Annual Assessment of Florida's Water Resources and Conservation Lands

2020 Edition

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Executive Summary

The Office of Economic and Demographic Research (EDR) has completed the fourth annual assessment of Florida's water resources and conservation lands pursuant to section 403.928, Florida Statutes. This 2020 Edition is the first version to largely address all statutory requirements and identify the next steps necessary to fully comply with section 403.928, Florida Statutes.

Lands can be acquired for conservation by public or private entities and can be obtained in fee or less-than-fee simple ownership.[1] Once acquired, the lands are typically managed to maintain their conservation purposes. As such, expenditures on conservation lands can be categorized into acquisition expenditures and management expenditures. In Fiscal Year 2018-19, the State of Florida expended $49.53 million on conservation land acquisition and $226.35 million on conservation land management.[2] Regarding the impact on ad valorem taxation, roughly 2.42 percent of the statewide county tax base and 2.15 percent of the statewide school tax base have been removed from the tax roll. As a result, on net, approximately $513 million in county taxes and $397 million in school taxes were shifted to other property owners or lost due to lands being held in conservation in 2019.[3]

Approximately 30 percent of all land in the State of Florida is currently designated for conservation purposes, with eight counties already over 50 percent.[4] If all lands identified in plans set forth by state agencies and water management districts are acquired, this share will jump to over 41 percent.[5] If federal, local, and private plans were accounted for, this share would be even greater. Summing the projected total acquisition costs for the additional conservation lands identified in the plans developed by the state and water management districts produces a preliminary cost estimate of just over $25 billion, of which the analysis suggests that roughly 86 percent would be a state responsibility. At the current rate of annual state conservation land acquisition expenditures, it would take about 370 years to generate the state's share; within the next five years, about one quarter of a percent of the total state cost would be generated. Any future conservation lands that are acquired will entail additional costs for management as well as the acquisition cost. Currently, a dedicated revenue source for managing the state's lands does not exist. Assuming the current level of expenditures per acre, the additional cost to the state to manage its potential land acquisitions is projected to be $100.87 million, annually.

With just under one-third of the land in the State of Florida already acquired for conservation purposes and approaching one-half after accounting for potential conservation land acquisition in the future, significant policy questions arise. For example, how much conservation land is needed and for what purpose? Where should it be located? Should the current pace of the state's conservation land acquisition efforts be accelerated? At what point does the volume of conservation land acreage alter the pattern of economic growth as expanding metropolitan areas are forced upward instead of outward? Is this change acceptable to policy makers? Should there

[1] *See* Section 2.5 for further details on ownership types.
[2] *See* Table 2.2.8.
[3] *See* Table 2.1.3.
[4] *See* Tables 2.1.1. The eight counties are: Broward, Collier, Miami-Dade, Monroe, Okaloosa, Franklin, Liberty, and Wakulla.
[5] *See* Table 2.3.3. This projection does not include any additions to current federal, local, or private conservation lands and is lower than previous editions indicated because overlap between state lists has now been removed.

be a greater focus on selling non-essential conservation lands as surplus? Is primarily owning conservation land in fee simple the most efficient strategy for Florida? Would encouraging less-than-fee simple ownership help to alleviate economic concerns associated with government ownership of conservation land? Are adequate funds available for managing current and future acquisitions? It is EDR's objective that this ongoing report will assist policy makers in developing the answers to these types of questions.

Regarding water supply and demand, according to the water management districts, water demand is projected to increase by nearly 18 percent between 2015 and 2035 and reach 7,549.7 millions of gallons daily by 2035 (assuming average annual rainfall and not accounting for potential new water conservation activities). EDR's prototype water demand model produces similar results. The two largest drivers of water demand are and will continue to be population growth and agriculture. According to the districts' regional water supply plans and water supply assessments, the water needs of the state can be met through the 2035 planning horizon with a combination of traditional and alternative water sources, appropriate management, conservation, and implementation of the projects identified in the applicable regional water supply plans. Because no district can meet its future demand solely with existing source capacity,[6] these extra efforts (and the funding for them) are critical over the period from now through 2035.

The total costs, excluding operations and maintenance, associated with ensuring that future water supplies are available to meet the increasing water demands are estimated to be between $0.31 and $1.77 billion over the 2015 through 2035 planning horizon[7]. EDR's prototype model suggests that the costs are more likely to be at the high end of this range. These estimates are based on an analysis of projects identified by water management districts through the water supply planning process and may change significantly in the future as the methodologies, both of EDR and the water management districts, are refined. This cost estimate only captures the costs of developing alternative water supplies. The future demand not met with existing supply assumes average weather conditions and that the demand which has been met in the past will continue to be met in the future. The risk inherent in these assumptions needs to be explored. In addition, the estimated cost of the projects identified for the natural systems that are currently in recovery or prevention status to meet the minimum flow and minimum water levels are $7.80 billion.[8] The state's share of all of the expenditures necessary to ensure sufficient water supply is expected to be about 4.5 percent.

Preliminary forecasts of the expenditures necessary to comply with several of the federal and state laws and regulations governing water quality protection and restoration indicate a future state expenditure will be needed of approximately $267.29 million for the development of total maximum daily loads,[9] $5.26 billion for the implementation of basin management action plans,[10] and $8.46 billion for completion of the comprehensive Everglades restoration plan.[11] Future editions will expand the water quality analysis to include expenditure forecasts for other activities required by or implemented pursuant to federal or state law, including alternative plans for

[6] *See* Table 4.1.2.
[7] *See* Table 4.6.9.
[8] *See* Section 4.8.
[9] *See* Table 5.1.4.
[10] *See* Table 5.1.6.
[11] *See* the conclusion of Section 7.2.

impaired waters, water quality monitoring, and Everglades restoration initiatives outside of the Comprehensive Everglades Restoration Plan. Alone, the expected state expenditures for Total Maximum Daily Load development, Basin Management Action Plan implementation, and Comprehensive Everglades Restoration Plan implementation will exceed currently dedicated revenues and result in funding shortfalls. The degree to which the assumed timeframes and cost shares underlying these expenditure forecasts are legally required is still being assessed.

In the 2018-19 fiscal year, the State of Florida expended approximately $140 million on water supply[12] projects and an additional $1,021.94 million on water quality and other water resource-related programs.[13] In the most recent three fiscal years, expenditures for water resources have increased significantly, leading to questions about financial sustainability. Based on historical trends, EDR's forecasts indicate that the recent levels of increases in expenditures cannot be sustained into the future using only the implied revenue shares historically allocated to water quality. In this regard, a gap exists in every future year, growing to $577.23 million[14] by the end of the ten-year forecast period—and this does not include any specific adjustments for new or expanding initiatives. Potential options to close the projected gap include the use of statutorily uncommitted Documentary Stamp Taxes, additional General Revenue funds, or bonding. As a result, substantial policy questions arise. What is the total amount of funding that should be committed to these initiatives? What are the appropriate levels of funding and shares among public and private stakeholders? To what extent should land acquisition programs be required to identify quantifiable water resource benefits? It is EDR's objective that this annual report will assist policy makers in developing the answers to these types of questions.

Expenditures necessary to replace, maintain, and expand Florida's aging infrastructure over the next decades will reach tens of billions of dollars statewide. The U.S. Environmental Protection Agency's most recent drinking water, wastewater, and stormwater 20-year survey-based estimates for Florida total $44.3 billion after adjusting for inflation. The surveys only include capital investment needs, so Florida's state, regional, and local governments and its public and private utilities will likely spend far more in total. Similar to the work underway in other states, more research is needed to fully identify all of Florida's water infrastructure needs. A key policy question arises: once they have been identified, what is the state's role in addressing these infrastructure costs?

Subsequent editions of this report will further analyze the future expenditures necessary to comply with laws governing water supply and water quality as well as achieve the Legislature's intent that sufficient water be available for all existing and future reasonable-beneficial uses and the natural systems, while avoiding the adverse effects of competition for water supplies. EDR is continuing to refine the integrated water supply and demand model and to collect the data necessary to address this analysis. After further refinement, the model will be submitted for peer review before full deployment.

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[12] *See* Table 3.1.1.
[13] *See* Table 3.3.7.
[14] *See* Table 8.1.2.

1. Introduction and Purpose

Florida's natural resources are abundant and include 825 miles of sandy beaches;[15] 27,561 miles of streams and rivers; more than 7,700 lakes larger than 10 acres in size covering a surface area of 1.6 million acres, 11.3 million acres of freshwater and tidal wetlands, 33 first magnitude springs,[16] and habitat for 528 endangered or threatened plant species and 55 endangered or threatened animal species.[17] In addition, Florida has fresh groundwater in underlying aquifers which provides drinking water through public supply or private residential wells to approximately 90 percent of Florida's population.[18] It is the intent of this report to assist policy makers with the information needed to effectively and efficiently manage Florida's natural resources.

1.1 Statutory Requirement

Section 403.928, Florida Statutes, directs the Office of Economic and Demographic Research (EDR) to conduct an annual assessment of Florida's water resources and conservation lands. The following directory includes the statutory language as well as the issue's placement in the 2020 Edition of the analysis.

Section 403.928, Florida Statutes:
Assessment of water resources and conservation lands.—The Office of Economic and Demographic Research shall conduct an annual assessment of Florida's water resources and conservation lands.

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(1) WATER RESOURCES.—The assessment must include all of the following:

(a) Historical and current expenditures and projections of future expenditures by federal, state, regional, and local governments and public and private utilities based upon historical trends and ongoing projects or initiatives associated with: 1. Water supply and demand; and 2. Water quality protection and restoration.	***Sections 3.1 & 3.3***

[15] https://floridadep.gov/water/beaches. (Accessed November 2019.)
[16] June 2016, *Integrated Water Quality Assessment for Florida: 2016 Sections 303(d), 305(b), and 314 Report and Listing Update*. Florida Department of Environmental Protection. https://floridadep.gov/dear/dear/content/integrated-water-quality-assessment-florida. (Accessed November 2019.)
[17] http://www.fnai.org/FieldGuide/plant_intro.cfm. (Accessed November 2019.)
[18] Marella, R.L., 2015, *Water withdrawals in Florida*, 2012: U.S. Geological Survey Open-File Report 2015–1156, 10 p., http://dx.doi.org/10.3133/ofr20151156. (Accessed November 2019.)

(b) An analysis and estimates of future expenditures by federal, state, regional, and local governments and public and private utilities necessary to comply with federal and state laws and regulations governing subparagraphs (a)1. and 2. The analysis and estimates must address future expenditures by federal, state, regional, and local governments and all public and private utilities necessary to achieve the Legislature's intent that sufficient water be available for all existing and future reasonable-beneficial uses and the natural systems, and that adverse effects of competition for water supplies be avoided. The assessment must include a compilation of projected water supply and demand data developed by each water management district pursuant to ss. 373.036 and 373.709, with notations regarding any significant differences between the methods used by the districts to calculate the data.	***Ch. 4, Ch. 5, Ch. 6, & Ch. 7***
(c) Forecasts of federal, state, regional, and local government revenues dedicated in current law for the purposes specified in subparagraphs (a)1. and 2. or that have been historically allocated for these purposes, as well as public and private utility revenues.	***Sections 3.2 & 3.4***
(d) An identification of gaps between projected revenues and projected and estimated expenditures.	***Ch. 8***
(2) CONSERVATION LANDS.—The assessment must include all of the following:	
(a) Historical and current expenditures and projections of future expenditures by federal, state, regional, and local governments based upon historical trends and ongoing projects or initiatives associated with real property interests eligible for funding under s. 259.105.	***Section 2.2***
(b) An analysis and estimates of future expenditures by federal, state, regional, and local governments necessary to purchase lands identified in plans set forth by state agencies or water management districts.	***Section 2.3***
(c) An analysis of the ad valorem tax impacts, by county, resulting from public ownership of conservation lands.	***Section 2.1***

(d) Forecasts of federal, state, regional, and local government revenues dedicated in current law to maintain conservation lands and the gap between projected expenditures and revenues.	***Section 2.4***
(e) The total percentage of Florida real property that is publicly owned for conservation purposes.	***Section 2.1***
(f) A comparison of the cost of acquiring and maintaining conservation lands under fee simple or less than fee simple ownership.	***Section 2.5***
(3) The assessment shall include analyses on a statewide, regional, or geographic basis, as appropriate, and shall identify analytical challenges in assessing information across the different regions of the state.	
(4) The assessment must identify any overlap in the expenditures for water resources and conservation lands.	***Section 2.6***
(5) The water management districts, the Department of Environmental Protection, the Department of Agriculture and Consumer Services, the Fish and Wildlife Conservation Commission, counties, municipalities, and special districts shall provide assistance to the Office of Economic and Demographic Research related to their respective areas of expertise.	
(6) The Office of Economic and Demographic Research must be given access to any data held by an agency as defined in s. 112.312 if the Office of Economic and Demographic Research considers the data necessary to complete the assessment, including any confidential data.	
(7) The assessment shall be submitted to the President of the Senate and the Speaker of the House of Representatives by January 1, 2017, and by January 1 of each year thereafter.	

Because this annual report may play a supporting role for future lawmaking regarding Florida's natural resources, EDR has focused on a structure that will facilitate the measurement of changes over time. By keeping the underlying methodologies consistent, the different editions can be directly compared. Some required components of the report are still in development and will be finalized in future editions. The anticipated timeline for introducing the major components is shown below, with each subsequent report building on the prior reports.

- January 1, 2017 – Initial assessment of conservation land acquisition programs.

- January 1, 2018 – Analysis of water supply and demand data and methodologies developed by the water management districts. Assessment of projects and initiatives related to water supply and demand as well as quality protection and restoration, including a review of financial assistance programs for various water projects such as potable water, wastewater, and surface water projects, and an assessment of regulatory programs and initiatives designed to protect water resources.

- January 1, 2019 – Continuation of the assessment in the 2018 report with a status update and initial results from the integrated water supply and demand model. Initial evaluation of the data and methodology to be used in forecasting expenditures necessary to comply with federal and state laws and regulations governing water quality.

- January 1, 2020 – Development of a prototype water demand model with preliminary statewide results. Expanded analysis of water quality programs and the expenditures necessary to comply with applicable laws and regulations. Introduction of water infrastructure systems and an overview of the existing estimates of the expenditures necessary to maintain them.

- January 1, 2021 and beyond – Deployment of the water demand model, capable of modelling various scenarios (*e.g.*, drought, climate change, population shifts), and the resulting annual statewide expenditure forecasts. Complete analysis of water quality programs and the expenditures necessary to comply with applicable laws and regulations. Development of independent estimates of expenditures necessary to maintain, repair, and replace Florida's aging water infrastructure.

Finally, some parts of this edition provided for background and context may not be included in future editions, although references may be made back to it. Other areas will be further developed and replacement tables and figures will be generated. In these cases, any significant differences will be noted. All tables and figures used in this edition supersede those reported in previous editions.

1.2 Principles of Natural Resource Economics

Certain economic principles apply to natural resources that frame many of the analyses in this report. A brief overview of these concepts may provide context to the reader. Inherently, economics is the study of the allocation of scarce resources.[19] Scarcity describes a state where available resources are finite, while the demand for the resource is potentially unlimited. Land,

[19] Russell, R.R. and M. Wilkinson. 1979. Microeconomics: A Synthesis of Modern and Neoclassical Theory. New York: John Wiley and Sons. Cited by: Griffin, R.C. 2006. Water Resource Economics: The Analysis of Scarcity, Policies, and Projects. MIT Press, Cambridge, MA.

freshwater, and the capacity of water resources to assimilate pollutants are examples of scarce resources. Policy decisions regarding the allocation of these resources can benefit from economic insights.

Given the scarcity of resources, society must evaluate economic tradeoffs associated with alternative resource use scenarios and select the optimal scenario. This report examines the combination of feasible and cost-effective projects and activities designed to achieve the following policy goals:

- Meet the growing demand for water.

- Restore and protect water quality.

- Restore and protect the natural systems.

Certain principals of economics apply to natural resource markets that require consideration. A market failure occurs when a free and competitive market leads to an equilibrium that is not socially optimal. This generally occurs due to unique attributes of the good or market. Regarding water resources, market failure potentially occurs due to the following attributes[20]:

- **Public Good**: This occurs if the use of a good by one person does not diminish the availability of the good for other users (non-rival) and it is prohibitively expensive to exclude someone from using the good (non-excludable). For example, recreational uses of public water bodies are generally non-rival and non-excludable and, as such, are public goods. With such goods, well-defined property rights cannot be established, preventing the market system from optimally allocating the resource.

- **Commons**: If a good is non-excludable and two or more users have access to the resource, and if use by one diminishes the use by the other(s), then each user has an incentive to overuse the resource while it is still available. In these instances, resources are often depleted quickly and are not allocated optimally.

  Aquifers serve as an example of commons since, in the absence of government regulation, individuals have incentives to over-withdraw water before it is withdrawn by others. Another example of commons is pollution loading from the Mississippi River Basin into the Gulf of Mexico. The Mississippi watershed includes, in part or in whole, 13 states. Nutrient loading from urban and agricultural areas in these states contributes to increased nutrient concentration in the Gulf, which leads to low-oxygen dead zones. Past reports have also linked nutrient loading from the Mississippi River with harmful algal blooms off the west coast of Florida.[21] Given the size of the watershed and the pollution impact that occurs

[20] Various sources: Griffin, R.C. 2006. Water Resource Economics: The Analysis of Scarcity, Policies, and Projects. MIT Press, Cambridge, MA.
Field, B.C. 2015. Natural Resource Economics: An Introduction. Third Edition. Waveland Press.
Hanley, N., Shogren, J.F., and B. White. Environmental Economics: in Theory and Practice. Macmillan International Higher Education.

[21] National Oceanic and Atmospheric Administration. (2007, November 9). Florida Red Tides Linked To Mississippi River Nutrient Outflow. ScienceDaily. www.sciencedaily.com/releases/2007/11/071108190413.htm . (Accessed November 2019.)

in distant downstream locations, it has been extremely difficult to exclude economic agents from using (and overusing) the pollution assimilative capacity of the Gulf of Mexico.

- **Externalities**: This occurs when a party other than those involved in a market transaction are directly affected by the outcome of the transaction. Externalities can be positive or negative. Water pollution is a classic example of a negative externality. When an economic agent, such as an industrial facility, is responsible for pollution downstream, the downstream effects (without existing regulations) are not reflected in the economic transactions of the plant. An example of a positive externality is return flow. Some water used by one agent, such as a hydroelectric power plant, may be returned back to a stream or aquifer and is available for others to use and potentially benefit from. However, the agents using the water likely do not consider the effects of their activities on the return flow because "they do not derive personal benefits or costs from their own return flow, so, they are not motivated to control return flow to the benefits of agents lying downstream."[22]

- **Natural Monopoly**: This form of monopoly exists when large investments are needed to be in a position to serve customers, and one supplier can serve the entire market at a smaller cost than multiple suppliers. This prevents the competition that is necessary for a market to lead to a socially optimal outcome, but the monopoly may be preferred to the market not existing due to high barriers to entry. Examples of natural monopolies include water utilities and wastewater treatment services. For these markets to be competitive, significant duplication of infrastructure costs would be necessary, which ultimately leads to a more costly provision of goods relative to one supplier. Under a natural monopoly, one supplier controls the market, and in the absence of regulatory mechanisms to appropriately limit their market power, such a monopoly would be expected to set higher prices for goods and services, even if that constrains consumption in comparison with the socially optimal outcome.

- **Overdiscounting**: Private agents tend to overuse depletable resources (such as groundwater) and underinvest in large-scale projects designed to extend or augment the useful life of such resources (such as reservoirs). Decisions depend on individuals' preferences for present-day versus future outcomes. As such, individual preferences determine the rate of discounting of future events. Some studies argue that individuals tend to over-discount future events: "individuals have faulty 'telescopic' vision concerning the future, and are inclined not to make sufficient provision to it."[23] Such over-discounting may lead to over-use of resources today and underinvestment in resource preservation and augmentation.

Market failures provide justifications for institutions other than markets to be developed to achieve a more societally desirable water resource or land allocation. Government policies that are intended to correct for market failures should be designed to achieve an allocation of goods that is

[22] Griffin, R.C. 2006. Water Resource Economics: The Analysis of Scarcity, Policies, and Projects. MIT Press, Cambridge, MA. At P. 111.

[23] Sassone, P.G., and W.A. Schaeffer. 1978. Cost-Benefit Analysis. New York: Academic Press. Cited in: Griffin, R.C. 2006. Water Resource Economics: The Analysis of Scarcity, Policies, and Projects. MIT Press, Cambridge, MA. At p. 105.

as close to the socially optimal allocation of goods as possible. This is traditionally attempted through two tools:

- Regulations (such as standards or quotas).
- Economic instruments (such as subsidies, taxes and fees, and market-based instruments such as water quality credit trading and payment for ecosystem services).

Policies used to correct for market failures in the Florida water markets include a mix of regulations and economic instruments. Examples of regulatory policies include the permitting programs that regulate consumptive uses of water or pollutant discharges into waterbodies. Examples of economic instruments include the inclining block rate structure of many water utilities under which the price per unit of water increases with the amount of water demanded.

This framework may offer guidance in evaluating two particular parts of section 403.928(1)(b), Florida Statutes, which states that this annual report's analysis and estimates must address future expenditures "necessary to achieve the Legislature's intent that sufficient water be available for all existing and future reasonable-beneficial uses and the natural systems, and that adverse effects of competition for water supplies be avoided." The interpretation of this subsection is crucial to the foundation of much of the water supply and demand analysis in this report.

The first part, regarding "the Legislature's intent that sufficient water be available for all existing and future reasonable-beneficial uses" is made difficult by the fact that the determination of whether or not a use is reasonable-beneficial can change over time and is, in part, determined by the quantity of water to be used.[24] For example, imagine an agricultural producer who can produce a crop using a variety of irrigation systems. In a world without water scarcity, irrigation relying on a low-efficiency and low-cost system could be considered a reasonable-beneficial use. In reality, as population and other commercial water uses grow, water scarcity increases. As such, for a use to be considered reasonable-beneficial in the future, more costly technologies with higher irrigation efficiencies may be required. In this regard, as time goes on and demand for water in the state continues to increase, the efficiency requirements for agricultural irrigation systems could become more stringent[25] and an agricultural operation with a specific irrigation system that would have been considered a reasonable-beneficial use 20 years ago may not pass muster 20 years from now. Similarly, considering water use permits for public supply, the projected per capita water use cap could be reduced over time in response to increasing water scarcity due to more and more users of the limited existing supply.

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[24] To obtain a water use permit, an applicant must establish that the proposed use of water: (a) is a reasonable-beneficial use; (b) will not interfere with any presently existing legal use of water; and (c) is consistent with the public interest. The term "Reasonable-beneficial use" is defined in section 373.019, Florida Statutes, as: "the use of water in such quantity as is necessary for economic and efficient utilization for a purpose and in a manner which is both reasonable and consistent with the public interest." Further guidance is provided in rule 62-40.410 of the Florida Administrative Code, DEP's Water Resource Implementation Rule, which identifies the first of 18 factors to be considered in determining if a water use is a reasonable-beneficial use is the "quantity of water requested for the use."

[25] For example, see the changes in the efficiency goals over time for supplemental irrigation in SWFWMD on p. 62 in Water Use Permit Applicant's Handbook, Part B, available at: https://www.swfwmd.state.fl.us/sites/default/files/medias/documents/WUP_Applicants_Handbook_Part_B.pd_.pdf. (Accessed November 2019.)

The question arises: when is it possible that there is not sufficient water available for a reasonable-beneficial use, particularly if it is possible that the determination of a use as reasonable-beneficial can partially depend on whether sufficient water is available? Considering all of this, EDR assumes that this part of section 403.928(1)(b), Florida Statutes, is to be interpreted to include a similar regulatory structure to address water scarcity as is seen today. For example, if an entity is seeking to withdraw 100 million gallons of water daily from an aquifer, it must seek a permit from the appropriate water management district and, depending on the efficiency of water use in the proposed activity, availability of water, and the status of affected natural systems, it may need to invest in alternative water supply projects (for which governmental subsidies may be available).

The second part of section 403.928(1)(b), Florida Statutes, indicates that the report's analysis must address the Legislature's intent that "adverse effects of competition for water supplies be avoided." As a scarce resource in high demand, competition for water supplies is inevitable. In *A Model Water Code*, used as a basis for the existing water regulations in Florida, it was suggested that the:

> [R]egulation of consumptive uses and reallocation of water to more productive uses … would enable state officials to prevent overdevelopment and competition for water, requiring low value users to seek new supplies. Underdevelopment as well as overdevelopment can be avoided by a choice of the better use when pending applications for water use relate to the same supply and the available water is not sufficient for both. … Long-range plans must not only anticipate such changes in water use patterns, but must actually induce transfers to higher value uses.[26]

In other words, when the water policies in Florida were developed, the choice of the types of use in the process of granting water use permits was envisioned as a strategy to address the competition for water resources. While the water policies in Florida have evolved since *A Model Water Code* was written, competition for water supplies remains inherent and essential. The question that arises is: when is competition for water supplies considered adverse? EDR interprets "adverse effects of competition for water supplies" to mean that water scarcity has driven the costs associated with obtaining water supplies to such a level that reasonable-beneficial uses exist that can no longer be afforded due to this increased cost, even after accounting for government subsidies. Thus, if there are sufficient water supplies available for all existing and future reasonable-beneficial uses, then the adverse effects of competition for those water supplies have been avoided.

The economic concepts and principles presented in the section provide a framework for evaluating the unique aspects of natural resources and the role of government in both preserving and allocating them.

[26] Malone et al. "A Model Water Code" 1972 at 74-75, available at: https://ufdc.ufl.edu/WL00004678/00001/. (Accessed November 2019.)

2. Assessment of Florida's Conservation Lands

Florida has a long tradition of acquiring land and water areas to conserve and protect natural and cultural resources and to provide for outdoor, resource-based recreation. Prior to the 1960s, Florida did not have any formal land acquisition programs and no dedicated funding sources for land acquisition for conservation and outdoor, resource-based recreation. Instead, land acquisition was *ad hoc* and the result of either specific appropriations to purchase particular parcels of land or donations from private landowners or the federal government.[27]

In 1963, the Land Acquisition Trust Fund (LATF) was created to fund the newly-established Outdoor Recreation and Conservation Program for the purchase of land for parks and recreation areas. The program was funded by a 5 percent tax collected on outdoor clothing and equipment. In 1968, the LATF was funded for the first time with bond proceeds: debt service on the $20 million bond issuance was paid from Documentary Stamp Tax receipts collected from deeds and notes. In the 1970s, Florida voters approved a ballot referendum authorizing a $200 million bond program to fund the Environmentally Endangered Lands (EEL) program and authorized an additional $40 million in recreation bonds. Debt service on these bonds continued to be paid from a portion of the Documentary Stamp Tax.[28]

In 1979, the Conservation and Recreation Lands (CARL) program was created to replace and expand the former EEL program. Under the CARL program, funds were allocated for the acquisition of lands to protect and conserve natural resources and, for the first time, archeological and historical resources. However, unlike its predecessor, the CARL program was initially funded by proceeds collected from taxes levied on the severance of phosphate and other minerals. Later on, it received funding from the Documentary Stamp Tax. From 1979 through 1990, the CARL program protected approximately 181,000 acres of conservation and recreation lands at a cost of nearly $356 million.[29]

In 1981, the Legislature authorized the sale of $275 million in bonds to purchase lands along Florida's coastline. Known as the Save Our Coast program, this coastal land acquisition program was implemented as part of the LATF-funded programs and resulted in the purchase of more than 73 miles of coast line or 73,000 acres of coastal land.[30]

Also in 1981, the Save Our Rivers program was created for the acquisition and restoration of water resources by encouraging the acquisition of buffer areas alongside surface waters. The program was funded from Documentary Stamp Tax revenues; the funds were distributed to the five water management districts (WMDs) roughly in proportion to the population within their districts. Through the Save Our Rivers program, the WMDs acquired more than 1.7 million acres of land, including land acquired by the South Florida Water Management District as part of the restoration efforts of the Florida Everglades.[31]

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[27] Farr, James A., *Florida's Landmark Programs for Conservation and Recreation Land Acquisition* (2006), Sustain, a Journal of Environmental and Sustainability Issues, Issue 14, Spring/Summer 2006, available at: http://partnershipgreencity.wixsite.com/greencitypartnership/sustain-magazine. (Accessed November 2019.)
[28] *Id.*
[29] *Id.*
[30] *Id.*
[31] *Id.*

The Preservation 2000 program (P2000) was created in 1990 as an aggressive public land acquisition program aimed at preserving the quality of life in Florida. Under the P2000 program, $3 billion in bonds were authorized over a ten-year period running from 1991 to 2000. The debt service was paid from Documentary Stamp Tax revenues. Each year, in an effort to counteract the alteration and development of natural areas resulting from Florida's rapidly growing population, bond proceeds were distributed to land acquisition programs such as the CARL program, the WMDs' Save Our Rivers programs, Florida Communities Trust, and the recreational trails program. Under the P2000 program, over 1.7 million acres of land was acquired at a cost of nearly $3.3 billion.[32]

Florida's current blueprint for public land acquisition is the Florida Forever program, which was created in 1999 as the successor to the P2000 program.[33] To date, the Florida Forever program has been responsible for the acquisition of 813,213 acres of land at a cost of nearly $3.1 billion dollars.[34] The Florida Forever program is discussed in greater detail in section 2.2 of this edition.

Except as otherwise provided in law, the Board of Trustees of the Internal Improvement Trust Fund (Board of Trustees), comprised of the Governor, Attorney General, Chief Financial Officer, and Commissioner of Agriculture, holds title to state-owned lands and is charged with "acquisition, administration, management, control, supervision, conservation, protection, and disposition" of state lands.[35] Accordingly, under the Florida Forever program and the previous acquisition programs, title to state land acquired for conservation purposes is held by the Board of Trustees.[36] Lands acquired by the WMDs and local governments with funding from the Florida Forever program are held in the name of the acquiring governmental entity.

The Board of Trustees and the WMDs also have authority to sell real property or interests in real property determined to be surplus in accordance with applicable procedures prescribed in law. The process of selling lands determined to be surplus may ultimately result in a sale or exchange of real property or interests in real property. In general, the procedures under which the Board of Trustees may surplus state-owned lands is set forth in section 253.0341, Florida Statutes. The WMDs must follow the requirements set forth in sections 373.056, 373.089, and 373.139, Florida Statutes. Further, for any conservation lands acquired under the P2000 program, the Board of Trustees and the WMDs must also comply with additional requirements set forth in section 259.101(6), Florida Statutes. For more information regarding the surplus process for conservation lands, see the 2019 Edition.[37]

Once state-owned conservation lands are sold through the surplus process, proceeds from the sale of conservation lands purchased before July 1, 2015, must be deposited into the Florida Forever Trust Fund.[38] Proceeds from the sale of conservation lands purchased after July 1, 2015, must be deposited into the LATF unless the lands were purchased with funds from a trust fund other than

[32] Florida Department of Environmental Protection, Statistical Abstract of Land Conservation as of September 30, 2016. This data excludes payments for debt service.
[33] Ch. 99-247, Laws of Fla. (codified as amended at § 259.105, Fla. Stat.).
[34] Florida Department of Environmental Protection, Florida Forever Monthly Complete Report (as of September 30, 2019) available at https://floridadep.gov/lands/environmental-services/content/florida-forever. (Accessed October 2019.)
[35] § 253.03(1), Fla. Stat.
[36] § 259.105(7)(c), Fla. Stat.
[37] *See*: http://edr.state.fl.us/Content/natural-resources/LandandWaterAnnualAssessment_2019Edition.pdf.
[38] § 253.0341(12), Fla. Stat.

LATF or a trust fund created to implement section 28, article X of the Florida Constitution.[39] In that instance, those proceeds must be deposited in the trust fund from which the conservation lands were purchased.[40] For the WMDs, revenues derived from the sale of surplus lands may only be used for (1) the payment of debt service on revenue bonds or notes or (2) the purchase of other lands for flood control, water storage, water management, conservation and protection of water resources, aquifer recharge, water resource and water supply development, or preservation of wetlands, streams, and lakes.[41]

A summary of conservation land sales reported by each WMD and the Florida Department of Environmental Protection, on behalf of the Board of Trustees (BOT), is provided in Table 2.0.1.

Table 2.0.1 Summary of Recent Surplus Conservation Land Sales and Available Surplus

WMD/State	FY2016-17		FY2017-18		FY2018-19		Available Acres for Surplus
	Acres	Revenue ($millions)	Acres	Revenue ($millions)	Acres	Revenue ($millions)	
NWFWMD	-	$-	-	$-	-	$-	161.39
SJRWMD	948.35	$0.01	1.53	$0.00	-	$-	-
SFWMD	-	$-	2,591.73	$1.27	-	$-	-
SWFWMD	333.50	$0.57	1,151.81	$5.90	-	$-	905.13
SRWMD	-	$-	100.22	$0.00	-	$-	328.82
BOT	204.76	$0.4	40.84	$0.02	1.16	$0.17	7.66
Total:	**1,486.61**	$0.98	**3,886.13**	**7.19**	**1.16**	**$0.17**	**1,403.00**

Note: "$-" indicates a zero, whereas "$0.00" indicates an amount less than $5,000.
Source: Disposition of State Lands and Facilities Annual Reports for the 2017, 2018, and 2019 fiscal years, produced by the Florida Department of Environmental Protection and the Florida Department of Management Services.

2.1 Percentage and Effect of Publicly-owned Real Property for Conservation Purposes

The Office of Economic and Demographic Research (EDR) is directed to analyze the percentage of Florida real property that is publicly owned for conservation purposes as well as the ad valorem tax impacts, by county, resulting from public ownership of conservation lands. Lands held in conservation by public entities are totally exempt from ad valorem taxation and, as such, reduce ad valorem tax collections. It is possible that this reduction in collections is offset, at least in part, by an increase in property values of surrounding properties.

The Percentage of Florida Owned in Conservation by Public Entities

The Florida Natural Areas Inventory (FNAI), a non-profit organization administered by Florida State University, is one of the most complete repositories for geo-information on conservation land areas in Florida.[42] FNAI's primary contract is with the Florida Department of Environmental

[39] § 253.0341(13), Fla. Stat.
[40] *Id.*
[41] § 373.139(1), (6), Fla. Stat.
[42] Florida Natural Areas Inventory, Conservation Lands, http://www.fnai.org/conservationlands.cfm. (Accessed September 2019.)

Protection (DEP), through which FNAI provides various services such as natural resource assessments in aid of assessing and setting priorities for the Florida Forever program.[43] Through its funding from DEP, FNAI also compiles the "Summary of Florida Conservation Lands," which provides a summary of conservation land acreages managed by federal, state, local, and private entities in Florida.[44]

In order to be considered conservation lands for the purpose of FNAI's database, "a significant portion of the property must be undeveloped and retain most of the attributes one could expect it to have in its natural condition. In addition, the managing agency or organization must demonstrate a formal commitment to the conservation of the land in its natural condition."[45] EDR uses the FNAI data in identifying conservation lands in Florida as it provides the most comprehensive information on lands managed for conservation purposes by federal, state, local, and private entities.[46]

It is clear from Figure 2.1.1 that much of the conservation land identified by FNAI is in fact water areas being managed as part of conservation land. In determining the share of the state held as conservation lands, it is imperative that the numerator (the amount of Florida land held as conservation land) and the denominator (the amount of Florida land) be from the same source and not include water. The United States Census Bureau maintains annually updated geographic files of each state, its counties, and all waterbodies.[47] The Census Bureau county and waterbody geographies are used to calculate the total acres and conservation land acres of each Florida county.[48]

As of August 2019, all non-submerged conservation lands in Florida cover 10.41 million acres, comprising 30.32 percent of the total state land area (34.34 million acres). Figure 2.1.1 provides a map of all conservation lands in Florida. Table 2.1.1 provides county level detail regarding acreage in and out of conservation and the share of total county land acreage held in public or private conservation. Also included are the population density and effective population density calculated

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[43] Florida Natural Areas Inventory, Partnerships, http://www.fnai.org/partnerships.cfm. (Accessed September 2019.)

[44] *See* Florida Natural Areas Inventory, Summary of Florida Conservation Lands Acreages (Including Less-than-Fee) February 2019, available at: http://www.fnai.org/PDF/Maacres_201902_FCL_plus_LTF.pdf. (Accessed September 2019.)

[45] Florida Natural Areas Inventory, Conservation lands, Frequently Asked Questions about Florida Conservation Lands, http://www.fnai.org/conlands_faq.cfm. (Accessed September 2019.)

[46] It is important to note that with regard to state-owned lands, section 253.034, Florida Statutes, broadly defines the term "conservation lands" to mean: "[L]ands that are currently managed for conservation, outdoor resource-based recreation, or archaeological or historic preservation, except those lands that were acquired solely to facilitate the acquisition of other conservation lands. Lands acquired for uses other than conservation, outdoor resource-based recreation, or archaeological or historic preservation may not be designated conservation lands except as otherwise authorized under this section." The most notable differences in the definition of conservation lands observed thus far are with respect to historical or archaeological sites and certain less than fee interests. While the state's definition includes lands managed for historical or archaeological preservation (*e.g.,* lands managed by the Florida Department of State's Division of Historical Resources), according to FNAI, such lands would only be included in the FNAI database if the property is preserved in its natural state, and not for the purpose of preserving or restoring historic buildings or other land improvements. However, the FNAI data does include less-than-fee interests, such as conservation easements as defined in section 704.06, Florida Statutes, which are conveyed in perpetuity and are regularly monitored by an agency or other organization. This may include, for example, conservation easements that are held by the State or a water management district for the purpose of mitigating adverse impacts to wetlands and other surface waters caused by a permitted activity under part IV of chapter 373, Florida Statutes.

[47] United States Census Bureau, TIGER/Line Shapefiles, https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-line-file.html. (Accessed October 2019.)

[48] This results in minor variances in county and statewide acreage between editions of this report.

as the population of a county as of 2018 divided by the land acreage and the land acreage not held for conservation, respectively.

The effective population density provides a more realistic view of density, particularly in counties like Monroe County where population density jumps from less than 0.12 persons per acre to more than 2.2 persons per acre when the effects of conservation lands are considered. Statewide, population density in 2018 was 0.61 persons per acre but increases to 0.87 when conservation lands are removed. This latter statistic will become important to EDR's future assessment of conservation land. For example, the most dense county in the state is typically considered to be Pinellas County at 5.54, but when the effect of conservation land is considered, it switches to Miami-Dade County at 7.30.

[See figure on following page]

Figure 2.1.1 Map of All Conservation Lands in Florida

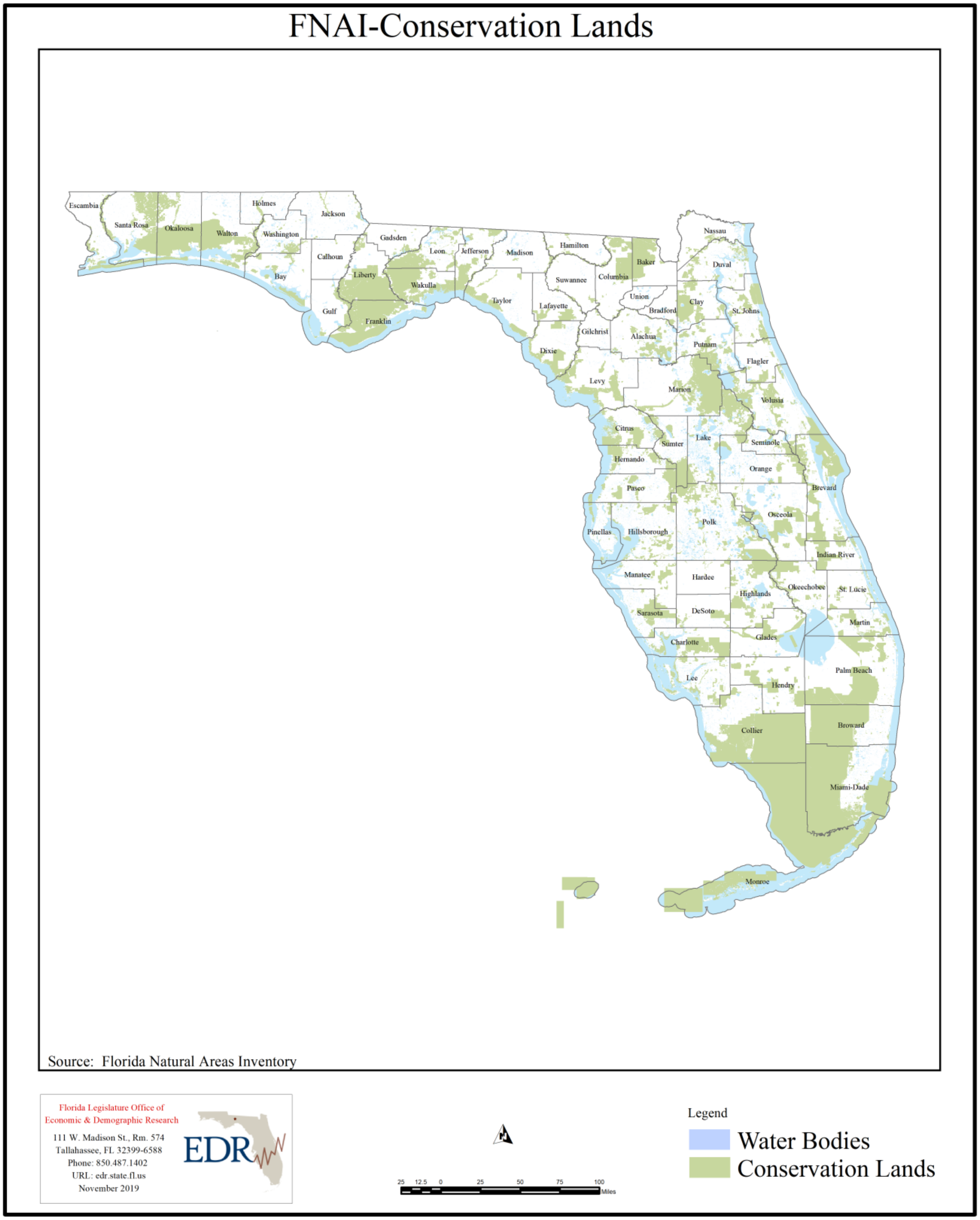


Table 2.1.1 Conservation Lands and Effective Population Density

	County Acres	Non-Conservation Acres	Conservation Acres	Public Conservation Acres	Private Conservation Acres	Share of County in Conservation	Pop. Density	Effective Pop. Density
Alachua	560,344.80	462,134.95	98,209.85	94,235.20	3,974.65	17.53%	0.47	0.57
Baker	374,547.30	209,946.03	164,601.27	164,567.41	33.86	43.95%	0.07	0.13
Bay	485,498.75	415,626.13	69,872.62	63,636.96	6,235.66	14.39%	0.37	0.44
Bradford	188,136.68	177,018.15	11,118.54	10,279.40	839.14	5.91%	0.15	0.16
Brevard	649,677.23	378,816.95	270,860.28	268,777.64	2,082.64	41.69%	0.90	1.54
Broward	769,804.83	287,715.04	482,089.79	482,058.61	31.18	62.62%	2.47	6.60
Calhoun	363,095.33	357,070.64	6,024.69	5,970.89	53.80	1.66%	0.04	0.04
Charlotte	435,908.39	263,923.19	171,985.19	171,938.31	46.89	39.45%	0.41	0.67
Citrus	372,489.17	248,754.11	123,735.06	123,541.01	194.06	33.22%	0.39	0.59
Clay	386,953.80	244,050.72	142,903.08	127,493.00	15,410.08	36.93%	0.55	0.87
Collier	1,278,040.26	403,822.55	874,217.70	861,936.31	12,281.39	68.40%	0.29	0.91
Columbia	510,432.86	362,033.82	148,399.04	145,966.56	2,432.48	29.07%	0.14	0.19
DeSoto	407,483.72	358,008.15	49,475.57	49,072.00	403.57	12.14%	0.09	0.10
Dixie	451,269.35	332,487.55	118,781.81	118,781.81	-	26.32%	0.04	0.05
Duval	488,082.77	407,198.29	80,884.47	68,714.99	12,169.48	16.57%	1.95	2.34
Escambia	420,462.89	375,588.87	44,874.02	42,487.06	2,386.96	10.67%	0.76	0.85
Flagler	310,492.83	265,741.34	44,751.50	41,126.48	3,625.02	14.41%	0.35	0.40
Franklin	348,890.19	65,670.59	283,219.60	281,758.01	1,461.59	81.18%	0.03	0.18
Gadsden	330,437.70	311,644.19	18,793.52	16,525.73	2,267.78	5.69%	0.14	0.15
Gilchrist	223,804.74	215,369.79	8,434.95	8,316.06	118.88	3.77%	0.08	0.08
Glades	516,203.67	420,533.97	95,669.70	77,383.14	18,286.56	18.53%	0.03	0.03
Gulf	354,201.16	306,804.25	47,396.91	47,396.91	-	13.38%	0.05	0.05
Hamilton	328,820.55	304,150.00	24,670.56	24,534.06	136.50	7.50%	0.04	0.05
Hardee	408,048.02	396,109.99	11,938.03	11,453.47	484.56	2.93%	0.07	0.07
Hendry	739,986.61	584,944.60	155,042.01	151,326.21	3,715.79	20.95%	0.05	0.07
Hernando	302,694.76	215,546.16	87,148.60	86,874.25	274.35	28.79%	0.61	0.86
Highlands	651,295.35	459,188.29	192,107.06	175,415.73	16,691.33	29.50%	0.16	0.22
Hillsborough	654,031.64	545,307.44	108,724.19	108,303.18	421.02	16.62%	2.15	2.58
Holmes	306,470.53	293,477.26	12,993.27	12,993.27	-	4.24%	0.07	0.07
Indian River	321,781.59	223,451.48	98,330.11	95,288.35	3,041.76	30.56%	0.47	0.68
Jackson	587,727.44	568,004.08	19,723.36	18,853.32	870.04	3.36%	0.09	0.09
Jefferson	382,769.48	271,623.01	111,146.47	75,271.59	35,874.88	29.04%	0.04	0.05
Lafayette	347,740.63	287,818.82	59,921.81	59,921.81	-	17.23%	0.02	0.03
Lake	608,484.91	410,488.50	197,996.41	194,748.63	3,247.78	32.54%	0.56	0.84
Lee	500,132.28	399,655.16	100,477.12	96,755.49	3,721.63	20.09%	1.43	1.79
Leon	426,809.68	266,476.88	160,332.80	132,131.39	28,201.41	37.57%	0.68	1.10
Levy	715,662.46	542,383.97	173,278.50	173,268.24	10.26	24.21%	0.06	0.08
Liberty	534,760.61	195,590.17	339,170.44	332,736.68	6,433.75	63.42%	0.02	0.05
Madison	445,786.32	428,817.48	16,968.84	16,547.39	421.45	3.81%	0.04	0.05
Manatee	475,923.72	413,632.40	62,291.32	60,829.48	1,461.84	13.09%	0.79	0.91
Marion	1,016,586.40	670,854.98	345,731.43	345,484.67	246.75	34.01%	0.35	0.53
Martin	348,045.92	254,483.63	93,562.29	91,839.05	1,723.24	26.88%	0.45	0.61
Miami-Dade	1,215,898.43	380,691.33	835,207.10	821,811.38	13,395.71	68.69%	2.29	7.30
Monroe	629,139.01	31,866.91	597,272.10	596,407.89	864.21	94.93%	0.12	2.32
Nassau	415,155.56	386,153.67	29,001.90	22,740.86	6,261.03	6.99%	0.20	0.21
Okaloosa	595,344.11	278,161.20	317,182.92	317,182.92	-	53.28%	0.33	0.71
Okeechobee	492,260.60	383,815.65	108,444.95	105,962.55	2,482.40	22.03%	0.08	0.11
Orange	577,193.98	480,464.66	96,729.32	92,493.37	4,235.95	16.76%	2.34	2.81
Osceola	849,755.59	671,460.22	178,295.37	167,109.75	11,185.62	20.98%	0.41	0.52
Palm Beach	1,257,149.80	780,415.33	476,734.47	476,721.75	12.72	37.92%	1.14	1.84
Pasco	477,831.14	366,605.55	111,225.59	109,900.56	1,325.03	23.28%	1.08	1.40
Pinellas	175,217.26	157,904.82	17,312.44	17,312.44	-	9.88%	5.54	6.15
Polk	1,150,425.36	861,686.29	288,739.06	269,612.27	19,126.79	25.10%	0.59	0.78
Putnam	465,834.98	348,834.60	117,000.38	116,114.89	885.49	25.12%	0.16	0.21
Santa Rosa	647,922.85	391,377.04	256,545.81	255,024.45	1,521.36	39.60%	0.27	0.45
Sarasota	355,841.14	247,403.50	108,437.63	107,564.27	873.36	30.47%	1.17	1.69
Seminole	199,608.64	160,998.50	38,610.14	37,952.21	657.94	19.34%	2.32	2.88
St. Johns	384,361.59	304,330.23	80,031.36	73,461.47	6,569.89	20.82%	0.62	0.78
St. Lucie	365,856.33	332,947.64	32,908.69	30,407.99	2,500.70	8.99%	0.83	0.91
Sumter	356,569.53	246,681.64	109,887.89	109,778.84	109.05	30.82%	0.35	0.51
Suwannee	440,673.46	419,445.17	21,228.29	21,130.76	97.53	4.82%	0.10	0.11
Taylor	667,723.36	570,546.21	97,177.15	92,282.29	4,894.86	14.55%	0.03	0.04
Union	155,875.20	155,640.19	235.01	199.09	35.92	0.15%	0.10	0.10
Volusia	704,795.24	493,710.91	211,084.33	208,445.34	2,638.99	29.95%	0.75	1.08
Wakulla	388,107.62	136,564.87	251,542.75	250,164.00	1,378.75	64.81%	0.08	0.23
Walton	664,155.10	413,945.37	250,209.73	244,736.13	5,473.60	37.67%	0.10	0.16
Washington	374,193.19	323,895.69	50,297.49	49,583.52	713.97	13.44%	0.07	0.08
Statewide	34,336,706.41	23,927,510.78	10,409,195.63	10,130,640.75	278,554.88	30.32%	0.61	0.87

Conservation lands in Florida are owned[49] by federal, state, and local governments, or by private entities.[50] Of the total 10.41 million acres of conservation lands in Florida in 2019, 97.32 percent is publicly-owned (10.13 million acres). Among the publicly-owned conservation lands, 53.92 percent is owned by the state government, 41.14 percent is owned by the federal government, and 4.94 percent is owned by local governments. At this time, every county in Florida has publicly-owned lands dedicated to conservation purposes. Table 2.1.2 provides a breakdown of publicly held conservation lands by county and indicates that 29.50 percent of the state's total land area is publicly held for conservation.

[See table on following page]

[49] Due to the lack of ownership data at the county level, the FNAI managed area data is used as a proxy to calculate ownership shares. For the purposes of this report, ownership reflects the primary managing entity.

[50] Some of the state-owned conservation lands are managed across regions in the state (*e.g.*, the conservation lands managed by the five water management districts). In Table 2.1.2, such regional conservation lands are included in the State/Regional category.

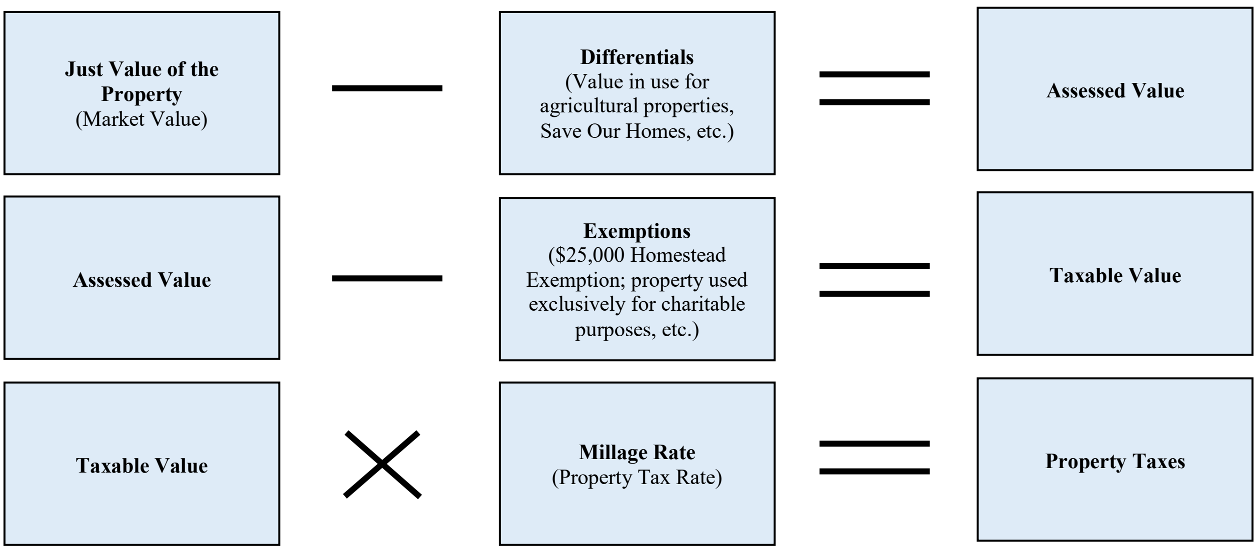
Table 2.1.2 Conservation Lands by Public Ownership

County	Local		State/Regional		Federal		Total Public Cons.	
	Acres	%	Acres	%	Acres	%	Acres	%
Alachua	17,973.62	3.21%	76,258.10	13.61%	3.49	0.00%	94,235.20	16.82%
Baker	2,591.17	0.69%	37,905.45	10.12%	124,070.79	33.13%	164,567.41	43.94%
Bay	2,940.40	0.61%	31,173.02	6.42%	29,523.54	6.08%	63,636.96	13.11%
Bradford	149.77	0.08%	10,105.33	5.37%	24.31	0.01%	10,279.40	5.46%
Brevard	18,382.35	2.83%	154,869.91	23.84%	95,525.37	14.70%	268,777.64	41.37%
Broward	4,974.38	0.65%	477,066.79	61.97%	17.43	0.00%	482,058.61	62.62%
Calhoun	-	0.00%	5,059.95	1.39%	910.94	0.25%	5,970.89	1.64%
Charlotte	4,480.61	1.03%	166,894.01	38.29%	563.69	0.13%	171,938.31	39.44%
Citrus	304.94	0.08%	113,989.52	30.60%	9,246.55	2.48%	123,541.01	33.17%
Clay	1,165.12	0.30%	126,327.89	32.65%	-	0.00%	127,493.00	32.95%
Collier	4,578.71	0.36%	213,518.16	16.71%	643,839.44	50.38%	861,936.31	67.44%
Columbia	1,048.79	0.21%	28,249.10	5.53%	116,668.67	22.86%	145,966.56	28.60%
DeSoto	210.85	0.05%	45,828.89	11.25%	3,032.25	0.74%	49,072.00	12.04%
Dixie	-	0.00%	90,779.27	20.12%	28,002.54	6.21%	118,781.81	26.32%
Duval	22,994.02	4.71%	29,558.46	6.06%	16,162.50	3.31%	68,714.99	14.08%
Escambia	1,772.86	0.42%	28,218.06	6.71%	12,496.15	2.97%	42,487.06	10.10%
Flagler	6,870.65	2.21%	34,255.82	11.03%	-	0.00%	41,126.48	13.25%
Franklin	296.17	0.08%	247,768.11	71.02%	33,693.73	9.66%	281,758.01	80.76%
Gadsden	232.80	0.07%	16,292.93	4.93%	-	0.00%	16,525.73	5.00%
Gilchrist	273.19	0.12%	8,042.87	3.59%	-	0.00%	8,316.06	3.72%
Glades	206.02	0.04%	72,362.84	14.02%	4,814.28	0.93%	77,383.14	14.99%
Gulf	96.08	0.03%	46,464.60	13.12%	836.23	0.24%	47,396.91	13.38%
Hamilton	4.46	0.00%	24,053.81	7.32%	475.79	0.14%	24,534.06	7.46%
Hardee	-	0.00%	10,629.10	2.60%	824.37	0.20%	11,453.47	2.81%
Hendry	-	0.00%	110,976.34	15.00%	40,349.87	5.45%	151,326.21	20.45%
Hernando	1,054.81	0.35%	79,913.27	26.40%	5,906.17	1.95%	86,874.25	28.70%
Highlands	1,351.51	0.21%	61,256.77	9.41%	112,807.45	17.32%	175,415.73	26.93%
Hillsborough	60,815.25	9.30%	42,180.01	6.45%	5,307.92	0.81%	108,303.18	16.56%
Holmes	-	0.00%	12,993.27	4.24%	-	0.00%	12,993.27	4.24%
Indian River	4,912.17	1.53%	88,989.45	27.66%	1,386.73	0.43%	95,288.35	29.61%
Jackson	854.52	0.15%	17,998.80	3.06%	-	0.00%	18,853.32	3.21%
Jefferson	59.94	0.02%	66,563.93	17.39%	8,647.72	2.26%	75,271.59	19.66%
Lafayette	-	0.00%	59,921.81	17.23%	-	0.00%	59,921.81	17.23%
Lake	8,988.53	1.48%	103,693.31	17.04%	82,066.79	13.49%	194,748.63	32.01%
Lee	39,843.65	7.97%	51,518.00	10.30%	5,393.84	1.08%	96,755.49	19.35%
Leon	4,046.69	0.95%	23,520.97	5.51%	104,563.72	24.50%	132,131.39	30.96%
Levy	3,681.66	0.51%	144,621.92	20.21%	24,964.66	3.49%	173,268.24	24.21%
Liberty	-	0.00%	58,374.11	10.92%	274,362.57	51.31%	332,736.68	62.22%
Madison	-	0.00%	16,473.00	3.70%	74.39	0.02%	16,547.39	3.71%
Manatee	26,870.71	5.65%	32,710.26	6.87%	1,248.51	0.26%	60,829.48	12.78%
Marion	1,616.79	0.16%	79,997.66	7.87%	263,870.22	25.96%	345,484.67	33.98%
Martin	2,765.64	0.79%	84,799.79	24.36%	4,273.63	1.23%	91,839.05	26.39%
Miami-Dade	10,234.56	0.84%	274,551.57	22.58%	537,025.26	44.17%	821,811.38	67.59%
Monroe	1,600.10	0.25%	14,386.88	2.29%	580,420.90	92.26%	596,407.89	94.80%
Nassau	317.89	0.08%	22,414.45	5.40%	8.52	0.00%	22,740.86	5.48%
Okaloosa	313.50	0.05%	71,789.69	12.06%	245,079.73	41.17%	317,182.92	53.28%
Okeechobee	-	0.00%	87,803.97	17.84%	18,158.58	3.69%	105,962.55	21.53%
Orange	8,909.37	1.54%	83,584.00	14.48%	-	0.00%	92,493.37	16.02%
Osceola	6,601.77	0.78%	158,546.13	18.66%	1,961.85	0.23%	167,109.75	19.67%
Palm Beach	48,586.43	3.86%	284,475.89	22.63%	143,659.43	11.43%	476,721.75	37.92%
Pasco	16,952.22	3.55%	92,948.33	19.45%	-	0.00%	109,900.56	23.00%
Pinellas	15,744.84	8.99%	1,412.80	0.81%	154.81	0.09%	17,312.44	9.88%
Polk	17,362.68	1.51%	193,726.44	16.84%	58,523.15	5.09%	269,612.27	23.44%
Putnam	1,320.70	0.28%	87,894.70	18.87%	26,899.49	5.77%	116,114.89	24.93%
Santa Rosa	245.96	0.04%	181,835.28	28.06%	72,943.20	11.26%	255,024.45	39.36%
Sarasota	47,400.87	13.32%	60,157.06	16.91%	6.35	0.00%	107,564.27	30.23%
Seminole	6,936.29	3.47%	30,522.71	15.29%	493.21	0.25%	37,952.21	19.01%
St. Johns	7,294.48	1.90%	65,867.05	17.14%	299.95	0.08%	73,461.47	19.11%
St. Lucie	10,618.20	2.90%	19,696.72	5.38%	93.08	0.03%	30,407.99	8.31%
Sumter	3.75	0.00%	109,775.08	30.79%	-	0.00%	109,778.84	30.79%
Suwannee	77.23	0.02%	21,053.50	4.78%	0.03	0.00%	21,130.76	4.80%
Taylor	-	0.00%	90,997.58	13.63%	1,284.71	0.19%	92,282.29	13.82%
Union	-	0.00%	199.09	0.13%	-	0.00%	199.09	0.13%
Volusia	51,201.26	7.26%	124,193.49	17.62%	33,050.59	4.69%	208,445.34	29.58%
Wakulla	368.33	0.09%	12,277.86	3.16%	237,517.80	61.20%	250,164.00	64.46%
Walton	238.40	0.04%	90,569.18	13.64%	153,928.55	23.18%	244,736.13	36.85%
Washington	-	0.00%	49,583.52	13.25%	-	0.00%	49,583.52	13.25%
Statewide	500,737.65	1.46%	5,462,437.63	15.91%	4,167,465.46	12.14%	10,130,640.75	29.50%

The Reduction of Ad Valorem Tax Collections Resulting from Public Ownership of Conservation Lands

While FNAI provides data regarding boundaries and management, the data does not provide any economic information regarding the conservation lands. To acquire this information, EDR used the FNAI boundaries in conjunction with the county level parcel maps to identify whole and partial[51] parcels identified as conservation lands. These parcels are then matched up to the real property roll available from the Florida Department of Revenue (DOR) to identify value-related data.[52] Broadly speaking, the essential operation of Florida's property tax system takes on the form shown in Figure 2.1.2. The mechanics of implementation, however, vary slightly.[53]

Figure 2.1.2 Property Tax System Diagram



To analyze the ad valorem tax impacts resulting from public ownership of conservation lands, the just value (JV) reported for each parcel on the real property rolls is used as a rough proxy for the market value of real properties designated as conservation lands. The county taxable value (CTV) and school-district taxable value (STV) are used in conjunction with the respective county-wide effective CTV and STV millage rates[54] to approximate actual collections from public conservation lands. These millage rates are then applied to the JV to estimate the potential collections if the lands were not held in conservation. The difference between the potential collections and the actual collections is the estimated impact on ad valorem taxes from public ownership of conservation lands. This estimated impact is then added to the total CTV and STV for each county, with their

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[51] For a parcel that is only partially in the conservation land area, the share of acres in the conservation area is identified and used later to share out taxable features. Previous editions of this report did not do this, resulting in a lower tax base loss.
[52] All final rolls were retrieved on November 21, 2019. The rolls available from the Department of Revenue may be further adjusted and will not be truly final until the summer of 2020.
[53] For additional discussion, *see* the section on Property Taxes in Florida included in the 2007 report by EDR at the following link: http://edr.state.fl.us/Content/special-research-projects/property-tax-study/Ad%20Valorem-iterim-report.pdf.
[54] Provided upon request by the Florida Department of Revenue.

respective millage rates applied, to estimate total tax collections for each county if there were no land publicly held for conservation. Finally, the estimated impact on collections is compared to the total potential collections to determine the implied share of tax base lost.

Table 2.1.3 identifies the impact by county on ad valorem tax collections resulting from conservation lands along with an implied share of tax base lost for both CTV and STV. For five counties (Dixie, Glades, Hendry, Liberty, and Wakulla) the implied share of the tax base that is lost due to the presence of conservation lands was greater than 25 percent for both CTV and STV, while in eight counties (Flagler, Lee, Manatee, Orange, Pasco, Pinellas, Polk, and Seminole) the implied base loss was less than one percent for both CTV and STV. The potential tax shifts or losses for all counties are projected to be approximately $513.4 million, or a 2.42 percent base loss, and for school taxes, the potential tax shifts or losses are projected to be approximately $397.20 million, or a 2.15 percent base loss.

[See table on following page]

Table 2.1.3 2019 Tax Impact of Conservation Lands by County (in $millions)

County	Potential Tax Collection from all Conservation Land		Actual Tax Collection on Conservation Land		Impact on Tax Collection from Conservation Land		Implied Share of Tax Base Lost	
	County Tax	School Tax	County Tax	School Tax	County Tax	School Tax	County Base	School Base
Alachua	$34.45	$22.00	$3.84	$2.80	$30.60	$19.20	4.99%	4.40%
Baker	$1.50	$1.08	$0.13	$0.10	$1.37	$0.98	14.31%	12.62%
Bay	$13.91	$15.82	$0.13	$0.17	$13.78	$15.66	14.56%	13.65%
Bradford	$0.66	$0.44	$0.27	$0.18	$0.39	$0.26	1.36%	1.20%
Brevard	$14.69	$13.80	$1.55	$1.65	$13.14	$12.15	3.80%	3.39%
Broward	$34.15	$29.76	$4.66	$4.35	$29.49	$25.41	1.51%	1.39%
Calhoun	$0.18	$0.12	$0.02	$0.01	$0.16	$0.10	3.11%	2.75%
Charlotte	$4.40	$2.98	$0.48	$0.36	$3.92	$2.62	1.53%	1.38%
Citrus	$9.92	$7.18	$2.10	$1.62	$7.82	$5.57	7.79%	6.98%
Clay	$3.63	$2.77	$0.61	$0.50	$3.02	$2.26	2.93%	2.61%
Collier	$28.07	$26.19	$11.77	$12.46	$16.30	$13.73	2.92%	2.52%
Columbia	$2.27	$1.56	$0.24	$0.18	$2.03	$1.39	6.82%	6.06%
DeSoto	$3.40	$1.96	$0.15	$0.10	$3.26	$1.86	16.13%	14.52%
Dixie	$3.36	$1.58	$0.27	$0.13	$3.09	$1.45	28.94%	27.78%
Duval	$26.38	$14.55	$3.43	$2.02	$22.94	$12.53	2.25%	2.04%
Escambia	$27.32	$23.06	$2.46	$2.18	$24.86	$20.88	16.38%	14.91%
Flagler	$2.00	$1.38	$0.81	$0.60	$1.19	$0.79	0.85%	0.75%
Franklin	$5.05	$4.54	$1.06	$1.06	$3.99	$3.48	18.75%	17.34%
Gadsden	$0.46	$0.33	$0.10	$0.07	$0.36	$0.26	1.64%	1.44%
Gilchrist	$0.84	$0.48	$0.18	$0.11	$0.66	$0.37	5.76%	5.04%
Glades	$7.22	$3.52	$0.23	$0.11	$6.99	$3.41	39.70%	37.76%
Gulf	$3.40	$2.91	$0.13	$0.12	$3.27	$2.78	19.88%	18.68%
Hamilton	$1.02	$0.63	$0.14	$0.09	$0.88	$0.54	11.89%	10.93%
Hardee	$0.69	$0.46	$0.22	$0.15	$0.47	$0.31	2.85%	2.59%
Hendry	$13.00	$6.46	$0.67	$0.34	$12.33	$6.12	29.34%	27.64%
Hernando	$5.60	$3.93	$0.98	$0.79	$4.62	$3.14	4.64%	3.99%
Highlands	$3.32	$2.37	$1.09	$0.81	$2.23	$1.56	3.55%	3.20%
Hillsborough	$25.13	$15.58	$4.06	$2.60	$21.07	$12.98	1.78%	1.62%
Holmes	$0.35	$0.23	$0.02	$0.02	$0.33	$0.21	6.04%	5.15%
Indian River	$5.34	$4.68	$0.77	$0.72	$4.57	$3.97	2.33%	2.17%
Jackson	$1.34	$1.01	$0.10	$0.08	$1.23	$0.93	8.38%	7.67%
Jefferson	$1.12	$0.89	$0.07	$0.06	$1.05	$0.83	15.48%	13.75%
Lafayette	$0.91	$0.57	$0.08	$0.05	$0.83	$0.51	22.36%	20.52%
Lake	$5.74	$4.69	$1.32	$1.18	$4.42	$3.52	2.05%	1.81%
Lee	$12.04	$10.42	$2.87	$2.77	$9.17	$7.65	0.72%	0.65%
Leon	$6.21	$4.45	$0.72	$0.56	$5.49	$3.89	1.87%	1.73%
Levy	$4.76	$3.18	$0.49	$0.35	$4.27	$2.83	18.96%	17.10%
Liberty	$4.04	$2.67	$0.08	$0.05	$3.96	$2.61	70.90%	68.39%
Madison	$0.45	$0.28	$0.07	$0.04	$0.38	$0.24	4.18%	3.79%
Manatee	$3.60	$3.36	$0.87	$0.86	$2.72	$2.50	0.41%	0.38%
Marion	$9.75	$9.43	$1.17	$1.25	$8.59	$8.18	5.01%	4.49%
Martin	$13.63	$9.79	$3.29	$2.51	$10.34	$7.27	3.63%	3.38%
Miami-Dade	$42.75	$35.71	$5.04	$4.60	$37.71	$31.12	1.14%	1.03%
Monroe	$26.31	$20.51	$9.96	$8.66	$16.35	$11.85	8.31%	7.55%
Nassau	$3.64	$2.43	$1.05	$0.79	$2.59	$1.65	2.40%	2.21%
Okaloosa	$9.06	$11.15	$2.02	$2.62	$7.04	$8.54	5.77%	5.36%
Okeechobee	$5.02	$3.67	$0.47	$0.35	$4.54	$3.32	15.99%	14.55%
Orange	$18.45	$18.48	$6.73	$7.13	$11.72	$11.35	0.51%	0.47%
Osceola	$12.99	$9.98	$0.97	$0.78	$12.03	$9.20	3.98%	3.66%
Palm Beach	$38.62	$29.63	$7.36	$6.00	$31.26	$23.63	1.32%	1.24%
Pasco	$7.08	$4.54	$3.04	$2.06	$4.03	$2.48	0.97%	0.87%
Pinellas	$13.59	$9.87	$6.61	$5.03	$6.98	$4.84	0.57%	0.52%
Polk	$5.45	$4.17	$2.11	$1.74	$3.34	$2.43	0.65%	0.57%
Putnam	$4.04	$2.30	$0.54	$0.35	$3.50	$1.94	7.37%	6.61%
Santa Rosa	$12.26	$11.71	$2.50	$2.56	$9.75	$9.15	9.62%	8.63%
Sarasota	$11.01	$14.40	$3.25	$5.36	$7.76	$9.04	1.39%	1.31%
Seminole	$5.19	$4.57	$2.79	$2.56	$2.40	$2.01	0.47%	0.43%
St. Johns	$28.07	$22.57	$5.23	$4.45	$22.84	$18.11	8.50%	7.88%
St. Lucie	$10.55	$5.26	$3.17	$1.71	$7.39	$3.56	2.14%	1.85%
Sumter	$5.60	$5.47	$0.12	$0.13	$5.48	$5.35	7.07%	6.37%
Suwannee	$0.76	$0.52	$0.17	$0.13	$0.59	$0.39	2.88%	2.57%
Taylor	$0.86	$0.66	$0.12	$0.10	$0.74	$0.57	7.07%	6.45%
Union	$0.18	$0.11	$0.07	$0.04	$0.11	$0.06	3.05%	2.63%
Volusia	$10.35	$6.82	$1.67	$1.26	$8.68	$5.56	1.99%	1.76%
Wakulla	$4.78	$3.79	$0.38	$0.35	$4.40	$3.44	29.56%	26.43%
Walton	$11.10	$11.66	$1.26	$1.43	$9.85	$10.23	8.72%	8.25%
Washington	$0.80	$0.56	$0.12	$0.10	$0.67	$0.46	7.64%	6.79%
Statewide	$633.81	$503.66	$120.45	$106.45	$513.37	$397.20	2.42%	2.15%

The Potential for Offsetting the Reduction of Tax Collections Resulting from Conservation Lands

Academic research suggests that a monetary benefit of conservation land would exist to the extent that nearby property values increase and help offset the reduction of the local tax base due to the removal of the conservation land from the property tax roll. The theory, known as the "proximity principle," suggests that people are willing to pay more for a residential property if it is close to an attractive amenity.[55] In this case, the attractive amenity is the nearby conservation (open space) land.

The academic research primarily relies on hedonic pricing models to investigate the proximity principle. These models assume that the price of a house reflects a number of characteristics.[56] Characteristics commonly used in hedonic housing models include total square footage, age of the house, number of bedrooms and bathrooms, school quality, and the surrounding area's crime rate. Open space (*e.g.*, parks and fields) and conservation land have been included in multiple hedonic pricing models under the assumption that the consumer values being in close proximity to open space.

Most hedonic pricing studies have found a link between property values and open space. For example, a study of the Dallas residential property market found a 22 percent premium on house prices if the property was adjacent to a park.[57] This premium gradually dissolved as the distance between the residential property and park increased. A similar study of the Boulder, Colorado greenway system found that the price of residential properties decreased an average of $4.20 for every additional foot added to the distance from the greenway system.[58] Further, a study of Portland, Oregon open spaces and residential property values found a property price premium of 19 percent if the distance between the property and the open space ranged from 400 to 600 feet.[59] However, the property price premium was lowered to only 2.9 percent if the residential property was immediately adjacent to the open space.[60]

Hedonic pricing studies of conservation land (excluding parks or greenways) also found positive relationships. A study of North Carolina conservation land found that property values adjacent to conservation land increased by 46 percent. A 2002 Maryland study found that the conversion of land from developable to non-developable increased the value of nearby residential properties.[61] A Florida hedonic price study of conservation land purchased with Florida Forever funds found

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[55] Constance de Brun, "The Economic Benefits of Land Conservation", *Trust for the Public Land.* 2007:1.
[56] For a good overview of Hedonic Housing Price Theory, please see: Y. Xiao, "Urban Morphology and Housing Market", *Springer Geography. 2017: 11.*
[57] Andrew, Miller, "Valuing Open Space: Land Economics and Neighborhood Parks", *MIT Department of Architecture.* 2001: 201-214.
[58] M. Correl, J.H. Lillydahl, L.D. Singell, "The Effects of Greenbelts on Residential Property Values: Some Findings on the Political Economy", *Land Economics,* Vol. 54. 1978: 2017-17.
[59] M. Lutzenhiser and N. Netusil, "The Effect of Open Spaces on a Home's Sale Price", *Contemporary Economic Policy,* Vol 3. 2001: 291-98.
[60] Ibid.
[61] Elena Irwin, "The Effects of Open Space on Residential Property Values", *Land Economics.* Vol 78. 2002:465-80.

that nearby residential property values went up for five of the nine study areas after the land was purchased for permanent conservation.[62]

EDR developed hedonic pricing models for both Miami-Dade County and Columbia County. Both hedonic pricing models used just value as the dependent variable and over a dozen housing characteristics commonly found in hedonic pricing models as the independent variables. The benefits of open space land (state parks, county parks, and conservation land) is captured by two separate variables. Distance to the nearest conservation land was the independent variable used to gauge the proximity effect of conservation land on just value. Distance to the nearest park (local and state) was the independent variable used to evaluate the proximity effect of parks on nearby residential just values. See Figures 2.1.3 and 2.1.4 for an overview of the open space land in both Miami-Dade County and Columbia County.

Miami-Dade County and Columbia County were chosen for several reasons. First, the analysis needed detailed residential property tax data that many Florida counties do not freely provide to the public. Both Miami-Dade County and Columbia County were able to provide EDR with this data. Second, academic research has suggested that a buyer's willingness to pay a premium to live near open space differs between urban and rural counties.[63] Therefore, both an urban county (Miami-Dade) and a rural county (Columbia) were selected to reflect this difference.

At this time, it is not possible to conduct a statewide analysis using a hedonic pricing model since the necessary ad valorem tax roll data is not readily available for all counties. In addition, hedonic pricing models should be tailored to each county to account for any unique housing characteristics. For example, the Miami-Dade hedonic pricing model includes proximity to shoreline. This housing characteristic was not included in the hedonic pricing model for Columbia County because that county has no coastline.

[See figure on following page]

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[62] Mary Beal-Hodges, "Conservation Land Acquisition Lists and Nearby Property Values: Evidence from the Florida Forever Programme", *Studies in Agricultural Economics.* Vol 114. 2016:16-23.

[63] An overview of the existing academic literature can be found in the following report: V. McConnell and M. Wells, "The Value of Open Space: Evidence from Studies of Nonmarket Benefits" *Resources for the Future.* January 2005: 30.

Figure 2.1.3 Open Space in Miami-Dade County

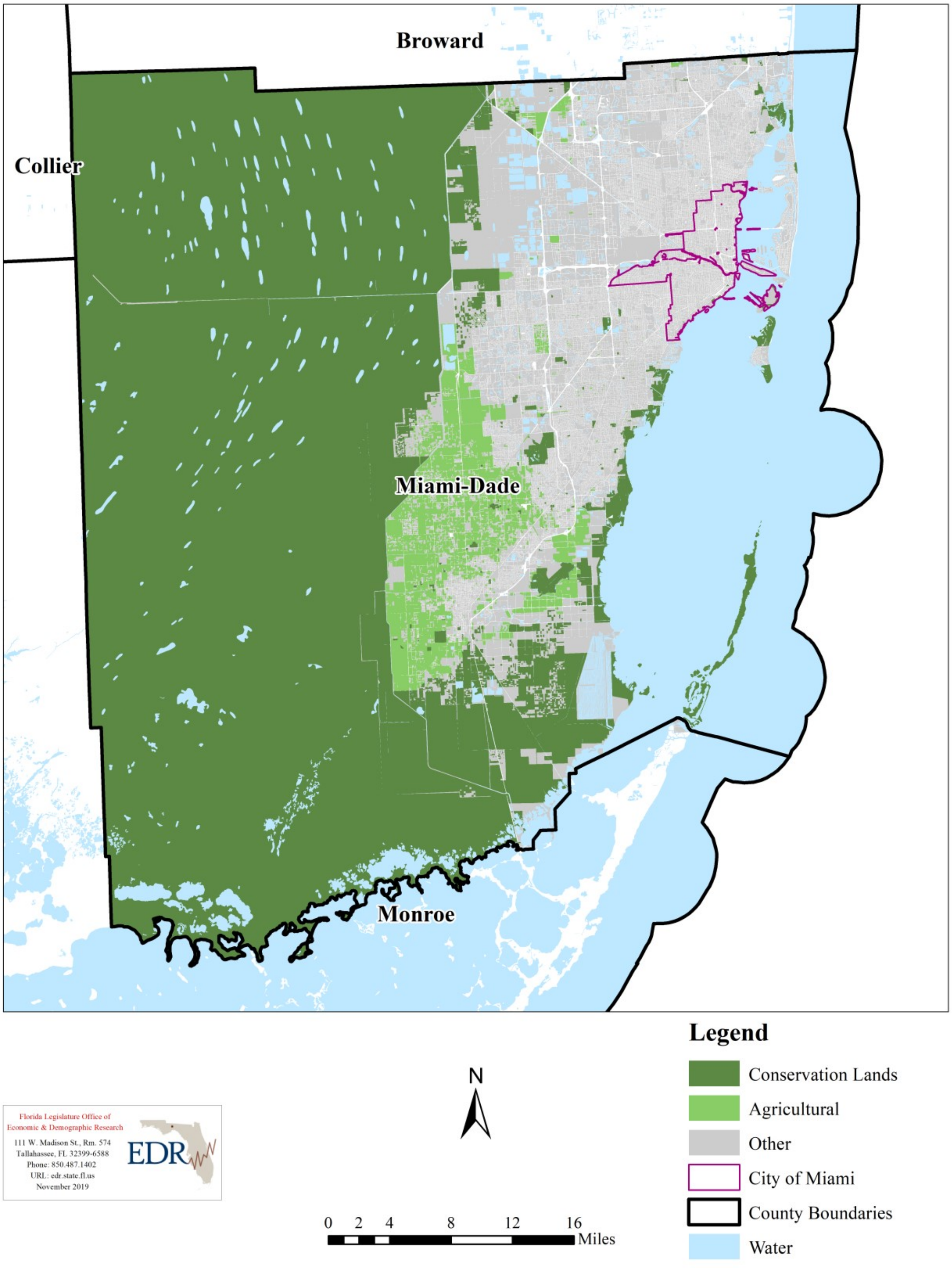
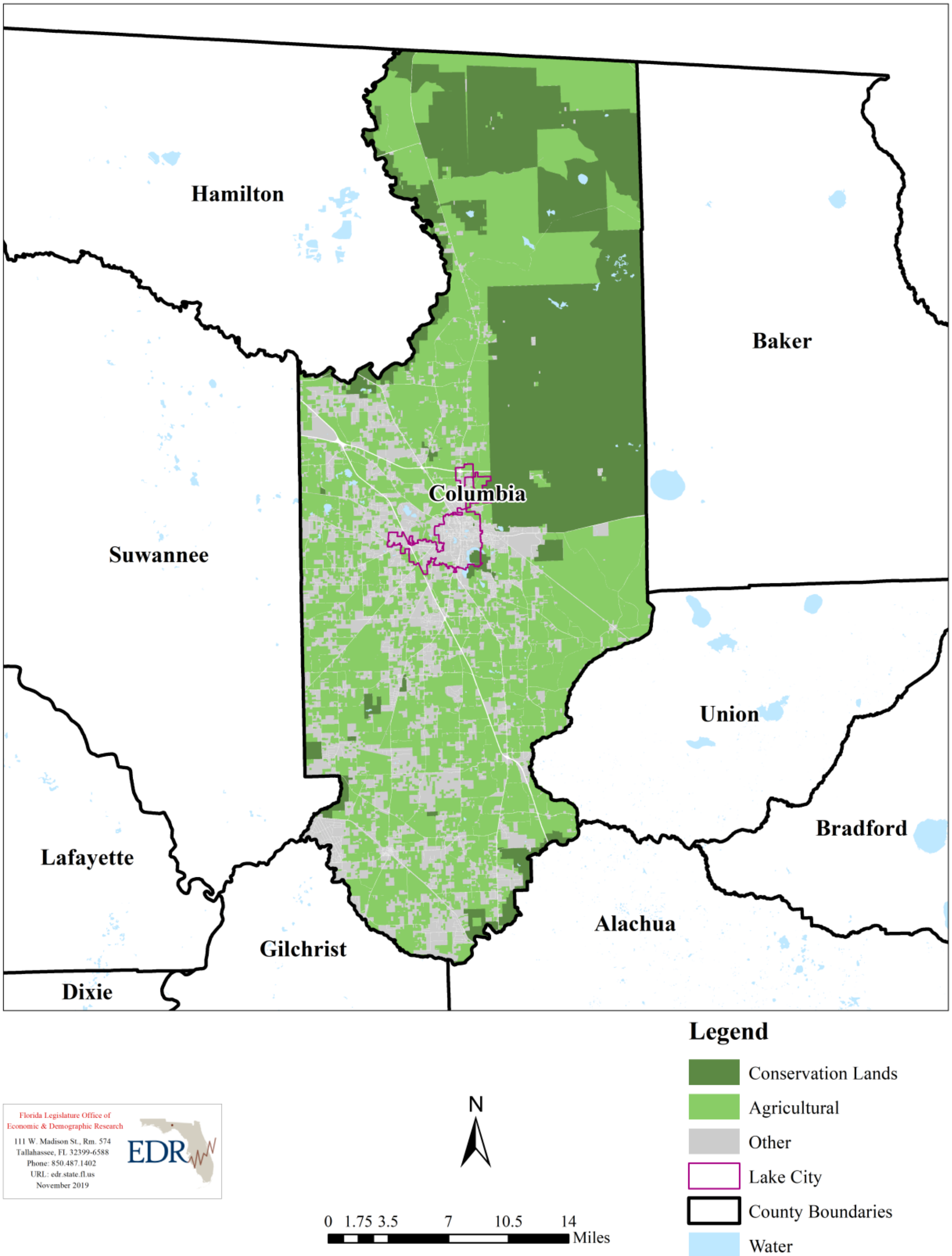


Figure 2.1.4 Open Space in Columbia County



Methodology
While most hedonic pricing studies have used recent housing sales as the dependent variable, this analysis used just value of residential properties. Just value was chosen because it is the starting point for every property's taxable valuation, the focus of this analysis. Logarithms were taken of the dependent and several independent variables to adjust for the expected non-linear relationship between the variables.

The following structural characteristics were included as independent variables in these analyses:

- *Age of the Structure (Miami-Dade and Columbia):* The age of the residential building can influence the selling price. Typically, an older house will have a lower selling price. However, some hedonic pricing studies have seen the opposite relationship in historic cities.

- *Number of Bedrooms (Miami-Dade and Columbia):* A structure with a greater number of bedrooms will likely have a higher just value.

- *Number of Bathrooms (Miami-Dade and Columbia):* A structure with a greater number of bathrooms will likely have a higher just value.

- *Total Square Feet of the Structure (Miami-Dade and Columbia):* A structure with more square feet will likely have a higher just value.

- *Total Lot Size of the Parcel (Miami-Dade and Columbia):* Larger lots will likely have higher just values.

- *Single-Family House (Miami-Dade):* A structure detached and separate from other housing units will likely have a higher just value.

- *Mobile Home (Columbia):* Mobile homes will likely have lower just values.

- *Quality of the Structure (Columbia):* A high quality or well-maintained structure will likely have a higher just value.

Locational characteristics are intended to capture the community's appeal and proximity to notable areas. The following locational characteristics were included as independent variables in the analysis:

- *Percentage of Rental Homes in the Parcel's Census Block (Miami-Dade and Columbia):* A high percentage of rental housing in the nearby area will likely lead to a lower just value.

- *Share of Population with a Bachelor's Degree in the Parcel's Census Block (Miami-Dade and Columbia):* A structure located in a Census Block with a highly-educated population will likely have a higher just value.

- *Proximity to Downtown (Miami-Dade and Colombia):* A structure located farther from the county's core downtown area will likely have a lower just value.

- *Proximity to the Shoreline (Miami-Dade):* A structure located farther from the shoreline will likely have a lower just value.

- *Proximity to Parks (Miami-Dade and Colombia):* A structure located farther from a park will likely have a lower just value.

- *Proximity to Conservation Land (Miami-Dade and Colombia):* This variable attempts to answer the question of whether the distance to the nearest conservation land impacts the just value of the property.

Results

The results for Miami-Dade County can be found in Table 2.1.4. All of the independent variables were significant at a 95 percent confidence level. Except for the number of bedrooms, all the independent variables behaved in accordance with the existing literature for hedonic pricing models. The parks and conservation land variables both had negative coefficients, which can be interpreted to mean that just value decreases with greater distance from the open space. For the conservation variable, as a parcel gets one percent farther away from a conservation area, the just value of the parcel decreases by 0.013 percent. For the park variable, as a parcel gets one percent farther away from the nearest park, the just value of the parcel decreases by 0.0055 percent. Neither coefficient was large, but both were significant.

Table 2.1.4 Miami-Dade County Hedonic Pricing Model of Residential Housing

Number of observations	406,692
Prob > F	0.0000
R-squared	0.7826
Root MSE	0.27766

Independent Variable
Just Value of Residential Housing*

Dependent Variables	**Coefficient**	**t**	**P>|t|**	**[95% Conf.**	**Interval]**
Number of Bedrooms	-0.0108	-13.88	0.00	-0.0124	-0.0093
Number of Bathrooms	0.1547	181.43	0.00	0.1530	0.1563
Single Family Dummy	0.0392	25.07	0.00	0.0361	0.0422
Total Square Feet of Structure*	0.7073	418.48	0.00	0.7040	0.7106
Total Lot Size of the Parcel*	0.0454	88.74	0.00	0.0444	0.0465
Age of the Structure	0.0002	12.68	0.00	0.0002	0.00028
Percentage of Bachelor Degrees	0.0232	309.66	0.00	0.0231	0.0234
Percentage of Rental Homes	-0.3177	-134.68	0.00	-0.3223	-0.3131
Parcel Distance from Downtown*	-0.3247	-262.17	0.00	-0.3272	-0.3223
Parcel Distance from Shoreline*	-0.0117	-23.18	0.00	-0.0126	-0.0107
Parcel Distance from a Park*	-0.0055	-9.7	0.00	-0.0067	-0.0044
Parcel Distance from a Conservation Area*	-0.013	-28.91	0.00	-0.0139	-0.0121

*Logarithmic Values

The results for Columbia County can be found in Table 2.1.5. All of the independent variables were significant and, except for the rental home variable, all of the independent variables behaved in accordance with existing literature for hedonic pricing models.

The parks and conservation land variables in the Columbia County hedonic model contradicted each other. The conservation land variable was positive meaning just value increased by 0.015 percent as the distance from the nearest conservation land area increased by one percent. This positive value meant that people value being farther away from conservation land. The park variable's coefficient was negative, with just value decreasing by 0.021 percent as the distance to the nearest park increased by one percent. This negative value meant people value being closer to a park in Columbia County.

The contradiction could be due to multiple reasons. First, some academic research has found that a person's valuation of proximity to open space may depend on the type of habitat and its accessibility for recreational purposes.[64] Second, a person may place less value on proximity to conservation land in a rural county since open space is abundant.

Table 2.1.5 Columbia County Hedonic Pricing Model of Residential Housing

Number of observations	17,906
Prob > F	0.0000
R-squared	0.8869
Root MSE	0.2326

Independent Variable
Just Value of Residential Housing*

Dependent Variables	**Coefficient**	**t**	**P>|t|**	**[95% Conf.**	**Interval]**
Number of Bedrooms	0.0250	7.4	0.00	0.0184	0.0317
Number of Bathrooms	0.0546	12.5	0.00	0.0460	0.0632
Mobile Home Dummy	-0.6726	-138.71	0.00	-0.6821	-0.6631
Total Square Feet of Structure*	0.5727	97.97	0.00	0.5612	0.5841
Total Lot Size of the Parcel*	0.1510	75.18	0.00	0.1471	0.1550
Age of the Structure	-0.0090	-71.37	0.00	-0.0092	-0.0088
Percentage of Bachelor Degrees	0.0057	13.29	0.00	0.0049	0.0065
Percentage of Rental Homes	0.0729	4.68	0.00	0.0424	0.1034
Parcel Distance from Downtown*	-0.0152	-5.34	0.00	-0.0208	-0.0096
Quality of the Structure	0.1101	57.57	0.00	0.1064	0.1139
Parcel Distance from a Park*	-0.0210	-10.76	0.00	-0.0248	-0.0172
Parcel Distance from a Conservation Area*	0.0157	9.71	0.00	0.0126	0.0189

*Logarithmic Values

These results provide insight into how conservation land may impact Florida's property values. In Miami-Dade County, open space, whether conservation land or parks, is more likely to be considered an amenity and positively impact the just value of nearby homes. While parks may be considered an amenity in Columbia County, conservation land does not appear to be.

[64] *See* V. McConnell and M. Wells, "The Value of Open Space: Evidence from Studies of Nonmarket Benefits" *Resources for the Future.* January 2005: 30 (discussing how valuations change based on the type and quality of conservation land).

EDR cannot apply these results to the rest of the state. The coefficient's value is likely to be different for each county due to the diverse nature of Florida's conservation land and each county's unique housing characteristics. The two analyzed counties simply represent the breadth of population density across Florida's counties. Different levels of density would likely produce different results. It is also possible that different effects may be produced by the analysis of a landlocked urban county. Even at the extremes of density analyzed, any positive impact on housing values resulting from proximity to conservation land is relatively small.

