Mandatory Reuse Zone |
| **MS-4** | Municipal Separate Storm Sewer System |
| **NE-PES** | Northern Everglades Payment for Environmental Services Program |
| **NFRWSP** | North Florida Regional Water Supply Partnership |
| **NPDES** | National Pollutant Discharge Elimination System |
| **NWFWMD** | Northwest Florida Water Management District |
| **RIB** | Rapid Infiltration Basin |
| **RWSP** | Regional Water Supply Plan |
| **SFWMD** | South Florida Water Management District |
| **SJRWMD** | St. Johns River Water Management District |
| **SRF** | State Revolving Fund |
| **SRWMD** | Suwannee River Water Management District |
| **SWFWMD** | Southwest Florida Water Management District |
| **SWUCA** | Southern Water Use Caution Area (in SWFWMD) |
| **TDS** | Total Dissolved Solids |
| **TECO** | Tampa Electric Company |
| **TMDL** | Total Maximum Daily Load |
| **UIC** | Underground Injection Control |
| **USDW** | Underground Source of Drinking Water |
| **USGS** | United States Geological Survey |
| **WCII** | Water Conserv II aquifer recharge project |
| **WF-PES** | Water Farming Payment for Environmental Services |
| **WMDs** | Water Management Districts |
| **WRCA** | Water Resource Caution Area |
| **WSA** | Water Supply Assessment |
| **WSIS** | Water Supply Impact Study |
| **WWTP** | Wastewater Treatment Plant |

# Appendix C: Public Input

## Appendix C-1: Public Input Overview

The Department used several tools to receive public input as part of the SB 536 Study, including:

- A web-based survey conducted from August 7 - August 24, 2014.
- Five public workshops held in Panama City, Live Oak, Palatka, West Palm Beach, and Brooksville in October-November 2014.
- Individual stakeholder meetings.
- A webpage with study updates, workshop presentations, and an e-mail address to submit comments.
- Teleconference access to agency study working group meetings.
- A statewide webinar on the draft legislative report held on August 20, 2015.
- A public meeting on the draft legislative report held in Maitland on August 25, 2015.
- A FTP site where the public could access all submitted comments, raw survey data, and a recording of the webinar.

Survey

The web-based survey for interested stakeholders was the first step in receiving public input as part of the SB 536 Study. The survey itself had two sections of questions; one for respondents interested in reclaimed water issues and another for those interested in stormwater/excess surface water issues. Respondents could answer questions in either or both sections. Each survey section had two types of questions. First, there were lists of impediments, incentives, and storage methods that survey respondents could rate in importance on a five-point scale. Second, there were essay questions (text boxes) where respondents could discuss up to two of the impediments, incentives, or storage methods in more detail. Additionally, there was a text box where respondents could discuss any additional related topic they wished.
DEP developed a master mailing list for the survey by combining numerous mailing lists of DEP and the WMDs related to:

- Water supply planning;
- Consumptive use permitting;
- Chapter 62-40, F.A.C. (State Water Policy) rulemaking;
- Reclaimed water;
- Wastewater treatment system operators; and,
- Stormwater.

From August 7-14, 2014, the Department emailed 14,847 survey invitations to recipients compiled from these mailing lists. The Department received 1,539 survey responses (31% response rate). During post-survey data processing, the Department removed those surveys with responses from individuals who indicated they did not wish to continue taking the survey, those who wished to continue but did not provide any responses to the survey questions, and duplicate responses, leaving 951 stakeholder responses.

- **Appendix C2** contains the survey questions.
- **Appendix C3** presents some characteristics of the 951 stakeholders responding to the survey.
- **Appendix C4** presents the rating results from all survey respondents combined.
- **Appendix C5** lists the major themes raised in the essay portion of the survey.

Table C1.1 summarizes the top issues that were most important to survey respondents. Funding and regulatory changes are the most common issues that appear in Table C1.1.

| Impediments | Incentives | Storage Methods | Indirect Potable Reuse |
|---|---|---|---|
| Fiscal constraints | Funding for projects | Wetlands, natural areas | Fiscal constraints |
| Infrastructure availability | Regulatory changes | Aquifer recharge | Public perception |
| Storage availability | Funding for education | | Regulation/regulatory actions |

*Table C1.1: Survey Results -- Most Important Issues by Category*

Stakeholder Comments

DEP received public comments concerning SB 536 throughout the study process. All written public comments are available at http://publicfiles.dep.state.fl.us/SEC/SB536Study/ until June 1, 2016. After that date, please contact DEP's Office of Water Policy at (850) 245-3166 to request copies of public comment documents.

## APPENDIX C2: SURVEY

**Survey for Senate Bill 536 Study**
**Use of Reclaimed Water and Stormwater/Excess Surface Water**

The 2014 Florida Legislature passed Senate Bill 536 requiring the Department of Environmental Protection to conduct a study and submit a report on the expansion of the use of reclaimed water and stormwater/excess surface water. As a first step in our study, we are conducting a survey to gather stakeholder input and ideas related to expansion of these water sources. In the fall, we plan to hold public workshops in each water management district to present initial findings from the survey and to solicit further comments from stakeholders.

Please complete the survey no later than **August 19, 2014** [later extended to August 24, 2014]. Thank you for your help with our study.

Please note that your response to this survey is subject to disclosure as a public record pursuant to Chapter 119, Florida Statutes.

- o I understand and wish to continue
- o I do not wish to continue (end survey)

---

The following questions will help us understand more about you and ensure you only see questions about subjects that relate to your interests.

To start the survey, please tell us about yourself:

**Name: _______________________________________________**

**Agency/Association: _______________________________________________**

**Email Address: _______________________________________________**

Please provide us with the best contact number (with extension if applicable) to reach you:

**Phone number: (_____) ______-________ Extension: ______________**

**Which water management district(s) do you interact with?** (Select all that apply)

[Northwest Florida, South Florida, St. Johns River, Suwannee River, Southwest Florida, All, None ]

**Which DEP regulatory district(s) do you interact with?** (Select all that apply)

[Central District, Northwest District, Northeast District, South District, Southeast District, Southwest District, All, None ]

**How would you describe yourself?** (Select all that apply)

[public utility, private utility, water supply authority, wastewater utility, consultant, industrial association, professional association, environmental organization, community outreach group, individual water user, regulatory or oversight agency, local government, attorney, research organization, academia, other interested party (specify: __________)

**Please indicate which water use sectors are of interest to you:** (Select all that apply)

[agriculture, commercial/industrial, power generation, public supply, recreational irrigation, all]

**Please indicate which areas you are interested in:** (Select one)

[reclaimed water, stormwater/excess surface water, both]

---

In general, there are two major components to Senate Bill 536 covered by this survey:

1. Identify factors that prohibit or complicate the expansion of the beneficial use of reclaimed water and stormwater/excess surface water, and recommend how those factors can be mitigated or eliminated.
2. Determine the feasibility, benefit, and cost estimate of the infrastructure needed to construct regional storage features for reclaimed water and stormwater/excess surface water, including the collection and delivery mechanisms for beneficial uses such as agricultural irrigation, power generation, public water supply, wetland restoration, groundwater recharge, and water body base flow augmentation.

Please focus on these provisions as you fill out this survey.

---

### Reclaimed Water Survey

There are five primary questions in this section. After each question there will be an opportunity to further describe your ideas concerning reclaimed water. You are not obligated to answer the open-ended questions, but your insight will help us identify and develop solutions to the constraints on the expanded use of reclaimed water.

We appreciate any further details or insight you can offer in addition to these five questions.

Question 1: Please evaluate the degree of importance of the following factors in prohibiting or complicating the expanded use of reclaimed water: [These are the ratings type questions.]

| **Factors** | **Not Important** | **Somewhat Important** | **Moderately Important** | **Important** | **Very Important** |
|---|---|---|---|---|---|
| Engineering constraints/technology not available | ○ | ○ | ○ | ○ | ○ |
| Environmental constraints | ○ | ○ | ○ | ○ | ○ |
| Fiscal constraints (cost prohibitive, bond funding, utility rate structures, etc.) | ○ | ○ | ○ | ○ | ○ |
| Inefficient use of current reclaimed water supplies | ○ | ○ | ○ | ○ | ○ |
| Infrastructure availability | ○ | ○ | ○ | ○ | ○ |
| Public health issues | ○ | ○ | ○ | ○ | ○ |
| Public perception/customer resistance | ○ | ○ | ○ | ○ | ○ |
| Public's trust of utility operators | ○ | ○ | ○ | ○ | ○ |
| Reliability of supply/back-up water supply availability | ○ | ○ | ○ | ○ | ○ |
| Regulations/regulatory actions | ○ | ○ | ○ | ○ | ○ |
| Storage availability | ○ | ○ | ○ | ○ | ○ |
| Supplementation needed | ○ | ○ | ○ | ○ | ○ |
| Technical expertise of local utility operators | ○ | ○ | ○ | ○ | ○ |
| Indirect potable reuse not allowed/considered | ○ | ○ | ○ | ○ | ○ |
| Direct potable reuse not allowed/considered | ○ | ○ | ○ | ○ | ○ |
| Other 1 (specify: ____________________) | ○ | ○ | ○ | ○ | ○ |
| Other 2 (specify: ____________________) | ○ | ○ | ○ | ○ | ○ |

[These are the essay type questions.]
Below you have the opportunity to tell us more about the two most important impediments you rated in the previous question. You are not required to provide this information, but your thoughts are important and will help with our efforts to expand the use of reclaimed water.

Please identify the most important impediment from question 1: [dropdown]
Please describe the above impediment in more detail: [text box]
Please tell us what you think could be done to mitigate or eliminate this impediment: [text box]
Please identify the second most important impediment from question 1: [dropdown]
Please describe the above impediment in more detail: [text box]
Please tell us what you think could be done to mitigate or eliminate this impediment: [text box]

Question 2: Please evaluate the importance of the following incentives that could further the expanded use of reclaimed water:

| Incentives | Not Important | Somewhat Important | Moderately Important | Important | Very Important |
|---|---|---|---|---|---|
| Funding assistance for reclaimed water projects | ○ | ○ | ○ | ○ | ○ |
| Funding or other assistance for educational programs to influence public perception | ○ | ○ | ○ | ○ | ○ |
| Increased permit durations for related groundwater permits | ○ | ○ | ○ | ○ | ○ |
| Regulatory Changes | ○ | ○ | ○ | ○ | ○ |
| Other 1 (specify: ____________________) | ○ | ○ | ○ | ○ | ○ |
| Other 2 (specify: ____________________) | ○ | ○ | ○ | ○ | ○ |

Please identify the most important incentive from question 2: [dropdown]
Please describe the above incentive in more detail: [text box]
Please identify the second most important incentive from question 2: [dropdown]

Please describe the above incentive in more detail: [text box]

Question 3: Please evaluate the importance of the following methods for increasing storage of reclaimed water in your area:

| Methods | Not Important | Somewhat Important | Moderately Important | Important | Very Important |
|---|---|---|---|---|---|
| Aquifer recharge | ○ | ○ | ○ | ○ | ○ |
| Aquifer storage and recovery | ○ | ○ | ○ | ○ | ○ |
| Dispersed Water Storage | ○ | ○ | ○ | ○ | ○ |
| Reservoirs | ○ | ○ | ○ | ○ | ○ |
| Salt Water Barrier | ○ | ○ | ○ | ○ | ○ |
| Wetlands and other natural features | ○ | ○ | ○ | ○ | ○ |
| Other 1 (specify: ____________________) | ○ | ○ | ○ | ○ | ○ |
| Other 2 (specify: ____________________) | ○ | ○ | ○ | ○ | ○ |

Please identify the most important storage method in question 3: [dropdown]
Please tell us why you think this is the most important method for increasing storage of reclaimed water: [text box]
Can you tell us what you believe are the impediments to developing this regional storage method: [text box]
What could be done to mitigate or eliminate these impediments? [text box]
Please identify the second most important storage method in question 3: [dropdown]
Please tell us why you think this is the most important method for increasing storage of reclaimed water: [text box]
Can you tell us what you believe are the impediments to developing this regional storage method: [text box]
What could be done to mitigate or eliminate these impediments? [text box]

Question 4: Please evaluate the degree of importance of the following factors in prohibiting or complicating the indirect potable use of reclaimed water:

| Factors | Not Important | Somewhat Important | Moderately Important | Important | Very Important |
|---|---|---|---|---|---|
| Engineering constraints/technology not available | ○ | ○ | ○ | ○ | ○ |
| Environmental constraints | ○ | ○ | ○ | ○ | ○ |
| Fiscal constraints (cost prohibitive, bond funding, utility rate structures, etc.) | ○ | ○ | ○ | ○ | ○ |
| Public health issues | ○ | ○ | ○ | ○ | ○ |
| Public perception/customer resistance | ○ | ○ | ○ | ○ | ○ |
| Regulations/regulatory actions | ○ | ○ | ○ | ○ | ○ |
| Other 1 (specify: ____________________) | ○ | ○ | ○ | ○ | ○ |
| Other 2 (specify: ____________________) | ○ | ○ | ○ | ○ | ○ |

Please identify the most important impediment from question 4: [dropdown]
Please describe the above impediment in more detail: [text box]
Please tell us what you think could be done to mitigate or eliminate this impediment: [text box]
Please identify the second most important impediment from question 4: [dropdown]
Please describe the above impediment in more detail: [text box]
Please tell us what you think could be done to mitigate or eliminate this impediment: [text box]

Question 5: Are there other issues concerning reclaimed water that you'd like to discuss? [text box]

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## Stormwater/Excess Surface Water Survey

There are four primary questions in this section. After each question there will be an opportunity to further describe your ideas concerning stormwater and excess surface water. You are not obligated to answer the open-ended questions, but your insight will help us identify and develop solutions to the constraints on the expanded use of stormwater and excess surface water.

We appreciate any further details or insight you can offer in addition to these four questions.

Question 1: Please evaluate the degree of importance of the following factors in prohibiting or complicating the expanded use of stormwater/excess surface water:

| Factors | Not Important | Somewhat Important | Moderately Important | Important | Very Important |
|---|---|---|---|---|---|
| Engineering constraints/technology not available | ○ | ○ | ○ | ○ | ○ |
| Environmental constraints | ○ | ○ | ○ | ○ | ○ |
| Fiscal constraints (cost prohibitive, bond funding, utility rate structures, etc.) | ○ | ○ | ○ | ○ | ○ |
| Infrastructure availability | ○ | ○ | ○ | ○ | ○ |
| Permit durations are too short | ○ | ○ | ○ | ○ | ○ |
| Public health issues | ○ | ○ | ○ | ○ | ○ |
| Public perception/customer resistance | ○ | ○ | ○ | ○ | ○ |
| Public's trust of facility operators | ○ | ○ | ○ | ○ | ○ |
| Regulations/regulatory actions | ○ | ○ | ○ | ○ | ○ |
| Reliability/seasonality of source | ○ | ○ | ○ | ○ | ○ |
| Storage availability | ○ | ○ | ○ | ○ | ○ |
| Technical expertise of local facility operators | ○ | ○ | ○ | ○ | ○ |
| Other 1 (specify: ____________________) | ○ | ○ | ○ | ○ | ○ |
| Other 2 (specify: ____________________) | ○ | ○ | ○ | ○ | ○ |

Below you have the opportunity to tell us more about the two most important impediments you rated in the previous question. You are not required to provide this information, but your thoughts are important and will help with our efforts to expand the use of stormwater/excess surface water.

Please identify the most important factor in prohibiting or complicating the expanded use of stormwater/excess surface water: [dropdown]
Please describe the above constraint in more detail: [text box]
Please tell us what you think could be done to mitigate or eliminate this constraint: [text box]
Please identify the second most important factor in prohibiting or complicating the expanded use of stormwater/excess surface water: [dropdown]
Please describe the above constraint in more detail: [text box]
Please tell us what you think could be done to mitigate or eliminate this constraint: [text box]

Question 2: Please evaluate the importance of the following incentives that could further the expanded use of stormwater/excess surface water:

| Incentives | Not Important | Somewhat Important | Moderately Important | Important | Very Important |
|---|---|---|---|---|---|
| Funding assistance for stormwater/ excess surface water projects | ○ | ○ | ○ | ○ | ○ |
| Funding or other assistance for educational programs to influence public perception | ○ | ○ | ○ | ○ | ○ |
| Increased permit durations | ○ | ○ | ○ | ○ | ○ |
| Regulatory changes | ○ | ○ | ○ | ○ | ○ |
| Other 1 (specify: ____________________) | ○ | ○ | ○ | ○ | ○ |
| Other 2 (specify: ____________________) | ○ | ○ | ○ | ○ | ○ |

- Please identify the most important incentive from question 2: [dropdown]
- Please describe the above incentive in more detail: [text box]
- 
- Please identify the second most important incentive from question 2: [dropdown]
- Please describe the above incentive in more detail: [text box]

Question 3: Please evaluate the importance of the following methods for increasing storage of stormwater/excess surface water in your area:

| Methods | Not Important | Somewhat Important | Moderately Important | Important | Very Important |
|---|---|---|---|---|---|
| Aquifer recharge | ○ | ○ | ○ | ○ | ○ |
| Aquifer storage and recovery | ○ | ○ | ○ | ○ | ○ |
| Dispersed Water Storage | ○ | ○ | ○ | ○ | ○ |
| Reservoirs | ○ | ○ | ○ | ○ | ○ |
| Salt Water Barrier | ○ | ○ | ○ | ○ | ○ |
| Wetlands and other natural features | ○ | ○ | ○ | ○ | ○ |
| Other 1 (specify: ____________________) | ○ | ○ | ○ | ○ | ○ |
| Other 2 (specify: ____________________) | ○ | ○ | ○ | ○ | ○ |

Please identify the most important storage method in question 3: [dropdown]
Why do you believe this is the most important compared to other options? [text box]
What are the impediments to developing this regional storage method? [text box]
What could be done to mitigate or eliminate these impediments? [text box]
Please identify the second most important storage method in question 3: [dropdown]
Why do you believe this is the most important compared to other options? [text box]
What are the impediments to developing this regional storage method? [text box]
What could be done to mitigate or eliminate these impediments? [text box]

<u>Question 4</u>: Are there other issues concerning stormwater/excess surface water that you'd like to discuss? [text box]

-----------------------------------------------------------------------------------------------------------------------------

<u>Definitions Used in the Survey</u>

Aquifer Recharge means the enhancement of natural groundwater supplies using man-made conveyances such as infiltration basins or injection wells.
Aquifer Storage and Recovery means injecting water underground and storing it for future withdrawal for beneficial purposes.
Direct potable reuse, for the purposes of this survey, means the introduction of reclaimed water directly into a drinking water treatment plant for final treatment to drinking water standards before distribution.
Dispersed Water Storage means the retention of regional stormwater runoff by private and public land owners, rather than allowing this water to drain off site into rivers and lakes. Typically, this water is stored using relatively simple structures to hold water on the landscape.
Excess Surface Water, for the purpose of this survey, means water withdrawn from rivers, lakes or other water bodies that is in excess of the amount of water needed to sustain healthy ecological conditions in the water body.
Indirect potable reuse means the augmentation of either surface water or groundwater with reclaimed water, where natural processes of filtration and dilution of the water with natural flows will occur prior to intake by a drinking water treatment plant.
Reclaimed water, except as specifically provided in Chapter 62-610, F.A.C., means water that has received at least secondary treatment and basic disinfection, and is reused after flowing out of a domestic wastewater treatment facility [Rule 62-610.200(48), F.A.C.].
Stormwater, for the purpose of this survey, refers to the flow of water which results from, and which occurs immediately following, a rainfall event and which is normally captured in ponds, swales, or similar areas for water quality treatment or flood control.
Wetlands and other natural features, for the purposes of this survey, means the storage of water to create, enhance, or restore wetlands, and to indirectly recharge the aquifer or augment stream flows from these areas.