2.2 Historical, Current, and Projected Future Conservation Land Expenditures

EDR is directed to analyze historic expenditures and to forecast future expenditures based upon historical trends and ongoing projects or initiatives associated with real property interests eligible for Florida Forever funding under section 259.105, Florida Statutes. Funding for the acquisition and management of conservation lands in Florida is provided by a variety of institutions, including federal and state governments, regional governments, local governments, and private non-governmental entities. This part of the analysis focuses on governmental expenditures. To the extent that private non-governmental entities provide funding to governmental agencies, those funds are also included. A variety of available data sources were reviewed and analyzed for historical and current information on conservation land appropriations and expenditures.[65] This section summarizes the most relevant information.[66]

Expenditures of State and Federal Funds

Several state agencies receive legislative appropriations for programs related to conservation land acquisition and management, including the Department of Environmental Protection (DEP), the Department of Agriculture and Consumer Services (DACS), the Fish and Wildlife Conservation Commission (FWC), and the Department of State (DOS). Because the related expenditures are fully contemplated in the state's budget, state and federal expenditures are addressed together.[67]

Land Acquisition

Florida Forever
The state's current land conservation program is the Florida Forever program. The Florida Constitution authorizes the issuance of tax-supported bonds to finance or refinance the acquisition and improvement of land and water areas for the purposes of conservation, restoration of natural systems, water resource development, outdoor recreation, and historic preservation.[68] The state's environmental bonds, including Florida Forever bonds and Everglades restoration bonds, are

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[65] Sources include the annual General Appropriations Acts, the Florida Accounting Information Resource (FLAIR) System, the Legislative Appropriations/Planning and Budgeting System (LAS/PBS), periodic agency reports, Water Management District annual financial reports, and local government annual financial reports.
[66] It should be noted that the structure of federal, state, and local funding often results in the duplicative reporting of the same dollars. Attempting to sum the reported expenditures across the various sectors may lead to erroneous conclusions.
[67] The 2020 Edition includes expenditures beginning in Fiscal Year 2009-10, which provides a 10-year history. For a longer history, *see* the 2017 Edition, at p. 24, available at:
http://edr.state.fl.us/Content/natural-resources/LandandWaterAnnualAssessment_2017Edition.pdf.
[68] Art. VII, §11, Fla. Const.

secured by Documentary Stamp Tax revenues and are not backed by the full faith and credit of the state.[69]

The Florida Forever program was initially authorized in 1999 in response to a voter-approved constitutional amendment to acquire land for conservation purposes.[70] Under the Florida Forever program, $3 billion of bonds were authorized to be issued over ten years. In 2008, the Florida Forever bonding authorization was extended for another ten years. This increased the maximum amount of potential Florida Forever bonds to $5.3 billion. To date, the state has issued approximately $2.0 billion of Florida Forever bonds. In 2017, the Legislature authorized $800 million in new Florida Forever bonds, subject to the existing $5.3 billion overall bonding limit, to pay for costs related to land acquisition, planning, and construction of water storage reservoirs.[71] At the end of Fiscal Year 2018-19, the aggregate principal amount of outstanding bonds was $669.29 million with debt service of $134.91 million due in Fiscal Year 2019-20. If no new bonds are sold, the estimated debt service is expected to decline through Fiscal Year 2028-29, at which time the existing Florida Forever bonds would be retired.[72] Table 2.2.1 shows the estimated debt service that will be due each fiscal year.

Table 2.2.1 Florida Forever Bonds Outstanding Debt Service (in $millions)

	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	FY 26-27	FY 27-28	FY 28-29	Total
Principal	$101.73	$106.83	$90.63	$84.12	$68.14	$71.54	$58.19	$40.67	$32.83	$14.63	**$669.29**
Interest	$33.18	$28.09	$22.75	$18.22	$14.01	$10.60	$7.03	$4.12	$2.08	$0.73	**$140.80**
Outstanding Debt Service	$134.91	$134.92	$113.38	$102.33	$82.15	$82.14	$65.21	$44.78	$34.91	$15.36	**$810.08**

Source: State Board of Administration of Florida Annual Debt Service Report for the Fiscal Year Ended June 30, 2019
Note: Values may not sum to totals due to rounding.

Funding for the Florida Forever program, including bond proceeds and cash transfers, is held in the Florida Forever Trust Fund and administered by the Department of Environmental Protection (DEP). Section 259.105, Florida Statutes, provides for the distribution of any cash or bond proceeds from the Florida Forever Trust Fund to various agencies and programs. The statutory distributions under the original authorization and under the 2008 reauthorization are displayed in Table 2.2.2. Detailed descriptions of the programs receiving distributions under the Florida Forever program were provided in the 2017 Edition of this report.[73] Any expenditures from the trust fund are subject to annual evaluation and appropriation by the Legislature.

[69] Chapter 7 of this report provides additional information on Everglades restoration bonds.
[70] Ch. 99-247, § 21, Laws of Fla. (codified as amended at § 259.105, Fla. Stat.).
[71] *See* Ch. 2017-10, § 3, Laws of Fla. (codified at § 373.4598, Fla. Stat.).
[72] *See* § 201.15(3)(a), Fla. Stat. ("It is the intent of the Legislature that all bonds issued to fund the Florida Forever Act be retired by December 31, 2040.")
[73] *See* http://edr.state.fl.us/Content/natural-resources/LandandWaterAnnualAssessment_2017Edition.pdf at page 29.

Table 2.2.2 Statutory Distribution of Florida Forever Funds

Florida Forever Statutory Distribution	FY 2000-01 Through FY 2007-08	FY 2008-09 Through Present
Dep. Environmental Protection - State Lands	35.0%	35.0%
Dep. Environmental Protection - Water Management Districts	35.0%	30.0%
Dep. Environmental Protection - Florida Communities Trust	22.0%	21.0%
Dep. Agriculture & Consumer Services - Rural & Family Lands Protection	0.0%	3.5%
Dep. Environmental Protection - Working Waterfronts	0.0%	2.5%
Dep. Environmental Protection - Fla Recreation Development Assistance Grants	2.0%	2.0%
Dep. Environmental Protection - Recreation & Parks*	1.5%	1.5%
Dep. Environmental Protection - Greenways & Trails	1.5%	1.5%
Fish & Wildlife Conservation Commission - Land Acquisition*	1.5%	1.5%
Dep. Agriculture & Consumer Services - Florida Forest Service*	1.5%	1.5%

*These distributions are limited to inholdings and additions to lands managed by these agencies.

Since the inception of the program in Fiscal Year 2000-01, the State of Florida has spent more than $3.0 billion for Florida Forever. In the most recent ten years, Fiscal Year 2009-10 through Fiscal Year 2018-19, the total expenditures have been $450.30 million. Figure 2.2.1 shows that the largest share of these expenditures (32.90 percent) has been to support land conservation efforts by the DEP Division of State Lands. The next two highest expenditures were Aid to the Water Management Districts (28.40 percent) and Florida Communities Trust (15.93 percent). Table 2.2.3 shows the annual cash expenditures for each program since Fiscal Year 2009-10.[74]

[See figure on following page]

[74] Detailed expenditures for each program are available from the "Monthly Complete Report" at https://floridadep.gov/lands/environmental-services/content/florida-forever. (Accessed October 2019.)

Figure 2.2.1 Shares of Florida Forever Expenditures in Past Ten Years

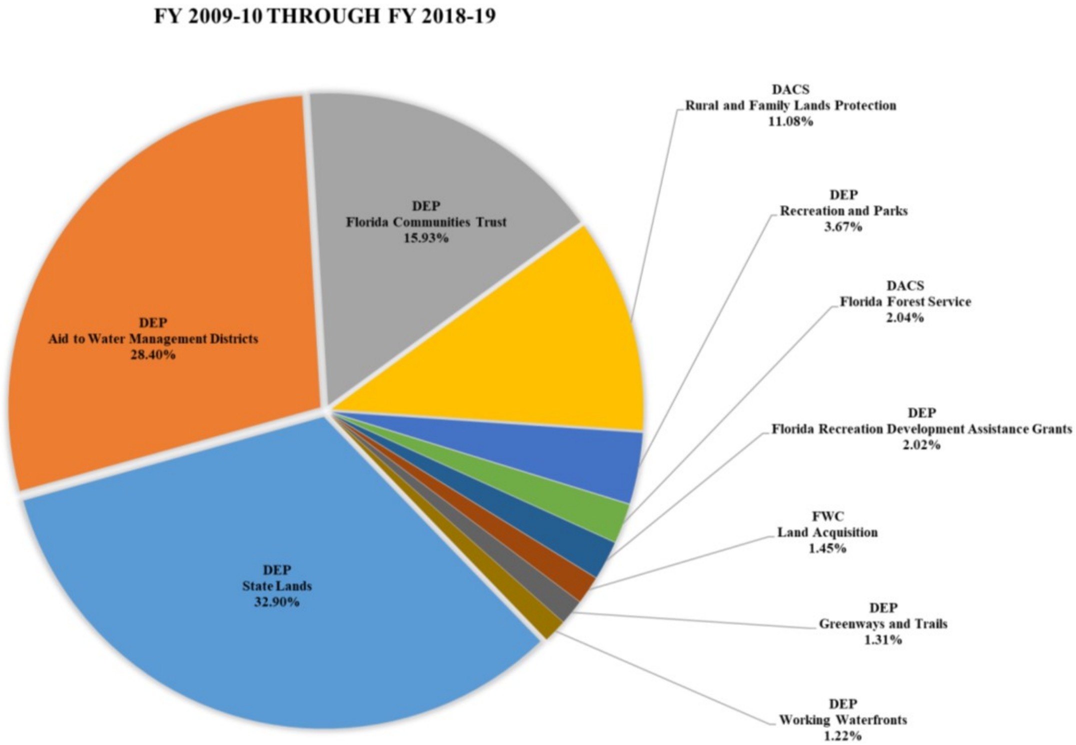


Table 2.2.3 Florida Forever Program Expenditures* by Fiscal Year (in $millions)

Agency and Division/Program		FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19
DEP	State Lands	$30.54	$3.86	$10.23	$6.81	$14.53	$19.85	$3.41	$18.46	$25.31	$18.54
	Florida Communities Trust	$24.88	$17.15	$5.59	$7.12	$2.79	$1.25	$0.00	$2.34	$3.48	$8.75
	Working Waterfronts	$5.23	$0.01	$-	$0.01	$0.00	$0.32	$-	$0.02	$0.01	$0.00
	Recreation and Parks	$3.02	$3.22	$0.90	$0.05	$0.02	$0.51	$0.77	$7.33	$0.94	$0.15
	Florida Recreation Development Assistance Grants	$5.19	$3.69	$-	$0.30	$-	$-	$-	$-	$-	$0.10
	Greenways and Trails	$0.70	$3.07	$0.03	$0.01	$0.00	$0.64	$0.03	$0.14	$1.42	$-
	Aid to Water Management Districts	$25.43	$63.37	$9.52	$3.14	$0.48	$21.12	$1.66	$5.70	$0.16	$0.23
DACS	Florida Forest Service	$6.08	$0.66	$0.93	$0.76	$0.18	$0.23	$0.02	$0.00	$0.05	$0.50
	Rural and Family Land Protection Program	$1.42	$7.47	$0.01	$0.04	$0.08	$1.49	$0.51	$7.92	$27.25	$4.83
FWC	Land Acquisition	$5.32	$0.05	$0.35	$0.01	$-	$-	$0.01	$-	$0.71	$0.22
	Total	**$107.80**	**$102.56**	**$27.55**	**$18.25**	**$18.09**	**$45.41**	**$6.39**	**$41.92**	**$59.35**	**$33.32**

*Beginning in the 2020 Edition, this table is compiled from state accounts rather than agency-provided data to match the source of all other state expenditure data.

To supplement distributions provided through the Florida Forever program, the Legislature has provided additional funds for the following land acquisition programs: the Florida Recreation Development Assistance Program (FRDAP), the Rural and Family Lands Protection Program (RFLPP), Water Management Districts (WMDs), and State Parks. During the period covering Fiscal Year 2009-10 through Fiscal Year 2018-19, the total additional expenditures for these programs were $242.88 million. Table 2.2.4 shows the annual cash expenditures for these programs that were in addition to their Florida Forever distributions.

Table 2.2.4 Annual Cash Expenditures Outside of Florida Forever (in $millions)

	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19
FRDAP	$18.48	$8.96	$-	$-	$0.10	$0.32	$0.94	$2.83	$5.13	$3.88
RFLPP	$-	$-	$-	$-	$0.01	$0.45	$11.01	$14.63	$0.11	$4.47
WMDs	$43.30	$32.70	$29.21	$29.64	$19.52	$8.76	$5.64	$1.45	$0.06	$0.13
State Parks	$2.00	$-	$-	$-	$-	$0.05	$0.67	$11.00	$2.06	$1.17
Total	**$63.77**	**$41.66**	**$29.21**	**$29.64**	**$19.63**	**$9.57**	**$18.26**	**$29.91**	**$7.35**	**$9.65**

Other Land Acquisition Programs

In addition to the land acquisition programs funded through the Florida Forever program, the Legislature has funded other types of land acquisition programs. In the most recent ten years, these programs have included the Off-Highway Vehicle program, statewide forestry land acquisition, and the acquisition of historic properties throughout the state by DOS. Table 2.2.5 shows the annual cash expenditures for these programs during this period. Historic Properties is the only program that has received new appropriations in the most recent five fiscal years; however, this funding includes dollars for stand-alone restoration projects as well as land acquisition.

Table 2.2.5 Expenditures for Other Land Acquisition Programs (in $millions)

	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19
DACS Off Highway Vehicle	$1.21	$0.07	$0.01	$0.02	$0.07	$0.03	$-	$-	$-	$-
DACS Forestry	$0.10	$0.14	$0.00	$-	$0.01	$0.00	$-	$-	$-	$-
DOS Historic Properties	$2.13	$0.67	$-	$-	$0.13	$1.78	$5.72	$12.27	$7.41	$6.56
Total	**$3.44**	**$0.88**	**$0.02**	**$0.02**	**$0.21**	**$1.81**	**$5.72**	**$12.27**	**$7.41**	**$6.56**

Land Management

The agencies responsible for management of Florida's public lands for conservation purposes include DEP (State Lands, Recreation and Parks, Coastal and Aquatic Managed Areas (CAMA), and Greenways and Trails); DACS (Florida Forest Service or FFS); FWC; and DOS (Historical Resources). Pursuant to section 259.037, Florida Statutes, the Land Management Uniform Accounting Council (Council) is comprised of representatives from each of the land managing agencies. The Council has established specific cost accounting categories in order to provide consistent data for purposes of policy making. To that end, the Council publishes an annual report detailing the prior year's land management activities and expenditures.[75]

As reported by the Council, these agencies have spent more than $1.6 billion over the most recent ten fiscal years to manage the state's conservation lands. The reports include expenditures from all appropriated funds, including both state and federal sources. Table 2.2.6 shows the annual amounts spent for the major cost categories that were described in detail in the 2017 Edition of this report[76] plus the eradication of terrestrial invasive plants by FWC on lands managed by agencies other than FWC and the FFS's wildfire protection on lands not designated as state forests.

Table 2.2.6 Direct Land Management Expenditures by Cost Category (in $millions)

	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19
Resource Management	$33.33	$29.62	$30.62	$30.92	$26.47	$29.32	$34.55	$36.52	$40.05	$44.76
Administration	$26.16	$23.40	$20.75	$21.70	$12.29	$14.57	$13.25	$14.65	$15.37	$19.60
Support	$12.99	$12.83	$14.01	$14.81	$18.96	$20.86	$24.64	$30.48	$27.67	$25.00
Capital Improvements	$56.00	$34.77	$16.15	$22.07	$26.52	$30.46	$38.39	$42.03	$41.84	$38.61
Recreation/ Visitor Services	$41.96	$43.57	$40.14	$38.78	$50.26	$54.44	$55.37	$61.40	$72.77	$69.92
Law Enforcement	$12.81	$12.28	$12.65	$13.63	$6.05	$6.06	$7.16	$7.49	$7.67	$7.55
Terrestrial Invasive Plant Control	$7.71	$6.96	$5.21	$5.41	$12.15	$13.08	$15.24	$16.00	$14.08	$13.24
Wildfire Protection	$7.11	$7.11	$7.11	$7.11	$7.11	$7.11	$7.11	$7.11	$7.10	$7.66
Total	**$198.07**	**$170.54**	**$146.64**	**$154.43**	**$159.81**	**$175.90**	**$195.71**	**$215.68**	**$226.55**	**$226.35**

While the Council's land management reports provide a wealth of knowledge about the state's efforts to manage land for conservation purposes, there are significant management costs that are related to managing state lands but are not categorized in this report as direct land management expenditures. This includes the management of submerged lands by CAMA, aquatic invasive plant control by FWC, and law enforcement by FWC on non-FWC managed areas.

[75] *See* State of Florida Land Management Uniform Accounting Council (LMUAC) 2019 Annual report (FY 2018-19), available at: http://publicfiles.dep.state.fl.us/DSL/OES/2019_LMR_LMUAC_Reports/. (Accessed October 2019.)
[76] *See* http://edr.state.fl.us/Content/natural-resources/LandandWaterAnnualAssessment_2017Edition.pdf at page 39.

Table 2.2.7 quantifies these indirect or additional management expenditures related to conservation land. A large portion of land management expenditures for FWC law enforcement activities on non-FWC managed areas is not included in the expenditures shown below because only data for Fiscal Years 2017-18 and 2018-19 are available.[77] These totals are not considered in the forecasting of land management expenditures found below in Table 2.2.8.

Table 2.2.7 Additional Management Expenditures Related to State Lands (in $millions)

	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19
CAMA Submerged Lands	$5.89	$5.83	$4.84	$8.96	$7.51
Aquatic Invasive Plant Control	$14.30	$18.03	$23.33	$16.97	$13.49
FWC Law Enforcement (non-FWC land)	N/A	N/A	N/A	$29.95	$26.35
Total	**$20.19**	**$23.86**	**$28.16**	**$55.89**	**$47.36**

Further, as noted in the Council's 2019 report, the expenditures do "not include local and federal governments or nonprofit conservation organizations that provide significant services towards the state's land conservation and resource-based recreation goals and objectives."[78] For example, the state has provided regular funding for the acquisition and improvement of conservation lands by water management districts and through the Florida Communities Trust, Florida Recreation Development and Assistance Grants, and Stan Mayfield Working Waterfronts programs. While the properties acquired under these programs are purchased with state dollars, the titles are vested in other entities. Any management costs borne by these entities for those properties are not included in the report.

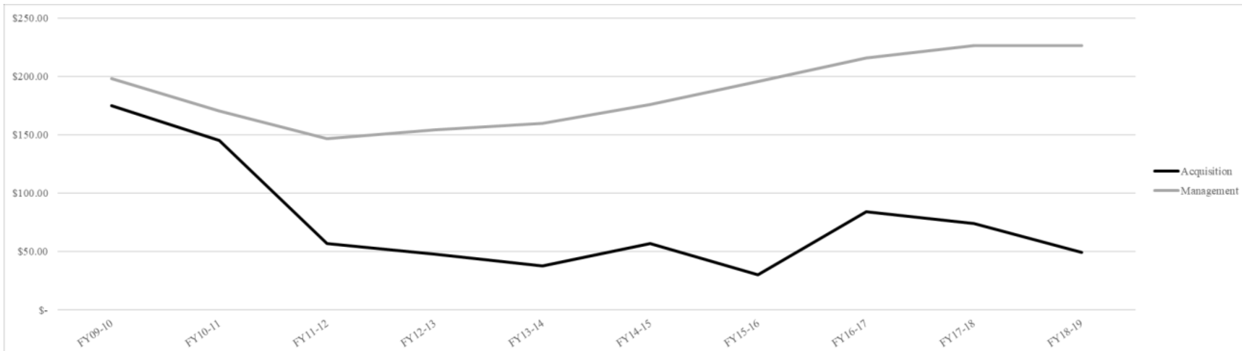
Forecast of State Expenditures on Conservation Land

Forecasting annual state conservation land acquisition expenditures is a difficult task because the level varies greatly based on the willingness of sellers, the use of bonding to fund acquisitions, and the particular set of circumstances facing changing sets of policy makers. For example, overall funding for environmental programs in the last decade has been significantly affected by the protracted recovery from the state's housing market collapse and the Great Recession. In this regard, the three sources of state acquisition expenditures from Tables 2.2.3, 2.2.4, and 2.2.5 above along with the land management expenditures from Table 2.2.6 are compiled in Figure 2.2.2. There was a clear decline in acquisition expenditures over the early years in the 10 year history that mimics the state's economic condition; however, funding in recent years appears to have stabilized. Alternatively, land management expenditures have generally been increasing steadily

[77] Chapter 2012-088, Laws of Florida, transferred the responsibility of law enforcement on DEP-managed conservation lands, such as state parks, from DEP to FWC. At that time, expenditures for FWC law enforcement activities on non-FWC managed lands were not included in the LMUAC reports. It was not until the LMUAC reporting for Fiscal Year 2017-18 that these land management expenditures were included. Chapter 2019-141, Laws of Florida, transferred this responsibility back to DEP.
[78] *See* State of Florida Land Management Uniform Accounting Council (LMUAC) 2019 Annual report (FY 2017-19), at 3 (Chair Submittal and Report Abstract), available at: http://publicfiles.dep.state.fl.us/DSL/OES/2019_LMR_LMUAC_Reports/. (Accessed October 2019.)

over the 10 year period, with approximately 5.1 percent average annual growth in the most recent 3-year period.

Figure 2.2.2 Historic State Expenditures on Conservation Land (in $millions)



Both the acquisition and management forecasts rely on a three year moving average of the growth rates of the data. The forecast for all state conservation land expenditures is shown in Table 2.2.8.

Table 2.2.8 History and Forecast of State Conservation Land Expenditures (in $millions)

History	**FY 09-10**	**FY 10-11**	**FY 11-12**	**FY 12-13**	**FY 13-14**	**FY 14-15**	**FY 15-16**	**FY 16-17**	**FY 17-18**	**FY 18-19**
Land Acquisition	$175.02	$145.10	$56.78	$47.91	$37.93	$56.79	$30.37	$84.10	$74.11	$49.53
Land Management	$198.07	$170.54	$146.64	$154.43	$159.81	$175.90	$195.71	$215.68	$226.55	$226.35
Total	**$373.09**	**$315.64**	**$203.42**	**$202.34**	**$197.74**	**$232.70**	**$226.08**	**$299.78**	**$300.66**	**$275.87**
Forecast	**FY 19-20**	**FY 20-21**	**FY 21-22**	**FY 22-23**	**FY 23-24**	**FY 24-25**	**FY 25-26**	**FY 26-27**	**FY 27-28**	**FY 28-29**
Land Acquisition	$71.30	$71.04	$73.50	$85.03	$90.36	$98.02	$107.96	$116.92	$127.41	$139.05
Land Management	$237.78	$245.70	$252.50	$261.88	$270.45	$279.24	$288.78	$298.34	$308.26	$318.59
Total	**$309.07**	**$316.74**	**$326.00**	**$346.92**	**$360.81**	**$377.27**	**$396.74**	**$415.26**	**$435.67**	**$457.64**

Federally Funded Program Expenditures

In addition to appropriations from General Revenue and state trust funds, the Legislature also provides appropriations from federal trust funds. During the most recent ten years, a variety of federal grant programs have been appropriated on a regular basis through the state budget. Most of the programs, which were described in detail in the 2017 Edition of this report,[79] are matching grant programs administered by a state agency. Table 2.2.9 shows the ongoing programs and their annual cash expenditures, along with a forecast for future years. Since Fiscal Year 2009-10,

[79] *See* http://edr.state.fl.us/Content/natural-resources/LandandWaterAnnualAssessment_2017Edition.pdf at page 41.

expenditures have totaled more than $75 million with an average of $7.6 million being spent annually. Although the federal funding and associated state appropriations have remained fairly constant over this period, the actual expenditures fluctuate from year to year based on the completion of specific projects receiving grants. Further, the federal grant periods extend across multiple state fiscal years, which can also lead to ebbs and flows of expenditures. For these reasons, the final forecast is the average of the results from two models: one based on the three year moving average of the expenditures and the other based on the three year moving average of the expenditure growth rates. Since funding for specific programs is contingent on federal actions, only the total is estimated.

Table 2.2.9 Federally Funded Conservation Land Programs – Expenditures and Forecast (in $millions)

History	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19
America the Beautiful	$1.09	$1.25	$0.98	$0.96	$0.79	$0.76	$1.18	$0.76	$0.68	$0.69
AmeriCorp	$0.56	$0.55	$0.63	$0.57	$0.44	$0.37	$0.41	$0.55	$0.61	$0.50
Recreational Trails	$0.25	$1.53	$1.10	$0.82	$0.60	$6.89	$2.12	$2.44	$0.64	$1.71
Land and Water Conservation Fund	$2.23	$1.03	$2.05	$0.94	$0.38	$0.39	$2.04	$1.19	$0.55	$0.46
Coastal Partnership Initiative	$1.72	$1.76	$1.56	$1.93	$0.84	$1.02	$0.61	$0.59	$0.57	$1.02
Endangered Species Conservation Fund	$0.95	$0.78	$3.37	$1.01	$3.67	$1.18	$1.12	$1.06	$0.31	$1.07
Land Acquisition Grants	$-	$-	$0.60	$-	$3.80	$-	$-	$-	$-	$-
Historic Preservation Grants	$0.30	$0.12	$0.20	$0.21	$0.09	$0.12	$0.16	$0.14	$0.19	$0.18
Total	**$7.09**	**$7.02**	**$10.47**	**$6.45**	**$10.60**	**$10.73**	**$7.63**	**$6.74**	**$3.54**	**$5.63**
Forecast	**FY 19-20**	**FY 20-21**	**FY 21-22**	**FY 22-23**	**FY 23-24**	**FY 24-25**	**FY 25-26**	**FY 26-27**	**FY 27-28**	**FY 28-29**
Total	**$5.46**	**$5.33**	**$6.15**	**$6.38**	**$6.77**	**$7.37**	**$7.87**	**$8.49**	**$9.21**	**$9.97**

Regional Expenditures

Regional expenditures can be undertaken separately from a specific appropriation in the state's budget. The Florida Water Resources Act of 1972, chapter 373, Florida Statutes, was enacted to provide the legal framework to conserve, protect, manage, and control waters and related land resources in the state. While state-level administration is vested in DEP, to the greatest extent possible, it is encouraged to delegate its powers to the governing boards of the five regional water management districts: Northwest Florida, Suwannee River, St. Johns River, Southwest Florida, and South Florida.[80]

[80] § 373.069, Fla. Stat. (dividing the state into five water management districts).

Among the enumerated powers vested in the WMDs is the authority to acquire lands for the purpose of conservation and protection of water and water-related resources.[81] The WMDs are authorized to acquire fee or less-than-fee interests in real property for purposes of "flood control, water storage, water management, conservation and protection of water resources, aquifer recharge, water resource and water supply development, and preservation of wetlands, streams, and lakes."[82]

In order to identify WMD expenditures related to conservation land acquisition and land management, EDR reviewed the WMDs' preliminary budgets and tentative budgets developed in accordance with sections 373.535 and 373.536, Florida Statutes, respectively. These budget documents included actual audited expenditures allocated to six program areas including "2.0 Land Acquisition, Restoration, and Public Works" and "3.0 Operation and Maintenance of Works and Lands." With respect to conservation land acquisition and management, EDR reviewed the actual audited expenditures for the following activities within those program areas: "2.1 Land Acquisition" and "3.1 Land Management."

Table 2.2.10 provides expenditure data for conservation land acquisitions by each of the WMDs. As explained above, these actual audited numbers are presented in the budgets[83] of the districts. Ideally, these would only include acquisition of conservation lands and not lands that were acquired for any other lawful purpose. In practice, these numbers cannot be categorized that cleanly and may include some land acquisition expenditures for other purposes. Similarly, some conservation land acquisition expenditures may not have been assigned to the "2.1 Land Acquisition" activity if a WMD assigned land acquisition expenditures to the particular program or activity that the acquisitions support. In these instances, land acquisition expenditures will not be accounted for here. Note that the historic data is in local fiscal years, which begin October 1 and end September 30. For forecasting purposes, the data has been converted to state fiscal years. Forecasts rely on a three-year moving average as it best fits the nature of the data.

Table 2.2.10 Water Management District Land Acquisition Expenditures (in $millions)

History	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17	LFY 17-18
NWFWMD	$0.03	$0.03	$0.09	$0.02	$0.74
SJRWMD	$11.37	$15.53	$12.68	$3.90	$16.24
SFWMD	$0.00	$0.00	$0.00	$0.00	$0.00
SWFWMD	$0.50	$3.09	$0.50	$6.35	$0.50
SRWMD	$0.65	$5.41	$0.07	$0.10	$3.26
Total	$12.56	$24.06	$13.34	$10.37	$20.74
Forecast	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**	**FY 22-23**
Total	$15.09	$14.78	$16.01	$15.30	$15.36

Source: Annual Budgets of the Water Management Districts.

[81] § 373.139(1), Fla. Stat.
[82] § 373.139(2), Fla. Stat.
[83] WMD actual audited budgets for a fiscal year are available in the tentative budgets two fiscal years later. This is required by section 373.536, Florida Statutes.

While these expenditures may at times seem lower than one would expect, they represent the actual audited budgets of the districts. To evaluate each district's conservation land expenditures, the 2017 Edition of this report used each district's Comprehensive Annual Financial Report along with historical documents provided by the districts. All three sources provide significantly different expenditures for the districts. Actual audited budgets were chosen because they are the only source with consistent expenditures categories across all districts and years. It would be beneficial to future editions of this report for the water management districts to report their conservation land expenditures as a distinct category in their budgets, annual financial reports, or as part of their Florida Forever work plans.

Table 2.2.11 provides expenditure data for conservation land management by each of the water management districts. Similar to the acquisition expenditures shown above, these numbers are presented in the actual audited budgets of the districts. Again, it would be ideal if these expenditures excluded lands that are managed for non-conservation purposes, if any. In practice, these numbers cannot be categorized that cleanly and will include some management expenditures for other purposes. Similarly, some conservation land management expenditures may not have been assigned to the "3.1 Land Management" activity and are not accounted for here. Note that the historic data is in local fiscal years, which begin October 1 and end September 30. For forecasting purposes, the data has been converted to state fiscal years. Forecasts rely on a three-year moving average as it best fits the nature of the data.

Table 2.2.11 Water Management District Land Management Expenditures (in $millions)

History	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17	LFY 17-18
NWFWMD	$2.15	$2.49	$2.32	$2.64	$2.41
SJRWMD	$3.95	$4.35	$4.10	$4.69	$4.83
SFWMD	$14.79	$14.20	$27.10	$14.45	$11.33
SWFWMD	$2.70	$3.75	$3.62	$4.07	$4.22
SRWMD	$1.69	$1.60	$1.68	$2.29	$2.59
Total	$25.27	$26.39	$38.81	$28.13	$25.38
Forecast	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**	**FY 22-23**
Total	$30.86	$29.24	$28.72	$29.61	$29.19

Source: Annual Budgets of the Water Management Districts.

In Florida, there are a number of special districts that are located across multiple counties. For the purposes of this report, EDR categorizes these entities as regional entities. Table 2.2.12 provides a forecast and details a history of conservation land expenditures[84] by regional special districts. Examples of these districts include the Port LaBelle Community Development District and the Tampa Bay Estuary Program. Note that the historic data is in local fiscal years, which begin October 1 and end September 30. For forecasting purposes, it has been converted to state fiscal years. Forecasts rely on a three-year moving average as it best fits the nature of the data.

[84] For further details on the source and methodology of this data, *see* the "Local Expenditures" section.

Table 2.2.12 Conservation Land Expenditures by Regional Special Districts (in $millions)

History	LFY 12-13	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17
Acquisition	$-	$-	$-	$-	$-
Management	$1.90	$3.54	$1.21	$0.45	$0.84
Forecast	**FY 17-18**	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**
Acquisition	$-	$-	$-	$-	$-
Management	$1.06	$0.81	$0.87	$0.92	$0.87

Source: Annual Financial Report data obtained from the Florida Department of Financial Services, Division of Accounting and Auditing, Bureau of Local Government. Accounts 537 and 572 are shared out in accordance with local government survey results.

Local Expenditures

Local expenditures can be undertaken separately from a specific appropriation in the state's budget. Section 218.32, Florida Statutes, requires each local government entity that is determined to be a reporting entity as defined by generally accepted accounting principles and each independent special district as defined in section 189.012, Florida Statutes, to submit to the Florida Department of Financial Services (DFS) a copy of its Annual Financial Report (AFR) for the previous fiscal year no later than nine months after the end of the fiscal year. The AFR is not an audit but rather a unique financial document that is completed using a format prescribed by DFS.

Furthermore, section 218.33, Florida Statutes, states: "Each local governmental entity shall follow uniform accounting practices and procedures as promulgated by rule of the department to assure the use of proper accounting and fiscal management by such units. Such rules shall include a uniform classification of accounts." Assisted by representatives of various local governments, DFS developed the Uniform Accounting System Chart of Accounts to be used as the standard for recording and reporting financial information to the State of Florida. Implementation of the standard Chart of Accounts and Standard Annual Reporting Form began in 1978, and since then, there have been minor changes and updates to both. As mandated by section 218.33, Florida Statutes, reporting entities use this Chart of Accounts as an integral part of their accounting system so that the preparation of their AFRs will be consistent with other local reporting entities.

AFR account code 537 is used to itemize conservation and resource management expenditures.[85] This may include land, water, or any other natural resource. Further, account code 572 is used to itemize parks and recreation expenditures which may include conservation land or water resource related expenditures. In an effort to narrow these expenditures to conservation land acquisition and management, EDR conducted a survey of all local and regional governments that had listed an expenditure in these accounts in the most recent five local fiscal years. The survey asked them to indicate, by year, the shares of these expenditure that were specifically for conservation land acquisition and management. While not all entities responded, a sufficient sample was provided to create average shares for the county-wide, municipality-wide, and special district-wide levels. Actual shares were applied to the data when given and weighted shares by government type and

[85] It is possible that some local government expenditures on conservation land acquisition may be reported in other AFR account codes. EDR will continue to explore this topic.

account were applied to the non-respondents. The updated survey for the 2020 Edition overrode previous results and has some material differences. See Table B.1 in Appendix B for response rates and applied shares and Table B.2 in Appendix B for unallocated financial account data. Table 2.2.13 provides a forecast and details a history of expenditures by local governments on conservation land acquisition. Note that the historic data is in local fiscal years, which begin October 1 and end September 30. For forecasting purposes, it has been converted to state fiscal years. Forecasts rely on a three-year moving average as it best fits the nature of the data.

Table 2.2.13 Conservation Land Acquisition Expenditures by Local Governments (in $millions)

History	LFY 12-13	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17
Counties	$12.98	$20.28	$21.90	$17.95	$14.13
Municipalities	$4.29	$3.45	$3.35	$3.78	$3.77
Special Districts	$-	$-	$-	$-	$-
Total	$17.28	$23.73	$25.25	$21.73	$17.90
Forecast	FY 17-18	FY 18-19	FY 19-20	FY 20-21	FY 21-22
Total	$22.11	$21.19	$20.72	$21.34	$21.09

Source: Annual Financial Report data obtained from the Florida Department of Financial Services, Division of Accounting and Auditing, Bureau of Local Government Accounts 537 and 572 are shared out in accordance with local government survey results.

Table 2.2.14 provides a forecast and details a history of expenditures by local governments on conservation land management. Note that the historic data is in local fiscal years, which begin October 1 and end September 30. For forecasting purposes, it has been converted to state fiscal years. Forecasts rely on a three-year moving average as it best fits the nature of the data.

Table 2.2.14 Conservation Land Management Expenditures by Local Governments (in $millions)

History	LFY 12-13	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17
Counties	$53.80	$59.40	$57.67	$73.01	$57.20
Municipalities	$48.58	$47.18	$51.57	$58.08	$62.97
Special Districts	$0.84	$0.83	$0.97	$1.01	$1.18
Total	$103.21	$107.42	$110.21	$132.10	$121.35
Forecast	FY 17-18	FY 18-19	FY 19-20	FY 20-21	FY 21-22
Total	$120.06	$123.57	$122.56	$122.06	$122.73

Source: Annual Financial Report data obtained from the Florida Department of Financial Services, Division of Accounting and Auditing, Bureau of Local Government Accounts 537 and 572 are shared out in accordance with local government survey results

2.3 Projecting Expenditures Required to Purchase Lands Identified for Conservation

Under the Florida Forever program, various acquisition lists or work plans are developed to identify projects that are eligible for Florida Forever funding. The Department of Environmental Protection (DEP), the Department of Agricultural and Consumer Services (DACS), the Fish and Wildlife Conservation Commission (FWC) and each of the five water management districts all maintain at least one list of lands identified for potential conservation. It is also possible that settlement agreements or final judgments would require discrete land acquisitions. While not incorporated in the report at this time, future editions may include this analysis if applicable. Note that in addition to land being identified as potential conservation land and funding being made available, a willing seller is necessary. Further, section 253.025(8)(j)1., Florida Statutes, states that: "An offer by a state agency may not exceed the value for that parcel as determined pursuant to the highest approved appraisal or the value determined pursuant to the rules of the board of trustees, whichever value is less."

Estimating Conservation Land Acquisition Costs using Ad Valorem Data

For the 2020 Edition, the approach used to estimate future expenditures necessary to purchase lands identified in plans set forth by state agencies or water management districts has been significantly improved. Prior editions relied on identifying future conservation lands from lists that generally consisted only of acreage and county. Future costs were based on the historical cost per acre in those counties. The 2019 Edition began to explore the possibility of using Geographic Information System (GIS) maps of the future conservation lands to identify overlap between lists. These maps can be overlaid to ensure the same land area appears on a maximum of one list and then can be cross referenced with the Florida Department of Revenue (DOR) real property roll to approximate the cost of acquisition.

There are a total of six plans identified by state agencies and one each for the five water management districts (WMDs). The six state plans are DEP's Florida Forever Priority List (FFPL) and Division of Recreation and Parks Optimum Boundaries (DRP); DACS' Rural and Family Lands Protection Program (RFLPP), Forest Legacy Program (FLP), and Florida Forest Service Inholdings and Additions (DACSI&A); and FWC's Inholdings and Additions (FWCI&A). GIS maps were provided[86] for all except for the DACSI&A, although DACS identified which areas overlapped with the FFPL. While the WMD lists would never have geographic overlap, any other combination of lists can. Further, these lists can overlap with existing conservation land identified by FNAI. This can happen if, for example, a municipality owns an area and it falls within the optimum boundary of a state park. Any such overlap is removed prior to analysis as the land has already been acquired for conservation.[87] Table 2.3.1 itemizes, in a mutually exclusive way, all of the acres identified in plans by which list(s) they appear on. As discussed in Section 2.5, less-than-

[86] The Northwest Florida Water Management District provided maps, however, the district continues to use a broad approach to identification and 3,053,425 acres are identified. As a result, this district has a unique methodology that differs from the rest.
[87] A total of 190,163.21 acres were removed from the analysis as existing conservation land identified for future acquisition.

fee acquisitions are considerably less costly than fee acquisitions. As such, the FFPL is divided into its fee[88] and less-than-fee components.

[See table on following page]

[88] Note that this category includes all properties in the FFPL not identified as less-than-fee. It is possible that the lands identified as fee will be acquire in less-than-fee.

Table 2.3.1 Overlap in Plans for Future Conservation Lands

	FLP	FFPL (fee)	FFPL (ltf)	DRP	RFLPP	FWC I&A	SWF WMD	SR WMD	SJR WMD	SF WMD	Acres	Priority List (purchaser)
	✓	✓		✓	✓						1,187	FLP
	✓	✓		✓							710	FLP
	✓	✓			✓						3,864	FLP
	✓	✓									1,372	FLP
	✓		✓		✓						3,295	FLP
	✓		✓								2,665	FLP
	✓			✓	✓						4	FLP
	✓			✓							162	FLP
	✓				✓						53	FLP
	✓										78	FLP
		✓		✓	✓						687	FFPL(fee)
		✓		✓		✓		✓			221	FFPL(fee)
		✓		✓		✓					175	FFPL(fee)
		✓		✓			✓				2,209	FFPL(fee)
		✓		✓				✓			146	FFPL(fee)
		✓		✓					✓		1,712	FFPL(fee)
		✓		✓						✓	4,938	FFPL(fee)
		✓		✓							44,261	FFPL(fee)
		✓			✓	✓					186	FFPL(fee)
		✓			✓		✓				0	FFPL(fee)
		✓			✓			✓			6,650	FFPL(fee)
		✓			✓				✓		4,908	FFPL(fee)
		✓			✓						38,546	FFPL(fee)
		✓				✓	✓				7,317	FFPL(fee)
		✓				✓		✓			2,399	FFPL(fee)
		✓				✓					103,726	FFPL(fee)
		✓					✓				78,642	FFPL(fee)
		✓						✓			4,935	FFPL(fee)
		✓							✓		31,851	FFPL(fee)
		✓								✓	27,993	FFPL(fee)
		✓									1,087,588	FFPL(fee)
			✓	✓	✓		✓				651	FFPL(ltf)
			✓	✓	✓						2,570	FFPL(ltf)
			✓	✓			✓				644	FFPL(ltf)
			✓	✓							3,156	FFPL(ltf)
			✓		✓	✓					5,483	FFPL(ltf)
			✓		✓		✓				10,116	FFPL(ltf)
			✓		✓			✓			14,092	FFPL(ltf)
			✓		✓						42,764	FFPL(ltf)
			✓			✓					3,316	FFPL(ltf)
			✓				✓				37,272	FFPL(ltf)
			✓					✓			1	FFPL(ltf)
			✓						✓		127	FFPL(ltf)
			✓								568,149	FFPL(ltf)
				✓	✓		✓				644	DRP
				✓	✓						6,748	DRP
				✓		✓		✓			124	DRP
				✓		✓					1,191	DRP
				✓			✓				5,661	DRP
				✓				✓			780	DRP
				✓					✓		686	DRP
				✓						✓	272	DRP
				✓							81,300	DRP
					✓	✓					12,875	RFLPP
					✓		✓				16,746	RFLPP
					✓			✓			5,102	RFLPP
					✓				✓		6	RFLPP
					✓					✓	8,491	RFLPP
					✓						144,766	RFLPP
						✓	✓				1,649	FWCI&A
						✓		✓			7	FWCI&A
						✓					107,171	FWCI&A
							✓				349,933	SWFWMD
								✓			50,940	SRWMD
									✓		75,665	SJRWMD
										✓	145,502	SFWMD
Acres on List	13,390	1,456,224	694,301	160,838	330,433	245,839	511,483	85,398	114,955	187,196	3,800,059	
Acres (purchaser)	13,390	1,449,091	688,341	97,405	187,986	108,826	349,933	50,940	75,665	145,502	3,167,081	

The individual GIS maps summed to 3,800,059 acres for potential future conservation across the state. With overlapping acres removed, 3,167,081 unique acres remain. These map files, with the overlap removed, were matched with the parcel data from the ad valorem tax rolls to identify just values. Often times an area identified for acquisition will not strictly follow parcel boundaries. As such, the percentage of the parcel within the area is applied to the just value amount. For acres to be acquired as less-than-fee acquisitions as identified on the FFPL (ltf) and RFLPP lists, 51.62 percent of its original value based on the methodology in Section 2.5.

To identify a potential acquisition as fee or less-than-fee and to identify a cost share between federal, state, regional, and local governments, a prioritization between lists must be created. In other words, for each acre identified, an assumption must be made as to which state agency or WMD will most likely acquire it. The order of prioritization is as follows: The DACS FLP is a federal grant program administered by the U.S. Forest Service, consisting of acquisitions expected to occur in the near future. All acreage on the FLP list is assumed to be purchased by FLP. This is followed by the FFPL, DRP, RFLPP, FWCI&A, and the district lists.

The Northwest Florida WMD (NWFWMD) identifies land for acquisition using a much broader approach and currently includes areas totaling more than 3 million acres. To make this comparable to the other districts and agency lists, EDR removed existing conservation lands using the FNAI database and narrowed the list to only agricultural parcels using the real property roll. This resulted in 2,145,266.38 acres remaining with parcel value information. Sharing out the just value by the portion of the parcel that falls into the NWFWMD list, the just value of the 2.1 million acres is $4.9 billion. In the 2019 Edition of this report, EDR, in coordination with district staff, identified 696,867 acres to be a fair estimate of NWFWMD's potential conservation land acquisition list. Since that time, the district has acquired 591.3 acres, leaving 696,275.7 on the potential list. Comparing this to the agricultural acres identified on NWFWMD's GIS list, EDR estimates 32.46 percent of the GIS agricultural acres may potentially be acquired. This allows for 32.46 percent of the just value of those acres, or $1.7 billion, to reflect the cost of potential conservation land acquisition for NWFWMD. Assuming the average overlap among other lists of 16.66 percent,[89] this reduces the total to 580,296.6 acres at a cost of $1.4 billion.

The DACSI&A list had no GIS component, providing no possibility for just value analysis. It does, however, identify 10,512.67 acres of which 3,032 were identified by DACS as being on the FFPL. The remaining acres are further reduced by the average overlap among non-FFPL areas (11.42 percent). The cost was based on the historical cost of conservation land per acre by county, adjusted for inflation to FY 2018-19 dollars, using the DEP maintained Land Inventory Tracking System database.[90]

Each list potentially has a unique form of cost sharing. DEP maintains the Florida State Owned Lands and Records Information System (SOLARIS), which is intended to be a complete history of all land purchases by the state. This database identifies conservation lands and the funding

[89] This results in an assumption that 115,979.1 acres will be acquired by state agencies. This is reasonable as state agencies identified over 487,000 acres for potential acquisition in the counties fully contained by the district alone.
[90] In previous editions of this report, all lists were evaluated using this method.

sources. A historical breakdown of funding sources[91] for the lands held by DEP was used to develop the cost sharing estimates.[92] The full estimate of future expenditures necessary to purchase lands identified in plans set forth by state agencies or water management districts is shown in Table 2.3.2.

Table 2.3.2 Estimated Future Expenditures on Conservation Lands (in $millions)

Entity	List	Acres	Federal	State	Regional	Local	Total
DEP	FFPL (fee)	1,449,091.39	$211.33	$8,844.78	$677.47	$14.83	$9,748.40
	FFPL (ltf)	688,340.56	$21.37	$894.48	$68.51	$1.50	$985.87
	DRP	97,405.21	$14.97	$626.34	$47.97	$1.05	$690.33
DACS	RFLPP	187,985.81	$5.74	$240.03	$18.39	$0.40	$264.55
	FLP	13,390.41	$7.69	$17.38	$-	$-	$25.07
	I&A	6,626.35	$0.56	$23.35	$1.79	$0.04	$25.73
FWC	I&A	108,826.31	$189.13	$427.37	$-	$-	$616.50
WMD	NWF	580,296.60	$-	$1,397.54	$21.04	$-	$1,418.58
	SR	50,940.06	$2.38	$103.31	$0.14	$21.19	$127.01
	SJR	75,665.42	$27.40	$637.05	$104.21	$113.22	$881.88
	SWF	349,933.35	$105.87	$3,596.01	$6.87	$572.06	$4,280.82
	SF	145,502.19	$150.31	$4,986.74	$736.05	$393.20	$6,266.30
	Total	3,754,003.64	$736.76	$21,794.38	$1,682.43	$1,117.48	$25,331.06
Statewide Cost Share			2.91%	86.04%	6.64%	4.41%	

Considering all lands identified in plans set forth by state agencies or water management districts, Table 2.3.3 identifies the total acreage and share of the state that would be acquired if all planned lands were obtained. While the current acreage and shares include federal, local, and private conservation land acquisitions, the additions based on future plans do not. If all identified state and WMD lands were acquired, approximately 41.25 percent of the state would be held as conservation land. If federal, local, and private plans were accounted for, this share would be even greater.

Table 2.3.3 Share of Florida to be Acquired as Conservation Lands

	Acres	Share
Current Cons. Land Acquired	10,409,195.63	30.32%
State Cons. Land to Acquire	2,551,666.03	7.43%
WMD Cons. Land to Acquire	1,202,337.61	3.50%
Total if all Acquired	14,163,199.27	41.25%

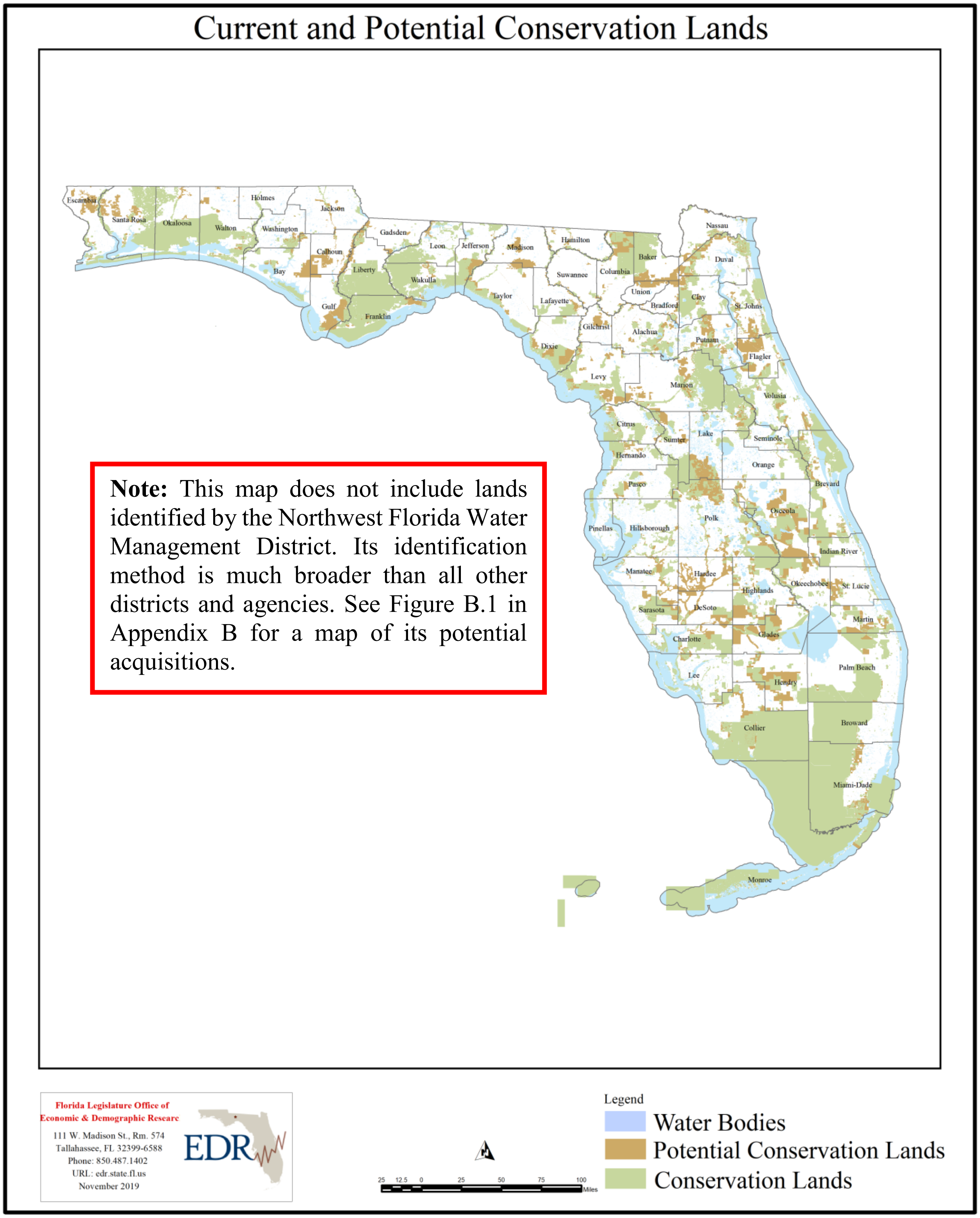
[91] The database was reduced to non-duplicate entries of conservation lands of more than zero acres acquired between Fiscal Years 1917-18 and 2016-17. The one hundred year date range is used to maintain a large sample and all prices are adjusted to a common base year to account for inflation.
[92] While DEP, FWC, and the WMDs each have the funding entity identified, the funding for the DACS acquisitions are not identified by agency. The RFLPP and DACSI&A lists assume the same cost share as DEP, and the more federally funded FLP assumes the FWC cost share.

Adding the projected total costs for the additional conservation lands identified in plans produces a preliminary cost estimate of $25.33 billion as shown in Table 2.3.2. Of the total, the analysis suggests that approximately 86 percent would be a state responsibility. At the average rate of annual state conservation land acquisition expenditures over the most recent five fiscal years, this would take about 370 years to produce the state's share. The extreme difference between the estimated costs and the current level of investment indicates that significant policy discussions are necessary if these acquisition plans are to be undertaken. As is, this projection does not include all costs of acquisition associated with real estate transactions, which makes the projection understated. Counteracting this effect is the possibility that the lands may be donated, exchanged, or sold at a lower price than other similar lands were historically. This would result in lower actual future expenditures than the preliminary estimate suggests.

For a visualization of the lands identified for potential future acquisition along with lands already held in conservation, see Figure 2.3.1.

[See figure on following page]

Figure 2.3.1 Current and Potential Conservation Land



2.4 Forecasting Dedicated Conservation Land Revenues

EDR is required to forecast revenues that are "dedicated in current law to maintain conservation lands" for federal, state, regional, and local forms of government. After conducting an extensive legal review, EDR discovered that no significant sources of revenue exist that are dedicated in law solely for this purpose. Assuming the Legislature desired to accomplish this in the future, the 2017 Edition of this report included a discussion that identified and forecasts revenues that have historically been used or might be available for this purpose.

Furthermore, as there is nothing in current law indicating that revenue sources are dedicated to conservation land maintenance, the identification of potential gaps in projected expenditure and dedicated revenues is problematic. The 2017 Edition of this report included a discussion of what the gap may look like if certain revenue sources were dedicated to maintaining conservation lands.

It is worth noting, however, that in Fiscal Year 2018-19 the state spent $39.53 per acre on conservation land management.[93] As discussed previously, the state alone has identified over 2.5 million acres of land in plans for potential future conservation. This indicates that an additional $100.9 million will be necessary, on an annual basis, to cover the state management costs of those future acquisitions. Using this cost per acre and the total acreage currently in existence and potentially to be acquired in the future, a total of $559.9 million would be spent annually by federal, state, regional and local forms of government as well as private entities for the purposes of managing conservation lands in Florida. Further, Table B.3 in Appendix B compiles survey results regarding the revenues listed in local government account code 343.700 Charges for Services – Conservation and Resource Management that were indicated as dedicated to or used for conservation land acquisition and management.

2.5 Costs of Acquisition and Maintenance under Fee and Less-than-fee Simple Ownership

EDR is required to compare the cost of acquiring and managing conservation lands under fee simple or less-than-fee simple ownership such as a conservation easement. To do this, EDR reviewed appraisal data from DEP and compared annual management costs reported by land management agencies with the cost to monitor conservation easements. It is important to note that while the acquisition of conservation easements provides an opportunity for the state to secure perpetual conservation of natural resources without acquiring the property outright, the type of property interest that is acquired is largely based upon the willingness of the seller.

Comparison of Acquisition Costs

Public land acquisition agencies are encouraged to include less-than-fee simple techniques to augment their traditionally fee simple acquisition programs.[94] It is intuitive that incorporating alternatives to fee simple acquisition allows more lands to come under public control for conservation purposes with less expenditure of state funds for acquisition. When a conservation

[93] *See* State of Florida Land Management Uniform Accounting Council (LMUAC) 2019 Annual report (FY 2018-19), at 51, available at: http://publicfiles.dep.state.fl.us/DSL/OES/2019_LMR_LMUAC_Reports/. (Accessed October 2019.)

[94] § 253.0251(1), Fla. Stat.

easement is acquired, public agencies purchase only those rights or interests in the land that are necessary to achieve the conservation or protection goals of the land. The private landowners retain the possessory interest over their land and all the rights or interests not specifically acquired by the public agency.[95] Allowing private landowners to remain stewards of their own land, when appropriate to achieve public policy goals, reduces the state's costs to manage the lands in the future and allows the properties to remain, at least to some degree, on the local tax rolls.

Based on the Florida Forever list, there are projects that are proposed for fee simple acquisition, conservation easement acquisition, or a combination of both within a project boundary. There are also specific state conservation land acquisition initiatives that identify only conservation easement projects such as the Rural and Family Lands Protection Program (RFLPP).[96] What type of interest is to be acquired is primarily based upon what interest the landowner is proposing to sell and whether that interest is consistent with the conservation goals of the state.

As part of the negotiation process, an appraisal of that value—whether the fee simple value or conservation easement value— is provided to the state. In order to compare the cost of acquiring fee simple interest or a conservation easement, EDR reviewed appraisal values of 28 conservation easements acquired under the Florida Forever Program and RFLPP in Fiscal Years 2016-17 through 2018-19. The values were derived from the Board of Trustees of the Internal Improvement Trust Fund meeting agendas, which identify the appraised value of the conservation easement, the number of acres to be acquired, and the Board of Trustees' proposed purchase price.[97] In some cases, the fee simple values were also provided. Where fee simple values were not identified, EDR requested that data from DEP.

Generally, appraisers provide an opinion of the market value of the proposed conservation easement by taking the difference between the market value of the land before placement of the easement (fee simple interest value) and the market value of the land once the easement is in place. EDR found that on average, the market value of the proposed conservation easements determined by the independent appraisers were approximately 51.62 percent of the fee simple values with a range from 33.33 percent to 64.77 percent of the fee simple values.[98] Note that the more rights and allowable uses for the property that an owner retains, the less costly the conservation easement is as a share of the fee simple value. As the terms of the conservation easement become more restrictive or demanding on the property owner, the more costly the acquisition becomes. The types of activities that are permissible while still meeting the conservation goals of the acquisition vary from project-to-project.

[95] § 253.0251(2), Fla. Stat.

[96] RFLPP is an acquisition program administered by DACS, which is designed to acquire conservation easements on agricultural lands to protect such lands from being converted to other uses while also promoting natural resource conservation. *See* § 570.71, Fla. Stat. (authorizing DACS, on behalf of the Board of Trustees, to acquire less-than-fee interests in agricultural land). For more information on RFLPP, including a current list of approved acquisition projects, visit: https://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/Our-Forests/Land-Planning-and-Administration-Section/Rural-and-Family-Lands-Protection-Program2. (Accessed in December 2019.)

[97] Prior to acquiring conservation land, the appropriate agency (typically DEP or DACS) must receive approval from the Board of Trustees of the Internal Improvement Trust Fund.

[98] Pursuant to section 253.025, Florida Statutes, two appraisals are required if the estimated value of the project exceeds $1,000,000. When calculating the average of the appraised market of the conservation easement project, EDR used the highest appraised value. When two appraised values were available, EDR used the highest value to calculate the percent of the fee simple value that the conservation easement represents.

Comparison of Management Costs

Conservation easements do not typically provide for active management by the state. Instead, the property owner retains the rights to continued use of the property in a manner that is consistent with the terms of the conservation easement. The costs to the state are generally limited to expenditures related to periodic monitoring to verify that activities and conditions on the property remain consistent with the conservation easement. While it is unclear what the State's management costs would have been for the acquired conservation easements had the acquiring agency purchased fee simple interests in those same lands, EDR compared the costs of monitoring existing conservation easements with the operational costs to manage conservation lands reported in the 2019 Land Management Uniform Accounting Council (LMUAC) Report.[99]

According to the 2019 LMUAC Report, the Division of State Lands (DSL) is responsible for monitoring approximately 232,537 acres of conservation easements purchased under Florida Forever and Preservation 2000 or obtained through land donations or exchanges. The easements are monitored every 36 months. The DSL contracts with the Florida Natural Areas Inventory to conduct site visits and produce monitoring reports for these conservation easements on a 36-month cycle.[100]

In Fiscal Year 2018-19, DSL reported that it spent $57,956 to monitor 39 conservation easements and Green Swamp land protection agreements covering approximately 46,388 acres.[101] Based on this information, the cost per acre to monitor conservation easements and land protection agreements in Fiscal Year 2018-19 was approximately $1.33 per acre. Note that DACS does not report the costs for monitoring conservation easements acquired under RFLPP in the LMUAC reports. Based on conversations with staff, DACS currently maintains one full-time position responsible for monitoring a total of 47 RFLPP conservation easements on a 12-month or 18-month cycle depending upon the monitoring requirements of the conservation easement.[102]

In comparison, according to the summary data of the operational costs of state-managed conservation land presented in the 2019 LMUAC Report, the average statewide operational costs was approximately $39.53 per acre for Fiscal Year 2018-19.[103] It is important to note that had the state acquired a fee simple interest in any of the conservation easement projects, an appropriate lead management entity would have been designated, which reflected how the acquisition was intended to be managed (*i.e.,* as a state park, state forest, or state wildlife management area). The operational costs vary per acre by lead management entity. Table 2.5.1 identifies the unit management operational costs per acre by lead management entity reported in the 2019 LMUAC Report.

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[99] As stated in section 2.2, above, the expenditures reported by the agencies in the Land Management Uniform Accounting Council Report may not reflect the total expenditures to the state to manage conservation lands.

[100] *See* State of Florida Land Management Uniform Accounting Council (LMUAC) 2019 Annual report (FY 2018-19), at 15, available at: https://floridadep.gov/lands/environmental-services. (Accessed December 2019.)

[101] *Id*.

[102] According to DACS staff, RFLPP conservation easements acquired with federal funding from the United States Department of Agriculture's National Resource Conservation Service (NRCS) must be monitored annually.

[103] The operational cost per acre identified in the 2019 LMUAC Report is likely underestimated if additional management activities conducted on the property by non-lead agencies are not included.

Table 2.5.1 Acreages and Costs of Managing State Owned Lands

	Total Acres	Operational Costs of Unit Management	Unit Management Operational Costs Per Acre
CAMA	15,639	$2,616,925	$167.34
DHR	97	$1,700,636	$17,572.18
DRP	795,628	$67,747,611	$85.15
FFS	1,152,429	$18,070,273	$15.68
FWC	1,433,945	$44,186,633	$30.81

Note: Rounding of acres and costs may result in different costs per acre than those displayed.
Source: Based on Operational Costs of State-Managed Conservation Land Management Units (FY 2018-19) Table, State of Florida Land Management Uniform Accounting Council Report (LMUAC) 2019 Annual Report (FY 2018-19).

2.6 Overlap of Conservation Land and Water Resource Expenditures

The annual assessment is required to identify any overlap in the expenditures for water resources and conservation lands. Segregating the cost of water resource protection from other conservation goals of a particular land acquisition project poses a great deal of difficulty. To EDR's knowledge, no agency maintains project-specific data apportioning expenditures based on specific natural resources goals or benefits. In previous editions, EDR identified land acquisition expenditures of the water management districts and acquisition projects identified for springs funding or in basin management action plans as primarily intended to provide water resource benefits.[104] While these expenditure amounts are informative, the data underestimates the true intersection of expenditures on conservation land and water resources because a large amount of spending on land acquisition is not being captured in the identified categories.

It is undeniable that the acquisition of land for conservation purposes is an important tool to conserve, protect, and manage all of the state's natural resources, including water resources. The natural relationship between land and surface and groundwater in Florida underscores the importance of land conservation as a tool for water resource protection. While some land acquisition projects may be selected primarily for their contribution toward achieving water resource-related goals, land conservation for other purposes, such as preservation of forestland, species habitat, or archeological sites, may also benefit water resources by maintaining land or water areas in a predominantly natural state. Accordingly, one can generally assume that when environmentally significant lands are acquired with the intent to be managed in a predominantly natural state, some portion of the expenditure may *always* be characterized as a water resource expenditure if an allocation of costs among expected benefits to natural resources were performed.

Under the Florida Forever program, acquisition projects are evaluated based on their contribution to achieving certain goals, with two goals relating specifically to water resources. Meeting multiple goals is among the criteria weighed in the project selection and ranking process.[105] The Florida Forever goals are:

[104] For land acquisition expenditures of the water management districts, see Table 2.2.10. For land acquisition expenditures identified in basin management action plans (BMAPs), see Table B.5 in Appendix B.
[105] § 259.105(9)(a), Fla. Stat.; *see also* Fla. Admin. Code R. 18-24.006(3)(d)1. (directing the Acquisition and Restoration Council to give greater consideration to projects that meet multiple Florida Forever criteria over those that meet fewer or only one criterion).

a. Enhance the coordination and completion of land acquisition projects;

b. Increase the protection of Florida's biodiversity at the species, natural community, and landscape levels;

c. Protect, restore, and maintain the quality and natural functions of land, water, and wetland systems of the state;

d. Ensure that sufficient quantities of water are available to meet the current and future needs of natural systems and the citizens of the state;

e. Increase natural resource-based public recreational and educational opportunities;

f. Preserve significant archaeological or historic sites;

g. Increase the amount of forestland available for sustainable management of natural resources;

h. Increase the amount of open space available in urban areas; and

i. Mitigate the effects of natural disasters and floods in developed areas.[106]

The potential overlap of conservation land and water resource expenditures may be illustrated using the Florida Forever Conservation Needs Assessment (FFCNA) Overview Maps developed by the Florida Natural Areas Inventory (FNAI) to support the Florida Forever program. The FFCNA is "an analysis of the geographic distribution of Florida's natural resources" identified in the Florida Forever Act.[107] According to FNAI, the FFCNA "establishes a baseline protection status for each natural resource" and also provides a "tool for tracking progress in resource acquisition." It includes ten data layers that correspond to resource-based performance measures or criteria of the Florida Forever program.[108] Four of the ten data layers pertain to water resource protection: surface water protection, fragile coastal resources, functional wetlands, and groundwater recharge. See Figures 2.6.1 through 2.6.4 for statewide maps of the water resource-related data layers.

[See figures on following pages]

[106] § 259.105(4)(a)-(h), Fla. Stat. (providing the Florida Forever goals and associated performance measures); *see also* Fla. Admin. Code Ch. 18-24.
[107] Fla. Admin. Code R. 18-24.001(2)(h) (defining "Florida Forever Conservation Needs Assessment").
[108] Florida Natural Areas Inventory, Florida Forever Conservation Data Viewer, https://www.fnai.org/webmaps/FFCNA_Map/ (Accessed November 2019.)

Figure 2.6.1 Surface Water Protection

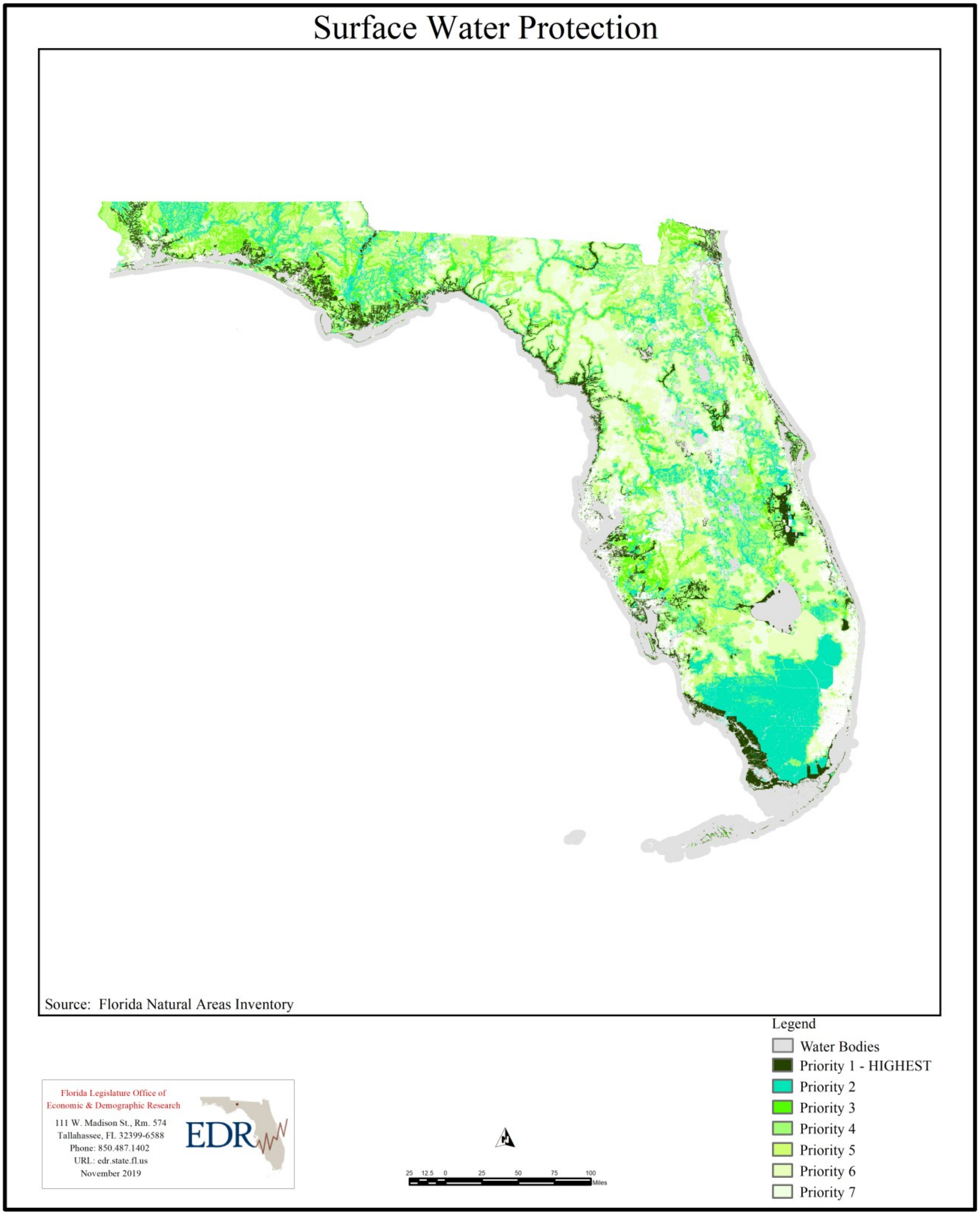


Figure 2.6.2 Fragile Coastal Resources

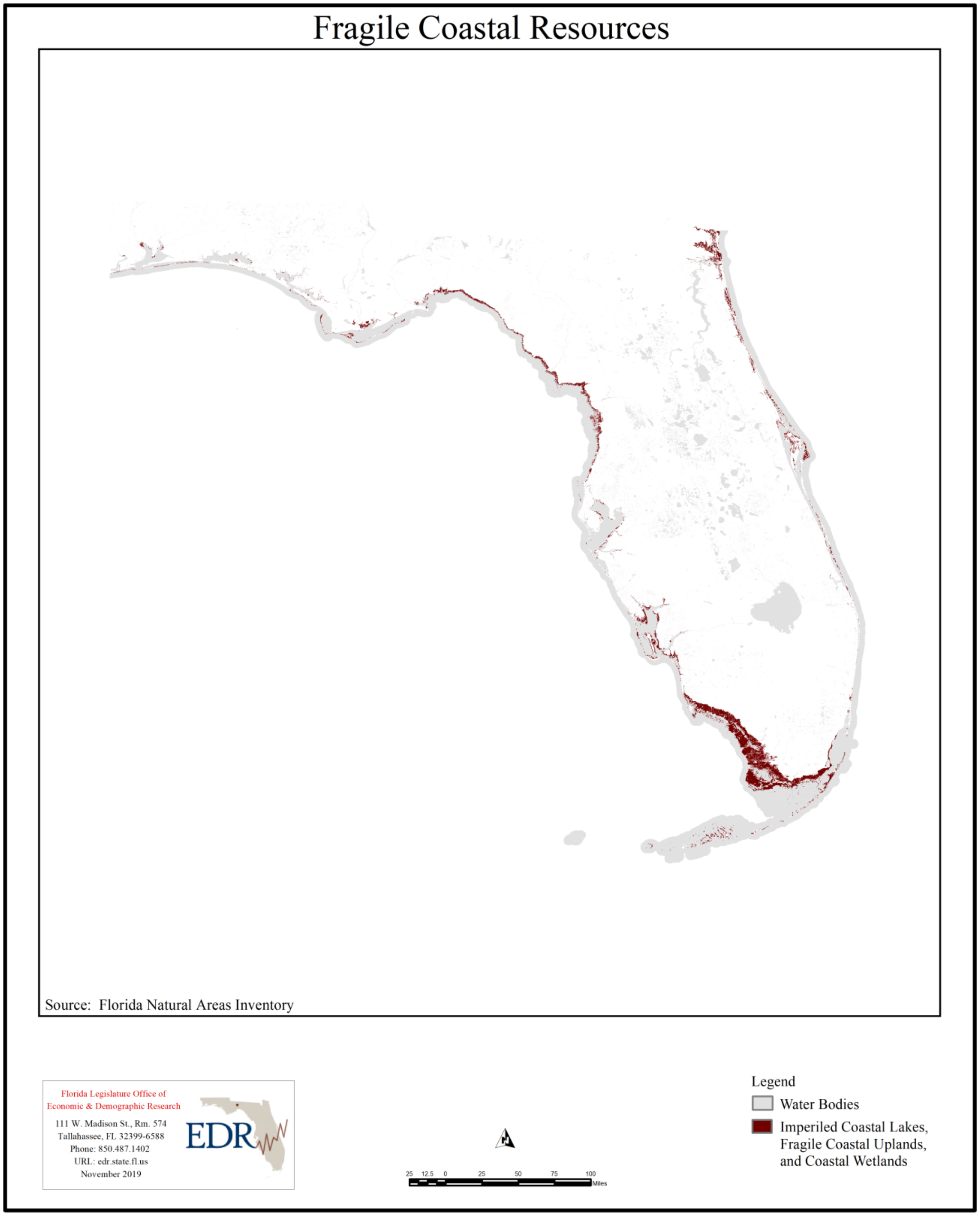


Figure 2.6.3 Functional Wetlands

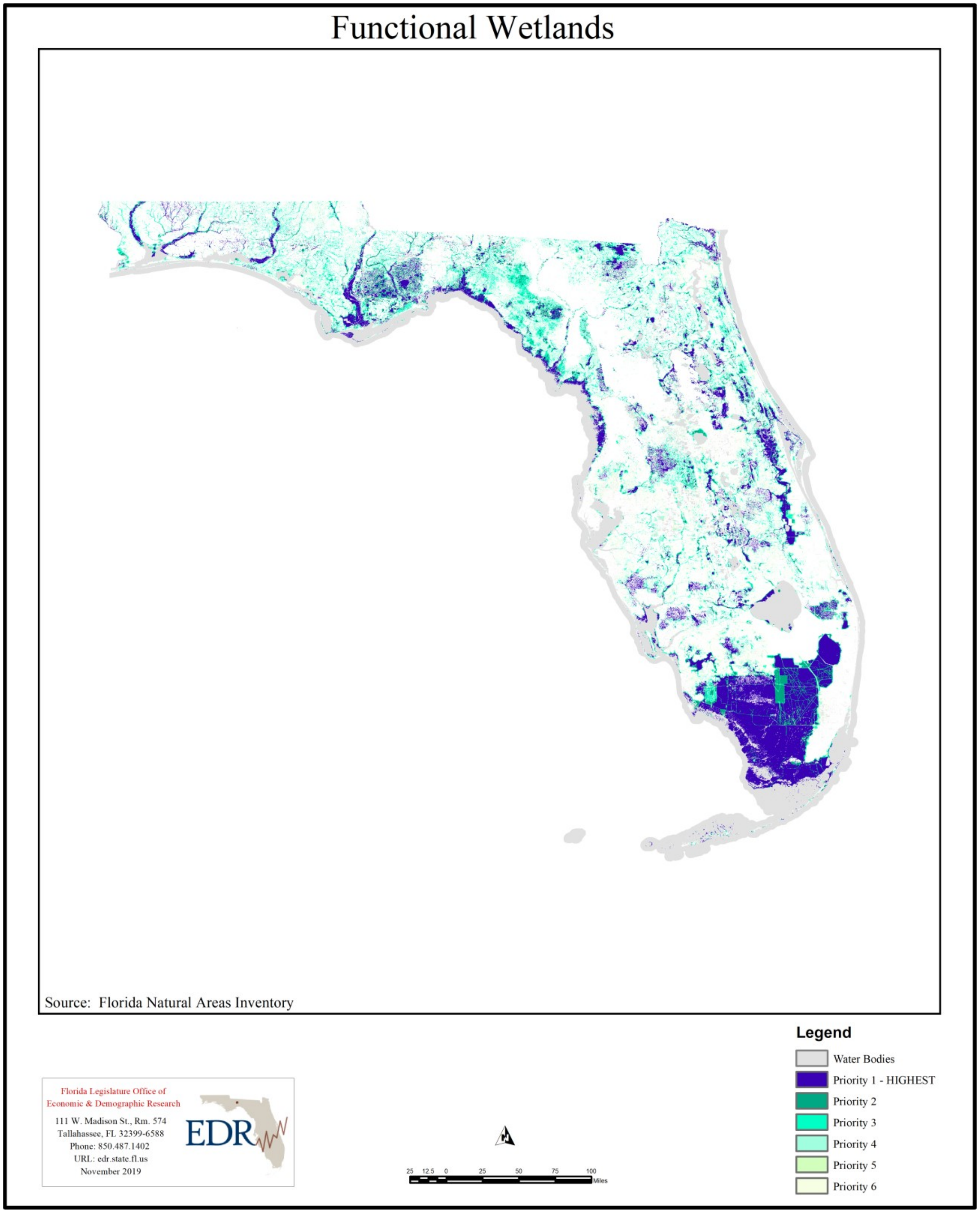
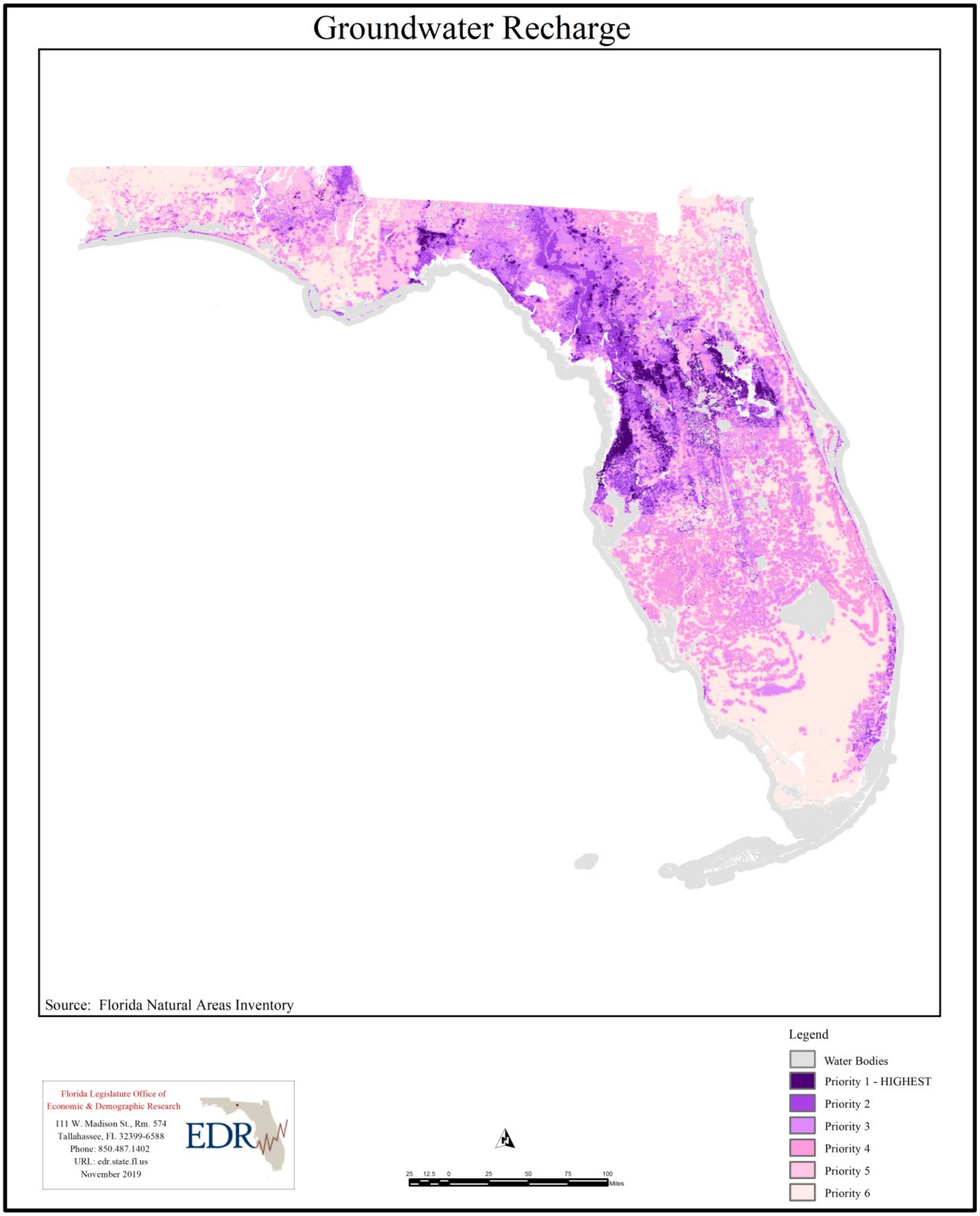


Figure 2.6.4 Groundwater Recharge



The extent of overlap between Florida Forever land acquisition projects and water resource protection may be further demonstrated by the Florida Forever Tool for Efficient Resource Acquisition and Conservation (F-TRAC) analysis conducted annually by FNAI.[109] The F-TRAC analysis on Florida Forever projects identifies the best opportunities to acquire multiple resources within the same project area.[110] It assumes that 500,000 additional Florida Forever project acres will be acquired through the life of the program.[111] The comparative analysis ranks the following natural resource values of existing projects relative to one another on a scale of 1 ("low" value) to 5 ("very high" value): species, communities, surface waters, wetlands and floodplains, forestry, aquifer recharge, and landscape.[112] This analysis can inform decision-makers on appropriate project ranking. For example, if additional emphasis is placed on acquiring functional wetlands; groundwater recharge areas critical to springs, aquifers, and other natural system; or acres necessary to protect surface waters, the F-TRAC analysis could assist in identifying projects that are ranked high for those water resource-related values.[113]

While identifying particular expenditure amounts for land acquisition that were used to protect water resources is not currently being documented under the Florida Forever program, the extent to which projects contribute to water resource-related goals are part of the consideration process for project selection and ranking. Within the remaining Florida Forever project acres, additional water resource protection is still available.

2.7 Next Steps and Recommendations

Efforts to quantify the offset of ad valorem loss from the acquisition of conservation lands have been largely fruitless. Rather than pursue this further, future editions will focus on the economic impacts of conservation land including the restriction of development and the increase in population density.

Additionally, EDR will continue to refine the methodology for cost estimates of future land acquisitions, particularly for entities with unreliable or missing GIS data as discussed in Section 2.3, and for land management expenditures for entities not broadly covered in the LMUAC report.

At this time, EDR has no formal land conservation recommendations for legislative consideration.

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[109] Florida Natural Areas Inventory, Florida Forever Project Evaluation Comparative Analysis, November 2018 available at: https://www.fnai.org/PDF/FF_Comparative_Analysis_11x17_Nov2018.pdf. (Accessed December 2019.)
[110] *Id.*
[111] *Id.* Note that FNAI also conducts an F-TRAC 2020 Statewide Scenario that looks at the best 500,000 acres statewide that will provide for the best opportunities to acquire multiple resources in the same location. Based on this analysis, only 17 percent of the acres identified were located within existing Florida Forever projects.
[112] *Id.*
[113] A copy of the November Florida Forever Project Evaluation Comparative Analysis can be found at: https://www.fnai.org/PDF/FF_Comparative_Analysis_11x17_Nov2018.pdf. (Accessed November 2019.)

3. Florida's Expenditures and Revenues Related to Water Supply and Water Quality

Florida's waters are the state's most basic and valued resource, providing an array of benefits crucial to existence, quality of life, and the economy. These benefits include water storage, flood protection, water purification, habitat for plant and animal species, recreational and educational opportunities, and scenic beauty. The management, protection, and restoration of Florida's surface water and groundwater require a coordinated effort among various state agencies, water management districts, public and private utilities, local governments, and other stakeholders.

Water resource management in Florida is conducted on a state and regional level.[114] Recognizing that water resource problems vary in magnitude and complexity from region to region across the state, the Legislature vests in DEP the power and responsibility to accomplish conservation, protection, management, and control of waters of the state, but with enough flexibility to accomplish these ends by delegating powers to the five water management districts (WMDs).[115] Chapter 373, Florida Statutes, provides the WMDs with broad authority to implement a wide range of regulatory and non-regulatory programs that address four areas of responsibility: water supply, water quality, flood protection and floodplain management, and natural systems. In addition, state agencies including the Florida Department of Agriculture and Consumer Services and the Florida Fish and Wildlife Conservation Commission implement activities that support water quality protection and restoration.

This section of the report provides an assessment of the various programs and initiatives associated with water supply and water quality. The assessment includes historic and estimated future expenditures on water programs and projects as well as forecasts of revenues used for these purposes. For an identification of gaps between projected revenues and estimated expenditures, see Chapter 8.

3.1 Historical and Projected Future Water Supply Expenditures

The Office of Economic and Demographic Research (EDR) defined water supply projects or initiatives as activities that appear to more directly promote the availability of sufficient water for all existing and future reasonable-beneficial uses and the natural systems. This would include activities associated with increasing available water supplies, drinking water infrastructure needed to convey and treat water supplies, and water supply planning activities.[116] For the most part, expenditures for water supply occur on the regional and local level with some programs and activities, such as funding assistance and statewide oversight of the water management districts (WMDs), occurring at the state level.

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[114] § 373.016(4)(a), Fla. Stat.
[115] § 373.016(5), Fla. Stat.
[116] Activities associated with the regulation of public water systems by DEP under the Florida Safe Drinking Water Act, part IV of chapter 403, Florida Statutes, or by the Florida Department of Health under section 381.0062, Florida Statutes, are included when identifiable within EDR's water quality and other water resource-related program component.

Expenditures of State and Federal Funds

State-appropriated funding is primarily associated with the Drinking Water State Revolving Fund (DWSRF) administered by DEP's Division of Water Restoration Assistance pursuant to section 403.8532, Florida Statutes, and the federal Safe Drinking Water Act.[117] With funding provided by federal and state sources, the DWSRF provides low interest loans that finance infrastructure improvements related to public water systems for the purpose of achieving and maintaining compliance with federal and state law.[118] In order to receive the federal capitalization grant for the state revolving fund, the state must match at least 20 percent of the total grant amount made available to the state.[119] The Fiscal Year 2019-20 appropriation for the DWSRF is $114.46 million.

In addition to the DWSRF, beginning in Fiscal Year 2017-18, the Water Storage Facility Revolving Loan program was created with an appropriation of $30.0 million.[120] At the time of this report, no disbursements have been made for this program; however, the funding remains available for expenditure in the Water Resource Protection and Sustainability Program Trust Fund. Since Fiscal Year 2009-10, the expenditures for the revolving funds have totaled over $673 million, with approximately 90 percent from federal funding sources.

In Fiscal Year 2005-06, funding for an alternative water supply grant program was established to provide funds for the WMDs to cost share alternative water supply projects with local applicants.[121] Between Fiscal Year 2005-06 and Fiscal Year 2008-09, $227.70 million was appropriated to this program. The statutory appropriation was repealed in Fiscal Year 2008-09.[122] Of the $227.70 million appropriated, $202.09 has been expended, with $106.69 million occurring in the most recent ten fiscal years. These expenditures were not captured in previous editions of this report.

Table 3.1.1 shows the annual cash expenditures since Fiscal Year 2009-10.[123] Due to the inconsistent history of these expenditures, the forecast relies on a 3-year moving average level of expenditures. Because these funds are provided for fixed capital outlay projects, the expenditures occur over multiple fiscal years.

[See table on following page]

[117] 42 U.S.C. §300f et. seq.
[118] § 403.8532(1), Fla. Stat.
[119] 42 U.S.C. § 300j-12(e).
[120] *See* § 12, ch. 2017-10, Laws of Fla.
[121] *See* § 17, ch. 2005-291, Laws of Fla. For more information on alternative water supply projects see Chapter 4 and the project list maintained by DEP available at: https://fdep.maps.arcgis.com/sharing/rest/content/items/bb71305ca45043a19b0466948df52132/data. (Accessed November 2019.)
[122] *See* § 1, ch. 2009-68, Laws of Fla.
[123] The personnel expenditures associated with the Drinking Water State Revolving Fund are included within the total personnel expenditures for Water Restoration Assistance, Table 3.3.3.

Table 3.1.1 Water Supply Annual Expenditures and Forecast (in $millions)

History	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19
Drinking Water Revolving Fund	$72.52	$76.45	$72.23	$34.75	$82.49	$52.95	$27.41	$57.49	$58.58	$138.41
Aid to WMDs for Alternative Water Supply	$39.81	$8.03	$1.63	$0.51	$0.27	$0.17	$1.65	$1.09	$3.42	$1.58
Total	**$112.33**	**$84.48**	**$73.86**	**$35.26**	**$82.77**	**$53.13**	**$29.05**	**$58.58**	**$62.00**	**$140.00**
Forecast	**FY 19-20**	**FY 20-21**	**FY 21-22**	**FY 22-23**	**FY 23-24**	**FY 24-25**	**FY 25-26**	**FY 26-27**	**FY 27-28**	**FY 28-29**
Total	$86.86	$96.28	$107.71	$96.95	$100.32	$101.66	$99.64	$100.54	$100.61	$100.27

Regional Expenditures

Similar to the analyses for the WMDs' conservation land acquisition and management, in order to identify expenditures of the WMDs related to water supply, EDR reviewed the WMDs' preliminary budgets and tentative budgets developed in accordance with sections 373.535 and 373.536, Florida Statutes, respectively. These budget documents include actual audited expenditures allocated to six program areas and across each of the four areas of responsibility, including water supply.[124]

Table 3.1.2 provides a forecast and details a history of expenditures that the WMDs attributed to the water supply area of responsibility. These expenditures include activities related to water supply assessments, regional water supply plans, alternative water supply, minimum flows and levels and associated recovery or prevention strategies, water conservation initiatives, water resource monitoring and data collection, land acquisition and management, and regulatory water use permitting. To avoid double counting WMD expenditures between the conservation land and water sections of this report, the total expenditures assigned to the "2.1 Land Acquisition" and "3.1 Land Management" activities have been removed[125] from the expenditures in Table 3.1.2 and the WMD water quality tables in Section 3.3. Note that the historic data is in local fiscal years, which begin October 1 and end September 30. For forecasting purposes, it was converted to state fiscal years. Forecasts rely on a three-year moving average as it best fits the nature of the data.

[124] The six program areas are: 1.0 Water Resources Planning and Monitoring; 2.0 Land Acquisition, Restoration and Public Works; 3.0 Operation and Maintenance of Works and Lands; 4.0 Regulation; 5.0 Outreach; and 6.0 District Management and Administration. The WMDs report expenditures in the four areas of responsibility at the program level only. Each program area contains multiple activities or sub-activities. The program allocation by area of responsibility are estimates since projects and initiatives may serve more than one purpose.

[125] While the districts are not required to allocate each activity and sub-activity among the four areas of responsibility, Northwest Florida WMD approximated that 10 percent of land acquisition and management is categorized as Water Supply, and 30 percent to each of Water Quality, Flood Protection, and Natural Systems. These shares are used across all districts and years to address the removal of subcategories 2.1 Land Acquisition and 3.1 Land Management.

Table 3.1.2 Water Management District Water Supply Expenditures (in $millions)

History	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17	LFY 17-18
NWFWMD	$8.31	$8.03	$8.20	$7.90	$5.23
SJRWMD	$22.27	$42.49	$42.38	$42.50	$41.33
SFWMD	$89.62	$90.43	$85.53	$93.71	$92.45
SWFWMD	$57.40	$53.38	$34.06	$26.16	$33.25
SRWMD	$3.20	$5.00	$6.19	$3.93	$5.38
Total	$180.81	$199.34	$176.35	$174.20	$177.64
Forecast	FY 18-19	FY 19-20	FY 20-21	FY 21-22	FY 22-23
Total	$177.87	$176.46	$177.04	$177.13	$176.88

Source: Annual Budgets of the Water Management Districts.

Table 3.1.3 provides a forecast and details a history of water supply expenditures[126] by special districts[127] that are located in multiple counties. Based on survey results, a portion of the local government expenditures identified in 537 Conservation and Resource Management and 572 Parks and Recreation may be for water supply purposes. Additionally, beginning in the 2020 Edition of this report, the Account 533 Water Utility Service Expenditures is included as a water supply expenditure of the respective government type as public utility data cannot be accurately separated from the local government data. Note that the historic data is in local fiscal years, which begin October 1 and end September 30. For forecasting purposes, it was converted to state fiscal years. Forecasts rely on a three-year moving average growth rate as it best fits the nature of the data.

Table 3.1.3 Water Supply Expenditures by Regional Special Districts (in $millions)

History	LFY 12-13	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17
Supply	$259.06	$267.38	$277.32	$281.26	$284.53
Forecast	FY 17-18	FY 18-19	FY 19-20	FY 20-21	FY 21-22
Supply	$290.14	$295.44	$300.67	$306.55	$312.22

Source: Annual Financial Report data obtained from the Florida Department of Financial Services, Division of Accounting and Auditing, Bureau of Local Government. Account 533 and a portion of accounts 537 and 572 are shared out in accordance with local government survey results.

Local Expenditures

Table 3.1.4 provides a forecast and details a history of water supply expenditures by local governments. Based on survey results, a portion of the local government expenditures[128] identified

[126] For further details on the source and methodology of this data, *see* "Local Expenditures" in Section 2.2.
[127] There exists a small number of governmental entities (*e.g.*, utility authorities) that cross counties but are technically not special districts. Their expenditures are included here.
[128] For further details on the source and methodology of this data, *see* "Local Expenditures" in Section 2.2.

in accounts 537 Conservation and Resource Management and 572 Parks and Recreation may be attributed to water supply. Additionally, beginning in the 2020 Edition of this report, the Account 533 Water Utility Service Expenditures is included as a water supply expenditure of the respective government type as public utility data cannot be accurately separated from the local government data. Note that the historic data is in local fiscal years, which begin October 1 and end September 30. For forecasting purposes, it was converted to state fiscal years. Forecasts rely on a three-year moving average growth rate as it best fits the nature of the data.