## Appendix C-3: Survey Respondent Characteristics

The following graphs summarize descriptive information about the 951 survey respondents. All charts present statewide data. The survey allowed multiple responses for questions graphed in Figures C3.1-C3.3; therefore, the percentage totals for these questions will not add to 100 percent.

1. Survey question: **Which water management district(s) do you interact with?**

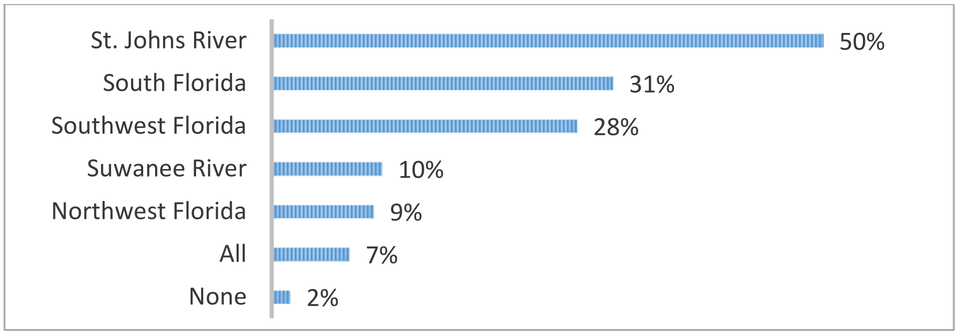


Figure C3.1: Survey Stakeholder and WMD Affiliation

2. Survey question: **How would you describe yourself?**

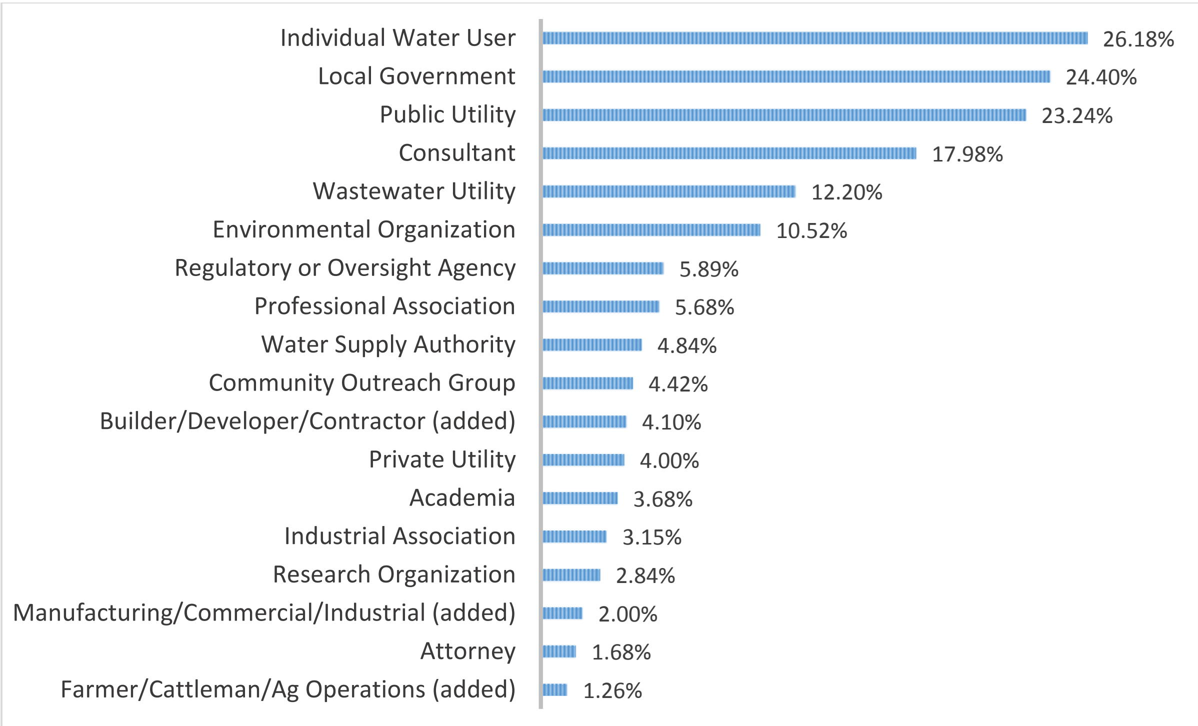


Figure C3.2: Respondent Self-Description

For this question, respondents could select among 15 categories, or select up to two “other” designations and specify a category name for each. Initially, when processing the “other” responses, DEP removed responses that had a rating but no corresponding text description, a text description but no corresponding rating, or nonresponsive answers (e.g., “none,” “I didn’t understand the question,” etc.). After examining the remaining 168 “other” responses, DEP placed 98 responses into existing categories. Many of these assignments could be made because respondents had used “other” to provide more details about their selection of an existing category. DEP then assigned the remaining 70 responses into one of three new categories, indicated by the term “added” after the category name in **Figure C3.2**. This figure shows that survey respondents represent a wide variety of interests.

3. Survey question: **Please indicate which water use sectors are of interest to you:**

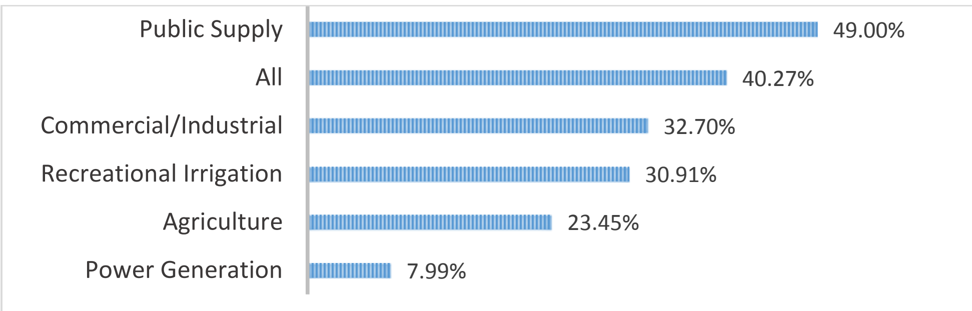


Figure C3.3: Water Use Sectors of Interest to Respondents

4. Survey question: **Please indicate which** [survey] **areas you are interested in:**

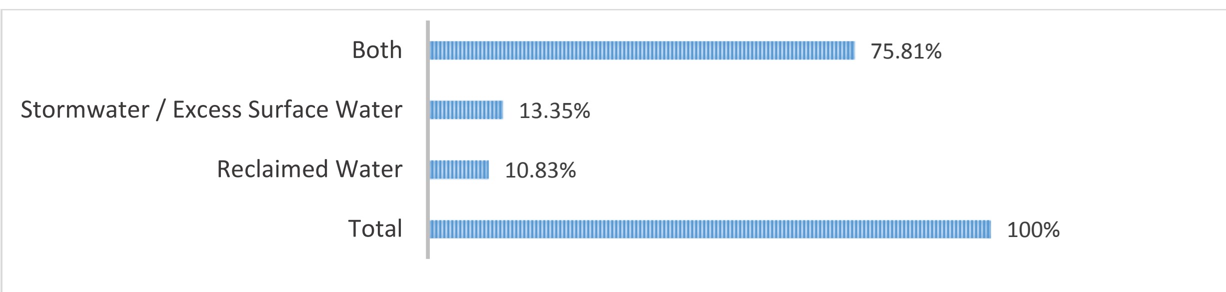


Figure C3.4: Survey Sections Completed by Respondents

## APPENDIX C-4: RANKING AND IMPORTANCE BY SURVEY TOPIC

The following tables summarize the survey ratings results for the lists of impediments, incentives, and storage methods. Respondents could rate as many items on a particular list as desired. Because ratings of all items on a list was not required, and because a few items applied to one survey section and not the other, there is not an equal number of ratings for each listed item.

To obtain an importance ranking, DEP added together the numbers of times important and most important were selected each item, and listed the ranked items in descending order based on this total. DEP also looked at the data distribution across the five rating categories for each item to determine how much agreement there was that a particular item indeed was important to most survey takers.

For each ratings question, respondents could specify up to two “other” categories and provide a name for each. Some respondents used “other” to provide more details about their ratings of existing categories. The more commonly identified “new” categories are provided at the end of each question. Listings in these “other” tables are in random order. Respondents identifying these new categories ranked them between “moderately important” and “very important.”

### 8.1.1 Impediments

| Reclaimed Water Impediments | Not Important | Somewhat Important | Moderately Important | Important | Very Important | Importance Ranking | Total Responses |
|---|---|---|---|---|---|---|---|
| Infrastructure availability | 13 | 37 | 101 | 337 | 317 | 654 | 805 |
| Fiscal constraints (cost prohibitive, bond funding, utility rate structures, etc.) | 13 | 49 | 145 | 255 | 349 | 604 | 811 |
| Storage availability | 19 | 55 | 148 | 313 | 271 | 584 | 806 |
| Regulations/regulatory actions | 25 | 59 | 166 | 278 | 278 | 556 | 806 |
| Environmental constraints | 37 | 88 | 142 | 291 | 255 | 546 | 813 |
| Reliability of supply/back-up water supply availability | 30 | 83 | 181 | 293 | 217 | 510 | 804 |
| Public perception/customer resistance | 52 | 106 | 176 | 231 | 243 | 474 | 808 |
| **Direct potable reuse not allowed/considered** | 70 | 77 | 172 | 257 | 210 | 467 | 786 |
| Public health issues | 65 | 141 | 142 | 205 | 254 | 459 | 807 |
| **Inefficient use of current reclaimed water supplies** | 62 | 128 | 164 | 271 | 186 | 457 | 811 |
| **Indirect potable reuse not allowed/considered** | 67 | 81 | 210 | 260 | 168 | 428 | 786 |
| **Supplementation needed** | 41 | 96 | 246 | 278 | 130 | 408 | 791 |
| Technical expertise of local utility operators | 49 | 135 | 212 | 264 | 142 | 406 | 802 |
| Public's trust of utility operators | 83 | 133 | 185 | 226 | 176 | 402 | 803 |
| Engineering constraints/technology not available | 135 | 174 | 164 | 216 | 119 | 335 | 808 |

Table C4.1: Reclaimed Water Impediments -- Ratings Results

*Impediments shown in purple were unique to the reclaimed water question only.*

| Storm/Excess Surface Water Impediments | Not Important | Somewhat Important | Moderately Important | Important | Very Important | Importance Ranking | Total Responses |
|---|---|---|---|---|---|---|---|
| Fiscal constraints (cost prohibitive, bond funding, utility rate structures, etc.) | 11 | 19 | 94 | 159 | 280 | 439 | 563 |
| Storage availability | 15 | 26 | 84 | 214 | 216 | 430 | 555 |
| Infrastructure availability | 13 | 34 | 88 | 226 | 198 | 424 | 559 |
| Reliability/seasonality or source | 21 | 38 | 117 | 214 | 164 | 378 | 554 |
| Environmental constraints | 24 | 66 | 110 | 210 | 154 | 364 | 564 |
| Regulations/regulatory actions | 21 | 67 | 126 | 179 | 162 | 341 | 555 |
| Public perception/customer resistance | 58 | 95 | 136 | 158 | 111 | 269 | 558 |
| Engineering constraints/technology not available | 84 | 111 | 115 | 169 | 80 | 249 | 559 |
| Public health issues | 64 | 97 | 145 | 142 | 103 | 245 | 551 |
| Technical expertise of local utility operators | 52 | 104 | 146 | 146 | 90 | 236 | 538 |
| **Permit durations are too short** | 97 | 99 | 144 | 139 | 68 | 207 | 547 |
| Public's trust of utility operators | 84 | 124 | 147 | 112 | 85 | 197 | 552 |

Table C4.2: Storm/Surface Water Impediments -- Ratings Results

*Impediment shown in blue was unique to the stormwater/excess surface water question only.*

| “Other” Impediment Categories |
|---|
| Water quality (nutrients, pharmaceuticals, disinfectant by-products, other micro constituents) |
| Water conservation |
| Land/funding for storage facilities; cost for land and storage is too expensive |
| Minimum flows and levels |
| Reduce DEP regulations/constraints, regulations based on rare exceptions instead of normal situations |
| Sea level rise limiting payback on investment |
| Balance supply and demand (where water is needed, how much is needed, distribution, future demand forecasting) |
| Protection of sensitive natural areas and vulnerable areas (karst areas, areas with TMDLs for nutrients) |
| Better coordination among governmental agencies, utilities, developers |
| Quantification of nutrient and microconstituent loading |
| Public/private costs to produce and use these sources |
| Government agency acceptance of practices, willingness to change, leadership |
| Lack of incentives to promote reuse and stormwater use |
| Public education |
| Cost vs. benefit, cost benefit analyses |
| Reluctance of use by agriculture,  acceptance of food irrigated with reclaimed water, food safety |
| Policy matching public desires |
| Lack of coordination among permittees for potential interconnected systems |
| Research/demonstration data needed, science emerging from agency studies that don’t reflect reality in the field |
| Credits needed for using on-site treatment ponds, constructing detention ponds |

Table C4.3:  "Other" Impediments Identified by Respondents

8.1.2 Incentives

| Reclaimed Water Incentives | Not Important | Somewhat Important | Moderately Important | Important | Very Important | Importance Ranking | Total Responses |
|---|---|---|---|---|---|---|---|
| Funding assistance for reclaimed water projects | 13 | 17 | 51 | 186 | 478 | 664 | 745 |
| Regulatory Changes | 27 | 50 | 118 | 234 | 256 | 490 | 685 |
| Funding or other assistance for educational programs to influence public perception | 40 | 88 | 133 | 220 | 257 | 477 | 738 |
| Increased permit durations for related groundwater permits | 104 | 94 | 166 | 219 | 151 | 370 | 734 |

Table C4.-4: Reclaimed Water Incentives – Ratings Results

| Storm/Excess Surface Water Incentives | Not Important | Somewhat Important | Moderately Important | Important | Very Important | Importance Ranking | Total Responses |
|---|---|---|---|---|---|---|---|
| Funding assistance for reclaimed water projects | 9 | 19 | 30 | 141 | 356 | 497 | 555 |
| Regulatory Changes | 22 | 43 | 115 | 175 | 181 | 356 | 536 |
| Funding or other assistance for educational programs to influence public perception | 39 | 72 | 137 | 168 | 130 | 298 | 546 |
| Increased permit durations | 71 | 89 | 134 | 152 | 94 | 245 | 540 |

Table C4.5: Storm/Excess Surface Water Incentives – Ratings Results

| **"Other" Incentives Categories** |
| --- |
| Water quality credits, |
| Water conservation, examine how to use less water—not use more of these sources |
| Tax incentives |
| Costs – discounted rate periods, rebates/cost assistance for customers, cost structures, decrease residential bills for use |
| Regulations – need to make sense/not impede solutions, ensure new regulations do NOT conflict with existing regulations |
| Regulations – regulation of agri-phosphorus, changes to stormwater regulations, eliminate 100% retention regulation |
| Identify more industrial, commercial, and agricultural uses |
| Dispersed storage incentives for land owners |
| Increase efficiency, waste less |
| Require connections for non-potable use by agricultural users, industrial users, and developers and use on public lands |
| Education needed for public, elected officials, utility boards |
| Raise standards for permitting, then monitor the "use" |
| Cap and trade, develop economic models for water use trading, ROMA banks |
| Regular inspections of all septic systems, utility wastewater discharges |
| Stop allowing non-essential uses (e.g., golf courses) |
| Stop selling groundwater to private industry |
| Uphold current requirements to share adversity |
| Decrease permit durations and renewal for groundwater permits |
| Disposal fees |
| End subsidies for waste |
| Tie funding to use of local ordinances |
| Recharge credits (transferable) |
| Streamline CUP permits for stormwater reuse |
| Funding assistance that recognizes community stewardship (success of past projects, etc.) over population density |

Table C4.6: "Other" Incentives Identified by Respondents

### 8.1.3 Storage Methods

| Reclaimed Water Incentives | Not Important | Somewhat Important | Moderately Important | Important | Very Important | Importance Ranking | Total Responses |
|---|---|---|---|---|---|---|---|
| Wetlands and other natural features | 34 | 48 | 115 | 211 | 288 | 499 | 696 |
| Aquifer recharge | 65 | 56 | 86 | 230 | 269 | 499 | 706 |
| Aquifer storage and recovery | 85 | 72 | 87 | 222 | 236 | 458 | 702 |
| Reservoirs | 49 | 77 | 148 | 227 | 199 | 426 | 700 |
| Dispersed Water Storage | 34 | 78 | 159 | 246 | 176 | 422 | 693 |
| Salt Water Barrier | 82 | 87 | 142 | 202 | 169 | 371 | 682 |

Table C4.7: Reclaimed Water Storage Methods – Ratings Results

| Storm/Excess Surface Water Incentives | Not Important | Somewhat Important | Moderately Important | Important | Very Important | Importance Ranking | Total Responses |
|---|---|---|---|---|---|---|---|
| Wetlands and other natural features | 13 | 39 | 76 | 183 | 221 | 404 | 532 |
| Aquifer recharge | 42 | 27 | 81 | 180 | 197 | 377 | 527 |
| Dispersed Water Storage | 27 | 44 | 100 | 207 | 139 | 346 | 517 |
| Reservoirs | 37 | 53 | 86 | 178 | 164 | 342 | 518 |
| Aquifer storage and recovery | 57 | 53 | 84 | 160 | 171 | 331 | 525 |
| Salt Water Barrier | 66 | 85 | 105 | 155 | 100 | 255 | 511 |

Table C4.8: Storm/Excess Surface Water Storage Methods – Ratings Results

| **“Other” Storage Method Categories** |
| --- |
| Storage tanks, ground storage tanks, ponds, irrigation ponds, cisterns |
| Aquifer recharge, dry season recharge of stormwater ponds, highlands recharge |
| Land application, irrigation rather than aquifer recharge to reduce nitrogen and phosphorous concentrations in our natural springs |
| Discharge directly to canals |
| Water conservation |
| Clay settling areas, SWMF that hold water rather than absorb water |
| Restoring natural drainage patterns, reversing excessive drainage features |
| Regulations - agricultural practices regulation, ERP and compensatory storage revisions |
| Pollution of aquifer, environment is unknown |
| Package plants, membrane bio reactors, actual stormwater treatment |
| Use of permeable materials in construction |

Table C4.9: “Other” Storage Methods Identified by Respondents

•

### 8.1.4 Indirect Potable Reuse Impediments (only for the reclaimed water section)

| Indirect Potable Reuse Impediments | Not Important | Somewhat Important | Moderately Important | Important | Very Important | Importance Ranking | Total Responses |
|---|---|---|---|---|---|---|---|
| Fiscal constraints (cost prohibitive, bond funding, utility rate structures, etc.) | 18 | 23 | 85 | 220 | 314 | 534 | 660 |
| Public perception/customer resistance | 21 | 50 | 99 | 190 | 303 | 493 | 663 |
| Regulations/regulatory actions | 18 | 60 | 113 | 246 | 208 | 454 | 645 |
| Environmental constraints | 37 | 85 | 146 | 229 | 163 | 392 | 660 |
| Public health issues | 34 | 80 | 153 | 186 | 204 | 390 | 657 |
| Engineering constraints/technology not available | 105 | 121 | 150 | 168 | 109 | 277 | 653 |

Table C4.10: Indirect Potable Reuse Impediments – Ratings Results

| "Other" Indirect Potable Reuse Impediment Categories |
|---|
| Loss of traditional water allocation |
| Groundwater is readily available and less expensive, cost effectiveness, need |
| Local utility knowledge and competence |
| Political will |
| Public ignorance of basic BMPs for reuse and irrigation |
| Land availability in urban areas |
| Not under private ownership and control |
| Government involvement |

Table C4.11: "Other" Incentives Identified by Respondents

## APPENDIX C-5: SURVEY ESSAY THEMES

1. **Reclaimed Water Themes**
   a. **Costs/Infrastructure**
      i. It's costly for utilities to treat and distribute reclaimed water. Less expensive non-reclaimed alternatives are available.
      ii. Need cost/benefit analyses & risk assessments. Formalize an economic framework or methodology for assessing the economic value of reclaimed and reuse.
      iii. Regional projects are more economically viable than local projects. Generally, local governments can take advantage only of needs/uses within its jurisdiction. Partnering with other local and regional governments by interconnecting reclaimed water transmission systems, in many instances, can increase the efficiency of use with and without storage.

   b. **Funding**
      i. More funding is needed for education, research, and projects.
      ii. Develop a Reclaimed Water Projects Grants Program. Provide funding for smaller communities, and more grants for municipalities.
      iii. Expand Legislative funding, grants, and low-interest loans for reuse projects to include permitting, design, construction, and land. Provide grants for developing storage to meet peak demands.
      iv. Significantly expand state funding on water infrastructure to compare with transportation infrastructure spending.

   c. **Environmental Concerns**
      i. Concerns with microconstituents and high nutrient levels in reclaimed water.
      ii. Differing opinions on whether or not reclaimed water should be used to recharge an aquifer or be stored in an aquifer.

   d. **Public Perception/Education**
      i. Issues related to poor public perception remain, and educational outreach programs for both elected officials and the general public are essential. There is customer resistance to cost, inconvenience, and quality of reclaimed water, as well as safety concerns.
      ii. People will support reclaimed water if they are informed and understand how projects will benefit them and their communities. Education will help develop reuse demand to support development of reclaimed system. Public education will induce voters to put more pressure on their elected officials to make better use of this important source of water.
      iii. We need credible individuals who will counter those who either deny we have a water supply problem or insist on "less government" no matter the reason. Frequent appearances of qualified individuals on public TV/radio/large and small group audience programs would help.
      iv. Need to educate public well in advance of a proposed project.

   e. **Seasonality/Storage**
      i. Seasonality of supply/demand is a problem. Quality, quantity, timing, and distribution are key. Storage and supplementation are the key elements in providing a sustainable supply of reclaimed water.

ii. Use stormwater to supplement reclaimed water. If enough supplemental water is available, there is no need to store the reclaimed product.

iii. Some ideas for storage are:

1. It's best to combine wetlands and reclaimed water storage. This should not be costly if the wetlands are on conservation lands. An impediment to reclaimed water systems that discharge to wetlands and natural water bodies is the risk of introducing additional nutrients to a system that could produce impacts to natural systems. There are technical solutions available in most cases to avoid impacts, such as advanced pretreatment and use of constructed wetland cells to remove nutrients. Also, the natural hydroperiod needs to be considered.
2. Dry season recharge of stormwater ponds with reclaimed water that can be used as an irrigation supply is a simple cost effective solution. The regulations need to be clearer and the limited effects of intermittent discharge need to be put into the proper perspective.
3. Interconnecting reclaimed water systems will decrease the need for storage.
4. The State should consider allowing direct discharge of reclaimed water to fresh water canals since many residents use local fresh water canals for irrigation purposes. This will limit the need to install reclaimed water distribution systems.
5. Dispersed water storage will allow more widespread use of reclaimed water. Large landscapes such as ranches, agricultural areas, and open spaces can provide environmental services by storing and allowing reclaimed water to filter nutrients, rehydrate wetlands, etc.

**f. <u>Regulations/Management</u>**

i. There were differing views on whether there were too many regulations or two few. Some wanted more regulations, more treatment, and more water quality monitoring for reclaimed water discharges into wetlands or basins with TMDLs. Others stated that stringent regulations will not promote the use of reclaimed water.

ii. Update regulations to meet current conditions. Revisiting the regulatory requirements on a more frequent basis is needed to stay up to speed with the changes in the treatment of reclaimed water.

iii. Long-term CUPs can reduce demand for reclaimed water. On the other hand, increased permit duration adds economic incentive and security to know that the system design won't be seriously impaired by a permit renewal in five years.

iv. Too many restrictive/vague/conflicting regulations. Clarify/improve reclaimed water regulations. Uniform and common sense permitting rules are needed.

v. More research before more regulation. WMDs and DEP need to complete their studies and be peer-reviewed by stakeholders before institution of new regulations.

vi. More incentives and less penalties. Focus on making it easier to build or expand reclaimed water systems.

vii. Some ideas were:
    1. Develop a Zone of Discharge (ZOD) concept, whereby regulatory limits involving injection of reclaimed water, need only be met at the edge of a defined ZOD, rather than in the water actually being injected. This would necessitate restrictions within the ZOD as to use of the water (i.e. would not be used for drinking water supply, but for other industrial uses).
    2. Current regulations do not allow for credits against groundwater withdrawals for use of rapid infiltration basins for wastewater effluent disposal. Thus, reclaimed water projects that cannot identify a user for reclaimed water that is acknowledged as beneficial reuse do not receive the credits against their groundwater withdrawals, which is a major incentive for implementing reclaimed water projects.

**g. Research**

i. The state should take the lead in conducting a study to identify the location and amount of excess reclaimed water resources and match these resources up with areas of need. One important consideration is location/distance to demand and the associated cost of transmission. Such a study would give local and regional governments a road map to storage alternatives they could take advantage of to increase the use efficiency of their water resources.
ii. More research into alternate methods of storage and recovery, and on reducing risks with better treatment.
iii. Improve feasibility analyses.

**h. Agriculture**

i. Find suitable crops for reclaimed water, such as citrus and other similar corps as well as grains, grass, peanuts, hay, alfalfa, corn, etc.
ii. Change regulations to expand agricultural use.

**i. Incentives**

i. Incentivize industrial and agricultural uses.
ii. Provide incentives for new development to capture and store runoff for irrigation use. Excess can be diverted to the existing reclaimed system.
iii. Incentivize utilities to scale-up/improve technologies.

**j. Indirect/Direct Potable Reuse**

i. Through the use of indirect or direct potable reuse 100% of reclaimed water resources could be achieved with an increase in use efficiency and potable water offset.
ii. Public education is key to IPR/DPR.
iii. IPR/DPR needs clear regulations.
iv. Other (better) options to IPR/DPR are available.
v. Develop low cost treatment for reclaimed water and purification to the degree of potable water to use the same distribution system.

**2. Stormwater Themes**

**a. Nutrient Pollution**

i. Controlling nutrient pollution from stormwater is a top priority. Lake Okeechobee, the St. Lucie River, and Caloosahatchee River are three examples of water bodies that suffer from the influx of nutrients from stormwater from urban areas. Nutrient loading from urban areas needs to be addressed by the Department and further development of urban Best Management Practices programs should then follow.

ii. Nutrient pollution reduction from stormwater runoff must be a top priority. Waterways across the state are impaired from too many nutrients triggering toxic algal blooms. Additional protection is necessary. Natural systems must be protected from excessive nutrient loading from urban areas as well as from runoff from agricultural lands.

**b. Regional Storage and Treatment**

i. Regional storage and treatment areas can be implemented where there is land available. Land owners can enter agreements with state and local agencies to provide sites to retain water and provide nutrient reduction services through natural filtration processes. In areas with the right soils, such projects can serve to recharge the aquifer, create wetlands and habitats, and reduce the costs of developing costly treatment facilities. This is already being done in the ranchlands areas of Florida and is referred to as *Payment for Environmental Services*.

ii. The City of Winter Haven supports the goals of Senate Bill 536 Study and has developed a regional water storage and ecosystem restoration project that provides the State a timely opportunity to evaluate the feasibility, benefits, and cost of expanding the beneficial use of reclaimed water, stormwater, and excess surface water through regional storage on public and private lands in the Peace Creek Drainage Canal watershed.

iii. We support storage on public and private lands that allow waters to recharge into the aquifer, a method for which you saw great support in the survey you conducted.

**c. Stormwater Harvesting**

i. Rainwater harvesting is a real time project ALL homeowners could use which could greatly reduce stormwater runoff.

ii. Provided reference to a potential project to harvest stormwater runoff for recharge of the Floridan Aquifer to maintain lake levels in the Keystone Heights area.

**d. Regulations**

i. Establish rules and regulations necessary to mandate and incentivize efficiency and protect our water resources. First and foremost, reinstate the rulemaking process to implement the following nine water conservation “rule enhancements” to the Consumptive Use Permit (CUP) and Environmental Resource Permit (ERP) application processes proposed by SRJWMD staff in 2010 to require: 1) landscape irrigation ordinance, 2) informative billing, 3) stormwater reuse, 4) water use reporting for per capita calculations, 5)updated regulatory approach for public supply water conservation, 6) ERP water conservation provisions, 7) concurrent ERP/CUP application processing, 8) water conservation rate structure, and 9) landscape irrigation system design/installation constraints.

**3. Excess Surface Water Themes**

**a. Funding**

i. Lack of funding for infrastructure was mentioned numerous times. Increased state and regional funding as well as forming regional partnerships can help address funding issues.

b. **Engineering Design**

**i.** Consider alternative design practices. Many comments suggested that innovation in engineering design and regulatory considerations are often in contrast.

**c. Permitting**

i. Many comments recommended streamlining permitting process or reducing permitting constraints. Flexibility in permitting was a key theme.

**d. Water Quality**

i. Be cautious of water quality considerations; this point was brought up a few times in different applications:
   1. Pollutant loads in stormwater from fertilizers and other sources should be more rigorously regulated “Control the Source.”
   2. Upstream water quality issues can reduce feasibility of surface water use for downstream users.

ii. Timing of flows and their impact on receiving waters/wetlands was brought up numerous times.
   1. The negative effects of fresh water timing on receiving estuaries were the focus of numerous comments.

iii. Some comments recommended increasing storage in natural wetlands/wetland enhancement.

e. **ASR**

i. Many opposing views on the use of Aquifer Storage and Recovery (ASR). ASR and aquifer recharge were frequently confused.

f. **Water Body Specific**

i. Several responses expressed that surface water should not be withdrawn from specific water bodies under any circumstances.

**4. Storage Methods – Aquifer Storage and Recovery Themes**

**a. Cost/Funding**

i. Cost drivers for ASR revolve primarily around treatment, operational and monitoring requirements for injecting water into potential drinking water aquifers.

ii. Because the success of ASR hinges upon hydrogeologic conditions that are typically not known or understood until the system is constructed and tested, there is an inherit uncertainty that a final permit can be obtained for an ASR project until it is already constructed and significant financial investment has already been made.

iii. Lack of funds for implementing ASR projects might inhibit expansion.

iv. Less expensive alternatives to storing water might make it a challenge to expand the use of ASR.

v. The additional energy (cost, carbon footprint) for required water treatment, monitoring and pumping may impact expansion of ASR.

b. **Regulations**
   i. ASR projects often involve acquiring multiple permits, such as UIC, NPDES, and Consumptive Water Use permits.
   ii. Underground Injection Control (UIC) regulations are typically configured for protection of the aquifer targeted for injection, but do not take into account the water resource benefits of the technology. Some of the criteria of other agencies inhibit the most beneficial implementation of the technology.
   iii. Some local regulations stricter than the State's may be hindering expansion of certain types of ASR.
   iv. Improved coordination between permitting agencies and with ASR permitting might provide improved incentives for expansion.

c. **Water Quality**
   i. Several ASR systems have experienced mobilization of metals (arsenic, uranium) during the initiation of cycle testing. These metals typically decrease over time. However, their occurrence can create perceived risk and concern about degradation of the aquifer and often necessitate increased monitoring and treatment processes. Permitting of the ASR systems is more difficult because of this occurrence.
   ii. Current regulations require the treatment (disinfection) for bacteria prior to injection into a potential drinking water aquifer. Recent studies have indicated that bacteria have a limited life span after being injected into deep, anoxic aquifers.

d. **Public Input/Involvement –**
   i. The public's perception of ASR will have an impact on implementation of reclaimed water ASR, especially when the projects are in close proximity to drinking water supplies obtained from aquifers.

**5. Storage Methods –Aquifer Recharge Themes**

a. **Cost/Funding**
   i. Cost drivers for Direct Recharge (DR) revolve primarily around treatment, ownership of land for a Zone of Discharge, transmission, and operational and monitoring requirements for injecting water into potential drinking water aquifers.
   ii. Because the success of DR hinges upon hydrogeologic conditions that are typically not known or understood until the system is constructed and tested, there is an inherit uncertainty that a final permit can be obtained for an DR project until it is already constructed and significant financial investment has already been made.
   iii. Lack of funds for implementing DR projects might inhibit expansion.
   iv. Less expensive alternatives to storing water might make it a challenge to expand the use of DR.
   v. The additional energy (cost, carbon footprint) for required water treatment, monitoring and pumping may impact expansion of DR.
   vi. Direct Recharge dedicated to environmental and aquifer level restoration will require an operator and funding.

**b. Regulations**

i. Aquifer Recharge projects often involve acquiring multiple permits, such as UIC and Consumptive Water Use permits.

ii. Underground Injection Control (UIC) regulations are typically configured for protection of the aquifer targeted for injection, but do not take into account the water resource or ecological benefits of the technology. Some of the criteria of other agencies inhibit the most beneficial implementation of the technology.

iii. Some local regulations stricter than the State's may be hindering expansion of certain types of Aquifer Recharge.

iv. Improved coordination between permitting agencies and with Aquifer Recharge permitting might provide improved incentives for expansion.

**c. Operation**

i. Finding cooperators for Aquifer Recharge will be challenging unless there is a credit that can be applied to increase water use.

**d. Water Quality**

i. Several ASR and aquifer recharge systems have experienced mobilization of metals (arsenic, uranium) during the initiation of testing. These metals typically decrease over time. However, their occurrence can create perceived risk and concern about degradation of the aquifer and often necessitate increased monitoring and treatment processes. The same metals mobilization issue will be an issue with DR. There are few studies looking at metals mobilization in from direct recharge activities.

ii. Current regulations require the treatment (disinfection) for bacteria prior to injection into a potential drinking water aquifer. Recent studies have indicated that bacteria have a limited life span after being injected into deep, anoxic aquifers.

**e. Public Input/Involvement**

i. The public's perception of ASR and Aquifer Recharge will have an impact on implementation of reclaimed water DR, especially certain types of projects, when they are in close proximity to drinking water supplies obtained from the same aquifer.

**6. Storage Methods – Dispersed Water Management Themes**

**a. Funding**

i. Dispersed Water Management (DWM) projects on private lands are typically subject to short-term agreements (e.g., 10-years). Securing long-term funding to continue and/or expand the program is a challenge.

ii. To optimize available funding, must match willing landowner participants with target watersheds.

**b. Seasonality/Reliability**

i. Primarily a tool for management of excess wet-season discharges. Limited dry season use.

ii. Stores excess wet season flows subject to significant seepage and ET losses (more significant in southern peninsular Florida than north Florida since north Florida receives appreciable precipitation in winter months from cold fronts and ET losses are lessened in the winter).

iii. Water availability unlikely in dryer than normal (e.g. 1-in-10 drought) years. Potential for local/regional supply benefits in wet years, but unreliable in average years.

**c. <u>Benefits of DWM Expansion</u>**

i. A wet season flow management tool.
ii. Reduction of harmful downstream discharges.
iii. Benefits to water quality, wetland restoration, and habitat enhancement.
iv. Promote public / private partnerships (successfully accomplished in the SFWMD and SRWMD).
v. Important beneficial use for enhanced aquifer recharge to sustain and enhance spring and river flows, and supplement water supply (particularly in north-central Florida in rural, sparsely populated areas with numerous springs, limited AWS opportunities, and economically dependent on self-supplied agriculture).

7. **Storage Methods – Reservoir Themes**

**a. <u>General Comments</u>**

i. Storage must well planned and sited to match expected service needs.
ii. Different types and methods of storage are needed to successfully expand the use of reclaimed water, stormwater and excess surface water. However, there are limiting factors and risks each utility needs to take into account. Surface storage reservoirs are costly due to site planning, acquisition and construction costs. Other alternatives to surface storage should also be considered, including rapid infiltration basins and aquifer storage and recovery systems which can be less constrained by siting and property acquisition issues, and can be more economically developed.

**b. <u>Reservoirs vs. Smaller Storage Ponds</u>**

i. Smaller water storage ponds can be more easily sited and acquired. Cost effectiveness to obtain, construct, and maintain will depend on evaluations of existing versus future capacity needs.
ii. Smaller storage ponds can be important if also developed as wetlands and interconnected with other stormwater ponds to function as a regional water storage and treatment system.