Table 3.1.4 Water Supply Expenditures by Local Governments (in $millions)

History	LFY 12-13	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17
Counties	$279.81	$278.74	$322.65	$315.98	$304.59
Municipalities	$623.25	$623.92	$663.20	$679.20	$724.79
Special Districts	$13.24	$13.14	$18.45	$17.71	$19.68
Total	**$916.30**	**$915.80**	**$1,004.29**	**$1,012.90**	**$1,049.06**
Forecast	**FY 17-18**	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**
Total	$1,085.22	$1,121.95	$1,161.69	$1,205.34	$1,248.26

Source: Annual Financial Report data obtained from the Florida Department of Financial Services, Division of Accounting and Auditing, Bureau of Local Government. Account 533 and a portion of accounts 537 and 572 are shared out by local government survey.

Private Utility Expenditures

Table 3.1.5 provides a forecast and details a history of water supply expenditures by private drinking water utilities. The basis for this data was provided to EDR by the Florida Public Service Commission (PSC) from the annual financial reports submitted by private drinking water utilities within jurisdictional counties. As of December 2019, only 38 of Florida's 67 counties had resolutions or ordinances adopted to impose PSC jurisdiction over private water and wastewater utilities.[129]. Because of this, the remaining expenditures from counties outside its jurisdiction were estimated based on per capita utility expenditures. This methodology should provide suitable estimates due to a similar mix of rural and urban counties both in and out of the PSC's jurisdiction. Note that the historic data is in calendar years. For forecasting purposes, it was converted to state fiscal years. Population growth drives the forecast as utility expenditures are generally expected to follow population growth.

[129] As of the date of this report, there were 38 jurisdictional counties: Alachua, Bradford, Brevard, Broward, Charlotte, Clay, Duval, Escambia, Franklin, Gadsden, Gulf, Hardee, Highlands, Jackson, Lake, Lee, Leon, Levy, Manatee, Marion, Martin, Monroe, Nassau, Okaloosa, Okeechobee, Orange, Osceola, Palm Beach, Pasco, Pinellas, Polk, Putnam, Seminole, St. Johns, St. Lucie, Sumter, Volusia, and Washington. The non-jurisdictional counties were: Baker, Bay, Calhoun, Citrus, Collier, Columbia, DeSoto, Dixie, Flagler, Gilchrist, Glades, Hamilton, Hendry, Hernando, Hillsborough, Holmes, Indian River, Jefferson, Lafayette, Liberty, Madison, Miami-Dade, Santa Rosa, Sarasota, Suwannee, Taylor, Union, Wakulla, and Walton. For an updated list of jurisdiction counties, see http://www.psc.state.fl.us/Files/PDF/Utilities/WaterAndWastewater/wawtextchart.pdf. (Accessed December 2019.)

Table 3.1.5 Water Supply Expenditures by Private Drinking Water Utilities (in $millions)

History	CY 2009	CY 2010	CY 2011	CY 2012	CY 2013	CY 2014	CY 2015	CY 2016	CY 2017	CY 2018
Total	$51.04	$46.24	$45.94	$44.78	$37.64	$38.71	$40.77	$40.65	$42.64	$41.78
Forecast	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**	**FY 22-23**	**FY 23-24**	**FY 24-25**	**FY 25-26**	**FY 26-27**	**FY 27-28**
Total	$42.95	$43.66	$44.34	$45.01	$45.66	$46.28	$46.88	$47.45	$48.00	$48.53

Source: A historical series was created using data provided by the Florida Public Service Commission.

3.2 Historical and Projected Future Revenues for Water Supply

EDR is required to forecast "federal, state, regional, and local government revenues dedicated in current law for the purposes… [of projects or initiatives associated with water supply and water quality protection and restoration] or that have been historically allocated for these purposes, as well as public and private utility revenues."[130] There are a variety of revenue sources that support water resources, including specific taxes and fees that are dedicated in law. The following discussion identifies and forecasts the relevant water supply revenues.

State-Appropriated Revenue Sources

The primary sources of state-appropriated revenue for water supply initiatives are federal grants and repayment of loans, which are deposited in the Drinking Water Revolving Loan Trust Fund.[131] The trust fund is used to provide low-interest loans for planning, engineering, design, and construction of public drinking water systems and improvements to such systems.

Based on a review of state accounts for the last ten fiscal years, a historical data series was constructed for the identified revenues. The Long-Term Revenue Analysis adopted by the Revenue Estimating Conference includes a forecast for federal grants, which is used as the basis for that part of the forecast through Fiscal Year 2028-29. For repayments of loans, a three-year moving average is used for the forecast. The historical series and the forecast are shown in Table 3.2.1.

[See table on following page]

[130] § 403.921(1)(c), Fla. Stat.
[131] § 403.8533, Fla. Stat.

Table 3.2.1 Revenues Available for Water Supply (in $millions)

History	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19
Federal Grants	$51.77	$68.39	$38.97	$42.40	$58.39	$21.26	$31.22	$29.69	$26.74	$31.55
Repayment of Loans	$23.72	$30.51	$34.32	$33.09	$41.30	$47.22	$44.83	$90.13	$36.37	$37.98
Total	**$75.49**	**$98.90**	**$73.29**	**$75.49**	**$99.69**	**$68.48**	**$76.05**	**$119.82**	**$63.11**	**$69.53**
Forecast	**FY 19-20**	**FY 20-21**	**FY 21-22**	**FY 22-23**	**FY 23-24**	**FY 24-25**	**FY 25-26**	**FY 26-27**	**FY 27-28**	**FY 28-29**
Federal Grants	$32.06	$32.95	$33.56	$33.36	$34.30	$35.34	$35.94	$36.83	$37.71	$38.52
Repayment of Loans	$54.83	$43.06	$45.29	$47.73	$45.36	$46.13	$46.40	$45.96	$46.16	$46.18
Total	**$86.89**	**$76.01**	**$78.86**	**$81.09**	**$79.66**	**$81.46**	**$82.34**	**$82.80**	**$83.87**	**$84.70**

Note: Values in this table differ from those seen in the 2019 Edition due to a source change. Previous editions used LAS/PBS, which included some anticipated revenues. This and future editions will use the trial balance.

In addition to the federal grants and repayment of loans, state funds including General Revenue and Land Acquisition Trust Fund receipts are also deposited in the Drinking Water Revolving Loan Trust Fund to provide the state match for federal grants. On average, the state matching funds were approximately $6.33 million per year during the past ten fiscal years. These dollars are included in the revenue forecast.

Regional Revenues

Revenues generated by the WMDs are identified in full in Section 3.4. While all of the WMDs' revenues may be dedicated to managing water resources, an attempt to categorize the split between water supply and water quality would be arbitrary. As a result, the revenues for water supply are blended into the revenues for water quality and other water resource-related expenditures.

Table 3.2.2 provides a forecast and details a history of water supply revenues from self-generated sources as well as federal and state sources to special districts that are located in multiple counties.[132] Similar to the expenditures, beginning with this edition of EDR's report, public utility revenues are contained in their respective government's revenues. Self-generated revenues include the accounts identified as 314.300 Utility Service Tax - Water, 323.300 Franchise Fee – Water, and 343.300 Charges for Services - Water Utility, as well as survey results regarding 343.700 Charges for Services – Conservation and Resource Management. The accounts identified as 334.310 State Grant – Water Supply System and 335.310 State Revenue Sharing – Water Supply System are categorized as water supply revenue from the state and the account identified as 331.310 Federal Grant – Water Supply System is categorized as a water supply revenue from the federal government. Note that the historic data is in local fiscal years, which begin October 1 and end September 30. For forecasting purposes, it was converted to state fiscal years. As revenues are largely based on population, forecasts rely on population growth rates.

[132] There exists a small number of governmental entities (*e.g.*, utility authorities) that cross counties but are technically not special districts. Their expenditures are included here.

Table 3.2.2 Water Supply Revenues Generated by Regional Special Districts by Government Source (in $millions)

History	LFY 12-13	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17
Self	$297.41	$312.02	$309.29	$317.56	$324.65
State	$-	$-	$-	$0.07	$0.13
Federal	$-	$0.48	$1.47	$1.33	$0.07
Forecast	**FY 17-18**	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**
Self	$330.20	$335.95	$341.52	$346.89	$352.10
State	$0.13	$0.14	$0.14	$0.14	$0.14
Federal	$0.07	$0.07	$0.07	$0.07	$0.07

Source: Annual Financial Report data obtained from the Florida Department of Financial Services, Division of Accounting and Auditing, Bureau of Local Government. Accounts 314.300, 323.300, 343.300, and survey results are applied to 343.700 for self; 334.310 and 335.310 for State; and 331.310 for Federal.

Local Revenues

Table 3.2.3 provides a forecast and details a history of water supply revenues that are self-generated by local governments. Based on survey results, a portion of the local government account[133] identified as 343.700 Service Charge – Conservation and Resource Management is self-generated for use on water supply projects and initiatives. Further, the accounts identified as 314.300 Utility Service Tax - Water, 323.300 Franchise Fee – Water, and 343.300 Charges for Services - Water Utility are categorized as water supply self-generated revenue. In addition, local governments may have other revenue sources used to fund water supply initiatives including impact fees and special assessments. Note that the historic data is in local fiscal years, which begin October 1 and end September 30. For forecasting purposes, it was converted to state fiscal years. As revenues are largely based on population, forecasts rely on population growth rates.

Table 3.2.3 Water Supply Revenues Generated by Local Governments (in $millions)

History	LFY 12-13	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17
Counties	$392.46	$403.00	$413.31	$432.65	$457.24
Municipalities	$1,083.41	$1,161.75	$1,173.88	$1,338.89	$1,437.41
Special Districts	$47.15	$47.28	$48.26	$48.56	$52.03
Total	$1,523.03	$1,612.04	$1,635.45	$1,820.11	$1,946.68
Forecast	**FY 17-18**	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**
Total	$1,979.91	$2,014.43	$2,047.82	$2,080.03	$2,111.28

Source: Annual Financial Report data obtained from the Florida Department of Financial Services, Division of Accounting and Auditing, Bureau of Local Government. Accounts 314.300, 323.300, 343.300 and survey results are applied to Account 343.700.

[133] For further details on the source and methodology of this data, *see* the "Local Expenditures" piece of Section 2.2.

Table 3.2.4 provides a forecast and details a history of water supply revenues generated by the state and provided to local governments. The accounts identified as 334.310 State Grant – Water Supply System and 335.310 State Revenue Sharing – Water Supply System are categorized as water supply revenues from the state. Note that the historic data is in local fiscal years, which begin October 1 and end September 30. For forecasting purposes, it was converted to state fiscal years. As revenues are largely based on population, forecasts rely on population growth rates.

Table 3.2.4 Water Supply Revenues Provided to Local Governments from the State (in $millions)

History	LFY 12-13	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17
Counties	$0.56	$2.02	$5.92	$0.85	$2.25
Municipalities	$2.62	$1.45	$15.72	$12.02	$10.47
Special Districts	$0.18	$0.18	$0.37	$0.21	$0.06
Total	$3.36	$3.65	$22.01	$13.08	$12.78
Forecast	**FY 17-18**	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**
Total	$13.00	$13.23	$13.45	$13.66	$13.86

Source: Annual Financial Report data obtained from the Florida Department of Financial Services, Division of Accounting and Auditing, Bureau of Local Government, Accounts 334.310 and 335.310.

Table 3.2.5 provides a forecast and details a history of water supply revenues generated by the federal government and provided to local governments. The account identified as 331.310 Federal Grant – Water Supply System is categorized as water supply revenue from the federal government. Note that the historic data is in local fiscal years, which begin October 1 and end September 30. For forecasting purposes, it was converted to state fiscal years. As revenues are largely based on population, forecasts rely on population growth rates.

Table 3.2.5 Water Supply Revenues Provided to Local Governments from the Federal Government (in $millions)

History	LFY 12-13	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17
Counties	$0.00	$0.08	$4.63	$2.34	$-
Municipalities	$6.73	$7.97	$8.50	$4.44	$6.70
Special Districts	$0.59	$0.38	$0.79	$-	$-
Total	$7.33	$8.42	$13.93	$6.78	$6.70
Forecast	**FY 17-18**	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**
Total	$6.81	$6.93	$7.05	$7.16	$7.26

Source: Annual Financial Report data obtained from the Florida Department of Financial Services, Division of Accounting and Auditing, Bureau of Local Government, Accounts 331.310.
Note: "$-" indicates a zero, whereas "$0.00" indicates an amount less than $5,000.

Private Utility Revenues

Table 3.2.6 provides a forecast and details a history of water supply related revenues generated by private drinking water utilities. The basis for this data was provided to EDR by the Florida Public Service Commission (PSC) from the annual financial reports submitted by drinking water utilities within jurisdictional counties. As of December 2019, only 38 of Florida's 67 counties had resolutions or ordinances adopted to impose PSC jurisdiction over private water and wastewater utilities.[134] As a result, the remaining revenues from counties outside of its jurisdiction were estimated based on per capita utility expenditures. This methodology should provide suitable estimates due to a similar mix of rural an urban counties both in and out of the PSC's jurisdiction. Note that the historic data is in calendar years. For forecasting purposes, it was converted to state fiscal years. As revenues are largely based on population, forecasts rely on population growth rates.

Table 3.2.6 Revenues Generated by Private Drinking Water Utilities (in $millions)

History	CY 2009	CY 2010	CY 2011	CY 2012	CY 2013	CY 2014	CY 2015	CY 2016	CY 2017	CY 2018
Total	$65.98	$66.93	$67.66	$66.17	$53.98	$54.55	$56.71	$59.98	$61.83	$59.73
Forecast	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**	**FY 22-23**	**FY 23-24**	**FY 24-25**	**FY 25-26**	**FY 26-27**	**FY 27-28**
Total	$61.84	$62.86	$63.85	$64.81	$65.74	$66.64	$67.50	$68.32	$69.12	$69.88

Source: A historical series was created using data provided by the Florida Public Service Commission.

3.3 Historical and Projected Future Water Quality and Other Water Resource-Related Expenditures

Article II, Section 7 of the Florida Constitution requires that adequate provision in law be made for the abatement of water pollution. Recognizing the importance of the state's water resources, the Florida Legislature passed the Florida Air and Water Pollution Control Act[135] in 1967 and the Florida Water Resource Act[136] in 1972. In addition, the Florida Safe Drinking Water Act[137] was passed in 1977 to ensure "safe drinking water at all times throughout the state, with due regard for economic factors and efficiency in government."[138] Further, chapter 376, Florida Statutes, addresses surface and groundwater pollution through various programs including state-funded

[134] As of the date of this report, there were 38 jurisdictional counties: Alachua, Bradford, Brevard, Broward, Charlotte, Clay, Duval, Escambia, Franklin, Gadsden, Gulf, Hardee, Highlands, Jackson, Lake, Lee, Leon, Levy, Manatee, Marion, Martin, Monroe, Nassau, Okaloosa, Okeechobee, Orange, Osceola, Palm Beach, Pasco, Pinellas, Polk, Putnam, Seminole, St. Johns, St. Lucie, Sumter, Volusia, and Washington. The non-jurisdictional counties were: Baker, Bay, Calhoun, Citrus, Collier, Columbia, DeSoto, Dixie, Flagler, Gilchrist, Glades, Hamilton, Hendry, Hernando, Hillsborough, Holmes, Indian River, Jefferson, Lafayette, Liberty, Madison, Miami-Dade, Santa Rosa, Sarasota, Suwannee, Taylor, Union, Wakulla, and Walton. For an updated list of jurisdiction counties, see http://www.psc.state.fl.us/Files/PDF/Utilities/WaterAndWastewater/wawtextchart.pdf. (Accessed December 2019.)
[135] Ch. 67-436, Laws of Fla.; § 403.011 et seq.
[136] Ch. 72-299, Laws of Fla.; Ch. 373, Fla. Stat.
[137] Ch. 77-337, Laws of Fla.; § 403.850, Fla. Stat. et seq.
[138] Ch. 77-337, § 2, Laws of Fla.; § 403.851(3), Fla. Stat.

cleanup for petroleum and dry-cleaning solvents, waste cleanup requirements for potentially responsible parties, and restoration of certain potable water systems or private wells impacted by contamination.

Expenditures of State and Federal Funds

To identify the water quality and other water resource-related program expenditures, EDR reviewed the projects and initiatives implemented by DEP and other state agencies related to the protection or restoration of water quality, as well as the activities associated with the regulation of drinking water in Florida. Potentially all existing environmental or natural resource-based programs, projects, and initiatives may influence the quality of water. Therefore, EDR attempted to identify those areas that appeared to be more directly related to the protection and restoration of water quality. Future editions may include refinements to these categorizations.

For the water quality and other water resource-related program component, EDR grouped the identified programs, projects, and initiatives into four categories generally following the internal structure of DEP: Environmental Assessment and Restoration; Water Restoration Assistance; Other Programs and Initiatives; and Regulatory/Clean-up Programs.

Environmental Assessment and Restoration
DEP's Division of Environmental Assessment and Restoration (DEAR) implements critical responsibilities under state and federal law relating to protecting and restoring water quality in Florida. These responsibilities include adopting, reviewing, and revising Florida's surface water quality standards; monitoring and reporting on water quality; assessing waterbodies to identify those that are impaired; developing water quality restoration targets for the impaired waterbodies (*i.e.,* total maximum daily loads or TMDLs), developing and implementing water quality restoration plans such as basin management action plans (BMAPs), and providing laboratory services to DEP and other agencies.[139]

Expenditures related to DEAR, including personnel and operational costs, monitoring programs, laboratory services and support, and the TMDL program are included in this category. The expenditures identified for the TMDL program are primarily related to projects and activities adopted in basin management action plans, which are developed with state, regional, and local stakeholders to achieve one or more TMDLs. The TMDL and BMAP programs are discussed in more detail in Chapter 5.

Since Fiscal Year 2009-10, expenditures for environmental assessment and restoration have totaled $299.32 million. The majority of the expenditures has been from state sources (72 percent) with the remaining 28 percent from federal sources. Most of the federal funding is associated with the TMDL program. Table 3.3.1 shows the annual cash expenditures over the past ten years.

[139] DEP, Division of Environmental Assessment and Restoration, https://floridadep.gov/dear. (Accessed November 2019.)

Table 3.3.1 DEP's Division of Environmental Assessment and Restoration Expenditures (in $millions)

	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19
Personnel	$12.67	$11.31	$10.67	$10.23	$11.30	$13.02	$12.81	$12.08	$12.00	$12.35
Operations	$2.25	$2.33	$2.22	$2.14	$2.56	$2.59	$2.63	$3.56	$3.25	$2.89
Lab Support	$1.51	$0.70	$0.50	$0.62	$0.62	$0.32	$0.19	$0.51	$0.44	$0.38
Watershed Monitoring	$2.02	$1.94	$1.93	$2.00	$3.59	$3.09	$2.30	$2.33	$2.62	$2.34
TMDL Program*	$2.82	$5.98	$7.08	$12.99	$12.72	$11.77	$24.32	$9.50	$9.46	$11.97
Other Projects	$2.52	$2.44	$1.88	$1.57	$1.68	$1.57	$1.75	$0.95	$0.67	$0.86
Total	**$23.78**	**$24.71**	**$24.29**	**$29.56**	**$32.46**	**$32.36**	**$43.99**	**$28.93**	**$28.44**	**$30.78**

* The history of these expenditures has been revised to include additional TMDL program accounts. Note that this table only includes TMDL expenditures by DEAR and does not include grants awarded to eligible entities by the DEP's Division of Water Restoration Assistance for TMDL implementation. The latter is included in the Nonpoint Source Funds category of Table 3.3.3.

In addition to the expenditures for water quality initiatives associated with assessment and restoration at DEP, the Legislature also provides funding to support water-related programs administered by the Department of Agriculture and Consumer Services (DACS). Since Fiscal Year 2009-10, the expenditures for these programs have totaled $260.54 million, primarily from state sources. Table 3.3.2 shows the annual cash expenditures over the past ten years.

Table 3.3.2 DACS Water-Related Expenditures (in $millions)

	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19
Personnel	$2.65	$2.64	$2.61	$2.26	$2.32	$2.43	$2.58	$2.77	$3.45	$3.91
Operations	$0.30	$0.27	$0.27	$0.35	$0.38	$0.39	$0.50	$0.56	$0.75	$0.53
Best Management Practices*	$6.55	$10.98	$10.74	$14.58	$14.94	$21.29	$20.24	$34.53	$33.18	$33.68
Hybrid Wetlands*	$-	$-	$-	$-	$0.03	$4.61	$4.30	$11.55	$-	$-
Nitrate & Nitrite Research and Remediation*	$0.54	$0.42	$0.33	$0.86	$0.64	$0.42	$0.54	$0.69	$0.60	$0.80
Total	**$10.00**	**$14.28**	**$13.68**	**$18.15**	**$18.44**	**$29.41**	**$28.40**	**$50.96**	**$38.22**	**$38.99**

*In the 2019 Edition, Hybrid Wetlands category was included within the Best Management Practices total and the Nitrate & Nitrite Research and Remediation was included within n Other Projects. As of the 2020 Edition, Other Projects only contains that topic.

Much of this funding is to support projects and initiatives related to the implementation of agricultural best management practices (BMPs). In addition to cost-sharing programs that assist farmers in implementing BMPs, DACS' water-related expenditures include operation of ten hybrid wetland treatment technology systems and three floating aquatic vegetative tilling wetland treatment facilities (with one under construction), as well as ongoing nitrate and nitrite research and remediation.

DACS has primary authority to develop and adopt BMP manuals, by rule, that address agricultural nonpoint sources of pollution, as well as to verify the implementation of BMPs. BMPs are designed to improve water quality while maintaining agricultural production through practices and measures that reduce the amount of fertilizers, pesticides, animal waste, and other pollutants that enter the state's waters. Typical practices include nutrient management, irrigation management, and water resource protection.[140]

Agricultural BMPs serve as the primary tool to prevent and reduce water pollution. DEP, WMDs, and DACS are required to assist agricultural entities with implementation of BMPs. To that end, DACS implements cost-share programs to provide financial assistance for BMP implementation. According to DACS' Office of Agricultural Water Policy, as of their status report dated July 1, 2019, there were an estimated 3,714,922 agricultural acres enrolled in BMPs statewide representing approximately 54 percent of total agricultural areas statewide (not including silviculture).[141]

Water Restoration Assistance

DEP's Division of Water Restoration Assistance (DWRA) is responsible for providing financial assistance in the form of low-interest loans or grants to fund water quality and water quantity projects throughout the state.[142] This includes the federal and state-funded State Revolving Fund; nonpoint source grants under both the federal Clean Water Act Section 319(h) grants and the state's TMDL Water Quality Restoration grants; and the Deepwater Horizon program.[143] DWRA also manages legislatively appropriated water projects and springs restoration funding.[144]

Expenditures related to DEP's DWRA, including personnel and the various loan and grant programs, are included in this category. Since Fiscal Year 2009-10, the expenditures for the identified programs total nearly $2.50 billion. Of the total appropriations, approximately 64 percent has been funded from federal sources and 36 percent from state sources. Most of the federal funding is associated with the State Revolving Fund, including grants for Wastewater Treatment Facilities Construction and grants for Small Community Wastewater Treatment. Table 3.3.3 shows the annual cash expenditures since Fiscal Year 2009-10.

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[140] DACS, *What are Agricultural Best Management Practices?*, available at: https://www.fdacs.gov/content/download/30796/file/What-Are-FDACS-best-management-practices.pdf. (Accessed November 2019.)

[141] *See* Florida Department of Agriculture and Consumer Services, Status of Implementation of Agricultural Nonpoint Sources Best Management Practices, July 1, 2019, available at: https://www.freshfromflorida.com/Divisions-Offices/Agricultural-Water-Policy. (Accessed November 2019.)

[142] DEP, *Division of Water Restoration Assistance*, https://floridadep.gov/wra. (Accessed November 2019.)

[143] For the 2021 Edition and beyond, expenditures for beach management projects and non-mandatory land reclamation may be excluded as not being directly related to water quality restoration or improvement. In addition, these programs are currently being administered by DEP's Division of Water Resource Management.

[144] DEP, *Division of Water Restoration Assistance*, https://floridadep.gov/wra. (Accessed November 2019.)

Table 3.3.3 Water Restoration Assistance Expenditures (in $millions)

	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19
Personnel	$4.58	$4.47	$4.19	$3.84	$3.75	$3.38	$3.28	$6.58	$3.88	$4.42
Operations	$0.38	$0.61	$0.66	$0.64	$0.38	$0.48	$0.42	$0.50	$0.35	$0.38
Revolving Fund - Wastewater Facilities	$121.18	$107.04	$154.88	$101.75	$80.60	$162.99	$119.05	$161.73	$169.88	$244.56
Revolving Fund - Wastewater Small Community*	$22.00	$9.70	$12.88	$22.21	$37.47	$22.03	$16.49	$7.28	$0.89	$0.90
Water Projects	$41.31	$28.86	$16.58	$16.44	$9.26	$20.07	$43.43	$49.96	$47.79	$33.28
Nonpoint Source Funds*	$25.84	$19.60	$12.17	$7.68	$3.08	$2.80	$3.86	$12.72	$17.91	$10.74
Springs Restoration**	$-	$-	$-	$-	$10.00	$0.06	$5.19	$9.36	$17.00	$15.47
Beach Projects/Restoration[145]	$16.87	$12.46	$15.97	$15.52	$15.69	$24.92	$37.42	$37.24	$38.74	$29.04
Non-Mandatory Land Reclamation	$2.48	$2.29	$4.92	$1.44	$0.86	$1.53	$2.18	$1.02	$0.17	$0.60
Deepwater Horizon Projects[146]	$0.51	$2.02	$1.18	$1.88	$3.29	$32.87	$12.92	$19.01	$20.00	$29.96
Other Projects	$-	$-	$0.50	$-	$0.12	$0.01	$0.16	$0.37	$1.82	$4.47
Total	**$235.15**	**$187.06**	**$223.94**	**$171.38**	**$164.50**	**$271.13**	**$244.41**	**$305.78**	**$318.45**	**$373.82**

* The history of these expenditures has been revised to include additional accounts.
** According to DEP, approximately $5,280,355 of total expenditures for springs restoration were spent on land acquisition projects.

During this time, approximately 71 percent of identified expenditures were for water quality projects funded through the Clean Water State Revolving Fund (CWSRF),[147] Section 319 Clean Water Acts grants,[148] and the State Water-Quality Assistance Grants (formerly known as the TMDL Water Quality Restoration grants). Eligible projects under the CWSRF include the construction or upgrade of wastewater and stormwater infrastructure. A more extensive discussion of CWSRF eligibility and federal funding allocation to states can be found in Chapter 6. Projects funded through Section 319 and TMDL grants (nonpoint source funds) are intended to reduce

[145] Beach restoration and inlet management projects may not be considered traditional water quality restoration or improvement projects. However, because of the significance of funding assistance for beaches in Florida, as well as their potential value as a defense against storm surge, EDR continues to include these expenditures within this section for reference among the other water funding assistance programs. In future editions, EDR may reevaluate including these expenditures.
[146] The amounts shown are those expenditures identified as being related to water resources and are not inclusive of all expenditures funded through Deepwater Horizon-related settlements.
[147] *See* 33 U.S.C. § 1383; § 403.1835, Fla. Stat.
[148] 33 U.S.C. § 1329(h).

nonpoint source pollution and may include demonstration and evaluation of urban and agricultural best management practices, stormwater retrofits, and public education projects.[149]

A more recent funding initiative is the annual statutory distribution from the Land Acquisition Trust Fund for spring restoration, protection, and management projects. Of the funds remaining after payment of debt service for Florida Forever bonds and Everglades restoration bonds, the lesser of 7.6 percent or $50 million is to be appropriated for springs projects.[150] In the five most recent General Appropriations Acts, the Legislature appropriated funds for land acquisition to protect springs and for projects that protect water quality and water quantity that flow from springs. Through the end of Fiscal Year 2018-19, approximately $57.09 million of the funds appropriated for springs restoration had been spent.

The final major category of funding assistance is provided through specific legislative appropriations for water projects identified each year in the General Appropriations Act. These water projects vary from year to year, although some projects have received funding in multiple years. The projects address water quality improvement (including septic-to-sewer projects), stormwater management, wastewater management, waterbody restoration, water supply,[151] flooding, and other water resource-related concerns. Expenditures on water projects have ranged from as high as $49.96 million in Fiscal Year 2016-17 to as little as $9.3 million in Fiscal Year 2013-14. In Fiscal Years 2018-19 spending on water projects was $33.28 million.

Other Programs and Initiatives
In addition to Environmental Assessment and Restoration and Water Restoration Assistance, the Legislature has funded a variety of other water quality restoration projects and initiatives over the past ten years. Since Fiscal Year 2009-10, expenditures for these programs have exceeded $1.18 billion. More than 98 percent of expenditures were from state sources and less than two percent from federal sources. The largest initiative in this category is Everglades restoration, with total expenditures of $1.03 billion or 87 percent of the total over this time period. See Chapter 7 for a dedicated discussion of Everglades expenditures.

The annual cash expenditures since Fiscal Year 2009-10 are shown in Table 3.3.4. Note that the Everglades Restoration category now includes the previously separately itemized expenditures that were identified in the 2019 Edition as Transfer to Everglades Trust Fund and Hoover Dike Rehabilitation.[152]

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[149] DEP, Nonpoint Source Funds, https://floridadep.gov/WRA/319-TMDL-Fund. (Accessed November 2019.)
[150] § 375.041(3)(b)2., Fla. Stat.
[151] Water supply projects such as drinking water infrastructure projects and alternative water supply projects have also received legislatively-appropriated funding under this category. Although expenditures for drinking water infrastructure projects and alternative water supply projects would relate to water supply, these expenditures are included in this category because insufficient project level data currently exists to allocate the expenditures between water supply and water quality.
[152] The $50 million expenditure on Hoover Dike Rehabilitation was identified as a FY17-18 expenditure in the 2019 Edition, however, it did not actually occur until FY18-19 where it is now reflected.

Table 3.3.4 Other Programs and Initiatives Expenditures (in $millions)

	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19
Everglades Restoration	$38.35	$69.27	$27.54	$26.60	$93.92	$54.56	$115.77	$140.37	$184.53	$276.28
Office of Water Policy	$-	$-	$-	$1.79	$2.27	$2.29	$2.36	$2.32	$2.43	$2.48
Other Projects	$5.21	$6.47	$6.91	$8.06	$7.61	$15.46	$14.88	$17.76	$19.59	$24.08
Red Tide Research	$1.00	$1.00	$0.64	$0.64	$1.28	$1.26	$0.62	$0.68	$0.43	$3.67
Total	**$44.57**	**$76.73**	**$35.09**	**$37.09**	**$105.09**	**$73.57**	**$133.63**	**$161.12**	**$206.98**	**$306.51**

Ongoing toxic algae blooms and red tide have posed a threat to the state's public health, safety, and welfare as well as the state's environment and ecosystems, prompting Governor Scott to issue a series of executive orders detailed in the 2019 Edition of this report. Since that time, Governor DeSantis issued Executive Order 2019-12 in January 2019 which, among other things, directed DEP to establish the Blue-Green Algae Task Force, accelerate Everglades Restoration, and participate in the Fish and Wildlife Conservation Commission's Harmful Algal Bloom Task Force which studies causes and impacts of red tide.[153] This resulted in Fiscal Year 2018-19 expenditures of approximately $12.55 million for Lake Okeechobee restoration and $2.83 million for red tide mitigation that are included in the Everglades Restoration and Red Tide Research categories of Table 3.3.4, respectively.

Over the past ten fiscal years, the state has spent an average of $1.12 million per year for ongoing red tide research. The Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute partners with Mote Marine Laboratory to monitor the organism that causes most red tides along the southwest coast. Through this partnership, scientists conduct water sampling and monitoring and update the public on the status of red tide.[154]

Regulatory and Clean-Up Programs

EDR included DEP's regulatory section in its analysis of expenditures for water quality and other water resource-related programs because program areas within this section implement or enforce laws related to water quality, provide research that supports water-related programs, or implement programs that are associated with the assessment or remediation of surface and groundwater pollution.

Since Fiscal Year 2009-10, the State of Florida has spent more than $2.34 billion for regulatory and clean-up programs administered by DEP. The majority of this funding, approximately 92.6 percent, has been funded from state sources. Most of the expenditures are associated with clean-up programs for hazardous waste sites, petroleum tanks, underground tanks, and water wells. The personnel included in this grouping are employed by DEP's district offices, water resource

[153] Fla. Exec. Order No. 19-12 (January 10, 2019). Available at https://www.flgov.com/wp-content/uploads/orders/2019/EO_19-12.pdf. (Accessed November 2019.)

[154] *See* Florida Fish and Wildlife Conservation Commission, FWC/FWRI-Mote Cooperative Red Tide Program, https://myfwc.com/research/redtide/monitoring/current/coop/. (Accessed November 2019.)

management, waste management, and the Florida Geological Survey. DEP's district offices are responsible for implementing programs relating to air and waste regulation, as well as water resource protection and restoration. EDR was unable to identify the personnel who exclusively work on water within the available data; therefore, all personnel costs have been included. Table 3.3.5 shows the annual cash expenditures since Fiscal Year 2009-10.

Table 3.3.5 Regulatory and Clean-up Program Expenditures (in $millions)

	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19
Personnel	$66.67	$65.60	$61.48	$58.87	$59.07	$58.15	$56.24	$52.74	$65.04	$66.20
Operations	$7.25	$7.37	$8.04	$6.88	$7.13	$7.65	$8.42	$8.63	$10.04	$9.56
Petroleum Restoration	$28.35	$109.54	$120.29	$132.11	$81.85	$59.73	$80.97	$119.44	$122.40	$119.08
Waste Clean-Up	$147.16	$37.79	$41.45	$36.68	$26.38	$28.68	$37.40	$36.11	$36.61	$38.06
Other Projects	$38.83	$35.74	$21.47	$16.83	$14.63	$15.02	$15.29	$16.74	$18.87	$17.31
Total	**$288.26**	**$256.05**	**$252.73**	**$251.38**	**$189.06**	**$169.24**	**$198.32**	**$233.66**	**$252.96**	**$250.20**

The expenditures shown for Waste Clean-Up include the activities associated with the following major types of clean-up efforts: dry-cleaning solvent contamination; hazardous waste; underground storage tanks; water wells; and contracts with local governments. In addition, the expenditures shown for Other Projects include various programs and projects including waste planning grants, underground storage tank compliance verification, solid waste management activities, and transfers to other agencies for specified activities (*e.g.*, to the Department of Health for Biomedical Waste Regulation).

State Aid to Water Management Districts

Each year in the state budget, the Legislature provides funding to support the WMDs. Since Fiscal Year 2009-10, direct expenditures to support the districts' water quality and other water resource-related programs have totaled nearly $137 million. Most of the funding is provided through DEP; however, the expenditures related to Everglades restoration are provided through the Florida Department of Transportation. In this regard, a portion of the toll revenue deposited into the State Transportation Trust Fund from the Alligator Alley Toll Road has been provided, when available, to the South Florida Water Management District for Everglades restoration projects.[155] Table 3.3.6 shows the annual cash expenditures since Fiscal Year 2009-10.

[155] § 338.26, Fla. Stat. (Each year, tolls are generated from the use of Alligator Alley. The Department of Transportation is authorized to transfer any funds in excess of those used to conduct certain activities prescribed in paragraph (3)(a) to SFWMD for Everglades restoration.)

Table 3.3.6 State Aid to Water Management Districts (in $millions)

	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19
Operations and Permitting Assistance*	$3.76	$4.74	$0.19	$1.71	$2.26	$8.08	$7.95	$7.95	$7.95	$7.95
Minimum Flows and Levels	$-	$-	$-	$-	$-	$-	$1.50	$1.50	$3.45	$3.45
Wetland Protection*	$0.49	$0.61	$0.36	$0.73	$2.44	$0.88	$1.31	$0.00	$-	$-
Dispersed Water Storage	$-	$-	$-	$-	$-	$10.00	$5.00	$5.00	$5.00	$5.00
Everglades Restoration	$-	$-	$-	$4.40	$4.40	$8.60	$7.06	$-	$8.01	$5.24
Total	**$4.24**	**$5.35**	**$0.55**	**$6.84**	**$9.10**	**$27.56**	**$22.83**	**$14.45**	**$24.41**	**$21.63**

Note: "$-" indicates a zero, whereas "$0.00" indicates an amount less than $5,000.
*Included accounts have been revised to more accurately represent the expenditure history.

Forecast of Expenditures on Water Quality and Other Water Resource-Related Programs
Table 3.3.7 provides a forecast for total state expenditures on water quality and other water resource-related programs. Beginning in Fiscal Year 2009-10, the expenditures for these programs declined each year before resuming growth after the low point in Fiscal Year 2012-13. Since that time, the annual growth rate has averaged approximately 12 percent as increased revenues became available to reinvest in these programs. The highest growth rate occurred in Fiscal Year 2016-17 at 18.36 percent, followed by increases of 9.38 percent in Fiscal Year 2017-18 and 17.54 percent in Fiscal Year 2018-19. Because of this unusual pattern, the forecast uses the average growth rate over the ten year history of 3.93 percent.

Table 3.3.7 History and Forecast of State Expenditures on Water Quality and Other Water Resource-Related Programs (in $millions)

History	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19
Total	$606.01	$564.18	$550.28	$514.39	$518.65	$603.27	$671.59	$794.91	$869.46	$1,021.94

Forecast	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	FY 26-27	FY 27-28	FY 28-29
Total	$1,062.06	$1,103.75	$1,147.09	$1,192.12	$1,238.92	$1,287.56	$1,338.10	$1,390.63	$1,445.23	$1,501.96

Regional Expenditures

Similar to the analyses for the WMDs' conservation land acquisition, land management, and water supply, in order to identify WMD expenditures related to water quality, EDR reviewed the WMDs' preliminary budgets and tentative budgets developed in accordance with sections 373.535 and 373.536, Florida Statutes, respectively. These budget documents include actual audited expenditures allocated to six program areas and across each of the four areas of responsibility, including water quality.[156] Note that due to the SFWMD's unique responsibilities related to Everglades restoration, a large component of water quality expenditures is related to the implementation of the Restoration Strategies Regional Water Quality Plan, water quality features of the Comprehensive Everglades Restoration Plan (CERP), and other ecosystem restoration projects supporting water quality goals within the Everglades ecosystem.

Table 3.3.8 provides a forecast and details a history of expenditures across all program areas that the WMDs attribute to the water quality area of responsibility. These expenditures include activities related to water quality improvement and restoration, environmental monitoring and data collection, land acquisition and management, and regulatory permitting (*e.g.,* environmental resource permitting program and water well construction permitting). To avoid double counting WMD expenditures between the conservation land and water sections of this report, the total expenditures assigned to "2.1 Land Acquisition" and "3.1 Land Management" activities have been removed from the expenditures in Table 3.3.8, 3.3.9, and 3.3.10. Note that the historic data is in local fiscal years, which begin October 1 and end September 30. For forecasting purposes, it was converted to state fiscal years. The latest actuals continue to significantly outpace the forecasted values. Forecasts continue to rely on the average of the three-year moving average and three-year moving average growth rate.

Table 3.3.8 Water Management District Water Quality Expenditures (in $millions)

History	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17	LFY 17-18
NWFWMD	$3.67	$5.67	$4.92	$5.35	$6.25
SJRWMD	$23.76	$24.57	$25.05	$27.34	$51.88
SFWMD	$87.03	$88.53	$89.18	$113.99	$121.59
SWFWMD	$23.52	$19.12	$25.12	$22.23	$23.74
SRWMD	$1.65	$2.01	$4.09	$2.29	$2.73
Total	$139.63	$139.89	$148.36	$171.21	$206.19
Forecast	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**	**FY 22-23**
Total	$195.78	$216.27	$238.08	$256.47	$282.67

Source: Annual Budgets of the Water Management Districts.

Table 3.3.9 provides a forecast and details a history of expenditures across all program areas that the WMDs attribute to the flood protection area of responsibility. Note that the historic data is in local fiscal years, which begin October 1 and end September 30. For forecasting purposes, it was converted to state fiscal years. Forecasts rely on a three-year moving average as it best fits the nature of the data.

[156] The six program areas are: 1.0 Water Resources Planning and Monitoring; 2.0 Land Acquisition, Restoration and Public Works; 3.0 Operation and Maintenance of Works and Lands; 4.0 Regulation; 5.0 Outreach; and 6.0 District Management and Administration. The WMDs report expenditures in the four areas of responsibility at the program level only. Each program area contains multiple activities or sub-activities. The program allocation by area of responsibility are estimates since projects and initiatives may serve more than one purpose.

Table 3.3.9 Water Management District Flood Protection Expenditures (in $millions)

History	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17	LFY 17-18
NWFWMD	$2.34	$2.89	$2.70	$2.36	$2.62
SJRWMD	$17.93	$7.44	$8.42	$11.47	$15.30
SFWMD	$93.58	$90.29	$90.42	$98.50	$109.50
SWFWMD	$30.87	$26.11	$17.47	$17.94	$26.12
SRWMD	$1.99	$2.38	$4.47	$2.62	$3.00
Total	$146.70	$129.11	$123.48	$132.89	$156.55
Forecast	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**	**FY 22-23**
Total	$135.35	$138.84	$141.61	$138.60	$139.68

Source: Annual Budgets of the Water Management Districts.

Table 3.3.10 provides a forecast and details a history of expenditures across all program areas that the WMDs attribute to the natural systems area of responsibility. Note that the historic data is in local fiscal years, which begin October 1 and end September 30. For forecasting purposes, it was converted to state fiscal years. Forecasts rely on a three-year moving average as it best fits the nature of the data.

Table 3.3.10 Water Management District Natural Systems Expenditures (in $millions)

History	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17	LFY 17-18
NWFWMD	$2.91	$4.33	$3.60	$4.26	$4.32
SJRWMD	$17.28	$30.63	$31.10	$34.03	$7.53
SFWMD	$120.00	$134.85	$121.42	$147.16	$136.48
SWFWMD	$27.17	$34.21	$32.77	$32.58	$25.61
SRWMD	$2.73	$3.61	$5.86	$3.55	$4.29
Total	$170.09	$207.63	$194.75	$221.57	$178.23
Forecast	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**	**FY 22-23**
Total	$200.63	$201.52	$197.07	$199.74	$199.45

Source: Annual Budgets of the Water Management Districts.

Table 3.3.11 provides a forecast and details a history of water quality protection and restoration expenditures[157] by special districts[158] that are located in multiple counties. The expenditures in accounts 535 Sewer/Wastewater Services, 536 Water-Sewer Combination Services, and 538 Flood Control/Stormwater Management have been classified as water quality protection and restoration expenditures. Note that the historic data is in local fiscal years, which begin October 1 and end September 30. For forecasting purposes, it was converted to state fiscal years. Forecasts rely on a three-year moving average as it best fits the nature of the data.

[157] For further details on the source and methodology of this data, *see* "Local Expenditures" in Section 2.2.
[158] There exists a small number of governmental entities (*e.g.*, utility authorities) that cross counties but are technically not special districts. Their expenditures are included here.

Table 3.3.11 Water Quality Protection and Restoration Expenditures by Regional Special Districts (in $millions)

History	LFY 12-13	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17
Quality Protection & Restoration	$259.06	$267.38	$277.32	$281.26	$284.53
Forecast	**FY 17-18**	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**
Quality Protection & Restoration	$290.14	$295.44	$300.67	$306.55	$312.22

Source: Annual Financial Report data obtained from the Florida Department of Financial Services, Division of Accounting and Auditing, Bureau of Local Government. Accounts 535, 536, 538, and a portion of accounts 537 and 572 are shared out in accordance with local government survey results.

Local Expenditures

Table 3.3.12 provides a forecast and details a history of water quality protection and restoration expenditures by local governments. Based on survey results, a portion of the local government expenditures in accounts 537 Conservation and Resource Management and 572 Parks and Recreation may be attributed to water quality protection and restoration. Further, expenditures in accounts 535 Sewer/Wastewater Services, 536 Water-Sewer Combination Services, and 538 Flood Control/Stormwater Management have been classified as water quality protection and restoration expenditures. Note that the historic data is in local fiscal years, which begin October 1 and end September 30. For forecasting purposes, it was converted to state fiscal years. Forecasts rely on a three-year moving average growth rate as it best fits the nature of the data.

Table 3.3.12 Water Quality Protection & Restoration Expenditures by Local Governments (in $millions)

History	LFY 12-13	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17
Counties	$2,088.24	$2,169.81	$2,204.88	$2,371.30	$2,446.70
Municipalities	$3,098.97	$3,169.13	$3,263.44	$3,395.27	$3,516.99
Special Districts	$377.65	$418.60	$497.16	$535.21	$589.46
Total	$5,564.85	$5,757.54	$5,965.48	$6,301.77	$6,553.15
Forecast	**FY 17-18**	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**
Total	$6,773.80	$7,087.57	$7,403.79	$7,736.01	$8,086.22

Source: Annual Financial Report data obtained from the Florida Department of Financial Services, Division of Accounting and Auditing, Bureau of Local Government. Accounts 535, 536, 538, and a portion of 537 and 572 are shared out by local government survey. Note: Data in this table has been revised and supersedes that reported in previous editions.

Private Utility Expenditures

Table 3.3.13 provides a forecast and details a history of water quality expenditures by private wastewater utilities. The basis for this data was provided to EDR by the Florida Public Service

Commission (PSC) from the annual financial reports submitted by wastewater utilities within jurisdictional counties. As of December 2019, only 38 of Florida's 67 counties had resolutions or ordinances adopted to impose PSC jurisdiction over private water and wastewater utilities.[159] Similar to the private drinking water utilities detailed in Section 3.1, the remaining expenditures from counties outside its jurisdiction were estimated based on per capita utility expenditures. This methodology should provide suitable estimates due to a similar mix of rural and urban counties both in and out of the PSC's jurisdiction. Note that the historic data is in calendar years. For forecasting purposes, it was converted to state fiscal years. Population growth drives the forecast as utility expenditures are generally expected to follow population growth.

Table 3.3.13 Water Quality Expenditures by Private Wastewater Utilities (in $millions)

History	CY 2009	CY 2010	CY 2011	CY 2012	CY 2013	CY 2014	CY 2015	CY 2016	CY 2017	CY 2018
Total	$52.00	$38.22	$38.14	$37.01	$32.99	$32.72	$33.50	$35.42	$37.08	$39.40
Forecast	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**	**FY 22-23**	**FY 23-24**	**FY 24-25**	**FY 25-26**	**FY 26-27**	**FY 27-28**
Total	$38.91	$39.55	$40.17	$40.78	$41.36	$41.93	$42.47	$42.99	$43.49	$43.97

Source: A historical series was created using data provided by the Florida Public Service Commission.

3.4 Historical and Projected Future Revenues for Water Quality and Other Water Resource-Related Programs

EDR is required to forecast "federal, state, regional, and local government revenues dedicated in current law for the purposes… [of projects or initiatives associated with water supply and water quality protection and restoration] or that have been historically allocated for these purposes, as well as public and private utility revenues." There are a variety of revenue sources that support water resources, including specific taxes and fees that are dedicated in law. The following discussion identifies and forecasts the relevant water quality and other water resource-related revenues.

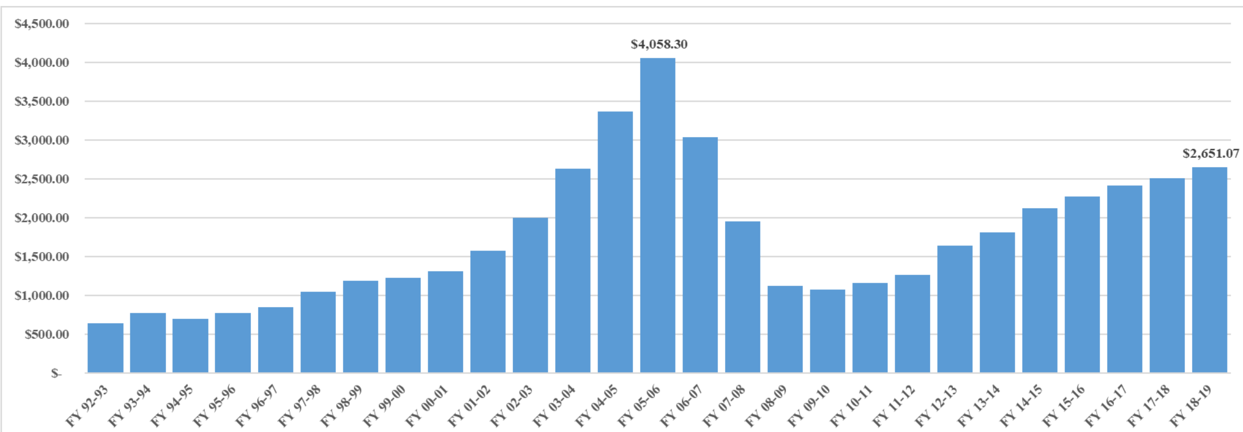
State-Appropriated Revenue Sources

There are a number of state and federal revenue sources that have been used historically to support appropriations related to water quality. For this analysis, these revenues are categorized as either Documentary Stamp Tax revenue or Non-Documentary Stamp Tax revenue.

[159]As of the date of this report, there were 38 jurisdictional counties: Alachua, Bradford, Brevard, Broward, Charlotte, Clay, Duval, Escambia, Franklin, Gadsden, Gulf, Hardee, Highlands, Jackson, Lake, Lee, Leon, Levy, Manatee, Marion, Martin, Monroe, Nassau, Okaloosa, Okeechobee, Orange, Osceola, Palm Beach, Pasco, Pinellas, Polk, Putnam, Seminole, St. Johns, St. Lucie, Sumter, Volusia, and Washington. The non-jurisdictional counties were: Baker, Bay, Calhoun, Citrus, Collier, Columbia, DeSoto, Dixie, Flagler, Gilchrist, Glades, Hamilton, Hendry, Hernando, Hillsborough, Holmes, Indian River, Jefferson, Lafayette, Liberty, Madison, Miami-Dade, Santa Rosa, Sarasota, Suwannee, Taylor, Union, Wakulla, and Walton. For an updated list of jurisdiction counties, see http://www.psc.state.fl.us/Files/PDF/Utilities/WaterAndWastewater/wawtextchart.pdf. (Accessed December 2019.)

Documentary Stamp Tax Revenue
The primary source of revenue currently dedicated to land conservation and water resource-related initiatives is the Documentary Stamp Tax,[160] which is largely dependent on the health of Florida's housing market. Today, Florida's housing market is still recovering from the extraordinary upheaval of the housing boom and its subsequent collapse. The housing boom was underway by late Fiscal Year 2002-03 and clearly in place by Fiscal Year 2003-04, with the peak occurring during Fiscal Year 2005-06. Documentary Stamp Tax collections (shown in Figure 3.4.1) also reached their peak in Fiscal Year 2005-06, posting total collections of nearly $4.06 billion. At the end of Fiscal Year 2018-19, collections were 65.32 percent of their prior peak and, based on the August 2019 Documentary Stamp Tax Collections and Distributions Revenue Estimating Conference, they are not expected to reach or surpass the Fiscal Year 2005-06 peak until Fiscal Year 2031-32.

Figure 3.4.1 Total Documentary Stamp Tax Collections (in $millions)



The availability of funding for water resources is closely linked to the trajectory of this revenue source. Table 3.4.1 shows the historical and forecasted total collections from the Documentary Stamp Tax, as well as the constitutionally required distribution to the Land Acquisition Trust Fund (LATF).[161] These estimates were adopted by the Revenue Estimating Conference in August 2019.

[See table on following page]

[160] Ch. 201, Fla. Stat.
[161] In 2014, Florida voters approved the Water and Land Conservation constitutional amendment (Amendment 1) to provide a dedicated funding source for water and land conservation and restoration. The amendment created article X, section 28 of the Florida Constitution, which requires that starting on July 1, 2015, for 20 years, 33 percent of the net revenues derived for the existing excise tax on documents must be deposited into the Land Acquisition Trust Fund.

Table 3.4.1 Documentary Stamp Tax History and Forecast (in $millions)

History	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19
Doc Stamp Collections	$1,078.60	$1,156.50	$1,261.60	$1,643.40	$1,812.50	$2,120.80	$2,276.87	$2,417.76	$2,510.02	$2,651.07
Percent Change	-3.94%	7.22%	9.09%	30.26%	10.29%	17.01%	7.36%	6.19%	3.82%	5.62%
Committed to Water Resources	$-	$-	$-	$-	$-	$-	$-	$-	$254.22	$294.77

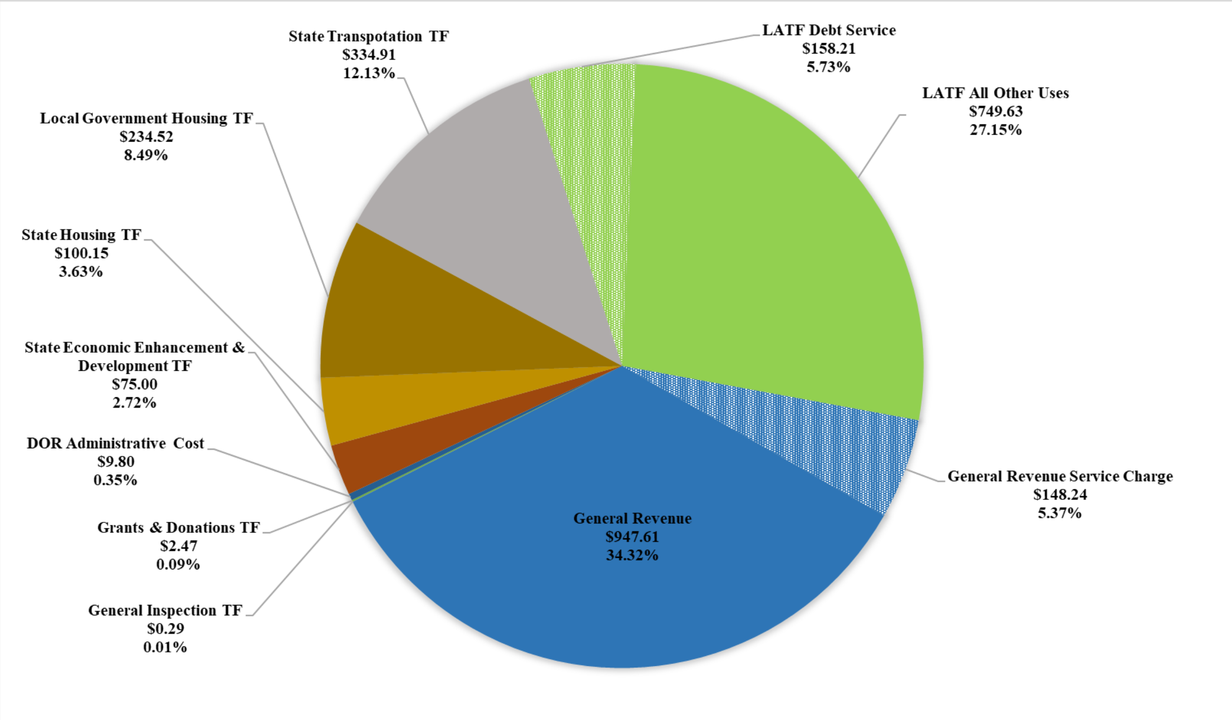
Forecast	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	FY 26-27	FY 27-28	FY 28-29
Doc Stamp Collections	$2,760.83	$2,868.96	$2,971.85	$3,076.75	$3,182.36	$3,288.68	$3,397.80	$3,507.10	$3,616.00	$3,724.40
Percent Change	4.14%	3.92%	3.59%	3.53%	3.43%	3.34%	3.32%	3.22%	3.11%	3.00%
Total to LATF	$907.84	$943.52	$977.48	$1,012.09	$1,046.94	$1,082.03	$1,118.04	$1,154.11	$1,190.05	$1,225.82
Debt Service	$158.21	$158.03	$136.66	$125.69	$105.54	$105.60	$82.20	$61.81	$44.37	$24.82
Remaining for LATF	$749.63	$785.49	$840.82	$886.40	$941.40	$976.43	$1,035.84	$1,092.30	$1,145.68	$1,201.00
Committed to Water Resources	**$306.41**	**$315.37**	**$319.00**	**$319.00**	**$319.00**	**$319.00**	**$319.00**	**$314.00**	**$314.00**	**$314.00**
Uncommitted LATF Based on Statute	**$443.22**	**$470.12**	**$521.82**	**$567.40**	**$622.40**	**$657.43**	**$716.84**	**$778.30**	**$831.68**	**$887.00**

Section 201.15, Florida Statutes, directs the distribution of Documentary Stamp Tax revenues.[162] Figure 3.4.2 illustrates the effect of the statutory distributions for Fiscal Year 2019-20. The total forecast for Documentary Stamp Tax revenue is $2.76 billion, with an estimated $2 billion (72.58 percent) expected to be distributed to the General Revenue Fund and the LATF. In the figure, the distribution to the LATF is split into two component parts (debt service and all other uses) that together reach the required 33 percent after the deduction for the Department of Revenue's administrative costs.

[See figure on following page]

[162] A forecast showing the distributions is available on EDR's website: http://edr.state.fl.us/content/conferences/docstamp/docstampresults.pdf.

Figure 3.4.2 Fiscal Year 2019-20 Statutory Distribution of Documentary Stamp Tax Revenue (in $millions)



The LATF is expected to receive approximately $908 million in total, including $158.21 million for debt service payments and $749.63 million for other uses. Pursuant to the Florida Constitution, the funds in the LATF must be expended only for the following purposes:

1) As provided by law, to finance or refinance: the acquisition and improvement of land, water areas, and related property interests, including conservation easements, and resources for conservation lands including wetlands, forests, and fish and wildlife habitat; wildlife management areas; lands that protect water resources and drinking water sources, including lands protecting the water quality and quantity of rivers, lakes, streams, springsheds, and lands providing recharge for groundwater and aquifer systems; lands in the Everglades Agricultural Area and the Everglades Protection Area, as defined in Article II, Section 7(b); beaches and shores; outdoor recreation lands, including recreational trails, parks, and urban open space; rural landscapes; working farms and ranches; historic or geologic sites; together with management, restoration of natural systems, and the enhancement of public access or recreational enjoyment of conservation lands.

2) To pay the debt service on bonds issued pursuant to Article VII, Section 11(e).

Of the LATF revenues available for other uses, approximately $306.41 million is dedicated in law to the Everglades, spring restoration, and Lake Apopka projects as provided in section 375.041, Florida Statutes. The remaining $443.22 million is available for other qualifying purposes authorized and appropriated by the Legislature. Table 3.4.2 shows all Fiscal Year 2019-20 appropriations from the LATF ($886.90 million). Excluding the WMDs, slightly less than one-half of these appropriations are for water quality and other water resource-related programs, with total combined appropriations of $416.46 million, or approximately 47 percent of the total. Within the water quality components, the largest program is Everglades restoration with an appropriation of $212.57 million. The trust fund is also used to pay debt service for Everglades and Florida Forever bonds; to support land conservation and management activities; and to support specific agency operations at DEP, DACS, FWC, and the Department of State (DOS).

Table 3.4.2 Land Acquisition Trust Fund Appropriations (in $millions)

Program Area	FY19-20 Recurring	FY19-20 Nonrecurring	FY19-20 Total	FY20-21 Base Budget
Water Quality - Other Programs and Initiatives	$131.99	$116.57	$248.57	$132.00
Land Conservation and Management	$216.53	$48.06	$264.59	$216.99
Debt Service	$158.29	$-	$158.29	$158.29
Water Quality - Water Restoration Assistance	$91.26	$14.57	$105.83	$91.27
Water Quality - Environmental Assessment and Restoration	$38.23	$4.00	$42.23	$38.27
Water Quality - Regulatory and Clean-up Programs	$19.84	$-	$19.84	$19.89
Water Management Districts	$18.68	$-	$18.68	$18.68
All Other Programs	$28.87	$-	$28.87	$28.95
TOTAL	**$703.70**	**$183.20**	**$886.90**	**$704.34**

The outcome of pending civil litigation pertaining to specific appropriations from the LATF and the spending of appropriated money by the executive agencies may affect future editions of this report.[163] The plaintiffs ultimately seek a determination that the state has violated the 2014 Water and Land Conservation constitutional amendment that sets aside 33 percent of the excise tax on documents for water and land conservation. From the funds set aside pursuant to this amendment since 2015, the Legislature has appropriated $3.3 billion for water and land conservation efforts.

The trial judge issued a final summary judgment declaring unconstitutional certain appropriations for 2015 and 2016 totaling $426.4 million. The trial court interpreted the amendment to mean that LATF funds may only be spent on: "(1) the acquisition of conservation lands or other property interests that the State did not own on the effective date of the amendment and (2) the improvement, management, restoration and enhancement of public access and enjoyment of those conservation lands purchased after the effective date of this amendment."[164]

Specifically, the trial court held that:

1. "Article X, Section 28 creates a trust fund that must be expended, if at all, to acquire conservation lands or other conservation property interests, as defined by that provision,

[163] *Fla. Wildlife Fed'n, Inc. v. Joe Negron, as President of the Fla. Senate*, No. 2015 CA 001423 (Fla. 2d Cir. Ct. amended complaint filed May 5, 2015).

[164] Final Judgment for the Plaintiffs at 3, *Fla. Wildlife Fed'n, Inc. v. Joe Negron, as President of the Fla. Senate*, No. 2015 CA 001423 (Fla. 2d Cir. Ct. June 28, 2018).

that the State of Florida did not own on the effective date of that amendment and thereafter, to improve, manage, restore natural systems thereon, and enhance public access or enjoyment of those conservation lands.

2. Funds in the Land Acquisition Trust Fund created by Article X, Section 28 may not be expended to improve, manage, restore natural systems on, or enhance public enjoyment of non-conservation lands or water, or for any non-conservation purpose without regard to when the State acquired any land, water or other property.

3. No appropriation from the Land Acquisition Trust Fund created by Article X, Section 28 may be made to any agency or other entity that receives funding from any other source, including General Revenue, without clear language limiting the use of the Land Acquisition Trust Fund money to the purposes authorized by Article X, Section 28.

4. Agencies expending money from the Land Acquisition Trust Fund must track expenditures to ensure they are being made in compliance with Article X, Section 28."[165]

On appeal from the trial court's order, the First District Court of Appeals reversed the summary judgment and remanded it to the trial court for further proceedings. The District Court held that "LATF revenue is not restricted to use on land purchased by the State after 2015."[166] Because the District Court found that the trial court's interpretation of the constitutional amendment was unsupportable, the Court also overturned the ruling that specific appropriations were unconstitutional and that the agencies must provide an accounting of how LATF funds are used.[167]

On November 15, 2019, the Plaintiffs/Appellees, filed a petition with the Florida Supreme Court for discretionary review of the appellate ruling.[168] Depending upon the ultimate outcome of this litigation, revenue forecasts for conservation land management and water resources may require future adjustments. Additionally, it is unclear what legislative action, if any, would have to be taken to address the use of those funds in Fiscal Years 2015-16 through 2018-19.

Total State Revenues for Water Quality and Other Water Resource-Related Programs

In addition to the Documentary Stamp Tax discussed above, there are a variety of other revenue sources available for water quality. In order to determine the types of revenue historically allocated for water quality and other water resource-related programs, the various state and federal trust funds from which funds have been appropriated in the most recent five-year period were identified and described in the 2018 Edition of this report.[169] They include the following: Internal Improvement Trust Fund, Inland Protection Trust Fund, General Inspection Trust Fund, Florida Coastal Protection Trust Fund, Minerals Trust Fund, Florida Permit Fee Trust Fund, Save Our Everglades Trust Fund, Solid Waste Management Trust Fund, Wastewater Treatment and

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[165] Final Judgment for the Plaintiffs at 7-8, *Fla. Wildlife Fed'n, Inc. v. Joe Negron, as President of the Fla. Senate*, No. 2015 CA 001423 (Fla. 2d Cir. Ct. June 28, 2018).
[166] *Oliva v. Fla. Wildlife Fed'n, Inc.,* No. 1D18-3141 (Fla. 1st DCA Sept. 9, 2019).
[167] *Id.*
[168] The Florida Supreme Court Docket for this case may be accessed at: http://onlinedocketssc.flcourts.org/DocketResults/CaseDocket?Searchtype=Case+Number&CaseYear=2019&CaseNumber=1935 (Accessed November 2019.)
[169] http://edr.state.fl.us/Content/natural-resources/LandandWaterAnnualAssessment_2018Edition.pdf at page 186.

Stormwater Management Revolving Loan Trust Fund, Water Quality Assurance Trust Fund, Nonmandatory Land Reclamation Trust Fund, Grants and Donations Trust Fund, and Federal Grants Trust Fund. Within the identified trust funds, the types of revenue were also identified and described.[170] These revenues include: Fees and Licenses; Fines, Penalties, and Judgments; Grants and Donations; Pollutant Taxes and Fees; Repayment of Loans; Sales and Leases; Severance Taxes, and Sale of Bonds.

Based on a review of state accounts for the last ten fiscal years, a historical data series was constructed for the identified revenues. With the exception of repayment of loans and sale of bonds, each of the revenue sources is forecasted by the Revenue Estimating Conference, meeting specifically on Transportation Revenues, General Revenue, and the Long-Term Revenue Analysis. The assumptions used within these conferences provide the basis for the overall forecast through Fiscal Year 2028-29. For the repayment of loans, a three-year moving average is used for the forecast. The historical series and the forecast for the total revenues available for water quality and other water resource-related programs, comprised of the non-Documentary Stamp Tax revenues and the Documentary Stamp Tax revenues committed to water resources from Table 3.4.1, are shown in Table 3.4.3.

[See table on following page]

170 *Id.* at 188.

Table 3.4.3 Revenues Available for Water Quality and Other Water Resource-Related Programs (in $millions)

History	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19
Fees and Licenses	$22.54	$26.61	$33.44	$28.54	$25.64	$28.23	$24.22	$24.23	$23.39	$25.04
Fines, Penalties, Judgements	$8.07	$0.08	$0.07	$16.38	$0.87	$78.62	$9.56	$3.74	$5.39	$47.15
Grants and Donations	$113.22	$175.58	$113.49	$86.93	$81.18	$93.08	$96.89	$82.62	$73.19	$106.87
Pollutant Taxes and Fees	$248.17	$251.02	$246.36	$246.85	$252.04	$260.33	$267.19	$273.15	$286.48	$301.35
Repayment of Loans	$47.87	$63.90	$75.52	$86.76	$102.86	$99.78	$83.38	$95.98	$68.24	$81.72
Sales and Leases	$0.86	$0.51	$2.37	$1.67	$4.96	$1.38	$1.33	$1.33	$1.58	$1.06
Severance Taxes	$32.32	$25.59	$5.00	$5.55	$5.24	$4.93	$6.85	$6.61	$6.83	$6.70
Sale of Bonds	$40.00	$-	$-	$49.90	$-	$-	$49.87	$-	$-	$-
Non-Doc Stamp Subtotal	**$440.73**	**$517.71**	**$471.24**	**$467.12**	**$467.55**	**$561.43**	**$482.57**	**$481.04**	**$458.28**	**$563.18**
Doc Stamp Committed to Water Resources	$-	$-	$-	$-	$-	$-	$-	$-	$254.22	$294.77
Total Water Quality Revenues	**$440.73**	**$517.71**	**$471.24**	**$467.12**	**$467.55**	**$561.43**	**$482.57**	**$481.04**	**$712.50**	**$857.95**

Forecast	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	FY 26-27	FY 27-28	FY 28-29
Fees and Licenses	$25.46	$25.86	$26.25	$26.63	$26.99	$27.34	$27.67	$27.99	$28.30	$28.60
Fines, Penalties, Judgements	$47.93	$48.68	$49.41	$50.12	$50.80	$51.46	$52.09	$52.70	$53.28	$53.84
Grants and Donations	$108.59	$111.61	$113.69	$113.01	$116.17	$119.70	$121.73	$124.75	$127.72	$130.48
Pollutant Taxes and Fees	$305.27	$307.92	$310.48	$312.59	$313.93	$315.03	$315.91	$316.36	$316.80	$317.02
Repayment of Loans	$81.98	$77.31	$80.34	$79.88	$79.18	$79.80	$79.62	$79.53	$79.65	$79.60
Sales and Leases	$1.07	$1.09	$1.11	$1.12	$1.14	$1.15	$1.17	$1.18	$1.19	$1.21
Severance Taxes	$6.99	$6.99	$6.99	$6.99	$6.99	$6.99	$6.99	$6.99	$6.99	$6.99
Sale of Bonds	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
Non-Doc Stamp Subtotal	**$570.30**	**$572.47**	**$581.27**	**$583.35**	**$588.21**	**$594.47**	**$598.19**	**$602.51**	**$606.94**	**$610.74**
Doc Stamp Committed to Water Resources	$306.41	$315.37	$319.00	$319.00	$319.00	$319.00	$319.00	$314.00	$314.00	$314.00
Total Water Quality Revenues	**$876.71**	**$887.84**	**$900.27**	**$902.35**	**$907.21**	**$913.47**	**$917.19**	**$916.51**	**$920.94**	**$924.74**

Note: Values in this table differ from those seen in the 2019 Edition due to a source change. Previous editions used LAS/PBS which included some anticipated revenues, while this and future editions use the trial balance.

Regional Revenues

The WMDs are required to report their annual revenues in their Comprehensive Annual Financial Reports. While each district must report its total revenues, the breakdown of categories is largely at the discretion of the district. As a result, intergovernmental sources cannot be identified at a granular level. Further, the amount of these revenues used for water supply purposes versus water quality is not identifiable, and projects or initiatives may benefit both purposes. Table 3.4.4 provides a forecast and details a history of WMD revenues from their own sources. Ad valorem collections[171] comprise 50 to 95 percent of this revenue, with the remainder a mix of investment earnings, timber harvesting and sales, apiary use, billboard and cell tower leases, sales of excavated materials, cattle grazing, alligator egg harvests, feral hog hunts, and other miscellaneous revenues. The ad valorem piece of the first two years of the forecast come from the adopted and tentative budgets of the WMDs while the final three rely on a three-year moving average growth rate by district.[172] The forecast for the remaining share of this revenue relies on population growth adopted by the July Demographic Estimating Conference. Note that the historic data is in local fiscal years, which begin October 1 and end September 30. For forecasting purposes, it was converted to state fiscal years.

Table 3.4.4 Water Management District Revenues from Own Sources (in $millions)

History	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17	LFY 17-18
NWFWMD	$4.90	$7.03	$5.08	$6.31	$7.05
SJRWMD	$85.48	$88.27	$90.89	$90.24	$91.81
SFWMD	$319.10	$326.46	$312.66	$310.64	$317.29
SWFWMD	$105.23	$110.48	$114.46	$112.72	$117.29
SRWMD	$6.20	$7.06	$7.69	$7.60	$6.91
Total	$520.90	$539.30	$530.78	$527.51	$540.35
Forecast	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**	**FY 22-23**
Total	$543.33	$555.83	$564.63	$573.31	$583.58

Source: Comprehensive Annual Financial Reports of the Water Management Districts.

Table 3.4.5 provides a forecast and details a history of WMD revenues sourced from other governments. This can be federal, state, or local cities and counties. Note that the historic data is in local fiscal years, which begin October 1 and end September 30. For forecasting purposes, it was converted to state fiscal years. As revenues are largely based on population, forecasts rely on population growth rates.

[171] Within the WMDs, there can exist basin boards for various purposes detailed in section 373.0695, Florida Statutes. The WMD's governing board can levy ad valorem taxes within the designated basin of the basin boards. Currently, only three such basin boards exist and all of them are within the SFWMD. Table B.4 in Appendix B contains a short history of these rates.
[172] In previous editions, the forecast for the ad valorem share of this revenue relied on the growth rate of county taxable value as adopted by the Ad Valorem Revenue Estimating Conference. The conference growth rate for the county taxable value was significantly outperforming the actual collections growth rate for the districts.

Table 3.4.5 Water Management District Revenues from Intergovernmental Sources (in $millions)

History	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17	LFY 17-18
NWFWMD	$11.88	$12.87	$14.00	$14.86	$17.88
SJRWMD	$20.80	$28.84	$23.45	$28.57	$38.31
SFWMD	$85.61	$103.36	$137.45	$176.79	$170.20
SWFWMD	$8.53	$12.37	$6.24	$13.62	$6.92
SRWMD	$8.34	$14.20	$15.75	$8.41	$14.03
Total	$135.15	$171.64	$196.88	$242.25	$247.34
Forecast	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**	**FY 22-23**
Total	$250.36	$254.51	$258.51	$262.39	$266.16

Source: Comprehensive Annual Financial Reports of the Water Management Districts.

Table 3.4.6 provides a forecast and details a history of revenues used for water quality purposes by special districts that are located in multiple counties. Based on survey results, a portion of the account identified as 343.700 Service Charge – Conservation and Resource Management is self-generated for use on water quality protection and restoration projects and initiatives. Further, accounts 323.600 Franchise Fee – Sewer, 343.500 Charges for Services - Sewer-Wastewater Utility, and 343.600 Charges for Services - Water-Sewer Combination Utility are categorized as water quality protection and restoration self-generated revenue. Accounts 334.350 State Grant – Sewer/Wastewater, 334.360 State Grant – Stormwater Management, and 335.350 State Shared Revenues – Sewer/Wastewater are categorized as water quality protection and restoration revenues from the state. Finally, account 331.350 Federal Grant – Sewer/Wastewater is categorized as water quality protection and restoration revenue from the federal government. Note that the historic data is in local fiscal years, which begin October 1 and end September 30. For forecasting purposes, it was converted to state fiscal years. As revenues are largely based on population, forecasts rely on population growth rates.

Table 3.4.6 Water Quality Protection & Restoration Revenues Generated to Regional Special Districts by Government Source (in $millions)

History	LFY 12-13	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17
Self	$89.29	$91.35	$94.65	$97.83	$102.40
State	$2.26	$0.31	$0.74	$0.43	$0.15
Federal	$1.06	$1.28	$0.03	$-	$-
Forecast	**FY 17-18**	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**
Self	$104.15	$105.96	$107.72	$109.41	$111.06
State	$0.15	$0.16	$0.16	$0.16	$0.16
Federal	$-	$-	$-	$-	$-

Source: Annual Financial Report data obtained from the Florida Department of Financial Services, Division of Accounting and Auditing, Bureau of Local Government. Accounts 323.600, 343.500, 343.600, and survey results are applied to 343.700 for self; 334.350, 334.360, and 335.350 for State; and 331.350 for Federal.

Local Revenues

Table 3.4.7 provides a forecast and details a history of self-generated revenues by local governments used for water quality purposes. Based on survey results, a portion of the local government account 343.700 Service Charge – Conservation and Resource Management is self-generated for use on water quality protection and restoration projects and initiatives. Further, accounts 323.600 Franchise Fee – Sewer, 343.500 Charges for Services - Sewer-Wastewater Utility, and 343.600 Charges for Services - Water-Sewer Combination Utility are categorized as water quality protection and restoration self-generated revenue. Note that the historic data is in local fiscal years, which begin October 1 and end September 30. For forecasting purposes, it was converted to state fiscal years. As revenues are largely based on population, forecasts rely on population growth rates.

Table 3.4.7 Water Quality Protection & Restoration Revenues Generated by Local Governments (in $millions)

History	LFY 12-13	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17
Counties	$1,929.73	$2,005.30	$2,092.15	$2,241.08	$2,378.98
Municipalities	$2,965.18	$3,073.71	$3,211.88	$3,221.87	$3,369.69
Special Districts	$203.52	$216.37	$221.94	$235.17	$241.70
Total	$5,098.42	$5,295.38	$5,525.96	$5,698.12	$5,990.37
Forecast	**FY 17-18**	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**
Total	$6,092.62	$6,198.83	$6,301.60	$6,400.69	$6,496.87

Source: Annual Financial Report data obtained from the Florida Department of Financial Services, Division of Accounting and Auditing, Bureau of Local Government. Accounts 323.600 and survey results are applied to Account 343.700.

Table 3.4.8 provides a forecast and details a history of revenues generated by the state and provided to local governments for water quality purposes. Accounts 334.350 State Grant – Sewer/Wastewater, 334.360 State Grant – Stormwater Management, and 335.350 State Shared Revenues – Sewer/Wastewater are categorized as water quality protection and restoration revenues from the state. Note that the historic data is in local fiscal years, which begin October 1 and end September 30. For forecasting purposes, it was converted to state fiscal years. As revenues are largely based on population, forecasts rely on population growth rates.

[See table on following page]

Table 3.4.8 Water Quality Protection & Restoration Revenues Provided to Local Governments from the State (in $millions)

History	LFY 12-13	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17
Counties	$8.19	$27.74	$21.53	$8.00	$9.79
Municipalities	$12.37	$13.42	$21.99	$30.23	$34.57
Special Districts	$0.64	$0.74	$0.80	$2.56	$0.26
Total	$21.20	$41.91	$44.31	$40.78	$44.63
Forecast	**FY 17-18**	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**
Total	$45.39	$46.18	$46.94	$47.68	$48.40

Source: Annual Financial Report data obtained from the Florida Department of Financial Services, Division of Accounting and Auditing, Bureau of Local Government, Accounts 334.350, 334.360, and 335.350.

Table 3.4.9 provides a forecast and details a history of revenues generated by the federal government and provided to local governments for water quality purposes. Account 331.350 Federal Grant – Sewer/Wastewater is categorized as water quality protection and restoration revenue from the federal government. Note that the historic data is in local fiscal years, which begin October 1 and end September 30. For forecasting purposes, it was converted to state fiscal years. As revenues are largely based on population, forecasts rely on population growth rates.

Table 3.4.9 Water Quality Protection & Restoration Revenues Provided to Local Governments from the Federal Government (in $millions)

History	LFY 12-13	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17
Counties	$2.61	$5.65	$0.97	$0.08	$0.51
Municipalities	$11.58	$11.55	$10.83	$12.07	$6.40
Special Districts	$-	$1.67	$1.77	$0.75	$0.54
Total	$14.18	$18.86	$13.57	$12.89	$7.46
Forecast	**FY 17-18**	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**
Total	$7.58	$7.72	$7.84	$7.97	$8.09

Source: Annual Financial Report data obtained from the Florida Department of Financial Services, Division of Accounting and Auditing, Bureau of Local Government, Accounts 331.350. Data in this table has been significantly revised and supersedes that reported in previous editions.

Private Utility Revenues

Table 3.4.10 provides a forecast and details a history of revenues generated by private wastewater utilities for water quality-related purposes. The basis for this data was provided to EDR by the Florida Public Service Commission (PSC) from the annual financial reports submitted by private wastewater utilities within jurisdictional counties. As of December 2019, only 38 of Florida's 67 counties had resolutions or ordinances adopted to impose PSC jurisdiction over private water and wastewater utilities.[173] As a result, the remaining revenues from counties outside of its jurisdiction were estimated based on per capita utility expenditures. This methodology should provide suitable estimates due to a similar mix of rural an urban counties both in and out of the PSC's jurisdiction. Note that the historic data is in calendar years. For forecasting purposes, it was converted to state fiscal years. As revenues are largely based on population, forecasts rely on population growth rates.

Table 3.4.10 Revenues Generated by Private Wastewater Utilities (in $millions)

History	CY 2009	CY 2010	CY 2011	CY 2012	CY 2013	CY 2014	CY 2015	CY 2016	CY 2017	CY 2018
Total	$71.42	$63.92	$55.79	$53.07	$45.65	$47.81	$50.12	$54.64	$56.71	$58.12
Forecast	**FY 18-19**	**FY 19-20**	**FY 20-21**	**FY 21-22**	**FY 22-23**	**FY 23-24**	**FY 24-25**	**FY 25-26**	**FY 26-27**	**FY 27-28**
Total	$58.42	$59.38	$60.32	$61.23	$62.10	$62.95	$63.76	$64.54	$65.29	$66.01

Source: A historical series was created using data provided by the Florida Public Service Commission.

[173] As of the date of this report, there were 38 jurisdictional counties: Alachua, Bradford, Brevard, Broward, Charlotte, Clay, Duval, Escambia, Franklin, Gadsden, Gulf, Hardee, Highlands, Jackson, Lake, Lee, Leon, Levy, Manatee, Marion, Martin, Monroe, Nassau, Okaloosa, Okeechobee, Orange, Osceola, Palm Beach, Pasco, Pinellas, Polk, Putnam, Seminole, St. Johns, St. Lucie, Sumter, Volusia, and Washington. The non-jurisdictional counties were: Baker, Bay, Calhoun, Citrus, Collier, Columbia, DeSoto, Dixie, Flagler, Gilchrist, Glades, Hamilton, Hendry, Hernando, Hillsborough, Holmes, Indian River, Jefferson, Lafayette, Liberty, Madison, Miami-Dade, Santa Rosa, Sarasota, Suwannee, Taylor, Union, Wakulla, and Walton. For an updated list of jurisdiction counties, see http://www.psc.state.fl.us/Files/PDF/Utilities/WaterAndWastewater/wawtextchart.pdf. (Accessed December 2019.)

4. Modeling Future Water Demand and Supply

Abstract

The expenditures associated with ensuring that future water supplies are available to meet the increase in water demands are projected to be between $0.31 and $1.77 billion over the 2015 through 2035 planning horizon, with an average of $1.04 billion. These expenditures are based on the water demand forecast and existing supply estimates produced by the water management districts. If the preliminary water demand forecast produced by the EDR prototype model is considered, it points to even greater future expenditures needed to meet the increase in the future water demand. The future demand not met with existing supply assumes average weather conditions and that the demand which has been met in the past will continue to be met in the future. An overview of the expenditures needed to maintain and replace existing infrastructure required for current demand is discussed in Chapter 6. In addition, regarding the expenditures necessary to ensure that sufficient water is available for the natural systems, EDR examined projects implementing the recovery and prevention strategies for minimum flows and minimum water levels of water courses, water bodies, and aquifers. The estimated cost of these projects is $7.80 billion. These estimates may change in the future as methodologies are refined. Additional research will be undertaken to provide more complete and more precise cost estimates for future editions of this annual report.

In Chapter 3, the historical expenditures related to water supply and demand management, as well as the spending for the protection and restoration of natural systems, are discussed. The objective of Chapter 4 is to determine if the expenditure level is sufficient to meet the Legislature's intent. Specifically, section 403.928(1)(b), Florida Statutes, requires the Office of Economic and Demographic Research (EDR) to estimate future expenditures necessary to achieve the Legislature's intent that sufficient water is available for all existing and future reasonable-beneficial uses and the natural systems, and that adverse effects of competition for water supplies be avoided.[174] The historical level of expenditures discussed in Chapter 3 may differ from the expenditures necessary to achieve this intent.

To achieve this objective, EDR reviews existing water supply estimates developed by Florida's five water management districts (WMDs) and compares them with the 2015-2035 water demand forecasts. The period of 2015-2035 was selected to match the 20-year planning period used in the WMDs' regional water supply plans.[175] The projected water demand exceeds existing water supply in several Florida regions, which EDR refers to as an inferred supply shortage. Based on the types and implementation cost of the alternative water supply projects listed by the WMDs, EDR estimates the spending needed to eliminate the inferred supply shortage. Further, based on the historical split of the funding, EDR estimates the shares of the future expenditures for the state, regional, and local entities. Finally, to estimate the spending needed to ensure that sufficient water

[174] This section also requires EDR to compile water supply and demand projections developed by each water management district (WMD), documenting any significant differences between the methods used by the WMDs.

[175] For selected planning regions, the WMDs are now using the 2020–2040 planning period, with 2015 estimates also provided. However, the majority of the regional water supply plans still rely on 2015–2035 planning period.

is available for the natural systems, EDR summarizes the costs reported by WMDs for the recovery or prevention strategies for the minimum flow and minimum water level program.

In comparison with the previous editions of this report, the 2020 Edition advances the expenditure analysis in several key directions. In the 2018 Edition, EDR provided a compilation of existing water supply and demand projections. In the 2019 Edition, EDR provided preliminary estimates of the costs associated with developing the alternative water supplies (AWS) necessary to meet the increase in water demand projected for 2015-2035. In the 2020 Edition, EDR further advances the analysis by presenting the results of a prototype water demand forecasting model that incorporates the most recent population projections, along with a broad range of economic water demand drivers. While the model is still preliminary, in the future it will allow for the annual adjustment of the projected water demand based on the updated economic and population forecasts. This model is intended to be used only for statewide forecasting to fulfill EDR's responsibilities under section 403.928, Florida Statutes, and is not suitable as a basis for regional or local water supply planning or permitting decisions.

Also in this edition, EDR enhances the analysis of the project expenditures by a more accurate accounting for the projects implemented in stages. Further, EDR presents the initial estimates of the expenditures necessary to ensure that sufficient water is available for the natural systems. While the WMDs may use a variety of tools to protect the natural systems, EDR focuses on projects included in recovery or prevention strategies for the implementation of minimum flows and minimum water levels. In addition, while the analysis presented in this chapter focuses on the cost to meet the future increase in water demand, EDR plans to provide preliminary estimates of the costs associated with operating and maintaining drinking water infrastructure to continue providing for the existing water demand (see Chapter 6).

This chapter starts with a review of the existing water supply planning framework in Florida. It continues with the analysis of water demand and supply, inferred supply shortage, and the expenditure estimates. The final section of this chapter discusses future steps to further improve the expenditure forecast.

4.1 Water Supply Planning in Florida

Florida law provides a comprehensive framework for water supply planning. Water supply assessments (WSAs) and regional water supply plans (RWSPs) developed by the water management districts (WMDs) are the primary tools for long-term water demand and supply planning in Florida. According to section 373.036, Florida Statutes, the governing board of each WMD must develop a district water management plan. The plan is generally prepared for a 20-year planning period and is required to address water supply, water quality, flood protection and floodplain management, and natural systems. For water supply specifically, district water management plans include WSAs. The assessment determines whether the existing and reasonably anticipated sources of water and conservation efforts are adequate to supply water for all existing legal uses and reasonably anticipated future needs and to sustain the water resources and related natural systems.

Furthermore, where it is determined that existing sources of water are inadequate, more in-depth RWSPs must be developed. Each RWSP contains a list of water supply development project options and water resource development programs.[176] The total capacity of the projects included in the regional water supply plans must exceed the water supply needs for all existing and future reasonable-beneficial uses within the 20-year planning horizon. An RWSP should also take into account water conservation and other demand management measures, as well as water resources constraints, including adopted minimum flows and minimum water levels and water reservations. Both districtwide WSAs and RWSPs are required to be updated at least once every five years.[177]

It is important to emphasize the collaborative nature of the WMDs water supply planning process. Florida law requires that such planning be conducted in an open public process. The WMDs work "with local governments, regional water supply authorities, government-owned and privately owned water and wastewater utilities, multijurisdictional water supply entities, self-suppliers, reuse utilities, the Department of Environmental Protection, the Department of Agriculture and Consumer Services, and other affected and interested parties."[178] While developing RWSPs, the districts share information about planning results and solicit comments from interested stakeholders via meetings, public workshops, webpage updates, and other means.

The Florida Department of Environmental Protection (DEP) is charged with providing the Governor and Florida Legislature an annual status summary of the regional water supply planning in each district.[179] The most recent (2018) status summary was published in August 2019 and is referred to in this chapter as "DEP (2019a)."[180] As shown in this summary, Florida is divided into 21 mutually exclusive water supply planning regions, as seen in Figure 4.1.1. DEP (2019a) recombines these regions into 15 mutually exclusive areas. For these, DEP includes data for "Estimated Existing Sources Available to Meet Future Demands," from which EDR infers supply data. The WMDs use different schedules for their five-year updates of the water supply assessments and plans. Specifically, 12 of the areas currently use the 2015-2035 plan with 2010 or 2015 being the base year for calculations, and 3 areas have transitioned to the 2020-2040 plan with 2010, 2014, or 2016 being the base year for calculation.[181] Table 4.1.1 summarizes the RWSPs/WSAs used in "Annual Status Report on Regional Water Supply Planning" in DEP (2019a). This information is consistent with that presented in the 2019 Edition of this report, except for the Lower East Coast (SF-LEC) region of the SFWMD where the updated RWSP became available. Note that additional updates to RWSPs/WSAs have been completed since DEP (2019a) was finalized. They are identified in the footnotes (a)-(e) to Table 4.1.1.

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[176] § 373.709, Fla. Stat.
[177] § 373.036, Fla. Stat. For more details on water supply planning process in Florida, see pages 66-70 of the 2018 Edition of this report, available at: http://edr.state.fl.us/Content/natural-resources/index.cfm.
[178] § 373.709, Fla. Stat.
[179] § 373.709, Fla. Stat.
[180] DEP. 2019a. Regional Water Supply Planning 2018 Annual Report, available at: https://fdep.maps.arcgis.com/apps/MapSeries/index.html?appid=932ef4223c304dc4a0ff5653e1e3615a. (Accessed November 2019.)

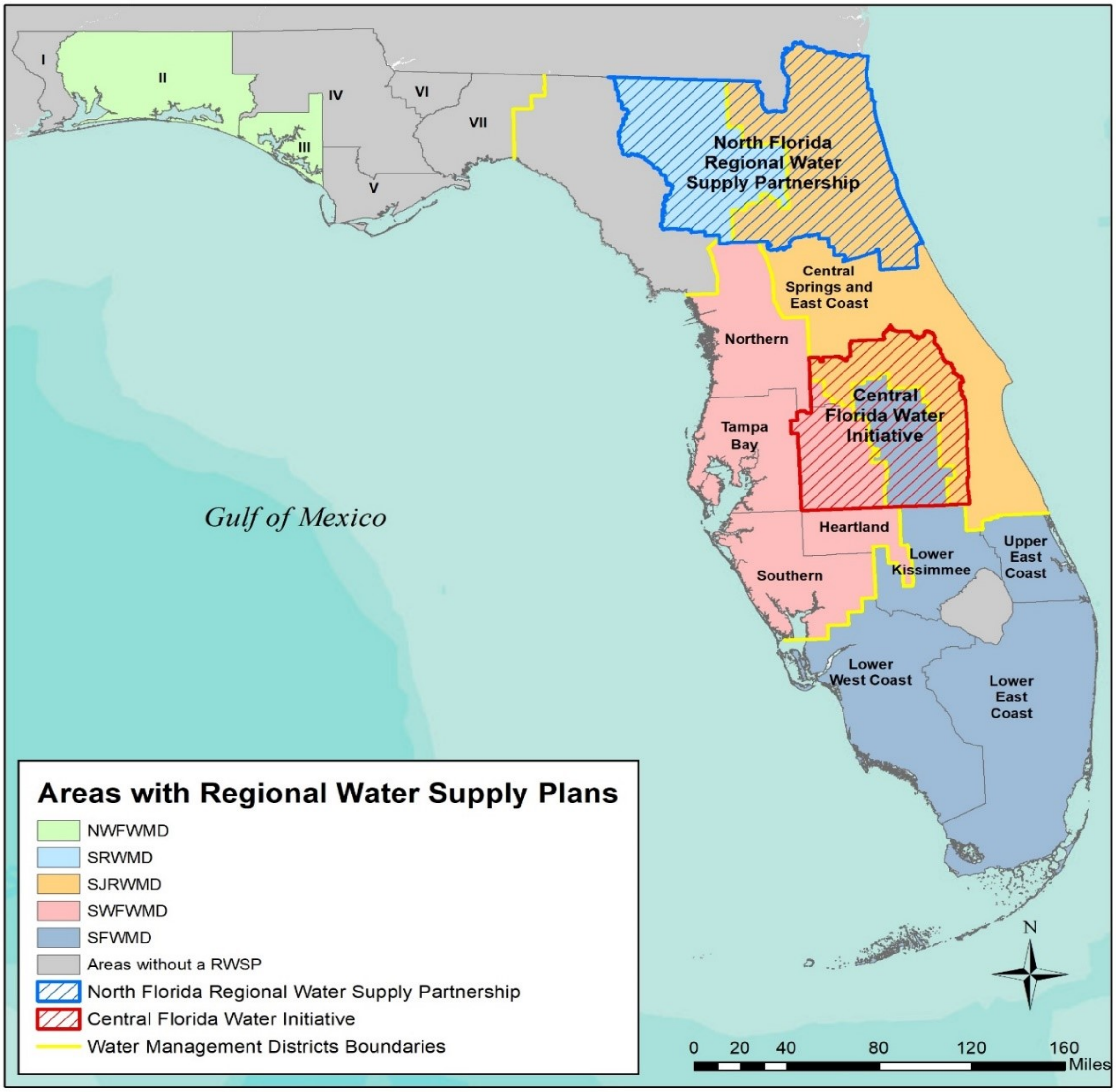
[181] The number of water supply planning regions identified in DEP (2019a) as those with 2015-2035 planning horizon varies. Appendix A indicates 15 regions and Appendix B reports 16 regions. The difference between the Appendices is due to the Lower Kissimmee Basin water supply planning region of SFWMD. According to the SFWMD website (see https://www.sfwmd.gov/our-work/water-supply/lower-kissimmee), as of September 2019, the current RWSP for that region is for the 2015-2035 planning period; the district is currently working on the RWSP updates. Furthermore, DEP (2019a) refers to the 2015-2035 planning horizon defined in NWFWMD' Districtwide Water Supply Assessment published in 2013. An updated version of NWFWMD' Districtwide Water Supply Assessment was published in 2018.