**c. <u>Benefits</u>**

i. Reservoirs are a proven way to store water. Properly located, they can be constructed with acceptable environmental impact.
ii. Reservoirs can be funded as a Public-Private Partnership.
iii. Methods for reservoir water storage operations and management are well understood and reliable. Surface water reservoir storage is a method that is commonly used and accepted.
iv. Reservoirs can retain and treat nutrient-laden, stormwater runoff from discharge into lakes and rivers.
v. Reservoirs can be planned for reasonable access and water supply to regional water distribution systems.
vi. With proper design and treatment, reservoirs provide beneficial habitats and recreational areas.

vii. Reservoirs may be able to be used in parts of the state where the geology is not suitable for aquifer storage and recovery.

**d. <u>Impediments/Incentives</u>**

i. Land availability and costs for acquisition and development are the primary issues impacting building of new reservoirs. Large lands areas would be precluded from other uses. Some ideas on how to reduce reservoir costs include:

- 1. Provide as much advance planning as practical to reduce the potential for conflicts with other land uses and competition for land development.
- 2. Secure land development rights by purchase and/or donation well in advance of potential site development
- 3. Include reservoir site development among potential plans for open space reservation and protection.
- 4. Develop and implement long-range programs for asset management and development and include the program costs for new water sources in the costs for water supply.

ii. Funding assistance is needed for projects, education, and research. Sufficient cost-share funding is needed to generate interest in larger and, possibly, more cost-effective projects. Funding for regional systems may be more cost effective than building multiple smaller local systems. Cost-benefit analyses incorporating Triple Bottom Line methods of analysis are increasingly important for assessing the true value of alternatives.

iii. Location, land availability, and storage size are the predominant limiting factors. State and federal lands may be good candidates for storage. Topography (e.g., using upland areas) is an important consideration for siting reservoirs.

iv. Effective long-term planning and coordination among the utilities, local governments, state agencies and the private sector is needed. Suggestions included:

1. Develop a plan to hold workshops among the parties to encourage understanding of each other’s viewpoints.
2. Coordinate with the private sector and showing them how water storage projects could benefit them and their communities.
3. Encourage cooperation among WMDs, FDOT, and public work departments to develop regional stormwater management facilities that serve the dual purposes of water supply and stormwater volume retention/detention. FDOT could work with water utilities to facilitate the conveyance, through gravity and pumping of stormwater, from FDOT's and/or County/City right of ways.

v. More education is needed to understand and address concerns about reservoirs. Both the public (including land owners) and regulatory agencies need to be educated. One way to alleviate people's concerns is through a history of successful projects.

vi. Many respondents stated there are too many regulations and existing regulations are too stringent. Some advocated for “reasonable” environmental considerations. Other respondents believe unenforceable regulations are a problem. There was a recommendation to provide performance criteria for surface water sources instead of all-encompassing treatment requirements, since filtration and disinfection may be overkill in many instances. Possible solutions are:

1. Provide water quality and/or performance criteria for surface water sources instead of all-encompassing treatment requirements. There need to be more incentives on water withdrawal permits to entice utilities to provide for storage.
2. Provide incentives for new development to capture and store runoff for irrigation use. Excess can be diverted to the existing reclaimed system.

vii. Seepage of contaminants into the aquifer is a concern. Also, high levels of nutrients in a reservoir can create problems with algae and duck weed vegetation.

viii. Local geology determines where reservoirs can be placed. In some areas (e.g., south Florida), reservoirs are impractical. In other areas, reservoirs are the only feasible storage option.

**e. <u>Technical Issues</u>**

i. Capturing and managing local runoff from the surrounding land areas is fundamental to a successful reservoir plan.

ii. Developing systems that mimic natural systems rather than systems that show our ability to build "solutions" Generally results in lower costs and better quality water.

iii. Competent design. The selection of a reservoir site and development of a basis for design, construction, and operation/maintenance is highly site specific. For example, without adequate planning and design, any reservoir can have seepage issues, structural issues, high construction costs, and water quality issues. For example, there can be large water losses to evaporation; which, though planning, design, construction, and operation might be mitigated with the use of NSF approved biofilms, and other technology.

# APPENDIX D: RECLAIMED WATER

## APPENDIX D-1: SUMMARY OF KEY STATUTORY PROVISIONS

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- **Chapter 403, F.S.** authorizes DEP to regulate domestic wastewater facilities including the issuance of construction permits and operation permits for reuse facilities.

<u>Section 403.064, F.S. - Reuse of Reclaimed Water</u>

(1) The encouragement and promotion of water conservation, and reuse of reclaimed water, as defined by the department, are state objectives and are considered to be in the public interest. The Legislature finds that the reuse of reclaimed water is a critical component of meeting the state's existing and future water supply needs while sustaining natural systems. The Legislature further finds that for those wastewater treatment plants permitted and operated under an approved reuse program by the department, the reclaimed water shall be considered environmentally acceptable and not a threat to public health and safety. The Legislature encourages the development of incentive-based programs for reuse implementation.

(2) All applicants for permits to construct or operate a domestic wastewater treatment facility located within, serving a population located within, or discharging within a water resource caution area shall prepare a reuse feasibility study as part of their application for the permit. Reuse feasibility studies shall be prepared in accordance with department guidelines adopted by rule and shall include, but are not limited to:

(a) Evaluation of monetary costs and benefits for several levels and types of reuse.

(b) Evaluation of water savings if reuse is implemented.

(c) Evaluation of rates and fees necessary to implement reuse.

(d) Evaluation of environmental and water resource benefits associated with reuse.

(e) Evaluation of economic, environmental, and technical constraints.

(f) A schedule for implementation of reuse. The schedule shall consider phased implementation.

(3) The permit applicant shall prepare a plan of study for the reuse feasibility study consistent with the reuse feasibility study guidelines adopted by department rule. The plan of study shall include detailed descriptions of applicable treatment and water supply alternatives to be evaluated and the methods of analysis to be used. The plan of study shall be submitted to the department for review and approval.

(4) The study required under subsection (2) shall be performed by the applicant, and, if the study shows that the reuse is feasible, the applicant must give significant consideration to its implementation if the study complies with the requirements of subsections (2) and (3).

(5) A reuse feasibility study is not required if:

(a) The domestic wastewater treatment facility has an existing or proposed permitted or design capacity less than 0.1 million gallons per day; or

(b) The permitted reuse capacity equals or exceeds the total permitted capacity of the domestic wastewater treatment facility.

(6) A reuse feasibility study prepared under subsection (2) satisfies a water management district requirement to conduct a reuse feasibility study imposed on a local government or utility that has responsibility for wastewater management. The data included in the study and the

conclusions of the study must be given significant consideration by the applicant and the appropriate water management district in an analysis of the economic, environmental, and technical feasibility of providing reclaimed water for reuse under part II of chapter 373 and must be presumed relevant to the determination of feasibility. A water management district may not require a separate study when a reuse feasibility study has been completed under subsection (2).

(7) Local governments may allow the use of reclaimed water for inside activities, including, but not limited to, toilet flushing, fire protection, and decorative water features, as well as for outdoor uses, provided the reclaimed water is from domestic wastewater treatment facilities which are permitted, constructed, and operated in accordance with department rules.

(8) Permits issued by the department for domestic wastewater treatment facilities shall be consistent with requirements for reuse included in applicable consumptive use permits issued by the water management district, if such requirements are consistent with department rules governing reuse of reclaimed water. This subsection applies only to domestic wastewater treatment facilities which are located within, or serve a population located within, or discharge within water resource caution areas and are owned, operated, or controlled by a local government or utility which has responsibility for water supply and wastewater management.

(9) Local governments may and are encouraged to implement programs for the reuse of reclaimed water. Nothing in this chapter shall be construed to prohibit or preempt such local reuse programs.

(10) A local government that implements a reuse program under this section shall be allowed to allocate the costs in a reasonable manner.

(11) Pursuant to chapter 367, the Florida Public Service Commission shall allow entities under its jurisdiction which conduct studies or implement reuse projects, including, but not limited to, any study required by subsection (2) or facilities used for reliability purposes for a reclaimed water reuse system, to recover the full, prudently incurred cost of such studies and facilities through their rate structure.

(12) In issuing consumptive use permits, the permitting agency shall consider the local reuse program.

(13) A local government shall require a developer, as a condition for obtaining a development order, to comply with the local reuse program.

(14) After conducting a feasibility study under subsection (2), domestic wastewater treatment facilities that dispose of effluent by Class I deep well injection, as defined in 40 C.F.R. s. 144.6(a), must implement reuse to the degree that reuse is feasible, based upon the applicant’s reuse feasibility study. Applicable permits issued by the department shall be consistent with the requirements of this subsection.

(a) This subsection does not limit the use of a Class I deep well injection facility as backup for a reclaimed water reuse system.

(b) This subsection applies only to domestic wastewater treatment facilities located within, serving a population located within, or discharging within a water resource caution area.

(15) After conducting a feasibility study under subsection (2), domestic wastewater treatment facilities that dispose of effluent by surface water discharges or by land application methods must implement reuse to the degree that reuse is feasible, based upon the applicant’s reuse feasibility study. This subsection does not apply to surface water discharges or land application systems which are currently categorized as reuse under department rules. Applicable permits issued by the department shall be consistent with the requirements of this subsection.

(a) This subsection does not limit the use of a surface water discharge or land application facility as backup for a reclaimed water reuse system.
(b) This subsection applies only to domestic wastewater treatment facilities located within, serving a population located within, or discharging within a water resource caution area.
(16) Utilities implementing reuse projects are encouraged, except in the case of use by electric utilities as defined in s. 366.02(2), to meter use of reclaimed water by all end users and to charge for the use of reclaimed water based on the actual volume used when such metering and charges can be shown to encourage water conservation. Metering and the use of volume-based rates are effective water management tools for the following reuse activities: residential irrigation, agricultural irrigation, industrial uses, landscape irrigation, irrigation of other public access areas, commercial and institutional uses such as toilet flushing, and transfers to other reclaimed water utilities. Beginning with the submittal due on January 1, 2005, each domestic wastewater utility that provides reclaimed water for the reuse activities listed in this section shall include a summary of its metering and rate structure as part of its annual reuse report to the department.

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Section 403.086(9), F.S. – Ocean Outfalls
The Legislature finds that the discharge of domestic wastewater through ocean outfalls wastes valuable water supplies that should be reclaimed for beneficial purposes to meet public and natural systems demands. The Legislature also finds that discharge of domestic wastewater through ocean outfalls compromises the coastal environment, quality of life, and local economies that depend on those resources. The Legislature declares that more stringent treatment and management requirements for such domestic wastewater and the subsequent, timely elimination of ocean outfalls as a primary means of domestic wastewater discharge are in the public interest.
(a) The construction of new ocean outfalls for domestic wastewater discharge and the expansion of existing ocean outfalls for this purpose, along with associated pumping and piping systems, are prohibited. Each domestic wastewater ocean outfall shall be limited to the discharge capacity specified in the department permit authorizing the outfall in effect on July 1, 2008, which discharge capacity shall not be increased. Maintenance of existing, department-authorized domestic wastewater ocean outfalls and associated pumping and piping systems is allowed, subject to the requirements of this section. The department is directed to work with the United States Environmental Protection Agency to ensure that the requirements of this subsection are implemented consistently for all domestic wastewater facilities in the state which discharge through ocean outfalls.
(b) The discharge of domestic wastewater through ocean outfalls must meet advanced wastewater treatment and management requirements by December 31, 2018. For purposes of this subsection, the term “advanced wastewater treatment and management requirements” means the advanced waste treatment requirements set forth in subsection (4), a reduction in outfall baseline loadings of total nitrogen and total phosphorus which is equivalent to that which would be achieved by the advanced waste treatment requirements in subsection (4), or a reduction in cumulative outfall loadings of total nitrogen and total phosphorus occurring between December 31, 2008, and December 31, 2025, which is equivalent to that which would be achieved if the advanced waste treatment requirements in subsection (4) were fully implemented beginning December 31, 2018, and continued through December 31, 2025. The department shall establish the average baseline loadings of total nitrogen and total phosphorus for each outfall using monitoring data available for calendar years 2003 through 2007 and establish required loading reductions based on this baseline. The baseline loadings and required loading reductions of total

nitrogen and total phosphorus shall be expressed as an average annual daily loading value. The advanced wastewater treatment and management requirements of this paragraph are deemed met for any domestic wastewater facility discharging through an ocean outfall on July 1, 2008, which has installed by December 31, 2018, a fully operational reuse system comprising 100 percent of the facility's baseline flow on an annual basis for reuse activities authorized by the department.

(c)1. Each utility that had a permit for a domestic wastewater facility that discharged through an ocean outfall on July 1, 2008, must install, or cause to be installed, a functioning reuse system within the utility's service area or, by contract with another utility, within Miami-Dade County, Broward County, or Palm Beach County by December 31, 2025. For purposes of this subsection, a "functioning reuse system" means an environmentally, economically, and technically feasible system that provides a minimum of 60 percent of a facility's baseline flow on an annual basis for irrigation of public access areas, residential properties, or agricultural crops; aquifer recharge; groundwater recharge; industrial cooling; or other acceptable reuse purposes authorized by the department. For purposes of this subsection, the term "baseline flow" means the annual average flow of domestic wastewater discharging through the facility's ocean outfall, as determined by the department, using monitoring data available for calendar years 2003 through 2007.

2. Flows diverted from facilities to other facilities that provide 100 percent reuse of the diverted flows before December 31, 2025, are considered to contribute to meeting the reuse requirement. For utilities operating more than one outfall, the reuse requirement may be apportioned between the facilities served by the outfalls, including flows diverted to other facilities for 100 percent reuse before December 31, 2025. Utilities that shared a common ocean outfall for the discharge of domestic wastewater on July 1, 2008, regardless of which utility operates the ocean outfall, are individually responsible for meeting the reuse requirement and may enter into binding agreements to share or transfer such responsibility among the utilities. If treatment in addition to the advanced wastewater treatment and management requirements described in paragraph (b) is needed to support a functioning reuse system, the treatment must be fully operational by December 31, 2025.

3. If a facility that discharges through an ocean outfall contracts with another utility to install a functioning reuse system, the department must approve any apportionment of the reuse generated from the new or expanded reuse system that is intended to satisfy all or a portion of the reuse requirements pursuant to subparagraph 1. If a contract is between two utilities that have reuse requirements pursuant to subparagraph 1.the reuse apportioned to each utility's requirement may not exceed the total reuse generated by the new or expanded reuse system. A utility shall provide the department a copy of any contract with another utility that reflects an agreement between the utilities which is subject to the requirements of this subparagraph.

(d) The discharge of domestic wastewater through ocean outfalls is prohibited after December 31, 2025, except as a backup discharge that is part of a functioning reuse system or other wastewater management system authorized by the department. Except as otherwise provided in this subsection, a backup discharge may occur only during periods of reduced demand for reclaimed water in the reuse system, such as periods of wet weather, or as the result of peak flows from other wastewater management systems, and must comply with the advanced wastewater treatment and management requirements of paragraph (b). Peak flow backup discharges from other wastewater management systems may not cumulatively exceed 5 percent of a facility's baseline flow, measured as a 5-year rolling average, and are subject to applicable secondary waste treatment and water-quality-based effluent limitations specified in department rules. If peak flow backup discharges are in compliance with the effluent limitations, the discharges are deemed to meet the advanced wastewater treatment and management requirements of this subsection.

(e) The holder of a department permit authorizing the discharge of domestic wastewater through an ocean outfall as of July 1, 2008, shall submit the following to the secretary of the department:

1. A detailed plan to meet the requirements of this subsection, including the identification of the technical, environmental, and economic feasibility of various reuse options; the identification of each land acquisition and facility necessary to provide for reuse of the domestic wastewater; an analysis of the costs to meet the requirements, including the level of treatment necessary to satisfy state water quality requirements and local water quality considerations and a cost comparison of reuse using flows from ocean outfalls and flows from other domestic wastewater sources; and a financing plan for meeting the requirements, including identifying any actions necessary to implement the financing plan, such as bond issuance or other borrowing, assessments, rate increases, fees, other charges, or other financing mechanisms. The plan must evaluate reuse demand in the context of future regional water supply demands, the availability of traditional water supplies, the need for development of alternative water supplies, the degree to which various reuse options offset potable water supplies, and other factors considered in the Lower East Coast Regional Water Supply Plan of the South Florida Water Management District. The plan must include a detailed schedule for the completion of all necessary actions and be accompanied by supporting data and other documentation. The plan must be submitted by July 1, 2013.

2. By July 1, 2016, an update of the plan required in subparagraph 1., documenting any refinements or changes in the costs, actions, or financing necessary to eliminate the ocean outfall discharge in accordance with this subsection or a written statement that the plan is current and accurate.

(f) By December 31, 2009, and by December 31 every 5 years thereafter, the holder of a department permit authorizing the discharge of domestic wastewater through an ocean outfall shall submit to the secretary of the department a report summarizing the actions accomplished to date and the actions remaining and proposed to meet the requirements of this subsection, including progress toward meeting the specific deadlines set forth in paragraphs (b) through (e). The report shall include the detailed schedule for and status of the evaluation of reuse and disposal options, preparation of preliminary design reports, preparation and submittal of permit applications, construction initiation, construction progress milestones, construction completion, initiation of operation, and continuing operation and maintenance.

(g) By July 1, 2010, and by July 1 every 5 years thereafter, the department shall submit a report to the Governor, the President of the Senate, and the Speaker of the House of Representatives on the implementation of this subsection. In the report, the department shall summarize progress to date, including the increased amount of reclaimed water provided and potable water offsets achieved, and identify any obstacles to continued progress, including all instances of substantial noncompliance.

(h) The renewal of each permit that authorizes the discharge of domestic wastewater through an ocean outfall as of July 1, 2008, must be accompanied by an order in accordance with s. 403.088(2)(e) and (f) which establishes an enforceable compliance schedule consistent with the requirements of this subsection.

(i) An entity that diverts wastewater flow from a receiving facility that discharges domestic wastewater through an ocean outfall must meet the reuse requirement of paragraph (c). Reuse by the diverting entity of the diverted flows shall be credited to the diverting entity. The diverted flow shall also be correspondingly deducted from the receiving facility's baseline flow from which the required reuse is calculated pursuant to paragraph (c), and the receiving facility's reuse requirement shall be recalculated accordingly.
The department, the South Florida Water Management District, and the affected utilities must consider the information in the detailed plan in paragraph (e) for the purpose of adjusting, as necessary, the reuse requirements of this subsection. The department shall submit a report to the Legislature by February 15, 2015, containing recommendations for any changes necessary to the requirements of this subsection.