Table 4.1.1 Water Supply Planning Regions

Water Management District	Water Supply Planning Region	Abbreviation used in the report	Counties	Water Supply Planning Document Referenced in DEP (2019a)	Planning horizon
Northwest Florida Water Management District (NWFWMD)	I	**NW-I**	Escambia	Districtwide Water Supply Assessment (2013)[a]	2010-2035
	II	**NW-II**	Santa Rosa, Okaloosa, and Walton		
	III	**NW-III**	Bay	Regional Water Supply Plan (2014)[b]	2010-2035
	IV	**NW-IV**	Calhoun, Holmes, Jackson, Liberty, Washington	Districtwide Water Supply Assessment (2013)[c]	2010-2035
	V	**NW-V**	Gulf and Franklin		
	VI	**NW-VI**	Gadsden		
	VII	**NW-VII**	Jefferson (part), Leon, Wakulla		
Suwannee River Water Management District (SRWMD)	Area outside NFRWSP	**SR-outside NFRWSP**	Dixie, Jefferson (part), Lafayette, Levy (part), Madison, and Taylor	Districtwide Water Supply Assessment (2018)	2010-2035
St. Johns River Water Management District (SJRWMD)	Central Springs and East Coast (Region 2, formerly Regions 2, 4, and 5)	**SJR-CSEC**	Brevard, Indian River Marion (part), Lake (part), Volusia and Okeechobee (part)	Draft Central Springs East Coast Regional Water Supply Plan[d]	2015-2035
Southwest Florida Water Management District (SWFWMD)	Northern Planning Region (partially in Central Florida Water Initiative)	**SW-NR**	Citrus, Levy (part), Marion (part), Lake (part), and Sumter	Regional Water Supply Plan (2015); partially in CFWI Regional Water Supply Plan (2015)	2010-2035
	Tampa Bay Planning Region	**SW-TB**	Pasco, Hillsborough, and Pinellas	Regional Water Supply Plan (2015)	2010-2035
	Heartland Planning Region (partially in Central Florida Water Initiative)	**SW-HR**	Hardee, Highlands (part), Polk (part),	Regional Water Supply Plan (2015); partially in CFWI Regional Water Supply Plan (2015)	2010-2035
	Southern Planning Region	**SW-SR**	Charlotte (part), DeSoto, Manatee, and Sarasota	Regional Water Supply Plan (2015)	2010-2035
South Florida Water Management District (SFWMD)	Lower Kissimmee Basin	**SF-LKB**	Okeechobee (part), Highlands (part), and Glades (part)	Regional Water Supply Plan (2014)[e]	2010-2035
	Upper East Coast	**SF-UEC**	Martin, Okeechobee (part), and St. Lucie	Regional Water Supply Plan (2016)	2010-2040
	Lower East Coast	**SF-LEC**	Broward, Collier (part), Hendry (part), Miami-Dade, Monroe (part), and Palm Beach	Regional Water Supply Plan (2018)	2016-2040[f]
	Lower West Coast	**SF-LWC**	Charlotte (part), Collier (part), Glades (part), Hendry (part), Monroe (part), and Lee	Regional Water Supply Plan (2017)	2014-2040[f]
SRWMD and SJRWMD	North Florida Regional Water Supply Partnership	**NFRWSP**	Alachua, Baker, Bradford, Clay, Columbia, Duval, Flagler, Gilchrist, Hamilton, Nassau, Putnam, St. Johns, Suwannee, and Union	NFRWSP Regional Water Supply Plan (2017)	2010-2035
SJRWMD, SWFWMD, and SFWMD	Central Florida Water Initiative	**CFWI**	Lake (part), Orange, Osceola, Seminole and Polk	CFWI Regional Water Supply Plan (2015)	2010-2035

[a] The most recent NWFWMD WSA was finalized in 2018; and for region II, draft RWSP update is available as of September 2019. To be consistent with "District Demands" estimates reported in Appendix B of DEP (2019a), however, EDR references the older (2013) WSA.
[b] The Region III RWSP was first approved in 2008 and updated in 2014. This plan was discontinued in December 2018.
[c] The most recent WSA was finalized in 2018. To be in line with the DEP (2019a), EDR references the older (2013) WSA. Further, based on the data provided by DEP and NWFWMD, corrections were made for water demand projections for selected regions, as compared with the projections published in the 2013 districtwide WSA.
[d] For this planning region, the RWSP update has not been published. The demand estimates and projections are available in appendix B of DEP (2019a).
[e] Draft RWSP update is available on-line.
[f] Water demand projections for 2015 are available in appendix B of DEP (2019a).

Figure 4.1.1 Florida's WMDs and Water Supply Planning Regions



Note: WMD coloring applies only to regions that have a regional water supply plan. The hatching identifies the planning regions that cross the borders between WMDs and where regional water supply plans were developed through collaboration by two or three WMDs.
Source: Provided by DEP, Office of Water Policy.

In 7 of the 15 regions planning to 2035, the net demand is projected to exceed the existing water supplies by 408.9 million gallons per day (mgd) by 2035 (Table 4.1.2). In the three regions planning to 2040, the water demand is expected to surpass the existing water supply by 62.7 mgd by 2040 (Table 4.1.2). Note that in every WMD there is at least one region where water demand is projected to surpass existing supplies (referred in this EDR report as "regions with inferred supply shortage"). Therefore, investments in conservation and alternative water supply projects are needed in all five districts. The DEP status summary includes a project appendix that lists the options that could be used to meet the future water demand along with the completed projects funded by the state and the districts.

Table 4.1.2 Summary of Water Supply Assessments and Regional Water Supply Plans*

Water Management District	Water Supply Planning Region	Net Demand Change (mgd)	Estimated Existing Sources Available to Meet Future Demands (mgd)	Net Demand Change of which Additional AWS or Conservation Must Surpass (*aka* Inferred Supply Shortage) (mgd)	Region with Inferred Supply Shortage (Yes or No)	Conservation Projection to Meet Future Demands (mgd)	AWS Options to Meet Future Demands (mgd)
2015–2035 planning period							
NWFWMD	NW-II	19.5	18.1	1.4	Yes	6.5	48.0
	NW-III	8.9	8.9	0.0	No	9.5	35.0
	NW-I, NW-IV, NW-V, NW-VI, & NW-VII	12.0	12.0	0.0	No	3.6	0.0
SJRWSM	SJ-CSEC	78.8	50.8	28.0	Yes	33.6	307.4
SRWMD	SR-outside NFRWSP	21.8	21.8**	0.0**	No	10.9	0.0
SWFWMD	SW-NR (excluding CFWI)	51.7	23.9	27.8	Yes	23.0	113.6
	SW-TB	63.8	63.8	0.0	No	52.0	125.2
	SW-HR (excluding CFWI)	8.3	5.8	2.5	Yes	4.4	8.5
	SW-SR	50.2	46.8	3.4	Yes	18.8	238.0
SFWMD	SF-LKB	17.5	17.5	0.0	No	0.0	0.0
SJRWMD, SWFWMD, and SFWMD	CFWI	233.6	0.0	233.6	Yes	36.8	333.6
SJRWMD and SRWMD	NFRWSP	112.2	Not Quantified	112.2	Yes	40.7 – 53.0	97.2
Total for 2015–2035		**660.8**	**251.9**	**408.9**		**239.8 – 265.5**	**1,306.5**
2020–2040 planning period							
SFWMD	SF-UEC	75.5	71.8	3.8	Yes	14.1	92.1
	SF-LEC	192.6	143.0	49.6	Yes	102.4	286.6
	SF-LWC	180.4	171.1	9.3	Yes	26.3	101.3
Total for 2020–2040		**466.0**	**403.4**	**62.6**		**142.8**	**480.0**

* This summary is based on DEP (2019a). It does not explicitly address the water demand during a drought. Further, the “Net Demand Change” column focuses on the projected increases in demand in response to population growth and economic development. Water for the protection and restoration of the natural systems is not included in the “Net Demand Change.” Instead, it is accounted for as a constraint on “Estimated Existing Sources Available to Meet Future Demands” as well as the project options included in “AWS Options to Meet Future Demands.” This summary is consistent with that presented in the 2019 Edition of this EDR report, except for the three regions in SFWMD that use the 2020-2040 planning period. For SF-UEC and SF-LWC, the 2019 and 2020 Editions rely on the same RWSPs and only the period presented in the summary table is different between the Editions. For SF-LEC, the updated RWSP became available after the 2019 Edition was finalized. As a result, for SF-LEC, the projected net demand change increases as compared with that used in the 2019 Edition.

** These values are expected to be revised. Based on SRWMD’s WSA (2018), the existing sources of water are determined to be inadequate to supply all current and future reasonable beneficial uses and to sustain the water resources and related natural systems for the planning period. Water supply planning and water resource caution area are proposed for a part of SR-outside NFRWSP (referred to as the “Western Planning Region”). More accurate estimates will become available upon completion of the water supply planning.

4.2 The Expenditure Forecast: Role of EDR

Section 403.928, Florida Statutes, directs EDR to estimate future expenditures necessary to provide sufficient water for all existing and future reasonable-beneficial uses and the natural systems. As Florida’s legislative budgeting process is completed annually, EDR must develop estimates of future annual expenditures to be useful in the budgeting process. In order to estimate these annual expenditures, the quantity of water demanded in excess of the quantity available from existing water sources must be developed for each year. In addition, water necessary for protection and restoration of the natural systems must be estimated. The water that should be generated can be calculated for a given year as the total water demand for human purposes minus water available to meet that demand from existing sources (while ensuring that sufficient water is available for the natural systems) plus water needed to restore or protect natural systems.

The WMDs produce water demand forecasts for each of their planning regions. These forecasts fulfill the statutory requirements of water supply planning and provide the districts with sufficient information for planning purposes within their sub- regions. They do not, however, aggregate well to the annual statewide forecast needed by EDR to produce its required expenditure forecast. This is due to the following reasons that can be, in part, visualized in Table 4.2.1:

- The schedules to develop the forecasts are not synchronized among the planning regions. Further, the water demand forecasts are updated every five years, while the statewide population forecast is updated annually. The effect of this is that even if all regions were using the University of Florida's Bureau of Economic and Business Research (BEBR) medium projection for the 2035 population, the statewide population projections for 2035 would not equal the sum of the parts. As can be seen in Table 4.2.1, the forecast for NWFWMD's Region III would be using the BEBR data available before or in 2014 while the SFWMD's Lower East Coast (SF-LEC) would be using the BEBR data available before or in 2018. As required by law, the Demographic Estimating Conference adopts an annual long-term population forecast. In addition, EDR annually provides population estimates and projections to the Executive Office of the Governor. These estimates and projections serve as the basis for EDR's forecasts.

- The methodologies of the demand models used by the districts are independent from one another which can result in incongruous assumptions when aggregated to a statewide forecast. For a detailed analysis of the similarities and differences in methodologies used by the districts, see EDR's 2018 Edition.[182]

- Lack of synchronization and annual updates also lead to reliance on different versions of agricultural acreage and water use projections. The Florida Department of Agriculture and Consumer Services has been releasing annual updates of its Florida Statewide Agricultural Irrigation Demand (FSAID) Geodatabase. Currently, the sixth update of the agricultural acreage and irrigation demand is available. For illustration, existing forecasts from SWFWMD use the second update, while the forecast for SF-LEC uses the fourth update.

- The 20-year planning horizon is from the time of the district's estimate which results in different planning regions having different horizons (*i.e.*, 2015-2035 and 2020-2040).

- The forecasts from the districts are not required to be annual, preventing the direct development of an annual expenditure forecast. Consider the inferred supply shortages in Table 4.2.2. Between 2020 and 2025, an additional 60.52 mgd will need to be generated in the Central Florida Water Initiative (CFWI) region. An annual expenditure forecast for

[182] See page 74: http://edr.state.fl.us/Content/natural-resources/LandandWaterAnnualAssessment_2018Edition.pdf.

generating that water must know the timing of that 60.52 mgd shortage over the 5-year period.

- Increases in demand are not strictly linear and should be more closely tied to the long term economic forecast. According to district staff, they incorporate the latest economic information when developing their forecasts; however, it is unclear whether the implied state results would be consistent with the official Florida Economic forecast or share the same overarching economic outlook as the other districts. Regardless, the official Florida Economic forecast is updated more frequently than district projections.

It is worth reiterating that the information produced by the WMDs is sufficient for the planning purposes of the district's sub-regions. Further, from discussion with district staff, the districts and DEP have made considerable effort to update their guidelines and methodologies to standardize the formats of their planning data. However, due to the importance of updated economic and demographic data for the water demand forecast, and considering the forecasting capacity of the office, EDR is confident that it can produce an independent demand projection to facilitate the expenditure forecast while ameliorating the difficulties bulleted above. Further, for the EDR forecast, adjustments can be made each year, and alternative scenarios can be explored, such as drought, fluctuations in tourism, economic cycles, and changes in residential water prices. A water demand forecast produced by EDR could also stretch beyond the 20-year planning horizon used by WMDs to better account for long-term trends, such as weather and climate patterns. Note that EDR's forecast should only be considered at the statewide level for the purposes identified in section 403.928, Florida Statutes, and is not appropriate for any regional planning or permitting use. This is because, in part, EDR is more focused on predicting a statistically valid and reliable statewide expenditure forecast, which is possible without meeting these criteria at the regional level. This distinction becomes even more important as alternative scenarios are developed.

For illustration, Table 4.2.2 summarizes the water demand and supply information provided by the WMDs. As discussed above, the inferred supply shortage is the difference between the WMD-projected water demand and existing water supply. No water availability determinations, groundwater or otherwise, are performed by EDR. Further, the analysis of regional inferred supply shortages is not an indicator of water availability on an individual permit basis. To calculate the inferred supply shortage for the sub-regions, water demand information reported in Appendix B of DEP (2019a) for the five-year intervals was compared with the existing supply. The supply data is calculated by adding the region's base year water demand, which was met by existing supply, to the region's "Estimated Existing Sources Available to Meet Future Demands" from DEP (2019a).[183] For 2040, Table 4.2.2 and 4.1.2 are consistent. Both tables report the inferred supply shortage of approximately 62.6 mgd for the three sub-regions in SFWMD planning to 2040. For 2035, the inferred supply shortage reported in Table 4.2.2 is approximately 415.5 mgd, which is the estimated inferred supply shortage for the three SFWMD regions – 6.6 mgd – plus the inferred supply shortage of 408.9 mgd for the other regions (see Table 4.1.2). In the future, an independent

[183] This inference follows the logic presented in DEP (2019a). The quantity of water to be demanded that is in excess of the quantity that will be obtainable from existing water sources is the **future demand** minus the existing supply. This quantity is titled "Net Demand Change of which Additional AWS or Conservation Must Surpass" in DEP (2019a) and it is calculated as the **final year's water demand forecast** minus the sum of the base year water demand and the "Estimated Existing Sources Available to Meet Future Demands", or the **future demand** minus the future supply. EDR's approach used in calculating supply from Appendices A and B of DEP's RWSP 2018 Annual Report is also illustrated in Appendix A.1.

water demand forecast produced by EDR will allow for all cells in Table 4.2.2 to contain a value, adding a necessary timing element to the expenditure forecast. The expenditure forecast, however, depends upon the inferred supply data shown in Table 4.2.1 and 4.2.2, which contains four assumptions:

- It assumes that the demand in the base year of the forecast was able to be met with the existing supply and that the base year quantity will continue to be met this way decades into the future.

- It assumes that the supply in a region does not change over time without investment in alternative water supplies.

- In DEP (2019a), regions with no "Net Demand Change of which Additional AWS or Conservation Must Surpass" are reported as having "Net Demand Change" equal to their "Estimated Existing Sources Available to Meet Future Demands." Realistically, in all such regions, it is highly unlikely that the existing sources to meet future demands are exactly equal to their increase in future demand.

- While the water needed to restore or protect natural systems is clearly not identified as a water demand, it is unclear to what degree it is taken out of the supply, particularly considering the differences in methodologies[184] used by WMDs in calculating the "Estimated Existing Sources Available to Meet Future Demands."

Regardless of these assumptions and due to the nature of quantifying water supply across the state, EDR relies on the water supply data of the WMDs. EDR defers to the districts and DEP for supply data, as well as the needs of the natural systems.

In 2019, by request from EDR, BEBR completed a special project titled "An Analysis of Methods to Allocate BEBR's County Population Estimates and Projections to Water Management District Boundaries."[185] In this report, several relatively simple methods for making small-area population estimates and projections are described and tested in six SWFWMD counties that are split by the district's boundaries. It is shown that when the results were aggregated to the county and district levels, these simple methods often provided estimates and projections that were similar to those produced by an elaborate, parcel-level population forecasting model currently available for SWFWMD. EDR foresees using the relatively simple methods discussed by BEBR for making population projections for sub-regions in future editions of the report.

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[184] See page 61: http://edr.state.fl.us/Content/natural-resources/LandandWaterAnnualAssessment_2019Edition.pdf.

[185] See Rayer, S., Dory, R., Teisinger, J., and S. Smith. 2019. An Analysis of Methods to Allocate BEBR's County Population Estimates and Projections to Water Management District Boundaries. Bureau of Economic and Business Research, University of Florida.

Table 4.2.1 WMD Water Demand and Inferred Supply Data

Demand	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Supply*
NWF - II				81.28					88.26					93.98					98.69					100.76						99.35
NWF - III				79.54					81.95					84.24					86.48					88.41						88.41
NWF - I, IV, V, VI, VII				212.84					217.12					219.27					222.22					224.82						224.80
SJR - CSEC				343.72					355.29					370.33					396.20					422.47						394.52
SR - OUTSIDE				100.55					106.53					110.92					116.69					122.35						122.35
SWF - Northern - Outside				150.89					164.89					178.02					190.51					202.60						174.79
SWF - Tampa Bay				411.24					425.66					443.90					459.91					475.02						475.04
SWF - Heartland - Outside				117.34					121.39					122.02					123.62					125.62						123.14
SWF - Southern				304.57					318.09					331.86					343.53					354.76						351.37
CFWI				850.46					910.28					970.80					1,029.15					1,084.04						850.46
NFRWSP				555.29					585.06					612.70					641.36					667.47						555.29
SF - LKB				204.46					217.01					218.64					220.26					221.97						221.95
SF - UEC				272.95					279.15					288.89					298.46					325.38					354.68	350.90
SF - LEC				1,739.61					1,813.99					1,863.91					1,923.28					1,963.65					2,006.54	1,956.99
SF - LWC				980.33					1,030.31					1,073.57					1,113.64					1,170.36					1,210.68	1,201.44
Statewide				6,405.07					6,714.98					6,983.04					7,263.99					7,549.69					> 3,571.90	7,190.80

*The supply data is inferred by adding the region's base year water demand, which was met by existing supply, to the region's "Estimated Existing Sources Available to Meet Future Demands" from DEP (2019a). This inference follows the logic presented in DEP (2019a). The quantity of water to be demanded that is in excess of the quantity that will be obtainable from existing water sources is the **future demand** minus the existing supply. This quantity is titled "Net Demand Change of which Additional AWS or Conservation Must Surpass" in DEP (2019a) and it is calculated as the **final year's water demand forecast** minus the sum of the base year water demand and the "Estimated Existing Sources Available to Meet Future Demands", or the **future demand** minus the future supply.

Note: Green highlighted cells indicate the year of the RWSP/WSA publication for that region that is identified in DEP (2019a). The "NWF-II" and "NWF - I, IV, V, VI, VII" demand data, however, appears to come from the 2013 WSA and the "SF-LEC" RWSP is labelled 2018. SJR - CSEC is still awaiting initial publication, but demand data is available from DEP.

Table 4.2.2 Inferred Supply Shortage: Water Demand Forecast minus the Existing Supply

Shortage	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
NWF - II	-					-					-					-					1.41					-
NWF - III	-					-					-					-					-					-
NWF - I, IV, V, VI, VII	-					-					-					-					0.02					-
SJR - CSEC	-					-					-					1.68					27.95					-
SR - OUTSIDE	-					-					-					-					-					-
SWF - Northern - Outside	-					-					3.23					15.72					27.81					-
SWF - Tampa Bay	-					-					-					-					-					-
SWF - Heartland - Outside	-					-					-					0.48					2.48					-
SWF - Southern	-					-					-					-					3.40					-
CFWI	-					59.82					120.34					178.69					233.58					-
NFRWSP	-					29.77					57.41					86.07					112.18					-
SF - LKB	-					-					-					-					0.02					-
SF - UEC	-					-					-					-					-					3.78
SF - LEC	-					-					-					-					6.66					49.55
SF - LWC	-					-					-					-					-					9.24
Statewide (sum of regions)	-					89.59					180.98					282.63					415.51					> 62.57

Note: These values are calculated by subtracting the inferred supply from Table 4.2.1 from the demand in each year of the same table and only displays a value when the demand is higher than the supply. When rounded, the values for the final year of each regions planning region in this table match the "Net Demand Change of which Additional AWS or Conservation Must Surpass" in DEP (2019a).

4.3 Water Demand Projections

Demand projections are an essential step in forecasting future expenditures. As part of their water supply assessment and planning, Florida's WMDs are required to evaluate existing legal uses and reasonably anticipated future needs. In many water supply assessments and planning documents, the words "need," "use," and "demand" are often used interchangeably. Further, the evaluation of future needs is linked with the water supply sources, whereby the "use" categories are characterized by their supply means such as "public supply" or "self-supplied."

In contrast, economic literature focuses on estimating a water demand function that characterizes the economic values derived from water. This approach allows examining substitution between water and other resources (*e.g.*, substitution between irrigation water use and the time to adjust an irrigation system). This approach also emphasizes the changes in the quantity of water demanded, depending on water prices, income levels, economic conditions, consumer preferences, and other factors. Further, this approach helps to clarify that a particular use is not a "need." Some uses have low values and cannot be categorized as "needs" (*e.g.*, outdoor irrigation, patio wash, or leaks). High-valued water uses that can be reduced also do not constitute a "need" (*e.g.*, reduction in water use for personal hygiene by installing low-flow showerheads and toilets). The total "quantity demanded" is the total volume of water being applied to different uses. Change in the water use is referred to as "a change in quantity demanded" or "a movement along the demand curve."[186]

Further, dividing water demand quantities between the supply sources—such as "public supply" and "self-supplied"—can mask changes in the quantity of water demanded as well as shifts in the water demand function. For example, water demand for outdoor irrigation can potentially be met by three water supply sources: potable water provided by water utilities (*i.e.*, public supply), reclaimed water supplied by wastewater utilities, and groundwater from irrigation wells. The analysis of the water demand function for outdoor irrigation can help evaluate the role of water and energy prices, residential irrigation restrictions, and residents' attitudes towards reclaimed water and the environmental issues in the choice among the supply sources and the total volume of water applied for irrigation. In this edition, data limitations do not allow EDR to fully incorporate economic water demand modeling approaches; however, EDR will continue working on this in the future.

Below, the water demand projections developed by the WMDs are discussed. Next, EDR's prototype water demand model's forecast is presented. For this year, the strongest use of the preliminary results from EDR's prototype model is to identify the research direction necessary to improve EDR's statewide demand forecast. Given data availability, this preliminary EDR forecast still defines the water demand categories based on public supply or self-supply sources. It attempts, however, to incorporate a broader range of economic drivers of water demand relative to the WMD forecast. It also includes the latest population projections available from EDR and BEBR and the most recent agricultural water demand projections available from the Florida Department of Agriculture and Consumer Services (DACS). In the future, EDR intends to further improve the demand forecast by more fully integrating information on economic and demographic factors influencing water demand.

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[186] Based on Griffin (2006).

Water Use Projections Developed by WMDs

While water supply assessments (WSAs) and regional water supply plans (RWSPs) for various regions were developed or updated in different years, estimated or projected water uses for "average year" rainfall conditions are available for most regions for the period 2015 through 2035, using five-year intervals.[187] Note that RWSPs and WSAs typically do not separately identify the water that may be needed for the natural systems.[188] The protection of water resources and related natural systems is intended to be achieved through the districts' regulatory and non-regulatory authority. These include water use permitting, minimum flows and minimum water levels (MFLs), Water Reservations, Restricted Allocation Areas, and Water Shortage declarations. However, the water volume that may be needed for protection or restoration of the natural systems must be estimated because EDR is required by law to forecast the costs necessary to meet the Florida Legislature's intent that sufficient water is available for the natural systems. For future editions, EDR will continue to work with the WMDs and DEP to better evaluate these needs.

In each water supply planning region, the forecast is developed for the following use categories defined in part by the water supplier:[189]

a) public supply (*e.g.*, water utilities supplying water for household and community uses, and various commercial, industrial, institutional, mining, power generation, and recreational landscape uses).[190]

b) domestic self-supplied (*e.g.*, domestic wells providing for both indoor and outdoor household uses).[191]

c) agricultural self-supplied (*e.g.*, agricultural irrigation, livestock watering, and aquaculture).

d) recreational-landscape irrigation (*e.g.*, golf courses and parks that are not on public supply).

e) commercial-industrial-institutional-mining self-supplied (*e.g.*, various commercial activities that are not on public supply).

f) power generation (*e.g.*, power generation facilities that rely on groundwater, fresh surface water, or reclaimed water, rather than the supply from water utilities).[192]

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[187] Projections for a drought year (referred to as a "1-in-10 year drought") are also provided in RWSPs and WSAs for the last year in the 20-year planning period. For some regions, however, such projections are unavailable for the 5-year intervals within the 20-year planning period (*e.g.*, all regions in SRWMD and SJRWMD). It should be noted that WMDs are not required to develop water demand projections for 1-in-10 year drought conditions for the interim 5-year intervals in the 20-year planning period.

[188] Some SWFWMD RWSPs do include an "Environmental Restoration" category in their water demand forecast. See Section 3.1 of the 2018 Edition of this report for more details on this category.

[189] The names of the water use categories are selected to be consistent with those used in the 2018 and 2019 Editions. See EDR (2018) for the discussion of the use categories and their names as defined by various government entities.

[190] This category includes public supply systems with average annual permitted quantities equal to or above 0.1 mgd. The only exception is SWFWMD, which includes all public supply systems (even those smaller than 0.1 mgd) in this category.

[191] This category includes small utilities with withdrawals less than 0.1 mgd in all WMDs except SWFWMD, in which small public suppliers are included in the public supply category. SWFWMD combines public supply and domestic self-supply into one category.

[192] This category does not include the use of brackish surface water, seawater, and cooling water returned to its withdrawal source.

Note that SWFWMD combines public supply and domestic self-supplied uses into one category, which also includes the estimated water use for residential irrigation wells.[193] Other WMDs either include the residential irrigation well water use into recreational-landscape irrigation (NWFWMD) or do not account for this use (SFWMD, SJRWMD, and SRWMD).

For the public supply forecast, WMDs rely on the "unit water demand" approach, when a "unit water demand coefficient" is multiplied by the number of users in each category.[194] The districts estimate a five-year[195] average per-capita water use for each water utility service area (*i.e.*, the unit water demand coefficient), and then multiply it by the population projections for each service area. In all districts, except SWFWMD, the average per-capita water use is based on permanent population estimates only. In SWFWMD, the average per-capita use is based on a served functional population that includes permanent, seasonal, tourist, and net commuter populations. Further, section 373.709, Florida Statutes, contains guidance for the population projections to be used in the RWSPs. The WMDs are required to consider the medium population projections data produced by BEBR. Any adjustment of or deviation from the BEBR projections must be fully described, and the original BEBR data must be presented along with the adjusted data. In the existing WSAs/RWSPs, the districts employ a variety of methods to relate the population projections for utility service areas to the BEBR county population projections (medium scenario).[196]

A similar "unit water demand" method is used to forecast domestic self-supplied use. The approach is based on multiplying per-capita water use estimated from the public supply data by the estimated domestic self-supplied population.[197] The per capita is calculated by considering all types of uses served by the public supply including household use, commercial use, and others. The exception is the North Florida Regional Water Supply Partnership (NFRWSP) and SR-outside NFRWSP where the residential per-capita rate, also referred to as household water use rate, is calculated based on the residential water use allocation from relevant consumptive use permits (CUPs).[198] In all WMDs, the domestic self-supplied population is determined as the difference between the BEBR medium county population projections and the estimated county population served by the public supply of water.

193 The estimation is based on the assumption of 300 gallons per day average water use per well, the estimated number of wells, and the relation of the well to the functional population in each county.
194 For a description of various methods of long-term water demand forecasting, see Rinaudo (2015).
195 Since the RWSPs and WSAs were developed in different years, the five-year period is not consistent among the plans. Also, in some areas, the average was taken for less than five years (*e.g.*, the four-year average used in SF-UEC).
196 The methodologies used by the WMDs to estimate existing water use and to project future use are discussed in more detail in the 2018 Edition.
197 Median, weighted average, or average county public supply per-capita usage rates are used in different supply planning regions. If county-specific information is unavailable, then the estimates from other areas are applied. For example, the statewide average reported by U.S. Geological Survey (USGS) is used in selected counties in SFWMD. The SRWMD also used county averages from SJRWMD (for counties split between the WMDs) and SJRWMD districtwide averages.
198 Unless otherwise exempt, all water withdrawals in Florida are regulated through a system of consumptive use / water use permits (CUPs/WUPs) granted by WMDs. Pursuant to section 373.223, Florida Statutes, each permit applicant must establish that the proposed use of water is reasonable-beneficial, consistent with the public interest, and will not interfere with any existing legal uses of water. In addition, withdrawals may not be harmful to the water resources in the area. The information available for individual CUP/WUP holders differs among WMDs. For example, the information regarding residential water use allocation is included in CUPs issued to public water suppliers in SJRWMD, but not in SRWMD. In some RWSPs/WSAs, the domestic self-supplied per-capita use is estimated from the per-capita use of large public supply utilities only (*i.e.*, utilities with average annual permitted quantities greater than 0.1 mgd). In other regions, the analysis also includes smaller public supply utilities.

The “unit water demand” approach is also employed to forecast recreational-landscape irrigation projections, where the “unit water demand coefficient” is calculated as water use per capita for the permanent county population. For example, in NFRWSP and SR-outside NFRWSP, a historic average gallon per capita per day rate for each county is estimated using recreational-landscape irrigation data and the BEBR county population for 2010-2014. This average per capita per day rate is then multiplied by the forecasted future permanent county population (*i.e.*, the BEBR medium population projections). The exception from this forecasting approach is the golf course irrigation projections in SFWMD and SWFWMD. SFWMD assumes the golf course irrigated acreage and demand to remain unchanged (*e.g.*, SF-LEC) or to grow at a slow rate as suggested by the industry and local planning estimates (*e.g.*, the Lower West Coast, or SF-LWC). In SWFWMD, an industry-specific method for projecting the demand for golf is employed, which is then combined with an estimated water use per eighteen-hole equivalent.

The “unit water demand” method is also utilized by all districts, except SWFWMD, to forecast the commercial-industrial-institutional-mining self-supplied use. For example, in SF-LEC, 90 percent of the base year (2016) water use in this category was for the large mining operations assumed to support new construction related to population growth (such as sand, gravel, and stone mining). Therefore, commercial-industrial-institutional-mining self-supplied water use is projected to grow at the same rate as the permanent county population. The only exception to the unit water demand approach is the SWFWMD regions, where statistical modeling was applied, and a correlation of the water use in each county with various economic indicators (such as employment and gross regional product) was explored. Ultimately, the projected water use was related to the one-year growth rate for the county-level gross regional product.

The WMDs relied on a variety of forecasting methods to project water demand for each power generation facility. In the Lower Kissimmee Basin (SF-LKB), the “unit water demand” approach was employed, connecting the water use increase to the population growth. In the other water supply planning regions of SFWMD, the water use forecast is established in consultation with the owners and managers of the power generation facilities (such as Florida Power and Light). Other districts rely on the trends reported in ten-year site plans available for each power generation facility from the Public Service Commission. For example, NFRWSP projected the water use beyond the planned expansion in the ten-year site plans using BEBR medium population projection rates and the average daily gallon per megawatt use estimated for 2010-2014. Finally, in SWFWMD, water use is assumed to increase with the county-level gross regional project based on a statistical analysis of past trends.

Finally, for agriculture, section 570.93, Florida States, enacted in 2013, directs DACS to establish an agricultural water supply planning program that includes “the development of data indicative of future agricultural water supply demands,” based on at least a 20-year planning period. Section 373.709(2)(a), Florida Statutes, requires WMDs to “consider the data indicative of future water supply demands provided by the Department of Agriculture and Consumer Services.” Any adjustments or deviations from the projections published by DACS “must be fully described, and the original data must be presented along with the adjusted data.” The Florida Statewide

Agricultural Irrigation Demand (FSAID) project provides the agricultural acreage and water use projections for each WMD and planning region. This information is updated annually.[199]

For forecast purposes, the agricultural self-supplied use is generally split by WMDs into agricultural irrigation and other water applications (*e.g.*, livestock watering and aquaculture). In some regions, agricultural irrigation projections are adopted from the version of FSAID available at the time WSAs/RWSPs were developed (see WSA and RWSP for SRWMD and NFRWSP). In other regions, the agricultural irrigation forecast method combines FSAID agricultural acres projections[200] with per-acre irrigation needs assessed internally by the districts. Finally, in a few regions, RWSPs were developed when only the initial versions of FSAID were available. In these regions, agricultural irrigation projections were developed by WMDs internally (*e.g.*, RWSP for SF-LKB published in 2014, and RWSPs for all SWFWMD published in 2015). Predictions of the future agricultural water use for purposes other than agricultural irrigation are either assumed to be unchanged in the planning horizon (*e.g.*, SWFWMD) or they are based on FSAID projections.

The total water use forecasted by the WMDs is shown in Figure 4.3.1 and Table 4.3.1. The RWSPs and WSAs used in this report are the same as those used by DEP (2019a). Selected regions provide the water demand forecast for 2040; these estimates are not analyzed in this edition because most WSAs and RWSPs used in DEP (2019a) still rely on the 2015-2035 planning period.

From 2015 to 2035, statewide water use is expected to increase from 6,405 to 7,550 mgd (or by 18 percent). Driven by population growth, public supply is forecasted to increase from 2,475 to 3,136 mgd (or by 27 percent). More water will also be used for three other population-related categories: domestic self-supplied, recreational-landscape irrigation, and power generation. While by absolute value the increases in recreational-landscape irrigation and power generation categories are small (158 mgd and 64 mgd, respectively), the growth rate in each sector is substantial (30 percent and 43 percent, respectively). Agricultural self-supplied use is expected to grow from 2,557 to 2,671 mgd (or by 4 percent). Florida is ranked first in the nation in the agricultural production value of oranges, sugarcane, and fresh market tomatoes. Also, the state is among the leaders in the agricultural production value of various other crops such as strawberries and watermelons.[201] These crops will continue to account for a large portion of the state's irrigated acreage and agricultural irrigation water use.[202] Water use in the commercial-industrial-institutional-mining self-supplied category is also expected to grow, although the increase will be small.

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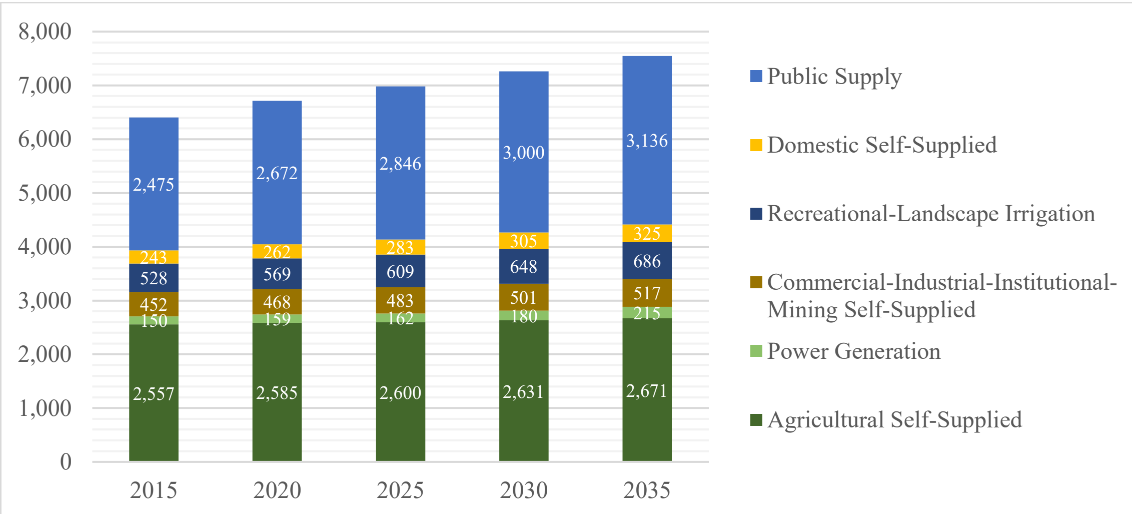
[199] The Balmoral Group. 2019. Florida Statewide Agricultural Irrigation Demand: Estimated Agricultural Water Demand, 2017 – 2040. Produced for the Florida Department of Agriculture and Consumer Services. The Balmoral Group, 35p. https://www.fdacs.gov/content/download/84471/file/FSAID-VI-Water-Use-Estimates-Final-Report.pdf. (Accessed October 2019.)

[200] With corrections if additional local information is available

[201] Florida Department of Agriculture and Consumer Services (DACS). Undated. Florida Agriculture Overview and Statistics. DACS, Division of Marketing and Development, Tallahassee, FL. https://www.fdacs.gov/Agriculture-Industry/Florida-Agriculture-Overview-and-Statistics. (Accessed October 2019.)

[202] The Balmoral Group. 2019. Florida Statewide Agricultural Irrigation Demand: Estimated Agricultural Water Demand, 2017 – 2040. Produced for the Florida Department of Agriculture and Consumer Services. The Balmoral Group, 35p. https://www.fdacs.gov/content/download/84471/file/FSAID-VI-Water-Use-Estimates-Final-Report.pdf. (Accessed October 2019.)

Figure 4.3.1 Total Statewide Water Use Projections for 2015-2035 Developed by the WMDs for Planning Purposes (assuming average rainfall, mgd)*



* The RWSPs and WSAs used in this report are the same as those used in DEP (2019a). The water demand estimates for individual planning regions are provided by DEP. The 2015 estimate/projection reported in the WMDs' regional water supply plans (RWSPs) and districtwide water supply assessments (WSAs) may differ from the actual 2015 water use. Some RWSPs and WSAs were developed prior to the date when the final 2015 data were available; hence, 2015 water use was projected based on water use in prior years (often 2010 or a previous five-year average water use).

Table 4.3.1 Total Statewide Water Use Projections for 2015-2035 Developed by the WMDs for Planning Purposes (assuming average rainfall, mgd)*

Use Category	2015	2020	2025	2030	2035	2015–2035 Change	2015–2035 % Change
Public Supply	2,474.97	2,672.29	2,845.77	3,000.14	3,136.07	661.10	26.71%
Domestic Self-Supplied	242.66	262.00	283.31	304.71	325.11	82.45	33.98%
Agricultural Self-Supplied	2,556.54	2,585.21	2,599.50	2,630.95	2,671.05	114.51	4.48%
Recreational-Landscape Irrigation	528.36	568.84	608.77	647.82	685.99	157.63	29.83%
Commercial-Industrial-Institutional-Mining Self-Supplied	452.38	467.97	483.44	500.56	516.80	64.42	14.24%
Power Generation	150.16	158.66	162.25	179.82	214.67	64.51	42.96%
Total	6,405.07	6,714.98	6,983.04	7,263.99	7,549.69	1,144.62	17.87%

* The RWSPs and WSAs used in this report are the same as those used in DEP (2019a). The water demand forecasts are available in Appendix B for DEP (2019a). The 2015 estimate/projection reported in the WMD regional water supply plans (RWSPs) and districtwide water supply assessments (WSAs) may differ from the actual 2015 water use. Some RWSPs and WSAs were developed before the date when the final 2015 data were available. Therefore, 2015 water use was projected based on water use in prior years (often 2010 water use or a previous five-year average water use).

It is important to note that for all the water use categories, the forecast methods used by WMDs account for the existing water conservation efforts, but not the potential future increase in water conservation. The potential for water conservation is reported separately (see Table 4.3.2). Moreover, in WSAs and RWSPs, water conservation generally refers to a reduction in per-capita water use due to various conservation programs such as the installation of more efficient fixtures in residential properties or infrastructure improvements that repair leaks in the delivery system.[203]

[203] See Appendix A.2 discussing the methods used by the WMDs to estimate future water conservation potential.

Other changes (such as water price increases or shrinking residential yards) may not be fully captured in the conservation programs included in WSAs and RWSPs. If the relevant data become available, these changes can be examined when a comprehensive economic analysis of water demand is conducted.

In this edition, WMDs' estimates of "Conservation Projection to Meet Future Demands (mgd)" are not accounted for in the inferred supply shortage calculations. Instead, conservation is discussed in the EDR expenditure forecast. The water conservation potential is reported by the districts as the total for the whole planning period, with no specific time frame to relate it to the five-year intervals used in the water demand forecast. Further, the water conservation projections are based on the selection of conservation measures (such as the percentage of existing homes that would install high-efficiency toilets or irrigation controllers, see Appendix A.2). These conservation measures are selected by the WMDs to be cost-effective; however, their implementation still depends on funding. As a result, in this edition, water conservation measures are considered as a part of the expenditure forecast, and not incorporated into the demand and inferred supply shortage calculations. See Table 4.3.2 for a summary of the districts' projections regarding conservation. In the future, EDR intends to incorporate water conservation measures into the water demand model.

Table 4.3.2 Summary of WMDs' Estimates of Water Use and Conservation Potential*

Water Management District	Water Supply Planning Region	Water Use (mgd)			Estimated Conservation Potential (mgd)
		2015**	2035	2015-2035 change	
NWFWMD	NW-II	81.3	100.8	19.5	6.5
	NW-III	79.5	88.4	8.9	9.5
	NW-I, NW-IV, NW-V, NW-VI, & NW-VII	212.8	224.8	12.0	3.6
SJRWMD	SJR-CSEC	343.7	422.5	78.8	33.6
SRWMD	SR-outside NFRWSP	100.6	122.4	21.8	10.9
SWFWMD	SW-NR	150.9	202.6	51.7	23.0
	SW-TB	411.2	475.0	63.8	52.0
	SW-HR	117.3	125.6	8.3	4.4
	SW-SR	304.6	354.8	50.2	18.8
SFWMD	SF-LKB	204.5	222.0	17.5	0.0
	SF-UEC	273.0	325.4	52.4	14.1***
	SF-LEC	1,739.6	1,963.7	224.0	102.4***
	SF-LWC	980.3	1,170.4	190.0	26.3***
SJRWMD, SWFWMD, and SFWMD	CFWI	850.5	1,084.0	233.6	36.8
SJRWMD and SRWMD	NFRWSP	555.3	667.5	112.2	40.7 – 53.0
Total Statewide		**6,405.1**	**7,549.7**	**1,144.6**	**382.6********

* Based on Appendices A and B of DEP (2019a).
** The 2015 estimate/projection reported in the WMDs' regional water supply plans (RWSPs) and districtwide water supply assessments (WSAs) may differ from the actual 2015 water use. Some RWSPs and WSAs were developed before the date when the final 2015 data were available. Therefore, 2015 water use was projected based on water use in prior years (often, 2010 water use or a previous five-year average of water use).
*** These estimates are for the 2020–2040 planning horizon; those for the 2015–2035 planning horizon are unavailable.
**** This estimate is based on the lower assessment for NFRWSP (40.7 mgd) since it is assumed to be more realistic.

It is also important to note that the water use forecast presented above is for “average year” weather conditions (also referred to as 5-in-10 year condition).[204] While the drought demand is also calculated for all regions, the estimates are often based on a simple multiplication of the average year demand by a coefficient.[205] The coefficient values were developed a decade or so ago and may need to be revised given the changing weather patterns. Moreover, the drought demand analysis is not explicitly linked with the corresponding analysis of drought-year water supplies. EDR relies on DEP (2019a) for a summary of the water supply estimates for each region that correspond to the average year conditions. Therefore, for this edition, EDR focuses on “average year” water demand only. For EDR, it is crucial for drought year water use and water supply to be quantified. For future editions, EDR will continue to work with the WMDs and DEP to quantify these values.

Water Demand Forecast Produced by EDR: A Prototype Model

As discussed above, to facilitate the expenditure forecast, EDR intends to produce an independent statewide water demand forecast to represent the continually updated outlooks on Florida’s demographics and economic conditions and to allow investigations of alternative scenarios of interest. In this edition, a preliminary water demand forecast is presented. This preliminary forecast is based on a prototype model of statewide water demand. The preliminary results are presented and compared with the forecasts produced by the WMDs in order to identify the future areas of research that EDR needs to undertake to refine the statewide demand forecast and prepare it for peer-review. At this time, the results should not be interpreted to be more robust than those developed directly by EDR from the WMDs’ demand projections.

The prototype model is based on the historical USGS county-level water withdrawals and the most recent BEBR medium population projections, the 2019 county-level economic forecast produced by Woods & Poole Economics, Inc.,[206] and the 2019 update of the agricultural water demand projections released by DACS. The forecast integrates weather indicators from the National Oceanic and Atmospheric Administration (NOAA) and the residential water price information available from the Florida Public Service Commission (PSC) and Raftelis Financial Consulting, Inc. For more information on the data used by EDR, see Appendix A.3.

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[204] Section 373.709, Florida Statutes, states that the level-of-certainty planning goal associated with identifying water demands shall be based on meeting demands during 1-in-10 year drought conditions. DEP guidance defines a 1-in-10 year drought event as “an event that results in an increase in water demand of a magnitude that would have a 10 percent probability of occurring during any given year” (DEP 2009: p. 16). All WMDs adopt this definition except SFWMD in which a 1-in-10 year drought definition focuses on the rainfall conditions. Specifically: “A 1-in-10 year drought is defined as a year in which below normal rainfall occurs with a 90 percent probability of being exceeded in any other year. It has an expected return frequency of once in 10 years” (SFWMD 2018: p. 32).

[205] For example, for the public supply sector, the drought year demand is calculated by multiplying average year demand by a coefficient. Districtwide coefficients of 1.06 or 1.07 are used by all districts, except SFWMD, where county-specific coefficients range from 1.03 (Monroe County) to 1.172 (NE Okeechobee County). The same approach was used to forecast water use for the domestic self-supplied category. Water use in the commercial-industrial-institutional-mining self-supplied category and power generation category is assumed to be equal for the drought and average year conditions. In turn, agricultural irrigation drought year demand can be based on FSAID projections, the ratio of drought year to average year use applied for the CUPs/WUPs, or other methods. Similarly, various techniques are applied to forecast drought year use for recreational-landscape irrigation, such as the Agricultural Field Scale Irrigation Requirements Simulation (AFSIRS) model, the drought year demand coefficient, or the comparison of the historical uses in the category during drought and average years.

[206] In future editions, the demand forecast will rely on county forecasts produced by EDR that are consistent with the official statewide forecast.

At the same time, the data available to produce the forecast are limited. First, EDR relies on a variety of data sources, and the consistent dataset was assembled for county-level water use in 2000, 2005, 2010, and 2015 only. While this dataset includes 268 observations, or four for each county, an increase in the number of the historical periods included in the dataset would enhance the accuracy of the forecast. Second, EDR relies on data about various water supply sources to estimate water use. Particularly, reclaimed water use is assumed to offset water withdrawals from surface and groundwater sources, with the offset coefficient ranging from 40 percent to 100 percent for various reuse categories. This offset coefficient reflects the fact that while 100 percent of reuse water is used to meet various demands, some of these demands are not relevant for water supply planning. The offset coefficients are not region-specific, and they are based on a publication released more than 15 years ago; therefore, they are an imperfect tool to translate the water supplied into the water demand. Third, the definitions of the use categories differ among the data sources, making the water use estimates from the various agencies not entirely comparable. Finally, the statistical power of the models developed by EDR for the demand forecasting can be further improved, and additional statistical specifications of the model should be tested. Despite these deficiencies, the preliminary forecast shows that after further refinements, the forecast can be used to explore the effects of weather, demographic, and economic variables on water demand and to assist in the EDR expenditure forecast.

Preliminary Forecast for the Public Supply and Domestic Self-Supplied Categories

To develop the forecast, historical (2000, 2005, 2010, and 2015) county-level public supply–water use data were obtained from published USGS reports[207] and DEP reuse inventory information. Despite the differences in the definitions of the use and reuse categories among the WMDs, DEP reuse inventory, and USGS, it was assumed that these datasets are generally compatible. The allocation of the data from the DEP reuse inventory to the water use categories is described in Appendix A.3. There are also slight differences in the definitions of public supply and domestic self-supplied categories between WMDs and USGS. Specifically, for WMDs, the public supply category includes only public supply systems with the average annual permitted quantities equal to or above 0.1 mgd except for SWFWMD, which considers all public supply systems. The domestic self-supplied category includes domestic use that is not provided by a public supply system or public supply use provided by a permitted public supply system with an average daily withdrawal below 0.1 mgd. In turn, USGS relies on a 0.01 mgd threshold to differentiate the public supply and domestic self-supplied categories.[208] USGS also excludes noncommunity water systems from public supply or domestic self-supplied categories.[209] There are also slight differences in the water use estimation methods employed by USGS and WMDs for the domestic

[207] The data for 2015 were shared by Richard Marella via e-mail (since the final report was not published as of December 2019).

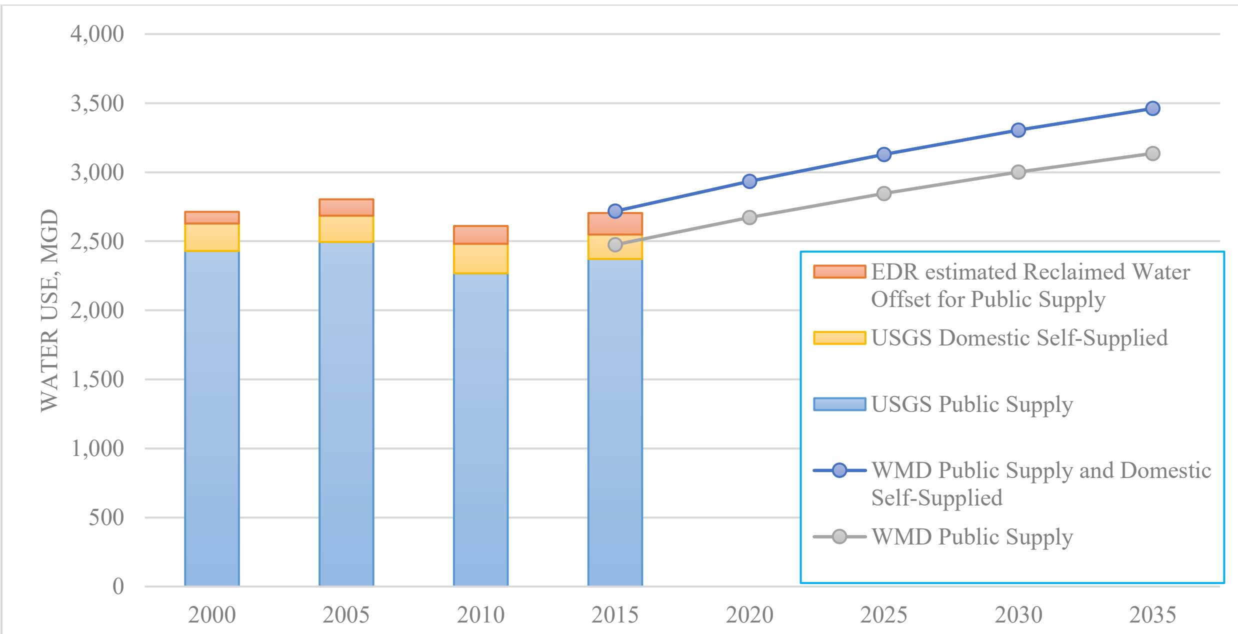
[208] Particularly, the USGS public supply category includes community water systems that serve more than 400 people or use more than 0.01 mgd (Marella 2014). Domestic self-supplied use includes water withdrawals from individual private domestic wells that serve one or more households and by the small community water systems not inventoried under public supply, each having a daily average pumpage of less than 0.01 Mgal/d or serving fewer than 400 people. For illustration, in 2010, of the 214 Mgal/d withdrawn for domestic self-supplied, an estimated 98 percent (209 Mgal/d) was from private domestic wells and 2 percent (5 Mgal/d) was from the estimated 600 small public-supply systems that were not inventoried as a part of Public Supply (Marella 2014).

[209] EPA defined three types of public water systems (see https://www.epa.gov/dwreginfo/information-about-public-water-systems). *Community Water System* is a public water system that supplies water to the same population year-round. *Nontransient Non-Community Water System* is a public water system that regularly supplies water to at least 25 of the same people at least six months per year (e.g., schools and hospitals that have their own water systems). Finally, *Transient Non-Community Water System* is a public water system that provides water in a place such as a gas station or campground where people do not remain for long periods. For example, in 2010, there were 869 nontransient noncommunity, and 2,940 transient noncommunity systems in Florida, and they were excluded from USGS public supply category, but included into commercial-industrial self-supplied (Marella 2014).

self-supply use category.[210] Despite the differences in the definitions and estimation methods, EDR assumed that USGS data combined with DEP reuse inventory information can be used to forecast the water use in the public supply and domestic self-supplied categories, especially when these two categories are combined and aggregated on the regional or statewide level.

Combining the data from various sources, past and projected water use is summarized in Figure 4.3.2. While in the past the water use remained relatively stable, it is projected that the future water use will increase in response to the growing population.

Figure 4.3.2 Total Public Supply and Domestic Self-Supplied Water Use: Historical Data and WMDs Forecasts (mgd)*



* In 2000, 2005, and 2015, USGS public supply water use excludes water losses in the process of water transfer among counties. In 2000, the losses were 7.11 mgd (or 0.3 percent of PS water withdrawals). In 2005, the losses were 45.75 mgd (or 1.8 percent of PS water withdrawals). Finally, in 2015, the losses were 13.28 mgd (or 0.6 percent of PS water withdrawals).

For the preliminary forecast, EDR relied on the "unit water demand" approach, similar to the one used by the WMDs. Unlike WMDs that utilized an average per capita water use as a "unit water demand coefficient," EDR focused on forecasting the per capita water use based on a statistical model. EDR then multiplied the projected per capita use by the most recent county population projections from BEBR to estimate the total water use for the category.

[210] Both WMDs and USGS assume that all people not served by the inventoried public suppliers are self-supplied. This population is then multiplied by an estimated per-capita water use rate. While WMDs generally use *region-specific* per-capita water use rates, USGS employs the *statewide per capita* water use. USGS also uses *public-supply domestic* per capita derived from public-supply withdrawals minus estimated deliveries to commercial, industrial, public uses, and other users (Marella 2014).The values used are: in 2000 - 106 gal/d (Marella, 2004), in 2005 - 95 gal/d (Marella 2009), and in 2010 - 85 gal/d. The exception is the counties within the SJRWMD and SWFWMD, where USGS relied on the WMDs' public-supply gross or an adjusted per capita (Marella, personal communications).

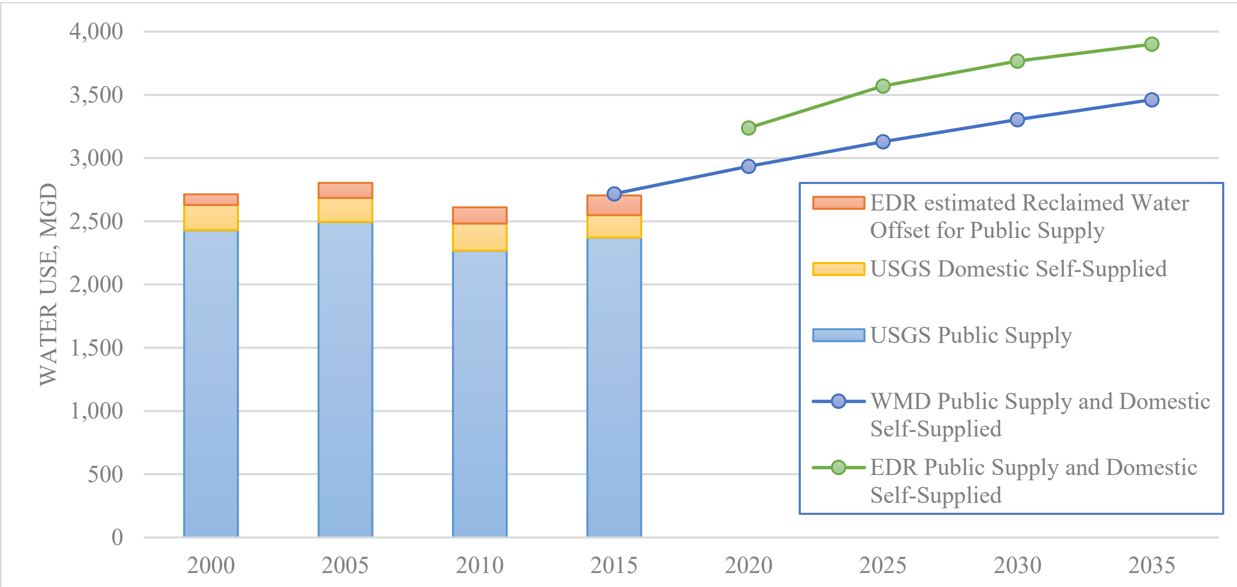
A statistical model was developed to relate the county-level per capita water use to the following drivers: (a) a time trend that reflects the per-capita use reduction due to conservation; (b) per capita retail and foodservice sales that serve as indicators of the tourism activity in the county; (c) average county temperature in the months March through May and June through August, when outdoor irrigation is especially high; (d) total precipitation in March through May and June through August; (e) county gross domestic product per capita as an indicator of overall economic activity and income levels in the county; and (f) average county residential water bill for 10,000 gallon per month.

The estimation results are presented in Appendix A.4. As expected, the analysis showed that the per capita water use increased with per capita retail and food services sales. Since the per capita sales are calculated based on the permanent population only, the increase in the per capita sales indicates more tourists in the area, which drives the water use up. The per capita water use increases with the gross domestic product per capita and an increase in temperature in June through August. Ultimately, the overall per capita water use was estimated to reduce over time due to conservation. The variable "Residential water bill for 10,000 gallons" was not statistically significant at a ten percent level, though it displayed the negative sign expected based on economic theory. The lack of statistical significance may be due to the quality of the data (*e.g.*, for selected counties and years, residential water bill information was derived by averaging the data available for the neighboring counties). Finally, the variables reflecting the average temperature in March through May and precipitation in March through May and June through August were not statistically significant at a ten percent level.

The statistical model was utilized to forecast the county-level water use. For the predictor variables, EDR relied on the forecasts produced by EDR, BEBR, and Woods and Poole Economics, as explained in Appendix A.4. Future county residential water bill was assumed to remain at the 2015 level and the weather variables were assumed to stay at the average calculated for 2000, 2005, 2010, and 2015. The forecast implies reductions in the per capita water use in many counties; however, increases in population and economic activities are expected to raise overall statewide water use, despite the per capita water use reduction. The preliminary statewide forecast for the Public Supply and Domestic Self-Supplied categories is displayed in Figure 4.3.3. In the future, EDR plans to further refine the forecasting model, which may result in revisions to the per capita and the total statewide projections.

[See figure on following page]

Figure 4.3.3 Total Public Supply and Domestic Self-Supplied Water Use: EDR's Preliminary Forecast (mgd)



Preliminary Forecast for Recreational-Landscape Irrigation

The definition of the recreational-landscape irrigation use category is generally consistent between the WMDs and USGS. This category includes the application of water to assist in growing turfgrass and landscape vegetation for lawns or recreational purposes but also includes water used for aesthetic purposes. Recreational irrigation includes golf-course irrigation. Landscape irrigation includes the irrigation of turfgrass and other vegetation associated with athletic fields, cemeteries, common public or highway areas, parks, playgrounds, school grounds, and nonresidential lawns and grasses primarily associated with commercial establishments. Aesthetic uses are associated with water used to fill or maintain nonagricultural lakes, ponds, and fountains.[211]

Since both the WMDs and USGS have limited metered water use data for this category, the water use is estimated rather than measured. For the historical water withdrawals, USGS relies on irrigated acreage and a calculated net irrigation requirement coefficient.[212] To forecast the future water use, WMDs rely on various models linking water use to county population.

In addition to the historical water withdrawals reported by WMD, DEP (2019b) includes data related to reclaimed water use for golf course irrigation. DEP also estimates the volume of water from traditional sources offset by such irrigation using the coefficient of 0.75. For this analysis,

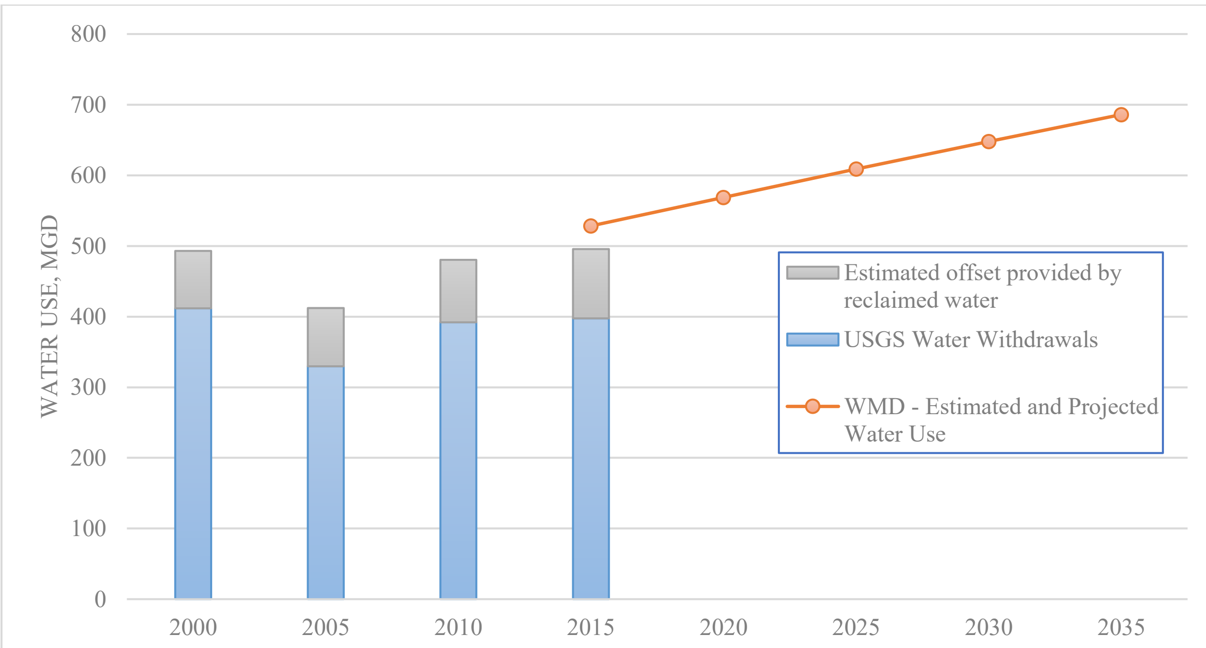
[211] Marella, R.L., 2014, Water withdrawals, use, and trends in Florida, 2010: U.S. Geological Survey Scientific Investigations Report 2014-5088, 59 p., available at: https://pubs.usgs.gov/sir/2014/5088/. (Accessed December 2019.)

[212] *Ibid.* Also, for 2010 water withdrawals, about 12 percent of the total recreational-landscape irrigation water withdrawals was derived from actual metered data. The remaining 88 percent were estimated from the county irrigated acreage and a calculated NIR coefficient.

EDR assumed that the golf course irrigation offset can be attributed to recreational-landscape irrigation category.[213]

In 2015, statewide water withdrawals for recreational-landscape irrigation was approximately 400 mgd, as shown in Figure 4.3.4, which was about one-fifth of the combined public supply and domestic self-supplied use. In 2005-2015, surface water and groundwater sources were almost equally important for this category, when considered from the statewide perspective. In addition, almost 100 mgd of withdrawals were estimated to be offset by using reclaimed water.

Figure 4.3.4 Recreational-Landscape Irrigation: Historical Water Use and WMDs Forecast (mgd)



EDR developed a statistical model to forecast the county-level water use in the recreational-landscape irrigation category. This includes water withdrawals and the offset volume provided by water reuse. It is expected that water use decreases with increased precipitation but increases as the population aged 65 and over grows. Water use is also expected to grow with wealth, indicating both an increase in demand for golf course recreation and the type of urban development that requires beautification. Finally, the kind of urban development that requires more substantial recreational landscape water use was assumed to be associated with the counties where mining, farm, forest, and related economic activities were relatively small.

The estimation results are presented in Appendix A.5. Generally, the variables showed the expected relationships described above and were significant at a ten percent level. Overall, the

[213] In reality, golf courses can be on public supply or self-supplied. The data on the split of golf course acreage and water use between public supply or self-supplied were not available.

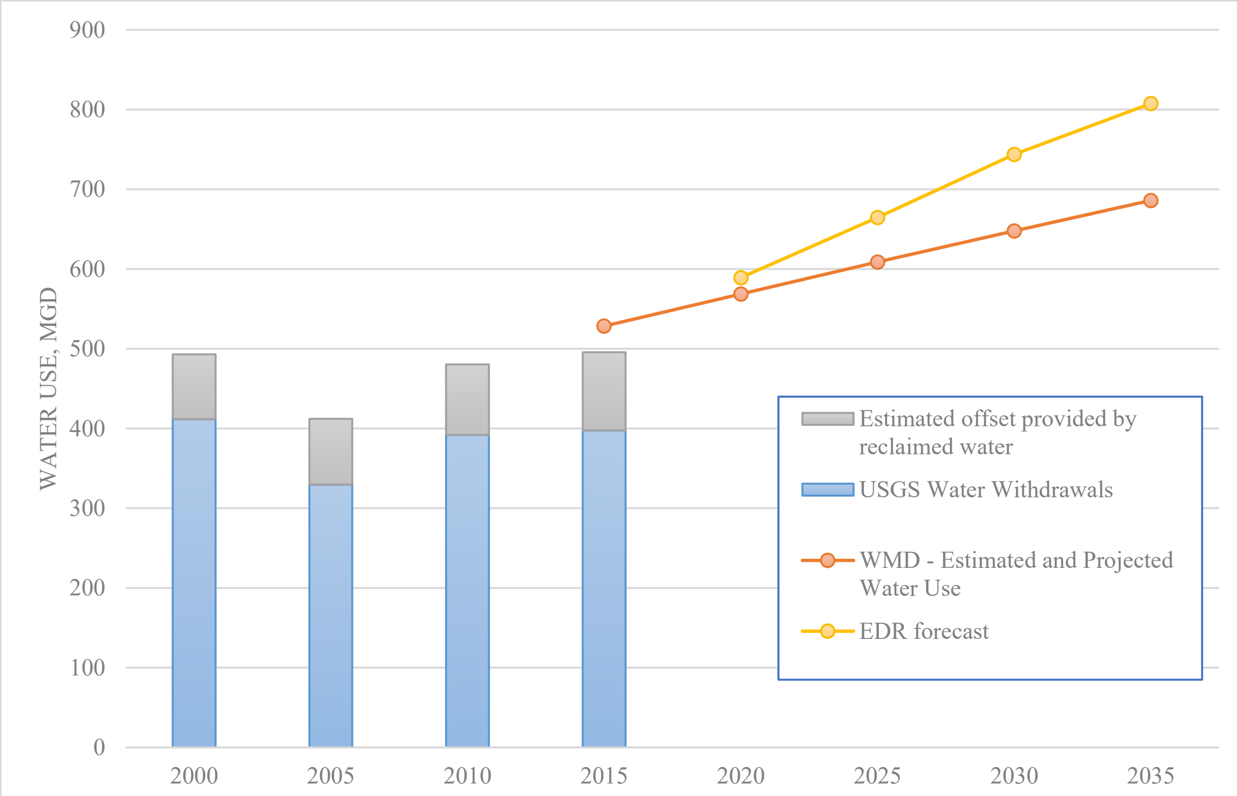
model explains almost 60 percent of variability in the dependent variable; however, most of this variability is explained by accounting for the differences among counties. The independent variables explain a small percentage of the total variability which indicates an opportunity to further improve the statistical model and the EDR forecast.

The statistical model was utilized to forecast the county-level recreational-landscape irrigation water use to 2035. For the predictor variables, EDR relied on the forecasts produced by Woods and Poole Consulting. The future annual precipitation was assumed to stay at the average level calculated for 2000, 2005, 2010, and 2015. Note that for several counties with no historical recreational water use levels, the modeled forecast performed poorly. These counties are: Gilchrist, Hamilton, Holmes, Liberty, and Union. For those counties, instead of using the model, the water use was assumed to remain at zero. In several other counties, recreational landscape irrigation fluctuated around zero historically, but was greater than zero for at least some years. For these counties, the model also predicted the future use to vary around zero; and when the EDR forecast fell below zero, the values were rounded up to zero. These were: Baker (in 2020), Calhoun (in 2020), Dixie (in 2020 and 2025), Jackson (in 2020), Wakulla (in 2020 and 2025), and Washington (2020-2035).

Overall, a significant increase in the recreational-landscape irrigation water use is forecasted. A projected increase in the population over 65 years old, urbanization (reflected in reduction in mining, farm, forest, and related earnings as a share of the total employees' earnings), and the increase in wealth level all drive up demand for recreational-landscape irrigation as shown in Figure 4.3.5. While the WMDs have differing outlooks for the golf course industry, EDR's forecast assumes that recreational-landscape irrigation in Florida will continue its historic trend and makes no specific adjustment for the golf course industry. In the future, EDR plans to further refine the forecasting model, which may result in revisions in the total statewide projections.

[See figure on following page]

Figure 4.3.5 Recreational-Landscape Irrigation: EDR's Preliminary Forecast (mgd)



Commercial-Industrial-Institutional-Mining and Power Generation Self-Supplied Categories

While commercial-industrial-institutional-mining self-supplied and power generation self-supplied are distinct categories in the USGS and WMDs documents, EDR combined these categories for forecasting purposes. The naming conventions and definitions of these categories vary somewhat between USGS and WMDs. USGS defines commercial-industrial-mining self-supplied as water withdrawn directly by commercial, industrial, and mining facilities. *Commercial users* include some self-supplied community water systems, such as government and military facilities, schools, prisons, hospitals, and recreational facilities. Commercial users also include nontransient and transient noncommunity water systems serving such places as churches, restaurants, theme parks, and nonmanufacturing facilities. In turn, *industrial users* include processing and manufacturing facilities, whereas *mining* use includes conveyance, extraction, milling, washing, and sometimes dewatering. Only those self-supplied commercial, industrial, or mining users that withdraw more than 0.01 mgd are included. Most nontransient and transient noncommunity water systems do not meet this minimum threshold.[214]

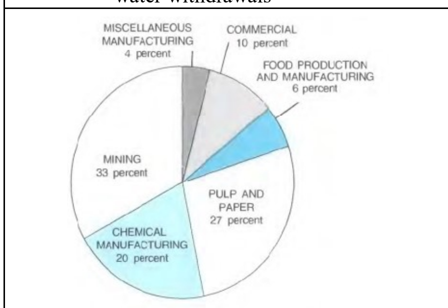
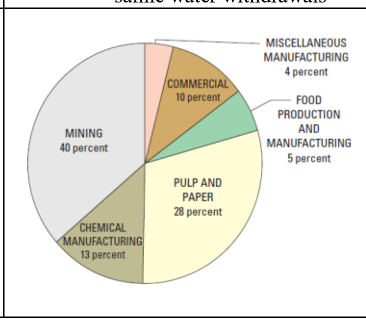
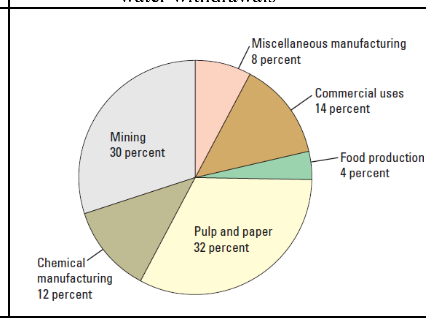
In turn, WMDs refer to this category as "industrial / commercial / institutional" (SFWMD), "industrial / commercial and mining / dewatering" (SWFWMD), "commercial / industrial /

[214] Marella, R.L., 2014, Water withdrawals, use, and trends in Florida, 2010: U.S. Geological Survey Scientific Investigations Report 2014-5088, 59 p., available at: https://pubs.usgs.gov/sir/2014/5088/. (Accessed December 2019.)

institutional and mining / dewatering" (CFWI), or other combinations of these words. The types of uses included into this category are similar to the ones listed by USGS. It is not clear, however, if WMDs consistently use the minimum withdrawal threshold for this category. For example, SWFWMD states that "[w]hile the Format and Guidelines (DEP et al., June 2009) identified 0.1 million gallons per day (mgd) as the mandatory reporting threshold for the I/C and M/D categories, the District examined and included all permitted or reported uses, regardless of the quantity in projecting demand."[215] The districts also exclude the water volumes withdrawn for heating and cooling systems that are returned to the source.

For forecasting purposes, EDR assumes that the USGS and WMD water use definitions are generally compatible. Based on USGS historical water use, pulp and paper manufacturing and mining accounted for the majority of water used (Figure 4.3.6). Most of the water withdrawn for this category is freshwater, with a very small percentage of saline or brackish water. Both groundwater and surface water sources are used. Relatively high levels of withdrawals are historically observed in Escambia, Taylor, Miami-Dade, Nassau, and Polk Counties.

Figure 4.3.6 Historical Shares of Water Withdrawals in Commercial-Industrial-Institutional-Mining Self-Supplied Category (mgd)*

A. 2000: 563.3 mgd freshwater withdrawals and 1.18 mgd saline water withdrawals	B. 2005: 411 mgd freshwater withdrawals and 1.19 mgd saline water withdrawals	C. 2010: 378 mgd freshwater withdrawals and 0 mgd saline water withdrawals
		

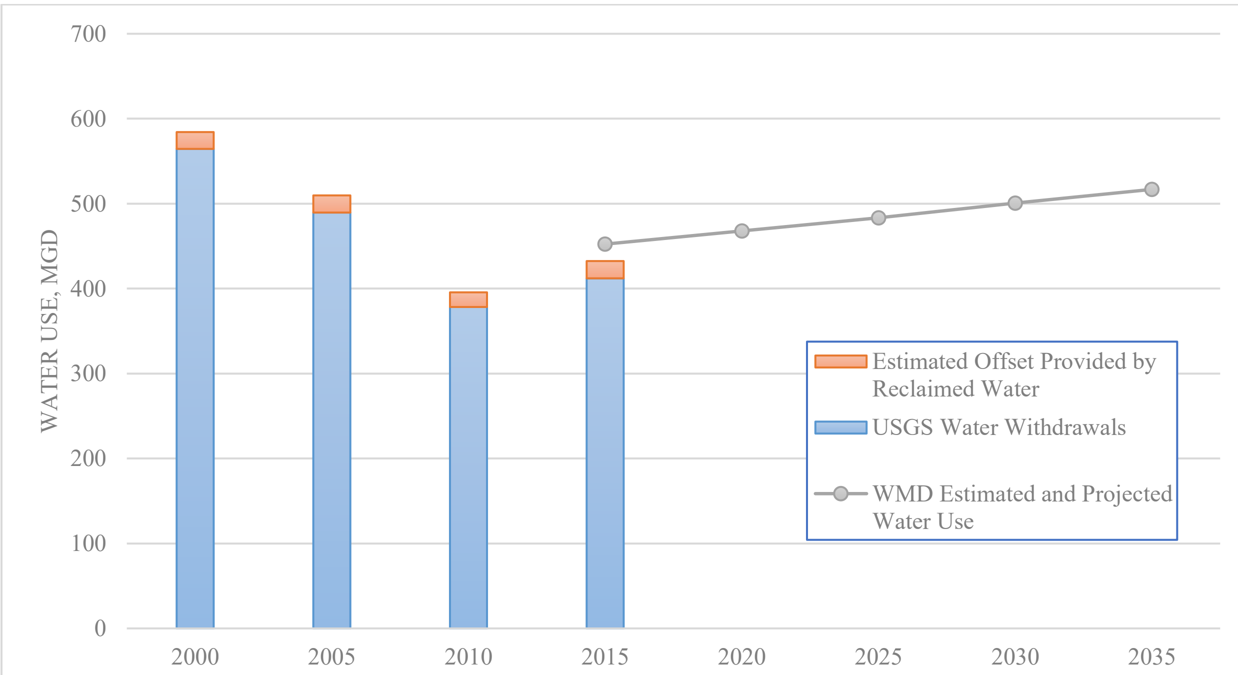
* Sources: copied from USGS reports. As of December 2019, the 2015 report had not yet been published.

In addition to water withdrawals, a portion of water use in the commercial-industrial-institutional-mining self-supplied category was supplied by reclaimed water. DEP (2019b) identified a reuse category "Industrial uses, toilet flushing, and fire protection" that does not align with the categories defined in USGS or WMDs since the reuse category potentially includes both publicly-supplied and self-supplied users. For EDR's analysis, it was assumed that one-third of the estimated "At Treatment Plant" sub-category within this category can be allocated to the commercial-industrial-institutional-mining self-supplied category.

[215] SWFWMD RWSPs, 2015, at page 1 available at: https://www.swfwmd.state.fl.us/sites/default/files/medias/documents/2015_RWSP_Appendix_3_2_IC_TechMemo_111715[1].pdf. (Accessed November 2019.)
DEP document referenced: DEP et al., June 2009. Format and Guidelines for Regional Water Supply Plans

Overall, the EDR forecast is based on the analysis of the historical freshwater and saline water withdrawals reported by USGS and the estimated share of reclaimed water reuse attributed to the commercial-industrial-institutional-mining self-supplied. The historical and forecasted statewide uses are displayed in Figure 4.3.7. Two trends are mentioned in Marella (2014): scaling down of the manufacturing employment in Florida and a shift to public supply for new commercial establishments. Both trends have reduced the commercial-industrial-institutional-mining water withdrawals. WMDs project a modest increase in this category in the future.

Figure 4.3.7 Water Withdrawals for Commercial-Industrial-Institutional-Mining Self-Supplied Category: Historical Use and WMDs Forecast (mgd)*



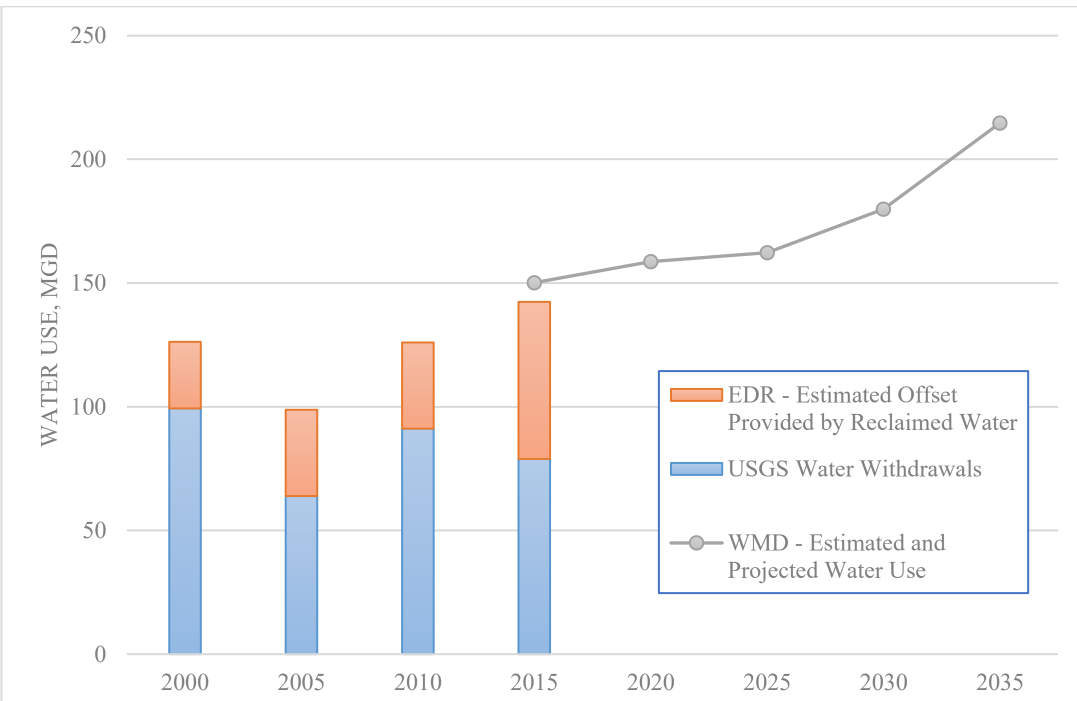
In turn, the USGS power generation category primarily includes water withdrawals for thermoelectric power generation facilities. In many cases, the withdrawal represents the amount used to augment cooling canals, ponds, or lakes, as opposed to the amount of water actually used for once-through cooling. The amount withdrawn for augmentation is often referred to as the amount of water consumed because it is not returned to the original source.[216] This definition appears to be generally consistent with the definition used by WMDs: "the consumptive use of water for steam generation, cooling and replenishment of cooling reservoirs."[217]

[216] Marella, R.L., 2014, Water withdrawals, use, and trends in Florida, 2010: U.S. Geological Survey Scientific Investigations Report 2014-5088, 59 p., http://dx.doi.org/10.3133/sir20145088.
[217] NFRWSP at p. 20 - https://northfloridawater.com/watersupplyplan/documents/final/NFRWSP_01192017.pdf . Similar definitions are found in other WSAs/RWSPs. In the description of the sector, SF-LEC mentions the threshold "a capacity greater than 60 megawatts" (p. B-49, https://www.sfwmd.gov/sites/default/files/documents/2018_lec_plan_appendices.pdf).

For EDR's analysis, fresh and saline groundwater and fresh surface water withdrawals for recirculating cooling in thermoelectric power generation[218] was obtained from the national USGS website. In addition, it was assumed that reclaimed water reuse subcategory "At Other Facilities" defined for "Industrial uses, toilet flushing, and fire protection" reuse category can be attributed to power generation.

Figure 4.3.8 displays historical and projected water use based on USGS and WMD data. The historical withdrawals for recirculating cooling in thermoelectric power generation reported by USGS has been relatively stable over time, with a slight decrease in 2005. The WMDs project a slow increase in the water use for this category in response to population increase and economic growth projections.

Figure 4.3.8 Power Generation Category: Historical Use and WMDs Forecast (mgd)



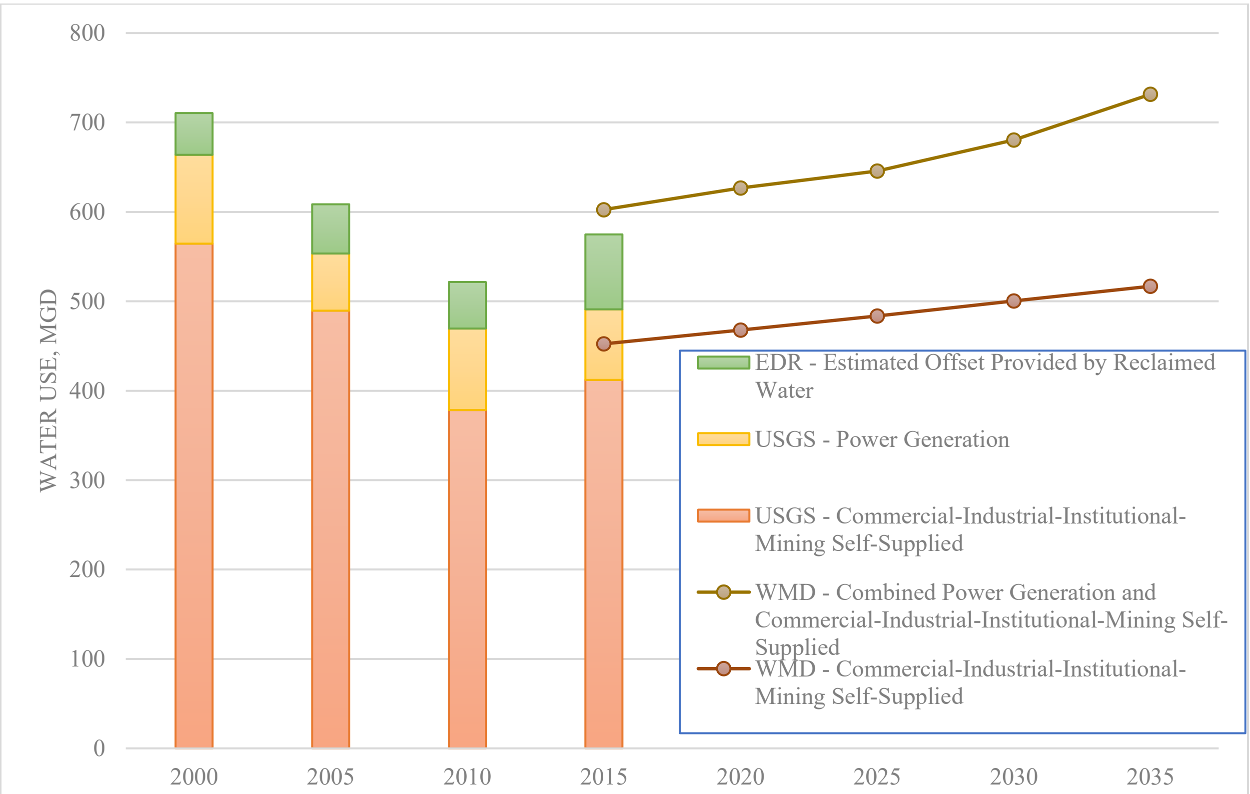
While power generation is a separate water use category in both USGS and WMDs documents, EDR combines it with commercial-industrial-institutional-mining self-supplied category for forecasting purposes. The historical water use for the power generation, after excluding once-through systems and saline water withdrawals, is significantly smaller than the other categories. Most of the counties exhibit zero historical groundwater and fresh surface water withdrawals,

[218] "Recirculating cooling refers to cooling systems in which water is circulated through heat exchangers, cooled using ponds or towers, and then recirculated. Subsequent water withdrawals for a recirculating system are used to replace water lost to evaporation, blowdown, drift, and leakage." (see https://www.usgs.gov/mission-areas/water-resources/science/thermoelectric-power-water-use?qt-science_center_objects=0#qt-science_center_objects)

which reduces the number of observations that can be used to develop an econometric model and forecast the future use.

The total historical withdrawals and estimated reclaimed water offset for the combined category, along with the future water use forecasted by the WMDs is presented on Figure 4.3.9. Overall, the water use declined somewhat in 2000-2015, but it is forecasted by the WMDs to slowly increase in the future.

Figure 4.3.9 Water Withdrawals for the Combined Commercial-Industrial-Institutional-Mining and Power Generation Self-Supplied Categories: Historical Use and WMDs Forecast (mgd)



The EDR analysis did not show a strong correlation between water use and the gross regional product or population. A statistical model that performed reasonably well included county-level mining employment, manufacturing earning, utilities employment as a proportion of the total county employment, wealth level, and residential water bill as independent variables (Appendix A.6). The increase in the residential water bill may signal the increase in water scarcity and water value in a county, driving water demand in various sectors down, or re-allocating water to more high-valued uses.

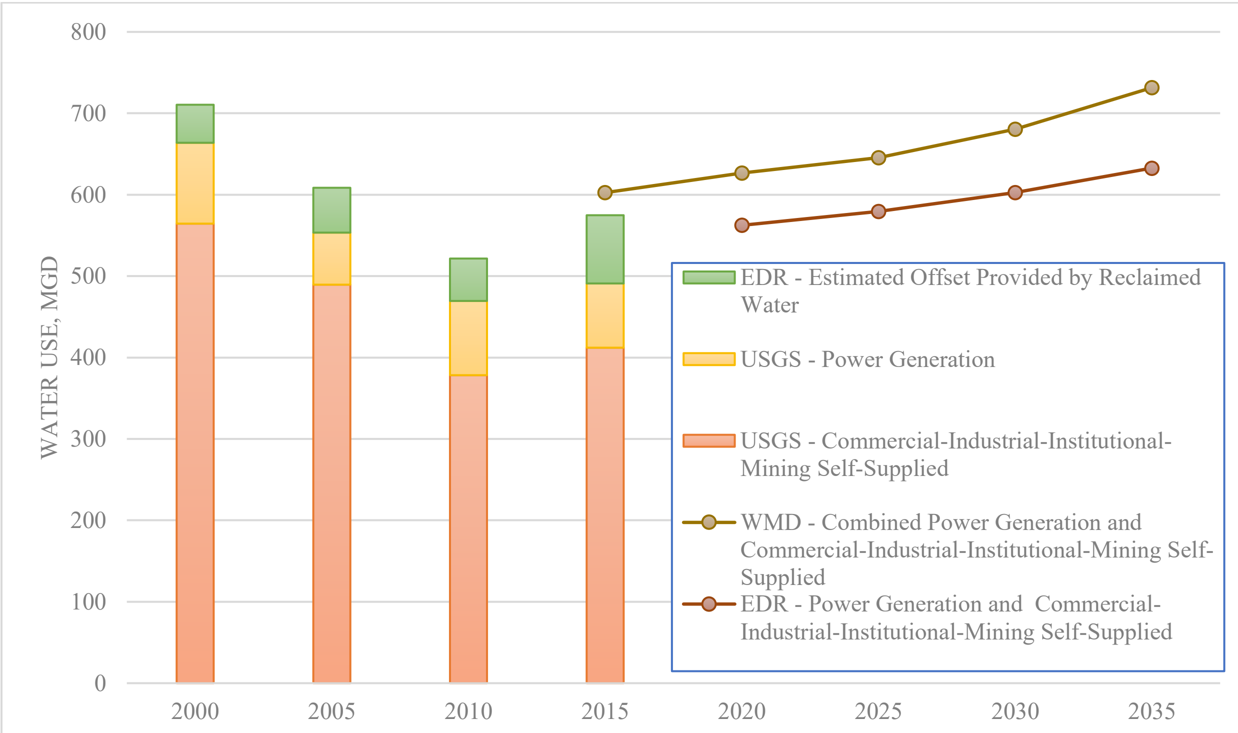
The statistical analysis shows that county water use is positively correlated with mining employment and utility employment.[219] The water use is negatively correlated with the wealth level and residential water billing amounts. Manufacturing earning had a positive sign, but the variable was not statistically significant at a ten percent level.

Note that the model performed poorly for five counties with negligible historical water use and as a result, zero withdrawals were assumed for some or all future years. These were Franklin, Highlands, Indian River, Monroe, and Walton Counties. For three more counties with moderate to high withdrawals, the model predicts significant dips in future water use. Specifically, in Charlotte County, where the historical water use decreased from 2.52 mgd in 2000 to 0.67 mgd in 2015, the model forecasted a significant further decrease in water use. In the EDR forecast, zero water use was assumed for Charlotte County for the planning period. In turn, in Collier County, the historical use fluctuates from 6.00 mgd in 2000 to 1.98 mgd in 2010 to 3.42 mgd in 2015. The model predicts a dip in water use in 2020 – 2025 (the use was assumed to go down to zero), and then an increase to 4.28 mgd in 2035. Finally, for Martin County, where 2000 – 2015 withdrawals were between 16.84 mgd and 29.11 mgd, the model predicts a significant reduction in future water withdrawals likely driven by the projected reduction in the proportion of the county employment allocated to utilities along with a high wealth level. The initial forecasted reduction is to 7.46 mgd for Martin County in 2020 and since further reductions seem implausible, EDR assumed that the withdrawals will stay at this level until 2035. This fine-tuning indicates the need to enhance the prototype model so that it better reflects the water use in various counties and regions. Overall, based on the prototype model, EDR forecasted the water use for the commercial-industrial-institutional-mining and power generation self-supplied categories to stay at approximately the same level as in 2015 with a modest increase. For statewide water use for the commercial-industrial-institutional-mining and power generation self-supplied categories, see Figure 4.3.10.