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- **Chapter 373, F.S.**, establishes the state's five WMDs and includes the authority for the WMDs to issue permits for the consumptive use of water.
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Section 373.250, F.S. - Reuse of Reclaimed Water
(1)(a) The encouragement and promotion of water conservation and reuse of reclaimed water, as defined by the department and used in this chapter, are state objectives and considered to be in the public interest. The Legislature finds that the use of reclaimed water provided by domestic wastewater treatment plants permitted and operated under a reuse program approved by the department is environmentally acceptable and not a threat to public health and safety.
(b) The Legislature recognizes that the interest of the state to sustain water resources for the future through the use of reclaimed water must be balanced with the need of reuse utilities to operate and manage reclaimed water systems in accordance with a variety and range of circumstances, including regulatory and financial considerations, which influence the development and operation of reclaimed water systems across the state.
(2) Reclaimed water is an alternative water supply as defined in s. 373.019(1) and is eligible for alternative water supply funding. A contract for state or district funding assistance for the development of reclaimed water as an alternative water supply may include provisions listed under s. 373.707(9). The use of reclaimed water may not be excluded from regional water supply planning under s. 373.709.
(3)(a) Reclaimed water may be presumed available to a consumptive use permit applicant when a utility exists which provides reclaimed water, which has determined that it has uncommitted reclaimed water capacity, and which has distribution facilities, which are initially provided by the utility at its cost, to the site of the affected applicant's proposed use.
(b) A water management district may not require a permit for the use of reclaimed water. However, when a use includes surface water or groundwater, the permit for such sources may include conditions that govern the use of the permitted sources in relation to the feasibility or use of reclaimed water.
(c) A water management district may require the use of reclaimed water in lieu of all or a portion of a proposed use of surface water or groundwater by an applicant when the use of reclaimed water is available; is environmentally, economically, and technically feasible; and is of such quality and reliability as is necessary to the user. However, a water management district may neither specify any user to whom the reuse utility must provide reclaimed water nor restrict the use of reclaimed water provided by a reuse utility to a customer in a permit or, unless requested by the reuse utility, in a water shortage order or water shortage emergency order.

(d) The South Florida Water Management District shall require the use of reclaimed water made available by the elimination of wastewater ocean outfall discharges as provided for in s. 403.086(9) in lieu of surface water or groundwater when the use of reclaimed water is available; is environmentally, economically, and technically feasible; and is of such quality and reliability as is necessary to the user. Such reclaimed water may also be required in lieu of other alternative sources. In determining whether to require such reclaimed water in lieu of other alternative sources, the water management district shall consider existing infrastructure investments in place or obligated to be constructed by an executed contract or similar binding agreement as of July 1, 2011, for the development of other alternative sources.

(4) The water management district shall, in consultation with the department, adopt rules to implement this section. Such rules shall include, but not be limited to:

(a) Provisions to permit use of water from other sources in emergency situations or if reclaimed water becomes unavailable, for the duration of the emergency or the unavailability of reclaimed water. These provisions shall also specify the method for establishing the quantity of water to be set aside for use in emergencies or when reclaimed water becomes unavailable. The amount set aside is subject to periodic review and revision. The methodology shall take into account the risk that reclaimed water may not be available in the future, the risk that other sources may be fully allocated to other uses in the future, the nature of the uses served with reclaimed water, the extent to which the applicant intends to rely upon reclaimed water, and the extent of economic harm which may result if other sources are not available to replace the reclaimed water. It is the intent of this paragraph to ensure that users of reclaimed water have the same access to ground or surface water and will otherwise be treated in the same manner as other users of the same class not relying on reclaimed water.

[1](b) Provisions to require permit applicants that are not reuse utilities to provide, as part of their reclaimed water feasibility evaluation for a nonpotable use, written documentation from a reuse utility addressing the availability of reclaimed water. This requirement shall apply when the applicant's proposed use is within an area that is or may be served with reclaimed water by a reuse utility within a 5-year horizon, as established by the reuse utility and provided to the district. If the applicable reuse utility fails to respond or does not provide the information required under paragraph (c) within 30 days after receipt of the request, the applicant shall provide to the district a copy of the written request and a statement that the utility failed to provide the requested information. The district is not required to adopt, by rule, the area where written documentation from a reuse utility is required, but the district shall publish the area, and any updates thereto, on the district's website. This paragraph may not be construed to limit the ability of a district to require the use of reclaimed water or to limit a utility's ability to plan reclaimed water infrastructure.(c) Provisions specifying the content of the documentation required in paragraph (b), including sufficient information regarding the availability and costs associated with the connection to and the use of reclaimed water, to facilitate the permit applicant's reclaimed water feasibility evaluation.

A water management district may not adopt any rule that gives preference to users within any class of use established under s. 373.246 who do not use reclaimed water over users within the same class who use reclaimed water.

(5)(a) No later than October 1, 2012, the department shall initiate rulemaking to adopt revisions to the water resource implementation rule, as defined in s. 373.019(25), which shall include:

1. Criteria for the use of a proposed impact offset derived from the use of reclaimed water when a water management district evaluates an application for a consumptive use permit. As used in this subparagraph, the term “impact offset” means the use of reclaimed water to reduce or eliminate a harmful impact that has occurred or would otherwise occur as a result of other surface water or groundwater withdrawals.

2. Criteria for the use of substitution credits where a water management district has adopted rules establishing withdrawal limits from a specified water resource within a defined geographic area. As used in this subparagraph, the term “substitution credit” means the use of reclaimed water to replace all or a portion of an existing permitted use of resource-limited surface water or groundwater, allowing a different user or use to initiate a withdrawal or increase its withdrawal from the same resource-limited surface water or groundwater source provided that the withdrawal creates no net adverse impact on the limited water resource or creates a net positive impact if required by water management district rule as part of a strategy to protect or recover a water resource.

(b) Within 60 days after the final adoption by the department of the revisions to the water resource implementation rule required under paragraph (a), each water management district shall initiate rulemaking to incorporate those revisions by reference into the rules of the district.

(6) Reuse utilities and the applicable water management district or districts are encouraged to periodically coordinate and share information concerning the status of reclaimed water distribution system construction, the availability of reclaimed water supplies, and existing consumptive use permits in areas served by the reuse utility.

(7) This section does not impair or limit the authority of a water management district to plan for and regulate consumptive uses of water under this chapter or regulate the use of surface water or groundwater to supplement a reclaimed water system.

(8) This section applies to applications for new consumptive use permits and renewals and modifications of existing consumptive use permits.

## APPENDIX D-2: ANALYSIS OF TYPES OF REUSE

8.1.5 <u>Landscape Irrigation/Public-Access Reuse</u>

*Description*

Public-access landscape irrigation is for those areas that are intended to be accessible to the general public; such as golf courses, cemeteries, parks, public landscape areas, and highway medians. It also includes private property that is not open to the public at large, such as residential dwellings and retail nurseries. Chapter 62-610, F.A.C., categoizes this type of reuse as "slow-rate land application; public access."

According to the most recent statewide survey, public access reuse, which also includes relatively minor non-irrigation components such as toilet flushing, fire protection, street cleaning, decorative fountains, dust control, and vehicle washing, is 54% of the reclaimed water utilization by flow (FDEP, 2014). It accounts for more than three times the volume of any other type of reuse (**Figure 2.3**). This corresponded to 388 million gallons per day (mgd) of public access reuse in 2013. Public-access irrigation is greatest, both in terms of flow and percentage, in the three largest water management districts (SFWMD, SWFWMD and SJRWMD). (**Table D.2.1**)

| Water Management District | Total Reuse by District (million gallons per day) | Amount of Public Access Reuse (million gallons per day) | Percentage of Public Access Reuse in water management district |
|---|---|---|---|
| SFWMD | 270.69 | 155 | 57% |
| SWFWMD | 191.61 | 115 | 60% |
| SJRWMD | 176.47 | 104 | 59% |
| NWFWMD | 70.36 | 12 | 17% |
| SRWMD | 10.36 | 0.3 | 25% |

Table D2.1: Public Access Irrigation by Water Management District

*FDEP, 2013 Reuse Inventory, May 2014*

The use of reclaimed water for irrigation typically replaces either a traditional water source (groundwater or surface water) or may replace potable water. Both cases can provide a "potable-quality water offset," which means that an amount of potable-quality water is replaced by the use of reclaimed water. The amount of potable-quality water offset is estimated to be 75% for efficient irrigation and as low as 25% for inefficient residential irrigation (The Reuse Coordinating Committee, 2003). Irrigation may also provide a "recharge fraction," depending upon its application - although any recharge to the aquifer is a secondary benefit and indicative of either inefficiency, or over irrigation, or both.

**Appendix D-3** provides two examples of successful public access reuse. The Orange County National Golf Center's use of reclaimed water for irrigation eliminates the use of a traditional water source. In Cape Coral, over 40,000 residences are connected to their irrigation-quality water reuse system.

*Constraints*

There are a number of factors that prohibit or complicate the expansion of using reclaimed water for irrigation in public access areas, including the cost of treating and distributing the reclaimed water to the end users. Often the treatment facilities and potential end users are in urban or suburban settings. The costs to run pipelines to the users in developed areas can be very expensive and disruptive to existing infrastructure. In addition, if the treatment facility is not already permitted to provide public access irrigation, additional costs could be required to upgrade treatment and monitoring at the facility.

Costs for the end user may also influence the acceptability of reclaimed water. For example, a golf course may have an existing consumptive use permit to irrigate with groundwater from wells, which may be less expensive than paying for reclaimed water from the local wastewater utility. Available and permittable water source options that are less expensive than reclaimed water may hinder the expansion of water reuse systems.

A lack of storage for reclaimed water is frequently a critical constraint in expanding an irrigation-based water reuse system. This is primarily due to the mismatched seasonality of supply and demands for reclaimed water. In wet times, demands for reclaimed water decrease, but production of reclaimed water remains relatively consistent. As a result, and without adequate storage, the need for disposal of reclaimed water increases. With storage, the utility would be able to retain the reclaimed water during wet periods for distribution when demands increase. The effects of lack of storage are most acute during dry times when demands for irrigation are highest. Many utilities struggle to provide full allocations of reclaimed water to their customers during dry periods. As a result, a utility may be reluctant to expand a reuse system until demands can be met during the driest of times. Adequate storage would allow these utilities to increase the dependability of their systems, thus allowing an expansion of their customer base.

Another constraint is a lack of available water from an alternate source to supplement the reclaimed water supply during times of high demand. Supplemental water sources can include groundwater, surface/stormwater, or potable water. Supplemental water allows a utility to expand its reuse system in a way similar to storage. During dry periods, supplemental water can be used by a utility to meet the increased irrigation demands of its customers. Without the use of supplemental water, a utility may be constrained in optimizing its use of reclaimed water throughout the year. One problem with supplemental water is that availability of the supplemental source may also be restricted during those times when it is most needed (i.e. dry times).

Some end users may resist using reclaimed water for irrigation because of its perceived unreliability, both seasonally and in the long-term. Demands for reclaimed water peak in the dry season, and supplies may be insufficient to meet the demands of all users during dry periods. These potential shortages may cause the end user to resist shifting from groundwater to reclaimed water for irrigation. Also, some end users are concerned that although the utility may be currently providing reclaimed water, the utility may re-direct that reclaimed water to another user in the future, thus leaving the water user to apply for a groundwater allocation from the water management district that may no longer be available without adversely affecting water resources or existing legal users.

A concern expressed by reclaimed water utilities is that private homeowners, recreational users (golf courses), or other landscape irrigators may choose to construct groundwater wells for irrigation as a cheaper alternative to using available reclaimed water. These users must apply to the applicable water management district for a well construction and a consumptive use permit to construct and use such wells. As part of the review of the consumptive use permit application, a water management district may require the use of reclaimed water in lieu of all or a portion of a proposed use of groundwater by an applicant when the use of reclaimed water is available; is environmentally, economically, and technically feasible; and is of such quality and reliability as is necessary to the user. As part of this feasibility evaluation, the applicant is required to provide documentation from the applicable reuse utility regarding the availability of reclaimed water.

Reclaimed water utilities have expressed the concern that in instances where reclaimed water is available, but the applicant claims that its use is not economically feasible, permits are often issued for groundwater use without a vigorous review of the applicant's claim of economic infeasibility. The DEP and WMDs have developed guidelines for the preparation of reuse feasibility studies for consumptive use permit applicants. However, the guidelines do not establish specific formulas or thresholds for feasibility – rather the determination is made on a case-by- case basis.

In one water management district, the consumptive use permit rules require that projects located in whole or part within areas designated by local ordinance as a mandatory reclaimed water zone will only be allocated groundwater quantities for emergency backup purposes. In these instances, the use of available reclaimed water is assumed to be economically feasible.

In some cases, regulations and the resulting public perception of using reclaimed water for irrigation may be constraining the expansion of reuse systems. For example, existing rules prohibit spraying reclaimed water on home gardens (edibles). This gives the impression that reclaimed water is harmful and perhaps is not safe to use for any public access irrigation. As a result of a negative perception, potential users of reclaimed water for irrigation may resist its use. The potential for inefficient landscape irrigation to contribute to nutrient enrichment and impairment of surface waters is an additional concern that may constrain the expansion of public access reuse. The recent development of numeric nutrient criteria for surface waters fostered concern among some wastewater utilities that reclaimed water is a non-point source of nutrients requiring TMDL/BMAP management considerations. Micro-constituents (pharmaceuticals, personal care products) in the reclaimed water are also a concern of some. Such negative perception of reclaimed water quality may be exacerbated by the concern that users irrigating with reclaimed water tend to use more water than when irrigating with potable quality water - ultimately resulting in an increased addition of nutrients and micro-constituents to surface and groundwaters. At least one local government in Florida restricts the use of reclaimed water for landscape irrigation in certain areas due to concerns for drinking water supplies. Knowledge of nutrient levels provided by reclaimed water and careful management of its application are required to ensure that runoff that is harmful to surface waters does not occur.

A site-specific constraint to using reclaimed water for irrigation is the elevated salinity in some reuse systems. Wastewater collection systems in some coastal areas are infiltrated by saline water, thus resulting in elevated salinity in the treated reclaimed water, which constrains its use for irrigation.

*Opportunities*

Two major factors that affect the opportunity to expand public access reuse are 1) the proximity of the areas where people live and work to the reclaimed water supply produced at the domestic wastewater treatment facilities, and 2) the ease with which the transmission and distribution system can be installed. Urban and suburban areas with irrigation needs at golf courses, parks, and residences provide good opportunities to expand reuse systems, but expansion in heavily developed areas where retrofitting of infrastructure is required can be costly and disruptive to existing communities. Therefore, areas of expanding and new development, or redevelopment, frequently provide the best opportunity to expand public access reuse systems. In these instances, dual distribution systems for potable and reclaimed water can be installed at the same time.

Several tools are available to more effectively use the water produced by reclaimed water systems. Increasing the ability to store reclaimed water and supplement it with other sources of water allows for balancing of supply and demand throughout the year, allowing more customers to be served and reducing the disposal of reclaimed water during wet times. Storage needs will vary depending on the needs of a given utility reuse system, while the availability of regional water resources will dictate the likelihood of supplementation being an option. Storage needs could be met with a variety of methods, such as above-ground tanks, lined reservoirs, and aquifer storage and recovery. Increased storage may provide the additional benefit of encouraging more efficient use of reclaimed water. Without an adequate storage for reclaimed water, increased irrigation efficiencies may create disposal problems for the utility. With adequate storage, more efficient use is likely to be encouraged.

Supplemental water may be available from groundwater, stormwater, or excess surface water. The challenge is finding an available supplemental source during dry periods when additional supplies are needed. With greater reliability and flexibility of these operational methods comes greater acceptance of reclaimed water by its users, and a reduced concern over a lack of supply in the future.

Another tool available to local governments to expand an irrigation-based water reuse system is the establishment of a Mandatory Reuse Zone (MRZ). MRZs are established by local governments by ordinance, and require non-potable water users to connect to the reclaimed water system made available by the utility. A MRZ allows the utility to serve those areas with reclaimed water for irrigation – reducing the pressure on local groundwater resources, and eliminating the need for the water management districts to conduct case-by-case determinations of reuse availability for consumptive use permit applicants within the MRZ.

Regulatory incentives, in the form of impact offsets and reclaimed water credits, currently exist in the WMDs' consumptive use programs to promote the expanded use of reclaimed water. Reclaimed water can be used to prevent impacts that would otherwise occur from the use of surface or groundwater (impact offset), thereby making that use of surface or groundwater permittable. A reclaimed water provider may also generate reclaimed water credits by providing reclaimed water to a user in lieu of using surface or groundwater. The generation of reclaimed water credits may allow a utility to increase its own CUP allocation of the traditional source replaced with reclaimed water.

### 8.1.6 Agricultural Irrigation

*Description*

Agricultural irrigation (such as irrigation of food, fiber, fodder and seed crops, wholesale nurseries, sod farms, and pastures) is included as a beneficial use of reclaimed water, and is categorized either as "slow-rate land application; public access" or "slow-rate land application; restricted public access" in Rule 62-610, F.A.C. . The rule makes a distinction between indirect and direct irrigation methods. Indirect irrigation methods (e.g. ridge and furrow, subsurface, and drip irrigation systems) are allowed to be used for any type of agricultural irrigation. Direct irrigation methods (e.g. spray) are not allowed on edible crops that are not peeled, skinned, cooked or thermally processed before consumption. Direct contact is allowed for tobacco and citrus, including citrus used for fresh table fruit, processing into concentrate or other purposes. It is also allowed if a special demonstration project determines that such application to edible crops is protective of public health.

The use of reclaimed water for agricultural irrigation in Florida dates back as early as the 1960s. In 2013, the State's reuse inventory (FDEP, 2014) listed agricultural irrigation as 10% (71 mgd) of the total reclaimed water usage (**Figure 2.3**). However, most of the reclaimed water (58 mgd) was used on sprayfields, which are less desirable in terms of providing benefits to water supply. A small fraction of the 58 mgd flow for "other crops" was used for irrigating nurseries, a more beneficial use. The remaining 13 mgd was reused on edible crops, totaling over 13,700 acres. The majority of these 13,700 acres (86%) was for the production of citrus.

The use of reclaimed water for agricultural irrigation of crops replaces a traditional water source (typically groundwater or surface water). The estimated "potable-quality water offset", which means replacement of an amount of potable-quality water through the use of reclaimed water, is estimated to be 75% for efficient agricultural irrigation and as low as 50% for inefficient irrigation (The Reuse Coordinating Committee, 2003). Irrigation may also provide a "recharge fraction," depending upon its application - although any aquifer recharge is indicative of over-irrigation.

The two largest reuse systems using reclaimed water for the irrigation of edible crops are the Manatee County Master Reuse System (5.5 mgd) and Water Conserv II in Orange County (5.4 mgd). The Water Conserv II reuse system is a cooperative project jointly owned by the City of Orlando and Orange County. Water Conserv II is the largest reclaimed water project of its kind in the world, and combines agricultural irrigation and aquifer recharge through rapid infiltration basins (RIBs). It was the first reclaimed water project in Florida permitted by DEP to irrigate crops produced for human consumption. More details on this project are provided in **Appendix D-3**.