[See figure on following page]

[219] Utility employment is measured as the share of the total county employment, while mining employment is measured as total number of employees in mining.

Figure 4.3.10 Water Use for the Combined the Combined Commercial-Industrial-Institutional-Mining and Power Generation Self-Supplied Categories: EDR's Preliminary Forecast (mgd)



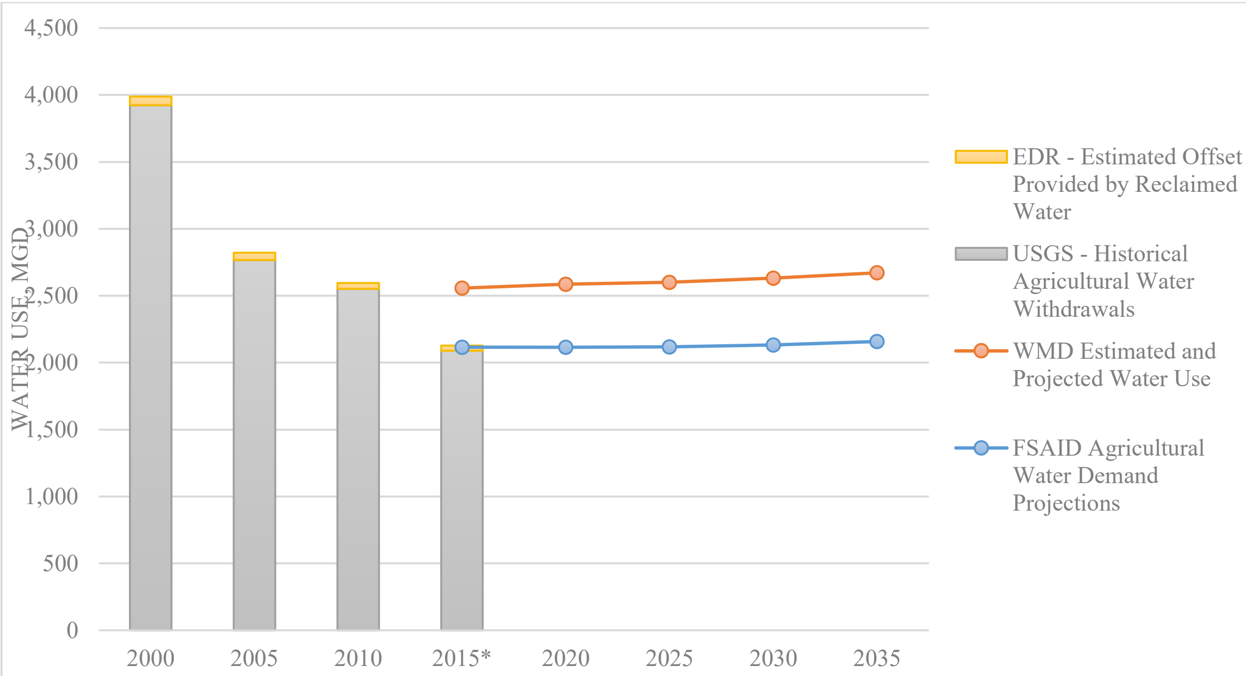
Agricultural Self-Supplied Category

For the agricultural water use analysis, EDR relied on the latest (2019) release of agricultural water demand projections developed by DACS. These projections include average estimated irrigation, freeze protection irrigation, aquaculture, and livestock water use. On the statewide level, the water demand projections available from FSAID are below the projections developed by the WMDs.[220] Therefore, the conservation potential projected by FSAID, which would reduce the forecast even further, was not accounted for in EDR's forecast. For the difference between FSAID and WMD projections for individual water supply planning regions, see Appendix A.7.

[See figure on following page]

[220] As mentioned in other sections of this chapter, the discrepancy is partially explained by the staggered update schedules. WSAs and RWSPs are generally updated every five years, while FSAID projections are updated annually. As of December 2019, draft RWSPs are available for several planning regions. The updated information for these regions will be incorporated in the 2021 Edition, to be consistent with the data in DEP's Regional Water Supply Planning Annual Report.

Figure 4.3.11 Statewide Agricultural Water Use: Historical Withdrawals and Future Use Projections (mgd)



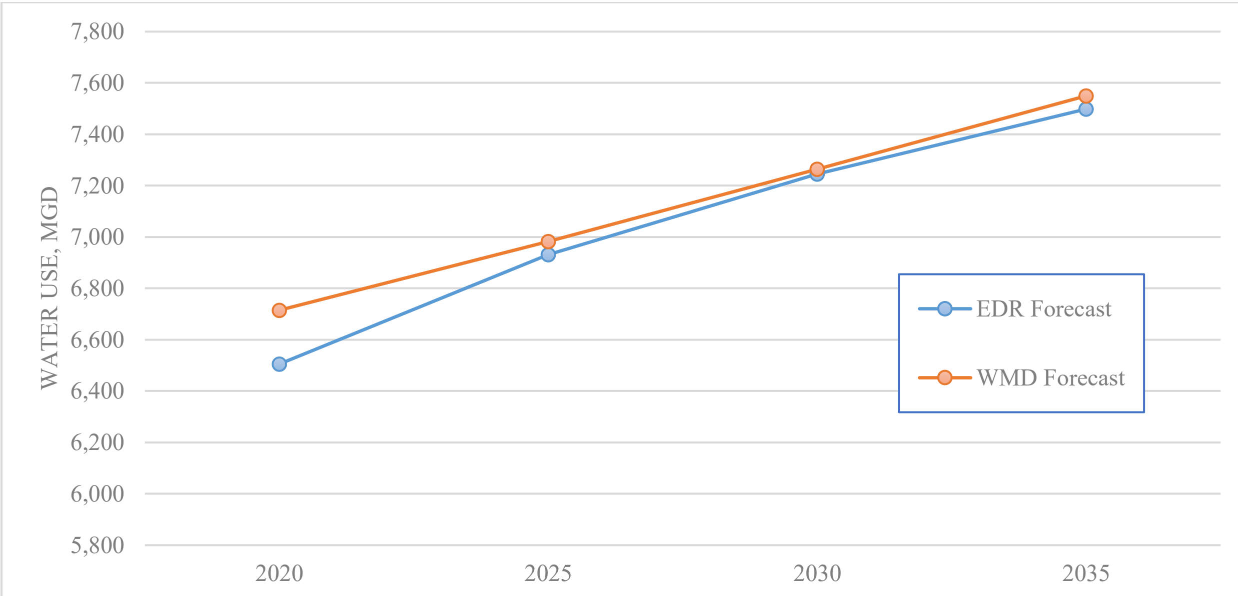
* For FSAID, 2015 estimates are not available, and 2017 values are used instead.

Summary of the Preliminary Forecast Produced by EDR's Prototype Model

The statewide EDR forecast is comparable with those produced by the WMDs as can be seen in Figure 4.3.12. On a statewide level, the total 2035 water demand forecast by EDR is 7,498.39 mgd, which is close to the total demand of 7,549.68 mgd projected by WMDs. The main difference can be attributed to the agricultural self-supplied category that EDR adopted from DACS. While the preliminary forecast produced by EDR for the other categories is also different from the WMDs forecasts, the difference on the statewide level is small.

[See figure on following page]

Figure 4.3.12 Statewide Water Use: Comparison of EDR's Preliminary Forecast and the WMD Forecast (mgd)



As discussed above, EDR's forecast released this year is preliminary; its major function is to identify areas of future research. EDR will continue refining the model in future editions. Critical areas of improvement include: (a) acquiring additional historical data, including annual data if available; (b) enhancing the modeling of demand for reclaimed water; (c) advancing the strategies to reflect the demand of the non-permanent population; (d) considering more advanced statistical methods and a range of alternative model specifications; and (e) exploring additional strategies to capture climate and economic information in the demand model.

4.4 Existing Water Supply Available to Meet the Growing Water Demand

For EDR's expenditure forecast, the water demand projections should be compared with existing water supplies and the need for and pace of developing additional supplies should be identified. DEP published the most recent (2018) summary of WMDs regional water supply planning in August 2019 (DEP 2019a). Appendix A to that publication sums-up the "Estimated Existing Sources Available to Meet Future Demands" in a table format which is shown in Table 4.1.2 above. In that appendix, "Estimated Existing Sources Available to Meet Future Demands" is constrained to not exceed the net demand change in each identified planning area. That appendix also implies that the existing supply can meet the use estimated for the base year throughout the 20-year planning period. This assumption may not hold. Further, as stated above, the "Net Demand Change" value does not include the water that may be needed for the natural systems. Therefore, water projects may be necessary for some areas to meet the base year water demand in addition to the “Net Demand Change.” Existing supplies may also be impacted by saltwater intrusion, requiring additional investments to maintain the supply for existing demand.[221]

Furthermore, no separate quantification of the drought effects on water supply is provided. While some RWSPs and WSAs include discussion of climate change effects, it is not clearly explained how these effects are accounted for in “Estimated Existing Sources Available to Meet Future Demands,” if at all.

Finally, different estimation methods are used to quantify “Estimated Existing Sources Available to Meet Future Demands,” which makes it difficult to compare the values reported for the various supply planning regions.[222] The following estimation methods to quantify “Estimated Existing Sources Available to Meet Future Demands” are utilized:

•***Permitted but unused water (SWFWMD)*****:** This value represents the permitted but unused quantities of surface water, brackish groundwater, and Upper Floridan Aquifer groundwater within each of the District’s four planning regions.[223] In general, the SWFWMD calculates this as the difference between total permitted allocations, which have been determined to not cause harm to the water resources of the area or interfere with existing legal uses, and the currently reported withdrawals of those permittees at the time of RWSP development.[224]

•***Permitted but unused water and unused DEP permitted treatment capacity (SFWMD)***: For SFWMD planning regions, the public supply category is projected to grow, while the other water use categories, such as agricultural self-supply, are expected to remain relatively stable or to decline. Therefore, the assessment of the existing water supply focuses only on the sources available for public supply. To estimate “Existing Sources Available to Meet Future Demand,” with the exception of the Upper Kissimmee Basin Planning Area which is included in the CFWI, the SFWMD considers the permitted but unused water and unused DEP permitted treatment capacity. For each supplier, projects are then identified to meet the difference between the projected demand[225] and the permitted allocation or existing treatment capacity.[226]

•***Currently permitted water for public supply (NWFWMD)***: The NWFWMD uses the currently permitted volumes of water for public supply to estimate “Existing Sources Available to Meet Future Demand.”

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[221] For example, “Water Level and Salinity Analysis Mapper” developed by USGS shows that groundwater chloride concentrations trend upward in southeast Florida (see https://fl.water.usgs.gov/mapper/). This increase in salinity may imply the need to relocate existing wellfield, which may impact existing water supplies.

[222] The WMDs are in the process of updating several of their RWSPs. This description refers to the methods used in the RWSPs/WSAs summarized in DEP (2019a).

[223] Potential water supplies from the surficial aquifer, seawater desalination, and reclaimed water are accounted for among the alternative water supply options.

[224] For each permittee, SWFWMD evaluates the level of water use as either a five-year average of reported withdrawals or a single year estimate.

[225] Utilities apply various methodologies to forecast future demand based on the number of people per connection, the number of connections, and other characteristics of their service areas. SFWMD has its own methodology to project demand (based on BEBR population projections, five-year average per capita use, etc.). As a part of the RWSP development process, SFWMD and utilities discuss and agree to the amount of water needed for the region.

[226] Note that the utilities are planning and reporting based on their peak capacity. The projects identified by the public supply companies also focus on projected peak capacity since utilities need to meet peak future demand. Unless utility-specific coefficients are estimated, the average capacity is approximately 80 percent of the peak capacity.

•***Hydrogeologic computer models of planning-level groundwater withdrawal scenarios (CFWI, NFRWSP, SJRWMD-CSEC, and SR-outside NFRWSP)***: Hydrogeologic computer models are used to examine groundwater withdrawal scenarios corresponding to the projected demands on the planning-region level for public supply (PS), domestic self-supply (DSS), commercial-industrial-institutional-mining self-supply (CII or CIIM), recreational landscape irrigation self-supply (REC), agricultural self-supply (AG), and power generation self-supply (PG) categories. The models are used to determine the estimated maximum withdrawal levels for which further increases in withdrawals may be constrained by at least one natural system (*e.g.*, a violation of a minimum flow or minimum water level).[227] For the CFWI, their model[228] indicated that, on a water supply planning level, alternative sources or conservation would be needed to meet all "Net Demand Change." For NFRWSP, several groundwater withdrawal scenarios were assessed using a hydrogeologic model.[229] For all scenarios considered, water withdrawals were constrained by at least one natural system. Therefore, "Estimated Existing Sources Available to Meet Future Demands" for NFRWSP were listed as "Not Quantified." It is possible that water projects must be completed in the NFRWSP area to meet the base year water demand in addition to the "Net Demand Change."

EDR estimated the existing water supply by combining the water demand for the base year and "Estimated Existing Sources Available to Meet Future Demands" as shown in Table 4.4.1. Note that these are planning-level estimates used by EDR for forecasting purposes and are not appropriate for the level of specificity and analysis required for permitting decisions.

[See table on following page]

[227] While water may be available on a permit-by-permit basis, the hydrogeologic modeling provides a planning-level estimate of how much water the WMDs must identify through conservation or AWS project options.
[228] The East Central Florida Transient Groundwater Flow Model.
[229] The North Florida-Southeast Georgia regional groundwater flow model, with groundwater being the traditional water source for the region.

Table 4.4.1 Summary of Water Supply Assessments and Regional Water Supply Plans

Water Management District	Water Supply Planning Region	Estimated Current Water Use (mgd)*	Estimated Existing Sources Available to Meet Future Demands (mgd)	Estimated Existing Total Supply (mgd)
(1)	(2)	(3)	(4)	(5) = (3) + (4)
NWFWMD	NW-II	81.3	18.1	99.4
	NW-III	79.5	8.9	88.4
	NW-I, NW-IV, NW-V, NW-VI, & NW-VII	212.8	12.0	224.8
SJRWSM	SJ-CSEC	343.7	50.8	394.5
SRWMD	SR-outside NFRWSP	100.6	21.8**	122.4**
SWFWMD	SW-NR (excluding CFWI)	150.9	23.9	174.8
	SW-TB	411.2	63.8	475.0
	SW-HR (excluding CFWI)	117.3	5.8	123.1
	SW-SR	304.6	46.8	351.4
SFWMD	SF-LKB	204.5	17.5	222.0
	SF-UEC	279.15***	71.8	350.9
	SF-LEC	1,813.99***	143.0	1,957.0
	SF-LWC	1,030.31***	171.1	1,201.4
SJRWMD, SWFWMD, and SFWMD	CFWI	850.5	0.0	850.5
SJRWMD and SRWMD	NFRWSP	555.3	Not Quantified****	555.3

* These estimates are calculated water use in 2015. The exceptions are SF-UEC, SF-LEC, and SF-LWC regions, for which 2020 projected water use is utilized to be consistent with DEP (2019a).
** These values may be preliminary. Based on SRWMD WSA (2018), the existing sources of water are determined not to be adequate to supply all current and future reasonable beneficial uses and to sustain the water resources and related natural systems for the planning period. Water supply planning and water resource caution area are proposed (referred to as the "Western Planning Region" in the WSA). More accurate estimates will become available upon completion of the water supply planning.
*** Note that these values refer to 2020 water use, and therefore, they are different from the estimates reported for 2015 in Table 2. Here, water use in 2020 is selected to be consistent with 2020–2040 estimates provided for "Estimated Existing Sources Available to Meet Future Demands" in DEP (2019a).
**** Assumed to be 0 mgd.

4.5 Inferred Supply Shortage and Additional Water Needs

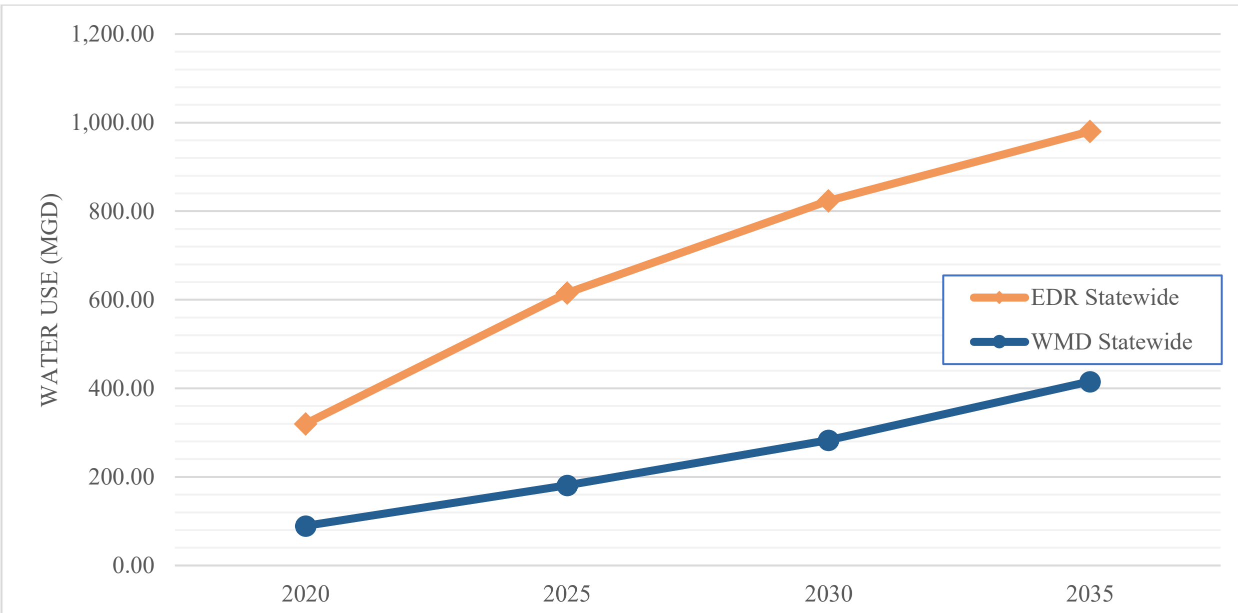
Based on the WMDs' water demand projections for 10 water supply planning regions, estimated existing water supplies are not sufficient to meet the 2035 expected water demand as shown in Table 4.1.2 above.[230] The most significant differences between existing water supplies and future use are found in the fast-growing CFWI, which includes Orlando, and the NFRWSP, which includes Jacksonville. Overall, every WMD in Florida identified at least one planning region where the estimated increase in demand exceeds existing water supplies. While water conservation can partially offset the rise in water demand, it cannot eliminate the need for developing alternative water supplies in the state, and most notably, in the CFWI, NFRWSP, and SW-NR (excluding CFWI) planning regions.

EDR's preliminary demand forecast is developed for individual counties and then aggregated to a statewide level. Since the water supply is available for specific supply planning regions, EDR

[230] Note that "Conservation Projection to Meet Future Demands (mgd)" estimated by the WMDs is not included in the inferred water supply shortage calculations.

made general assumptions about the split of the county forecasts among the regions.[231] After the demand and supply estimates are compared for each region, EDR projected the total inferred supply shortage for the state as a whole. The EDR analysis implies that by 2035, the inferred statewide supply shortage will be 980.11 mgd, which is more than twice the inferred shortage projected using WMD data as shown in Figure 4.5.1. It is important to emphasize that EDR's forecast is still in the testing stage and will be further refined in future editions. These revisions may result in changes in EDR's inferred shortage for certain planning regions, which could more closely align EDR's inferred shortage forecast to WMD data.

Figure 4.5.1 Inferred Supply Shortage: Comparison of WMDs' Data and EDR's Preliminary Projections (mgd)



Despite the potential deficiencies, EDR's preliminary water demand and inferred supply shortage forecasts lead to the following discussion points:

- The preliminary forecasts emphasize the importance of identifying water supply in the quantities not just sufficient but exceeding the WMDs' demand projections, even for the regions with no inferred supply shortage in the planning horizon. Such analysis of the existing water supply would also facilitate the assessment of the expenditures necessary for meeting water demand in drought scenarios.

[231] In 2019, by request from EDR, BEBR completed a special project titled "An Analysis of Methods to Allocate BEBR's County Population Estimates and Projections to Water Management District Boundaries." In this report, several relatively simple methods for making small-area population estimates and projections are described and tested in six SWFWMD counties that are split by the district's boundaries. It is shown that when the results were aggregated to the county and district levels, these simple methods often provided estimates and projections that were similar to those produced by an elaborate, parcel-level population forecasting model currently available for SWFWMD. EDR foresees using the relatively simple methods discussed by BEBR for making population projections for sub-regions in the next editions of the report.

- The difference between the EDR and WMDs demand forecasts demonstrates how sensitive the demand projections can be to the assumptions regarding future population growth and per capita use. Over the next year, it is important for EDR to further refine the per capita water use estimates used in the demand projections.

- Despite the differences between the WMDs' forecast and EDR's preliminary forecast, both project increases in water demand in all districts. Investments in water supply remains an important priority statewide.

As mentioned above, EDR will focus on refining and improving the demand forecast in future editions of this report. Particular emphasis will be placed on the water supply planning regions where the differences are currently the greatest.

4.6 Expenditure Forecasts

This section discusses the forecast of the funding needs to meet the increase in water demand over the 20-year planning horizon. The analysis is based on the dataset assembled by the Florida Department of Environmental Protection (DEP) and the five water management districts (WMDs) as a part of the regional water supply planning process. The dataset contains information about projects implemented in the past and project options that could be implemented in the future to meet the increase in water demand and to protect or restore natural water systems. Like the approach used in the 2019 Edition, the forecast relies on a statistical model that relates project funding to the project size, type, and region of implementation. EDR used the database updated and published by DEP in 2019.

In comparison to the 2019 Edition, five critical modifications to the analysis are made. First, the funding needs and water and reuse volumes for multi-phased projects are accounted for more precisely. Second, a broader range of project types is considered in the expenditure forecast, including relatively inexpensive options such as stormwater and groundwater recharge. Third, for completed projects, EDR more carefully analyzes the currently available volumes of water or reuse flow and the future volumes reported for the project completion stage. Fourth, the statistical model developed to examine historical AWS project costs is estimated using robust regression as opposed to the ordinary least squares approach used in the 2019 Edition. Fifth, a preliminary estimate of the expenditures needed for natural system protection or restoration is presented.

Overall, \$0.3 to \$1.8 billion will be needed to meet the statewide increase in water demand over the next 20 years given the inferred supply shortage identified in DEP (2019a). The midpoint of the expenditure range is \$1.0 billion. If EDR's preliminary water demand forecast is considered, the projected expenditures are higher (\$1.4 to \$3.4 billion). These projections are generally comparable with the estimate published in the 2019 Edition (\$1.1 to \$2.2 billion). Note that these expenditure forecasts focus on the need to implement projects that satisfy the increase in water demand. Expenditures for maintaining or replacing existing drinking water infrastructure to meet the present demand are not included. For a general overview of drinking water infrastructure needs, see Chapter 6 of this edition.

In addition, the projects that implement the minimum flow or minimum water level goals for the natural systems with existing recovery or prevention strategies require $7.8 billion, some portion of which is included in the total expenditures immediately above.[232] Critical issues that should be addressed in 2021 to further refine the forecast are discussed below.

Data Used in the EDR Expenditure Forecast

As part of the RWSPs developed in accordance with section 373.709, Florida Statutes, WMDs are required to compile a list of water supply development and water resource development project options, including water conservation. The water supply development component must include project options, such as traditional and alternative water supply projects, which are technically and financially feasible. Local governments, public and private utilities, regional water supply authorities, multi-jurisdictional water supply entities, self-suppliers, and others may choose from these project options for water supply development. The water that can be made available from these projects (total capacity) must exceed the water supply needs for all existing and future reasonable-beneficial uses within the 20-year planning horizon. In contrast, the water resource development component must include projects that support water supply development for all existing and future reasonable-beneficial uses and the natural systems. In addition, pursuant to section 373.0421, Florida Statutes, the WMDs must also include in each RWSP any water supply development or water resource development project identified in an applicable recovery or prevention strategy (RPS). The RPS must include a phased-in approach for development of additional water supplies, implementation of conservation strategies, and other actions to achieve recovery to an established minimum flow (for rivers, streams, estuaries, and springs) or minimum water level (for lakes, wetlands, and aquifers) or to prevent the existing flow or water level of such water resources from falling below the established minimum levels.

The project options identified in the current RWSPs, as well as projects funded in the past, are summarized in Appendix C of DEP (2019a) which is referred to below as "the project appendix". The project appendix is a spreadsheet, with rows describing projects or their phases and columns presenting the following information (if available):

- FDEP Unique ID
- WMD
- Year First Added to RWSP/RPS
- District Project Number
- Phased or Linked Project
- Project Name
- Cooperating Entity
- Latitude
- Longitude
- Project Type
- Land Acquisition Component
- Project Description
- Project Status
- Construction Beginning Date
- Construction Completion Date
- Construction Completion Year
- Storage Capacity Created (MG)
- Distribution / Transmission Capacity Created (mgd)
- Fiscal Year Included in 5-Year WRDWP, If Applicable
- Historic District Expenditures
- WRDWP Current FY Funding
- WRDWP Current FY+1 Funding
- WRDWP Current FY+2 Funding
- WRDWP Current FY+3 Funding
- WRDWP Current FY+4 Funding
- Budget Reference
- WRD or WSD (optional)
- Initial fiscal year funded
- Most recent fiscal year funded
- WPSP Funding
- Springs Funding
- Other state funding

[232] This estimate excludes Everglades restoration expenditures. An overview of expenditures related to Everglades restoration can be found in Chapter 7.

- Waterbody Benefited
- RWSP Region Supported
- RWSP or RPS Year Project Last Identified
- Primary MFL Supported
- Ancillary MFL Supported
- MFL RPS Supported, If Applicable
- Quantity of Water Made Available to Date (mgd)
- Quantity of Water Made Available on Completion (mgd)
- Reuse Flow Made Available to Date (mgd)
- Reuse Flow Made Available on Project Completion (mgd)
- Total State Funding
- Total District Funding
- Total Land Acquisition
- Funding by District or State
- Cooperating Entity Match
- Total Construction Costs
- Project Total
- Projected Total Funding (for RWSP/RPS Options Only)
- Comments
- Explanation for 5-Year WRDWP

The DEP project appendix includes 1,623 projects or project phases (referred to as "project items" below). For each project item, the "Project Status" column indicates whether the item is canceled, completed, in construction or underway, in design, on hold, or an RWSP or RPS option only. The "Project Total" column provides information about the total project funding by the state (if any), district, and cooperating entity (*e.g.*, county, city, water utility, farm, homeowner association, or golf club). This information is not always reflective of the total implementation cost of the project since it generally does not include information about land purchases[233] or the costs of project components ineligible for funding. This information also excludes funding provided by federal agencies, if any. EDR assumes, however, that the funding from the state, district, and cooperating entity accounts for most of the implementation cost.[234]

Further, for the projects that are listed as RWSP or RPS option only, the "Projected Total Funding (for RWSP/RPS Options Only)" column summarizes information about potential funding requirements (*i.e.*, planning-level cost estimates). This "Projected Total Funding" is an estimate only and is not verified until the project is submitted for cost-share funding to begin design or implementation. Still, this projected funding represents the best available information regarding the future funding needs and, therefore, EDR included it in the analysis. Below, the combined "Project Total" and "Projected Total Funding (for RWSP/RPS Options Only)" is referred to as the "project total ($)". EDR assumes that the "project total ($)" is a close representation of the project implementation cost and all funding needs.[235]

The columns "Quantity of Water Made Available on Completion (mgd)," "Quantity of Water Made Available to Date (mgd)," "Reuse Flow Made Available on Project Completion (mgd)," and "Reuse Flow Made Available to Date (mgd)" were used to characterize the volume of water that can be created by the projects. Specifically, for projects identified as "Complete," EDR used the volumes of the water or reuse flow reported as available today, and if these were not provided,

[233] As discussed below, 636 projects with relevant information were selected for the expenditure analysis. Out of these 636 projects analyzed, 569 projects were marked with "No" for the "Land Acquisition Component" in DEP (2019a). Only six projects were marked with "Yes"; these were five groundwater recharge and one surface water projects. Out of 636 projects, 61 projects were missing the relevant information. ANOVA showed no difference in the mean "project total ($)" and mean project size between Yes and No responses for the "Land Acquisition Component." Since 61 projects had missing information about the land acquisition component, this variable was not included in the regression analysis used by EDR to forecast expenditures.

[234] See additional discussion of infrastructure cost sharing in Chapter 6.

[235] To check this assumption, EDR examined a subset of project items for which "Total Construction Costs" were provided. These were only project items listed as "Complete" (based on the "Project Status" column). Among 891 project items for which both "Total Construction Costs" and "Project Total" were available, only three projects (0.2 percent) had "Total Construction Costs" exceeding "Project Total." For 680 projects (76.3 percent), the two values were equal. For the remaining 208 projects (23.3 percent), "Project Total" surpassed "Total Construction Costs." On average, "Total Construction Costs" were 95.9 percent of the "Project Total." This correspondence between "Project Total" and "Total Construction Costs" supports EDR's assumption that the "project total ($)" is a close approximation of the total implementation cost, at least for the completed projects.

then the volumes expected upon completion were used. For the projects that had not yet been completed, EDR used the estimates of volume available upon completion.

A large number of projects were described as “Reclaimed Water (for potable offset)”, and many of them were irrigation projects (Figure 4.6.1). “Reclaimed Water (for potable offset)” projects included the corresponding “Reuse Flow Made Available to Date (mgd)” and “Reuse Flow Made Available on Project Completion (mgd).” An important caveat is that reclaimed water is not always a direct substitute for water supplied by other sources. As stated in DEP (2015), “[n]ot all reuse types are created equal in terms of benefiting 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.”[236]

Figure 4.6.1 “Reclaimed Water (for potable offset)” Projects: Word Cloud Summary of Information Provided in the "Project Description" Column*

* This word cloud was created using an Add-On for Google Docs, after removing: reclaimed, water, project, mgd, reuse, approximately, provide, includes, mg, construction, and construct.

EDR reviewed the statewide “Total Flow” and “Total Offset” data for 2000, 2005, 2010, and 2015 from the Annual Reuse Inventory reports available from DEP (DEP 2019b).[237] On average, 1.00 mgd of reclaimed water was estimated to offset from 0.54 mgd to 0.56 mgd of water from traditional sources. While the offset depends on the type of reclaimed water use, EDR assumed that from 1.00 mgd of the “Reclaimed water (for potable offset),” 0.55 mgd contributes to meeting the net demand change in a region. This assumption may lead to over or underestimating the funding needs of reclaimed water projects. Depending on data availability, future editions of this report may differentiate the offset coefficient based on project locations and specifications.

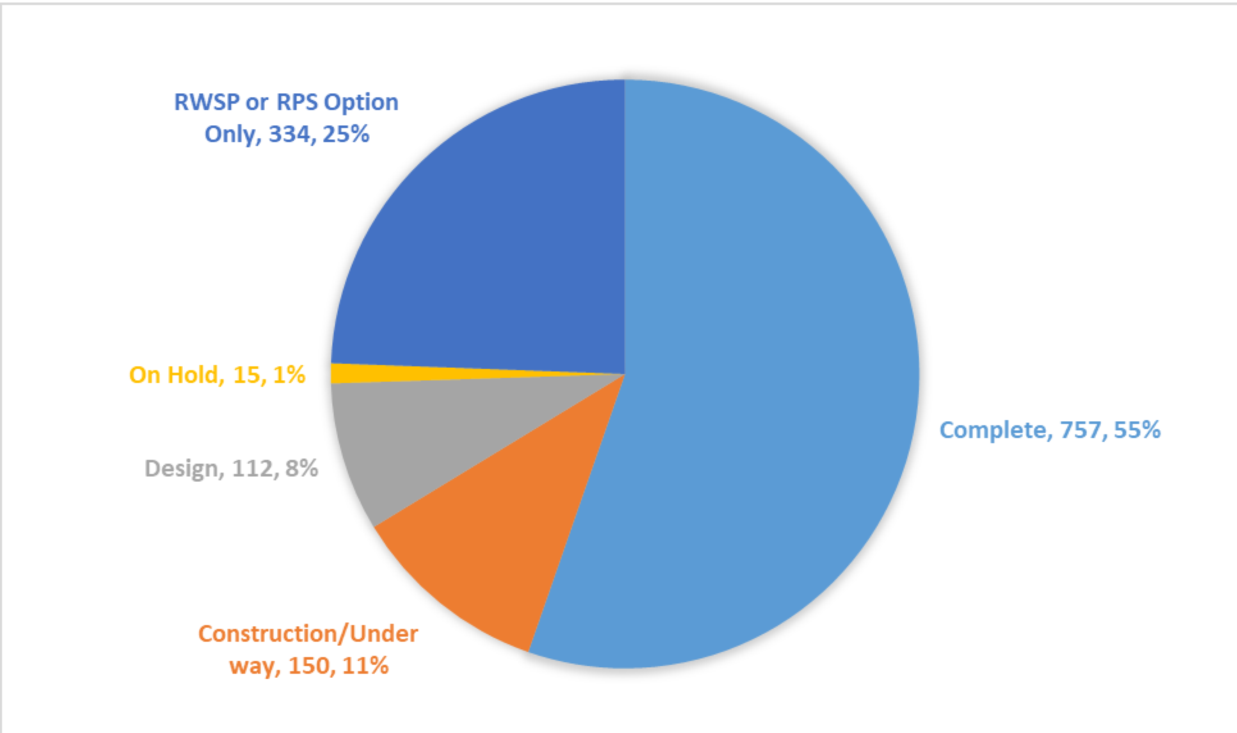
EDR indexed “project total ($)” to $2019 (see Appendix A.8). The effect of inflation on the cost and funding needs can be significant given that the earliest completion date of a project item listed in the project appendix was 2006. EDR also examined whether a project item on the list was a phase of a larger project. For example, the project appendix may list the stages of constructing

[236] DEP. 2015. 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, at p. 21, available at: https://floridadep.gov/sites/default/files/SB536%20Final%20Report.pdf. (Accessed December 2019.)

[237] These years were selected to match the years used by the U.S. Geological Survey for the assessment of Florida water withdrawals (USGS 2019).

water treatment, storage, and water distribution infrastructure as separate project items. Out of 1,623 project items, 349 included information in the column "Phased or Linked Project." After review and integration of related project items, 1,417 projects were identified. Among these, 49 projects were listed as "canceled" (3.45 percent). They were removed from the list, leaving 1,368 projects for the analysis. More than one-half of these projects are completed, while nearly one-fourth are RWSP or RPS options only as shown in Figure 4.6.2.

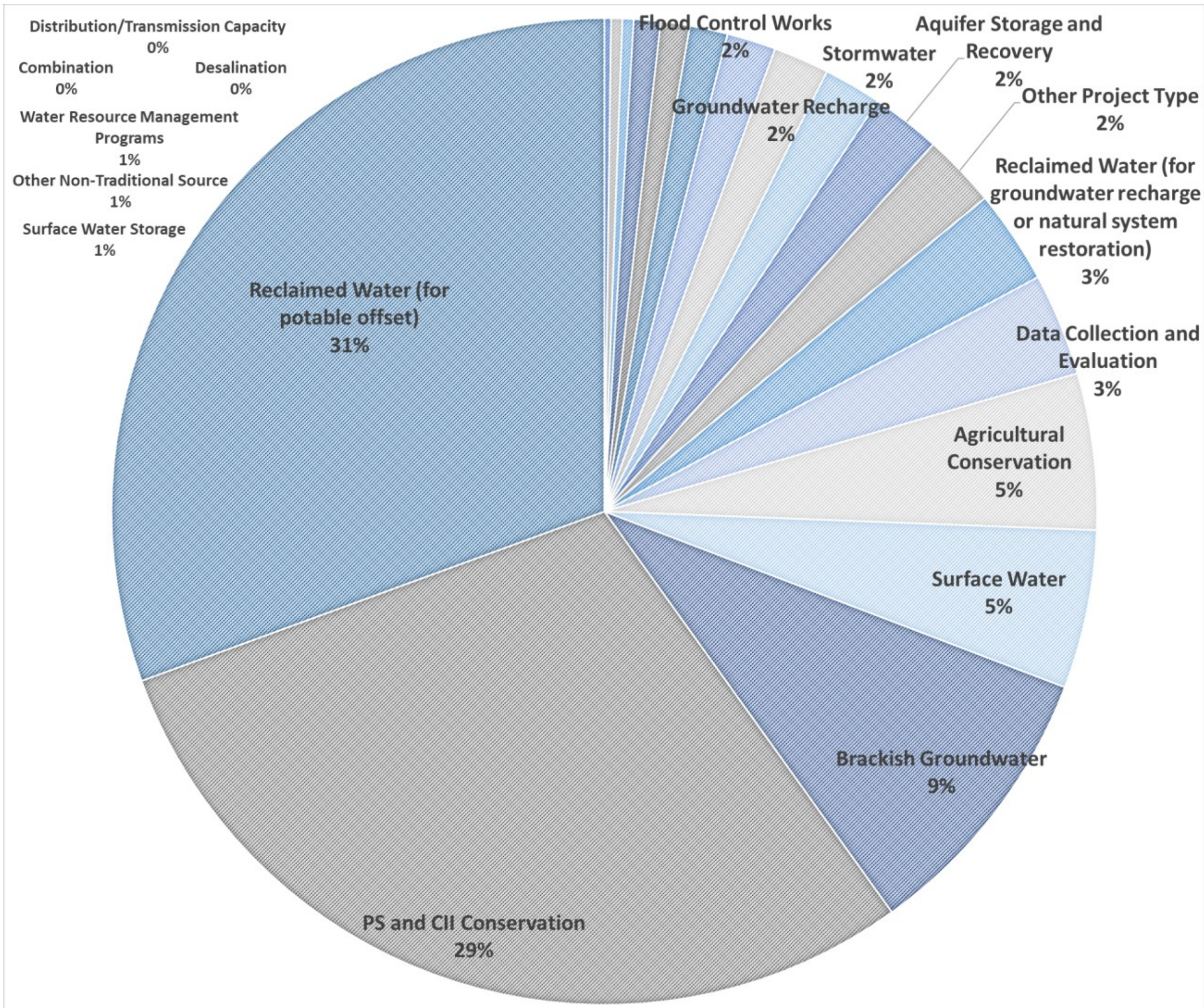
Figure 4.6.2 Project Count for Various Project Statuses (N=1,368)



Based on "Project Type" column, approximately one-third of the projects were conservation projects as shown in Figure 4.6.3. Reclaimed water for potable offset accounts for another third of the projects. Brackish groundwater and surface water projects account for 14 percent of the projects on the list.

[See figure on following page]

Figure 4.6.3 The Number of Projects for Various Project Types (N=1,367)*



* For one project (FDEP Unique ID = SJWS00286A), no "Project Type" is specified. This project is listed as being in design, and the "Project Name" column describes it as "Cost Share Program Placeholder." The "Project Description" column contains the following: "Funds are for projects approved during the District's annual application process for the District's general cost share program to include projects that will be listed in the Water Resource Development Work Program and Alternative Water Supply Plan." This project is excluded from the analysis.

Following the approach used in DEP (2019a) and summarized in Table 4.1.2 above, EDR considered conservation projects (both "agricultural conservation" and "PS and CII conservation") separately (see Appendix A.12). For the projects other than conservation (referred to below as non-conservation projects), EDR examined the volume of water or reuse flow that was created in the past or could potentially be created in the future. Out of 897 non-conservation projects, a non-zero quantity of water or reuse flow was reported for 709 projects. For another 30 projects, a non-zero quantity for "Storage Capacity Created (MG)" or "Distribution / Transmission Capacity Created (mgd)" was identified.[238]

[238] For the remaining 158 projects (or 17.61 percent of 897 non-conservation projects), water, reuse flow, "Storage Capacity Created (MG)", and "Distribution / Transmission Capacity Created (mgd)" were zero, missing, or "TBD", and so they were disregarded

For these 739 non-conservation projects with non-zero water, reuse flow, storage, or distribution / transmission capacity, EDR examined how the project types, numbers, and the volumes of water or reuse flow varied among the water supply planning regions. As identified in Table 4.6.1, the greatest numbers of projects were identified for CFWI (147), while no projects were listed for NWF-III. Similarly, among "RWSP or RPS Option Only" projects, many were from CFWI (66), while no projects were listed for any of the NWFWMD planning regions. For the Central Springs East Coast (SJR-CSEC), many projects were in design or construction/underway while several projects were on hold for NFRWSP.

Table 4.6.1 Sample Project Number, by Water Supply Planning Region*

Planning Regions	Number of Projects					
	Complete	Design	Construction / Underway	On Hold	RWSP or RPS Option Only	**Total**
NW-II	6	–	–	–	–	**6**
NW-III	–	–	–	–	–	**0**
NW-I, NW-IV, NW-V, NW-VI, & NW-VII	6	1	1	–	–	**8**
SJ-CSEC	38	15	10	1	6	**70**
SR-outside NFRWSP	1	–	4	–	–	**5**
SW-NR (excluding CFWI)	7	3	1	–	20	**31**
SW-TB	34	6	10	–	51	**101**
SW-HR (excluding CFWI)	1	–	2	–	11	**14**
SW-SR	26	3	10	–	37	**76**
SF-LKB	6	–	–	–	–	**6**
SF-UEC	12	–	–	–	16	**28**
SF-LEC	49	–	–	–	37	**86**
SF-LWC	38	–	4	–	20	**62**
CFWI	63	4	13	1	66	**147**
NFRWSP	47	15	14	5	18	**99**
Total	**334**	**47**	**69**	**7**	**282**	**739**

* This tables excludes conservation project types. Number of Projects includes projects with non-zero water, reuse flow, storage, or distribution / transmission capacity.

Overall, among the 739 non-conservation projects, 282 (or 38.16 percent) were "RWSP or RPS Option Only." If all of the projects were implemented, 1,384.80 mgd of water or reuse flow could be created. If one accounts for the imperfect substitution among reclaimed water and water from the other project types (using the offset coefficient of 0.55), the total estimated volume becomes 1,208.60 mgd.[239] This total volume level would be more than sufficient to fill the statewide inferred supply shortage identified by the WMDs (415.51 mgd) or EDR (980.11 mgd). Note, however, that although the total volume created by these projects exceeds the statewide inferred supply shortage,

from further analysis. Among these projects, approximately one-fourth were "Data Collection and Evaluation" and almost one-fifth were "Reclaimed Water (for potable offset)." By project status, more than one-half were completed projects.

[239] In addition, these "RWSP or RPS Option Only" non-conservation projects identified a total "Storage Capacity Created (MG)" of 900 million gallons, and a total "Distribution / Transmission Capacity Created (MGD)" of 10.5 mgd.

for selected regions, the inferred supply shortage cannot be met with the projects currently identified in the project appendix when conservation projects are excluded.

Moreover, part of this water volume may be intended to restore natural systems and, therefore, should not be applied to meeting the water demand increase. As shown in Table 4.6.2, more than one-half of the "RWSP or RPS Option Only" projects were linked to RPSs that implemented established minimum flow or minimum water levels (MFLs). The "RWSP or RPS Option Only" projects *not* associated with any RPS accounted for 773.47 mgd of water or reuse flow (or 654.04 mgd, accounting for the 0.55 offset coefficient). This volume was still significantly higher than the statewide inferred supply shortage identified using the WMD data (415.51 mgd). For specific water supply planning regions, the exclusion of the projects associated with RPSs significantly reduced the estimated volume of water and reuse flow associated with "RWSP or RPS Option Only."

Table 4.6.2 "RWSP or RPS Option Only" Projects, by Applicable Recovery or Prevention Strategies*

MFL RPS Supported**	Number of Projects	Total Volume of Water and Total Reuse Flow (mgd)	Total Volume of Water and Total Estimated Offset Provided by Reclaimed Water (mgd)***
MFL Recovery Strategies: Total	**151**	**588.23**	**531.47**
Dover/Plant City Water Use Caution Area (WUCA)	2	13.55	7.45
Lower Santa Fe and Ichetucknee River (LSFIR)	9	19.06	18.45
Northern Tampa Bay WUCA	31	189.52	170.66
Northern Tampa Bay WUCA and Lower Hillsborough River	2	2.00	1.10
Northern Tampa Bay and Dover/Plant City WUCA	4	12.00	11.10
Southern WUCA	103	352.10	322.71
MFL Recovery and Prevention Strategy: Total	**5**	**15.60**	**15.60**
Volusia	5	15.60	15.60
MFL Prevention Strategy: Total	**1**	**7.50**	**7.50**
Silver Springs	1	7.50	7.50
MFL RPS Not Applicable: Total	**125**	**773.47**	**654.04**
Overall Total	**282**	**1,384.80**	**1,208.61**

* Agricultural, public supply, and commercial-industrial conservation projects are excluded. Only the projects for which non-zero water, reuse flow, storage, or distribution / transmission capacity are identified.
** Based on the MFL RPS nomenclature used in the DEP project appendix.
*** The offset for the reclaimed water projects (for potable water offset) is estimated using the 0.55 offset coefficient.

Project Types Assumed for the EDR Expenditure Forecast

To forecast the expenditures, it was essential to identify the project types to be used to meet the inferred supply shortage in each region. The project status "RWSP or RPS Option Only" includes a range of projects; however, the choice of a project could depend on its compatibility with the existing supply options, infrastructure, or other factors. Therefore, instead of using specific lower cost "RWSP or RPS Option Only" projects in the expenditure forecast (*e.g.*, the project options that can meet the inferred supply shortage with the least cost), EDR identified the most common project categories in each region, and used the costs for these project categories to forecast the statewide expenditures.

EDR concluded that for four water supply planning regions, "RWSP or RPS Option Only" projects could not produce enough water to meet the inferred supply shortage identified by WMDs: NW-II, SJR-CSEC, CFWI, and NFRWSP (Table 4.6.3). This result implies that the projects in design, construction/underway, on hold, or recently completed are likely included in a WMD's assessment of meeting future demand, which would reduce the inferred supply shortage calculated by EDR.[240]

Table 4.6.3 Total Volume of Water or Reuse Flow for the Projects Other Than Conservation, by Water Supply Planning Regions*

Planning Regions	Total Volume of Water and Total Reuse Flow (mgd)*					Inferred Supply Shortage, based on WMDs Forecast (mgd)	Conservation Projection to Meet Future Demands (mgd)**
	Complete	Design	Construction / Underway	On Hold	RWSP or RPS Option Only		
NW-II	17.4	–	–	–	–	**1.4**	6.5
NW-III	–	–	–	–	–	**0.0**	9.5
NW-I, NW-IV, NW-V, NW-VI, & NW-VII	16.3	0.6	0.9	–	–	**0.0**	3.6
SJ-CSEC	48.6	66.0	21.0	0.0	**23.1**	**28.0**	33.6
SR-outside NFRWSP	0.5	–	0.0	–	–	**0.0**	10.9
SW-NR (excluding CFWI)	4.3	2.9	1.7	–	**95.2**	**27.8**	23
SW-TB	45.0	11.6	31.7	–	**320.0**	**0.0**	52
SW-HR (excluding CFWI)	0.1	–	0.8	–	**32.3**	**2.5**	4.4
SW-SR	27.8	0.1	16.8	–	**174.0**	**3.4**	18.8
SF-LKB	3.3	–	–	–	–	**0.0**	0
SF-UEC	56.0	–	–	–	**214.3**	**0.0**	14.1
SF-LEC	217.8	–	–	–	**291.2**	**6.7**	102.4
SF-LWC	208.2	–	176.3	–	**77.0**	**0.0**	26.3
CFWI	223.3	3.5	50.4	17.0	**112.2**	**233.6**	36.8
NFRWSP	78.6	33.9	9.3	9.1	**45.5**	**112.2**	40.7–53.0
Total	**946.9**	**118.7**	**308.8**	**26.1**	**1384.8**	**415.5**	**382.6–394.9**

* Total volume is for projects, other than conservation projects, for which non-zero water, reuse flow, storage, or distribution / transmission capacity is identified. For reclaimed water projects, total reuse flow is accounted for (the offset coefficient of 0.55 is disregarded). Some of these projects may be intended to protect and restore the natural systems rather than to meet the net demand change.
** The estimate is based on Appendix A of DEP (2019a).

[240] This result also implies that many regions placed a significant emphasis on water conservation to offset the demand increase.

Next, EDR examined 461 projects identified as "RWSP or RPS Option Only," "On Hold," "Construction / Underway," and "Design," and "Complete"[241] as shown in Appendix A.9. For the projects identified as "Complete," only those projects with completion dates in 2015-2019 were considered. In all supply planning regions, "Reclaimed Water (for potable offset)" was a major project type. In south and central Florida, brackish groundwater projects could also play a critical role in serving the increase in water demand. In addition, SWFWMD emphasizes the use of stormwater projects. Further, groundwater recharge, surface water, and surface water storage projects stood out as important categories for SWFWMD and SJR-CSEC. A relatively large volume of water was also associated with "Other Non-Traditional Sources" in SJ-CSEC, and "Other Project Types" in NW-II.[242]

Using this information, EDR identified the project types that could produce at least one-half of the inferred supply shortage estimated by WMDs for each region. These project types were shared with the WMDs' staff, and based on their feedback, the project types expected to meet the net demand increase in the regions were selected (Table 4.6.4). Note that the final list of project types is significantly broader than the list considered in the 2019 Edition, which primarily included reclaimed and brackish groundwater projects.

[See table on following page]

[241] The following project types were excluded: "Reclaimed Water (for groundwater recharge or natural system restoration)," "Flood Control Works," and "Distribution / Transmission Capacity." These project types were assumed to be for purposes other than meeting future demand. For "Distribution / Transmission Capacity" type, many of the projects contained missing and zero quantities of water or reuse flow to be made available.

[242] Examples of "Other Non-Traditional Sources" included an alternative inland well-field, conversion from Upper Floridan Aquifer (UFA) to Lower Floridan Aquifer (LFA), pond storage, agricultural wastewater reuse, and stormwater harvesting. "Other Project Types" included improvements at water treatment plants (WTPs) to increase water reuse (e.g., the construction of a backwash recovery system or installation of an ozone treatment system to treat concentrate); development of a new groundwater source to move the withdrawals away from a spring site; an expansion of the groundwater use from a Surficial Aquifer System (SAS), etc.

Table 4.6.4 Project Types Considered in the EDR Expenditure Forecast*

Planning Regions	Aquifer Storage and Recovery	Brackish Groundwater	Groundwater Recharge	Other Non-Traditional Source	Other Project Type	Reclaimed Water (for potable offset)	Stormwater	Surface Water	Surface Water Storage
NW-II					X	X		X	
NW-I, NW-IV, NW-V, NW-VI, & NW-VII					X	X			
SJR-CSEC				X		X		X	X
SW-NR (excluding CFWI)						X	X	X	
SW-HR (excluding CFWI)						X	X	X	
SW-SR	X	X	X			X	X	X	
SW-TB		X	X			X	X	X	
SF-UEC		X				X			
SF-LEC		X				X			
SF-LWC		X				X			
CFWI		X	X			X		X	
NFRWSP and SR-outside NFRWSP			X			X		X	

* Water conservation projects are analyzed separately in Appendix A.12.

Project Sizes Used in EDR Expenditure Forecast

EDR examined project sizes (in mgd) by project type, water supply planning region, and implementation status. Mean and median volume of reuse flow for "Reclaimed Water (for potable offset)" and brackish groundwater projects varied significantly among the regions (see highlighted values in the tables included in Appendix A.10). For the remaining project types, no statistically significant difference in project sizes among regions was detected, and the same project size was assumed for all regions in the EDR analysis. EDR assumed that the project size defined in Table 4.6.5 implicitly accounted for the distribution and transmission infrastructure and storage capacity typical for each project type and region.[243]

Table 4.6.5 Project Sizes Assumed in EDR Expenditure Forecast*

Project Type	Project Size (water or offset mgd)
Aquifer Storage and Recovery	0.60
Brackish Groundwater	0.21–4.00**
Groundwater Recharge	3.40
Reclaimed Water (for potable offset)	0.14–3.30**
Stormwater	4.50
Other Non-Traditional Source	0.34
Other Project Type	0.97
Surface Water	4.50
Surface Water Storage	3.00

* The project size reported in this table is equal to the median project size from the project sample analyzed.
** The project size differs among water supply planning regions.

"Project Total ($)" Values Analysis

Out of 739 projects (excluding conservation projects) for which water or reuse flow were provided, 18 projects were excluded due to missing information for "project total ($)."[244] Further, 62 projects

[243] EDR analyzed "Storage Capacity Created (MG)" and "Distribution / Transmission Capacity Created (mgd)" for the projects in the sample. Out of 636 non-conservation projects, only 37 projects contained zero or positive values of the distribution/transmission capacity. Thirty-five of these projects were "Reclaimed Water (for potable offset)" for which the distribution/transmission infrastructure capacity was 81.64 percent of their reuse water flow on average (with the median of 92.95 percent, minimum 8.75 percent, and maximum of 300.00 percent). The distribution/transmission capacity and the total reuse flow were correlated, with the Pearson correlation coefficient of 0.74. Based on a simple regression model, on average, for one mgd of reuse flow, 1.03 mgd of distribution/transmission capacity was created (with the intercept of 0.54 mgd); however, the sample size (*i.e.,* 37 projects) was too small to explicitly account for the distribution/transmission capacity of all reclaimed water projects. Further, for 79 projects, zero or greater than zero storage capacity values were reported. Three-quarters of these projects were "Reclaimed Water (for potable offset)" (*i.e.,* 60 projects). The storage was also reported for nine aquifer storage and recovery, two brackish groundwater projects, seven stormwater projects, and one surface water project. The storage correlated with the total water or reuse flow, with the Pearson correlation coefficient of 0.70. Median storage volume was 4.09 million gallons per 1 mgd of the total water or reuse flow. The overall number of projects with specific storage capacity values was too small to account for the storage volume in the expenditure analysis explicitly.

[244] Projects with missing information fall into five groups (A, B, C, D, and E) as follows:
(A) Five "Flood Control Works" and "Reclaimed Water (for groundwater recharge or natural system restoration)" projects, along with one "Surface Water" project described as "All surface water is solely for environmental purposes – no CUP uses").
(B) Five bulk water purchases projects (listed as "Other Project Type").
(C) Four projects for which the cost estimates were not provided by the primary funding agencies: (1) a groundwater recharge project with potential DOT funding (the funding source was mentioned but the amount was not quantified); (2) a project described as follows: "[…] Wells were permitted by SJRWMD, but SJRWMD did not provide funding for the project"; (3) a stormwater

that were determined to have limited direct implications for increasing water supply to meet future demand were excluded from the analysis. These were 18 "surface water" or "surface water storage" projects,[245] along with all "Flood Control Works," "Reclaimed Water" (for groundwater recharge or natural system restoration), "Data Collection and Evaluation," and "Distribution / Transmission Capacity" projects. Finally, 23 projects with zero or missing quantities of water or reuse flow were also omitted (note that some of them included non-zero storage or distribution capacity). The remaining dataset included 636 projects.

The analysis shows a strong correlation between "project total ($)" and the volume of water or estimated offset provided by the projects (Pearson correlation coefficient = 0.68). Interestingly, all projects with "project total ($)" above $200 million were from SWFWMD or SFWMD (Figure 4.6.4, panel A), and almost all of these more expensive projects were "RWSP or RPS Option Only" (Figure 4.6.4, panel B). Several of these more expensive projects were large desalination or surface water projects (Figure 4.6.4, panel C). These relations imply that project size, type, location, and the stage of completion can influence the project cost.

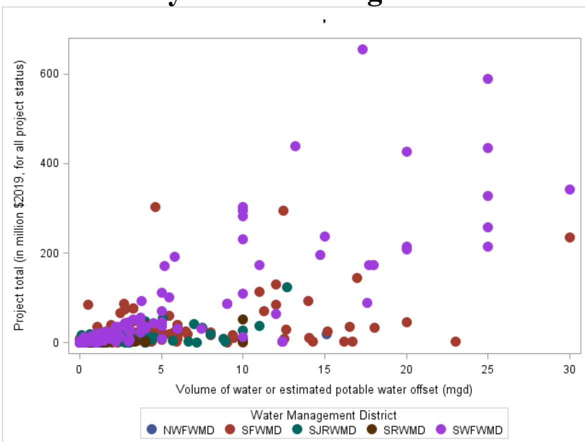
[See figure on following page]

project described as "Construction funded by Airport […] Total cost unknown"; and (4) a "Reclaimed Water (for potable offset)" project that included the comment "Cost for project not provided".
(D) Two projects described as brackish groundwater development, with no "project total ($)" estimates or additional explanations provided.
(E) One surface water project that involved an interconnection between utility infrastructures.

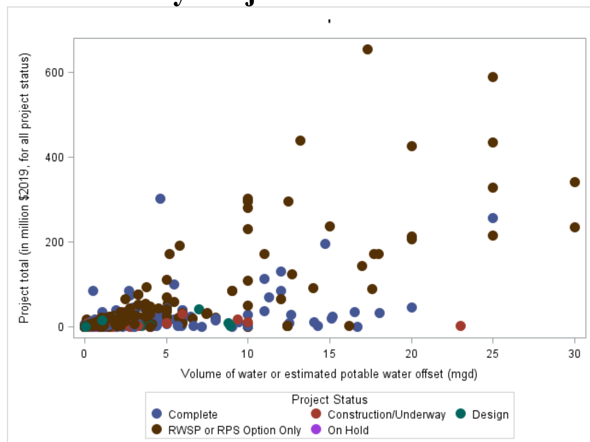
[245] Specifically, the following "surface water" or "surface water storage" projects were excluded: Northern Palm Beach County Improvement District Operable Gate Site 20 Structure (SFWS00025A); Weir Improvements (Gator Slough, Weir 19) (SFWS00086A); Devils Garden Golden Ox above-ground storage (4,000,000-gallon storage) (SFWS00107A); East County Aquifer Recharge Project, Phase 2.4 (SFWS00119A); Surface Water Recharge System (SFWS00305A); Grove Land Reservoir and Stormwater Treatment Area (SFWS00366A); Fellsmere Water Management Area (SJWS00053A); Taylor Creek Reservoir Improvement Project (SJWS00082A); Dispersed Water Storage Project – Fellsmere (SJWS00150A and SJWS00262A); Dispersed Water Storage Project – Graves Brothers (SJWS00153A and SJWS00263A); Gainesville Suburban Heights Beville Creek Restoration (SJWS00171A); Daytona Beach Bennett Swamp Rehydration and Conservation (SJWS00186A); City of Deltona – Alexander Avenue Water Resource Management Site (SJWS00238A); Dispersed Water Storage Project – Fellsmere (SJWS00262A); Lake Hancock Restoration (multi-phased project with phases numbered as H071, S043, H014, H008, S054, H009, and H009, according to the District Project Number); Lower Hillsborough River Recovery Strategy Morris Bridge Sink (SWWS00015A); and Lower Hillsborough River Recovery (multi-phased project; district project numbers: H400, H400-1, H400-3, and H401); and SWFWMD Tampa Bypass Canal/Hillsborough River Reservoir Diversion (SWWS00145A).

Figure 4.6.4 Scatter Plots of "Project Total ($)" and the Volume of Water or Potable Water Offset (mgd)

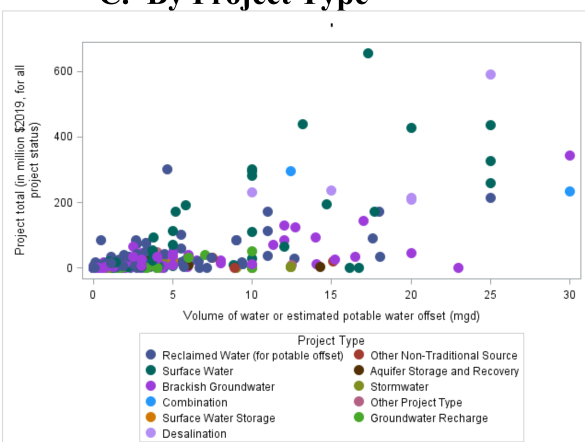
A. By Water Management District



B. By Project Status



C. By Project Type



Summary statistics for the ratio of "project total ($)" to the volume of water or estimated offset provided by the projects is presented in Table 4.6.6. Overall, the desalination projects had the highest median funding needs per mgd ($15.82 per mgd of project capacity) and groundwater recharge and stormwater projects had the lowest median funding needs per mgd ($0.84 and $1.03 per mgd of project capacity, respectively). For the sample as a whole, the median funding needs for completed projects were significantly lower than projects identified as "RWSP or RPS Option Only" ($3.82 and $11.43 per mgd, respectively).

[See table on following page]

Table 4.6.6 Summary Statistics for the Ratio of "Project Total ($)" to the Volume of Water or Potable Water Offset (by project type, alphabetically arranged)

Project Types and Status	N	$ per mgd of the project capacity			
		Mean	Median	Minimum	Maximum
Overall sample	**636**	**12.97**	**6.96**	**0.06**	**735.35**
Complete	299	13.38	3.82	0.06	735.35
Design or Construction / Underway	87	10.70	7.37	0.10	62.48
On hold	2	6.52	6.52	0.55	12.49
RWSP or RPS Option Only	248	13.33	11.43	0.11	186.20
Aquifer Storage and Recovery	**19**	**4.04**	**3.34**	**0.06**	**13.11**
Complete	13	3.91	3.41	0.06	13.11
Design or Construction / Underway	2	5.86	5.86	2.55	9.17
RWSP or RPS Option Only	4	3.55	2.97	1.53	6.74
Brackish Groundwater	**119**	**10.01**	**6.10**	**0.10**	**186.20**
Complete	49	5.08	3.54	0.27	29.40
Design or Construction / Underway	5	2.46	1.18	0.10	8.80
RWSP or RPS Option Only	65	14.30	7.83	0.77	186.20
Combination	**3**	**11.17**	**7.83**	**1.89**	**23.77**
Complete	1	1.89	1.89	1.89	1.89
Design or Construction / Underway	–	–	–	–	–
RWSP or RPS Option Only	2	15.80	15.80	7.83	23.77
Desalination	**5**	**16.73**	**15.82**	**10.39**	**23.59**
Complete	–	–	–	–	–
Design or Construction / Underway	–	–	–	–	–
RWSP or RPS Option Only	5	16.73	15.82	10.39	23.59
Groundwater Recharge	**20**	**2.13**	**0.84**	**0.11**	**13.63**
Complete	5	0.63	0.38	0.11	1.26
Design or Construction / Underway	10	3.11	1.12	0.19	13.63
RWSP or RPS Option Only	5	1.65	0.53	0.35	5.15
Other Non-Traditional Source	**8**	**5.09**	**3.15**	**0.27**	**12.86**
Complete	3	1.46	1.29	1.20	1.89
Design or Construction / Underway	3	6.47	6.29	0.27	12.86
On Hold	1	12.49	12.49	12.49	12.49
RWSP or RPS Option Only	1	4.41	4.41	4.41	4.41
Other Project Type	**15**	**10.19**	**5.67**	**0.17**	**62.48**
Complete	2	1.22	1.22	0.67	1.77
Design or Construction / Underway	2	42.44	42.44	22.39	62.48
RWSP or RPS Option Only	11	5.96	5.67	0.17	12.52
Reclaimed Water (for potable offset)	**377**	**16.11**	**9.58**	**0.07**	**735.35**
Complete	204	17.82	5.69	0.07	735.35
Design or Construction / Underway	61	12.58	9.12	0.24	57.37
RWSP or RPS Option Only	112	14.93	15.68	0.84	123.96
Stormwater	**23**	**1.65**	**1.03**	**0.08**	**11.48**
Complete	12	1.57	1.33	0.08	3.82
Design or Construction / Underway	2	1.26	1.26	0.64	1.88
On Hold	1	0.55	0.55	0.55	0.55
RWSP or RPS Option Only	8	2.01	0.26	0.15	11.48
Surface Water	**42**	**11.87**	**9.95**	**0.09**	**37.89**
Complete	10	3.59	1.91	0.09	13.35
Design or Construction / Underway	2	0.96	0.96	0.86	1.05
RWSP or RPS Option Only	30	15.36	13.49	0.11	37.89
Surface Water Storage	**5**	**4.16**	**4.69**	**2.04**	**4.70**
Complete	–	–	–	–	–
Design or Construction / Underway	–	–	–	–	–
On Hold	–	–	–	–	–
RWSP or RPS Option Only	5	4.16	4.70	2.04	4.70

This preliminary analysis showed that it was important to examine the relationship between "project total ($)" and a variety of project characteristics available in the project appendix. Multivariate regression analysis allowed EDR to conduct such an examination.

Regression Analysis for "Project Total ($)" of Non-Conservation Projects

Given the need to examine the relationship between "project total ($)" and various project characteristics, EDR developed a multivariate regression model, with the dependent variables being the natural logarithm of "project total ($)" (with "project total ($)" measured in million dollars). Various sets of independent variables were considered,[246] and the final set of variables is described in Appendix A.11. The regression model coefficients were estimated using robust regression procedure *rreg* implemented in Stata 13.1.[247] As shown in Appendix A.11, the R-squared measure implies that the model explained approximately 52 percent of the variability in the dependent variable. Based on the model results, "project total ($)" increases with the volume of water or offset provided by the projects, but this increase slows down for larger projects (*i.e.,* the effect of scale). Among small projects, completed projects tend to be cheaper as compared with the projects in the other statuses. In contrast, for large projects, completed projects tend to be more expensive as compared with large projects in design, construction/underway, or on hold. Interestingly, regression model results show that surface water and groundwater recharge projects are relatively inexpensive compared with the reclaimed water projects, all else being equal. Among the regions, projects implemented in CFWI, NFRWSP, SR-Outside NFRWSP, and SF-LKB tended to be less expensive than the projects in the other regions.

This model was used to estimate "project total ($)" for the project types and size assumed for each water supply planning region, as presented in Table 4.6.7. In this analysis, EDR focused on the model estimation results for completed projects. Note that the estimated "project total ($)" would be significantly higher if the model coefficient for "RWSP or RPS Option Only" projects was used instead.

The funding requirements per mgd of water or offset produced by the typical projects in each region were summarized in Tables 4.5.8 with the most and least costly options (in million dollars per mgd of project capacity) in each region highlighted. In most of the regions, reclaimed water for potable water offset was ranked as the most expensive option to meet the net demand change (among the options considered). In turn, surface water, stormwater, brackish groundwater, and groundwater recharge projects were ranked as less costly alternatives to meet the demand change.

Based on these funding needs estimates, two scenarios were developed for each region, given the most expensive and least expensive project types (per mgd). As shown in Table 4.6.9, the statewide funding needs to meet the increase in water demand by 2035 were estimated to range between $0.3 and $1.8 billion, or $1.0 billion if the average of the two is taken. If the EDR inferred shortage is considered, an even higher level of expenditures ranging between $1.4 billion and $3.4 billion would be anticipated. These forecasts were generally comparable with the estimate produced by EDR for the 2019 Edition ($1.6 to $2.2 billion).

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[246] EDR used stepwise option in *glmselect* procedure in SAS, along with the manual inclusion and exclusion of variables and re-estimation of the model using *robustreg* procedure in SAS.

[247] As opposed to the standard Ordinary Least Squares regression, robust regression estimates the model coefficients by assigning lower weights to outliers and influential observations. Procedure *rreg* implemented in STATA "performs an initial screening based on Cook's distance > 1 to eliminate gross outliers before calculating starting values and then performs Huber iterations followed by biweight iterations, as suggested in Li (1985)." (Stata. No date found).

Table 4.6.7 Model Estimation Results

Region and Project Types	Water Volume or Estimated Offset Assumed per Project, mgd	Estimated "Project Total", million $	"Project Total" per mgd, million $ per mgd of project capacity
Reclaimed Water (for potable offset)			
NW-II	0.28	2.64	9.44
NW-I, NW-IV, NW-V, NW-VI, & NW-VII	0.40	2.88	7.20
SJR-CSEC	0.29	1.67	5.75
SW-NR (excluding CFWI)	0.24	1.43	5.98
SW-HR (excluding CFWI)	0.14	0.81	5.80
SW-TB	0.41	1.95	4.75
SW-SR	0.55	2.27	4.12
SF-UEC	3.30	8.34	2.53
SF-LEC	1.71	3.05	1.78
SF-LWC	2.75	7.36	2.68
CFWI	0.33	1.09	3.30
NFRWSP	0.23	1.02	4.44
Brackish Groundwater			
SW-SR	2.00	5.55	2.77
SW-TB	3.00	11.94	3.98
SF-UEC	4.00	11.74	2.94
SF-LEC	3.50	6.01	1.72
SF-LWC	2.75	7.19	2.61
CFWI	0.21	0.80	3.79
Surface Water			
All regions in NWFWMD	4.50	18.80	4.18
SJR-CSEC	4.50	11.09	2.47
SW-NR (excluding CFWI)	4.50	14.68	3.26
SW-HR (excluding CFWI)	4.50	6.24	1.39
SW-TB	4.50	15.42	3.43
SW-SR	4.50	13.46	2.99
CFWI	4.50	5.26	1.17
NFRWSP	4.50	5.26	1.17
Stormwater			
SW-NR (excluding CFWI)	4.50	3.83	0.85
SW-HR (excluding CFWI)	4.50	1.63	0.36
SW-TB	4.50	4.02	0.78
SW-SR	4.50	3.51	0.89
Groundwater Recharge			
SW-SR	3.40	4.44	1.31
SW-TB	3.40	4.84	1.42
CFWI	3.40	1.91	0.56
NFRWSP	3.40	1.91	0.56
Aquifer Storage and Recovery			
SW-SR	0.60	2.76	4.60
Other Nontraditional Sources			
SJR-CSEC	0.34	1.41	4.15
Other Project Types			
All regions in NWFWMD	0.97	2.21	2.28
Surface Water Storage			
SJR-CSEC	3.00	9.92	3.31
SW-TB	3.00	12.54	4.18

Table 4.6.8 Estimated Funding Requirements per mgd of Water or Offset Produced by Typical Projects (in million dollars per mgd), with the Least and Most Expensive Options Highlighted

Supply Planning Regions	Aquifer Storage and Recovery	Brackish Groundwater	Groundwater Recharge	Other Non-Traditional Source	Other Project Type	Reclaimed Water (for potable offset)	Stormwater	Surface Water	Surface Water Storage
NW-II					2.28	9.44		4.18	
NW-I, NW-IV, NW-V, NW-VI, & NW-VII					2.28	7.20		4.18	
SJR-CSEC				4.15		5.75		2.47	3.31
SW-NR (excluding CFWI)						5.98	0.85	3.26	
SW-HR (excluding CFWI)						5.80	0.36	1.39	
SW-TB		3.98	1.42			4.75	0.78	3.43	4.18
SW-SR	4.60	2.77	1.31			4.12	0.78	2.99	
SF-UEC		2.94				2.53			
SF-LEC		1.72				1.78			
SF-LWC		2.61				2.68			
CFWI		3.79	0.56			3.30		1.17	
NFRWSP and SR-outside NFRWSP			0.56			4.44		1.17	

Table 4.6.9 Estimated Funding Needs to Meet the Increase in Demand by 2035

Regions with Inferred Supply Shortage	Inferred Supply Shortage (mgd)	Less Expensive			More Expensive			Average Estimated Funding Needs (million $)
		Project Type	Estimated million $ per mgd	Funding Needs (million $)	Project Type	Estimated million $ per mgd	Funding Needs (million $)	
Based on WMDs Inferred Supply Shortage								
NW-II	1.41	Other Project Type	2.28	3.21	Reclaimed Water (for potable offset)	9.44	13.31	8.26
SJR-CSEC	27.95	Surface Water	2.47	69.04	Reclaimed Water (for potable offset)	5.75	160.71	114.87
SW-NR (excluding CFWI)	27.81	Stormwater	0.85	23.64	Reclaimed Water (for potable offset)	5.98	166.30	94.97
SW-HR (excluding CFWI)	2.48	Surface Water	1.39	3.45	Reclaimed Water (for potable offset)	5.80	14.38	8.92
SW-SR	3.40	Stormwater	0.78	2.65	Aquifer Storage and Recovery	4.60	15.64	9.15
SF-LEC	6.66	Brackish Groundwater	1.72	11.46	Reclaimed Water (for potable offset)	1.78	11.85	11.66
CFWI	233.58	Groundwater Recharge	0.56	131.31	Brackish Groundwater	3.79	885.27	508.29
NFRWSP	112.18	Groundwater Recharge	0.56	63.06	Reclaimed Water (for potable offset)	4.44	498.08	280.57
Statewide Total	**415.50**		**0.74**	**307.81**		**4.25**	**1,765.55**	**1,036.70**
Based on EDR Preliminary Inferred Supply Shortage								
Statewide Total	**980.11**		**1.38**	**1,351.73**		**3.51**	**3,436.70**	**2,447.95**

4.7 Potential Funding Sources

To forecast the potential funding sources, EDR examined funding information from the original DEP (2019a) appendix project list, focusing on 205 project items that were completed in 2008 or later and that received funding in FY 2008 or later. This sample excluded conservation project items and the items with missing "Total State Funding," "Total District Funding," or "Cooperating Entity Match."

The analysis of the funding split between the state, WMDs, and cooperating entities showed that approximately 64 percent of the funding needs was covered by the cooperating entities based on the mean value for the sample. Cooperating entity primarily included cities and counties as shown in Figure 4.7.1. In turn, the state expenditure is an average of 4.5 percent.[248] Considering the estimated total expenditure of $1,036.70 million to meet the increase in water demand by 2035 (i.e., the average scenario from Table 4.6.9), the state would be expected to allocate $46.24 million for the alternative water supply projects. Note, however, that this scenario implies significant expenditures for the regional and local partners, and the implications of this assumption should be further explored. Moreover, EDR's preliminary water demand forecast suggests that the expenditures needed may be even higher. Further, as discussed in the next Section and Chapter 6, the need to restore the natural systems and maintain and replace existing water infrastructure, respectively, will increase the necessary expenditures even more.

Table 4.7.1 Estimated Share of Funding for Project Items Completed and Funded in FY 2008 through FY 2018

Variable	N	Mean	Median	Minimum	Maximum
State Share	205	4.46%	0.00%	0.00%	83.53%
WMD Share	205	31.64%	33.00%	0.00%	96.07%
Cooperating Entity Match	205	63.62%	60.00%	0.00%	99.86%

Note: Conservation project items are excluded.

[See figure on following page]

248 Note that this analysis does not explicitly account for any reduced or waived cost match requirements for projects in designated rural areas of opportunity (*i.e.*, REDI communities) under section 288.0656, Florida Statutes. For example, in the data examined, the average share of state funding was much higher for the items in SRWMD – 23.38 percent (median of 39.94 percent). In this district, the share of the cooperative entities was the lowest – 31.09 percent on average (25.48 percent on the median). Future editions will attempt to better identify and apply unique cost shares by region.

Figure 4.7.1 Word Cloud Summary of “Cooperating Entity” Information*

* Produced using word cloud Add-On for Google Doc and “Cooperating Entity” information**.** No words were removed. The names of 113 out of 205 cooperating entities contained the word “city,” 44 names contained the word “county,” and 24 names contained the word “utilities.”

4.8 Funding Needs to Implement Recovery and Prevention Strategies for Minimum Flows and Minimum Water Levels

Part of section 403.928, Florida Statutes, requires EDR to estimate the expenditures necessary to achieve the legislature’s intent that sufficient water be available for the natural systems. While the WMDs may use a variety of tools to protect the natural systems, EDR focuses on projects included in recovery or prevention strategies for the implementation of minimum flows and minimum water levels (MFLs).

Sections 373.042 and 373.0421, Florida Statutes, provides requirements for the WMDs with regard to the establishment and implementation of MFLs for water courses, water bodies, and aquifers. The MFLs are intended to define “the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area.”[249] These limits are relevant to water supply planning, permitting decisions, and the declaration of water shortages.[250]

The WMDs are required to adopt (or revise) and implement recovery or prevention strategies to achieve recovery to an MFL as soon as practicable or prevent violations of MFLs within 20 years.[251] When developing the recovery or prevention strategy, the WMD must include a phased-in approach or timetable to allow for the provision of water supplies for all existing and projected

[249] § 373.042, Fla. Stat.
[250] §§ 373.705 and 373.709, Fla. Stat.; Fla. Admin. Code R. 62-40.473(3)-(4);
[251] § 373.0421(2), Fla. Stat.

reasonable-beneficial uses.[252] Once the recovery or prevention strategy is adopted by the appropriate WMD, the applicable RWSP is amended to include any water supply or water resource development projects.[253] For a visual of all currently adopted MFLs, see Figure 4.8.1.

In 2016, the Florida Legislature strengthened the implementation of MFLs particularly for Outstanding Florida Springs (OFSs).[254] The WMDs were required to adopt MFLs for all OFSs within their jurisdiction by July 1, 2017. Recovery or prevention strategies for OFSs must identify a prioritized list of projects to implement the plan and include the estimated cost and date of completion for each project, the estimated benefit from each project, and the source and amount of financial assistance available by the applicable WMD.[255] Unlike recovery or prevention strategies for other water resources, those for OFSs must be designed to achieve the MFLs no later than 20 years after adoption of the strategy and must contain a schedule establishing 5-year, 10-year and 15-year targets to inform future planning and funding decisions.[256]

[See figure on following page]

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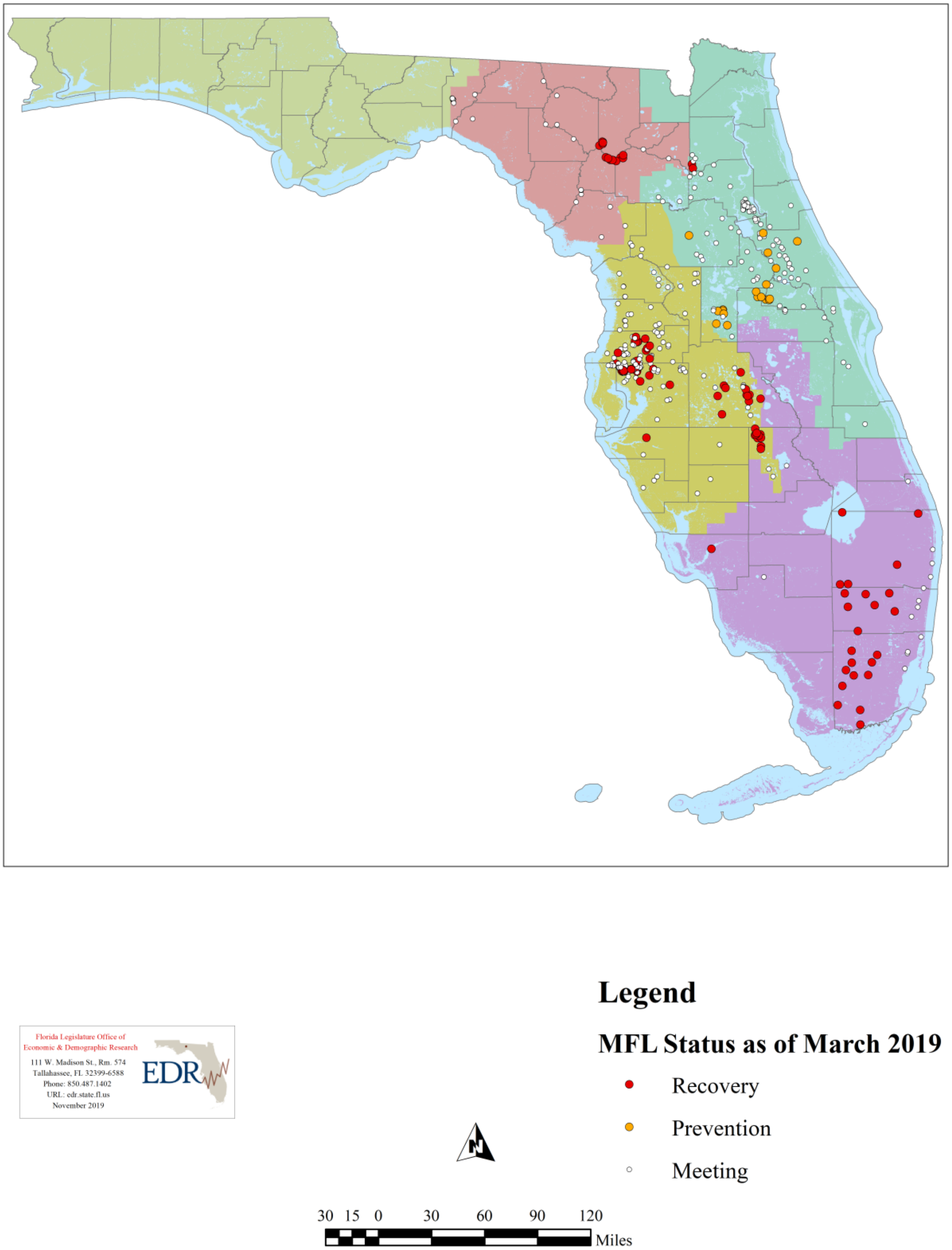
[252] § 373.0421(2), Fla. Stat.
[253] § 373.0421(2), Fla. Stat.
[254] *See* 2016-1, §§ 5 and 25, Laws of Fla. (amending section 373.042, Florida Statutes, and creating section 373.805, Florida Statutes, to establish additional MFL requirements for Outstanding Florida Springs).
[255] § 373.805(4), Fla. Stat.
[256] § 373.805(4), Fla. Stat.

Figure 4.8.1 Map of Established MFLs with WMD Boundaries



Source: provided by DEP staff.
Note: MFLs are established for various types of natural systems, such as an aquifer, lake, river, or stream. The map above does not differentiate among the system types but rather identifies a single approximate point location.

To develop preliminary estimates of the funding needs to implement existing recovery or prevention strategies, EDR analyzed "project total ($)" information for the projects associated with MFL RPSs listed in the project appendix (see Table 4.8.1). Out of 1,369 projects in the project appendix, 505 were listed as supporting an MFL Recovery or Prevention Strategy, and one-third of these projects were identified for future implementation (*i.e.*, 185 "RWSP or RPS Option Only" projects).

For "RWSP or RPS Option Only" projects associated with recovery or prevention strategies, $7.80 billion will be needed. Note that this estimate may be an underestimation, since it is unclear whether the projects in the appendix are sufficient to meet the MFL target for the related natural systems. Further, it does not account for Everglades restoration which is discussed in Chapter 7, as these projects are largely part of the Comprehensive Everglades Restoration Plan (CERP). Conversely, some of these projects may address the needs of the growing water demand in the region, leading to an overlap between the estimated expenditures for the natural system restoration and supplying the increase in water demand. Regardless of these deficiencies, if one assumes the same state share of funding as shown in Table 4.7.1, the state's expected future expenditure would be $371.14 million.

While DEP's Water Resource Implementation Rule states that the WMDs must expeditiously implement all adopted recovery or prevention strategies,[257] there is no generally applicable target date mandated by law to achieve the adopted MFL. Only recovery or prevention strategies for Outstanding Florida Springs (OFSs)[258] are required to contain 5-year, 10-year, and 15-year targets, with achievement of the adopted MFL to occur no later than 20 years after adoption of the strategy.[259] Without a required timeframe to achieve MFLs, timing of the $371.14 million required by the state is a decision for policy makers.

[See table on following page]

[257] Fla. Admin. Code R. 62-40.473(7).

[258] An "Outstanding Florida Spring" is defined as "all historic first magnitude springs, including their associated spring runs, as determined by the department using the most recent Florida Geological Survey springs bulletin, and the following additional springs, including their associated spring runs: (a) De Leon Springs; (b) Peacock Springs; (c) Poe Springs; (d) Rock Springs; (e) Wekiwa Springs; and (f) Gemini Springs. § 373.802(4), Fla. Stat.

[259] § 373.805(4), Fla. Stat.

Table 4.8.1 Projects Associated with MFL RPSs

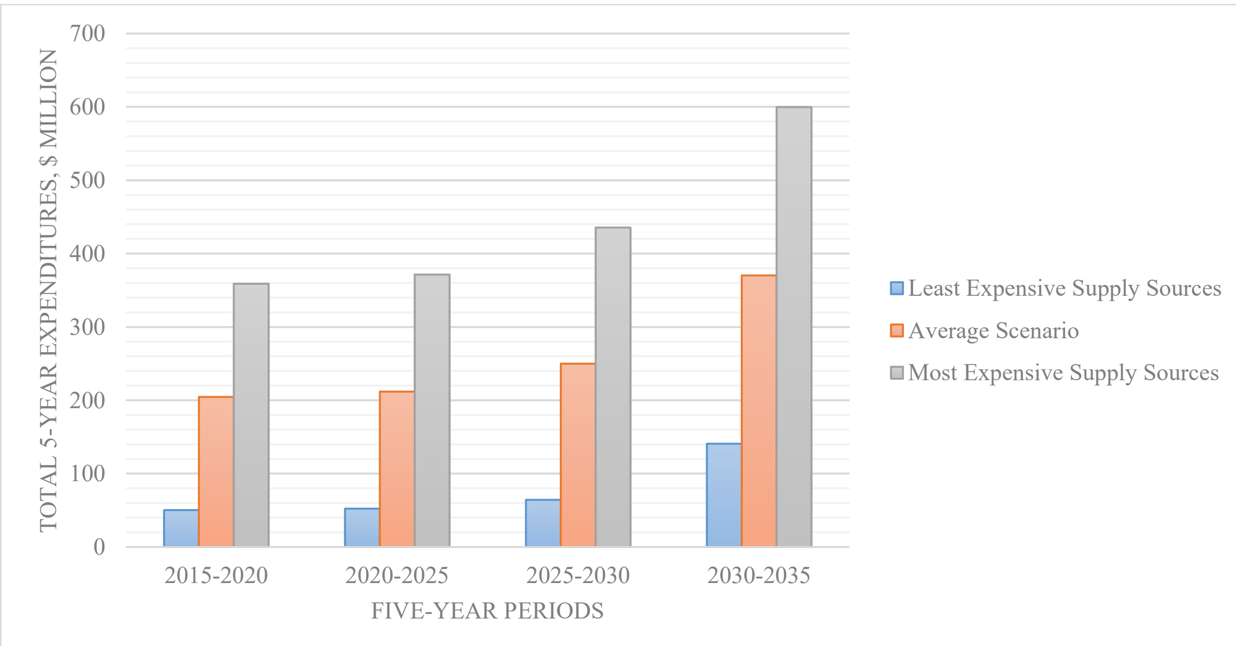
MFL RPS Supported	Project Status	Total Number of Projects	Quantity of Water Made Available on Project Completion		Reuse Flow Made Available on Project Completion		Storage Capacity Created		Project Total (million $2019)	
			Number of projects in estimations	mgd	Number of projects in estimations	mgd	Number of projects in estimations	mg	Number of projects in estimations	million $2019
Dover/Plant City WUCA Recovery Strategy*	Design	1	–	–	1	0.00	1	0.00	1	1.19
	RWSP or RPS Option Only	2	–	–	2	13.55	–	–	2	32.53
	Total	**3**	**0**	**0.00**	**3**	**13.55**	**1**	**0.00**	**3**	**33.72**
Lower Santa Fe and Ichetucknee River Recovery Strategy	Complete	6	3	1.00	2	1.20	–	–	6	5.18
	Construction/Underway	3	3	6.65	2	0.00	–	–	3	11.12
	Design	2	2	7.03	1	0.00	–	–	2	41.26
	On Hold	3	3	7.65	3	0.00	3	0.00	3	8.59
	RWSP or RPS Option Only	23	18	30.56	12	1.36	–	–	23	110.92
	Total	**37**	**29**	**52.89**	**20**	**2.56**	**3**	**0.00**	**37**	**177.08**
Lower Hillsborough River Recovery Strategy*	Construction/Underway	2	2	23.77	–	–	–	–	2	19.68
	Design	3	1	3.90	–	–	–	–	3	4.01
	Total	**5**	**3**	**27.67**	–	–	–	–	**5**	**23.69**
Northern Tampa Bay WUCA Recovery Strategy*	Complete	92	47	41.13	23	8.64	13	662.82	92	567.90
	Construction/Underway	15	8	2.50	6	3.53	5	0.00	15	48.73
	Design	13	8	8.01	4	0.14	3	0.00	13	23.24
	RWSP or RPS Option Only	33	15	147.60	16	41.92	–	–	33	2,770.83
	Total	**153**	**78**	**199.24**	**49**	**54.23**	**21**	**662.82**	**153**	**3,410.70**
Northern Tampa Bay WUCA and Lower Hillsborough River Recovery Strategies*	RWSP or RPS Option Only	2	–	–	2	2.00	–	–	2	17.25
Northern Tampa Bay and Dover / Plant City WUCA Recovery Strategies*	Complete	1	–	–	–	–	–	–	1	0.10
	RWSP or RPS Option Only	4	2	10.00	2	2.00	–	–	4	53.10
	Total	**5**	**2**	**10.00**	**2**	**2.00**	**0**	**0.00**	**5**	**53.20**
Silver Springs Prevention Strategy	Complete	6	1	0.01	3	2.70	–	–	6	13.71
	Construction/Underway	7	6	5.05	1	2.30	–	–	7	20.04
	Design	5	4	9.44	1	0.12	–	–	5	6.64
	RWSP or RPS Option Only	2	2	11.90	–	–	–	–	2	43.11
	Total	**20**	**13**	**26.39**	**5**	**5.12**	–	–	**20**	**83.50**
Southern WUCA Recovery Strategy*	Complete	80	38	40.35	18	26.55	17	8,507.41	80	592.78
	Construction/Underway	33	16	70.39	10	6.57	10	325.90	33	248.30
	Design	21	9	0.60	7	0.59	7	5.60	21	104.94
	RWSP or RPS Option Only	112	70	286.78	32	65.32	1	100.00	112	4,662.73
	Total	**246**	**133**	**398.12**	**67**	**99.03**	**35**	**8,938.91**	**246**	**5,608.74**
Southern and Dover/Plant City WUCA Recovery Strategies*	**Complete**	**1**	–	–	–	–	–	–	**1**	**0.35**
Volusia Recovery and Prevention Strategy	Complete	11	1	0.16	10	13.29	–	–	11	30.36
	Construction/Underway	2	1	4.00	1	0.14	1	3.00	2	8.95
	Design	5	2	0.45	3	0.91	–	–	5	6.50
	RWSP or RPS Option Only	7	6	16.70	–	–	–	–	7	106.63
	Total	**26**	**10**	**21.31**	**14**	**14.34**	**1**	**3.00**	**26**	**152.78**

*From discussion with district staff, data regarding projects implementing RPSs in the SWFWMD are expected to be significantly revised in 2020.

4.9 Timing of the Expenditures

As shown in Table 4.2.2, several regions in Florida run into inferred supply shortages much earlier than 2035. Therefore, it is essential to account for the timing of expenditures. Current projections developed by the WMDs allow estimation of five-year inferred supply shortages and related spending, as indicated in Tables 4.2.2, 4.9.1, and 4.9.2. The estimated total spending needed to meet the inferred supply shortages over the five-year periods is displayed on Figure 4.9.1.

Figure 4.9.1 Expenditures Needed to Meet the Inferred Supply Shortage ($ million)



One can also use a combination of the linear interpolation and back-extrapolation to estimate the inferred supply shortage on an annual basis, as displayed in Table 4.9.3. It is expected that annually, between 17 and 36 mgd of water should be made available from alternative water supply sources to meet the increasing water demand in various Florida regions.

[See tables on following pages]

Table 4.9.1 Expenditures Needed to Meet the Inferred Supply Shortage ($ million): Least Expensive Supply Sources

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
NWF - II	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$3.21
NWF - III	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
NWF - I, IV, V, VI, VII	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
SJR - CSEC	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$4.15	$-	$-	$-	$-	$64.89
SR - OUTSIDE	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
SWF - Northern - Outside	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$2.75	$-	$-	$-	$-	$10.62	$-	$-	$-	$-	$10.28
SWF - Tampa Bay	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
SWF - Heartland - Outside	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$0.67	$-	$-	$-	$-	$2.78
SWF - Southern	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$2.65
CFWI	$-	$-	$-	$-	$-	$33.63	$-	$-	$-	$-	$34.02	$-	$-	$-	$-	$32.80	$-	$-	$-	$-	$30.86
NFRWSP	$-	$-	$-	$-	$-	$16.74	$-	$-	$-	$-	$15.54	$-	$-	$-	$-	$16.11	$-	$-	$-	$-	$14.68
SF - LKB	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
SF - UEC	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
SF - LEC	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$11.46
SF - LWC	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
Statewide (sum of regions)	**$-**	$-	$-	$-	$-	**$50.36**	$-	$-	$-	$-	**$52.30**	$-	$-	$-	$-	**$64.35**	$-	$-	$-	$-	**$140.80**
Statewide - cumulative		$-	$-	$-	$-	**$50.36**	$-	$-	$-	$-	**$102.67**	$-	$-	$-	$-	**$167.01**	$-	$-	$-	$-	**$307.81**

Table 4.9.2 Expenditures Needed to Meet the Inferred Supply Shortage ($ million): Most Expensive Supply Sources

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
NWF - II	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$13.31
NWF - III	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
NWF - I, IV, V, VI, VII	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
SJR - CSEC	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$9.66	$-	$-	$-	$-	$151.05
SR - OUTSIDE	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
SWF - Northern - Outside	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$19.32	$-	$-	$-	$-	$74.69	$-	$-	$-	$-	$72.30
SWF - Tampa Bay	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
SWF - Heartland - Outside	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$2.78	$-	$-	$-	$-	$11.60
SWF - Southern	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$15.64
CFWI	$-	$-	$-	$-	$-	$226.72	$-	$-	$-	$-	$229.37	$-	$-	$-	$-	$221.15	$-	$-	$-	$-	$208.03
NFRWSP	$-	$-	$-	$-	$-	$132.18	$-	$-	$-	$-	$122.72	$-	$-	$-	$-	$127.25	$-	$-	$-	$-	$115.93
SF - LKB	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
SF - UEC	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
SF - LEC	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$11.85
SF - LWC	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
Statewide (sum of regions)	**$-**	$-	$-	$-	$-	**$358.90**	$-	$-	$-	$-	**$371.41**	$-	$-	$-	$-	**$435.53**	$-	$-	$-	$-	**$599.72**
Statewide - cumulative		$-	$-	$-	$-	**$358.90**	$-	$-	$-	$-	**$730.30**	$-	$-	$-	$-	**$1,165.84**	$-	$-	$-	$-	**$1,765.55**

Table 4.9.3 Inferred Supply Shortage: Interpolation and Back-Extrapolation Results (mgd)

Shortage	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
NWF - II	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.41
NWF - III	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NWF - I, IV, V, VI, VII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SJR - CSEC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.68	6.93	12.19	17.44	22.70	27.95
SR - OUTSIDE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SWF - Northern - Outside	0	0	0	0	0	0	0	0	0.00	0.73	3.23	5.73	8.23	10.72	13.22	15.72	18.14	20.56	22.97	25.39	27.81
SWF - Tampa Bay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SWF - Heartland - Outside	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.48	0.88	1.28	1.68	2.08	2.48
SWF - Southern	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.40
CFWI	0	11.40	23.51	35.61	47.72	59.82	71.92	84.03	96.13	108.24	120.34	132.01	143.68	155.35	167.02	178.69	189.67	200.65	211.62	222.60	233.58
NFRWSP	2.13	7.66	13.19	18.71	24.24	29.77	35.30	40.83	46.35	51.88	57.41	63.14	68.87	74.61	80.34	86.07	91.29	96.51	101.74	106.96	112.18
SF - LKB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SF - UEC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SF - LEC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.66
SF - LWC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Statewide (sum of regions)	**2.13**	**19.06**	**36.69**	**54.33**	**71.96**	**89.59**	**107.22**	**124.85**	**142.49**	**160.85**	**180.98**	**200.88**	**220.78**	**240.68**	**260.58**	**282.64**	**306.91**	**331.18**	**355.46**	**379.73**	**415.47**
Annual increase	**2.13**	**16.93**	**17.63**	**17.63**	**17.63**	**17.63**	**17.63**	**17.63**	**17.63**	**18.36**	**20.13**	**19.90**	**19.90**	**19.90**	**19.90**	**22.06**	**24.27**	**24.27**	**24.27**	**24.27**	**35.74**

The agencies and local partners will need to start investing in the alternative water supply projects ahead of the time the water is needed. EDR analyzed the number of months between the beginning and completion dates of construction for the 390 projects for which this information was available in DEP (2019a). The analysis showed that there is a wide variation in the project construction period. For instance, thirty-one projects required five or more years to construct. An example of such a project is a multi-phased reclaimed water project by the City of Pompano Beach in SFWMD. The initial phase of the project began in 2005, and the final phase of the project was completed in 2018. Overall, 3.1 mgd of reuse water flow and 1.93 mgd of distribution/transmission capacity were made available, benefitting residents and the surficial aquifer system in Broward County. The total funding need for this project was $7.31 million.

On the other hand, some projects were constructed fairly quickly. For example, a reclaimed water project implemented in Palm Beach in SFWMD involved the construction of approximately 17,000 linear feet of main, along with a duplex pump station to blend up to 3.0 mgd of brackish nanofiltration concentrate with 8 mgd of reclaimed water. The project took a year to construct, and it was completed in 2013 resulting in 3 mgd of reuse flow and costing $3.79 million.

Overall, the construction period differed among the project types,[260] as shown in Table 4.9.4. At the median, groundwater recharge, stormwater, and "other project type" projects take approximately a year or less to construct. Reclaimed water (for potable offset) and surface water projects take approximately 1.5 years to construct. Finally, other non-traditional sources, aquifer storage and recovery, and brackish groundwater projects take about two years (the median length of construction). Overall, EDR concludes that project construction should start and expenditures should be incurred at least two years prior to the year for which inferred supply shortage is projected.

Table 4.9.4 Estimated Construction Length (month), by Project Type

Project Type	N Obs	Mean	Median	Minimum	Maximum
Aquifer Storage and Recovery	17	55.71	**23.00**	11.00	192.00
Brackish Groundwater	53	24.94	**23.00**	9.00	87.00
Groundwater Recharge	6	20.67	**13.00**	6.00	45.00
Other Non-Traditional Source	5	19.80	**24.00**	3.00	41.00
Other Project Type	5	15.60	**8.00**	6.00	46.00
Reclaimed Water (for potable offset)	265	25.18	**18.00**	1.00	156.00
Stormwater	14	19.50	**11.00**	10.00	72.00
Surface Water	21	36.43	**15.00**	10.00	152.00
All project types*	**390***	**26.41**	**18.00**	**1.00**	**192.00**

* In addition to the project types listed in the table, this sample included four "surface water storage" and "combination" projects. The descriptive statistics for these four projects is not listed separately due to the small number of the projects.

[260] Based on Savage test and Cramer-von Mises Statistics, α=0.05, estimated using *proc npar1way* in SAS.

4.10 Next Steps and Recommendations

In this chapter, EDR examined the funding needs for alternative water supply and conservation projects intended to meet the statewide water demand in the 20-year planning period. Focusing on the project appendix in DEP (2019a) and analyzing the alternative water supply project types that could potentially provide large volumes of water, EDR estimated the funding needs to be $0.3 to $1.8 billion using WMD data to estimate inferred shortage, and between $1.4 and $3.4 billion if EDR's inferred shortage is used. Using water conservation projects to offset the demand increase is not expected to materially reduce these funding needs, given that promoting water conservation can be expensive (see Appendix A.12). Also, it is estimated that $7.8 billion will be needed to progress toward the water flow and water level restoration goals for the systems currently in recovery status.

It is important to recognize the limitations of this analysis. Some limitations are related to the data used. The project appendix of DEP (2019a) may not reflect the total cost of the project implementation. For example, the investment in the purchase of land is frequently excluded from the construction cost, "Project Total," and "Projected Total Funding (for RWSP/RPS Options Only)." Also, the cost of the project components not eligible for funding from the state or regional programs may not be adequately reflected.

Further, the project appendix lacks data related to the distribution, transmission, and storage capacity of the projects. Therefore, it is unclear whether the cost of distribution, transmission, and storage is included in the "project total ($)" reported in the appendix and used by EDR in the analysis. The lack of precise accounting for transmission, distribution, and storage infrastructure can lead to double-counting the water supply volumes created by the projects. For example, the same volume of water can be reported when funding for a treatment plant is provided and when the distribution infrastructure is funded.

Other study limitations are related to the assumptions and methods used in the EDR analysis. The estimates developed in this report rely on the statewide offset coefficient applied to the reuse water flow of the reclaimed water projects, while the actual offset can vary depending on project characteristics and location.

Moving forward, an important priority for EDR is to improve the assessment of the funding needs for natural system protection and restoration. EDR recognizes that projects can have multiple benefits (*e.g.*, groundwater recharge to feed the natural systems and support groundwater withdrawals). A strategy can be determined, however, to further classify the projects in the appendix of DEP (2019a) into those primarily focusing on meeting the demand increase in the region as opposed to the projects intended for the natural system protection and restoration.

EDR's forecast largely disregards the expenditures needed for data collection, monitoring, and studies in support of water resource and water supply development. Additional data collection efforts may be needed to reflect these costs for more comprehensive forecasts in future editions of this report. Also, the implications of drought scenarios for the water supply expenditures should be explored.

EDR's conclusions depend on assumptions regarding the types of projects to be implemented to meet the demand increase. Changes in the project mix can significantly alter the estimated costs. Additional discussions with WMD staff are needed to identify the potential project types more precisely. In addition, future editions will attempt to better identify and apply unique cost shares by region, particularly in designated rural areas of opportunity (*i.e.*, REDI communities) under section 288.0656, Florida Statutes, where the cost share for local partners may be significantly lower.

Finally, EDR will continue to work with the WMDs to refine its prototype model in preparation for peer review and final model deployment.

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5. Estimating Future Expenditures Necessary to Comply with Laws and Regulations Governing Water Quality Protection and Restoration

EDR is required to forecast expenditures necessary to comply with laws and regulations associated with water quality protection and restoration projects and initiatives. The 2020 Edition expands on last year's analysis, which presented estimated costs to implement projects identified in basin management action plans. This edition introduces additional expenditures relating to state programmatic costs to implement the total maximum daily loads program and alternative water quality restoration plans. Future editions will continue to refine on existing analyses as better data becomes available and will begin to analyze relevant compliance costs of local governments and public and private utilities to meet requirements related to water quality protection and restoration. While this chapter largely focuses on the primary water quality improvement initiatives required by the federal Clean Water Act and the Florida Watershed Restoration Act, future editions will incorporate other important state and regional water quality protection and restoration initiatives.

5.1 State and Federal Laws and Regulations Governing Surface Water Quality

Florida has an abundance of surface water resources. The protection of these resources is vitally important. Water pollution not only affects Florida's inland and coastal waters, it can also impact the public health of residents and visitors who use and enjoy Florida's waters. According to the United States Environmental Protection Agency (EPA), nonpoint sources of pollution are reported as the leading cause of surface waterbody impairment nationwide[261] and are the largest contributor of pollutants to surface and groundwater in Florida.[262] Unlike point sources of pollution that are conveyed to waterbodies by discrete means, nonpoint pollution comes from many diffuse sources that are transported to waterbodies through stormwater runoff. Potential sources of nonpoint source pollution include runoff from agricultural and urban landscapes, septic tanks, and atmospheric deposition. The most significant surface water quality issue identified statewide is excessive nutrients (nitrogen and phosphorus) from both point and nonpoint sources. The Florida Department of Environmental Protection (DEP) is responsible for implementing various surface water quality-related directives under federal and state law. Much of this effort is undertaken in coordination with other state agencies, the water management districts (WMDs), local governments, universities, and other public and private stakeholders.

In 1972, Congress passed the Clean Water Act (CWA) with a purpose to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters."[263] Two national goals were also declared: (1) the elimination of pollutant discharges into navigable waters by 1985; and (2) fishable and swimmable waters by 1983.[264] Although water pollution still remains an issue

[261] U.S. Environmental Protection Agency, Basic Information about Nonpoint Source (NPS) Pollution, Overview, https://www.epa.gov/nps/basic-information-about-nonpoint-source-nps-pollution (Accessed December 2019.)
[262] Florida Department of Environmental Protection, Nonpoint Source Program Update, April 2015 at 9, available at: https://floridadep.gov/sites/default/files/NPS-ManagementPlan2015.pdf (Accessed December 2019.)
[263] 33 U.S.C. § 1251(a).
[264] 33 U.S.C. § 1251(a).

nationwide, the intent behind these ambitious goals still embody the implementation of the CWA.

While the CWA establishes the federal framework governing water quality protection and restoration, it is structured in a manner that recognizes the primary responsibilities and rights of states to control water pollution.[265] To this end, the CWA imposes various wide-scale requirements on states with regard to water quality management. These initiatives include establishing and periodically reviewing surface water quality standards, assessing the condition of waterbodies, and establishing water quality goals through the adoption of total maximum daily loads (TMDLs) for waterbody segments which do not meet water quality standards, and implementing controls for permitted sources of pollution. This federal and state partnership is further demonstrated by the availability of federal grants to states for the implementation of various water quality programs and initiatives.

On even numbered years, states are required to meet reporting requirements under CWA sections 303(d), 305(b), and 314, which identify impaired waters, provide a description of the water quality of all waters in the state, and provide an assessment of the status and trends of significant publicly owned lakes, respectively.[266] DEP prepares the Integrated Water Quality Assessments for Florida, which are available on its website.[267]

The main regulatory components of the CWA prohibit discharges of pollutants into waters of the United States except in compliance with the provisions of the CWA. This includes the regulation of pollutants discharged from point sources under National Pollutant Discharge Elimination System (NPDES) permit program[268] and discharges of dredged or fill material.[269] The CWA also regulates the use and disposal of biosolids from wastewater treatment processes.[270] Although most nonpoint sources of pollution are not controlled through regulatory measures, the CWA incentivizes nonpoint source management through federal grants to address nonpoint source pollution.[271]

Water Quality Assessment and Total Maximum Daily Loads for Impaired Waters

Water quality assessment begins with water quality standards. The Clean Water Act directs states to establish surface water quality standards, or if the state fails to act, requires the EPA to do so.[272] Florida's surface water quality standards are adopted by rule in chapter 62-302 of the Florida Administrative Code, and consist of designated uses,[273] numeric and narrative criteria necessary to safely support such uses, the state's anti-degradation policy, and moderating provisions (such as variances, mixing zone rules, or exemptions).[274] See Table 5.1.1 identifying the seven classes

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[265] 33 U.S.C. § 1251(b).
[266] 33 U.S.C. §§ 1313, 1315, and 1324.
[267] https://floridadep.gov/dear/dear/content/integrated-water-quality-assessment-florida. (Accessed December 2019.)
[268] 33 U.S.C. § 1342
[269] 33 U.S.C. § 1344.
[270] 33 U.S.C. § 1345.
[271] 33 U.S.C. § 1329.
[272] 33 U.S.C. § 1313(a)-(c).
[273] The term "designated use" is defined as "the present and future most beneficial use of a body of water as designated by the Environmental Regulation Commission by means of the Classification system contained in [rule chapter 62-302]." Fla. Admin. Code R. 62-302.200(9).
[274] Fla. Admin. Code R. 62-302.200(42).

of designated uses in Florida beginning with the classification having the highest degree of protection (*i.e.,* Class I – Potable Water Supplies).

Table 5.1.1 Classification of Surface Waters

CLASS I	Potable Water Supplies
CLASS I-Treated	Treated Potable Water Supplies
CLASS II	Shellfish Propagation or Harvesting
CLASS III	Fish Consumption; Recreation, Propagation, and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife
CLASS III-Limited	Fish Consumption; Recreation or Limited Recreation; and/or Propagation and Maintenance of a Limited Population of Fish and Wildlife
CLASS IV	Agricultural Water Supplies
CLASS V	Navigation, Utility, and Industrial Use

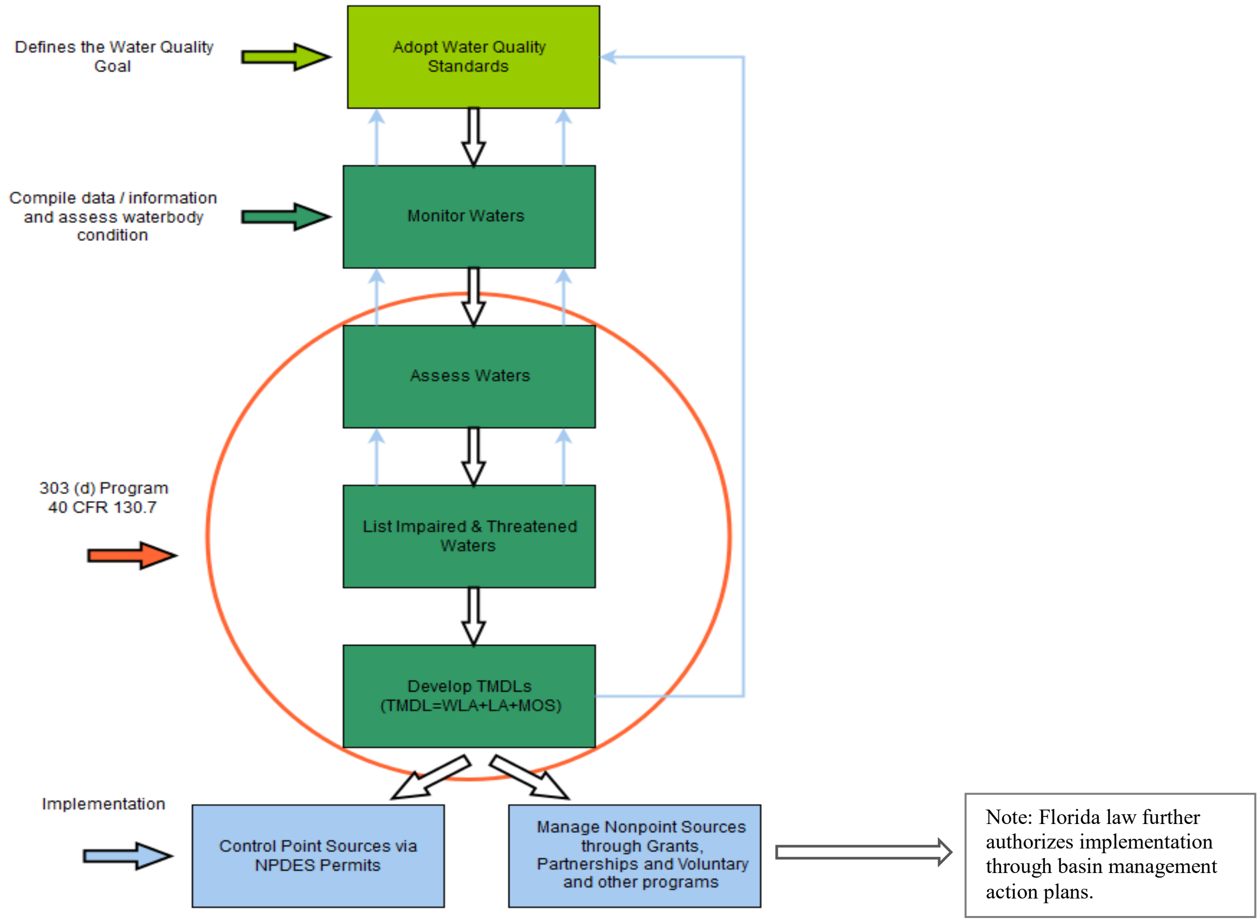
Source: Fla. Admin. Code R. 62-302.400(1).

The cornerstone of water quality restoration under the CWA is the development and implementation of total maximum daily loads for waterbodies or waterbody segments that are not fully meeting their designated uses. In 1999, the Florida Legislature passed the Florida Watershed Restoration Act, section 403.067, Florida Statutes, which established the state's TMDL program to implement the requirements in section 303(d) of the federal Clean Water Act.[275] Under this program, waters identified as impaired are placed on DEP's Verified List of impaired waterbodies for which TMDLs must be developed.[276] The list is adopted by DEP secretarial order and is submitted to the EPA biennially pursuant to 303(d) of the Clean Water Act.[277] The EPA must approve or disapprove the 303(d) list and may independently add additional waterbodies not identified by the state. Figure 5.1.1 illustrates the general approach for water quality restoration under the CWA.

[See figure on following page]

[275] 33 U.S.C. § 1313(d).
[276] *See generally* Fla. Admin. Code Ch. 62-303 (establishing the methodology for identifying impaired waters to be included on the state's Verified List of impaired waters, as well as the Planning List and Study List identifying potentially impaired waters and waters where additional information is needed, respectively).
[277] *See* Fla. Admin. Code R. 62-303.100(1); *see also* Fla. Admin. Code R. 62-303.150(1). The current Statewide Comprehensive Verified List of Impaired Waters is available at: https://floridadep.gov/dear/watershed-assessment-section/content/assessment-lists. (Accessed December 2019.)

Figure 5.1.1 Water Quality-Based Approach of the Federal Clean Water Act



Note: WLA refers to wasteload allocation for point sources, LA refers to load allocations for nonpoint sources, and MOS refers to the margin of safety to account for uncertainty.
Source: U.S. Environmental Protection Agency, Overview of Identifying and Restoring Impaired Waters under Section 303(d) of the CWA, https://www.epa.gov/tmdl/overview-identifying-and-restoring-impaired-waters-under-section-303d-cwa. (Accessed December 2019.)

The DEP utilizes a statewide watershed management approach for water resource management in Florida. First, DEP has delineated the state into assessment units with unique water body identification numbers (WBIDs) that represent waterbodies at the watersheds or sub-watershed scale.[278] These WBIDs include "drainage basins, lakes, lake drainage areas, springs, rivers and streams, segments of rivers and streams, coastal, bay and estuarine waters in Florida."[279] The WBIDs are used by DEP in implementation of a number of responsibilities including impaired waters assessment and the total maximum daily loads and basin management action plan programs.[280]

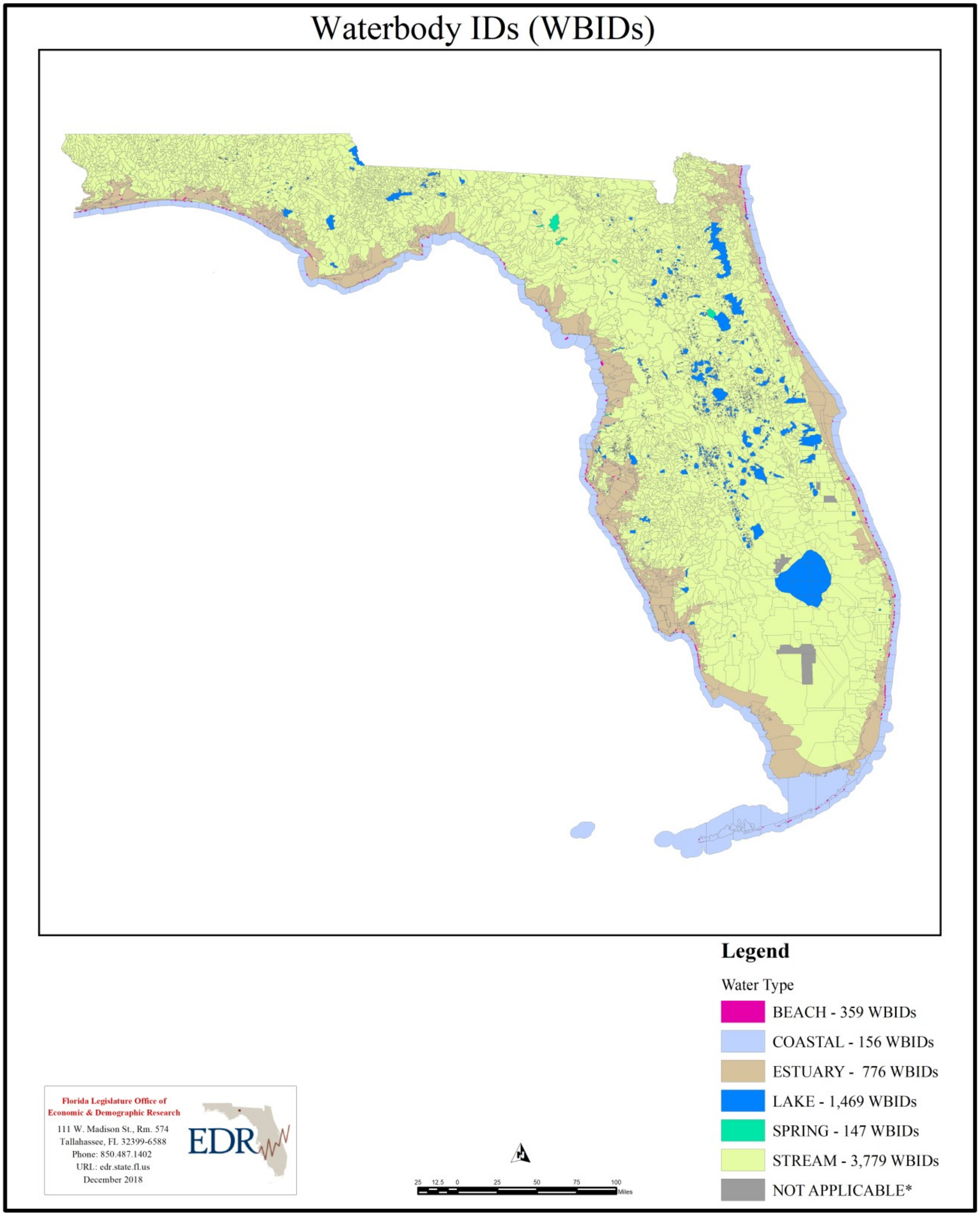
[278] Florida Department of Environmental Protection, Basin 411, What is a WBID?, https://floridadep.gov/dear/watershed-assessment-section/content/basin-411-0. (Accessed December 2019.)
[279] *Id.*
[280] *Id.*

Second, as part of the watershed management approach, Florida's 52 basins are divided into five basin groups that continuously move through a five-year, five-phase cycle of restoration activities that begins with the first phase of preliminary basin evaluation.[281] This approach allows DEP to focus its resources on specific basins throughout the state during each phase and ideally ensures that the WBIDs in each basin group will be assessed every five years. Assessed WBIDs are then placed in assessment categories or subcategories from one through five. See Figure 5.1.2 for a map of WBIDs statewide. See Figure 5.1.3 for a map of the five basin groups. See Figure 5.1.4 for an illustration of the rotating watershed management approach. See Table 5.1.2 for the assessment categories.

[See figures and tables on following pages]

[281] *See* Florida Department of Environmental Protection, Final Integrated Water Quality Assessment for Florida: 2016 Sections 303(d), 305(b), and 314 Report and Listing Update, Table 6.2. Phases of the basin management cycle at 168, available at: https://floridadep.gov/sites/default/files/2016-Integrated-Report.pdf. *See also* (Accessed December 2019.) Florida Department of Environmental Protection, Final Integrated Water Quality Assessment for Florida: 2018 Sections 303(d), 305(b), and 314 Report and Listing Update, at 136-39 (describing the watershed management approach), available at: https://floridadep.gov/sites/default/files/2018_integrated_report.pdf. (Accessed December 2019.)

Figure 5.1.2 WBIDs



*The six areas shown as not applicable are identified in DEP's GIS data as Hollywood Indian Reservation, Miccosukee Indian Reservation, Big Cypress Indian Reservation, Brighton Indian Reservation, Fellsmere Stick Marsh, and C-52 (Blue Cypress Watershed Management Area).

Figure 5.1.3 Basin Groups

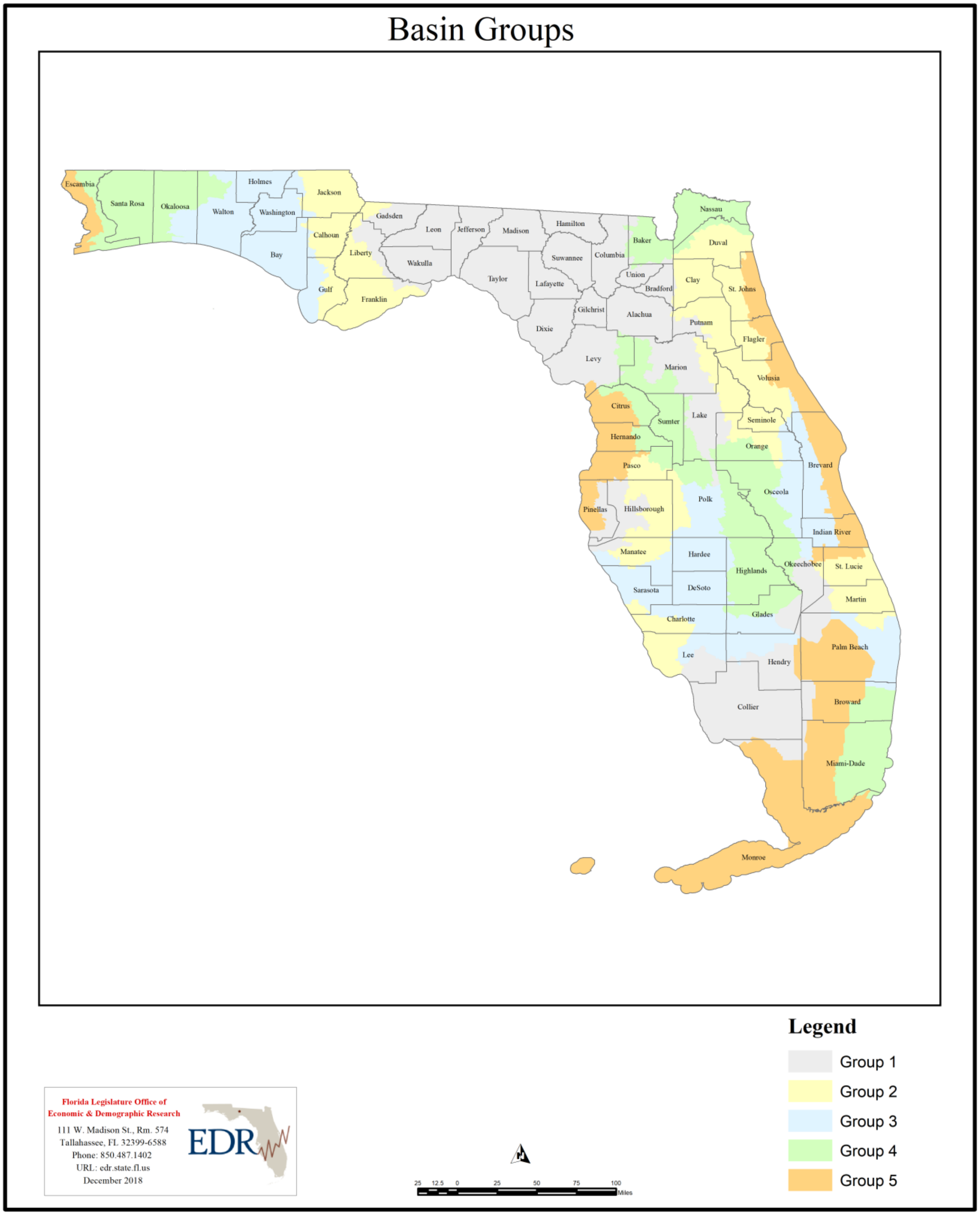
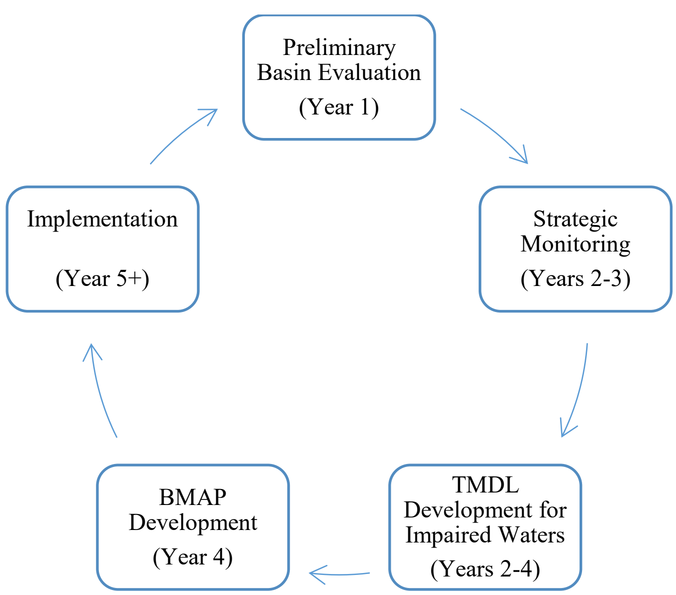


Table 5.1.2 Assessment Categories

Assessment Category	Assessment Category Definitions
1	Attains all designated uses
2	Attains some designated uses and insufficient or no information or data are present to determine if remaining uses are attained
3a	No data and information are present to determine if any designated use is attained
3b	Some data and information are present but not enough to determine if any designated use is attained
3c	Enough data and information are present to determine that one or more designated uses may not be attained according to the Planning List methodology in Chapter 62-303 of the Florida Administrative Code
4a	Impaired for one or more designated uses but does not require TMDL development because a TMDL has already been completed
4b*	Impaired for one or more designated uses but does not require TMDL development because the water will attain water quality standards due to existing or proposed measures
4c	Impaired for one or more criteria or designated uses but does not require TMDL development because impairment is not caused by a pollutant
4d	Waterbody indicates non-attainment of water quality standards, but the Department does not have enough information to determine a causative pollutant; or current data show a potentially adverse trend in nutrients or nutrient response variables; or there are exceedances of stream nutrient thresholds, but the Department does not have enough information to fully assess non-attainment of the stream nutrient standard.
4e**	Waterbody indicates non-attainment of water quality standards and pollution control mechanisms or restoration activities are in progress or planned to address non-attainment of water quality standards, but the Department does not have enough information to fully evaluate whether proposed pollution mechanisms will result in attainment of water quality standards.
5	Water quality standards are not attained and a TMDL is required.

Source: Florida Department of Environmental Protection, Watershed Assessment Section, available at: https://floridadep.gov/dear/watershed-assessment-section. (Accessed December 2019.) *See also* Memorandum from Robert H. Wayland III, Director, Office of Wetlands, Oceans and Watersheds to EPA Regional Directors et al. dated November 19, 2001, 2002 Integrated Water Quality Monitoring and Assessment Report Guidance, available at: https://www.epa.gov/sites/production/files/2015-10/documents/2002_02_13_tmdl_2002wqma.pdf. (Accessed December 2019.)
*Water segments in the 4b assessment category have Reasonable Assurance Plans in place and are not included in the state's 303(d) list.
** Water segments categorized in the 4e assessment category have Alternative Restoration Plans (also referred to as Pollutant Reduction Plans) in place and are included in the state's 303(d) list. Note that Florida's 4e category is comparable to EPA's 5-alternative (or 5-alt) category as they both recognize ongoing restoration activities for otherwise impaired waterbody segments.

Figure 5.1.4 Watershed Management Approach



Assessed water segments that are identified as impaired and placed in assessment category 5 require TMDL development. Establishing TMDLs for impaired waters represents a major first step towards restoring water quality. A TMDL is a water quality restoration goal that represents the maximum amount of a specific pollutant that a waterbody or waterbody segment can assimilate from all sources while still maintaining applicable water quality standards.[282] Using the TMDL as the maximum value, DEP then assigns individual wasteload allocations for point sources, load allocations for nonpoint sources, and a margin of safety to account for uncertainty in the scientific analysis.[283] Existing point sources may include wastewater treatment facilities, industrial facilities, and municipal separate storm sewer systems (known as MS4s). Existing nonpoint sources may include agricultural runoff and atmospheric deposition. These allocations along with other management and restoration strategies are intended to achieve the pollutant reductions necessary to meet the TMDL.[284]

Expressed mathematically, the TMDL is the summation of the wasteload for existing NPDES wastewater facilities and NPDES stormwater systems, the load allocation for existing nonpoint sources and natural background, and a margin of safety:

$$\mathbf{TMDL} = \sum \mathbf{WLA_{NPDES}} + \sum \mathbf{WLA_{NPDES\ Stormwater}} + \sum \mathbf{LA_{Nonpoint\ Sources}} + \mathbf{MOS}$$

As of December 31, 2018, DEP has adopted a total of 426 TMDLs for impaired WBIDs (425 site-specific TMDLs and 1 statewide TMDL).[285] Specifically, there are 241 TMDLs for dissolved oxygen (DO), nutrients, and/or un-ionized ammonia; 179 TMDLs for bacteria; and five for other parameters (iron, lead, and turbidity).[286] In addition to these site-specific TMDLs, in 2013, DEP adopted a single statewide TMDL for mercury that affects over 1,100 waterbody segments in fresh and marine waters previously listed for mercury impairment.[287] For a map of TMDL activities in the state, see Figure 5.1.5.

[See figure on following page]

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[282] *See* Fla. Admin. Code R. 62-303.200(31).

[283] All TMDLs include either an explicit margin of safety (*i.e.*, a specified amount of loading held in reserve) or implicit margin of safety (*i.e.*, conservative assumptions made and documented during TMDL development).

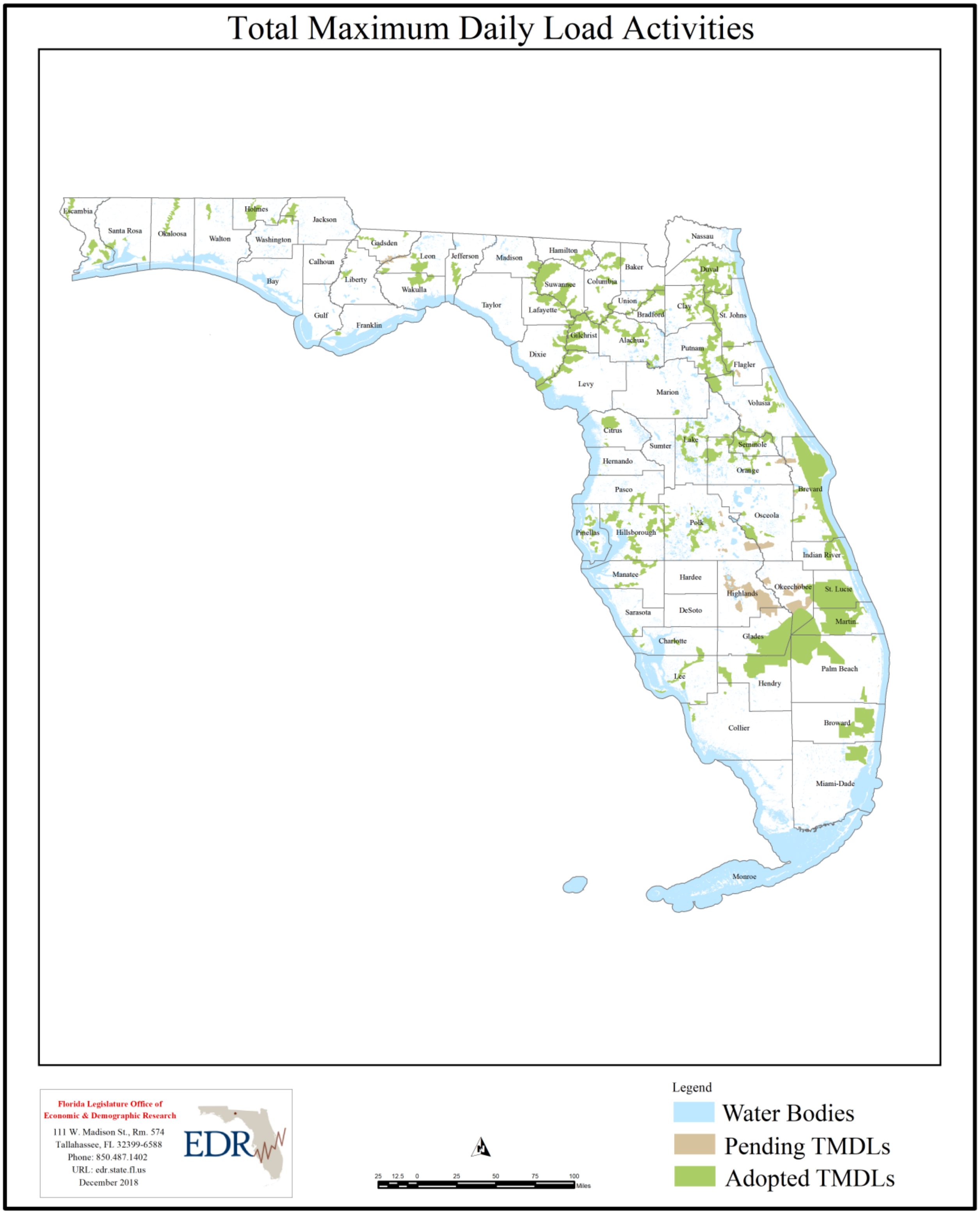
[284] § 403.067(6), Fla. Stat.

[285] Florida Department of Environmental Protection, 2018 Statewide Annual Report on Total Maximum Daily Loads, Basin Management Action Plans, Minimum Flows or Minimum Levels, and Recovery or Prevention Strategies, available at: https://floridadep.gov/dear/water-quality-restoration/content/statewide-annual-report. (Accessed December 2019.)

[286] *Id*.

[287] *Id*. Note that mercury impairment is based upon potential risks to human health through consumption of fish with elevated levels of mercury in their tissues and not on an exceedance of the state's water quality criterion for mercury. *See* Final Report, Mercury TMDL for the State of Florida, October 24, 2013, available at: https://floridadep.gov/sites/default/files/Mercury-TMDL.pdf (Accessed December 2019.)

Figure 5.1.5 TMDLs in Florida



Based on DEP's statewide Comprehensive Verified List of impaired waters, which includes the most recent updates published on November 26, 2019, there are approximately 1,686 waterbody-parameter combinations in Florida that are listed as impaired and require a TMDL.[288] Overall, the most frequently identified pollutants causing water impairment relate to excessive nutrients.

In 2015, DEP set forth a priority framework document addressing how Florida's TMDL program will implement the new long term vision that EPA announced for section 303(d) of the Clean Water Act.[289] For the 2015 through 2022 time period, DEP expects to develop site-specific TMDLs for 80 priority waterbodies or waterbody segments.[290] The TMDL priority setting focuses on impaired waters where site-specific TMDLs are the best available option for water quality restoration.[291] Where appropriate, alternatives to the TMDL approach will be implemented.

Forecast of Future Expenditures Necessary to Comply with Laws Governing TMDLs

The DEP's statewide Comprehensive Verified List of impaired waters provides a list of WBIDs over which TMDLs will need to be established.[292] Further, they are prioritized into high, medium, or low priority.[293] While these priorities are not associated with a legally required time to completion, the list indicates that high priority are to be addressed within 5 years, medium within 5 to 10 years, and low within 10 years. As of the November 2019 update, there were 226 WBIDs with high priority for TMDL development, 1,013 with medium priority, and 447 with low priority.[294] Methodology regarding TMDL establishment provided by DEP suggests that for each WBID, impairments for dissolved oxygen, total nitrogen, total phosphorus, chlorophyll-a, macrophytes, biology, algal mats, nitrates-nitrites, total ammonia, and unionized ammonia could be combined to a single TMDL and that all other impairments would require their own TMDL. Applying this methodology and assuming the highest priority among combined impairments, there are expected to be 206 TMDLs with high priority, 718 with medium, and 433 with low priority.

DEP further provided a history of the 438 existing TMDLs established per year and by pollutant parameter.[295] This history can be found in Table 5.1.3.

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[288] Florida Department of Environmental Protection, Statewide Comprehensive Verified List of Impaired Waters, available at: https://floridadep.gov/dear/watershed-assessment-section/content/assessment-lists. (Accessed December 2019.) Note that a waterbody or waterbody segment not meeting more than one water quality standard would be identified more than once on the State's Verified List as separate waterbody-parameter combinations.

[289] Letter from Gregory P. DeAngelo, P.E.., Florida Department of Environmental Protection, to Gracy Danois, Chief, U.S. Environmental Protection Agency (September 1, 2015), available at:

[290] *See* Appendix A of Letter from Gregory P. DeAngelo, P.E.., Florida Department of Environmental Protection, to Gracy Danois, Chief, U.S. Environmental Protection Agency (September 1, 2015), available at: https://floridadep.gov/sites/default/files/PriorityFrameworkDocument.pdf. (Accessed December 2019.)

[291] Letter from Gregory P. DeAngelo, P.E.., Florida Department of Environmental Protection, to Gracy Danois, Chief, U.S. Environmental Protection Agency (September 1, 2015) at 2, available at: https://floridadep.gov/sites/default/files/PriorityFrameworkDocument.pdf. (Accessed December 2019.)

[292] Available at: https://floridadep.gov/dear/watershed-assessment-section/documents/comprehensive-verified-list. (Accessed December 2019.)

[293] Less than 1 percent of the WBIDs on the verified list are not assigned a priority. EDR categorizes them as low priority.

[294] According to DEP staff, the state's bacteria water quality criteria for fresh waters in Florida Administrative Code Rule 62-302.530 were updated from fecal coliform to E.Coli to be consistent with EPA recommendations. As DEP begins assessing waters under the new E.Coli criteria, waterbody segments currently identified as impaired for fecal coliform and requiring a TMDL may be updated accordingly to reflect E.Coli impairment or delisted for fecal coliform.

[295] As previously mentioned, 426 TMDLs were developed as of December 31, 2018. As shown in Table 5.1.3, 12 additional TMDLs were developed in 2019 for a total of 438 TMDLs at the time of this edition.

Table 5.1.3 TMDLs Established by Parameter and Year

	CY 2001	CY 2002	CY 2003	CY 2004	CY 2005	CY 2006	CY 2007	CY 2008	CY 2009
DO, Nutrients, Unionized Ammonia	9	-	-	1	1	28	8	53	46
Fecal Coliform	-	-	-	6	1	18	5	21	40
Iron	-	-	-	-	-	1	-	-	-
Lead	-	-	-	-	-	-	-	-	3
Mercury in Fish Tissue (statewide)	-	-	-	-	-	-	-	-	-
Turbidity	-	-	-	-	-	-	-	-	-
Total	**9**	**-**	**-**	**7**	**2**	**47**	**13**	**74**	**89**

	CY 2010	CY 2011	CY 2012	CY 2013	CY 2014	CY 2015	CY 2016	CY 2017	CY 2018	CY 2019
DO, Nutrients, Unionized Ammonia	2	-	2	37	10	10	4	13	17	12
Fecal Coliform	31	-	39	1	17	-	-	-	-	-
Iron	-	-	-	-	-	-	-	-	-	-
Lead	-	-	-	-	-	-	-	-	-	-
Mercury in Fish Tissue (statewide*)	-	-	-	1	-	-	-	-	-	-
Turbidity	-	-	-	1	-	-	-	-	-	-
Total	**33**	**-**	**41**	**40**	**27**	**10**	**4**	**13**	**17**	**12**

*The one TMDL for Mercury covers 1,131 WBIDs.

Finally, DEP provided internal expenditure data that allowed a breakdown between TMDL development expenditures and other TMDL related expenditures (*e.g.*, funding for restoration efforts). This was able to be produced with confidence going back to Fiscal Year 2012-13. Between that time and Fiscal Year 2018-19, the state of Florida has expended $22.94 million on TMDL development. Using CPI to adjust each year, this represents $24.23 million in Fiscal Year 2018-19 dollars. Over that same time period, 123 TMDLs were established. Assuming similar costs going forward, this suggests an average cost per TMDL of $196,970.27. Applying this cost to the anticipated TMDLs from the verified list and considering the timing differences between priority groups produces the expenditure forecast shown in Table 5.1.4.

[See table on following page]

Table 5.1.4 Forecast of TMDL Development Expenditures Necessary to Comply with the Law (in $millions)

	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	FY 26-27	FY 27-28	FY 28-29
Total	$30.79	$30.79	$30.79	$30.79	$30.79	$22.67	$22.67	$22.67	$22.67	$22.67

Underlying this forecast is an assumption of approximately 156 TMDLs established per year for the first five years of the forecast and approximately 115 TMDLs established per year for the last five years of the forecast based on priorities. This may not be currently feasible. DEP staff indicates that under their current staffing and funding they are capable of developing TMDLs for approximately 20 WBIDs per year. At that rate, the state would need to expend approximately $3.94 million annually through Fiscal Year 2086-87 to establish TMDLs over WBIDs on the current verified list. Establishing a TMDL, however, is not the only method through which waterbodies can be removed from the verified list. The Comprehensive Delist List is also maintained by DEP[296] and indicates a wide variety of reasons for a WBID being removed from the Verified List, including becoming part of an alternative restoration approach, analysis flaws, TMDL establishment, and no longer being impaired.

Basin Management Action Plans

In 2005, the Florida Watershed Restoration Act was amended to authorize DEP to adopt basin management action plans (BMAPs), which are water quality restoration plans that are unique to Florida. The BMAPs provide the state's primary mechanism and blueprint for restoring impaired waters by meeting TMDLs. Addressing surface waters and groundwater-fed springs, they provide an opportunity to manage nonpoint sources of pollution. The plans are intended to integrate all of the management strategies committed to by state, regional, local, and private stakeholders to reduce pollutant sources, and thereby achieve water quality standards for the pollutants causing impairment. BMAPs are adopted by DEP secretarial order and are enforceable by law.[297]

A BMAP includes an equitable allocation of pollutant reductions to individual basins, as a whole to all basins, or to each identified point source or category of nonpoint sources.[298] Through participation from governmental and private stakeholders, DEP identifies appropriate management strategies, schedules for implementation, feasible funding strategies, plans for evaluating the effectiveness of the management strategies, and strategies to address potential future increases in pollutant loadings.[299] A BMAP must include milestones for implementation and water quality improvement, as well as an associated water quality monitoring component to evaluate the progress of pollutant reductions. Except as discussed below, while the implementation of a BMAP is not required to achieve the appropriate TMDLs within a particular time frame, an assessment of the progress toward meeting the milestones is conducted every five years and revisions to BMAPs

[296] Available at: https://floridadep.gov/dear/watershed-assessment-section/documents/comprehensive-delist-list. (Accessed December 2019).
[297] § 403.067(7)(d)1., Fla. Stat. (providing that BMAPs are enforceable pursuant to sections 403.067, 403.121, 403.141, and 403.161, Florida Statutes).
[298] § 403.067(7)(a)2., Fla. Stat.
[299] *See* § 403.067(7)(a), Fla. Stat.

are made when deemed necessary or appropriate. For Outstanding Florida Springs BMAPs[300] and BMAPs adopted for Lake Okeechobee, the Caloosahatchee Estuary Basin, and the St. Lucie Estuary Basin under the Northern Everglades and Estuaries Protection Program,[301] a notable requirement relating to TMDL implementation places a 20-year target to achieve the TMDLs, with 5-year, 10-year, and 15-year intermediate milestones.[302]

Beginning in 2016, there are additional requirements for BMAPs. Each new or revised BMAP must also include:

- A description of best management practices (BMP) adopted by rule (*e.g.,* DACS-adopted BMP manuals);

- A list of projects in priority ranking with planning-level cost estimates and an estimated date of project completion;

- The source and amount of financial assistance available by DEP, a WMD, or other entity, if applicable; and

- A planning-level estimate of each listed project's expected load reduction, if applicable.[303]

In June 2019, DEP submitted its second statewide annual report (STAR Report) to the Governor and Florida Legislature, which, in part, provides the status of each TMDL and BMAP as of December 31, 2018.[304] In the STAR Report, DEP must include the status of BMAP projects identified to achieve a TMDL, and, if applicable, an explanation of possible causes and potential solutions for any unmet 5-year, 10-year, or 15-year milestone, or 20-year target.[305] The report must also include project descriptions, estimated costs, proposed priority project ranking, and funding needs to achieve the TMDLs.[306]

The latest STAR Report provides a progress report on the 24 adopted BMAPs, the majority of which address nutrient impairments. Note that EDR has not included in its analysis any pending BMAPs or revisions to BMAPs that were not included in DEP's STAR Report.[307] For a map of

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[300] *See* Florida Springs and Aquifer Protection Act, §§ 373.801 – 373.813, Fla. Stat.
[301] § 373.4595, Fla. Stat.
[302] *See* § 373.4595, Fla. Stat. (requiring DEP to develop a schedule establishing 5-year, 10-year, and 15-year milestones and targets to achieve the TMDL within 20 years after adoption of the Lake Okeechobee BMAP, Caloosahatchee Estuary BMAP, and the St. Lucie River and Estuary BMAP; or else provide an explanation of the constraints that prevent achievement within 20 years, an estimate of the time needed, and additional 5-year measurable milestones); *see also* § 373.807, Fla. Stat. (requiring DEP to develop a schedule establishing 5-year, 10-year, and 15-year milestones and targets to achieve the nutrient TMDLs within 20 years of adopting a BMAP for an Outstanding Florida Spring).
[303] § 403.067(7)(a)4.c., Fla. Stat.
[304] Florida Department of Environmental Protection, 2018 Statewide Annual Report on Total Maximum Daily Loads, Basin Management Action Plans, Minimum Flows or Minimum Water Levels, and Recovery or Prevention Strategies, June 28, 2019, available at: https://floridadep.gov/dear/water-quality-restoration/content/statewide-annual-report. (Accessed December 2019.)
[305] § 403.0675(1), Fla. Stat.
[306] *Id*.
[307] A current list of pending and adopted BMAPs is available at: https://floridadep.gov/dear/water-quality-restoration/content/basin-management-action-plans-bmaps. (Accessed December 2019.)

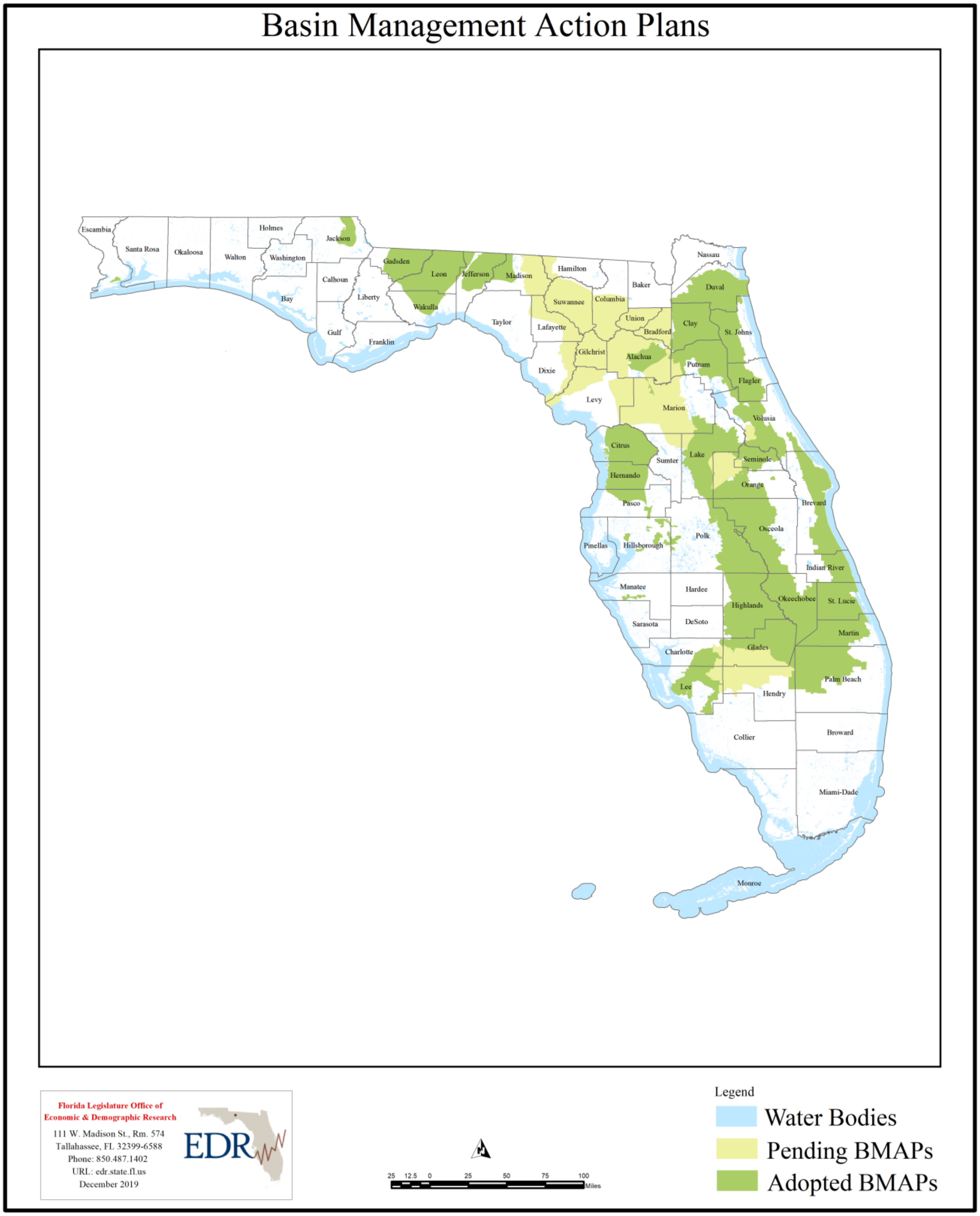
adopted and pending BMAPs as of December 1, 2019, see Figure 5.1.6. For a list of adopted BMAPs included in the STAR Report see Table 5.1.5.

Table 5.1.5 BMAPs Included in Analysis

BMAP Type	BMAP Name	FY Adopted
Fecal Indicator Bacteria BMAPs	Hillsborough River Basin	2010
	Lower St. Johns River (LSJR) Tributaries I and II	2009 and 2010
	Bayou Chico	2012
	Alafia River Basin	2014
	Manatee River Basin	2014
Northern Everglades and Estuaries Protection Program BMAPs	Caloosahatchee Estuary Basin	2013
	St. Lucie River and Estuary	2013
	Lake Okeechobee	2015
Outstanding Florida Springs BMAPs	Santa Fe River	2012
	Rainbow Springs Basin	2016
	Silver Springs, Silver Springs Group, and Upper Silver River	2016
	Wekiva River, Rock Springs Run, and Little Wekiva Canal	2016
	Jackson Blue Spring and Merritts Mill Pond Basin	2018
	Upper Wakulla River and Wakulla Springs	2018
Surface Water BMAPs for Nutrients	Upper Ocklawaha River Basin	2008
	Orange Creek	2008
	Lower St. Johns River (LSJR) Mainstem	2009
	Lake Jesup	2010
	Indian River Lagoon (IRL) Basin: Banana River Lagoon	2013
	Indian River Lagoon (IRL) Basin: Central Indian River Lagoon	2013
	Indian River Lagoon (IRL) Basin: North Indian River Lagoon	2013
	Everglades West Coast Basin	2013
	Lakes Harney, Monroe, Middle St. Johns River (MSJR), and Smith Canal	2013

[See figure on following page]

Figure 5.1.6 Basin Management Action Plans



While TMDLs are implemented by point sources of pollution through timely changes in NPDES permit conditions (such as new discharge limits), the reduction of nonpoint sources of pollution is achieved through the implementation of best management practices (BMPs). Nonpoint source dischargers included in BMAPs are required to implement BMPs or conduct water quality monitoring approved by DEP or the applicable WMD to demonstrate compliance with pollutant load reductions.[308]

To address nonpoint source pollution from urban and suburban areas (*i.e.,* non-agricultural areas) within BMAPs, responsible stakeholders have identified structural and non-structural BMPs to address stormwater runoff and discharges to receiving waterbodies. Structural BMPs involve constructed systems that are generally intended to reduce the volume of stormwater discharge or reduce concentrations of pollutants. This includes wet or dry detention ponds. Non-structural BMPs focus on preventing, controlling, and treating pollutants at their source before they enter the environment. This includes land conservation, local ordinances (such as fertilizer ordinances), land use planning, watershed planning, and low impact development strategies. According to the BMAP project list provided in DEP's 2019 STAR Report, the most widely identified structural BMPs are wet detention ponds while education efforts and street sweeping are the most common non-structural practices.[309] Including structural and non-structural projects, stormwater practices related to fecal indicator bacteria ("FIB-Stormwater") are the most common project type overall.

Agricultural BMPs are intended to be practical, cost-effective measures that agricultural producers can undertake to conserve water and reduce the amount of pollutants that enter water resources.[310] An agricultural producer who implements and maintains verified, DACS-adopted BMPs receives a presumption of compliance with state water quality standards for the pollutants addressed by the BMPs.[311] According to the DACS Office of Agricultural Water Policy, based on data available as of December 31, 2018, 54 percent of the agricultural acreage in Florida, excluding silviculture, is enrolled in the BMP program.[312] Of those, approximately 58 percent of the enrolled acres are within BMAP areas. See Figure 5.1.7 for a map of BMP-enrolled agricultural lands statewide, excluding silviculture and aquaculture. As of December 2019, there were still five pending BMAPs for Outstanding Florida Springs that are not yet final and awaiting the outcome of legal challenges.[313] Once the pending BMAPs shown in Figure 5.1.6 are adopted and final, BMP enrollment statewide is expected to increase further.

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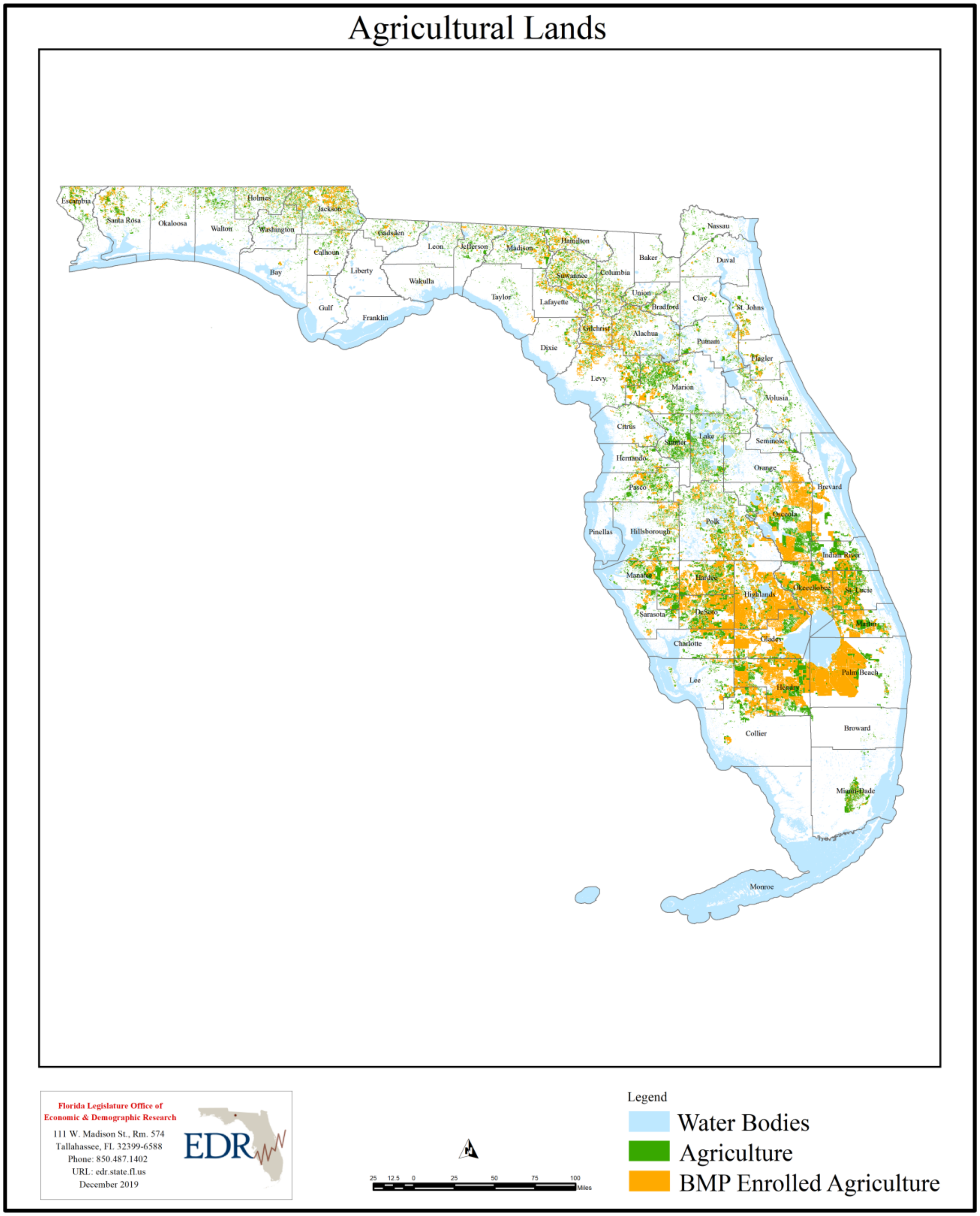
308 *See* § 403.067(7)(g), Fla. Stat.
309 Available at: https://floridadep.gov/dear/water-quality-restoration/content/statewide-annual-report. (Accessed December 2019.)
310 *See* DACS, Agricultural Best Management Practices, What Are Agricultural Best Management Practices?, https://www.fdacs.gov/Agriculture-Industry/Water/Agricultural-Best-Management-Practices. (Accessed December 2019.)
311 § 403.067(7)(c), Fla. Stat.
312 DACS, Status of Implementation of Agricultural Nonpoint Source Best Management Practices, July 11, 2019, available at: https://www.fdacs.gov/Divisions-Offices/Agricultural-Water-Policy. (Accessed December 2019.)
313 The five pending BMAPs for Outstanding Florida Springs are: (1) Santa Fe River; (2) Silver Springs and Upper Silver River and Rainbow Springs Group and Rainbow River; (3) Suwannee River (Lower Suwannee River, Middle Suwannee River, and Withlacoochee River Sub-basins); (4) Volusia Blue Spring; and (5) Wekiwa and Rock Springs.

Figure 5.1.7 Map of BMP-enrolled Agricultural Lands (Excluding Silviculture & Aquaculture)



Forecast of Future Expenditures Necessary to Implement Adopted BMAPs
The STAR Report contains a full list of completed, underway, and planned projects within each BMAP. Project costs and nutrient load reductions are included when available. For some projects, a cost estimate or load reduction may not be applicable. For the instances where costs were unavailable but applicable, EDR estimates them based on average costs of projects of the same type that included cost information.[314]

For any BMAP with a required total nutrient load reduction for total nitrogen (TN) and/or total phosphorus (TP), the additional reduction necessary to meet that total is calculated as the initial load reduction requirement minus the load reductions from completed, underway, and planned projects. BMAPs identified as Fecal Indicator Bacteria BMAPs and those where TN or TP load reduction requirements are not identified are assumed to be achieved once the existing underway and planned projects are completed. This assumption may lead EDR to underestimate the necessary future expenditures.

The timing of the expenditure forecast is unique to each BMAP. Nutrient reduction achieved through completed projects is compared to the initial load reduction requirement and the duration of time since the BMAP's adoption to estimate the remaining time to completion. For example, if a total nitrogen reduction of 100 pounds per year has been achieved in the 5 years since the BMAP's adoption and 400 pounds per year is the load reduction requirement, EDR assumes the BMAP needs 15 more years. EDR caps this duration at 20 years from the adoption of the BMAP, assumes projects identified as planned will be completed over the lesser of the aforementioned estimated time to completion or five years, and assumes that the funding for costs associated with underway projects has already been spent.[315]

The cost per future project and resulting load reduction is also unique to each BMAP. The relevant existing projects in the STAR Report can reduce TN, TP, or both. For each BMAP, the cost and load reduction for each type are considered and the most cost effective project type is chosen. For BMAPs requiring a nutrient load reduction of both TN and TP, the most cost effective projects are always those that reduce both. In those instances, once enough projects are identified to satisfy one nutrient's load reduction, the most cost effective choice to reduce the other nutrient is then chosen.[316]

The final challenge in forecasting BMAP expenditures is estimating the cost sharing between governmental entities and private stakeholders considering that just under 11 percent of the projects include both a clearly identified dollar amount and a specified funding source. This funding amount accounts for nearly 24 percent of the total costs identified across all projects. The funding sources are sorted into categories, and those involving multiple levels of government are assumed to split evenly between those levels. For example, if the source is listed as

[314] Project types used are those identified in the project list and consist of 88 different types.
[315] Alternatively, assuming the underway projects have not been funded results in a total expenditure increase of $2,958.57 million, or an increase of 156 percent.
[316] For example, imagine BMAP X needs 30 pounds of TN and 10 pounds of TP reduced per year and the average TN reducing project cost $5 and reduced 1 pound of TN per year, the average TP reducing project cost $10 and reduced 1 pound of TP per year, and the average TN and TP reducing project cost $20 and reduced 3 pounds of TN and 2 pounds of TP per year. Five of the TN and TP reducing projects would be done first, costing $100 and meeting the required TP reduction and 15 of the 30 reductions necessary of TN, and then 15 of the TN reducing projects would be done, costing $75 and meeting the required TN reduction.

"DEP/SFWMD" and the funding amount is $1 million, $500,000 is assumed to be from state government and $500,000 is assumed to be from regional governments. In compiling the list of projects, DEP likely has more information on projects involving state funds than on those that do not, and as such the state share may be overestimated. The preliminary forecast of expenditures necessary to comply with laws governing the BMAP program is provided in Table 5.1.6. This forecast may change significantly as more project data becomes available and more BMAPs are adopted. Further, it is likely that the cheaper or more cost effective projects would be completed first, meaning that future projects would be more expensive. As such, EDR's methodology based on historical and existing projects may underestimate future project costs.

Table 5.1.6 Forecast of BMAP Expenditures Necessary to Comply with the Law (in $millions)

	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	FY 26-27	FY 27-28	FY 28-29
Local	$124.86	$122.09	$122.09	$117.77	$117.77	$79.88	$74.76	$74.76	$62.24	$58.34
Regional	$13.16	$12.87	$12.87	$12.41	$12.41	$8.42	$7.88	$7.88	$6.56	$6.15
State	$385.01	$376.45	$376.45	$363.13	$363.13	$246.30	$230.52	$230.52	$191.92	$179.88
Federal	$8.47	$8.28	$8.28	$7.99	$7.99	$5.42	$5.07	$5.07	$4.22	$3.96
Private	$3.23	$3.16	$3.16	$3.05	$3.05	$2.07	$1.93	$1.93	$1.61	$1.51
Total	$534.73	$522.84	$522.84	$504.34	$504.34	$342.08	$320.17	$320.17	$266.56	$249.83

	FY 29-30	FY 30-31	FY 31-32	FY 32-33	FY 33-34	FY 34-35	FY 35-36	Total
Local	$57.09	$53.66	$53.66	$39.12	$33.63	$33.63	$2.85	**$1,228.18**
Regional	$6.02	$5.65	$5.65	$4.12	$3.54	$3.54	$0.30	**$129.42**
State	$176.03	$165.46	$165.46	$120.62	$103.70	$103.70	$8.78	**$3,787.06**
Federal	$3.87	$3.64	$3.64	$2.65	$2.28	$2.28	$0.19	**$83.29**
Private	$1.48	$1.39	$1.39	$1.01	$0.87	$0.87	$0.07	**$31.77**
Total	$244.48	$229.80	$229.80	$167.53	$144.02	$144.02	$12.19	**$5,259.72**

Alternative Restoration Plans

The EPA recognizes that under certain circumstances, the TMDL development approach required under the CWA may not be the most efficient and effective strategy to attain water quality standards.[317] In some limited cases, water quality standards may be attained through (1) technology-based effluent limitations for permitted point sources, (2) more stringent effluent

[317] *See* Integrated Reporting Guidance under CWA Sections 303(d), 305(b) and 314 for the years 2004, 2008 (providing, in part, guidance on the use of assessment category 4b) available at: https://www.epa.gov/tmdl/integrated-reporting-guidance-under-cwa-sections-303d-305b-and-314. (Accessed December 2019.)

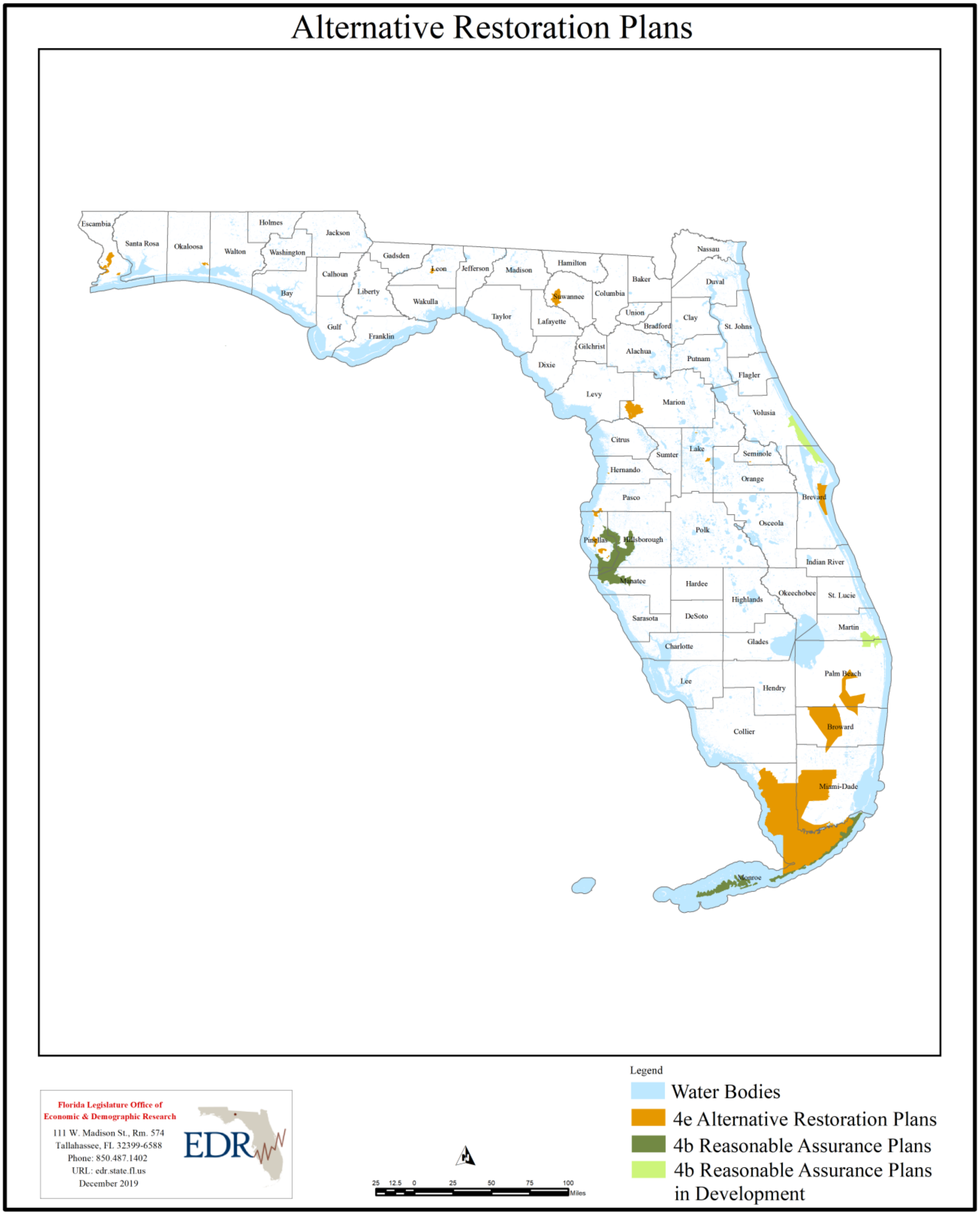
limitations required by local, state, or federal authority, (3) or other pollution requirements such as best management practices.[318]As a result, EPA created assessment category 4b for CWA reporting purposes,[319] which recognizes that other pollution control mechanisms in lieu of TMDL development may result in the attainment of applicable water quality standards in the near-term. The 4b waters are not included in a state's 303(d) impaired waters list, and therefore, are not prioritized for TMDL development. The EPA also recognizes a 5-alternative category of waters that are included in a state's 303(d) list and prioritized for TMDL development but are being addressed in the near-term through alternative restoration efforts.

In Florida, DEP encourages local stakeholders to develop and implement water quality restoration activities as soon as practicable, which may obviate the need to use limited state resources to develop TMDLs and implement BMAPs.[320] At a minimum, effectively addressing water quality concerns ahead of these regulatory steps may reduce the state and local expenditures necessary restore water quality.[321] In Florida, there are two types of restoration plans that are intended to promote water quality improvements prior to development of a TMDL: 4b reasonable assurance plans (4b plans or RAPs) and 4e water quality restoration plans (4e plans). Both types of alternative approaches are initiated and driven by stakeholder involvement. The main difference between the 4b and 4e plans concerns the level of certainty regarding when applicable water quality standards will be attained, with 4b plans having greater certainty that reasonable progress will be made by the next assessment cycle for that basin.[322] For a full list of the state's assessment categories, see Table 5.1.2. See Figure 5.1.8 for a map of the 4b and 4e plans currently being implemented in Florida.

[See figure on following page]

[318] *See* 40 C.F.R § 130.7(b)(1).
[319] As discussed previously, the state water quality reporting requirements are under sections 303(d), 305(b), and 314 of the CWA. These reports are often referred to as integrated reports since a single report meeting all of the requirements are submitted to EPA.
[320] *See* Florida Department of Environmental Protection, *Guidance on Developing Plans as Alternatives to TMDLs – Assessment Category 4b and 4e Plans*, June 2015, at 1, available at: https://floridadep.gov/sites/default/files/4b4ePlansGuidance.pdf. (Accessed December 2019.)
[321] Florida Department of Environmental Protection, *Category 4e Assessments and Documentation*, https://floridadep.gov/dear/alternative-restoration-plans/content/category-4e-assessments-and-documentation. (Accessed December 2019.)
[322] Florida Department of Environmental Protection, *Category 4e Assessments and Documentation*, https://floridadep.gov/dear/alternative-restoration-plans/content/category-4e-assessments-and-documentation. (Accessed December 2019.)

Figure 5.1.8 Alternative Restoration and Reasonable Assurance Plans



For 4b plans, there is reasonable assurance that, due to pollution control mechanisms, the waterbody is "expected to attain water quality standards in the future and is expected to make reasonable progress towards attainment of water quality standards by the time the next section 303(d) list for the basin is scheduled to be submitted to EPA."[323] The 4b plans are developed by local stakeholders, approved by DEP, and adopted by DEP secretarial order. As of December 2019, there are five 4b plans that are being implemented in Florida.[324] See Table 5.1.7 for project implementation costs identified in 4b plans. According to DEP staff, while not required, DEP may try to track 4b project implementation data in a similar format as basin management action plan projects, which may include cost estimates and timeframes for completion. As this data becomes available, EDR will refine the expenditure analysis to include 4b plans.

Table 5.1.7 Reasonable Assurance Plans (4b Plans)

Reasonable Assurance Plans	Lead Entity	Year of Plan and Updates	Total Identified Expenditures*
Lake Seminole	Pinellas County	2007, 2011	$29.12
Florida Keys	DEP	2008, 2011, 2018	$721.99
Shell, Prairie, and Joshua Creeks	SWFWMD	2004, 2006, 2008, 2010, 2012, 2014	$47.22
Tampa Bay Estuary	Tampa Bay Estuary Program	2002, 2007, 2009, 2012, 2014	$-
Mosquito Lagoon	City of Edgewater, City of New Smyrna Beach, City of Oak Hill, DOT, and Volusia County	2019	$20.92

*These expenditures are in millions of dollars and may be historical or planned.

DEP's 4e category is comparable to EPA assessment category 5-alternative (or 5-alt). This category recognizes that there are recently completed or ongoing water quality restoration activities being implemented to address impairment.[325] The 4e waters are included in the state's 303(d) list and the state's study list (for additional data gathering),[326] but the decision to develop a TMDL is deferred until the next assessment cycle. As explained above, 4e plans involve less certainty of when water quality standards will be attained than the 4b plans.[327] The goal of an approved 4e plan "is to implement appropriate restoration activities and, if necessary, additional study so that by the next assessment cycle either a 4b plan can be approved [by DEP] or the

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[323] Fla. Admin. Code R. 62-303.600.
[324] *See* Florida Department of Environmental Protection, *Reasonable Assurance Plans (RAPs): Category 4b Assessments and Documentation*, https://floridadep.gov/dear/alternative-restoration-plans/content/reasonable-assurance-plans-raps-category-4b-assessments. (Accessed December 2019.)
[325] Florida Department of Environmental Protection, *Category 4e Assessments and Documentation*, https://floridadep.gov/dear/alternative-restoration-plans/content/category-4e-assessments-and-documentation. (Accessed December 2019.)
[326] Fla. Admin. Code R. 62-303.390(2)(d).
[327] Fla. Admin. Code R. 62-303.390(2)(d).

waterbody attains water quality standards for the parameter causing impairment."[328] As of December 2019, local stakeholders were implementing restoration projects for 51 waterbody segments as a near-term alternative to TMDL development. Figure 5.1.9 shows the current progress of the water quality restoration activities under 4e plans. In future editions, EDR work with DEP staff to determine what project data is available for 4e plans.

[See figure on following page]

[328] Florida Department of Environmental Protection, *Guidance on Developing Plans as Alternatives to TMDLs – Assessment Category 4b and 4e Plans*, June 2015, at 10, available at: https://floridadep.gov/sites/default/files/4b4ePlansGuidance.pdf. (Accessed December 2019.)

Figure 5.1.9 Water Quality Restoration Plan Progress (Category 4e)

Waterbodies Addressed by Plan	Parameter(s) of Impairment	*Steps in the Process*									
		Plan Initiated	Develop Restoration Document	Finalize Restoration Plan	Finalize Assessment	Implement Restoration Plan	Evaluate Progress	Progress Demonstrated	Evaluate Progress	Continued Progress Demonstrated	Water Quality Standard Attained
Lake Tohopekaliga	Biology - Lake Vegetation Index							2017			
Central Drainage Ditch	Nutrients								2018		
Reedy Creek	Fecal Coliform									2017	
Cedar Creek (Tidal)	Dissolved Oxygen, Nutrients									2018	
Rocky Bayou	Nutrients					2016					
Everglades	Dissolved Oxygen, Nutrients					2018					
Florida Keys	Dissolved Oxygen, Nutrients							2018			
Banana River	pH					2018					
Lake Howell	Biology, Nutrients					2018					
Lakes Kinsale, Killarney, and Kanturk	Nutrients, Un-ionized Ammonia						2018				
Lake Lafayette (Upper Segment)	Dissolved Oxygen, Fecal Coliform, Nutrients						2018				
Alachua Sink	Dissolved Oxygen						2018				
West Emeralda Marsh Conservation Area	Dissolved Oxygen, Nutrients						2018				
Bayou Chico and Bayou Chico Drain	Enterococci						2018				
Perdido Bay (Upper Segment) and Perdido River (South Marine)	Nutrients						2018				
Elevenmile Creek	Escherichia coli						2018				
Crystal Lake	Nutrients					2018					
Weeki Wachee River	Nutrients					2018					
Anclote River Tidal and Anclote River Bayou Complex (Spring Bayou)	Enterococci, Nutrients						2018				
Cedar Creek (Tidal)	Enterococci						2018				
Seminole Bypass Canal	Nutrients						2018				
Joe's Creek	Nutrients					2018					
Blue Spring (Madison County)	Nutrients					2018					
Peacock Slough	Nutrients					2018					
Ichetucknee Head Spring	Nutrients					2018					
Blue Springs (Lafayette County)	Nutrients					2018					
Devils Ear	Nutrients					2018					
Hornsby Spring	Nutrients					2018					
Lake Maggiore and Salt Creek	Nutrients, Specific Conductance						2018				
Rainbow River (Blue Run)	Nutrients					2018					
Indian Creek Springs Group	Nutrients					2018					

Source: DEP website at https://floridadep.gov/dear/alternative-restoration-plans/content/category-4e-assessments-and-documentation accessed December 2019.

5.2 Next Steps and Recommendations

Future editions of this report will continue to improve upon the TMDL development and BMAP implementation forecasts. This will include development costs for TMDLs over any water segments added to the Comprehensive Verified List and BMAP implementation costs for any newly adopted BMAPs identified in DEP's STAR Report. In addition, discussion with DEP staff indicates that project lists, similar to those used to develop the cost estimates for BMAP implementation, will be developed for the Alternative Restoration Plans. Once that data is available, EDR will produce a forecast of the expenditures necessary to comply with laws regarding those plans. EDR will also begin working with DEP staff to identify available data on regulatory costs associated with TMDL implementation by local governments and public and private utilities. Lastly, EDR will work toward identifying the water quality monitoring costs to be presented as a separate expenditure forecast or as a component of other applicable programs.[329] This includes water quality monitoring programs such as the state's Status and Trend monitoring networks for surface waters and the groundwater monitoring network.

At this time, EDR has no formal recommendations for legislative consideration regarding water quality protection and restoration.

[329] Note that EDR has identified DEP's watershed monitoring expenditures from Fiscal Years 2009-10 to 2018-19 in Table 3.3.1 of Chapter 3.

6. Infrastructure Investments Necessary to Meet Growing Water Demand and Laws and Regulations Governing Water Quality Protection and Restoration

Part of section 403.928(1)(b), Florida Statutes, requires an annual assessment of future governmental and utility expenditures to comply with laws and regulations governing water supply and demand and those governing water quality protection and restoration. Intrinsic to supplying water and water quality protection is the infrastructure that transports and the facilities that treat drinking water, wastewater, and stormwater.

This chapter is a new addition to this report. While water infrastructure expenditure needs are partially addressed in earlier chapters, those chapters only consider the infrastructure expenditures relevant to those chapters' primary focuses. Chapter 4, for example, examines the projects needed to meet the future increase in water demand, omitting the spending to support the infrastructure necessary to continue meeting the existing water demand. Meanwhile, the topic of aging infrastructure and related investment needs has been an increasing concern for federal, state, and local entities.[330] The American Society of Civil Engineers' "2016 Report Card for Florida's Infrastructure" assigned a "C+" grade to Florida's drinking water infrastructure, grade "C" to the wastewater infrastructure, and grade "D" to the stormwater management systems. The report card concludes, "Investing in infrastructure must be Florida's top priority so we can continue to be the place people want to live and work and attract visitors from around the country and the world."[331] Tens of billions of dollars will be required, but further investigation into the amount and timing of expenditures to maintain and enhance Florida's infrastructure is needed.

This edition is only a first step towards the goal of estimating future drinking water, wastewater, and stormwater infrastructure expenditures by governments and public and private utilities. It does not contain independently calculated estimates. It does, however, present a review of existing expenditure estimates developed by federal government entities, offer examples of alternative estimates, and discuss planning strategies used in other states. This review shows that among all the existing reports, only the U.S. Environmental Protection Agency's (EPA) two surveys isolate Florida's needs. Together, the EPA's most recent 20-year estimates for Florida's drinking water and clean watersheds infrastructure total $44.3 billion (in 2019 dollars, adjusted using the Consumer Price Index). The EPA's estimates underreport Florida's actual needed expenditures as they exclude population growth-related needs, focus primarily on human health-related goals, have strict documentation requirements, and exclude operations and maintenance (O&M) expenditures.

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[330] For example, as part of the President Trump's 2020 proposed budget, an infrastructure Fact Sheet states "America's physical infrastructure has been a catalyst in making our economy the largest and most vibrant in the world. However, decades after building-out the core of our infrastructure, much of it is in urgent need of repair, expansion, and modernization. The World Economic Forum ranked America's overall infrastructure 9th in the world, and the quality of its roads 11th. Without continued investment and maintenance, America's infrastructure will continue to age, deteriorate in quality and performance, and gradually contribute less to American economic output." Office of Management and Budget, 2020 President's Budget Fact Sheet, "Infrastructure Initiative," (March 2019), https://www.whitehouse.gov/wp-content/uploads/2019/03/FY20-Fact-Sheet_Infrastructure_FINAL.pdf. (Accessed December 2019.)

[331] American Society of Civil Engineers, Florida Section, "2016 Report Card for Florida's Infrastructure," (July 2016), https://www.infrastructurereportcard.org/wp-content/uploads/2017/01/2016_RC_Final_screen.pdf. (Accessed December 2019.)

Due to the magnitude of this subject, this chapter will be expanded in subsequent editions with more data. In this edition, this chapter will provide a basic overview of water supply and wastewater systems, examine existing federal estimates of Florida's infrastructure expenditure needs, and explore various funding sources.

6.1 Definitions

Before discussing expenditure needs, what a "utility" is should be defined. The parameters of what's included in that definition may change in future analysis as this introduction does not contain independently calculated estimates. Section 403.928, Florida Statutes, requires the estimate to include expenditures by "federal, state, regional, and local governments and public and private utilities." Though it does not define "utility," it is defined in chapter 367, Florida Statutes, "Water and Wastewater Services." Section 367.021(12), Florida Statutes, defines utility as "a water or wastewater utility and, except as provided in s. 367.022, includes every person, lessee, trustee, or receiver owning, operating, managing, or controlling a system, or proposing construction of a system, who is providing, or proposes to provide, water or wastewater service to the public for compensation."[332]

On the drinking water (or water supply) side, this chapter and future estimates will concentrate on community water systems, which are a subset of public water systems. A public water system is one that provides "water to 25 or more people for at least 60 days each year or serves 15 or more service connections"[333] and may be publicly or privately owned. The Florida Department of Environmental Protection (DEP) further specifies that a community water system is one that serves "at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents. This group provides water to residences and includes a range of sizes from small mobile home courts to large city utilities."[334]

Wastewater systems are classified as either domestic or industrial by DEP. This edition focuses solely on domestic wastewater systems. Domestic wastewater treatment plants and collection systems are defined in section 403.866, Florida Statutes. The statute defines "domestic wastewater treatment plant" as "any plant or other works used for the purpose of treating, stabilizing, or holding domestic wastes" and defines "domestic wastewater collection system" as "pipelines or conduits, pumping stations, and force mains and all other structures, devices, appurtenances, and facilities used for collecting or conducting wastes to an ultimate point for treatment or disposal."[335] Like community water systems, they can be privately or publicly owned. Publicly owned treatment works (POTWs) are a subset of domestic wastewater treatment plants and collection facilities. The majority of domestic wastewater systems serving communities are publicly owned. According to the Congressional Budget Office's (CBO) 2002 report "Future Investment in Drinking Water and

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[332] § 367.022, Fla. Stat., provides a list of entity types that are not regulated by the Florida Public Service Commission and, therefore, are not subject to the provisions of chapter 367 except as expressly provided.
[333] DEP, Source Water Assessment and Protection Program, Public Water Systems, https://fldep.dep.state.fl.us/swapp/PWSType.asp. (Accessed December 2019.)
[334] *Id.*
[335] § 403.866, Fla. Stat., provides definitions for the statutory sections requiring water and wastewater facility personnel to be licensed.

Wastewater Infrastructure," roughly 3 percent of American households are served by private wastewater systems.[336]

For stormwater infrastructure, this chapter will largely focus on municipal separate storm sewer systems (MS4s) owned or operated by state entities, municipalities, counties, and special districts, which are regulated by the National Pollutant Discharge Elimination System (NPDES) program.[337] The NPDES stormwater program is intended to protect water quality through control measures that prevent or reduce pollutant discharges to receiving waterbodies.

Florida regulations define an MS4 as the following:

> (8) Municipal separate storm sewer or MS4 means a conveyance or system of conveyances like roads with stormwater systems, municipal streets, catch basins, curbs, gutters, ditches, constructed channels, or storm drains:
> (a) Owned or operated by a State, city, town, county, special district, association, or other public body (created by or pursuant to State Law) having jurisdiction over management and discharge of stormwater and which discharges to surface waters of the state;
> (b) Designed or used for collecting or conveying stormwater;
> (c) Which is not a combined sewer; and,
> (d) Which is not part of a Publicly Owned Treatment Works (POTW). POTW means any device or system used in the treatment of municipal sewage or industrial wastes of a liquid nature which is owned by a "State" or "municipality." This definition includes sewers, pipes, or other conveyances only if they convey wastewater to a POTW providing treatment.[338]

To fund local stormwater management programs, Florida law authorizes a local government to create a stormwater utility and adopt stormwater utility fees similar to a water or wastewater utility, set aside funds from other sources for these purposes, or charge special assessment fees for properties within a designated stormwater benefit area.[339]

Both stormwater management systems and wastewater systems address the collection and treatment of water to ensure water quality, protecting public health and the environment. They are often grouped together under the umbrella of 'clean water.' The EPA, for example, surveys POTWs and MS4s in one of its quadrennial surveys. In this edition, they are discussed together in the Clean Watersheds Needs Survey section.

For this report, "public and private utilities" will encompass drinking water and wastewater systems that primarily serve permanent communities, along with MS4s. The expenditure estimates will generally be divided into two groups: capital improvement and O&M. Capital improvements include, but are not necessarily limited to, the facilities and transmission networks necessary to:

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[336] Congressional Budget Office, "Future Investment in Drinking Water and Wastewater Infrastructure," (November 2002), p. 4, https://www.cbo.gov/publication/14205. (Accessed December 2019.)
[337] In Florida, DEP administers a federally approved state NPDES permit program. The DEP's NPDES Stormwater program regulates point source discharges from construction activities, industrial activities, and MS4s.
[338] Fla. Admin. Code R. 62-624.200(8).
[339] § 403.0893, Fla. Stat.