*Constraints*

There are a number of issues that may limit expansion of reclaimed water use in the agricultural sector. Perhaps the most significant constraint is the typical distances from domestic wastewater facilities to agricultural lands. Domestic wastewater facilities with capacities greater than 100,000 gallons per day (those that would be permitted to provide reclaimed water) are typically found near population centers, far from agricultural areas. In those cases, costs to run pipelines to agricultural customers can be a limiting and cost prohibitive factor.

Another obstacle is public perception over human health concerns with irrigation of crops with reclaimed water, including concerns related to the potential presence of pathogens, heavy metals, pharmaceuticals, and endocrine disruptors. These water quality concerns focus primarily on public health concerns and not crop production. Some agricultural operations in the State have expressed concern that irrigation with reclaimed water will constrain their ability to sell their crop, especially to overseas markets. (USDA, 2015)

The federal Food Safety Modernization Act (FSMA) provides added conditions regarding the quality of water used for crop irrigation. It appears that Florida's (DEP) requirements for reclaimed water quality, especially for disinfection, satisfy FSMA conditions for water quality, and therefore these federal regulations are not expected to be a constraint to the agricultural use of reclaimed water.

Additional water quality concerns include the potential for salt accumulation in soil, which may affect water uptake and inhibit root growth (Harivandi, 2000). High nitrogen content may also cause excessive microbial growth. Plant tolerances and crop production vary depending on crop type and water quality. Variability in water quality can affect crop production.

The cost of reclaimed water to the user, and the potential for future increased costs may be constraining the expansion of agricultural irrigation with reclaimed water. If less expensive and permittable alternatives (e.g. groundwater) are available to the user, acceptance of reclaimed water for agricultural irrigation will be hindered.

The reliability and seasonal availability of reclaimed water can also be a concern of a potential agricultural user. Availability of reclaimed water is often at its lowest when crop demands are at their peak. Water for freeze protection, when relatively large volumes of water are needed for short time periods, may also be a consideration. Available reclaimed water alone may not be able to meet the freeze demands without a backup source.

Agricultural users may also be hesitant to use reclaimed water because of its perceived long-term unreliability. In some cases, utilities have re-directed reclaimed water supplies away from agriculture to other customers. The agricultural user would be concerned that the traditional source of water (e.g. groundwater) is no longer permittable/available and other viable solutions are not available.

*Opportunities*
There are a number of ways to evaluate potential opportunities for increasing reclaimed water use for agricultural irrigation. The Florida Department of Agriculture and Consumer Services (DACS) conducted a statewide Geographic Information System based analysis by examining agricultural acreage/irrigated acreage, and proximity to DEP domestic wastewater facilities with treatment capacities above 100,000 gallons per day (i.e. potential reclaimed water). The analysis looked at agricultural irrigation within 10-miles of these wastewater facilities (**Figure D.2.1)**. It showed that approximately 78% of agricultural acreage lies within this distance. The analysis did not specifically identify available reclaimed water or locations of reclaimed water lines but spatially presented irrigated acreage with respect to treatment plant locations.

In most cases, individual agricultural users will be unable to afford the infrastructure costs of building reclaimed water transmission lines to agricultural areas. Partnerships with the WMDs and other entities, such as public water suppliers, with an interest in replacing non-potable uses with reclaimed water and "freeing up" groundwater for potable uses, may be an effective way to expand agricultural reuse.

### 8.1.7 Industrial

*Description*
This type of reuse system involves the use of reclaimed water for applications such as cooling water, wash water, or process water at industrial facilities. Recycling within the industrial facility, or other reuse or disposal methods is not governed by Chapter 62-610, F.A.C. and is not included in this report.

In 2013, reclaimed water for industrial uses totaled about 17% (125 mgd) of total reclaimed water usage (**Figure D2.1**). Almost half of that flow (59 mgd) was used as process water at the wastewater treatment facility. The remaining flow (66 mgd) was used at other facilities, such as power plants. Statewide the use of reclaimed water for industrial purposes varies, with the largest use occurring in the SFWMD (50 mgd), followed by SWFWMD (41 mgd), and SJRWMD (22 mgd). The NWFWMD and SRWMD collectively make up the remaining 12 mgd of reuse flows used for industrial purposes.

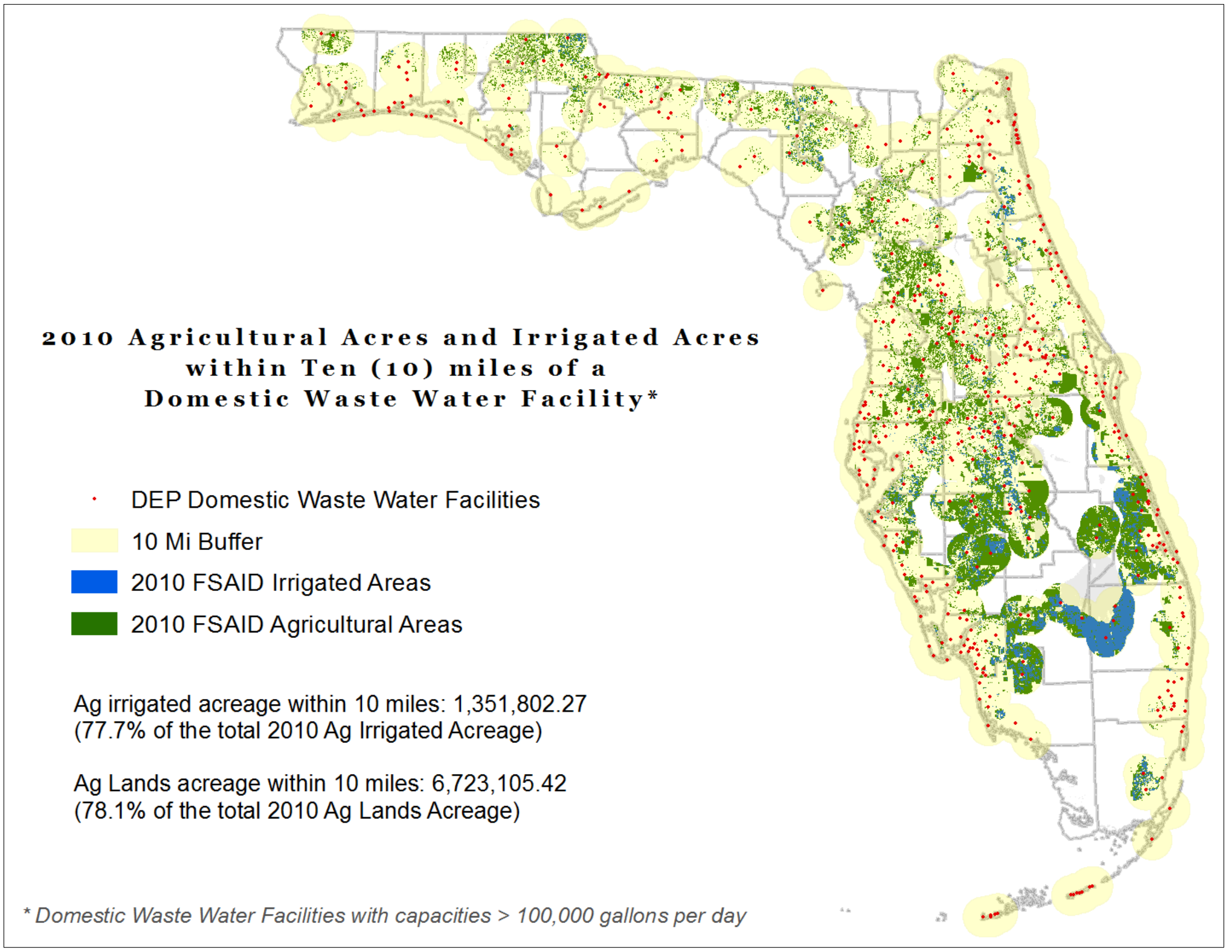


Figure.D2.1: 2010 Agricultural Areas and Irrigated Acres within Ten (10) Miles of a Domestic Wastewater Facility

The primary industrial uses of reclaimed water occurring in Florida are for power plants and cooling towers. Power plants use reclaimed water for cooling, process water, or for boiler make up if membranes are used to provide additional water quality treatment. Other industrial facilities use reclaimed water for cooling towers or for cooling for air conditioning. According to the DEP 2013 Reuse Inventory, there were 15 power plants and 78 cooling towers in Florida making use of reclaimed water as of 2013. Also that year there were 104 domestic wastewater treatment facilities that used reclaimed water for operations and maintenance at the plant including sludge press wash water, pelletizer spray down to reduce emissions, flushing, wash down, and pump seal water. Additional industrial uses in Florida are for mining operations, paper making machines, concrete mixing, and process water (FDEP, 2014).

Industrial uses are the most efficient reuse activities at 100 % potable quality water offset (The Reuse Coordinating Committee, 2003). As such, continued expansion of industrial reuse will extend water supplies to a greater extent than some other types of reuse.

The $97 million dollar Tampa Electric Company (TECO) Polk Reclaimed Water Project is a good example of the industrial reuse of reclaimed water. The project, which recently went on-line, was cooperatively funded by SWFWMD and TECO. The project will supply 10.0 mgd of reclaimed water to the TECO Polk Power Generation Facility in southern Polk County. Ultimately this project will supply up to 17.0 mgd of reclaimed water from three utilities (Lakeland, Mulberry, and Polk County) in the Southern Water Use Caution Area (SWUCA) that would otherwise come from groundwater sources. More information about this project is included in **Appendix D-3**.

*Constraints*

Fiscal constraints are the primary obstacle to expanded industrial reuse. With advances in filtration, technical constraints can be overcome with adequate funding even where the purest water is required for industrial use. In areas where water supplies are not limited there is little impetus to expand industrial, or any other type, of reuse.

*Opportunities*

Industrial reuse opportunities discussed here are focused on power plant uses to capitalize on the efficiency of transferring large volumes of reclaimed water to a single user rather than distributing reclaimed water to many small users. There are approximately 91 power plants operating in Florida that use water for cooling in the production of power for resale. Of these, 22 power plants currently use reclaimed water, two plants are undergoing reclaimed system repairs, one plant has a new reclaimed system under construction, one plant has future reuse project that has not yet been funded, and one plant is under discussion with a reclaimed provider. The Cedar Bay Cogeneration Facility uses reclaimed water from industrial, rather than domestic, wastewater. Of the remaining 64 resale power plants, 58 are located in areas where water supplies are limited and would therefore appear to be good candidates for reuse. However, for some plants substantial reclaimed water is not available from nearby sources and it is not cost feasible to transport reclaimed water from distant sources. Also, some of these are peaking plants that do not operate continuously and as such may present timing issues for reclaimed suppliers.

There are also many industrial and institutional facilities that have their own combustion power plants on site. Some of these already use reclaimed water for cooling, and others may be good candidates. The Emissions & Generation Resource Integrated Database (eGRID), a geodatabase and inventory developed by the US EPA of electricity generating plants that provide power to the electric grid, lists 42 power plants (not including solar or hydropower facilities) located in Florida in addition to the ones mentioned above. Current data can be found at the Environmental Protection Agency eGRID web site. (EPA, 2015)

### 8.1.8 Ground Water Recharge

*Description*

Ground water (GR) recharge involves the planned use of reclaimed water to augment Class F-I, G-I, or G-II groundwaters (Chapter 62-520.410, F.A.C.). This can be accomplished using injection wells or rapid infiltration basins (RIBs). Ground water recharge includes the use of reclaimed water to create salinity barriers and discharges to surface waters that are directly connected to groundwater (62-610.550, F.A.C.). Different methods of GR have distinctively different construction specifications, regulatory requirements, and operational maintenance considerations. The hydrogeologic setting of an area often determines which GR approach is appropriate. Groundwater recharge is also called aquifer recharge.

Successful GR projects may (1) improve local groundwater quality, (2) increase aquifer levels to mitigate or offset existing drawdown impacts due to withdrawals, (3) provide storage of seasonally available waters and thereby augmenting water supplies, (4) potentially provide for additional new permitted groundwater withdrawals in areas of limited water supply, and (5) support healthy environmental flows in natural systems. Sources of water for use in GR projects are often available seasonally and may include high quality reclaimed water, surface water and stormwater. GR project success criteria can include demonstration of the level to which aquifers levels have increased, demonstrated improvements to aquifer water quality and/or increases in the volume of available water supply for existing and future demands, and natural systems.

In 2013, groundwater recharge using reclaimed water totaled about 14% (101 mgd) of total reclaimed water usage (**Figure 2.3**). RIBs accounted for almost all of that flow (99 mgd). The remaining 2 mgd was sent to adsorption fields. No reclaimed water flows were reported in Florida for surface water augmentation or direct groundwater injection. The most recharge flow occurs in the SFWMD (53 mgd), followed by SWFWMD (22 mgd), and SJRWMD (16 mgd). The NWFWMD and SRWMD collectively make up the remaining 10 mgd of reclaimed water used for groundwater recharge (FDEP, 2014).

For purposes of this report, indirect groundwater recharge (IGR) will be considered the application of reclaimed water to the land surface in rapid infiltration basins (RIBs). IGR is used in areas where there is a good connection between the shallow and deep aquifers. Water applied to RIBs must meet minimum water quality standards approved by DEP. Determining the feasibility of using RIBS for IGR requires an analysis of the infiltration capacity and permeability of the soil, presence of drainage features, depth to the water table, local hydrogeology, locations of nearby drinking water wells, as well as the locations of nearby wetlands and lakes. Areas suitable for IGR in Florida are typically composed of elevated land surface with deeper water tables and unsaturated sediments that provide higher infiltration capacity. In favorable regions, aquifer recharge using RIBs can provide additional natural water quality treatment to the water as it percolates through sediments at the RIBs during infiltration, in addition to subsequently increasing aquifers levels. However, it is important that aquifer water quality be considered in the design and implementation of aquifer recharge projects with reclaimed water. Nitrate enrichment of the Upper Floridan aquifer is a widespread problem for springs.

Although considered as reuse under DEP rule and included in the DEP Reuse Inventory, RIBs vary in the degree of recharge they provide that is beneficial to meeting water supply needs. Ground water recharge at RIBs in areas distant from water supply withdrawals may not provide significant potable water offsets. IGR to an aquifer that is being used for potable water supply is estimated at 90 %. Recharge is estimated at 25 % if that aquifer is not being used for potable water supply.

Direct Aquifer Recharge is the use of recharge wells to inject water meeting applicable DEP water quality standards into an aquifer. The project may be designed to improve aquifer conditions through recharge, or may include recovery of the injected water through other wells constructed in the area. The feasibility and capacity of recharge will be determined by the local hydrogeology. This can be similar to the natural capture and recharge of entire rivers as is common in karstic areas of north Florida. Direct aquifer recharge to a potable-quality aquifer has a 100 % recharge fraction (The Reuse Coordinating Committee, 2003).

Examples of indirect recharge through RIBS include Conserve II in Lake County, and the City of Winter Haven's proposed RIBs at the Tilden Groves site in the Winter Haven area. Examples of proposed projects for the direct recharge through wells include the Hillsborough County system that would provide a saltwater intrusion barrier along the coast of Tampa Bay, and the City of Clearwater project for indirect potable reuse. The City of Clearwater is proposing a state-of-the-art water treatment and injection system to recharge a brackish water interval of the Upper Floridan aquifer in northeast Pinellas County with 3 mgd of purified reclaimed water that meets all potable drinking water standards. More information on these projects is provided in **Appendix D-3**.

*Constraints*

Expanded application of groundwater recharge using RIBs and/or pond-based methods is constrained by reasonable access to affordable land and the ability to apply water at rates which can both accomplish effective aquifer recharge without also impacting off-site land and water users or aquifer water quality.

Expanded applications of well-based, direct-recharge systems are limited by the initial high costs of water treatment upgrades and new infrastructure requirements. Uncertainties regarding water quality requirements, permitting, and public acceptance of injection of reclaimed water can all serve as constraints for direct aquifer recharge. However, due to the numerous benefits of groundwater recharge, there is an increasing emphasis on new recharge projects in many areas of the state, especially in those areas where land-based systems for groundwater recharge is not feasible or where karst features naturally capture large volumes of surface water.

*Opportunities*

Increased indirect groundwater recharge opportunities are greatest in areas which have relatively permeable soils, relatively deep groundwater levels and reasonably large areas of land that can accept large quantities of water for recharge. Such conditions are common in central Florida where RIBs for reclaimed water recharge have been successfully operated since the late 1980s. However, opportunities for IGR exist wherever soil and hydrogeologic conditions are conducive and the water would be augmenting Class F-I, G-I, or G-II groundwaters.

Opportunities for direct groundwater recharge systems are available in those areas where the hydrogeology is suitable, particularly where large land areas are not available. Suitable locations for direct aquifer recharge should be available in most areas of the State.

The use of groundwater recharge for a salt-water barrier is another potential opportunity. Reclaimed water could be used to resist the intrusion of saltwater, especially along impacted areas along the coasts.

### 8.1.9 Environmental Enhancement and Restoration

*Description*

Reclaimed water can and has been used for wetland rehydration and restoration purposes. These uses can be associated with water storage as surface or groundwater although evaporative water loss needs to be accounted for in storage estimates. Wetlands can also provide additional water quality treatment, typically to reduce nutrient concentrations so that nutrient loads leaving the wetland as surface runoff or groundwater recharge are reduced. The wetlands can be either natural wetlands, receiving reclaimed water in addition to natural inputs, or constructed treatment wetlands, specifically designed to accept a particular reclaimed water source and associated nutrient load. Constructed treatment wetlands are primarily designed to reduce nutrient loads to meet Total Maximum Daily Load (TMDL), or Basin Management Action Plan (BMAP) requirements.

Since 1979, DEP has formally recognized the potential of wetlands as a means of providing wastewater treatment. Currently, DEP regulates domestic wastewater discharge activities in wetlands through Chapter 62-611, F.A.C., which provides specific regulation and standards for the treatment of domestic wastewater such that the type nature and function of wetland will be protected. The rule controls (1) the quality and quantity of wastewater which may be discharged to wetlands, and (2) the quality of water discharged from wetlands to contiguous surface waters. It also provides water quality, vegetation, and wildlife standards which provide protection of other wetland functions and values, and establishes permitting procedures and extensive monitoring requirements for wastewater discharges to wetlands.

The rule promotes the use of man-made (constructed) and hydrologically-altered wetlands by requiring less monitoring and allowing higher hydraulic and nutrient loading rates for those systems. These regulatory incentives attempt to create and restore wetlands. Many wetland systems are classified as reuse of reclaimed water per rule 62-610.810(g), F.A.C., which states that wetlands creation, restoration, and enhancement projects....shall be classified as "reuse."

In 2013, the use of reclaimed water for wetlands totaled about 4.6% (33 mgd) of total reclaimed water usage. Statewide, the most use of reclaimed water for wetlands is in SJRWMD (25 mgd), followed by NWFWMD (7 mgd), and SFWMD (1 mgd). SWFWMD and SRWMD did not have any flows listed in the State’s inventory (FDEP, 2014).

The use of reclaimed water for wetland hydration and restoration falls into two categories: (1) those cases where the wetland needs additional water; and (2) those cases where the wetland does not need additional water. In those situations where the reclaimed water replaces a potable-quality water source, the offset is estimated to be 75 %. For those cases where the wetland does not need additional water, the offset is zero. Wetland hydration may also provide a “recharge fraction”, depending upon the location and characteristics of the wetland. A typical recharge fraction for wetlands is estimated to be 10 % (The Reuse Coordinating Committee, 2003).

Once built, constructed wetlands offer relatively low cost operation and maintenance and provide wetland functions along with resource-based recreational opportunities. Several constructed treatment wetlands are now part of the Great Florida Birding Trail. The value associated with nutrient removal through wetlands application is likely to increase as Florida's numeric nutrient criteria (NNC) become fully implemented and result in additional BMAP requirements to reduce nutrient loads associated with reclaimed water. The largest wetland receiving reclaimed water, Orlando's Wetland Park, accounted for almost half of the total flow (15 mgd) of reclaimed water for wetland hydration in 2013. More information about the Orlando Wetland Park is provided in **Appendix D-3**.

*Constraints*

The most significant constraint on the use of constructed treatment wetlands is the cost. Land acquisition and the capital costs associated with their design and construction all contribute to the costs of constructed wetlands.

One of the potential constraints with the use of reclaimed water for wetland hydration is that the potable-quality offsets may be limited. If the introduction of reclaimed water is not replacing potable-quality water, no offset benefits would be realized, and the groundwater recharge fraction may be insignificant.

The quality of the reclaimed water, and its compatibility with the receiving wetland, is an issue that must be addressed. Direct discharges to wetlands, or even through constructed wetlands to other surface waters that need rehydrating, need to meet surface water quality criteria and other NPDES requirements (TMDL's, antidegradation, etc.).

*Opportunities*

As wetland rehydration may not offset water use, the use of reclaimed water for environmental purposes is generally in areas with greater reclaimed water supply than demand. This imbalance between supply and demand can be due to the high costs of increasing demand in urbanized areas where the costs of retrofitting traditional reclaimed water infrastructure are prohibitive or distance between the water reclamation facility and potential users is too great. In some cases, wetland rehydration and restoration with reclaimed water can contribute to water-supply solutions by offsetting the otherwise adverse impacts of water use.

There is a significant opportunity for the use of constructed wetlands to provide additional water quality treatment, especially nutrient removal, between water reclamation facilities and storage prior to beneficial reuse locations, RIBs or other storage locations. In areas with groundwater recharge potential, treatment wetlands and recharge features have been successfully combined, reducing land requirements. This has been employed at the infiltrating wetlands located at the Kanapaha Water Reclamation Facility in Gainesville. Treatment wetlands offer a means to reduce nutrient concentrations prior to aquifer recharge using RIBs. Such a system operates at Orange County's Northwest Water Reclamation Facility, where a constructed wetland built with lined treatment cells reduces nitrate concentrations prior to aquifer recharge through Lake Marden and associated RIBs, all located within the Wekiva springshed. In areas where reclaimed water is used for irrigation and the reclaimed water's nutrient concentration is in excess of what is needed or desired by the irrigated vegetation, wetland pre-treatment may provide a means to better balance nutrient loads from reclaimed water and vegetation uptake capacity, thus lessening the potential for nutrient runoff and impacts. Wetland treatment prior to storage in either surface or groundwaters will also lessen the potential for nutrient enrichment problems, such as algal blooms and associated problems.

Treatment wetland use may also be limited by the continued expansion of reuse networks that better balance reclaimed water supply and consumptive use demand. However, while supply and demand may balance on average, there will likely be the ongoing need for wet weather reclaimed water disposal options, which do not induce or contribute to nutrient impairment. Thus having a constructed treatment wetland included as a feature of reclaimed water networks provides a means to treat water prior to either long-term storage in the ground or in reservoirs or disposed to surface water while not creating or contributing significantly to a nutrient impairment liability. The challenge is anticipating the future supply/demand ratio which affects the maximum reclaimed water volume needing disposal throughout the year. This is directly related to the size and cost associated with the treatment wetland. Treatment wetlands, due to their relatively low operation and maintenance costs, can offer an attractive treatment option prior to wet weather discharge to surface waters, RIBs, or sprayfields.

### 8.1.10 Indirect Potable Reuse

*Description*

Florida's official definition of Indirect Potable Reuse (IPR) is "…the planned discharge of reclaimed water to surface waters to augment the supply of water available for drinking water and other uses." (Rule 62-610.200(27), F.A.C.. The use of reclaimed water to augment potable water supplies has significant potential for helping to meet future needs, but planned potable water reuse only accounts for a small fraction of the volume of water currently being reused nationally (EPA, 2012). However, a much larger volume of reclaimed water augments potable needs through what is called "de facto" (or unplanned) potable reuse. This is especially true on a national level where a typical city obtains its water supply from a river that contains treated wastewater from upstream cities. The "unplanned" use of treated water as a potable source is not new, as many surface water sources that are used for potable raw water supplies have upstream wastewater/reclaimed water discharges. For instance, the Trinity River in Texas serves as the main drinking water source for the City of Houston, which during the dry season receives most of its flow from upstream Dallas and Fort Worth wastewater treatment plants. Additionally, cities all along the Mississippi River use it for both wastewater disposal and drinking water.

The term "indirect potable reuse" is also frequently used for the concept of recharging groundwater upgradient of potable water supply wells. In Florida, this type of planned IPR would be accomplished through RIBs and direct groundwater injection, which were discussed extensively in the previous section on groundwater recharge. An example of an operational groundwater recharge-based IPR system is Orange County, California's Ground water Replenishment System, where wells are used to recharge the aquifer and extract it downgradient for water supply purposes. **Appendix D-3** provides examples of successful national IPR projects.

The efficiency of IPR, as it is defined by the potable-quality water offset, varies based on application. On one end of the spectrum, reclaimed water that recharges an aquifer far from any water supply withdrawal has a 100 % recharge fraction, but little value in terms of offsets. The other end of the sprectrum would be where reclaimed water recharges an aquifer that is under the influence of a water supply wellfield. Depending on the aquifer characteristics and the configuration of the recharge and wells, the offset could approach 100 % (The Reuse Coordinating Committee, 2003).

*Constraints*

There are a number of constraints to using indirect potable reuse in Florida. These constraints will vary depending on the location and method used The use of RIBs has the advantage of having less stringent water quality treatment requirements than direct injection into a potable-quality groundwater or discharge to surface waters. However, RIBs require large tracts of land. In many cases, large tracts of permeable land are not available in proximity to the wastewater treatment facilities, where the reclaimed water may be available. The use of injection wells requires much less land area, but requires higher levels of treatment, and therefore cost, to meet the permitting requirements for injection.

Public perception is also a significant constraint for IPR. While water injected into potable-quality aquifers is required to meet drinking water standards, the public may remain concerned about micro-constituents. These concerns have resulted in some entities, who are contemplating indirect potable reuse, to plan for treatment that exceeds the regulatory standards. In addition, natural systems' sensitivity to nutrient enrichment, may require nutrient removal beyond drinking water standards to comply with TMDLs and BMAPs.

*Opportunities*

Planned indirect potable reuse represents a significant opportunity in Florida to increase the use of reclaimed water to the benefit of water supply and natural systems. Indirect potable reuse can be accomplished in two fundamental ways:

- Ground water recharge of an aquifer used as a potable water source.
- Surface-water augmentation (e.g. reservoir, river, lake, etc.) that is used as a potable water source.

In either case, the raw water supply source, whether groundwater or surface water, would be treated by a water treatment facility before it is distributed as potable water.
In general, opportunities for IPR are where reclaimed water is available, and where drinking water sources and natural system needs can be supplemented through groundwater recharge or surface water augmentation.

### 8.1.11 Direct Potable Reuse

*Description*

Recently, as drought and long-term water shortages have occurred within other states and countries, reclaimed water has been investigated as a potable (drinking water) source. According to the U.S. EPA, direct potable reuse (DPR) refers to the introduction of purified water, derived from municipal wastewater directly into a municipal water supply system after extensive treatment and monitoring to assure that strict water quality requirements are met.

As the costs for wastewater disposal have increased, confidence in advanced water treatment has also increased and the regulatory conditions for disposal have become more restrictive. The result has been an increased consideration of DPR, which would entail direct or nearly direct connection of purified reclaimed water systems to potable water facilities. Several high profile potable reuse projects have been investigated in western states and in other countries which involve the process of treating reclaimed water to state and federal drinking water standards so that it can be recycled for potable water supply uses. Four notable DPR projects that are in operation or under construction include the Singapore NEWATER Project, the Colorado River Municipal Water District's Big Spring Project, the Wichita Falls Texas project, and the Cloudcroft New Mexico project. Additional information on these projects can be found in **Appendix D-3**.

In 2011, the WateReuse Foundation and WateReuse California published a report, Direct Potable Reuse – A Path Forward (WateReuse Research Foundation, 2011) . This report cited various factors that would likely cause consideration of DPR as a supply source:

- DPR is lower in cost than indirect potable reuse.
- DPR is a "feasible alternative approach" for water supply.
- DPR can be a reliable source of supply "through a combination of monitoring, storage, and treatment reliability measures."

It appears that the direct reuse of purified water can be considered a viable alternative source of potable water. Direct potable reuse is the most efficient reuse activity at 100 % potable quality water offset (The Reuse Coordinating Committee, 2003). As such, implementation of direct potable reuse would extend water supplies to a greater extent than other types of reuse.

*Constraints*

There are a number of constraints on DPR including,

- The relative availability and lower costs of ground and surface water supplies.
- The established regulatory and testing requirements are generally based on using "natural" sources of water supply; there is not a clear regulatory structure for direct potable reuse.
- Concerns for the sustained reliability of purified water systems.
- Concerns for the impacts of commercial and industrial discharges on water quality.
- Public perception or "yuck factor."

It is significant that the U.S. EPA has published a series of reports titled *Guidelines for Water Reuse*. Those guidelines were first published in 1980 and were subsequently updated with new guidelines issued in 1992, 2004 and most recently in 2012 (EPA, 2012). Those guidelines are comprehensive reviews of the experience, regulations, science, and practice of reclaimed water development and use. The guidelines state that *"In many parts of the world, direct potable reuse may be the most economical and reliable method of meeting future water supply needs."*

*Opportunities*

Although DPR is not currently being implemented by utilities in Florida, there is increasing interest in the concept and it is included in this study as a viable future water supply option. There are several planned indirect potable reuse projects under development in the state that are anticipated to be valuable foundations for future DPR projects in Florida. The WateReuse Research Foundation recently examined DPR with a White Paper report titled; *The Opportunities and Economics of Direct Potable Reuse* (WateReuse Research Foundation, 2014). The report considered the challenges of potable water supply resulting from "prolonged and severe droughts" in California to better understand the potential offered by DPR. The White Paper details how reclaimed water can be economically purified using a series of treatment processes collectively referred to as "complete advanced treatment (CAT)." It cited a water purification process used by the California Orange County Water District as having demonstrated, since 2008, an ability to produce a water, which "meets or exceeds all potable drinking water standards… considered to be safe for direct human consumption." The cost for CAT is judged to range from $2.52/1000 gallons to $6.14/1000 gallons which is considered to be comparable to other alternative water supplies. The White Paper concluded that the treatment technologies, which can be employed in CAT purification systems, are well established and could offer a cost-effective alternative water supply.

Currently, Florida does not have specific regulations for Direct Potable Reuse. The largest opportunities for DPR occur in areas of Florida in which the following two circumstances occur:

- Utilities exist with large uncommitted (excess/unused/disposed) reclaimed water supplies, and
- Where traditional water sources are limited

The large supply of uncommitted excess reclaimed water exists statewide. More than 883 mgd of unused reclaimed water was disposed in 2013, primarily into surface waters or deep injection wells (FDEP, 2014). There are also large portions of the state where traditional water resources have been identified as limited.

The nexus of these two circumstances occurs within six counties. The following six urban coastal counties account for more than 80 % of the excess reclaimed water disposed of into surface waters and/or deep injection wells (Miami-Dade, Broward, Palm Beach, Hillsborough, Duval, and Pinellas). If DPR development is maximized within only these six counties, it would approximately double Florida's total statewide reclaimed water use.

## APPENDIX D-3: EXAMPLES OF RECLAIMED WATER PROJECTS

**Project Name:** Orange County National Golf Center
**Reuse Type:** Public-Access Irrigation & Groundwater Recharge
**Project Location:** Orange County, Florida
**Project Owner:** Orange County and the City of Orlando

**Project Description:** The Orange County National Golf Center encompasses 911 acres west of Orlando. It is owned by the Orange County Utility ratepayers and the City of Orlando, and leased as a world-class golf facility. It was developed first and foremost as a reclaimed water site, providing reclaimed water from the Conserv II facility for irrigation of the golf courses and aquifer recharge through rapid infiltration basins (RIBs) integrated into the course layout. Large RIB sites in this area typically consist of a series of basins interspersed across the site with large areas of open land between them. Hoping to achieve multiple uses on the new lands, the County pursued the option of including golf facilities and providing the reclaimed water for irrigation. Construction began in 1996 and the first golf course opened in 1998. Because the golf course's main water lines are fed directly from the reclaimed water plant, there is no need for a pump station for the 400+ acre facility.

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**Project Name:** Water Independence for Cape Coral Program
**Reuse Type:** Public-Access Irrigation
**Project Location:** Lee County, Cape Coral, Florida
**Project Owner:** City of Cape Coral

**Project Description:** The Water Independence for Cape Coral program was started by the City of Cape Coral in the late 1980’s and was designed to reduce the impact irrigation was having on the shallow aquifer, which also serves as one of the City’s main sources of drinking water supply. The City of Cape Coral has been recognized as having one of the largest municipal residential irrigation demands with a daily average of 26.3 million gallons per day. The map above shows the vast array of pipelines in the City that are used to distribute the irrigation-quality water. The City’s irrigation water is supplied by treated wastewater from the City’s two wastewater facilities and supplemented by water pumped from the City’s five freshwater canal pumping stations. Cape Coral’s freshwater canal system is comprised of 300 miles of canals that provide storage through an extensive system of weirs and pumping stations. The 25 weirs and five canal inter-connects are strategically located to provide storage of freshwater during the rainy season for dry season use. The freshwater canal system also provides management of excess stormwater flows, protects the sensitive estuary environment, and provides flood control for the City.

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**Project Name:** Water CONSERV II
**Reuse Type:** Agricultural Irrigation & Groundwater Recharge
**Project Location:** Orange & Lake Counties
**Project Owner:** Orange County & City of Orlando

**Project Description**: This indirect reclaimed water recharge and irrigation project is the largest in the world and is capable of supplying up to 68 mgd annual average daily flow. Operations began in December 1986. The project area is situated within the SJRWMD and the SFWMD. Highly treated reclaimed wastewater is reused by a combination of agricultural and residential irrigation users and aquifer recharge through rapid infiltration basins (RIBs). The project was the first DEP-permitted use of reclaimed water to irrigate crops for human consumption. Daily flows of reclaimed water not needed for irrigation are diverted to the RIBs for indirect recharge of the Floridan aquifer. The project eliminates discharge of treated wastewater into surface waters and is a proven beneficial, cost effective, year-round reclaimed water reuse. In addition to reducing the demand for groundwater from the Floridan aquifer, replenishment of the Floridan aquifer is achieved through discharge of reclaimed water into RIBs. The 3,725 acres of RIB sites also function as a preserve for over 14 species of plants and animals that are threatened, endangered or of special concern.
Additional features of CONSERV II include:

- 25-30 mgd average reclaimed water flow
- 65 square mile project area
- 21 miles of transmission pipeline
- 70 miles of distribution pipeline
- 2 water reclamation facilities
- 63 RIBs with 123 total cells
- 161 acres RIBs percolation area
- 29.2 mgd RIBs disposal capacity
- 3,250 acres of citrus irrigation
- 1,725 acre RIBs expansion capacity

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**Project Name:** TECO –Lakeland/Mulberry/Polk Reclaimed Water Project
**Reuse Type:** Industrial Reuse
**Project Location:** Polk County, Mulberry, Florida
**Project Owner:** Tampa Electric Company

**Project Description:** The first phase of this project allows the Tampa Electric Company (TECO) to collect reclaimed water from the city of Lakeland, treat it, and use it for cooling water at the Polk Power Station. The project minimizes groundwater withdrawals for cooling and allows the City of Lakeland to reduce discharges into the Alafia River. The next phase of the project will include reclaimed water from Polk County and the City of Mulberry. That phase is scheduled to be complete in 2017. The project is sized to a 2045 build-out capacity of 17 mgd. This public-private partnership, which was designed, permitted, and constructed for $97 million, includes a reclaimed-water pumping station and approximately 20-mile pipeline between the City of Lakeland's wetland treatment system, east of Mulberry, and the power station. The project also includes a 10-mgd treatment and disposal system at the power station that includes advanced treatment (filtration and membranes), a storage tank, and two deep-injection wells. The co-funded project is located in southwest Polk County in the SWUCA.

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**Project Name:** City of Winter Haven Recharge & Surface Water Augmentation
**Reuse Type:** Groundwater Recharge & Natural System Enhancement Reuse
**Project Location:** Polk County, Winter Haven, Florida

**Project Owner:** City of Winter Haven

**Project Description:** This project includes the design, permitting and construction of a groundwater recharge (Lake Starr and others), and surface water augmentation (Peace Creek) reclaimed water system with all necessary infrastructure (transmission, storage, pumping, and advanced wastewater treatment). The system, which is estimated to cost $23.7 million, will have the capacity to recharge 2.7 mgd of effluent to improve groundwater levels in the SWUCA and assist in meeting MFLs. The project would also allow the City to reduce discharges to the Peace Creek Canal during the wet season. The future project is in central Polk County in the SWUCA and in the SWFWMD related portion of the CFWI. The Project will be sized to a 2035 build-out capacity of 4 mgd.