- withdraw, treat, and distribute drinking water.
- collect, treat, and recycle or dispose of wastewater.
- collect, convey, and store rainfall and, if necessary, treat the collected water.

6.2 Water Use Cycle Summary

A drinking water utility withdraws water from either a surface body (surface water) or via a well (groundwater). In Florida, approximately 87 percent of water withdrawals categorized as "public supply" are groundwater.[340] The remaining portion is surface water, withdrawn either from freshwater sources such as rivers or from seawater. After withdrawal, the water is often transported to a facility to be treated (or treated onsite).[341] While treatment needs may be minimal for some groundwater, surface water typically undergoes more extensive filtration. Treatment steps can include coagulation and sedimentation, during which dirt and "floc" (coagulated particles) settle out of the water, filtration to remove even smaller particles, and disinfection. Other steps may be necessary depending on the quality of the source water. Potential treatment options include water softening (*e.g.*, ion exchange or by adding lime and soda ash), corrosion control (adding a small amount of a chemical compound to reduce pipe corrosion), and fluoridation. Some treatment plants use entirely different processes (*e.g.*, desalination plants using reverse osmosis). After treatment, drinking water is stored in tanks or reservoirs and distributed through a network of drinking water pipes. It is pressurized either by gravity (via natural topography or water stored in water towers) or by directly pumping water when stored at ground level.

After the water is used, a network of collection pipes (sewer mains) transport wastewater to a central treatment facility. Sewer mains can be broadly grouped into two types: gravity and force. Gravity mains are installed on a slight incline to ensure flow in one direction, with lift stations installed at strategic points to lift the wastewater for the next part of its journey towards the treatment facility, thereby avoiding extreme pipe depths. Force mains are pressurized to ensure one-way flow. A single system often uses a combination of the two types. The City of Tallahassee, for instance, had 893 miles of gravity main and 126 miles of force main in use as of August, 2019.[342] Besides the pipes themselves, the collection network consists of things like appurtenances (*e.g.*, manholes), valves, pump stations, and sensors.

At wastewater treatment facilities, treatment steps are grouped into primary, secondary, and advanced (or tertiary) treatment. Primary treatment includes the use of screens and settling tanks to remove floating or heavy material from the wastewater. Secondary treatment is not a specific method of treatment, but rather a set of standards which are "reflected in terms of five-day

[340] Marella, R.L. and Dixon, J.F., 2018, Data tables summarizing the source-specific estimated water withdrawals in Florida by water source, category, county, and water management district, 2015: U.S. Geological Survey data release, Table 1, https://doi.org/10.5066/F7N29W5M.
[341] EPA, "The History of Drinking Water Treatment," EPA-816-F-00-006 (February, 2000), p. 4, https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P1002SMN.TXT. (Accessed December 2019.)
[342] Charles Ziegmont, City of Tallahassee Utilities, personal communication (August 16, 2019).

biochemical oxygen demand (BOD5), total suspended solids (TSS) removal, and pH."[343] The treatment method most commonly associated with secondary treatment is activated sludge,[344] "a suspended growth process for removing organic matter from sewage by saturating it with air and microorganisms that can break down the organic matter."[345] Advanced treatment can further reduce pollutants such as phosphorus or nitrogen. Treated wastewater can be disinfected and reused, mainly for irrigation purposes. If not reused, it is in some way discharged to the ocean,[346] surface water, a deep injection well, or through land application.

6.3 Context of Expenditure Estimates

In a 2001 report, the American Water Works Association (AWWA) declared that American drinking water utilities were at the "Dawn of the Replacement Era"[347] regarding their aging infrastructure. That report, a study of 20 large drinking water utilities and their replacement needs, concluded that drinking water utilities across the country must begin a decades-long process of replacing buried infrastructure reaching the end of its useful life. Though none of the 20 utilities were located in Florida, the report's conclusions apply. This section introduces some overarching concepts to provide context for infrastructure expenditure estimates. The concepts heavily rely on reports published by the EPA and the AWWA. Though the AWWA's focus is drinking water, concepts like the useful life of assets, demographic and regulatory echoes, or the practice of asset management apply equally to wastewater and stormwater infrastructure.

Useful Life of Infrastructure Assets

An infrastructure asset, that is, a physical object used in the larger interconnected system, cannot last forever. Its useful life is the period of time it can satisfactorily operate until either it breaks down completely or its replacement would be cheaper than continued repair. For both drinking water and wastewater, the pipes in distribution and collection systems represent a significant portion of the capital assets owned by utilities. The AWWA estimates that water mains constitute over 60 percent of the replacement value of drinking water utility assets.[348] Additionally, transmission and collection mains tend to have much longer useful lifespans than other assets. Due to differing average useful lifespans of different pipe materials and infrastructure investment during different eras, replacement needs can arrive in waves. Early cast iron pipes, for example,

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343 EPA, National Pollutant Discharge Elimination System (NPDES) Secondary Treatment Standards, https://www.epa.gov/npdes/secondary-treatment-standards. (Accessed December 2019.)

344 EPA, "Report on the Performance of Secondary Treatment Technology," EPA-821-R-13-001 (March 2013), p. 1, https://www3.epa.gov/npdes/pubs/npdes_secondary_treatment_report_march2013.pdf. (Accessed December 2019.)

345 EPA, "Primer for Municipal Wastewater Treatment Systems," EPA-832-R-04-001 (September 2004), p. 25, https://www.epa.gov/sites/production/files/2015-09/documents/primer.pdf. (Accessed December 2019.)

346 Note that in 2008, the Leah Schad Memorial Ocean Outfall Program was established to prohibit the construction of new ocean outfalls or expansion of existing ocean outfalls for domestic wastewater discharges. In addition, discharges through ocean outfalls after December 31, 2025, is prohibited except as a backup discharge during periods of reduced reclaimed water demand or as a result of peak flows from other wastewater management systems. *See* Ch. 2008-232, § 6, Laws of Fla. (codified as amended at § 403.086(9), Fla. Stat.). In Florida, there are six ocean outfalls, all of which are located in Palm Beach, Broward, and Miami-Dade Counties.

347 American Water Works Association, "Dawn of the Replacement Era," (AWWA, 2001), https://www.awwa.org/Portals/0/AWWA/ETS/Resources/DawnReplacementEra.pdf. (Accessed December 2019.)

348 American Water Works Association, "Dawn of the Replacement Era," (AWWA, 2001), p. 11, https://www.awwa.org/Portals/0/AWWA/ETS/Resources/DawnReplacementEra.pdf. (Accessed December 2019.)

were installed in the late 1800s through the 1910s and have an average life expectancy of 120 years. After manufacturing changes, cast iron pipes installed during the infrastructure boom of the 1920s last an average of 100 years. Post-World War II cast iron pipes have an even shorter life expectancy of around 75 years.[349] A utility with pipes from these eras would have had relatively low repair and replacement costs throughout the late 20th century, but all three groups of pipes will reach the end of their average lives around the same time.

Table 6.3.1, adapted from the AWWA's 2012 report "Buried No Longer: Confronting America's Water Infrastructure Challenge,"[350] contains estimates of the average service life for commonly used pipe materials in Southern utilities (the region ranges from Texas to Maryland to Florida in the report). This table illustrates two major points. First, utilities serving different size populations may weigh the cost and benefits of replacing or repairing pipes differently. Second, age of an asset is not the sole factor determining its condition.

Table 6.3.1 Estimated Average Service Life by Material for Southern Region Drinking Water Utilities (in years)

	Size and Population Served		
	Large 50,000 and over	Medium & Small 3,300 - 49,999	Very Small less than 3,300
Cast Iron	110	105	130
Cast Iron, Cement Lined (LSL)	100	100	110
Cast Iron, Cement Lined (SSL)	100	100	100
Ductile Iron (LSL)	105	105	105
Ductile Iron (SSL)	55	55	55
Asbestos Cement (LSL)	100	100	100
Asbestos Cement (SSL)	80	80	80
Polyvinyl Chloride*	55	55	55
Steel	70	70	70
Concrete and Prestressed Concrete Cylinder Pipe	105	105	105

Note: LSL means "long service life." The AWWA credits these cases to "some combination of benign ground conditions and evolved laying practices, etc." SSL means "short service life." The AWWA blames these on "some combination of harsh ground conditions and early laying practices, etc." AWWA, "Buried No Longer," 2012, p. 8.
* Why polyvinyl chloride's service life is only 55 years in the Southern region is not explained in the AWWA report. Its estimated service life is 100 years in the Northeast and 70 years in the West (for all utility sizes), so the estimate is not based on the fact that the material has only been commercially available for water pipes since the 1950s. The low estimate could be due to improperly installed pipes during construction booms, as polyvinyl chloride has a relatively high failure rate early in its life due to improper installation and, when properly installed, a life expectancy of over 100 years. Folkman, Steven, "Water Main Break Rates in the USA and Canada: A Comprehensive Study," (Utah State University Buried Structures Laboratory, April 2012), p. 18.

More broadly, Table 6.3.2 presents a "Useful Life Matrix" adapted from the EPA's 2002 report "The Clean Water and Drinking Water Infrastructure Gap Analysis."[351] These useful life estimates were used to estimate the timing of expenditures in the EPA's analysis. The table provides a fuller

[349] *Id.*
[350] American Water Works Association, "Buried No Longer: Confronting America's Water Infrastructure Challenge," (AWWA, 2012), p. 8, https://www.awwa.org/Portals/0/AWWA/Government/BuriedNoLonger.pdf. (Accessed December 2019.)
[351] EPA, "The Clean Water and Drinking Water Infrastructure Gap Analysis," EPA-816-R-02-020 (September 2002), p. 11, https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=901R0200.txt. (Accessed December 2019.)

view of infrastructure components in terms of their useful life. Note that pipes are included in drinking water's trunk mains and distribution categories and clean water's collections and force mains categories.

Table 6.3.2 Useful Life Matrix of Infrastructure Assets

Drinking Water		Clean Water	
Years	**Component**	**Years**	**Component**
50 - 80	Reservoirs & Dams	80 - 100	Collections
60 - 70	Treatment Plants - Concrete Structures	50	Treatment Plants - Concrete Structures
15 - 25	Treatment Plants - Mechanical & Electrical	15 - 25	Treatment Plants - Mechanical & Electrical
65 - 95	Trunk Mains	25	Force Mains
60 - 70	Pumping Stations - Concrete Structures	50	Pumping Stations - Concrete Structures
25	Pumping Stations - Mechanical & Electrical	15	Pumping Stations - Mechanical & Electrical
65 - 95	Distribution	90 - 100	Interceptors

Asset Management

In recent years, the EPA has encouraged water and wastewater utilities to adopt asset management practices, both in the utilities' general operations and to better report needs in the EPA's drinking water and clean watersheds needs surveys. Asset management, as a practice, has many definitions and is used in multiple industries. The EPA defines asset management for water utilities as "the practice of managing infrastructure capital assets to minimize the total cost of owning and operating these assets while delivering the desired service levels."[352] Maintenance and repair costs increase as assets like pipes, treatment plants, and lift stations near the end of their useful lives. While replacement is inevitable for infrastructure assets, proactive maintenance can delay or eliminate expensive failures, keep long-term costs lower, and ensure service is kept at acceptable levels.

As a starting point, the EPA offers a framework of five core questions for utilities: "What is the current state of my assets? What is my required 'sustainable' level of service? Which assets are critical to sustained performance? What are my minimum life-cycle costs? What is my best long-term funding strategy?"[353] The U.S. Government Accountability Office, in a 2004 report on water infrastructure, summarized the approach as "the systematic collection of key data and the application of analytical tools such as life-cycle cost analysis and risk assessment."[354]

As part of its push for utilities to adopt asset management practices, the EPA began to allow asset management plans as approved project documentation in the 2012 Clean Watersheds Needs Survey. The most recent Drinking Water Infrastructure Needs Survey and Assessment report concluded, "In addition to its fundamental purpose as a data collection instrument, the Assessment

[352] EPA, Asset Management for Water and Wastewater Utilities, https://www.epa.gov/sustainable-water-infrastructure/asset-management-water-and-wastewater-utilities. (Accessed December 2019.)
[353] *Id.*
[354] U.S. Government Accountability Office, Report to the Ranking Minority Member, Committee on Environment and Public Works, U.S. Senate, "Water Infrastructure: Comprehensive Asset Management Has Potential to Help Utilities Better Identify Needs and Plan Future Investments," (March 2004) GAO-04-461, p. 4, https://www.gao.gov/products/GAO-04-461. (Accessed November 2019.)

also strives to serve as a useful tool for utilities by promoting asset management, including the development of a record of system infrastructure assets and their condition. EPA has received feedback from partners that the approach to the survey has been successful in contributing to enhanced asset management in the drinking water sector."[355]

The EPA publishes a document containing comparisons and descriptions of state asset management initiatives.[356] In Florida, both drinking water and wastewater utilities are "encouraged" to develop asset management plans when participating in the Drinking Water and Clean Water State Revolving Funds via a financing rate adjustment of 0.1 percent.[357] Additionally, asset management plan development is eligible for Florida's state revolving loan funds with partial principal forgiveness for small disadvantaged communities.[358]

Demographic and Regulatory Echoes

A major aspect of the AWWA reports on replacing buried infrastructure is the idea of 'demographic echoes,' where strong "demographic trends—in our case, pipes laid down as long as a century ago—created a future financial obligation that is now coming due." The 2001 report compares these liabilities to the Social Security Trust Fund and states, "Just as in Social Security, a threat to affordability arises when there were powerful demographic and economic trends at work originally, but the liability arrives at a later time when the demographic and economic conditions have changed. In the water business, the challenge is magnified by pipes that last through several generations of customers before they need to be replaced."[359]

One factor to keep in mind with Florida's demographic trends is the state's relatively late development. Florida's population boomed after World War II and has continued to grow by double-digits every decade. Figure 6.3.1 tracks the number and growth percentage of housing units reported on the decennial census from 1940 to 2010.[360]

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[355] EPA, "Drinking Water Infrastructure Needs Survey and Assessment, Sixth Report to Congress," EPA-816-K-17-002 (March 2018), p. 46, https://www.epa.gov/sites/production/files/2018-10/documents/corrected_sixth_drinking_water_infrastructure_needs_survey_and_assessment.pdf. (Accessed December 2019.)

[356] EPA, "2018 State Asset Management Initiatives," EPA-800-F-19-002 (March 2019), https://www.epa.gov/dwcapacity/2018-state-asset-management-initiatives-document. (Accessed December 2019.)

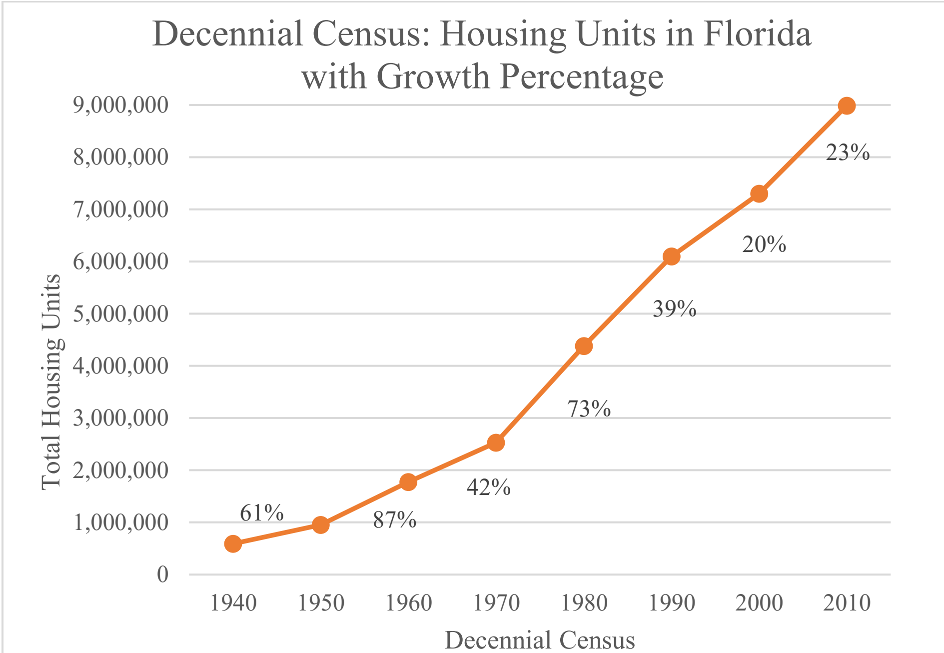
[357] The Clean Water SRF rate adjustment is set out in 62-503.300(5)(b)1, F.A.C. Rate adjustment requirements for the asset management plan are enumerated in 62-503.700(7). The Drinking Water SRF rate adjustment is in 62-552.300(6)(c)1, F.A.C., with rate adjustment requirements for the plan in 62-552.700(7).

[358] EPA, "2018 State Asset Management Initiatives," EPA-800-F-19-002 (March 2019), https://www.epa.gov/dwcapacity/2018-state-asset-management-initiatives-document. (Accessed December 2019.)

[359] American Water Works Association, "Dawn of the Replacement Era," (AWWA, 2001), p. 13, https://www.awwa.org/Portals/0/AWWA/ETS/Resources/DawnReplacementEra.pdf. (Accessed December 2019.)

[360] Counts from 1940 to 1990 were taken from the 1990 decennial census, while later counts were from the 2010 census. United States Census Bureau, 1990 Census of Population and Housing, Florida, Table 3, "Population and Housing Units: 1940 to 1990," https://www.census.gov/prod/cen1990/cph2/cph-2-11.pdf. (Accessed December 2019.) United States Census Bureau, 2010 Census of Population and Housing, Florida, Table 4, "Population and Housing Units: 1970 to 2010," https://www2.census.gov/library/publications/decennial/2010/cph-2/cph-2-11.pdf. (Accessed December 2019.)

Figure 6.3.1 Housing Units in Florida



This relatively recent development does not mean Florida's water distribution and collection networks are all young and healthy. Florida's early waterworks were developed in the latter half of the 1800s and five Floridian utilities have had at least one cast iron pipe continually in service for over 100 years.[361] The demographic echoes spurred by infrastructure age may arrive slightly later in Florida than in other areas of the country, but they will soon or are already being felt.

Like demographic echoes, regulatory echoes may affect the timing and extent of future expenditures. In the wake of the Clean Water Act, there was a huge increase in capital investment to build treatment facilities compliant with the Act. The federal government's grants and loan subsidies for water supply and wastewater treatment facility infrastructure grew from $2.6 billion in 1970 to $18.1 billion in 1977 (in 2017 dollars) before tapering downward.[362] Some of that funding was used to build treatment plants in the 1970s and 1980s, which had an average useful life of 15 to 25 years (for mechanical and electrical assets) and about 50 years (for structures). As stated in a 2010 Congressional Research Service report, "many that were built in response to environmental standards in the 1970s and 1980s also will begin to be due for replacement in a few years."[363] Demographic and regulatory echoes will not be felt by every utility at the same time, but increased repair and replacement expenditures are a reality across the industry.

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[361] Five Floridian utilities have been inducted into the "Cast Iron Pipe Century Club" sponsored by the Ductile Iron Pipe Research Association. They are the City of Ocala Water/Sewer Department, Orlando Utilities Commission, Pensacola Department of Public Utilities, City of St. Petersburg Water Resources, and the Tampa Water Department. Ductile Iron Pipe Research Association, https://www.dipra.org/ductile-iron-pipe/benefits/cast-iron-pipe-century-club-and-cast-iron-pipe-sesquicentennial-club.
[362] Congressional Budget Office, "Public Spending on Transportation and Water Infrastructure, 1956 to 2017," Supplemental Tables, (October 2018), https://www.cbo.gov/publication/54539. (Accessed December 2019.)
[363] Claudia Copeland, Mary Tiemann, "Water Infrastructure Needs and Investment: Review and Analysis of Key Issues," RL31116 (Congressional Research Service, December 21, 2010), p. 16, https://fas.org/sgp/crs/homesec/RL31116.pdf. (Accessed December 2019.)

Finances and Localization

It is important to remember that water utilities are extremely localized. While it is generally agreed that drinking water and wastewater infrastructure is not in great condition and large investments are needed, that statement is not equally true for every water utility in Florida. Each drinking water and wastewater utility has its own history. A proactive drinking water utility with an aggressive asset management plan supported by rate increases could be in excellent physical and financial shape, while the utility 10 miles away could have a distribution network at the end of its useful life and may need to take out large loans and sharply increase rates to be able to continue providing safe drinking water.

Utilities generally pay for O&M from their current funds and often use loans, grants, their reserves, or a combination of the three to undertake large capital improvement projects. The cost to provide service is subject to economies of scale. Beyond the difficulty smaller systems face in retaining skilled employees or keeping up with industry changes, treatment costs vary significantly. According to the Congressional Budget Office, the EPA's data "on the costs of monitoring and treatment to comply with the Safe Drinking Water Act's standards in force as of September 1994 suggest that the average cost per household was about $4 per year in systems serving more than 500,000 people but about $300 per year for systems serving no more than 100 people."[364]

In both the drinking water and wastewater industries, the largest systems are few in number but serve a disproportionate number of people. Table 6.3 shows the distribution of population served across community water systems in Florida based on a statewide report downloaded from EPA's Safe Drinking Water Information System in November 2019. For example, 57.7 percent of Floridians are served by 41 community water systems that serve over 100,000 people, while 3.5 percent of Floridians receive their drinking water from 1,243 small systems (each serving up to 3,300 people). The wastewater treatment industry has a similar, though not quite as extreme, distribution across population and system counts.[365]

[See table on following page]

[364] Congressional Budget Office, "Future Investment in Drinking Water and Wastewater Infrastructure" (November 2002), p. 5, https://www.cbo.gov/publication/14205. (Accessed December 2019.)
[365] According to the EPA's 2012 Clean Watersheds Needs Survey when comparing the present population receiving treatment and the number of wastewater treatment facilities (publicly owned treatment works). EPA, Clean Watersheds Needs Survey 2012, Florida database, https://ofmpub.epa.gov/apex/cwns2012/f?p=134:25:. (Accessed December 2019.)

Table 6.3.3 Florida's Community Water Systems and Population Served by Size of System in 2019

Size Group by Population Served	Total Population Served	Number of Systems	Percent of Population	Percent of Systems
Up to 500	155,004	866	0.8%	53.2%
501 to 3,300	552,972	377	2.7%	23.2%
3,301 to 10,000	832,632	147	4.1%	9.0%
10,001 to 100,000	7,044,293	197	34.7%	12.1%
More than 100,000	11,698,951	41	57.7%	2.5%

Note: This table aggregates reported population data for public water systems in Florida considered "community water systems."
Source: EPA, Safe Drinking water Information System, Florida search, https://ofmpub.epa.gov/apex/sfdw/f?p=108:200:::NO. (Accessed November 2019.)

The largest water and wastewater systems tend to be publicly owned. In Florida, privately owned water and wastewater utilities in 38 counties are under the jurisdiction of the Public Service Commission (PSC). The PSC processes certification, transfer, amendment, and cancellation requests and notices of abandonment, as well as reviews rate change applications. Additional regulation for these utilities is still the responsibility of DEP, the water management districts, and county health departments.

6.4 EPA Expenditure Estimates

The EPA periodically conducts two surveys to estimate needed capital expenditures over a 20-year forecast period.[366] The EPA produces drinking water infrastructure estimates from the Drinking Water Infrastructure Needs Survey and Assessment (DWINSA), most recently conducted in 2015. In it, Florida's drinking water infrastructure needs estimate was $21.886 billion (in January 2015 dollars).[367] As shown in Table 6.4.1, Florida's estimated drinking water infrastructure needs are $23.718 billion adjusted for inflation to state fiscal year 2018-19.[368]

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[366] These two surveys are generally referred to as "quadrennial," though neither is consistently conducted at four year intervals. Previous Drinking water Infrastructure Needs Survey and Assessments were conducted every four years from 1995 to 2015, but the next survey was delayed a year until 2020. The Clean Watersheds Needs Survey (previously called the Clean Water Needs Survey) was conducted every two years from 1978 to 1992, every four years from 1996 to 2012, and has not been conducted since. In response to an inquiry about the timing of a future Clean Watersheds Needs Survey, the EPA's Clean Watersheds Needs Survey team stated "Due to lack of funding there was no 2016 CWNS. We are just starting to begin an effort for the next CWNS but it looks like it won't be released until 2020 or beyond." EPA, CWNS Team, personal communication (November 5, 2019).

[367] EPA, "Drinking Water Infrastructure Needs Survey and Assessment, Sixth Report to Congress," EPA-816-K-17-002 (March 2018), p. 36, https://www.epa.gov/sites/production/files/2018-10/documents/corrected_sixth_drinking_water_infrastructure_needs_survey_and_assessment.pdf. (Accessed December 2019.)

[368] BLS, CPI-All Urban Consumers, Series ID: CUUR0000AA0. The *Engineering News-Record*'s Construction Cost Index was the index used by the EPA for its 2002 report "The Clean Water and Drinking Water Infrastructure Gap Analysis" to adjust DWINSA and CWNS estimates. A cached version of the Construction Cost Index as of October, 2019, is available at https://webcache.googleusercontent.com/search?q=cache:Pck3_HUJ8RwJ:https://www.enr.com/economics/historical_indices/construction_cost_index_history+&cd=12&hl=en&ct=clnk&gl=us. (Accessed November 2019.)

Table 6.4.1 DWINSA Expenditures Estimates for Florida (in $millions)

Adjustment Period	CPI Multiplier	ENR CCI Multiplier*
1/1/2015 to FY18-19	1.083699004	1.122609975

Category	2015 DWINSA	FY18-19	FY18-19
Transmission and Distribution	$13,734.00	$14,883.52	$15,417.93
Treatment	$4,702.50	$5,096.09	$5,279.07
Storage	$1,551.60	$1,681.47	$1,741.84
Source	$1,446.20	$1,567.25	$1,623.52
Other	$452.20	$490.05	$507.64
Total	**$21,886.40**	**$23,718.27**	**$24,569.89**

* Calculated using the *Engineering News-Record*'s Construction Cost Index.

The EPA's other regular survey is the Clean Watersheds Needs Survey (CWNS), conducted and published in compliance with the Clean Water Act, section 516(b)(1)(B). It is a survey of POTWs' wastewater and stormwater capital investment needs. The 2012 CWNS is the most recent completed assessment. In it, Florida's official documented clean water infrastructure needs totaled $18.423 billion (in January 2012 dollars).[369] Adjusted for inflation, the estimate grew to $20.585 billion (see Table 6.4.2 below).[370] In addition to the total from POTW survey responses, sanitary surveys from DEP and county health departments reported $5.586 billion for decentralized wastewater treatment systems (onsite sewage treatment and disposal systems).

Table 6.4.2 CWNS Expenditures Estimates for Florida (in $millions)

Adjustment Period	CPI Multiplier	ENR CCI Multiplier*
1/1/2012 to FY18-19	1.117367685	1.219994188

Category	2012 CWNS	FY18-19	FY18-19
I. Secondary Wastewater Treatment	$-	$-	$-
II. Advanced Wastewater Treatment	$11,328.06	$12,657.61	$13,820.17
III. Conveyance System Repair	$1,691.62	$1,890.17	$2,063.77
IV. New Conveyance Systems	$2,802.39	$3,131.30	$3,418.90
V. CSO Correction	$-	$-	$-
VI. Stormwater Management Program	$499.08	$557.66	$608.88
X. Recycled Water Distribution	$2,101.66	$2,348.33	$2,564.01
Total Official Needs	**$18,422.82**	**$20,585.06**	**$22,475.73**
XII. Decentralized Wastewater Treatment Systems	$5,585.65	$6,241.23	$6,814.47

* Calculated using the *Engineering News-Record*'s Construction Cost Index.

[369] EPA, Clean Watersheds Needs Survey 2012, Florida database, https://ofmpub.epa.gov/apex/cwns2012/f?p=134:25:. (Accessed December 2019.)

[370] BLS, CPI-All Urban Consumers, Series ID: CUUR0000AA0. *Engineering News-Record*, Construction Cost Index, October 2019.

These two surveys serve two very different purposes. This section contextualizes the estimates by summarizing the methodologies and aims of the two surveys, then explores the shortcomings of the reports and presents alternative estimates.

Drinking Water Infrastructure Needs Survey and Assessment

In 1996, amendments to 1974's Safe Drinking Water Act (SDWA) established the Drinking Water State Revolving Loan Fund (DWSRF) to assist states and public water systems in protecting the health of the public through low-interest loans. By statute, the EPA allocates the DWSRF capitalization grants among the states and other areas[371] based on the need reported in the most recent needs estimate.

Between surveys, the EPA reviews the methodology and, when necessary, revises it. The following description refers to the 2015 survey. The next survey, which will be the seventh conducted and include projects planned for January 1, 2020 to December 31, 2039, may differ from the methodology described here. In addition to the information collected in 2015, it will also require an inventory and replacement cost estimates for lead service lines.[372]

Due to the large number of public water systems, the EPA uses statistical sampling to conduct the survey. Community water systems (CWS) are stratified into three groups by population served (directly or by selling water to another utility).

- Large systems, which serve over 100,000 people, are all surveyed. Fifty-six large Floridian systems responded to the 2015 survey.

- Medium systems, which can serve anywhere from 3,301 to 100,000 people, are further divided into up to four strata (depending on the number of medium systems in the state and their distribution along the range of population served). The survey sample for medium systems is chosen on a state-specific basis to meet the EPA's required precision target. In 2015, the EPA's estimated inventory of Florida's community water systems included 304 medium systems, 33 of which were surveyed. The EPA stratified Florida's medium systems into four population groups.

- Small systems (serving 3,300 people or fewer) were not surveyed in 2015. Their needs estimate was based on field surveys conducted for the 2007 DWINSA and adjusted using 2015 cost models and an updated inventory of small systems.[373]

[371] In addition to the 50 states, the District of Columbia, and Puerto Rico, funding is allocated to American Indian and Alaskan Native Village Water Systems and American Samoa, Guam, the Northern Mariana Islands, and the Virgin Islands.
[372] 42 U.S.C. 300j-12(h)(2). Section 2015(e)(2) of the America's Water Infrastructure Act of 2018 added a requirement for lead service line costs.
[373] New field surveys for small systems are expected to be conducted for the 2020 survey. Paul Brandl, DEP, Division of Water Restoration Assistance Drinking Water State Revolving Fund Program, personal communication (December 3, 2019).

- A fourth group consists of not-for-profit noncommunity water systems (NPNCWS). These systems were not surveyed in 2015. The estimate was based on 1999 field surveys and adjusted in a manner similar to the small CWSs.

Large and medium systems are further divided by water source and their needs weighted to calculate state-wide need from the limited sample size (as all large systems are surveyed, they all have a weight of 1). In the 2015 assessment, the weight calculation for medium systems depended on the number of systems with each water source in the stratum, the percent of that state's need in that stratum in the 2011 DWINSA, and the state's variance of need for that stratum in 2011. Table 6.4.3 contains a count of the systems in Florida's initial 2015 sample by size and water source (the final sample differed slightly). The initial weights for medium systems ranged from 1 to 22.667.

Table 6.4.3 2015 DWINSA Initial Florida Sample

Size	Population Served	Source*	Count**
Medium	3,301-10,000	Ground	6
Medium	3,301-10,000	Surface	0
Medium	10,001-25,000	Ground	7
Medium	10,001-25,000	Surface	3
Medium	25,001-50,000	Ground	5
Medium	25,001-50,000	Surface	2
Medium	50,001-100,000	Ground	9
Medium	50,001-100,000	Surface	1
Large	>100,000	Ground	47
Large	>100,000	Surface	10
		Total Surveyed	**90**

*The EPA treats systems that purchase finished water from other systems as groundwater, regardless of the water's original source. Environmental Protection Agency, "Drinking Water Infrastructure Needs Survey and Assessment, Sixth Report to Congress," EPA-816-K-17-002 (March 2018), p. 49, https://www.epa.gov/sites/production/files/2018-10/documents/corrected_sixth_drinking_water_infrastructure_needs_survey_and_assessment.pdf. (Accessed December 2019.)
**Counts taken from initial sample, which differed slightly from final sample included in the assessment due to survey response and migration between strata.

The small system and NPNCWS estimates were updated and added to the large and medium systems' needs to calculate the state's total community water system needs.

There are strict rules defining what is and is not considered a "need." In short, allowable projects are those that are eligible for DWSRF funding, further the SDWA's public health aims, have the required documentation, and will be undertaken and finished within the 20-year time frame. Table 6.4.4, recreated from the 2015 DWINSA Report to Congress, summarizes allowable and unallowable projects.[374]

[374] EPA, "Drinking Water Infrastructure Needs Survey and Assessment, Sixth Report to Congress," EPA-816-K-17-002 (March 2018), p. 57, https://www.epa.gov/sites/production/files/2018-10/documents/corrected_sixth_drinking_water_infrastructure_needs_survey_and_assessment.pdf. (Accessed December 2019.)

Table 6.4.4 DWINSA Allowable and Unallowable Projects

DWINSA Allowable Projects	DWINSA Unallowable Projects
Criteria: • Eligible for DWSRF funding • Capital improvement needs • In furtherance of the public health goals of the SDWA • Within the Assessment time frame • Adequate documentation Project Types: • New or expanded/upgraded infrastructure to meet the needs of existing customers • Replacement or rehabilitation of existing undersized or deteriorated infrastructure	• Raw water reservoir- or dam-related needs • Projects needed primarily to serve future population growth • Projects solely for file suppression • Projects for source water protection • Non-capital needs (including studies, operation and maintenance) • Needs not related to furthering the SDWA's public health objectives • Acquisition of existing infrastructure • Projects not the responsibility of the water system • Projects or portions of projects started prior to January 1, 2015 • Projects or portions of projects needed after December 31, 2034

There are a few types of projects that are unallowable for the survey but are eligible for DWSRF funding. These include, but are not limited to, the acquisition of existing infrastructure/water systems, refinancing loans, and funding to conduct studies. One major project type excluded from the survey is projects to serve future population growth. This is particularly significant in Florida, whose population is expected to grow approximately 28 percent between 2015 and 2035.[375]

The EPA conducts the survey through an online portal.[376] In states like Florida, where the EPA delegates primary enforcement responsibility (or 'primacy') to the state, the state's environmental protection agency receives the questionnaires from the EPA and works with the sampled utilities to complete the survey. In addition to basic system information, utilities are asked to fill out a table with individual projects and specify details including[377]:

- the type of need (source, treatment, storage, transmission and distribution, or other),
- reason for need (e.g., correct a deficiency in source water quality or correct pressure problems),
- whether the project is new, will expand capacity, or will replace or rehabilitate current infrastructure,

[375] The Florida Demographic Estimating Conference's February 2019 adopted estimates contained a 2015 population of 19,815,183 and adopted a 2035 population estimate of 25,429,340.
[376] During the preparation of this edition, the 2015 DWINSA portal could be accessed at https://dwneeds.epa.gov/. (Accessed December 2019.)
[377] EPA, "2015 Drinking Water Infrastructure Needs Survey and Assessment Questionnaire," Project Table, https://dwneeds.epa.gov/Downloads/2015/DWINSAQuestionnaireJune2015.xlsm. (Accessed December 2019.)

- whether the project will address a current problem or a future problem (e.g., a pipe expected to last another decade is a future need),
- what regulation the project will maintain or comply with (if any),
- depending on the project type, information such as design capacity or pipe diameter and length,
- cost estimate, if one exists,
- date of the cost estimate, and
- what type of documentation would be submitted with the questionnaire to prove the need and costs.

DEP reviews the questionnaires to ensure that the projects listed are allowable and are accompanied by sufficient documentation. If a project does not have a cost estimate, the EPA will model the cost. Additionally, if a project does not have existing documentation (*e.g.*, listed in a capital improvement plan or other strategic document), "survey generated documentation" may be accepted. According to the 2015 report, "[p]rojects for infrastructure that is generally expected to require rehabilitation or replacement within a 20-year period are accepted with minimum documentation of need."[378] For example, this allows smaller systems without detailed capital improvement plans or even a complete assessment of pipe health to include the replacement or rehabilitation of up to 10 percent of their system's total pipe inventory.

Though the survey's requirements can be onerous, there is a very high response rate. In 2015, 99.7 percent of sampled systems responded to the survey. The allocation calculation for DWSRF money is based on the state or territory's reported need and will be updated after the completion of the next survey.

Clean Watersheds Needs Survey

The EPA conducts the Clean Watersheds Needs Survey to compile the estimated capital investment needed to comply with the requirements of the Clean Water Act by POTWs. The statutory objectives of the Clean Water Act encompass both wastewater and stormwater management systems. Though the survey is usually conducted every four years, the most recent one was conducted in 2012. Like the DWINSA, the survey asks for needs within a 20-year window (2012-2031). Beyond that, the methodologies and goals of the two surveys diverge.

Instead of stratifying facilities and sampling them to calculate a total statewide needs estimate, the EPA, working with state agencies, sends a survey to every eligible facility. The 2012 CWNS included 434 wastewater and 79 stormwater facilities in Florida, as well as decentralized

[378] EPA, Drinking Water Infrastructure Needs Survey and Assessment, Sixth Report to Congress, (March 2018), p. 66, https://www.epa.gov/sites/production/files/2018-10/documents/corrected_sixth_drinking_water_infrastructure_needs_survey_and_assessment.pdf. (Accessed December 2019.)

wastewater treatment management projects managed by county health departments (for onsite sewage treatment and disposal systems estimates). The CWNS has a much lower response rate than the drinking water survey. In Florida, one-third of wastewater treatment facilities and half of stormwater management facilities did not participate in the survey. Table 6.4.5 contains a breakdown of the response rate by facility type.

Table 6.4.5 2012 CWNS Responses by Facility Type

	Submitted Documentation*	Total Facilities	Did Not Respond	Non-Response Rate
Wastewater	288	434	146	33.6%
Stormwater	79	162	83	51.2%
Decentralized Wastewater Treatment**	134	134	0	0.0%

* Four facilities provided documentation but had no official needs; two of those facilities only had unofficial cost estimates. They are included in the Submitted Documentation column.
** Each county health department has two decentralized wastewater treatment facilities in the data. One was described in the facility name field as "OSDS Rehab" and was associated with current population data. The other was described as "OSTDS New" with projected population data. The supporting documentation for all 134 entries was authored by "FDOH/FDEP."
Source: EPA, Clean Watersheds Needs Survey 2012, Florida database, https://ofmpub.epa.gov/apex/cwns2012/f?p=134:25:. (Accessed December 2019.)

The non-responsive wastewater facilities tended to be smaller ones. Of the reported current population receiving wastewater treatment from any of the surveyed facilities, only 10.15 percent received wastewater treatment from a non-responsive treatment facility.[379]

The survey asked facilities to report documented needs that address either water quality or public health-related objectives (or both). Table 6.4.6 contains a complete list of subcategories included in 2012's survey and Florida's reported needs.

[See table on following page]

[379] This is the proportion of the reported population of "present residents actually receiving treatment" (PRES_RES_ACTUAL_RECEIVNG_TRMT) for wastewater facilities that did not have an entry on the SUMMARY_NEEDS table in the EPA's detailed data Access database download. EPA, Clean Watersheds Needs Survey 2012, Florida database, https://ofmpub.epa.gov/apex/cwns2012/f?p=134:25:. (Accessed December 2019.)

Table 6.4.6 2012 CWNS Categories (in $millions)

2012 Category	Description	2012 Needs
I	Secondary Wastewater Treatment	$-
II	Advanced Wastewater Treatment	$11,328.06
III-A	Conveyance System Repair: Inflow / Infiltration Correction	$274.11
III-B	Conveyance System Repair: Sewer Replacement / Rehabilitation	$1,417.51
IV-A	New Conveyance Systems: New Collector Sewers and Appurtenances	$1,034.06
IV-B	New Conveyance Systems: New Interceptor Sewers and Appurtenances	$1,768.32
V-A	CSO Correction— Traditional Infrastructure	$-
V-B	CSO Correction— Green Infrastructure	$-
VI	Stormwater Management Program (pre-2008 needs only)	$-
VI-A	Stormwater Management Program: Stormwater Conveyance Infrastructure	$210.23
VI-B	Stormwater Management Program: Stormwater Treatment Systems	$249.08
VI-C	Stormwater Management Program: Green Infrastructure	$-
VI-D	Stormwater Management Program: General Stormwater Management	$39.77
X	Recycled Water Distribution	$2,101.66
XII	Decentralized Wastewater Treatment Systems	$5,585.65

The official estimate for Florida of $18.423 billion excludes needs reported in category XII, which meet the same criteria as the official needs but aren't statutorily required to be included in the survey. Florida's category XII estimates, based on sanitary surveys conducted by the Florida Department of Health and the Florida Department of Environmental Protection, were the highest in the nation at $5.586 billion.

For a facility or project to include a need on the CWNS, it must address an existing water quality or water quality-related public health issue or an issue expected within the 20-year survey window. Additionally, the facility or project must "[m]eet the CWNS documentation criteria that includes: (1) a description and location of a water quality or water quality-related public health problem, (2) a site-specific solution to the problem, and (3) detailed cost information to implement the solution."[380] The EPA did apply cost curves for certain projects that did not exceed specific capacity limits if the POTW had documented the need but had not yet documented the cost. However, if a POTW identified a site-specific problem but had not yet decided between multiple possible solutions, an estimated cost (*e.g.*, average of the estimated costs, or lowest cost option) could not be included in the survey response. Additionally, the documentation requirements were less stringent for smaller systems serving communities with fewer than 10,000 people, which typically have fewer resources for evaluations and planning.

Though the survey asks about needs for the next 20 years, the documentation requirements and short planning windows for most POTWs mean that the needs are closer to a 5-year estimate. The 2012 report stated, "While this Report might capture needs over a period of up to 20 years, nearly

[380] EPA, "Clean Watersheds Needs Survey 2012 Detailed Scope and Methods," (January 2016), p. 1, https://www.epa.gov/sites/production/files/2015-10/documents/cwns_2012_detailed_scope_and_methods-508.pdf. (Accessed December 2019.)

all needs it includes are for projects that will be completed within 5 years (i.e., 2012–2017). States do not generally have documentation for needs over a 20-year time frame."[381] In Florida, 42 percent of the CWNS 2012 needs were documented with capital improvement plans, which only include projects the local government plans to budget for (even if more work is, in fact, needed) and only look about five years into the future.[382]

One major difference between the CWNS and the DWINSA is that the CWNS does not extrapolate reported need to create a total needs estimate. Instead, the CWNS results are the sum of the reported needs. Due to this, Florida's $18.423 billion needs estimate does not include the needs of any non-responsive POTW, any need for a responding POTW that didn't have the required documentation, and any expenditures needed by non-POTW facilities.

While most of Florida's domestic wastewater treatment plants are publicly owned, privately owned treatment works are significant. According to DEP, domestic wastewater treatment facilities have a total permitted capacity to treat over 2.7 billion gallons of wastewater per day (though permitted capacity is larger than the actual "flow" volume). On the November, 2019, domestic wastewater facility list published by DEP, approximately 10.55 percent of the permitted capacity (in millions of gallons per day) for active domestic wastewater treatment plants is permitted to privately-owned facilities.[383] Some of these facilities serve golf clubs, travel parks, campgrounds or other sites without permanent residents, but many of these facilities serve permanent communities. These communities include mobile home parks, condominiums, and investor-owned wastewater treatment plants serving the public.

Survey Criticisms and Alternative Estimates

The two EPA surveys are the most comprehensive bottom-up estimates of water infrastructure needs available. Both reports underreport needs, so a number of entities attempted to estimate needs using alternative methodologies about 15 to 20 years ago. Unlike the EPA's surveys, these estimates included O&M costs as well as capital needs.

Both the EPA and the Congressional Budget Office published gap analyses in 2002, producing ranges of expenditures by revising the most recent surveyed needs and adding O&M estimates. These analyses were published just after reports from the Water Information Network and the AWWA. The AWWA's "Dawn of the Replacement Era" report did not calculate a gap estimate but warned readers of the rising need for investment. The other three reports focus on potential funding gaps, or the difference between projected expenditures needed and projected spending.

A 2010 report published by the Congressional Research Service, "Water Infrastructure Needs and Investment: Review and Analysis of Key Issues," contains a table comparing average annual

[381] EPA, "Clean Watersheds Needs Survey 2012 Report to Congress," (January 2016), p. 2, https://www.epa.gov/sites/production/files/2015-12/documents/cwns_2012_report_to_congress-508-opt.pdf. (Accessed December 2019.)

[382] Of 625 documents listed in Florida's SUMMARY_DOCUMENT table, 264 are capital improvement plans. Excluding the sanitary surveys for OSTDS estimates, 54% of Florida's documentation were capital improvement plans (264 of 491). EPA, Clean Watersheds Needs Survey 2012, Florida database, https://ofmpub.epa.gov/apex/cwns2012/f?p=134:25:. (Accessed December 2019.)

[383] DEP, Wastewater Facility Lists, Domestic Wastewater Facilities, https://floridadep.gov/water/domestic-wastewater/content/wastewater-facility-information. (Accessed November 2019.)

expenditures and the potential annual gap in the three national estimates that include both drinking water and wastewater.[384] It is reproduced in Table 6.4.7 below.

Table 6.4.7 Comparison of Average Annual Expenditure Estimates (National, in billions of 2001 dollars)

		CBO 2002		EPA Gap Analysis	
Average annual cost 2000-2019	**WIN***	**Low-end**	**High-end**	**Low-end**	**High-end**
Capital Investment	$40.3	$24.6	$41.0	$25.0	$46.5
Operations and Maintenance	$52.6	$46.1	$57.0	$46.1	$82.0

		CBO 2002		EPA Gap Analysis	
Average annual cost above baseline spending (gap) 2000-2019	**WIN***	**Low-end**	**High-end**	**Low-end**	**Low-end**
Capital Investment	$18.6	$3.0	$19.4	$1.6	$23.1
Operations and Maintenance	$11.8	$7.1	$18.1	$0.3	$36.3

* Water Information Network. As stated in the Congressional Research Service report's table notes, the Water Information Network's capital investment needs ($40.3 and $18.6) in this table reflect the CBO's recalculation of the Water Information Network's published estimate. "CBO re-estimated the WIN information to reflect investment costs as financed, in order to give comparability with CBO's and EPA's analyses. CBO did not re-estimate O&M needs or gap." An in-depth explanation of the reasoning behind the recalculation can be found in the CBO's report "Future Investment in Drinking Water and Wastewater Infrastructure." CBO, (November 2002), https://www.cbo.gov/publication/14205. (Accessed December 2019.)

A funding gap is not inevitable. As explained by the AWWA in 2001 when describing the Water Information Network's gap analysis, "[i]t is important to stress that the gap estimate represents the challenge ahead—the ramp we must climb—in increasing utility expenditures in order to avoid such a deficiency… There is no current crisis in [the 20 utilities the AWWA studied]. Rather, they are challenged with finding significant additional funds over the next 30 years for investments in repair and replacement, in order to avoid getting behind."

Estimates and Surveys from Other States

In addition to national estimates, many states have begun to survey their water utilities to better plan for the future.[385] Some states, like Maine and Washington, have started to conduct their own Clean Watersheds Needs Surveys. The Pennsylvania Department of Environmental Protection published "The Pennsylvania Water and Wastewater Gap Study" in 2015, building off of work undertaken by the Governor's Sustainable Water Infrastructure Task Force. Kentucky established a state-wide infrastructure GIS database that contains current and proposed water and wastewater infrastructure. West Virginia's Infrastructure and Jobs Development Council publishes a comprehensive inventory of the state's drinking water and wastewater systems and a needs assessment every three years.

In 2016, the Indiana Finance Authority surveyed the state's community water systems and conducted a water audit. The Indiana Finance Authority estimated the state's immediate needs to be $2.3 billion, with an additional $815 million in annual expenditures to maintain utility and

[384] Claudia Copeland, Mary Tiemann, "Water Infrastructure Needs and Investment: Review and Analysis of Key Issues," Report for Congress RL31116 (Congressional Research Service, December 21, 2010), p. 14, https://fas.org/sgp/crs/homesec/RL31116.pdf. (Accessed December 2019.)

[385] This is not an exhaustive list of state-level efforts. It is meant to demonstrate different strategies adopted across the country.

infrastructure quality. In 2016 dollars, Indiana's 20-year drinking water infrastructure estimate totals $17.785 billion.[386] If the first year expenditures were reduced from $2.3 billion to the annual $815 million estimate, Indiana's 20-year estimate would be $16.3 billion.[387] By contrast, Indiana's 2015 DWINSA 20-year reported need was $7.5 billion. The Indiana University Public Policy Institute, working with the Indiana Finance Authority, published a 20-year stormwater expenditure estimate in 2018. The statewide estimate for 2017-2036 expenditures was $1.83 billion in infrastructure, or investment, needs and a further $4.53 billion in "programming"[388] needs. Indiana's 2012 CWNS reported stormwater investment needs were only $161 million.[389]

In 2015, researchers at the Environmental Finance Center at the University of North Carolina estimated North Carolina's 20-year infrastructure needs by updating the 2011 DWINSA and 2012 CWNS estimates, comparing that value to Capital Improvement Plans (CIPs) from North Carolina utilities, and then extrapolating the needs to better represent the full 20-year forecast window. The CIPs included projects that weren't eligible for the EPA's surveys. The inflation-adjusted EPA needs estimates were $10.585 billion for drinking water and $5.968 billion for wastewater and stormwater. The expanded needs estimates ranged from $10.8 to $15 billion for drinking water and from $7.4 to $11.1 for wastewater and stormwater.[390] The authors noted that their estimates were largely based on the EPA's own numbers, so many of the same limitations apply.

Ultimately, only the EPA's surveys isolate Florida's needs. Together, the EPA's most recent 20-year estimates for Florida's drinking water and clean water infrastructure total $44.3 billion (in 2019 dollars using the CPI). However, these surveys underreport the expenditures necessary to keep Florida's water infrastructure safe and properly functioning due to their exclusion of population growth-related needs, non-health related needs, their strict documentation requirements, and the lack of O&M expenditure estimates.

6.5 Funding Sources

The vast majority of expenditures on water utility infrastructure are from local sources, though there are some federal and state sources. The Congressional Budget Office periodically updates a

[386] This total includes $2.3 billion for the first year plus 19-years of $815 million of annual investments. If the costs of fire hydrants are removed, the 20-year total is $17.029 billion. Indiana Finance Authority, "Evaluation of Indiana's Water Utilities: An Analysis of the State's Aging Infrastructure," (November 2016), pp. 28-29, https://www.in.gov/ifa/files/IFA-Report-11-18-2016.pdf. (Accessed December 2019.)

[387] If the costs of fire hydrants are removed, the 20-year total would be $16.0 billion. *Id*.

[388] The report describes programming as the "remaining elements of stormwater management" after excluding capital investment needs. Quoting an earlier publication, these elements are described as "administration and financial management, operations and maintenance, regulation and enforcement, engineering and planning … water quality, public involvement and education, technology, and other miscellaneous activities." Indiana University Public Policy Institute, "Financial Needs for Stormwater Infrastructure and Programming in Indiana," (August 2018), p. 2, http://ppidb.iu.edu/publication/details/755. (Accessed December 2019.)

[389] EPA, "Clean Watersheds Needs Survey 2012 Report to Congress," (January 2016), p. A-1, https://www.epa.gov/sites/production/files/2015-12/documents/cwns_2012_report_to_congress-508-opt.pdf. (Accessed December 2019.)

[390] Shadi Eskaf, Jeff Hughes, Report to the North Carolina State Water Infrastructure Authority and the North Carolina Department of Environmental Quality Division of Water Infrastructure, "Extrapolating to a More Comprehensive Drinking Water and Wastewater Infrastructure Needs Estimates from the EPA Needs Surveys for the State of North Carolina," (UNC Environmental Finance Center, 2016), pp. 2, 6, 13-14, https://efc.sog.unc.edu/sites/default/files/2017/Report%202%20-%20Extrapolating%20Statewide%20Needs.pdf. (Accessed December 2019.)

report on public spending on transportation and water infrastructure, most recently to include data from 1956 to 2017. The report, which relies on data from the Office of Management and Budget and the Census Bureau, indicates that less than 4 percent of the public funding for water utilities (which includes water supply and wastewater treatment) comes from the federal government.[391] The remaining 96 percent of the funding comes from state and local sources. In the years following the passage of the Clean Water Act, the federal government's water infrastructure spending reached as high as 30 percent of the total, but fell by the late 1980s. The report also divides spending between capital spending and O&M (which is almost entirely borne by state and local governments). In 2017, over 70 percent of public spending on water utilities was for O&M, the highest percentage of the spending total in any year in the study.[392]

There are multiple federal agencies and programs that provide assistance directly or through state-level agencies. Assistance programs from federal agencies are described in Table 6.5.1, which was adapted and expanded from testimony and a report published by the Government Accountability Office.[393]

[See table on following page]

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[391] Congressional Budget Office, "Public Spending on Transportation and Water Infrastructure, 1956 to 2017," October 2018, Supplemental Tables W-7 and W-8 available at: https://www.cbo.gov/publication/54539. (Accessed December 2019.)

[392] Congressional Budget Office, "Public Spending on Transportation and Water Infrastructure, 1956 to 2017," October 2018, Supplemental Table W-7 available at: https://www.cbo.gov/publication/54539. (Accessed December 2019.)

[393]Testimony of J. Alfredo Gomez, Director, Natural Resources and Environment, Government Accountability Office, before the Subcommittee on Interior, Environment, and Related Agencies of the House Committee on Appropriations, "Water Infrastructure: Approaches and Issues for Financing Drinking Water and Wastewater Infrastructure," GAO-13-451T (March 13, 2013), p. 3, https://www.gao.gov/products/GAO-13-451T. Government Accountability Office, "Drinking Water and Wastewater Infrastructure: Information on Identified Needs, Planning for Future Conditions, and Coordination of Project Funding," GAO-17-559 (September 2017), p. 40, https://www.gao.gov/products/GAO-17-559.

Table 6.5.1 Federal Funding Assistance

Department, Agency	Program Name(s)	Assistance Provided
Environmental Protection Agency	Drinking Water State Revolving Fund, Clean Water State Revolving Fund	Grants funds to states that provide loans to communities of all sizes for drinking water infrastructure and for wastewater treatment infrastructure, nonpoint pollution management, and estuary programs.
Environmental Protection Agency	Water Infrastructure Finance and Innovation	Funding program administered by the EPA (not through state agency). Low interest loans for large projects ($5 million minimum), grants for disadvantaged communities.
Agriculture, Rural Utilities Service	Water and Waste Disposal Program	Provides funding for water and wastewater infrastructure projects in communities with populations less than 10,000.
Commerce, Economic Development Administration	Public Works and Economic Development Program	Provides grants to small and disadvantaged communities to construct public facilities, including drinking water and wastewater facilities, to alleviate unemployment.
Defense, Army Corps of Engineers	Environmental Infrastructure Program Planning Assistance to States	Provides assistance for water and wastewater infrastructure projects, typically for specific locations as authorized by Congress.
Health and Human Services, Indian Health Service	Sanitation Facilities Construction Program	Provides funding for water and wastewater infrastructure on tribal lands.
Homeland Security, Federal Emergency Management Agency	Hazard Mitigation Grant Program	Provides grants to states, local governments, and tribes post-disaster; recipients use funds to undertake projects that reduce or eliminate long-term risk from future disasters.
Housing and Urban Development	Community Development Block Grant Program	Provides block grant funds to states for distribution to communities, and to certain metropolitan areas; communities use funds for a broad range of activities including water and wastewater infrastructure. According to department officials, about 10 percent of funding is used for this purpose.
Department of the Treasury, Internal Revenue Service	n/a	The Tax Exempt and Government Entities Division administers provisions for tax-exempt bonds issued by local governments to finance qualified projects.

The two major funding programs are the Clean Water State Revolving Fund (CWSRF) and the Drinking Water State Revolving Fund, granted to Florida DEP by the EPA. (A longer discussion of CWSRF allocation is in the next section.)

Table 6.5.2, State Revolving Fund Expenditures, contains annual expenditure data on Florida's Drinking Water and Clean Water State Revolving Funds (extracted from Table 3.1.1 and Table 3.3.3). The EPA's state revolving fund allocations to Florida are much less than the fund's expenditures due to state matching requirements and the nature of revolving funds.

[See table on following page]

Table 6.5.2 State Revolving Fund Expenditures (in $millions)

History	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19
Drinking Water Revolving Fund	$72.52	$76.45	$72.23	$34.75	$82.49	$52.95	$27.41	$57.49	$58.58	$138.41
Revolving Fund - Wastewater Facilities	$121.18	$107.04	$154.88	$101.75	$80.60	$162.99	$119.05	$161.73	$169.88	$244.56
Revolving Fund - Wastewater Small Community*	$22.00	$9.70	$12.88	$22.21	$37.47	$22.03	$16.49	$7.28	$0.89	$0.90
Total	**$215.70**	**193.19**	**239.99**	**158.71**	**200.56**	**237.97**	**162.95**	**226.5**	**229.35**	**383.87**

* The history of these expenditures has been revised to include additional accounts.

In addition to the state revolving funds, the EPA also administers a more recent loan program under the Water Infrastructure Finance and Innovation Act (WIFIA). Since 2017, eight projects in Florida have been invited to apply for WIFIA loans. The invited projects include[394]:

- Miami-Dade County Water and Sewer Department: a $99.7 million loan for their Ocean Outfall Reduction & Resiliency Enhancement Project in 2017.
- Florida Keys Aqueduct Authority: a $45 million loan for their Florida Keys Imperiled Water Supply Rehabilitation project in 2018.
- City of North Miami Beach: a $62 million loan for their Regional Potable Water Improvements project in 2018.
- Miami-Dade County Water and Sewer Department: a $343 million loan for their Wastewater Treatment Plant Electrical Distribution Building Upgrade project in 2018.
- Tohopekaliga Water Authority: a $32 million loan for their Accelerated Gravity Sewer Assessment and Rehabilitation project in 2018.
- Pinellas County Utilities: a $13 million loan for their Water Reclamation Facility Improvements project in 2018.
- Miami-Dade County Water and Sewer Department: a $223 million loan for their South District Wastewater Treatment Plant Expansion project in 2019.
- Polk Regional Water Cooperative: a $235 million loan for their Alternative Water Supply Program project in 2019.

[394] EPA, WIFIA Selected Projects, https://www.epa.gov/wifia/wifia-selected-projects. (Accessed November 2019.)

The U.S. Department of Agriculture's (USDA) Rural Utilities Service provides assistance directly to the utility instead of to the state for distribution.[395] Table 6.5.3, below, contains summary information on the Rural Utilities Service's grants and loans to Florida communities for Water and Waste Disposal purposes. Note that included in "waste disposal" are loans and grants for both wastewater and solid waste, so the actual funding devoted to drinking water, wastewater, and stormwater utilities may be overstated in some years.

Table 6.5.3 USDA Rural Utilities Service Water and Waste Disposal Grants and Loans to Florida Communities, Dollar Amount (Count)

Federal Fiscal Year	Direct Loans	Guaranteed Loans	Grants	Total Assistance
2009	$22,019,200 (8)		$12,178,980 (8)	$34,198,180 (16)
2010	$48,141,000 (14)	$200,000 (1)	$22,387,440 (14)	$70,728,440 (29)
2011	$21,996,000 (10)		$11,265,550 (12)	$33,261,550 (22)
2012	$20,211,600 (8)		$9,324,170 (9)	$29,535,770 (17)
2013	$4,878,000 (2)		$3,261,230 (3)	$8,139,230 (5)
2014	$9,784,100 (5)		$6,318,670 (12)	$16,102,770 (17)
2015	$3,178,000 (3)		$3,678,830 (7)	$6,856,830 (10)
2016	$19,042,000 (5)		$9,135,320 (6)	$28,177,320 (11)
2017	$1,909,000 (3)		$4,486,525 (6)	$6,395,525 (9)
2018	$22,653,600 (6)		$13,467,020 (7)	$36,120,620 (13)
2019	$17,754,000 (7)		$17,279,180 (12)	$35,033,180 (19)
2009 - 2019	$191,566,500 (71)	$200,000 (1)	$112,782,915 (96)	$304,549,415 (168)

Note: The three funding types listed in the original Progress Report tables were Water and Waste Disposal Direct Loans, Water and Waste Disposal Loan Guarantees, and Water and Waste Disposal Grants. Included in the grants column are two additional specialized grant programs: Special Evaluation Assistance for Rural Communities and Households and Emergency Community Water Assistance Grants.

Sources: USDA, Rural Development, "USDA Rural Development Progress Report 2013," (March 2014), p. 35, https://www.rd.usda.gov/files/reports/RD_2013ProgressReport.pdf. (Accessed December 2019.) USDA, Rural Development, "USDA Rural Development Progress Report 2014," (May 2015), p. 30, https://www.rd.usda.gov/files/RD2014ProgressReport.pdf. (Accessed December 2019.) USDA, Rural Development, "USDA Rural Development Progress Report 2016," (January 2017), p. 26, https://www.rd.usda.gov/files/reports/USDARDProgress2016Report.pdf. (Accessed December 2019.) Kenda Robison, USDA, Rural Development, personal communication (December 9, 2019).

State Revolving Fund Allocation

The DWSRF uses the most recent DWINSA needs estimates as the basis of the allocation formula for drinking water state revolving loan funding. The CWSRF, by contrast, uses a state-by-state allotment which was set in statute by the Water Quality Act of 1987[396] and slightly administratively revised in 1999.[397] According to a report published by the Congressional Research Service on the allocation of federal assistance for wastewater treatment, "The legislative history of Congress's final action on the 1987 amendments does not include an explicit statement describing the

[395] More information on the USDA's Rural Utility Service's Water and Environmental Programs can be found at https://www.rd.usda.gov/programs-services/all-programs/water-environmental-programs. (Accessed December 2019.)

[396] Public Law 100-4, Title 33 Chapter 26 s. 1285, Allotment of Grant Funds.

[397] The 1987 allotment to the Pacific Trust Territories (0.1295% of available funds) was redistributed after the territories became ineligible to receive funding. The EPA's administrative allotment change went into effect in federal fiscal year 2000. Jonathan L. Ramseur, "Allocation of Wastewater Treatment Assistance: Formula and Other Changes," RL31073, (June 2, 2016), p. 10, https://crsreports.congress.gov/product/pdf/RL/RL31073. (Accessed December 2019.)

weighting or factors that went into the final allocation formula."[398] The starting points of the U.S. House and U.S. Senate formulas, which were merged in the final version, were population and need (current and anticipated).

Currently, Florida receives 3.43 percent of the CWSRF moneys reserved for the states, the District of Columbia, and Puerto Rico (1.5 percent of the total funding available is set aside for the territories of American Samoa, Guam, the Northern Mariana Islands, and the Virgin Islands). There are nine states with larger allotments (California, Illinois, Massachusetts, Michigan, New Jersey, New York, Ohio, Pennsylvania, and Texas). Michigan, for example, has a 2019 CWSRF allotment that is nearly a third larger than Florida's despite reporting only 11.27 percent of Florida's need on the most recent CWNS. In the 2012 CWNS, only New York and California had larger reported needs. In the 2008 CWNS, New York, California, and New Jersey's needs were larger than Florida's.

In 2014, section 5005 of the Water Resources Reform and Development Act (WRRDA) required the EPA to publish a report reviewing the allotment formula for CWSRF funding based on "(1) the most recent survey of needs developed by the Administrator under section 516(b) of that Act (33 U.S.C. 1375[b]); and (2) any other information the Administrator considers appropriate."[399] That report, "Review of the Allotment of the Clean Water State Revolving Fund (CWSRF) Report to Congress," was published in 2016. Taking the 2012 CWNS results and the 2010 Census state populations into account, the "EPA concluded that the current allotment ***does not adequately*** reflect the reported water quality needs or the most recent census population for the majority of states"[400] (emphasis in original).

The report included potential allotments based on CWNS need and on population, as well as three alternative allotment formula options based on differing mixtures of needs, population, the Water Quality Impairment Component Ratio, and the ratio of CWSRF assistance to federal capitalization (2005-2014). Each alternative option was calculated twice: one version limited decreases to 25 percent. In every one of the recalculated allotment formulas, Florida's allotment rose significantly. The lowest increase was the allotment based solely on population. The three alternative options and the allotment based only on CWNS results all more than doubled Florida's allotment.

Since that report was published, the EPA has not conducted another CWNS. The EPA is beginning the effort to conduct another survey in the near future, but the schedule is uncertain.[401]

To summarize, federal funding sources are important but given the history of the federal spending in Florida, the bulk of the funding for the Florida infrastructure needs would need to be covered by the state, regional, and local sources.

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[398] *Id.*
[399] Section 5005 of the WRRDA of 2014.
[400] EPA, "Review of the Allotment of the Clean Water State Revolving Fund (CWSRF) Report to Congress," EPA-830-R-16-001 (May 2016) p.age 5, https://www.epa.gov/sites/production/files/2016-05/documents/review_of_the_allotment_of_the_cwrsf_report.pdf. (Accessed October 2019.)
[401] *Supra* note 366.

6.6 Next Steps and Recommendations

As mentioned in the introduction to this chapter, this edition is a first step in estimating Florida's expenditures for public and private utilities. Future editions will present more state-specific information and independently calculated estimates. Next year, this chapter will include more information on local spending and planned expenses as published in budget documents and capital improvement plans.

Additional research into asset management and a survey of both public and private utilities regarding assets, asset condition, and O&M expenditures are planned.

7. The Everglades

The Florida Everglades, also known as the "River of Grass," is a mosaic of sawgrass marshes, freshwater ponds, prairies, and forested uplands that supports a diverse plant and wildlife community. The Greater Everglades ecosystem originally encompassed 11,000 square miles from central Florida to the Florida Keys. Historically, sheets of freshwater naturally flowed from the Kissimmee chain of lakes to Lake Okeechobee, where its flood waters traveled southward through a variety of low-lying habitat types before finally reaching the Gulf of Mexico, Florida Bay, and Biscayne Bay.

Because of efforts to drain the marshland for flood control, agriculture, and development, the Everglades today is half the size it was a century ago. Yet, what remains of the Everglades is still considered one of the most unique ecosystems in the world and one of Florida's great treasures.[402] The Everglades wetlands provide numerous benefits to South Florida including water supply, flood control, and recreational opportunities, and serve as a unique habitat for diverse species of wildlife and plant life.[403] The Everglades wetlands also provide natural water storage for the environment during drier seasons, serve as an important water recharge area for South Florida, and play a significant role in the state's effort to combat sea level rise.

This chapter outlines major Everglades restoration plans or programs and identifies historic expenditures related to those initiatives. Further, this edition introduces a preliminary methodology for forecasting expenditures necessary to complete the Comprehensive Everglades Restoration Plan. Future editions will improve upon this forecast and provide forecasts of expenditures governing Everglades restoration including the state's water quality restoration initiatives.

7.1 Historical and Legal Context

To restore and protect the greater Everglades ecosystem, the Florida Legislature established the State of Florida's responsibilities in a series of statutes under chapter 373, Florida Statutes. In addition to authorizing the South Florida Water Management District (SFWMD) to serve as the local sponsor or lead entity for the state's restoration efforts, the Legislature directed the roles and responsibilities of both the Florida Department of Environmental Protection (DEP) and SFWMD for plans or programs authorized under Florida law including the Everglades Forever Act[404] and the Northern Everglades and Estuaries Protection Act,[405] as well as the federally authorized Comprehensive Everglades Restoration Plan (CERP).[406]

For a "forward-looking snapshot" of schedules and estimated costs for completing projects that implement CERP and non-CERP Everglades restoration initiatives, see the most recent Integrated Delivery Schedule of the U.S. Army Corps of Engineers (Corps).[407] For a summary of all the South

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[402] § 373.4592(1)(a), Fla. Stat.
[403] § 373.4592(1), Fla. Stat.
[404] § 373.4592, Fla. Stat.
[405] § 373.4595, Fla. Stat.
[406] *See* §§ 373.470, 373.1502, Fla. Stat.
[407] U.S. Army Corps of Engineers, Integrated Delivery Schedule, https://www.saj.usace.army.mil/Missions/Environmental/Ecosystem-Restoration/Integrated-Delivery-Schedule/.

Florida Ecosystem restoration activities by state and federal entities for the reporting period of July 1, 2016 through June 30, 2018, see the South Florida Ecosystem Restoration Task 2018 Biennial Report.[408] The major restoration programs that require state funding for implementation are discussed below.

Comprehensive Everglades Restoration Plan

Congress authorized phases of the Central and Southern Florida Project for Flood Control (C&SF Project) under the Flood Control Act of 1948[409] and the Flood Control Act of 1954[410] with subsequent modifications authorized by later acts of Congress. The purpose of the C&SF Project was to drain areas of the Everglades in order to provide "flood control; water supply for municipal, industrial, and agricultural uses; prevention of saltwater intrusion; water supply for the Everglades National Park (ENP); and protection of fish and wildlife resources."[411] The resulting canals, levees, and water control structures severely altered the Everglades ecosystem, which prompted Congress to require the Corps to conduct a restudy of the impacts of the C&SF Project and develop a proposed comprehensive plan to modify the project in order to restore, preserve, and protect the 18,000 square mile South Florida ecosystem, including the Everglades.[412]

In 2000, Congress approved the CERP with the passage of the Water Resources Development Act of 2000 to provide a coordinated plan for restoring the water resources of central and southern Florida, including the Everglades, while restoring other water-related needs such as water supply and flood protection.[413] The CERP is the largest hydrologic restoration initiative ever undertaken in the United States. It represents a comprehensive, long-term partnership between the federal government and the State of Florida (through SFWMD as the local sponsor), which focuses primarily on the restoration of the water quantity, quality, timing, and distribution within the Everglades ecosystem. Several projects included in CERP are comprised of multiple components due to their complexity and size.[414] In total, CERP consists of more than 50 projects totaling 68 project components[415] at a cost of $16.4 billion.[416] The federal government is responsible for 50 percent of the overall cost of implementing CERP, although any land acquisition necessary for CERP projects is the responsibility of the State (the amount of which is credited towards the State's share).[417]

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408 South Florida Ecosystem Restoration Task Force: 2018 Biennial Report, available at: https://evergladesrestoration.gov/content/documents/strategic_plan_biennial_report/2018_Biennial_Report.pdf. (Accessed December 2019.)
409 Pub. L. 80-858, § 201, 62 Stat. 1176 (1948).
410 Pub. L. 83-780, § 203, 68 Stat. 1248, 1257 (1954).
411 U.S. Army Corps of Engineers, Jacksonville District, Central and Southern Florida (C&SF) Project Fact Sheet, March 2019, https://www.saj.usace.army.mil/About/Congressional-Fact-Sheets-2019/C-SF-Project-C/. (Accessed December 2019.)
412 Water Resources Development Act of 1996, Pub. L. 104-303, § 601, 110 Stat. 3767, 3768. Section 528 of the Water Resources Development Act of 1996 also defined the "South Florida ecosystem" as the "area consisting of the lands and waters within the boundary of the South Florida Water Management District, including the Everglades, the Florida Keys, and the contiguous near-shore coastal waters of South Florida."
413 Public Law 106-541, 114 Stat. 2680, 2681.
414 2015 Central and Southern Florida Project, Report to Congress, Comprehensive Everglades Restoration Plan, at 3, available at: https://evergladesrestoration.gov/content/cerpreports/cerp_2015_rpt_to_congress.pdf. (Accessed December 2019.)
415 *Id.*
416 2015 Central and Southern Florida Project, Report to Congress, Comprehensive Everglades Restoration Plan, at 39, available at: https://evergladesrestoration.gov/content/cerpreports/cerp_2015_rpt_to_congress.pdf. (Accessed December 2019.)
417 Pub. L. 106-541, § 601, 114 Stat. 2680, 2684.

While the CERP itself has been approved as a modification to the CS&F Project, the projects identified therein are conditionally approved. Those that cannot be approved under the Corps' programmatic authority require federal authorization of construction before being eligible for federal appropriation.[418] Congress authorized four projects referred to as "Generation 1 Projects" and four projects referred as "Generation 2 Projects" in 2007 and 2014, respectively.[419] In addition, there are previously authorized projects that pre-date CERP, which were assumed to be completed during CERP planning. These projects are referred to as "Foundation Projects" as they were expected to serve as the foundation for CERP implementation.[420]

Considerable progress has been made toward CERP implementation in recent years. The progress has been driven in part by the commitment of long-term state funding for Everglades restoration, a push by the state to expedite the implementation of certain restoration activities, and more consistent federal approval of water resource projects within CERP. In 2016, Congress approved the Central Everglades Planning Project (CEPP), a suite of restoration projects targeting the central Everglades, which is estimated to cost a total of $1.98 billion.[421] The CEPP is designed to send more water south from Lake Okeechobee.[422] In October 2018, the Everglades Agricultural Area (EAA) reservoir was federally authorized as a change to the water storage components of CEPP.[423] This project will provide additional water storage south of Lake Okeechobee and is intended to reduce high-volume discharges from the lake to the St. Lucie and Caloosahatchee estuaries and restore the hydrological connection to the Everglades.[424]

For the most recent five year-report on the progress of implementation of CERP, see the 2015 Central and Southern Florida Project Report to Congress.[425]

Everglades Forever Act

In 1994, the Florida Legislature enacted the Everglades Forever Act (EFA) establishing a long-term commitment to restoring and protecting the remaining Everglades ecosystem by improving water quality and water quantity.[426] The EFA required SFWMD to develop a plan for achieving compliance with state water quality standards, including total phosphorous criterion, by 2003. In 2003, the EFA was amended to incorporate SFWMD's Long-Term Plan for Achieving Water

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[418] *See* Pub. L. 106-541, § 601, 114 Stat. 2680, 2683-2684.

[419] The first set of CERP projects that were authorized (Generation 1 projects) were approved in the Water Resources Development Act of 2007. These are the Indian River Lagoon South, the Picayune Strand Restoration, and the Site 1 Impoundment projects, and the Melaleuca Eradication Facility. The second set of CERP projects that were authorized (Generation 2) were approved in the Water Resources Development Act of 2014. These are the C-111 Spreader Canal, the Biscayne Bay Coastal Wetland Phase 1 projects, the Caloosahatchee River (C-43) West Basin Storage, and the Broward County Water Preserve Areas.

[420] South Florida Ecosystem Restoration Task Force, 2018 Biennial Report, at 5, available at: https://evergladesrestoration.gov/content/documents/strategic_plan_biennial_report/2018_Biennial_Report.pdf. (Accessed December 2019.)

[421] Pub. L. No: 115-270 (2018).

[422] U.S. Army Corp of Engineers, Central Everglades Planning Project Fact Sheet, November 2019, available at: https://usace.contentdm.oclc.org/utils/getfile/collection/p16021coll11/id/4197. (Accessed December 2019.)

[423] America's Water Infrastructure Act of 2018, Pub. L. No: 115-270 (2018). Note that in 2017, prior to federal authorization, section 373.4598, Florida Statutes, was enacted by the Florida Legislature to establish an expedited schedule for the SFWMD to expedite the design and construct of the Everglades Agricultural Area (EAA) reservoir project.

[424] *See* 373.4598, Fla. Stat.

[425] https://www.saj.usace.army.mil/Portals/44/docs/Environmental/Report%20to%20Congress/FINAL_RTC_2015_01Mar16fin-WithLetters-WithCovers-508Compliant.pdf. (Accessed December 2019.)

[426] Ch. 94-115, §§ 1-2, Laws of Fla. (codified as amended in § 373.4595, Fla. Stat.).

Quality Goals for the Everglades Protection Area consisting of various projects that would achieve compliance with the total phosphorous criterion.[427]

In 2013, the EFA was amended to include the State of Florida and U.S. Environmental Protection Agency's consensus plan on new strategies for improving water quality in the Everglades.[428] Known as the Restoration Strategies Regional Water Quality Plan dated April 27, 2012 (Restoration Strategies), this technical plan includes the creation of 6,500 acres of new stormwater treatment areas (STAs) and 116,000 acre-feet of additional water storage (flow equalization basins or FEBs) to work in conjunction with existing water quality features to achieve compliance with the state's numeric phosphorus criterion for the Everglades Protection Area.[429]

The cost of implementing the water quality improvement projects is estimated to be $880 million over a 13-year period. According to the SFWMD's Restoration Strategies Program Update, total program expenditures through July 2019 are approximately $327.6 million and all projects are scheduled to be constructed by December 2025.[430] A total of $500.7 million in funds will be provided by SFWMD with the balance to be provided by the state. The 2013 Legislature appropriated $32 million on a recurring basis through Fiscal Year 2023-24 to support the implementation of the water quality plan. For more detailed information on the status of these projects, see the SFWMD's 2019 South Florida Environmental Report, Chapter 5A, Restoration Strategies – Design and Construction Status of Water Quality Improvement Projects.[431]

In order to present a forecast of these expenditures in future editions, EDR will begin working with DEP and SFWMD staff to obtain annual data on program expenditures. This should include identifying regional and state expenditures, as well as information on the completion timeline and updated cost estimates for projects that have yet to be completed.

Northern Everglades and Estuaries Protection Act

In 2007, the Florida Legislature enacted the Northern Everglades and Estuaries Protection Program (NEEPP), which expanded the existing Lake Okeechobee Protection Program, to include protection and restoration of the Caloosahatchee River, St. Lucie River, and Lake Okeechobee watersheds.[432] The purpose of the NEEPP is to coordinate implementation of watershed-based protection plans to improve water quality and quantity, control exotic species, and restore habitat within the northern Everglades watersheds.[433]

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[427] The "Everglades Protection Area" is defined as Water Conservation Areas 1, 2A, 2B, 3A, 3B, the Arthur R. Marshall Loxahatchee National Wildlife Refuge, and the Everglades National Park. § 373.4592(2)(i), Fla. Stat.

[428] Ch. 2013-59, § 1, Laws of Fla. (amending § 373.4592, Fla. Stat.)

[429] SFWMD, Restoration Strategies Regional Water Quality Plan. 2012. Available at: https://www.sfwmd.gov/sites/default/files/documents/rs_waterquality_plan_042712_final.pdf. (Accessed December 2019). For additional information, *see also* SFWMD, Restoration Strategies for Clean Water for the Everglades, https://www.sfwmd.gov/our-work/restoration-strategies. (Accessed December 2019).

[430] South Florida Water Management District, Restoration Strategies Program Update (July 2019), available at: https://www.sfwmd.gov/sites/default/files/documents/restoration-strategies-update-2019-jul.pdf. (Accessed December 2019).

[431] Available at: https://apps.sfwmd.gov/sfwmd/SFER/2019_sfer_final/v1/chapters/v1_ch5a.pdf. (Accessed December 2019).

[432] Ch. 2007-253, § 3, Laws of Fla. (amending § 373.4595, Fla. Stat.).

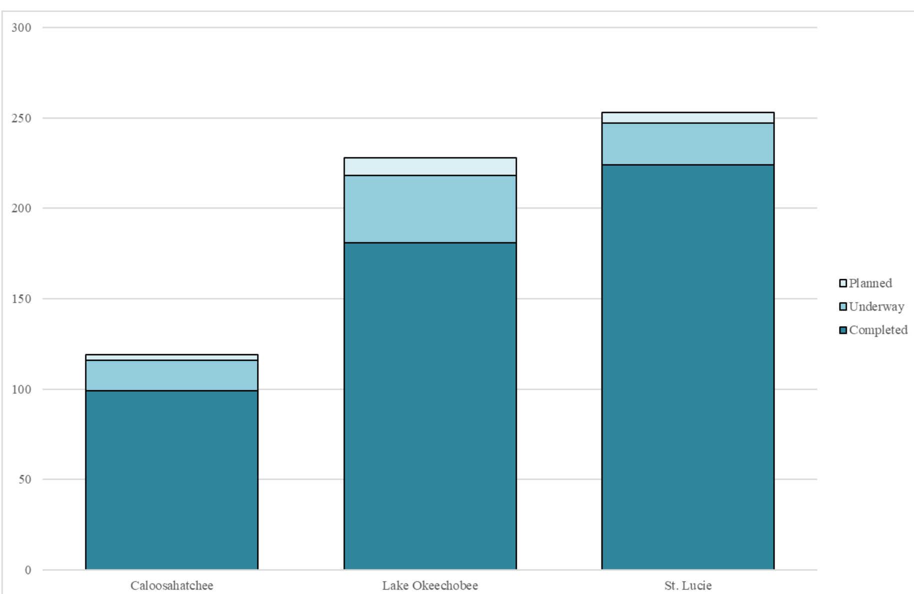
[433] § 373.4595, Fla. Stat.

In 2016, the Florida Legislature amended NEEPP to reflect the Basin Management Action Plans (BMAPs) adopted for Lake Okeechobee (2014), the Caloosahatchee Estuary Basin (2012), and the St. Lucie River and Estuary Basin (2013), as the pollution control programs for these watersheds. The amendments strengthened the implementation of these BMAPs and also clarified the roles and responsibilities of SFWMD, DEP, and DACS in implementing the program.[434]

The NEEPP requires these BMAPs to achieve the TMDLs within 20 years of BMAP adoption with 5-year, 10-year, and 15-year milestones to measure progress. The DEP is also required to conduct a review of each of these BMAPs every five years and identify further load reductions that may be necessary to achieve compliance with the applicable TMDLs. The first five-year reviews of the Caloosahatchee Estuary Basin BMAP and the St. Lucie River and Estuary Basin BMAP were completed in December 2017 and June 2018, respectively. The five-year review for the Lake Okeechobee BMAP is to be completed by December 2019.

According to DEP's 2018 STAR Report, the completed projects identified in the Caloosahatchee Estuary BMAP are estimated to achieve 77 percent of the reduction needed to meet the total nitrogen (TN) TMDL allocated to the Caloosahatchee Estuary Basin. For the Lake Okeechobee BMAP, the completed projects in the northern sub-watersheds are estimated to achieve 22 percent of the reduction needed to meet the total phosphorus (TP) TMDL. For the St. Lucie River and Estuary Basin, the completed projects are estimated to achieve 52 percent of the reduction needed to meet the TN TMDL and 35 percent of the reduction needed to meet the TP TMDL. See Figures 7.1.1 ad 7.1.2 for the status of the BMAP projects for the northern Everglades watersheds and progress towards nutrient reduction goals as of December 31, 2018.

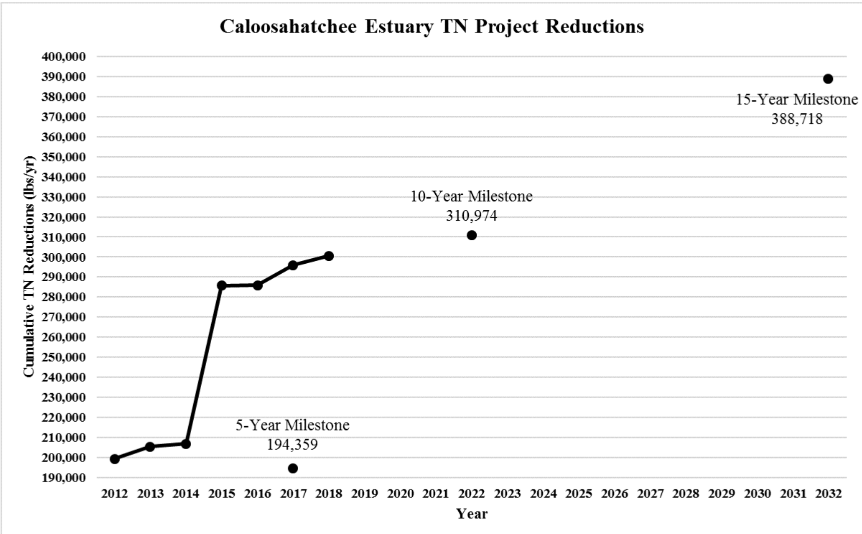
Figure 7.1.1 Status and Count of NEEPP BMAP Projects

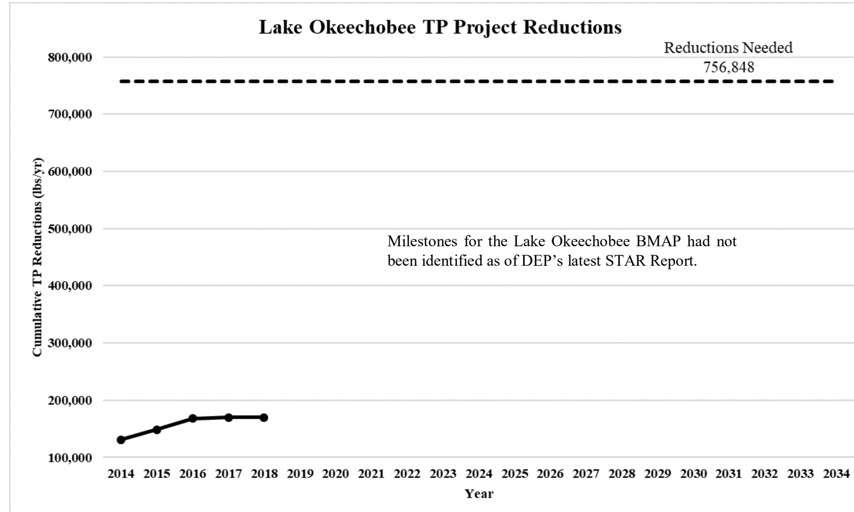


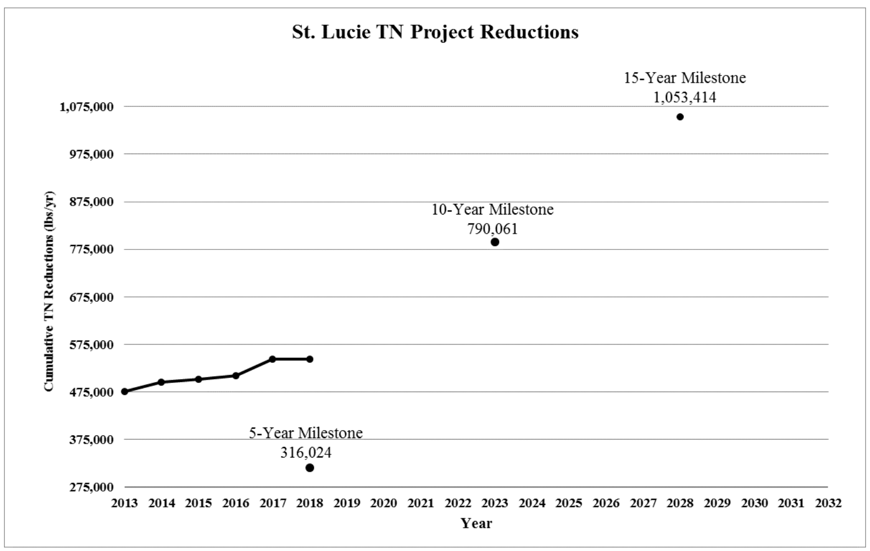
Source: Compiled from the STAR Report's Adopted BMAP Projects data.

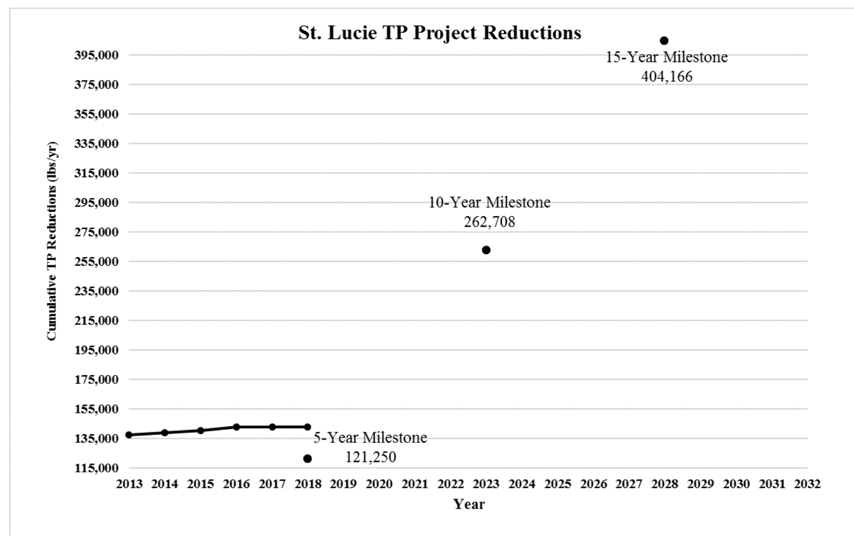
[434] Ch. 2016-1, § 15, Laws of Fla. (amending § 373.4595, Fla. Stat.). For more information on basin management action plans associated with NEEPP, see DEP, Basin Management Action Plans, available at: https://floridadep.gov/dear/water-quality-restoration/content/basin-management-action-plans-bmaps. (Accessed December 2019.)

Figure 7.1.2 Progress Toward NEEPP BMAP Nutrient Reduction Goals









Source: STAR Report, ADA Compliant Version, Figures 13-16.

For more information on the status of implementation of the Caloosahatchee Estuary Basin, St. Lucie River and Estuary Basin, and Lake Okeechobee BMAPS, see DEP's 2018 STAR Report.[435] In future editions of EDR's report, expenditures necessary to complete these particular BMAPs will be isolated from the statewide BMAP implementation analysis presented in Section 5.1, above.

Everglades Restoration Investment Act

In 2000, the Legislature passed the Everglades Restoration Investment Act, section 373.470, Florida Statutes, which provided the framework for the state to fund its share of the partnership, through cash or bonds to finance or refinance the cost of acquisition and improvement of land and water areas necessary for implementing CERP.[436] In 2007 and 2008, the Legislature expanded the use of the Save Our Everglades Trust Fund and bonds issued for Everglades restoration to include the Lake Okeechobee Watershed Protection Plan and the River Watershed Protection Plans under the Northern Everglades and Estuaries Protection Program, and the Keys Wastewater Plan.[437]

7.2 Everglades Expenditures

The primary funding sources for Everglades restoration are the federal government, the state of Florida, and the SFWMD. The share for each of these funding sources for projects varies depending upon the restoration plan or program being implemented. Many of the restoration projects are funded by some share of federal and state funding with the state funding including SFWMD. As such, distinguishing state and regional expenditures on Everglades restoration can be challenging. In this section, state and regional expenditures are largely reported together.

Federal Expenditures on Everglades Restoration

Federal funding for Everglades restoration is provided through the Corps and the U.S. Department of the Interior. EDR received data from SFWMD which breaks down historic CERP expenditures by year and government entity. Values included in previous editions of this report were CERP and non-CERP combined budgeted values as opposed to actual expenditures. Under CERP, the federal government is required to fund half of the total cost of implementing CERP projects. Over the history of the program, the federal government has spent just over 43 percent of the total expenditures to implement CERP. Table 7.2.1 shows the annual federal expenditures on CERP since Federal Fiscal Year 2000.

[435] Florida Department of Environmental Protection, 2018 Statewide Annual Report on Total Maximum Daily Loads, Basin Management Action Plans, Minimum Flows or Minimum Water Levels, and Recovery or Prevention Strategies, June 28, 2019, available at: https://floridadep.gov/dear/water-quality-restoration/content/statewide-annual-report. (Accessed December 2019.)
[436] Ch. 2000-129, § 5, Laws of Fla.
[437] The Keys Wastewater Plan is defined as "the plan prepared by the Monroe County Engineering Division dated November 2007 and submitted to the Florida House of Representatives on December 4, 2007)". § 373.470(2)(e), Fla. Stat.

Table 7.2.1 Federal Expenditures on CERP (in $millions)

	FFY 99-00	FFY 00-01	FFY 01-02	FFY 02-03	FFY 03-04	FFY 04-05	FFY 05-06	FFY 06-07	FFY 07-08	FFY 08-09
Real Estate	$-	$-	$-	$-	$-	$-	$-	$-	$-	$41.02
Design	$1.32	$10.61	$21.43	$30.69	$40.64	$49.59	$49.17	$57.00	$48.43	$48.46
Construction	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
Studies	$-	$0.38	$1.58	$1.24	$1.38	$1.30	$1.83	$0.10	$0.49	$1.08
Total	**$1.32**	**$10.99**	**$23.00**	**$31.92**	**$42.02**	**$50.89**	**$51.01**	**$57.10**	**$48.92**	**$90.56**

	FFY 09-10	FFY 10-11	FFY 11-12	FFY 12-13	FFY 13-14	FFY 14-15	FFY 15-16	FFY 16-17	FFY 17-18	FFY 18-19
Real Estate	$0.06	$0.03	$0.03	$0.06	$0.01	$0.00	$71.59	$0.00	$0.10	$0.02
Design	$51.27	$46.60	$37.42	$34.41	$23.34	$19.57	$17.98	$21.82	$21.85	$28.87
Construction	$10.19	$47.15	$67.29	$68.28	$50.36	$43.24	$32.21	$43.83	$52.12	$69.11
Studies	$0.21	$0.29	$0.12	$0.01	$0.01	$-	$-	$0.02	$0.20	$-
Total	**$61.73**	**$94.07**	**$104.86**	**$102.75**	**$73.72**	**$62.81**	**$121.78**	**$65.67**	**$74.27**	**$98.00**

In addition to CERP expenditures, the SFWMD provided running totals of expenditures for certain non-CERP Everglades restoration activities. Table 7.2.2 shows the cumulative non-CERP total federal expenditures on Everglades Restoration. EDR will work with district staff to determine annual expenditures and progress where applicable.