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**Project Name:** City of Clearwater Groundwater Replenishment
**Reuse Type:** Indirect Potable Reuse
**Project Location:** Pinellas County, Clearwater, Florida
**Project Owner:** City of Clearwater

**Project Description:** The City of Clearwater is moving forward with an indirect potable reuse project using groundwater replenishment technology. The project would include an advanced purification plant (filtration and membranes), an aquifer injection system, and all the monitoring infrastructure necessary to recharge the Floridan aquifer with 2.4 mgd of purified effluent from the City's Northeast Water Reclamation Facility. The Floridan aquifer can be protected by balancing the recharge from this project and the withdrawals from the potable water supply wells. Design, permitting, and construction of the indirect potable reuse project is estimated to cost $28.5 million. The co-funded project is under construction in Central Pinellas County in the Northern Tampa Bay Water Use Caution Area of the SWFWMD.

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**Project Name:** Orlando Wetland Park
**Reuse Type:** Environmental (Constructed Treatment Wetlands)
**Project Location:** Orange County, Christmas, Florida
**Project Owner:** City of Orlando

**Project Description:** The Iron Bridge Regional Water Reclamation Facility was constructed by the City of Orlando with a mandate to consolidate several wastewater treatment facilities and to expand the available sewer capacity in the area. However, this regional facility soon needed more effluent disposal or reuse capacity. An innovative solution to this situation was to develop a man-made wetlands system for the reuse of the highly-treated effluent. The 1,220 acre man-made wetland treatment system in Orlando Wetlands Park was completed in 1987 with the conversion of the former pasture areas into wetlands. The system was designed with a hydraulic capacity of 35 MDG of reclaimed wastewater. Seventeen cells and three distinct wetland communities were created to remove residual amounts of nutrients, such as nitrogen and phosphorus, from the reclaimed water. The ecological communities include deep marsh areas, mixed marsh and wet prairie, and hardwood–cypress swamps. A lake is contained within one of the cells. The reclaimed water meanders through the various habitats and after its 40-day journey leaves the Orlando Wetlands Park via a canal and flows into the St Johns River. On average, the wetland system removes about 64% of the total nitrogen and approximately 74% of the total phosphorus in the reclaimed water. The wetlands outflow remains consistently lower than the background levels of phosphorus that are found in the St Johns River.

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**Project Name:** Groundwater Replenishment System
**Reuse Type:** Groundwater Recharge & Indirect Potable Reuse
**Project Location:** Orange County, California
**Project Owner:** Orange County Water District and the Orange County Sanitation District

**Project Description:** The Groundwater Replenishment System (GWRS) in Orange County, California, takes highly treated wastewater that would have previously been discharged into the Pacific Ocean and purifies it to exceed all state and federal drinking water standards. Operational since 2008, this project can produce up to 70 million gallons per day (mgd). Approximately 35 mgd of GWRS water is pumped into recharge wells to create a seawater intrusion barrier. Another 35 mgd is pumped daily to rapid infiltration basins (RIBs) where it naturally filters through sand and gravel to the deep aquifers of the groundwater basin. The recharged groundwater is pumped from over 400 wells operated by local water agencies, cities and other groundwater users. The GWRS is an important and effective way to replenish the groundwater basin and provide indirect potable reuse.

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**Project Name:** Trinity River, Texas
**Reuse Type:** Unplanned Indirect Potable Reuse
**Project Location:** Between Dallas/Fort Worth and Houston, Texas
**Project Owners:** Various water districts and authorities along the river

**Project Description:** Unplanned, or unintentional, indirect potable reuse (IPR) has been occurring for many decades in the United States. Some cases of unplanned IPR are more evident than others. The Trinity River in Texas provides a good example of this unintentional form of IPR. For as long as there have been wastewater treatment plants along the river, and water treatment plants pulling from it for water supply – there has been IPR. The Trinity River is the primary source of water for the city of Houston. Upstream of Houston, the river also receives discharge from wastewater treatment plants in the Dallas/Fort Worth area. The treated wastewater typically takes a two-week journey down the river and collects in Lake Livingston, which is one of Houston's main drinking water reservoirs. During the summer, and other times when the river's natural flow is reduced, the river consists almost entirely of treated wastewater as it flows away from Dallas/Fort Worth. Over the course of a year, it is estimated that about half of the reservoir's water is comprised of treated wastewater from the Dallas/Fort Worth area. In recognition of this IPR, the quality of the treated wastewater has improved in recent years and the value of reclaimed water as a supplemental water supply source has become more widely recognized.

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**Project Name:** NEWater, Singapore
**Reuse Type:** Direct Potable Reuse, Industrial & Commercial
**Project Location:** Singapore
**Project Owner:** Singapore Public Utilities Board

**Project Description:** Singapore's NEWater initiative began in 1998. The primary objective was to determine the suitability of using NEWater as a source of raw water to supplement Singapore's water supply. Singapore wanted to reduce their water dependency on their upstream neighbor (Malaysia), which is treaty bound to sell water to Singapore until 2061, but it has no obligation to do so after that date. NEWater is high-grade reclaimed water. It is produced from treated wastewater that is further purified using advanced membrane technologies and ultra-violet disinfection. The water is potable and is consumed by humans, but is mostly used by industries requiring high-purity water. The latest and largest NEWater facility (50 mgd capacity) began operation in 2010. Currently, NEWater meets up to 30% of the nation's current water needs. By 2060, Singapore plans to expand the current NEWater capacity so that it can meet up to 55% of future water demand.

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**Project Name:** Big Spring, Texas
**Reuse Type:** Direct Potable Reuse
**Project Location:** Big Spring, Texas
**Project Owner:** Colorado River Municipal Water District

**Project Description:** The Colorado River Municipal Water District wanted to provide clean, safe water for their consumers during the region's worst drought in decades. Direct potable reuse (DPR) of highly-treated wastewater was chosen to increase water supplies, given the inability to construct additional surface reservoirs, fresh groundwater was limited, and indirect potable reuse (IPR) wasn't an option because of the high amount of evaporation in the area. The DPR pilot facility, which treats up to 2 mgd of wastewater effluent to drinking water standards, cost $14 million and began operation in 2013. The water district plans to expand the capacity in the future. The highly-treated water from the DPR facility is added to a raw water pipeline that also pulls water from an area lake. This mix (20 % reclaimed water, 80 % raw water) is then distributed to five drinking water facilities in the region where it is treated again using conventional drinking water techniques. Gaining community support for DPR was important, although the communities were mostly supportive from the beginning. The dire drought conditions and public outreach helped convince the public that DPR was necessary. Because DPR is still a developing technology in the U.S., permitting and regulating these new facilities presented some challenges. Texas, not unlike other states, does not have regulations and rules for DPR. As a result, considerable coordination was required with the state regulatory agency to develop guidelines.

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**Project Name:** Wichita Falls Direct Potable Reuse Project
**Reuse Type:** Direct Potable Reuse
**Project Location:** Wichita Falls, Texas
**Project Owner:** City of Wichita Falls

**Project Description:** The City of Wichita Falls, Texas, was facing a severe drought and a declining level in their water supply reservoir. To address the emergency, direct potable reuse (DPR) of highly-treated wastewater was chosen to increase water supplies. Following extensive testing and permitting, the DPR project went online in July 2014. There are plans to transition to an indirect potable reuse (IPR) configuration in several years, depending on the drought conditions. In that configuration, the reclaimed water would be sent to an environmental buffer of some kind before being treated at the drinking water treatment facility. The DPR project provides 5 mgd of water for the City, which is one-third of their daily demand. The City already used microfiltration and reverse osmosis for their brackish potable water supply, so all that was needed for DPR was a 13-mile above-ground pipeline to connect the wastewater treatment facility to the drinking water plant. The pipeline cost approximately $13 million. The mix of reclaimed water and raw water from the reservoir is approximately 50/50. The dire drought conditions helped convince the public that it was necessary, although education was also key. The City created a video about the DPR project, which featured utility representatives, doctors, and experts from local universities talking about the treatment process and the safety of drinking reclaimed water. Because DPR is a developing technology in the U.S., permitting and regulating these new facilities presented some challenges. Texas, not unlike other states, does not have regulations and rules for DPR. As a result, considerable coordination was required with the state regulatory agency to develop guidelines.

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**Project Name:** Cloudcroft Direct Potable Reuse Facility
**Reuse Type:** Direct Potable Reuse
**Project Location:** Cloudcroft, New Mexico
**Project Owner:** Village of Cloudcroft, New Mexico

**Project Description:** The small New Mexico Village of Cloudcroft was facing dry times and peak summer water demands. The local populace agreed to implement a direct potable reuse (DPR) project. Faced with a drought requiring 20,000 gallons of water to be trucked up the mountain daily during the summer, the nearly 1,000 residents quickly let go of any concerns about implementing and funding its new $2 million water reuse system. The DPR facility blends highly-treated wastewater with source water from springs and wells into a storage reservoir. This blended water is primarily used as the source to the drinking water treatment facility. It could also be used for irrigation or firefighting. During low demand times, the blended water will be used for aquifer recharge. What makes the DPR system at Village of Cloudcroft unique, other than being an early use of DPR, is that the Village’s water supply is clearly identifiable, the intervening residence time is relatively short, and the proportion of reclaimed water is relatively high. The purified wastewater constitutes up to 50 % of the drinking water supply. Prior to intake into the potable water treatment system, the reservoir water is stored an average of 30 days for natural treatment by diffusion and sunlight.

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# APPENDIX E: EXISTING AND PROPOSED RESERVOIRS

## APPENDIX E-1: SWFWMD RESERVOIR INVENTORY

1. Pasco County – Boyette Road, 512 Million Gallons Reclaimed Water – The Boyette Road Reservoir is a 500-million-gallon reclaimed water reservoir that serves as a major new component of the Pasco County Master Reuse System (PCMRS). The reservoir helps balance reclaimed water supply and demand, helping to make sufficient reclaimed water available to meet higher dry season demands to make reclaimed water available to more customers in Pasco County. The addition of reclaimed water customers helps to reduce demands for fresh drinking water supplies lawn and landscape irrigation. The Boyette Road Reservoir was required to address a FDEP requirement to stop the discharge of treated wastewaters into area surface waters. The reservoir is located in central Pasco County on Boyette Road, east of Interstate 75 and north of the current Wesley Center Wastewater Treatment Facility. Construction began in May 2013, and was recently completed at a cost of about $31.4 million.
2. C. W. Bill Young Regional Reservoir – The C.W. Bill Young Regional Reservoir is a 15.5 billion gallon reservoir that collects water from the Alafia and Hillsborough Rivers in central Florida. Tampa Bay Water, the regional water authority for Hillsborough, Pinellas, and Pasco counties, worked for nearly a decade to construct the reservoir. It was originally placed in service in mid-2005 and was recently modified. The reservoir is situated on 1,100-acres as an earthen embankment impoundment. It cost $146 million to build. The surrounding 5,200-acre site is designated as a wildlife preserve.
3. Lake Manatee – Lake Manatee is an older reservoir (1967) located in Manatee County near Highway 64 which crosses the eastern end of the lake. The Lake Manatee State Park is found at the southwestern end of the reservoir. The Manatee River flows into the lake at the eastern end and continues to the west, where it flows into Tampa Bay. Lake Manatee is a major source of water for unincorporated Manatee County, Sarasota County and other cities in Manatee and Sarasota counties, providing 32 million gallons per day.
4. Lake Rousseau is an older reservoir on the Withlacoochee River on the boundary of Levy County to the north-west, Marion County to the north-east, and Citrus County to the south. It was created in the 1920s when the river was dammed. The lake is about 35 miles west of Ocala and 10 miles east from the Gulf Coast. It is approximately twelve miles long by one mile wide, covering an area of about 3,700 acres. The lake forms the centerpiece for the Lake Rousseau State Recreation Area and Campground.
5. Hillsborough River Reservoir – The Hillsborough River Reservoir is an older (1944) reservoir located in the City of Tampa and serves as the City's primary water source. The reservoir has a nominal capacity of 1.4 billion gallons.
6. Peace River Reservoir – The Peace River Water Treatment Facility provides a 48 mgd surface water supply to Charlotte, DeSoto, Manatee and Sarasota counties, as well as the City of North Port. The Facility draws water from the Peace River during periods of high river flow and stores that water in an off-stream, 6 billion gallon surface reservoir. During dry periods, when river water is not being harvested, stored water is treated and distributed for use as drinking water.
7. Shell Creek Reservoir - Constructed in 1964, Shell Creek Reservoir is fed by Shell Creek from the east and Prairie Creek from the northwest. The total drainage area at Hendrickson Dam

is 373 square miles creating a reservoir surface area of approximately 800 acres containing 765 million gallons of water. The reservoir serves as a source of water supply, with a capacity of 10 million gallons per day, to the City of Punta Gorda.

8. Ward Lake (Bill Evers Reservoir) – Originally constructed in the late 1930s, Ward Lake is a 2,400 acre reservoir that serves as a primary source of water for the City of Bradenton.

9. Manatee County Reclaimed Water Storage System – Manatee County's reclaimed water system (MARS) has 1.21 billion gallons capacity in six ground storage reservoirs constructed proximate to its three wastewater treatment plants

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## APPENDIX E-2: SJRWMD RESERVOIR INVENTORY:

1. Taylor Creek Reservoir is located in Orange and Osceola County and has a capacity of 10.4 billion gallons. The reservoir was constructed for flood protection and a source for water supply.

2. City of Apopka Reservoir is located in Orange County and has a capacity of 120 million gallons. The reservoir was constructed for reclaimed and storm water storage.

3. C-10 Reservoir will be located in Brevard County. Construction will start on this 1,300-acre reservoir in late 2015. The reservoir will be used for water storage and treatment as part of the Sawgrass Lake Water Management Area.

4. Fellsmere Water Management Area is located in Indian River County. Construction will be completed on this 10,000 acre restored wetlands in 2015. The restored wetlands will provide irrigation water supply and increase water storage in the Blue Cypress Lake watershed.

5. Grove Land Reservoir & Stormwater Treatment Area will be located in Okeechobee and Indian River Counties. The reservoir is identified in SJRWMD's draft 2013 Water Supply Plan as part of the Indian River Lagoon projects. This 3,200-acre reservoir will provide groundwater storage.

6. Mid-Clay Water Storage Project will be located in Clay County. Construction will be complete in 2016. The project consists of storage & recovery of reclaimed water at a Land Application & Recovery Site (LARS), which is a series of surficial aquifer rapid infiltration basins (SARIBs) that flow into an earthen, sub-surface collection system where it can be captured and pumped to CCUA's Reclaimed Water Distribution Facility.

7. Rodman Reservoir is located in Marion and Putnam Counties. The 13,000-acre reservoir was originally constructed for navigation use as part of the Cross Florida Barge Canal. After construction was discontinued on the Barge Canal, the reservoir has been used mainly for recreation.

8. Stick Marsh / Farm 13 is located in Indian River County. The 6,500-acre impoundment was originally constructed for water quality treatment and is currently used for recreation.

9. Lake Asbury Reservoir is located in Clay County. This reservoir was constructed as part of a real estate development and is used for recreation.

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## APPENDIX E-3: SFWMD RESERVOIR INVENTORY:

1. The C-9 Impoundment is located in Broward County. This 1,804 acre impoundment has a projected capacity of 2.1 billion gallons. The project is part of the overall Comprehensive Everglades Restoration Plan and is to be constructed by the US Army Corps of Engineers.

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2. The C-11 Impoundment is located in Broward County. This 1,790 acre impoundment has a projected capacity of 1.9 billion gallons. The project is part of the overall Comprehensive Everglades Restoration Plan and is to be constructed by the US Army Corps of Engineers.

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3. The L-8 Flow Equalization Basin is located in Palm Beach County. This 1,000 acre flow equalization basin has a capacity of 15 billion gallons. The project is part of the State's Restoration Strategies Initiative and is currently under construction by the South Florida Water Management District.

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4. The A-1 Flow Equalization Basin is located in Palm Beach County. This 16,000 acre flow equalization basin has a capacity of 19.5 billion gallons. The project is part of the State's Restoration Strategies Initiative and is currently under construction by the South Florida Water Management District.

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5. The C-51 Reservoir is located in Palm Beach County. This 950 acre reservoir has a projected capacity of 4.6 billion gallons. The project is a planned public private partnership currently in the planning stages.

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6. The C-43 West Reservoir is located in Hendry County. This 10,000 acre reservoir has a projected capacity of 55.4 billion gallons. The project is part of the overall Comprehensive Everglades Restoration Plan and is under construction by the South Florida Water Management District.

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7. The C-44 Reservoir and Stormwater Treatment Area is located in Martin County. This 12,000 acre reservoir and stormwater treatment area has a capacity of 17.9 billion gallons. The project is part of the overall Comprehensive Everglades Restoration Plan and is under construction by the South Florida Water Management District and the US Army Corps of Engineers.

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8. The C-25 Reservoir and Stormwater Treatment Area is located in St. Lucie County. This 904 acre reservoir and stormwater treatment area has a capacity of 1.7 billion gallons. The project is part of the overall Comprehensive Everglades Restoration Plan and is to be constructed by the South Florida Water Management District and the US Army Corps of Engineers.

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9. The C-23 / C-24 Reservoir and Stormwater Treatment Area located in St. Lucie County. This 8,500 acre reservoir and stormwater treatment area has a capacity of 29.9 billion gallons. The project is part of the overall Comprehensive Everglades Restoration Plan and is to be constructed by the South Florida Water Management District and the US Army Corps of Engineers.

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## Appendix E-4: SRWMD Reservoir Inventory:

At the time of the publication of this report, there are no regionally significant water supply reservoirs in the SRWMD. Future alternative water supply project concepts developed in the NFRWSP will likely identify water storage components, potentially including surface reservoirs.

## Appendix E-5: NWFWMD Reservoir Inventory:

Deer Point Lake Reservoir has a surface area of approximately 4,572 acres and a watershed covering approximately 282,880 acres. The reservoir is located about eight miles north of Panama City, and was created through construction of a dam across the northern portion of North Bay in 1961. The reservoir impounds flow from Econfina, Bear, and Cedar creeks and Bayou George and discharges into North Bay. Econfina Creek is the primary tributary to Deer Point Lake, contributing between 57 and 80 percent of the water entering the lake. The reservoir serves as the primary source of drinking water for most of Bay County.

Water from Deer Point Lake Reservoir is provided to the County's retail water service area customers and as a wholesale supply to municipal utilities. Additionally, the County provides water for industrial uses to the RockTenn Paper Mill and Arizona Chemical Company, and for institutional use at Tyndall Air Force Base (AFB). Bay County provides water from Deer Point Lake Reservoir to these wholesale, mostly municipal public supply customers:

- Callaway
- Lynn Haven
- Mexico Beach
- Panama City Beach
- Parker
- Springfield
- Tyndall Air Force Base

The City of Lynn Haven is the only municipality in the region that does not purchase all of its public supply water from the County's utility.