Table 7.2.2 Non-CERP Federal Expenditures on Everglades Restoration (in $millions)

Modified Water Deliveries to Everglades National Park	$394.80
Critical Projects	$88.40
Kissimmee River Restoration	$377.50
Herbert Hoover Dike	$1,023.00
Central and South Florida Project (Non-CERP)	$823.60
Total	**$2,707.30**

Source: Provided by the SFWMD. Values are cumulative totals as of September 30, 2018.

State and Regional Expenditures on Everglades Restoration

The State of Florida has spent more than $1 billion for projects related to Everglades restoration over the most recent ten fiscal years. These expenditures are largely included in the reported state expenditures for water quality restoration projects and initiatives in Chapter 3.[438] Table 7.2.3 shows the annual cash expenditures for various projects or initiatives related to Everglades restoration. The majority of the funding (shown in the "Everglades Restoration" row) is for projects that support CERP and Restoration Strategies.

Table 7.2.3 State Expenditures for Everglades Restoration (in $millions)

	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19
Everglades Restoration*	$38.35	$69.27	$27.54	$26.60	$54.77	$39.12	$82.86	$121.89	$148.38	$257.29
Land Acquisition	$-	$-	$-	$-	$-	$-	$0.05	$6.52	$22.61	$14.52
Florida Keys Wastewater Treatment	$-	$-	$-	$-	$39.16	$10.72	$26.20	$6.23	$6.01	$10.49
Lake Okeechobee Agricultural Projects	$-	$-	$-	$-	$-	$4.72	$6.65	$5.72	$7.53	$6.53
Total	**$38.35**	**$69.27**	**$27.54**	**$26.60**	**$93.92**	**$54.56**	**$115.77**	**$140.37**	**$184.53**	**$288.83**

* Previous editions of this table included an "Other Projects" category that, upon further analysis, is now included in Everglades Restoration.

Funding sources for Everglades restoration projects have included General Revenue, trust fund balances, and bond proceeds. Current law authorizes the issuance of bonds to finance or refinance the cost of Everglades restoration.[439] Bonds may be issued in Fiscal Years 2002-03 through 2019-20, in an amount not to exceed $100 million per fiscal year except under certain conditions.[440] To date, the state has issued approximately $336.8 million of Everglades bonds. The most recent year that new bonds were authorized was Fiscal Year 2014-15, when the Legislature authorized bonds of up to $50.0 million for the purpose of constructing sewage collection, treatment, and disposal facilities included in the Florida Keys Area of Critical State Concern.[441]

The aggregate principal amount of outstanding bonds is approximately $180 million, with net debt service of approximately $22 million due in Fiscal Year 2019-20. If no new bonds are sold, the estimated debt service is expected to generally decline each year through Fiscal Year 2034-35, at which time the Everglades bonds would be retired. Table 7.2.4 shows the estimated debt service that will be due each fiscal year.

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[438] *See* Table 3.3.4.
[439] § 215.619, Fla. Stat.
[440] Section 215.619(1)(a), Florida Statutes, authorizes bonds to exceed $100 million per fiscal year if DEP requests additional amounts to achieve cost savings or accelerate the purchase of lands, or the Legislature authorizes additional bonds to fund the Florida Keys and Key West Areas of Critical State Concern.
[441] Specific Appropriation 1626A, ch. 2014-51, Laws of Fla. (Fiscal Year 2014-15 General Appropriations Act).

Table 7.2.4 Everglades Restoration Bonds Outstanding Debt Service (in $millions)

	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	FY 26-27	
Principal	$15.74	$16.48	$17.27	$18.08	$18.94	$19.86	$14.22	$14.85	
Interest*	$6.62	$6.00	$5.35	$4.70	$3.98	$3.24	$2.48	$2.04	
Outstanding Debt Service	$22.36	$22.48	$22.62	$22.77	$22.92	$23.09	$16.70	$16.89	
	FY 27-28	**FY 28-29**	**FY 29-30**	**FY 30-31**	**FY 31-32**	**FY 32-33**	**FY 33-34**	**FY 34-35**	**Total**
Principal	$7.88	$8.17	$5.94	$6.15	$6.38	$3.10	$3.20	$3.32	**$179.54**
Interest*	$1.59	$1.30	$0.99	$0.78	$0.55	$0.33	$0.23	$0.12	**$40.30**
Outstanding Debt Service	$9.46	$9.47	$6.93	$6.93	$6.93	$3.43	$3.43	$3.43	**$219.83**

*Assumes 1.88% interest rate on the Series 2007A and 1.85% on the Series 2007B variable rate Everglades Bonds.
Source: State Board of Administration of Florida Annual Debt Service Report for the Fiscal Year Ended June 30, 2019.
Note: Values may not sum to totals due to rounding.

The Everglades bonds have been issued on a parity basis with Florida Forever bonds, which means both bond programs have a first lien on pledged revenues (*i.e.*, Documentary Stamp Tax). The debt service is paid from the LATF for both Florida Forever bonds and Everglades bonds.

Similar to the federal expenditure data above, the SFWMD provided data on annual CERP expenditures by the state and the SFWMD. Over the history of the program, the state/regional governments have contributed nearly 57 percent of the total expenditures. Table 7.2.5 details the complete history of state and regional expenditures on CERP.

[See table on following page]

Table 7.2.5 State/SFWMD CERP Expenditures for Everglades Restoration (in $millions)

	LFY 98-99	LFY 99-00	LFY 00-01	LFY 01-02	LFY 02-03	LFY 03-04	LFY 04-05	LFY 05-06	LFY 06-07	LFY 07-08	LFY 08-09
Real Estate	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$508.99
Design	$0.58	$1.88	$9.69	$17.83	$31.61	$41.67	$64.83	$105.55	$66.29	$59.61	$33.43
Construction	$-	$-	$-	$-	$0.02	$0.82	$2.00	$0.62	$12.84	$0.79	$0.11
Studies	$-	$-	$0.09	$0.94	$1.95	$1.91	$1.37	$1.35	$3.19	$1.03	$0.31
Total	**$0.58**	**$1.88**	**$9.78**	**$18.77**	**$33.58**	**$44.40**	**$68.20**	**$107.53**	**$82.32**	**$61.42**	**$542.83**

	LFY 09-10	LFY 10-11	LFY 11-12	LFY 12-13	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17*	LFY 17-18*	LFY 18-19*
Real Estate	$-	$1.64	$1.06	$4.61	$0.55	$0.41	$518.57	$-	$-	$-
Design	$22.02	$16.90	$8.31	$10.30	$8.70	$7.60	$9.60	$-	$-	$-
Construction	$3.82	$2.24	$1.48	$1.11	$1.65	$32.55	$42.19	$-	$-	$-
Studies	$0.07	$0.04	$0.05	$0.04	$0.01	$-	$-	-$0.02	$-	$-
Total	**$25.91**	**$20.82**	**$10.90**	**$16.07**	**$10.92**	**$40.56**	**$570.36**	**-$0.02**	**$-**	**$-**

*Full expenditure values for these years are not included because the Corps is in the process of reviewing the district's final expenditure reports for cost-share purposes.

In addition to CERP expenditures, SFWMD provided EDR with running totals of expenditures for non-CERP Everglades restoration activities. Table 7.2.6 shows the cumulative non-CERP total state and regional expenditures on Everglades restoration. EDR will work with district staff to determine annual expenditures and progress, where applicable.

Table 7.2.6 State/SFWMD Non-CERP Expenditures for Everglades Restoration (in $millions)

Critical Projects	$54.00
Kissimmee River Restoration	$202.20
Herbert Hoover Dike	$100.00
Restoration Strategies	$346.00
Everglades Construction Project	$1,627.80
Northern Everglades	$533.60
Central and South Florida Project (Non-CERP)	$215.60
Total	**$3,079.20**

Source: Provided by the SFWMD. Values are cumulative totals as of September 30, 2019.

Expenditures Necessary to Comply with Laws and Regulations Governing CERP

When CERP was originally authorized in 2000, it was estimated that it would cost $8.2 billion and take 30 years to complete.[442] This cost was updated in 2015 to be $16.4 billion.[443] Since that time, additional costs associated with the Everglades Agricultural Area Reservoir ($1.3 in billions of $2018) and Lake Okeechobee Watershed Project ($1.4 in billions of $2018) have been added to that total.[444] Adjusting each of these for inflation results in a total implementation cost of $20.31 billion in Fiscal Year 2018-19 dollars. Similarly, summing the CERP expenditure totals from Tables 7.2.1 and 7.2.5 and adjusting them to Fiscal Year 2018-19 dollars results in $3.39 billion spent, leaving $16.93 billion remaining. Over the most recent five years, the inflation adjusted expenditures have averaged $217.73 million, putting CERP on track to require more than an additional 78 years to reach full implementation in the year 2097.

If the original 30 year goal were to be met, total expenditures would need to increase nearly eightfold to a total of $1.69 billion per year. If an alternative goal of 50 years were to be met,[445] expenditures would need to more than double to $564.20 million per year. These costs would be shared approximately 50-50 between the federal government and the state of Florida, including the South Florida Water Management District. If Florida accelerates the pace of its spending to meet a 30- or 50-year goal, it is unlikely that the federal government would accelerate its funding in tandem. However, if the state advances the full cost, it runs the risk that such funds will not be reimbursed.

7.3 Next Steps and Recommendations

Future editions of this report will continue to refine the forecast of expenditures necessary to complete CERP. Additionally, EDR will work with DEP and SFWMD staff to produce a forecast of the expenditures necessary to implement non-CERP Everglades restoration projects required by law. These include the state's water quality initiatives in the Restoration Strategies and the updated BMAPs for the Caloosahatchee River, St. Lucie River, and Lake Okeechobee watersheds.

At this time, EDR has no formal recommendations for legislative consideration regarding Everglades restoration.

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[442] Everglades Restoration: Federal Funding and Implementation Progress. Congressional Research Service. Available at: http://www.nationalaglawcenter.org/wp-content/uploads/assets/crs/R42007.pdf. (Accessed December 2019.)

[443] 2015 Central and Southern Florida Project, Report to Congress, Comprehensive Everglades Restoration Plan, at 39, available at: https://evergladesrestoration.gov/content/cerpreports/cerp_2015_rpt_to_congress.pdf. (Accessed December 2019.)

[444] Progress Toward Restoring the Everglades: The Seventh Biennial Review – 2018. National Academies of Sciences, Engineering, and Medicine. National Academic Press. Available at: https://www.nap.edu/catalog/25198/progress-toward-restoring-the-everglades-the-seventh-biennial-review-2018. (Accessed December 2019.) Note that some portion of these costs may be included in CERP cost estimates. EDR will work with DEP to remove any potential redundancy.

[445] *See* Congressional Research Service, Recent Developments in Everglades Restoration, October 17, 2019 (stating that CERP will take approximately 50 years to implement), available at: https://fas.org/sgp/crs/misc/IF11336.pdf. (Accessed December 2019.)

8. Analyzing the Potential Future Gap Between Water Resource-Related Revenues and Expenditures

This assessment is required by section 403.928(1)(d), Florida Statutes, to identify the gap between the state's[446] projected revenues and the projected and estimated expenditures for water resources. Projected revenues and projected expenditures are the forecast of future water resource related revenues and expenditures, respectively, based upon historical trends and ongoing projects or initiatives. Estimated expenditures are the forecast of future expenditures that are necessary to comply with federal and state laws and regulations governing water supply and demand as well as water quality protection and restoration and to also achieve the Legislature's intent that sufficient water be available for all existing future reasonable-beneficial uses and the natural systems.

8.1 Evaluating the Gap Considering the Current Trend

In Chapter 3, the projected revenues and projected expenditures necessary to conduct a gap analysis were developed.

Projected Water Supply Funding Gap

Historical and projected revenues dedicated to or historically allocated for water supply can be found in Table 3.2.1in Chapter 3 of this report. These revenue sources consist of federal grants and loan repayments, neither of which provide for a smooth history. Further, between Fiscal Years 2005-06 and 2008-09, $227.70 million was appropriated from the Doc Stamp Tax to aid the Water Management Districts with alternative water supply funding. The use of that funding source for this purpose did not continue in the most recent ten fiscal years, but $58.16 million was expended. The delay in expenditures creates the appearance of a gap that does not actually exist. These historical and projected revenues are shown in Figure 8.1.1.

Water supply expenditures by the state have been inconsistent over the past ten years. This is likely due, in order of magnitude, to: (1) the protracted effect on state revenues caused by the collapse of the housing market and the onset of the Great Recession; (2) the varying size of federal grant awards; and (3) the terms and rates of loan repayments. The historical and projected state expenditures on water supply can be found in Table 3.1.1 in Chapter 3 of this report. This type of data is very difficult to forecast with any reliable degree of accuracy. These historical and projected expenditures are shown in Figure 8.1.1.

[See figure on following page]

[446] State is inclusive of federal revenues appropriated in the General Appropriations Act each year.

Figure 8.1.1 Projected Water Supply Funding Gap (in $millions)

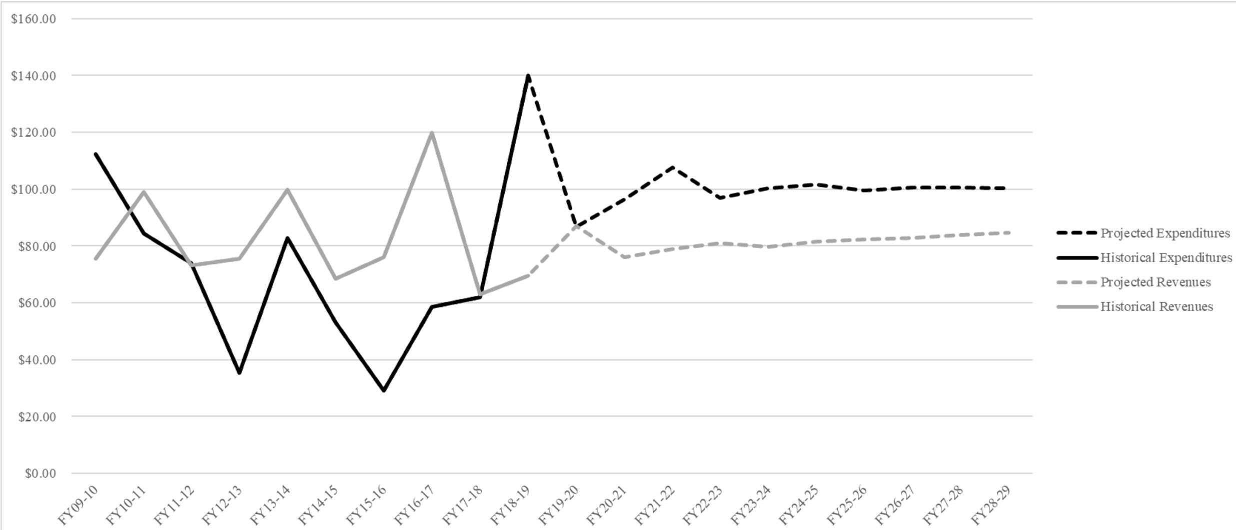


Figure 8.1.1 indicates that a gap in water supply funding may emerge beginning in Fiscal Year 2020-21 and exists from there onward. The gap is quantified in Table 8.1.1 below. This gap is partly inflated by the assumption of ongoing expenditures from revenues generated prior to the history presented. Further, it is comprised entirely of federal grants and loan repayments and as such, may be assumed to balance itself over time.

Table 8.1.1 Projected Water Supply Funding Gap (in $millions)

	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	FY 26-27	FY 27-28	FY 28-29
Projected Expenditures	$86.86	$96.28	$107.71	$96.95	$100.32	$101.66	$99.64	$100.54	$100.61	$100.27
Projected Revenues	$86.89	$76.01	$78.86	$81.09	$79.66	$81.46	$82.34	$82.80	$83.87	$84.70
Gap	**$0.00**	**($20.27)**	**($28.86)**	**($15.86)**	**($20.66)**	**($20.20)**	**($17.30)**	**($17.74)**	**($16.74)**	**($15.57)**

Projected Water Quality Funding Gap

Historical and projected revenues dedicated or historically allocated to water quality can be found in the "Committed to Water Resources" row of Table 3.4.1 and the "Total" row of Table 3.4.3 in Chapter 3 of this report. These historical and projected revenues are shown in Figure 8.1.2.

Water quality expenditures by the state have been more stable than supply; however, there was a significant decline following the collapse of the housing market, which was exacerbated by the Great Recession. After reaching a low point in Fiscal Year 2012-13, expenditures have increased approximately 12 percent per year, on average. The historical and projected state expenditures on water quality can be found in Table 3.3.7 in Chapter 3 of this report. This type of data is very difficult to forecast with any reliable degree of accuracy and, as such, forecasts will vary between editions of this report based on the latest data. These historical and projected expenditures are shown in Figure 8.1.2.

Figure 8.1.2 Projected Water Quality Funding Gap (in $millions)

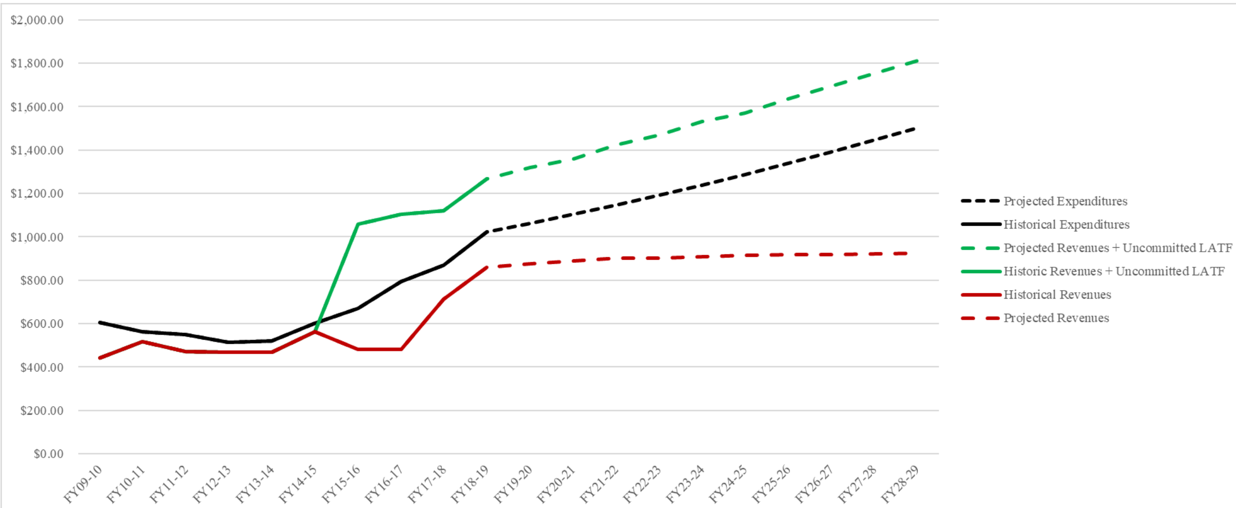


Figure 8.1.2 indicates that a gap has existed in water quality funding for at least ten fiscal years. This gap would have been filled either through revenues generated and saved from previous years or from a source not dedicated or historically allocated to water quality. Because those revenues are technically not "committed" to this purpose, they are not assumed in the future. Going forward, the gap persists and broadens over the ten year forecast period. The gap is quantified in Table 8.1.2 below. The gap is eliminated from the forecast horizon if the uncommitted documentary stamp tax distribution to the LATF is included as a revenue source.

Table 8.1.2 Projected Water Quality Funding Gap (in $millions)

	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	FY 26-27	FY 27-28	FY 28-29
Projected Expenditures	$1,062.06	$1,103.75	$1,147.09	$1,192.12	$1,238.92	$1,287.56	$1,338.10	$1,390.63	$1,445.23	$1,501.96
Projected Revenues	$876.71	$887.85	$900.27	$902.35	$907.21	$913.47	$917.19	$916.51	$920.94	$924.74
Gap	**($185.36)**	**($215.91)**	**($246.82)**	**($289.77)**	**($331.71)**	**($374.08)**	**($420.91)**	**($474.13)**	**($524.29)**	**($577.23)**
Projected Revenue + Uncommitted LATF	$1,319.93	$1,357.96	$1,422.09	$1,469.75	$1,529.61	$1,570.90	$1,634.03	$1,694.81	$1,752.62	$1,811.74
Gap with Uncommitted LATF	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-

8.2 Evaluating the Gap Considering the Expenditures Necessary to Comply with the Law and Meet the Legislature's Intent

In Chapter 3 the projected revenues dedicated or historically allocated to water supply and water quality and other water resource-related programs were evaluated. Chapter 4 provides a limited estimate of future water supply expenditures necessary to achieve the Legislature's intent that sufficient water be available for all existing and future reasonable-beneficial uses and the natural systems, while Chapters 5 and 7 provide limited estimates of future water quality protection and restoration expenditures necessary to comply with federal and state laws and regulations governing water quality protection and restoration. This data provides a basis to compare the estimated future expenditures calculated thus far to the total revenue forecasts.

Estimated Water Supply Funding Gap

Tables 4.9.1 and 4.9.2 provide least and most expensive water supply expenditure options based on data available from the Department of Environmental Protection and the Water Management Districts (WMDs). These can be averaged to produce an average expenditure forecast. Table 4.9.3 attempts to interpolate and back-extrapolate the annual amount of water that needs to be generated by projects to meet future water demand. The average cost per project can be evaluated by dividing the average expenditure forecast by the water to be generated to meet future demand and then applied to the annual water to be generated forecast to determine annual expenditures. Further, Section 4.9 evaluates the time to completion of project and determines that two years is a reasonable estimate of standard project construction duration. As such, the expenditures necessary to generate water for each given year must occur two years prior to the water generation needs. Moreover, Table 4.7.1 indicates that the state's share of this funding is 4.5 percent on average. Applying this to the methodology described produces the annual expenditure forecast for alternative water supply (AWS) seen in Table 8.2.1. Since the WMDs forecasts generally begin in 2015, there is a total expenditure of $10.92 million of state dollars estimated for the Fiscal Years 2014-15 through 2018-19. According to Table 3.1.1, $7.91 million of state dollars were provided for AWS during that time period.

Section 4.8 estimates a necessary expenditure of $7.80 billion on implementation of minimum flows and minimum water levels (MFLs) over waterbodies in recovery to restore the natural systems. Applying the state share discussed above indicates that the state would pay approximately $347.75 million of this cost. While only the MFLs over outstanding Florida springs have a 20 year achievement deadline, if one assumes 20 years from today for all MFL recovery implementation then the annual state expenditure would be $17.39 million. This time horizon is likely too long as many of these MFL recovery strategies are not recently developed. The MFL Recovery forecast can be seen in Table 8.2.1.

[See table on following page]

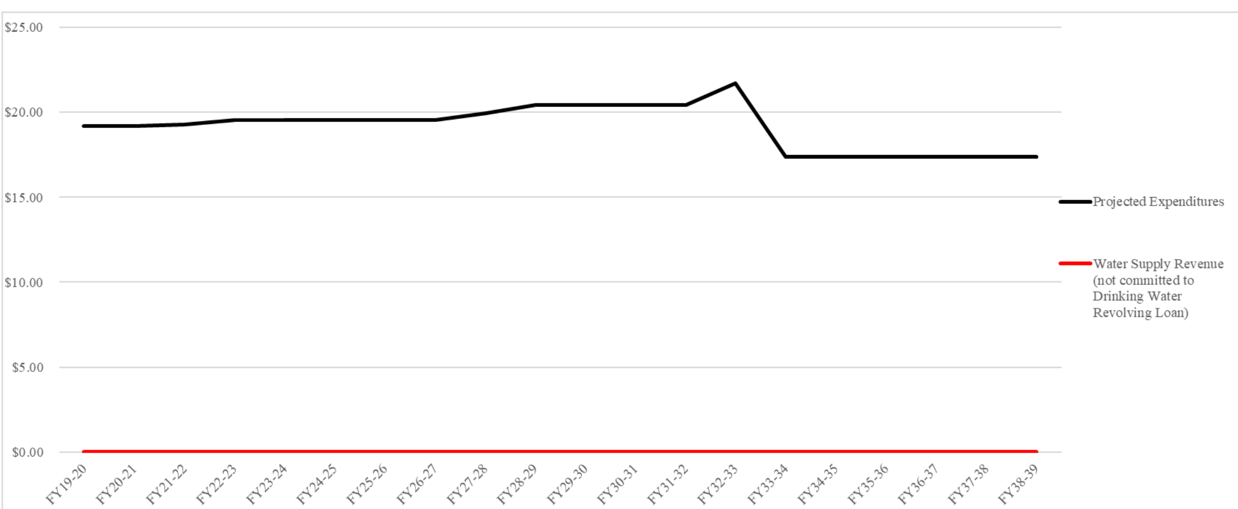
Table 8.2.1 Estimated Future Water Supply Expenditures (in $millions)

	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	FY 26-27	FY 27-28	FY 28-29
AWS	$1.79	$1.79	$1.90	$2.17	$2.15	$2.15	$2.15	$2.15	$2.54	$3.04
MFL Recovery	$17.39	$17.39	$17.39	$17.39	$17.39	$17.39	$17.39	$17.39	$17.39	$17.39
Total	**$19.18**	**$19.18**	**$19.29**	**$19.56**	**$19.54**	**$19.54**	**$19.54**	**$19.54**	**$19.93**	**$20.43**
	FY 29-30	**FY 30-31**	**FY 31-32**	**FY 32-33**	**FY 33-34**	**FY 34-35**	**FY 35-36**	**FY 36-37**	**FY 37-38**	**FY 38-39**
AWS	$3.04	$3.04	$3.04	$4.34	$N/A*	$N/A*	$N/A*	$N/A*	$N/A*	$N/A*
MFL Recovery	$17.39	$17.39	$17.39	$17.39	$17.39	$17.39	$17.39	$17.39	$17.39	$17.39
Total	**$20.43**	**$20.43**	**$20.43**	**$21.73**	**$17.39**	**$17.39**	**$17.39**	**$17.39**	**$17.39**	**$17.39**

*FY33-34 through FY38-39 AWS expenditures are not expected to be zero. Statewide demand forecasts are not currently available beyond 2035 and with a two-year construction period would be for the unknown water needs of 2036 through 2041.

The revenue available for water supply must be evaluated prior to considering a gap between expenditures and revenues. All water supply revenue identified in Section 3.2 is either federal grants for the drinking water revolving loan fund or repayment of loans given as part of the drinking water revolving loan fund. By the concept of a revolving loan fund, all of this money is rededicated to future loans of the program. It is extremely unlikely that any of these loans would be used for AWS or MFL recovery. As such, Figure 8.2.1 shows the gap between the expenditure itemized in Table 8.2.1 and the zero water supply revenues when the revolving loan funds are not considered.

Figure 8.2.1 AWS and MFL Recovery State Funding Gap (in $millions)



As a result, the gap in state funding for water supply expenditures necessary to achieve the Legislature's intent that sufficient water be available for all existing and future reasonable-beneficial uses and the natural systems can be seen in the row labeled "Total" in table 8.2.1.

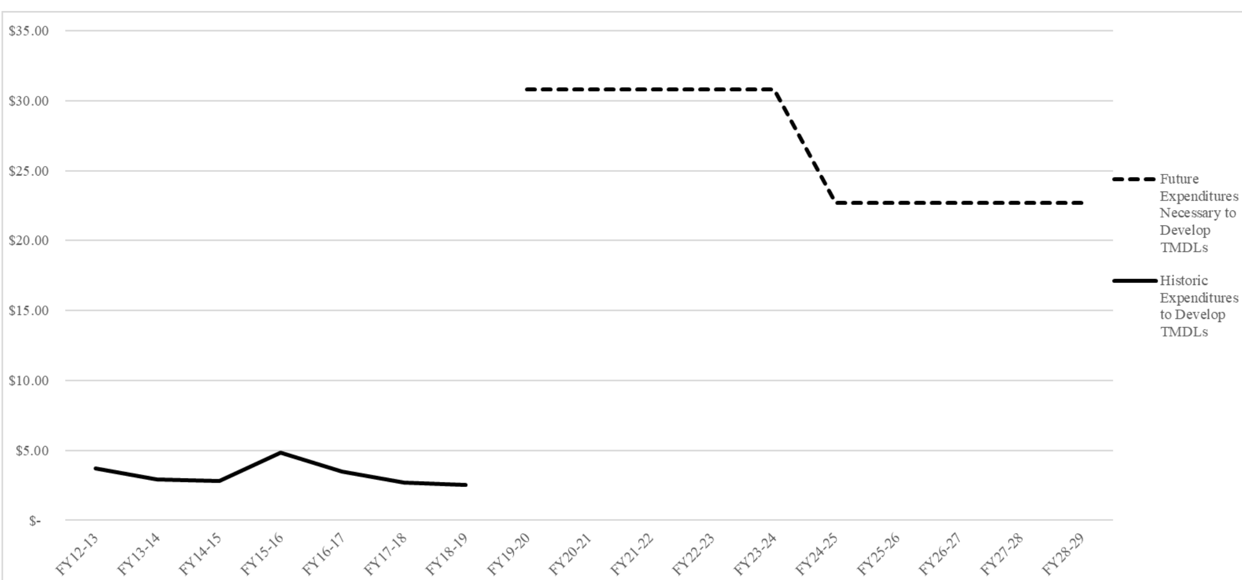
Estimated Water Quality Funding Gap

Existing water quality expenditures address a broad range of projects, programs, and initiatives. See Section 3.3 for a categorization of historic expenditures. Some of these expenditures are for long term legally required laws and regulations, such as the Total Maximum Daily Load (TMDL) program, while some may occur with consistency but are not part of a broader structure, such as annual water projects. It is thus possible that the projected revenue appears to exceed the estimates of future water quality protection and restoration expenditures necessary to comply with federal and state laws and regulations while still having a funding gap due to the consistent expenditures that are made without a specific legal requirement to do so.

In this 2020 Edition, EDR has identified the monitoring of water bodies and development of TMDLs, the implementation of Basin Management Action Plan (BMAP) projects, Alternative Restoration Plans, Surface Water Improvement and Management (SWIM) program, and the Comprehensive Everglades Restoration Plan (CERP) and non-CERP everglades restoration as federal and state laws and regulations governing water quality protection and restoration that require future expenditures. Estimates of TMDL development, BMAP implementation, and CERP expenditures are developed in Chapters 5 and 7.

Compared to the others, TMDL development expenditures appear small. It is worth noting, however, that the future expenditures necessary to develop TMDLs over the currently identified waterbodies is much higher than the historic rate. This is shown in Figure 8.2.2.

Figure 8.2.2 TMDL Development History and Forecast (in $millions)



In order to consider a single CERP expenditure forecast, two additional assumptions will be required regarding the duration of the time to completion and the cost share between federal and state/regional governments. Chapter 7 provides three time-to-completion estimates consisting of the current trend concluding in 2097, the 50-year time horizon concluding in 2049, and the 30-year time horizon concluding in 2029. The original 30-year time horizon is selected and a fifty-fifty cost share is assumed. Table 8.2.2 identifies the current state expenditure forecast for TMDL development, BMAP implementation, and CERP.

Table 8.2.2 State Expenditure Forecast for TMDL Development, BMAP Implementation, and CERP (in $millions)

	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	FY 26-27	FY 27-28	FY 28-29
TMDL Dev.	$30.79	$30.79	$30.79	$30.79	$30.79	$22.67	$22.67	$22.67	$22.67	$22.67
BMAP Imp.	$385.01	$376.45	$376.45	$363.13	$363.13	$246.30	$230.52	$230.52	$191.92	$179.88
CERP	$846.31	$846.31	$846.31	$846.31	$846.31	$846.31	$846.31	$846.31	$846.31	$846.31
Total	**$1,262.10**	**$1,253.54**	**$1,253.54**	**$1,240.22**	**$1,240.22**	**$1,115.28**	**$1,099.50**	**$1,099.50**	**$1,060.90**	**$1,048.86**

	FY 29-30	FY 30-31	FY 31-32	FY 32-33	FY 33-34	FY 34-35	FY 35-36
TMDL Dev.	**$-***	**$-***	**$-***	**$-***	**$-***	**$-***	**$-***
BMAP Imp.	$176.03	$165.46	$165.46	$120.62	$103.70	$103.70	$8.78
CERP	**$-**	**$-**	**$-**	**$-**	**$-**	**$-**	**$-**
Total	**$176.03**	**$165.46**	**$165.46**	**$120.62**	**$103.70**	**$103.70**	**$8.78**

*While the TMDL development forecast considers all waterbodies on the comprehensive verified list, additional water bodies may be identified as impaired in the future and require TMDL development.
**The existing BMAP implementation forecast ends in FY35-36, however, there are at least 6 known additional BMAPs that will be accounted for in future editions. Further, as discussed in Section 5.2, the BMAP implementation estimate is likely understated.

Combining just the forecasts for TMDL development, BMAP implementation, and CERP implementation produces a revised expenditure total that exceeds projected revenues in every year unless the currently uncommitted LATF dollars are used for these purposes. This gap is shown in Table 8.2.3. The degree to which the timeframes and cost shares underlying the expenditure forecasts for the development of TMDLs and implementation of BMAPs and CERP are legally required is still being assessed. Figure 8.2.3 provides a snapshot of the projected revenues and the thus far estimated expenditures over the next ten fiscal years.

There are two caveats to this analysis. First, the statutorily uncommitted LATF dollars are currently being spent on other qualified purposes of the LATF. Redeploying them to TMDLs, BMAPs, and CERP would require the other purposes to be defunded or shifted to another revenue source. Second, the expenditure forecast shown in Figure 8.2.3 addresses only a stylized subset of water quality expenditures since it does not include other historical water quality initiatives required by law or in practice, as identified in Chapter 5.

Figure 8.2.3 Total Projected Water Quality Revenue Compared with Estimated Expenditures Necessary to Develop TMDLs, Implement BMAPs, and Implement CERP (in $millions)

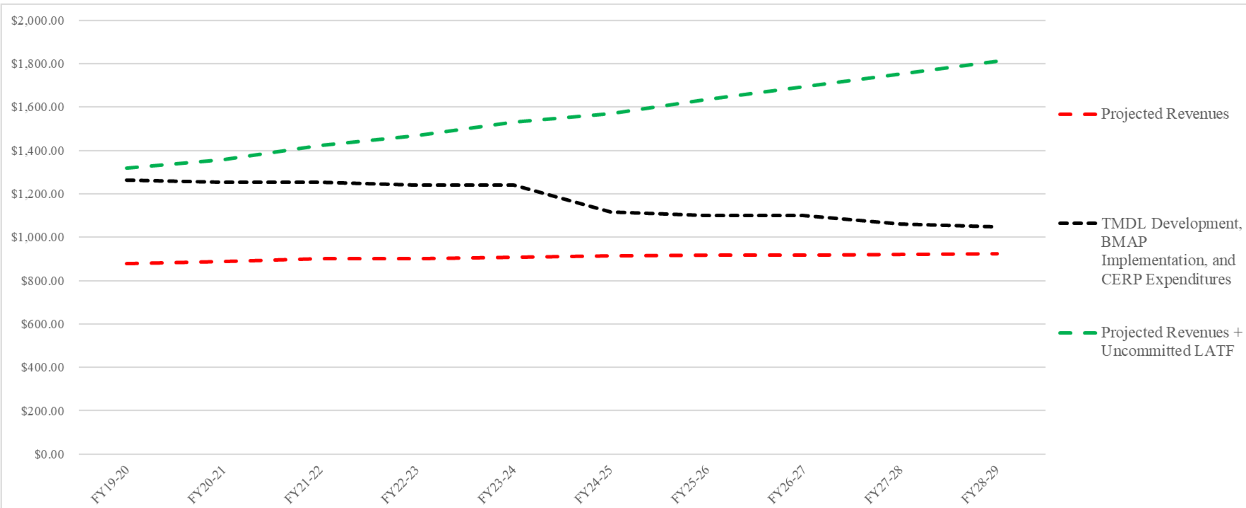


Table 8.2.3 Projected Water Quality Funding Gap (in $millions)

	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26	FY 26-27	FY 27-28	FY 28-29
TMDL/BMAP /CERP Exp.	$1,262.10	$1,253.54	$1,253.54	$1,240.22	$1,240.22	$1,115.28	$1,099.50	$1,099.50	$1,060.90	$1,048.86
Projected Revenues	$876.71	$887.85	$900.27	$902.35	$907.21	$913.47	$917.19	$916.51	$920.94	$924.74
Gap	**($385.39)**	**($365.69)**	**($353.27)**	**($337.87)**	**($333.01)**	**($201.81)**	**($182.31)**	**($182.99)**	**($139.96)**	**($124.12)**
Projected Revenue + Uncommitted LATF	$1,319.93	$1,357.96	$1,422.09	$1,469.75	$1,529.61	$1,570.90	$1,634.03	$1,694.81	$1,752.62	$1,811.74
Gap with Uncommitted LATF	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-

Future editions aim to include updated forecasts form TMDL development, BMAP implementation, and CERP as well as estimated forecasts for Alternative Restoration Plans, the SWIM program, and non-CERP Everglades restoration. While a gap may not exist between total revenues and the subset of identified expenditures, it is not unreasonable to expect a gap to be revealed in future editions once all estimated expenditures are incorporated.

Appendix A: Additional Resources Regarding Water Supply and Demand Modelling and Expenditures Forecasts

The following are the appendices related to Chapter 4. For references, please see the end of Chapter 4.

A.1 Calculating Supply from DEP (2019a) Appendices

Table A.1.1. Calculating Existing Water Supply from Appendices A and B of DEP's RWSP 2018 Annual Report

From DEP Appendix B	DEP Appendix A							Combine A & B
	Data for the 2015-2035 planning dates are provided below.							
2015 Demand	Water Management District Planning Region	Net Demand Change (mgd)	Estimated Existing Sources Available to Meet Future Demands (mgd)	Net Demand Change of which Additional AWS or Conservation Must Surpass (mgd)	Conservation Projection to Meet Future Demands (mgd)	Additional Conservation Projection to Meet Future Demands (mgd)	AWS Options to Meet Future Demands (mgd)	Existing Supply (sum of green columns)
81.28	Region II	19.5	**18.07**	1.4	6.5	0.0	48.0	**99.35**
79.54	Region III	8.9	**8.87**	0.0	9.5	0.0	35.0	**88.41**
212.84	Regions I, IV, V, VI, & VII	12.0	**11.96**	0.0	3.6	0.0	0.0	**224.80**
343.72	Central Springs East Coast (Regions 2, 4, and 5)	78.8	**50.80**	28.0	33.6	13.4	307.4	**394.52**
100.55	SR District (excluding NFRWSP)	21.8	**21.80**	0.0	10.9	0.0	0.0	**122.35**
150.89	Northern (excluding CFWI)	51.7	**23.90**	27.8	23.0	0.0	113.6	**174.79**
411.24	Tampa Bay	63.8	**63.80**	0.0	52.0	0.0	125.2	**475.04**
117.34	Heartland (excluding CFWI)	8.3	**5.80**	2.5	4.4	0.0	8.5	**123.14**
304.57	Southern	50.2	**46.80**	3.4	18.8	0.0	238.0	**351.37**
850.46	CFWI	233.6	**0.00**	233.6	36.8	0.0	333.6	**850.46**
555.29	NFRWSP	112.2	Not Quantified	112.2	40.7	12.3	97.2	**555.29**
	Data for the 2020-2040 planning dates are provided below.							
2015 Demand for LKB 2020 else	Water Management District Planning Region	Net Demand Change (mgd)	Estimated Existing Sources Available to Meet Future Demands (mgd)	Net Demand Change of which Additional AWS or Conservation Must Surpass (mgd)	Conservation Projection to Meet Future Demands (mgd)	Additional Conservation Projection to Meet Future Demands (mgd)	AWS Options to Meet Future Demands (mgd)	Existing Supply (sum of green columns)
204.46	Lower Kissimmee Basin	17.5	**17.49**	0.0	0.0	0.0	0.0	**221.95**
279.15	Upper East Coast	75.5	**71.75**	3.8	14.1	0.0	92.1	**350.90**
1,813.99	Lower East Coast	192.6	**143.00**	49.6	102.4	0.0	286.6	**1,956.99**
1,030.31	Lower West Coast	180.4	**171.13**	9.3	26.3	0.0	101.3	**1,201.44**

A.2 Approaches Used by WMDs to Estimate the Future Water Conservation Potential

For the public supply category, WMDs use various computer programs and tools to estimate conservation potentials, such as the Water Conservation Tracking Tool by the Alliance for Water Efficiency or the EZGuide by the University of Florida's Conserve Florida Water Clearinghouse. When applying these programs and tools, assumptions are made about the percentage of users affected by the different conservation measures being considered (such as the percentage of existing homes that would install high-efficiency toilets or irrigation controllers). The conservation measures are selected to be cost-effective (i.e., expected to reduce water use at a cost (per mgd) lower than a certain threshold). In selected regions, the conservation potential for domestic self-supplied use is also estimated (e.g., based on the reductions achieved for the residential part of the public supply sector, or based on a residential end-users survey followed by a statistical evaluation of actual billing data).

For commercial-industrial-institutional-mining self-supplied category, potential water conservation is estimated as a certain percentage from the water use (e.g., 15 percent reduction and 20 percent participation rate assumed in SF-LEC). In some regions, the conservation potential is taken to be proportional to those achieved by commercial-industrial-institutional users on public supply utilities. A few regions also estimate the conservation potential for the recreational-landscape irrigation category, assuming conversion to more efficient irrigation practices and relying on the corresponding savings calculated for the publically supplied outdoors water use (e.g., SW-NR and CFWI).

In turn, conservation potential for agricultural irrigation can be based on FSAID estimates (e.g., SF-LEC and NFRWSP), assumptions about converting to the most efficient irrigation methods (e.g., SF-LWC and SF-UEC), estimates derived from a District's cost-share programs (e.g., SW-NR), or assessment by the mobile irrigation labs (see CFWI RWSP). Finally, in CFWI, conservation for the power generation sector is assessed, mimicking the potential conservation for commercial, industrial, and institutional users on public supply utilities (i.e., assuming 1.2 percent saving potential).

A.3 Data Used by EDR in the Prototype Water Demand Model

DACS FSAID: the water use forecast for the agricultural self-supplied sector is adopted from the latest – sixth – update of the DACS geodatabase called the Florida Statewide Agricultural Irrigation Demand or FSAID (The Balmoral Group 2019). FSAID was developed in response to the Section 570.92, Florida Statutes, which requires DACS to establish an agricultural water supply planning program. Further, according to Section 373.709, Florida Statutes, WMDs shall consider the data indicative of future water supply demands provided by DACS. Current FSAID model "…incorporates both agronomic and economic factors that affect irrigation water demand. The model's ability to capture the variation in water use by profitability across crops and within crops over time provides an enhanced estimate of future irrigation demands "(The Balmoral Group 2019, p. 4). In addition to supplemental irrigation, FSAID also includes projections of freeze protection irrigation, aquaculture, and livestock water use.

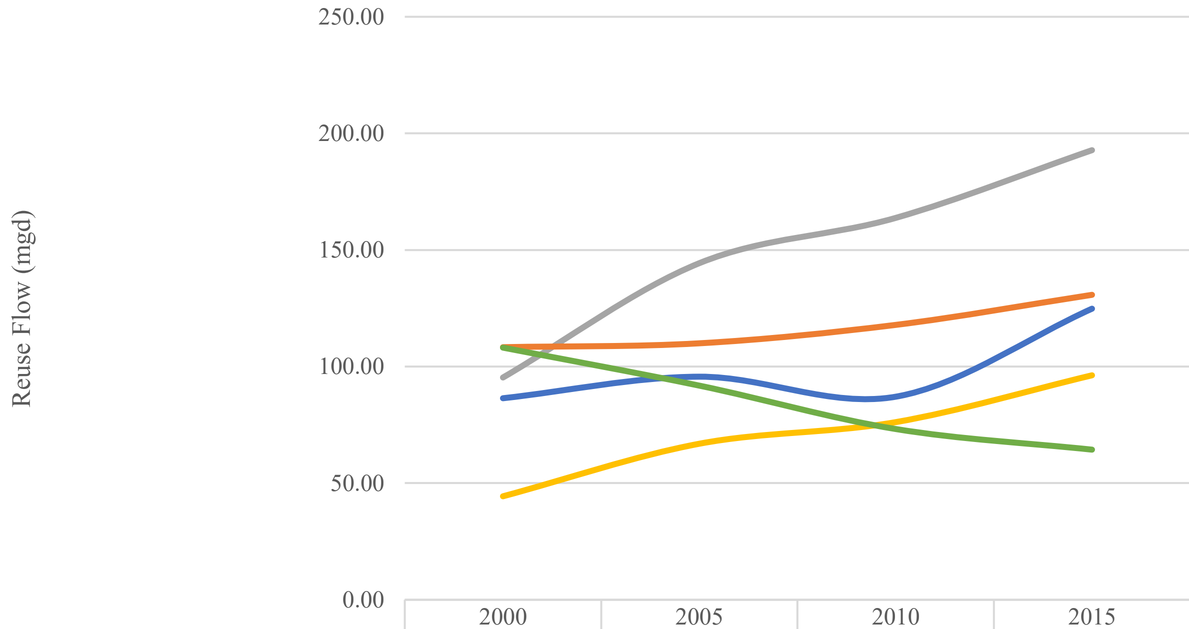
The FSAID forecast meets the EDR needs of being annually updated, consistent among the water supply planning regions, and based on the most recent economic projections. For each water supply planning region, EDR uses average-year supplemental irrigation, freeze protection irrigation, aquaculture, and livestock water use reported in FSAID-VI for 2017, 2020, 2025, 2030, and 2035. In the analysis, 2017 data were assumed to reasonably approximate the 2015 use. The potential effect of conservation reported in FSAID is not accounted for by EDR, since for many regions, FSAID projections without conservation were already below the projections available from the WMDs.

USGS county-level water withdrawals: The history of county-level water withdrawals for various use categories is provided in US Geologic Service (USGS) reports for 2000, 2005, 2010, and 2015.[447] These estimates serve as the basis for EDR preliminary forecast of the future water use.

DEP county-level water reuse inventory: Since the 1990s, increasing volumes of wastewater in Florida have been reused for beneficial purposes.[448] For this EDR report, county-level data from the DEP water reuse inventory reports for 2000, 2005, 2010, and 2015 were obtained and integrated with the USGS county-level water withdrawal. Total reuse flow for each category is presented on Figure A2.1. DEP (2019b) groups reclaimed water reuse into the categories that do not directly correspond to the use categories defined by either WMDs or USGS. To relate DEP reuse categories to WMD and USGS use categories, EDR made the assumptions summarized in Table A.2.1.

[447] While USGS also reports water withdrawal for the earlier years, the period from 2000 to 2015 was selected to reasonably match the data available from the other sources used in the analysis.
[448] DEP. 2019b. Florida's Reuse Activities. https://floridadep.gov/water/domestic-wastewater/content/floridas-reuse-activities

Figure A.3.1 Reuse Flow Volume in Florida (mgd), by Reuse Category*



	2000	2005	2010	2015
Residential Irrigation	95.31	144.35	163.75	192.80
Golf Course Irrigation	108.31	109.98	117.88	130.77
Industrial Uses, Toilet Flushing, and Fire Protection	86.42	95.67	87.07	124.82
Other Public Access Area	44.38	66.92	76.17	96.26
Agriculture	108.13	91.83	73.23	64.38

* Summarized from DEP Reuse Inventory Reports for 2000, 2005, 2010, and 2015 (DEP 2019b). "Groundwater recharge & indirect potable reuse" category is excluded.

Table A.3.1 EDR assumption about the equivalence between the use and reuse categories*

DEP Reuse Categories	EDR Use Categories
Golf course irrigation	Recreational-Landscape Irrigation
Residential irrigation	Public Supply
Other public access areas	Public Supply
Industrial uses, toilet flushing, and fire protection	Split between Power Generation, Commercial-Industrial-Institutional-Mining, and Public Supply; or disregarded
Agricultural irrigation	Agriculture Self-Supply

* DEP's "groundwater recharge & indirect potable reuse" category is excluded from this EDR demand analysis. Instead, it is assumed to be accounted for as a part of water supply assessment.

Further, since reclaimed water is not always a perfect substitute for water from the other sources, DEP defines "potable quality water offset" as follows:

"the amount of potable quality water (Class F-I, G-I, or G-II groundwater or water meeting drinking water standards) saved through the use of reclaimed water expressed as a percentage of the total reclaimed water used"[449] (DEP 2019b).

The potable quality water offset percentages for each reuse activity are taken by DEP (2019b) from the report by Reuse Coordinating Committee (2003), as summarized in Table A.2.2. While the offset percentages are likely outdated, and they are not regionally differentiated, these offset percentages were also accounted for by EDR when combining USGS water withdrawals with DEP reclaimed water volumes.

Table A.3.2 Reuse categories and offsets*

Reuse Categories	Examples of Reuse Activities	Potable Quality Water Offsets	Justification
Golf course irrigation	Golf course irrigation	75%	Efficient landscape irrigation
Residential irrigation	Residential irrigation	40%**	Rounded averages of efficient and inefficient residential irrigation**
Other public access areas	Parks, athletic fields, schools; other landscaped areas; decorative water features; and cleaning roads and sidewalks	60%	Rounded averages of efficient and inefficient landscape irrigation
Industrial uses, toilet flushing, and fire protection	Cooling water; process water; wash water; use at wastewater treatment plant; toilet flushing; and fire protection	100%***	High Desirability – cooling towers, toilet flushing and fire protection
Agricultural irrigation	Irrigation of feed, fodder & pasture crops; irrigation of edible crops	60%	Rounded averages of efficient and inefficient agricultural irrigation
Groundwater recharge & indirect potable reuse	Rapid infiltration basins; injection to recharge groundwater; canal discharge in southeast Florida; barriers to control saltwater intrusion; and wetlands that percolate to groundwater	0%	High Desirability - rapid infiltration basins

* Based on Reuse Coordinating Committee and the Water Conservation Initiative Water Reuse Work Group. 2003. Water Reuse for Florida Strategies for Effective Use of Reclaimed Water. https://floridadep.gov/sites/default/files/valued_resource_FinalReport_508C.pdf
** For residential irrigation in 2018, the offset coefficient used by DEP was compared with the offsets ratio calculated from the data provided by SWFWMD (Anthony Andrade, personal communications, August 2019). SWFWMD calculates offset based upon number of single family homes served by the reclaimed water multiplied by 330 gallon per day (i.e., the average potable irrigation use for an in-ground residential system). When EDR compared total reclaimed water flow and estimated offset for SWFWMD, the offset ratio was approximately 60 percent, which is significantly higher than the ratio assumed by DEP (40 percent).
*** SWFWMD does not consider some industrial "At Treatment Plant" uses to beneficially offset the potable quality water use (e.g., see SWFWMD 2004).

EDR recognized that reuse in "Industrial uses, toilet flushing, and fire protection" involves a variety of applications, some of which can be on public supply, while others being self-supplied. County-level data for 2018 reuse categories and sub-categories were reviewed. "Toilet Flushing" and "Fire Protection" was assumed to be linked to Public Supply use category. Based on an example given in DEP (2015), EDR further assumed that "At Other Facilities" subcategory was supplied to power generation facilities, which were otherwise self-suppled. In turn, "At Treatment

[449] Class F-I, G-I, or G-II are designated used of groundwater defined in Chapter 62-520.410, Florida Administrative Code. Water quality standards are established by DEP to protect these designated uses. Groundwater quality classifications are arranged in order of the degree of protection required, with Classes G-I and F-I generally requiring the most stringent water quality criteria and Class G-IV requiring the least stringent criteria. The designated use of Class F-I groundwater is potable water use, groundwater in a single source aquifer with a total dissolved solids content of less than 3,000 mg/L. According to Chapter 62-520.460, Florida Administrative Code, the surficial aquifers in northeast Flagler County, is classified as Class F-I groundwater.
In turn, Class G-I is also defined as the potable water use, groundwater in a single source aquifer that has a total dissolved solids content of less than 3,000 mg/L. Class G-II is Potable water use, groundwater in aquifers with a total dissolved solids content of less than 10,000 mg/L, unless otherwise classified by the Commission (§ 62-520.410).

Plant" subcategory was assumed to be equally split between the commercial-industrial-institutional-mining self-supplied, public supply, and the water use internal for the treatment plants (e.g., water to spray foam formed as a part of the treatment process). The internal water use was then disregarded. To summarize, for each county, "Industrial uses, toilet flushing, and fire protection" reuse flow in 2018 was attributed to "power generation," commercial-industrial-institutional-mining self-supplied, or public supply, or disregarded based on the shares of the reuse flow in "At Other Facilities", "Toilet Flushing", "Fire Protection", and "At Treatment Plant". A similar analysis was conducted for the 2000 reuse. Finally, for simplicity and due to the lack of data, the reuse shares in 2005 and 2010 were interpolated based on the shares in 2000 and 2015.[450] The shares of "Industrial uses, toilet flushing, and fire protection" used in the analysis are summarized in Table A.3.3.

[See table on following page]

[450] The only exception was the Palm Beach County, where prior to 2010 all "Industrial uses, toilet flushing, and fire protection" was assumed to be "At Treatment Plant". Based on the discussions with SFWMD staff member, the power plant that is included in "At Other Facilities" category was put into the operation after 2005.

Table A.3.3 "Industrial uses, toilet flushing, and fire protection" Reuse Category Shares Assumed by the EDR, by County

County***	Reuse Flow (mgd)		At Other Facilities					At Treatment Plant					Toilet Flushing & Fire Protection				
	2000*	2018**	2000*	2005	2010	2015	2018**	2000*	2005	2010	2015	2018**	2000*	2005	2010	2015	2018**
Alachua	0.53	1.39	0.00	0.17	0.33	0.50	0.60	1.00	0.83	0.67	0.50	0.40	0.00	0.00	0.00	0.00	0.00
Baker	0.00	0.08	0.00	0.00	0.00	0.00	0.00	1.00	0.72	0.44	0.17	0.00	0.00	0.28	0.56	0.83	1.00
Bay	2.20	0.05	0.00	0.04	0.08	0.12	0.14	1.00	0.96	0.92	0.88	0.86	0.00	0.00	0.00	0.00	0.00
Bradford	0.06	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Brevard	0.41	1.69	0.10	0.13	0.15	0.18	0.19	0.90	0.86	0.83	0.79	0.77	0.00	0.01	0.02	0.03	0.04
Broward	5.69	8.35	0.21	0.15	0.10	0.04	0.01	0.79	0.85	0.90	0.96	0.99	0.00	0.00	0.00	0.00	0.00
Charlotte	0.13	0.26	0.00	0.00	0.00	0.00	0.00	0.70	0.63	0.56	0.49	0.45	0.30	0.37	0.44	0.51	0.55
Citrus	0.00	0.63	0.00	0.28	0.56	0.83	1.00	1.00	0.72	0.44	0.17	0.00	0.00	0.00	0.00	0.00	0.00
Collier	0.56	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Columbia	0.00	0.20	0.00	0.00	0.00	0.00	0.00	1.00	0.72	0.44	0.17	0.00	0.00	0.28	0.56	0.83	1.00
De Soto	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Duval	4.38	7.80	0.00	0.04	0.08	0.12	0.14	1.00	0.96	0.92	0.88	0.86	0.00	0.00	0.00	0.00	0.00
Escambia	3.45	11.64	0.00	0.25	0.51	0.76	0.91	1.00	0.75	0.49	0.24	0.09	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.04	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Flagler	0.03	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Gadsden	0.00	0.08	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Hamilton	0.00	0.06	0.00	0.28	0.56	0.83	1.00	1.00	0.72	0.44	0.17	0.00	0.00	0.00	0.00	0.00	0.00
Hardee	0.15	1.05	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hernando	1.05	0.87	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Highlands	0.00	0.01	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Hillsborough	15.79	16.10	0.44	0.47	0.50	0.52	0.54	0.56	0.53	0.50	0.48	0.46	0.00	0.00	0.00	0.00	0.00
Indian River	0.68	0.00	0.41	0.30	0.18	0.07	0.00	0.59	0.70	0.82	0.93	1.00	0.00	0.00	0.00	0.00	0.00
Jackson	0.00	0.05	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Jefferson	0.03	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00
Lake	0.06	0.23	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Lee	0.53	1.26	0.97	0.91	0.86	0.80	0.77	0.03	0.09	0.14	0.20	0.23	0.00	0.00	0.00	0.00	0.00
Leon	0.22	1.97	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Manatee	0.46	0.48	0.02	0.01	0.01	0.00	0.00	0.98	0.99	0.99	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Marion	0.00	0.10	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Martin	0.00	0.28	0.00	0.08	0.16	0.24	0.29	1.00	0.73	0.46	0.19	0.03	0.00	0.19	0.38	0.57	0.68
Miami-Dade	15.1	18.89	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Monroe	0.04	0.02	0.00	0.03	0.05	0.08	0.09	0.00	0.25	0.51	0.76	0.91	1.00	0.72	0.44	0.17	0.00
Nassau	0.00	0.44	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Okaloosa	0.00	0.36	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Orange	10	9.04	0.87	0.85	0.82	0.80	0.78	0.13	0.16	0.18	0.21	0.22	0.00	0.00	0.00	0.00	0.00
Osceola	0.01	2.07	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Palm Beach	6.32	16.89	1.00	0.93	0.85	0.78	0.73	0.00	0.08	0.15	0.23	0.27	0.00	0.00	0.00	0.00	0.00
Pasco	0.57	0.95	0.45	0.43	0.40	0.38	0.36	0.55	0.58	0.60	0.63	0.64	0.00	0.00	0.00	0.00	0.00
Pinellas	5.35	11.50	0.19	0.33	0.46	0.60	0.68	0.81	0.67	0.54	0.40	0.32	0.00	0.00	0.00	0.00	0.00
Polk	7.43	16.04	0.05	0.31	0.56	0.82	0.97	0.95	0.69	0.44	0.18	0.03	0.00	0.00	0.00	0.00	0.00
Putnam	0.03	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Santa Rosa	0.05	0.23	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Sarasota	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Seminole	2.1	3.67	0.03	0.03	0.03	0.03	0.03	0.97	0.97	0.97	0.97	0.97	0.00	0.00	0.00	0.00	0.00
St. Johns	0.33	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
St. Lucie	0.00	0.11	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Sumter	0.00	0.50	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Taylor	0.00	0.29	0.00	0.28	0.56	0.83	1.00	1.00	0.72	0.44	0.17	0.00	0.00	0.00	0.00	0.00	0.00
Volusia	2.7	1.85	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Wakulla	0.00	0.04	0.00	0.28	0.56	0.83	1.00	1.00	0.72	0.44	0.17	0.00	0.00	0.00	0.00	0.00	0.00
Walton	0.01	0.05	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Washington	0.53	0.01	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Statewide	**86.42**	**137.87**															

* Based on Appendix D – Utilization in DEP (2000).
** Based on Appendix D – Utilization in DEP (2019b).
*** Calhoun, Clay, Dixie, Gilchrist, Glades, Gulf, Hendry, Holmes, Lafayette, Levy, Liberty, Madison, Okeechobee, Suwannee, and Union counties were not found in 2018 DEP inventory. For them, an equal split among the categories is assumed for all years.

EDR and BEBR county-level demographic information: EDR annually provides to the Executive Office of the Governor population estimates of local governmental units as of April 1. The latest population forecast (the medium projections) and the historical population estimates are used in this edition.

Woods and Poole Economics county-level database: The Woods & Poole Economics, Inc. database contains economic and demographic variables for every county in the United States for every year from 1970 to 2050. The data are updated annually in May, and the data for Florida counties was acquired in May 2019. The complete dataset includes historical data and forecast on the annual basis for the following: population by age, sex, and race; employment and earnings by major industry; personal income by source of income; retail sales by kind of business; and data on the number of households, their size, and their income. The projection for each county in the United States is made simultaneously so that changes in one county influence growth or decline in other counties. Much of the historical economic data in the Woods & Poole regional databases are obtained from the Bureau of Economic Analysis (BEA) of the Department of Commerce. Other sources of data include 1970, 1980, 1990, 2000, and 2010 Censuses and post-Censal reports for population and household data, and the Census of Retail Trade for retail sales data.

County monthly weather information from NOAA: EDR uses "Climate at a Glance: County Time Series" published by NOAA's National Centers for Environmental Information.[451] Monthly average and maximum temperature, as well as total precipitation, were downloaded for the period 2000-2016. Then 2000, 2005, 2010, and 2015 were selected to match USGS data. The monthly data were used to produce average annual temperature, yearly maximum temperature, and total precipitation. Since the weather in certain months may have a higher impact on water use, weather information was also summarized for March – May, and June – August.

Residential water bill information. Comparative rate statistics information from Florida Public Service Commission (2019) was used, supplemented with the water rate surveys by Raftelis Financial Consulting, Inc. (2012, 2014, 2016, 2018). The Florida Public Service Commission (PSC) assembles residential water and wastewater rate information for regulated utilities, and PSC's reports for 2006-2018 are available on-line (Florida Public Service Commission 2019). Water bill information for the usage of 10,000 gallons per month was acquired for 2015, 2010, and 2006. The number of utilities regulated by PSC varies among counties and years. For 2015, PSC data had at least one utility in 37 Florida counties. These rates were converted to $2019 using the BLS Consumer Price Index,[452] and averaged for each county.[453] For an additional 21 counties, the water rates were estimated from Raftelis Financial Consulting, Inc. (2014, 2016).[454] Finally, for the remaining nine counties, the average residential water bill for 10,000 gallons per month was estimated from the values for the neighboring counties. Next, for 2010, a similar approach was used to calculate the county average residential rate for 10,000 gallons per month, combining 2010 data from Florida Public Service Commission and Raftelis Financial Consulting, Inc, and indexing the data to $2019.

To estimate the county average residential water bill in 2005, first, simple average county rates for 2006 were calculated from the PSC, resulting in estimates for 33 counties. The grand average for the whole state was also estimated and indexed to $2019. This grand average was compared with the grand average for 2010, indicating a 40 percent increase in the average statewide price between

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[451] retrieved on June 26, 2019, from https://www.ncdc.noaa.gov/cag/county/time-series/FL-133/tavg/all/5/1985-2016?base_prd=true&firstbaseyear=1901&lastbaseyear=2000

[452] BLS Series Id: CUUR0000AA0.

[453] The simple average of the rates was estimated. Weighted average would have been more appropriate. Also, it is essential to note that the number of utilities regulated by PSC and included in the survey varies from county to county and from year to year, influencing the average values of the counties.

[454] Raftelis Financial Consulting, Inc. reports a residential water bill level for 8,000 gallons per month. These rates for 2014 and 2016 were indexed to $2019 and then averaged for each county (using a simple average). Then, to estimate the average residential water bill for 10,000 gallons per month, the county average was multiplied by 1.25. Note that this approach over-estimates the water bill since it does not differentiate between the fixed and variable fees.

2006 and 2010, after accounting for the inflation. This average rate of price increase was applied to the 2010 average rates for the 34 counties for which 2006 rates were not available. It was also estimated that the real water bill increased by almost 9 percent per year in 2006-2010. Given this rate of increase, the average county bills for 2005 and 2000 can be back-forecasted from the bills in 2006.

EDR recognizes limitations in the approach used to calculate the average residential bills and will focus on improving this approach in the next editions of the report.

A.4 Forecast for the Public Supply and Domestic Self-Supplied Use Categories

A statistical model for the per capita use in public supply and domestic self-supplied categories was estimated using Arellano and Bond estimator for dynamic panel analysis. The model was estimated employing *xtabond* procedure with *twostep vce(robust)* option in Stata 13.1. The variables and their values for historical period are described in Table A.4.1. Log-log model specification was applied for the model (Fig. A.4.1.) This model was then utilized to forecast the future values of the per capita water use, based on the future values of the explanatory variables (Table A.4.2.)

Table A.4.1 Variables Use in the Public Supply and Domestic Self-Supplied Water Use Model – Historical Values for 2000, 2005, 2010, and 2015

Variable	Notation	Description	Expected effect on the dependent variable	N	Mean	St.D.	Min	Max
Dependent variable: County average per-capita water use in public supply and domestic self-supplied (gallon per day)	**PSandDSSpercap**	Estimated as the sum of USGS water use data and the offset provided by reclaimed water (based on DEP reuse inventory). This sum is divided by the county population as reported by the EDR / BEBR.	NA	268	139.37	41.91	62.81	363.75
Time trend	t2	Years of 2000, 2005, 2010, and 2015, counted from 1 to 4	Negative, due to water conservation	268	2.50	1.12	1.00	4.00
Retail sales and food services sales per capita (millions $2012) per capita per year	RetailSalePerCap	Based on Woods and Poole (2019) County-level "Total Retail and Food Service Sales" divided by "Total Population"	Positive, capturing tourism activity	268	12.06	4.97	1.17	26.49
Gross Domestic Product (GDP) per person (in million current dollars per person per year)	GDPperPerson	Woods and Poole (2019) county-level "Gross Regional Product TT092" divided by the county population as reported by the EDR / BEBR	Positive, capturing income effects	268	0.03	0.01	0.01	0.07
County average residential water bill for 10,000 gallon per month ($2018/month)	ResWaterBill10K	Estimated based on Public Service Commission's and Raftelis Consulting, Inc. data	Negative, with higher bill encouraging to conserve water	268	41.66	20.55	10.88	137.06
County average temperature in March-May (°F)	AvTempMM	Monthly temperature averaged to the three-month period, based on NOAA	Positive, with higher water use with warmer temperature	268	70.05	3.38	63.83	77.87
County average temperature in June-August (°F)	AvTempJA	Monthly temperature averaged to the three-month period, based on NOAA	Positive, with higher water use with warmer temperature	268	82.22	0.90	80.47	84.63
County total precipitation in March-May (inches)	PrecipMM	Monthly precipitation summed over the three-month period, based on NOAA	Negative, with lower water use given higher precipitation	268	10.48	4.67	1.42	26.52
County total precipitation in June-May (inches)	PrecipJA	Monthly precipitation summed over the three-month period, based on NOAA	Negative, with lower water use given higher precipitation	268	20.78	5.16	10.85	34.13

[See figure and table on following pages]

Figure A.4.1 Public Supply and Domestic Self-Supplied Per Capita Analysis: Output from Stata 13.1

```
. xtabond logPSandDSSpercap logt2 logAvTempMM logAvTempJA logPrecipMM logPrecipJA logResWaterBill10K logGDPperPerson logRetail
> salesandfoodservicess if year<=2015 ,  vce(robust)

Arellano-Bond dynamic panel-data estimation  Number of obs         =       134
Group variable: fiptstbl1                    Number of groups      =        67
Time variable: t2
                                             Obs per group:    min =         2
                                                               avg =         2
                                                               max =         2

Number of instruments =     12               Wald chi2(9)          =     73.02
                                             Prob > chi2           =    0.0000
One-step results
                                 (Std. Err. adjusted for clustering on fiptstbl1)
-------------------------------------------------------------------------------------------------
                                |               Robust
              logPSandDSSpercap |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
--------------------------------+----------------------------------------------------------------
              logPSandDSSpercap |
                            L1. |   .4325112   .3368424     1.28   0.199    -.2276878     1.09271
                                |
                          logt2 |  -.2359209   .1431825    -1.65   0.099    -.5165534    .0447117
                    logAvTempMM |   1.239934   .7921582     1.57   0.118    -.3126675    2.792535
                    logAvTempJA |   2.754933   1.314723     2.10   0.036     .1781231    5.331742
                    logPrecipMM |   .0401127   .0457709     0.88   0.381    -.0495967    .1298221
                    logPrecipJA |  -.0535636    .050506    -1.06   0.289    -.1525536    .0454263
             logResWaterBill10K |  -.0227318   .0598583    -0.38   0.704    -.1400519    .0945883
                logGDPperPerson |   .2984225   .1570349     1.90   0.057    -.0093601    .6062052
logRetailsalesandfoodservicess  |    .225214   .1163801     1.94   0.053    -.0028869    .4533149
                          _cons |  -13.75669   7.497174    -1.83   0.067    -28.45088    .9374959
-------------------------------------------------------------------------------------------------
Instruments for differenced equation
        GMM-type: L(2/.).logPSandDSSpercap
        Standard: D.logt2 D.logAvTempMM D.logAvTempJA D.logPrecipMM D.logPrecipJA
                  D.logResWaterBill10K D.logGDPperPerson D.logRetailsalesandfoodservicess
Instruments for level equation
        Standard: _cons

. estat abond

Arellano-Bond test for zero autocorrelation in first-differenced errors
  +-----------------------+
  |Order |  z      Prob > z|
  |------+-----------------|
  |   1  |-.65117  0.5149 |
  |   2  |      .       .  |
  +-----------------------+
   H0: no autocorrelation
```

Table A.4.2 Supply and Domestic Self-Supplied Water Use Model – Summary of the Values Used in the Forecast

Variable	Notation	Description	N	Mean	St.D.	Min	Max
Dependent variable: County average per-capita water use in public supply and domestic self-supplied (gallon per day)	**PSandDSSpercap**	To be forecasted					
Time trend	t2	Years of 2020, 2025, 2030, and 2035, counted from 5 to 8	268	6.50	1.12	5.00	8.00
Retail sales and food services sales per capita (millions $2012) per capita per year	RetailSalePerCap	Based on Woods and Poole (2019) County-level "Total Retail and Food Service Sales" divided by "Total Population"	268	13.84	5.79	1.33	30.93
Gross Domestic Product (GDP) per person (in million current dollars per person per year)	GDPperPerson	Based on Woods and Poole (2019) county-level "Gross Regional Product TT092" divided by the county population as reported by the EDR / BEBR	268	0.03	0.02	0.01	0.08
County average residential water bill for 10,000 gallon per month ($2018/month)	ResWaterBill10K	Assumed to stay at the 2015 level for each county	268	52.66	20.83	17.27	114.30
County average temperature in March-May (ºF)	AvTempMM	For each county, assumed to be the same as the county average for 2000, 2005, 2010, and 2015	268	70.05	2.41	66.73	75.05
County average temperature in June-August (ºF)	AvTempJA	For each county, assumed to be the same as the county average for 2000, 2005, 2010, and 2015	268	82.22	0.49	81.58	83.82
County total precipitation in March-May (inches)	PrecipMM	For each county, assumed to be the same as the county average for 2000, 2005, 2010, and 2015	268	10.48	1.79	7.37	15.94
County total precipitation in June-May (inches)	PrecipJA	For each county, assumed to be the same as the county average for 2000, 2005, 2010, and 2015	268	20.78	3.26	15.10	26.54

A.5 Analysis of the Recreational Landscape Irrigation Water Use

The model was estimated using fixed effect panel data regression implemented in *xtreg* procedure with *vce(robust)* option in Stata 13.1.[455] The dependent variable was the county-level recreational-landscape irrigation water use (combining reported water withdrawals and estimated water offset provided by water reuse). The historical values of the dependent and independent variables used in the model are summarized in Table A.5.1.

Table A.5.1 Variables Used in the Recreational Landscape Irrigation (REC) Water Use Model (historical values)

Variable	Notation	Description	Expected effect on the dependent variable	N	Mean	Std Dev	Minimum	Maximum
Dependent variable: county-level recreational-landscape irrigation (including water withdrawals and water offset by water reuse)	**TotRLI**	**Dependent variable:** recreational-landscape irrigation, calculated as a sum of recreational landscape water withdrawals (reported by USGS) and offset provided by reclaimed water use in golf course irrigation (based on DEP 2019b)	NA	268	7.02	13.19	0.00	98.11
Total population age 65 and over	TotalPopulationAge65OverT	Based on Woods and Poole data series (in thousands of persons)	Positive: greater demand for golf courses and other amenities from people older than 65 years old.	268	48.50	70.91	0.71	414.56
The earnings in mining, farm, forestry, fishing and related activities, as a share in the total earning of employees	FarmForestMiningEarningShare	Based on Woods and Poole data, calculated as a sum of "Farm Earnings", "Forestry, Fishing, Related Activities & Other", and "Mining Earnings", divided by "Total Earnings of Employees"	Negative: high share of the earnings indicating rural areas with lower demand for golf courses and other recreational landscape amenities.	268	0.06	0.09	0.00	0.49
Wealth level	WoodsPooleWealthIndexTT09	Based on Woods and Poole data series "Woods & Poole Wealth Index"[456]	Positive: greater demand for golf courses and other amenities in counties with higher wealth levels.	268	84.64	26.92	45.73	180.93
Total annual precipitation	SumPrecipAnn	Based on total county precipitation in NOAA (inches)	Negative: more precipitation linked with lower water use	268	49.92	8.61	28.71	71.84

[See figure and table on following pages]

[455] Note that Arellano and Bond estimator for dynamic panel analysis would be more appropriate, given that just 4 observations for each county are available. However, various specifications examined for *xtabond* procedure with *twostep vce(robust)* option showed no statistical significance of the lagged dependent variable, and the resulting forecast contradicted the EDR's expectations.

[456] "The Woods & Poole Wealth Index is a measure of relative total personal income per capita weighted by the source of income. The Wealth Index is the weighted average of regional income per capita divided by U.S. income per capita (80 percent of the index); plus the regional proportion of income from dividends/interest/rent divided by the U.S. proportion (10 percent of the index); plus the U.S. proportion of income from transfers divided by the regional proportion (10 percent of the index). Thus, relative income per capita is weighted positively for a relatively high proportion of income from dividends, interest, and rent, and negatively for a relatively high proportion of income from transfer payments. Because the imputed rent of owner-occupied homes is added to rental income of persons in calculating total personal income, some of the appreciated value of owner-occupied homes is included in rental income. Since dividends, interest, and rent income are a good indicator of assets, the Woods & Poole Wealth Index attempts to measure relative wealth." (p. 38, Woods and Poole Economics, 2019).

Figure A.5.1 Recreational-Landscape Irrigation Model: Output from Stata 13.1

```
. . xtreg TotRLI  SumPrecipAnn TotalPopulationAge65OverT FarmForestMiningEarningshare WoodsPooleWealthIndexTT09 if year<=2015
> , fe vce(robust)

Fixed-effects (within) regression               Number of obs      =       268
Group variable: fipstb1                         Number of groups   =        67

R-sq:  within  = 0.1244                         Obs per group: min =         4
       between = 0.6116                                        avg =       4.0
       overall = 0.5844                                        max =         4

                                                F(4,66)            =      2.55
corr(u_i, Xb)  = 0.2526                         Prob > F           =    0.0469

                                (Std. Err. adjusted for 67 clusters in fipstbl)
------------------------------------------------------------------------------
                             |               Robust
                      TotRLI |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-----------------------------+------------------------------------------------------------------
                SumPrecipAnn |  -.0962256   .0310572    -3.10   0.003    -.1582333   -.0342178
   TotalPopulationAge65OverT |   .0891729   .0479535     1.86   0.067    -.0065694    .1849151
FarmForestMiningEarningshare |  -8.918802   4.011294    -2.22   0.030    -16.92761   -.9099938
   WoodsPooleWealthIndexTT09 |   .0872277   .0396314     2.20   0.031      .008101    .1663544
                       _cons |   .6623637   3.810675     0.17   0.863    -6.945895    8.270622
-----------------------------+------------------------------------------------------------------
                     sigma_u |  8.3098474
                     sigma_e |   3.365189
                         rho |   .8591096   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

```
. predict TotRLI_u, u
(268 missing values generated)

. estimate store TotRLI

. by fipstb1, sort: egen TotRLI_u2 = mean(TotRLI_u)

. forecast create TotRLI_model, replace
  (Forecast model TotRLImodel ended.)
  Forecast model TotRLI_model started.

. forecast estimates TotRLI, name(TotRLIforecast)
  Added estimation results from xtreg.
  Forecast model TotRLI_model now contains 1 endogenous variable.

. forecast adjust TotRLIforecast =  TotRLIforecast + TotRLI_u2
  Endogenous variable TotRLIforecast now has 1 adjustment.

. forecast solve, begin(5)
```

Table A.5.2 Summary of the Independent Variable Values Used to Develop Recreational-Landscape Irrigation Forecast

Variable	Notation	Description	N	Mean	Std Dev	Minimum	Maximum
Total population age 65 and over	TotalPopulationAge65OverT	Based on Woods and Poole data series (in thousands of persons)	268	87.89	124.57	1.32	740.52
The earnings in mining, farm, forestry, fishing and related activities, as a share in the total earning of employees	FarmForestMiningEarningShare	Based on Woods and Poole data, calculated as a sum of "Farm Earnings", "Forestry, Fishing, Related Activities & Other", and "Mining Earnings", divided by "Total Earnings of Employees"	268	0.05	0.08	0.00	0.43
Wealth level	WoodsPooleWealthIndexTT09	Based on Woods and Poole data series "Woods & Poole Wealth Index"	268	82.25	29.67	42.95	182.68
Total annual precipitation	SumPrecipAnn	For each county, assumed to be the same as the county average for 2000, 2005, 2010, and 2015	268	49.92	3.38	43.16	59.10

A.6 Forecast for the Combined Category of Commercial-Industrial-Institutional-Mining and Power Generation (CIIM and PG) Self-Supplied

The model was estimated using Arellano and Bond estimator for dynamic panel analysis implemented in *xtabond* procedure with *twostep vce(robust)* option in Stata 13.1. The dependent and independent variables are described in Table A.6.1. Based on the analysis, the county water use in this combined water use category increases with mining employment, and decreases with the wealth level and residential water bill. Manufacturing earning had a positive effect but was not statistically significant at α=0.10.

Table A.6.1 Variables Use in the Combined CIIM and PG Self-Supplied Model, with the Summary Statistics for Their Historical Values

Variable	Notation	Description	Expected effect on the dependent variable	N	Mean	Std Dev	Minimum	Maximum
Dependent variable: county-level commercial-industrial-mining water withdrawals (USGS), water withdrawals for recirculating cooling in thermoelectric power	**CIIMPG**	**Dependent variable:** county-level commercial-industrial-institutional-mining water withdrawals (USGS), water withdrawals for recirculating cooling in thermoelectric power generation (USGS) and estimated reclaimed water offset (based on DEP 2019b)	NA	268	9.01	15.57	0.00	85.73
Mining Employment	MiningEmploymentTT03	Woods and Poole data[457]	Positive: increase water use with increase in mining employment	268	0.28	0.43	0.00	2.97
Manufacturing Earning	ManufacturingEarningsTT062	Woods and Poole data[458]	Positive: increase water use with increase in the earning	268	383.72	696.36	0.78	3,114.75
Proportion of Utilities Employment	PropUtilEmp	Estimated as a ratio of Woods and Poole data series "Utilities Employment"[459] to "Total Employment"	Positive: increase in the share of the total county employment engaged in utilities is expected to increase water use	268	0.005	0.005	0.00	0.036
Wealth level	WoodsPooleWealthIndexTT09	Woods and Poole data series "Woods & Poole Wealth Index"[460]	Undetermined	268	84.64	26.92	45.73	180.93
County average residential water bill for 10,000 gallon per month ($2018/month)	ResWaterBill10K	Estimated based on Public Service Commission's and Raftelis Consulting, Inc. data	Undetermined	268	41.66	20.55	10.88	137.06

457 According to Woods and Poole, "***Mining*** includes establishments that extract naturally occurring mineral solids (*e.g.,* coal and ores), liquid minerals (*e.g.,* crude petroleum), and gases (*e.g.,* natural gas.) Mining includes quarrying, well operations, beneficiating (*e.g.,* crushing, screening, washing, and flotation), and other preparation customarily performed at the mine site, or as a part of mining activity." (p. 25, Woods and Poole Economics, 2019).

458 According to Woods and Poole, "***Manufacturing*** includes establishments engaged in the mechanical, physical, or chemical transformation of materials, substances, or components into new products. The assembling of component parts of manufactured products is considered manufacturing, except in cases where the component parts are associated with structures. Manufacturing establishments can be plants, factories, or mills as well as bakeries, candy stores, and custom tailors." (p. 26, Woods and Poole Economics, 2019).

459 According to Woods and Poole, "***Utilities*** includes establishments engaged in the provision of electric power, natural gas, steam supply, water supply, and sewage removal. … excluded from this sector are federal or state or local government operated establishments." (p. 25, Woods and Poole Economics, 2019).

460 "The Woods & Poole Wealth Index is a measure of relative total personal income per capita weighted by the source of income. The Wealth Index is the weighted average of regional income per capita divided by U.S. income per capita (80 percent of the index); plus the regional proportion of income from dividends/interest/rent divided by the U.S. proportion (10 percent of the index); plus the U.S. proportion of income from transfers divided by the regional proportion (10 percent of the index). Thus, relative income per capita is weighted positively for a relatively high proportion of income from dividends, interest, and rent, and negatively for a relatively high proportion of income from transfer payments. Because the imputed rent of owner-occupied homes is added to rental income of persons in calculating total personal income, some of the appreciated value of owner-occupied homes is included in rental income. Since dividends, interest, and rent income are a good indicator of assets, the Woods & Poole Wealth Index attempts to measure relative wealth." (p. 38, Woods and Poole Economics, 2019).

Figure A.6.1 CIIM and PG Analysis: Output from Stata 13.1

```
. xtabond CIIMPG MiningEmploymentTT03 ManufacturingEarningsTT062 WoodsPooleWealthIndexTT09 ResWaterBill10K prUtilitiesEmployme
> nt if t2<=4 , twostep vce(robust)

Arellano-Bond dynamic panel-data estimation  Number of obs         =       134
Group variable: fipstbl                      Number of groups      =        67
Time variable: t2
                                             Obs per group:    min =         2
                                                               avg =         2
                                                               max =         2

Number of instruments =      9               Wald chi2(6)          =     14.36
                                             Prob > chi2           =    0.0259
Two-step results
                                              (Std. Err. adjusted for clustering on fipstbl)
------------------------------------------------------------------------------------------
                           |              WC-Robust
                    CIIMPG |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
---------------------------+--------------------------------------------------------------
                    CIIMPG |
                       L1. |   .4255144   .2380261     1.79   0.074    -.0410081     .892037
                           |
      MiningEmploymentTT03 |   4.647037   2.136196     2.18   0.030     .4601688    8.833904
ManufacturingEarningsTT062 |   .0064513   .0046545     1.39   0.166    -.0026714    .0155739
 WoodsPooleWealthIndexTT09 |  -.1142639   .0575828    -1.98   0.047    -.2271242   -.0014036
           ResWaterBill10K |  -.0306423   .0142099    -2.16   0.031    -.0584932   -.0027914
     prUtilitiesEmployment |   373.3553   133.1583     2.80   0.005     112.3699    634.3407
                     _cons |   8.812243   5.157557     1.71   0.088    -1.296384    18.92087
------------------------------------------------------------------------------------------
Instruments for differenced equation
        GMM-type: L(2/.).CIIMPG
        Standard: D.MiningEmploymentTT03 D.ManufacturingEarningsTT062
                  D.WoodsPooleWealthIndexTT09 D.ResWaterBill10K D.prUtilitiesEmployment
Instruments for level equation
        Standard: _cons

. estat abond

Arellano-Bond test for zero autocorrelation in first-differenced errors
  +-----------------------+
  |Order |  z     Prob > z|
  |------+----------------|
  |   1  |-.907   0.3644  |
  |   2  |   .         .  |
  +-----------------------+
   H0: no autocorrelation
```

Table A.6.2 Summary of the Variable Values Use to forecast the Water Use in the Combined Category of Commercial-Industrial-Institutional-Mining and Power Generation Self-Supplied

Variable	Notation	Description	N	Mean	Std Dev	Minimum	Maximum
Mining Employment	MiningEmploymentTT03	Woods and Poole data	268	0.53	0.72	0.01	3.60
Manufacturing Earning	ManufacturingEarningsTT062	Woods and Poole data	268	427.57	751.77	0.90	3,013.43
Proportion of Utilities Employment	PropUtilEmp	Estimated as a ratio of Woods and Poole data series “Utilities Employment” to “Total Employment”	268	0.005	0.004	0.00	0.019
Wealth level	WoodsPooleWealthIndexTT09	Based on Woods and Poole data series “Woods & Poole Wealth Index”	268	82.25	29.67	42.95	182.68
County average residential water bill for 10,000 gallon per month ($2018/month)	ResWaterBill10K	Assumed to stay at the 2015 level for each county	268	52.66	20.83	17.27	114.30

A.7 Agricultural Self-Supplied Water Use Category: Comparison between WMDs' and FSAID Projections, By Supply Planning Regions

Figure A.7.1 Comparison of Agricultural Water Use Projections for NWFWMD's water supply planning regions

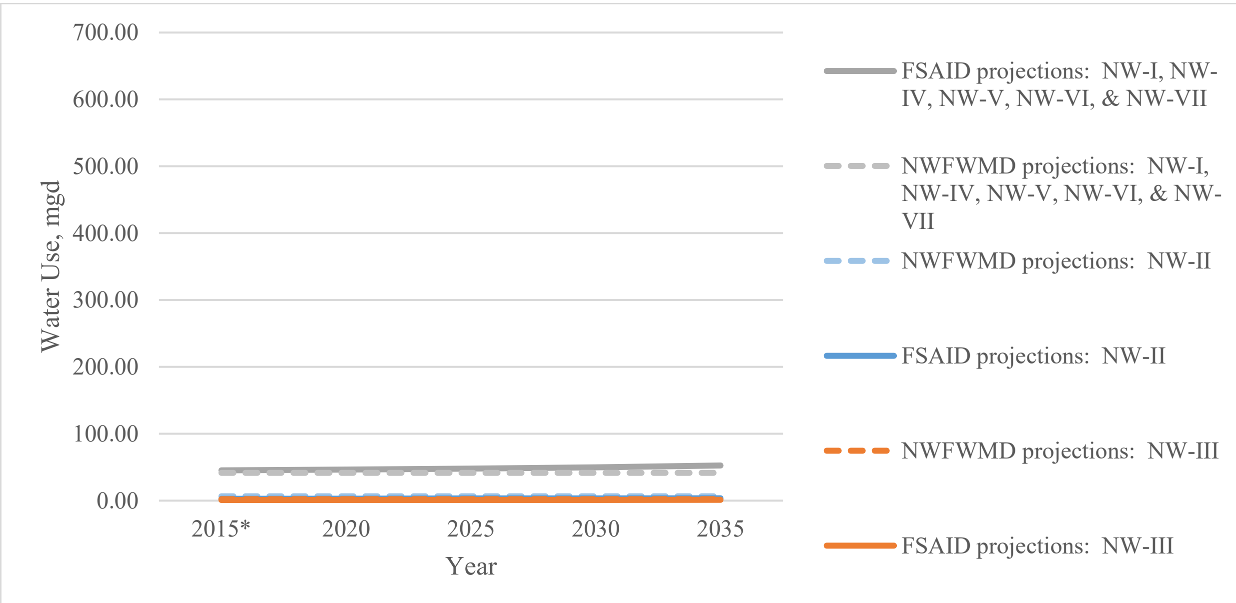


Figure A.7.2 Comparison of Agricultural Water Use Projections for SRWMD – outside NFRWSP

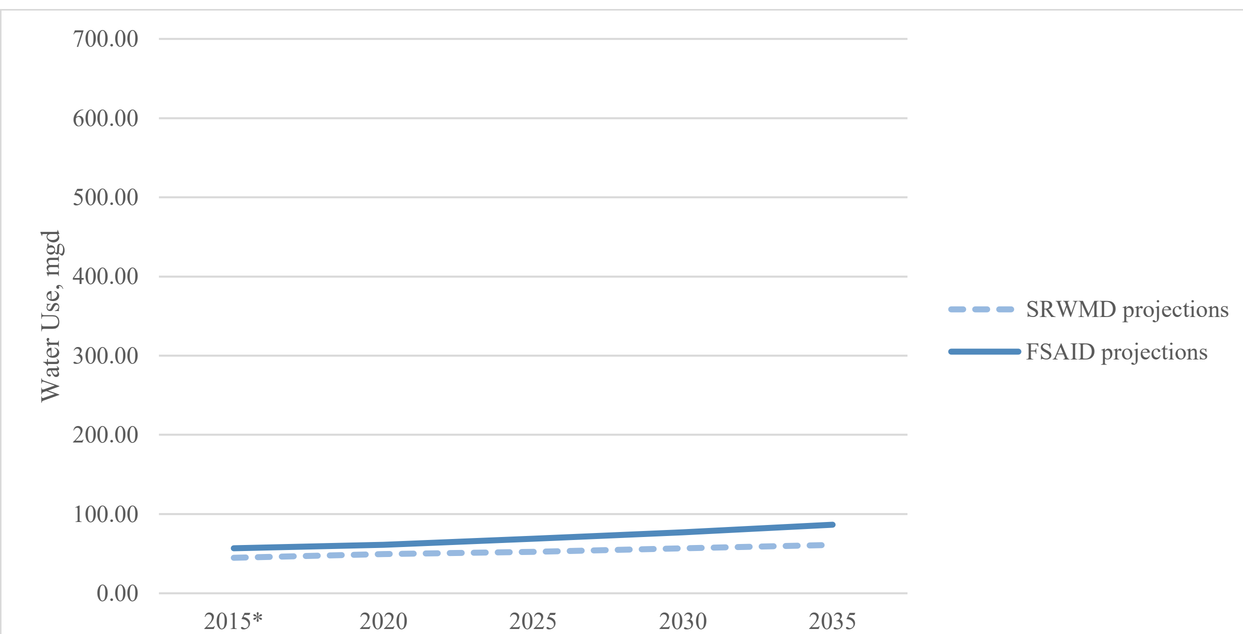


Figure A.7.3 Comparison of Agricultural Water Use Projections for SJRWMD–CSEC

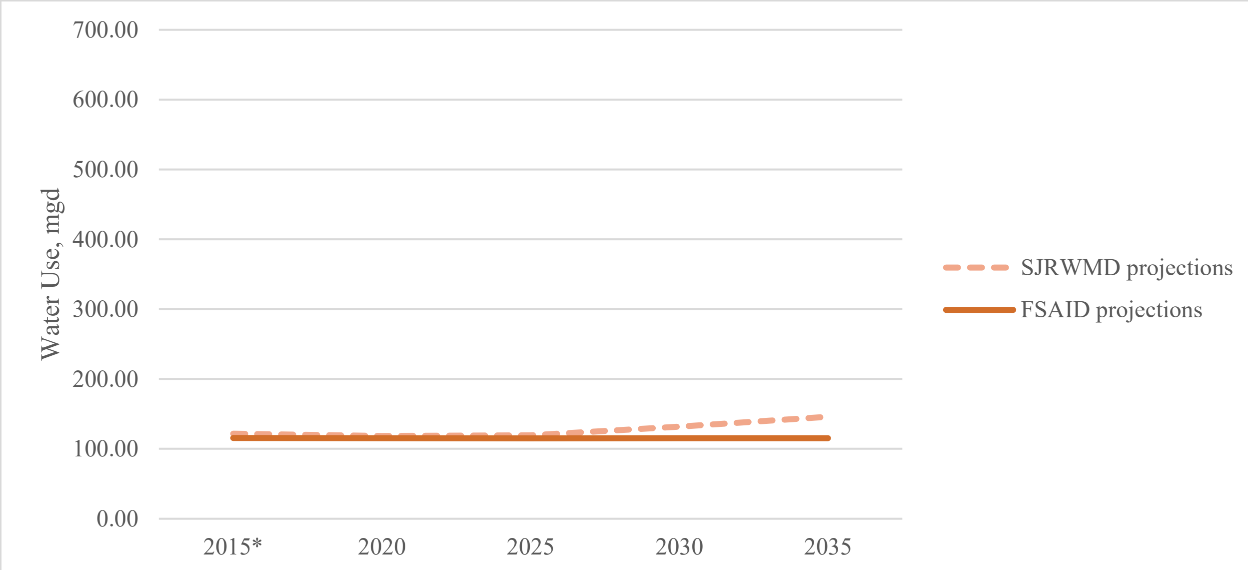


Figure A.7.4 Comparison of Agricultural Water Use Projections for SWFWMD

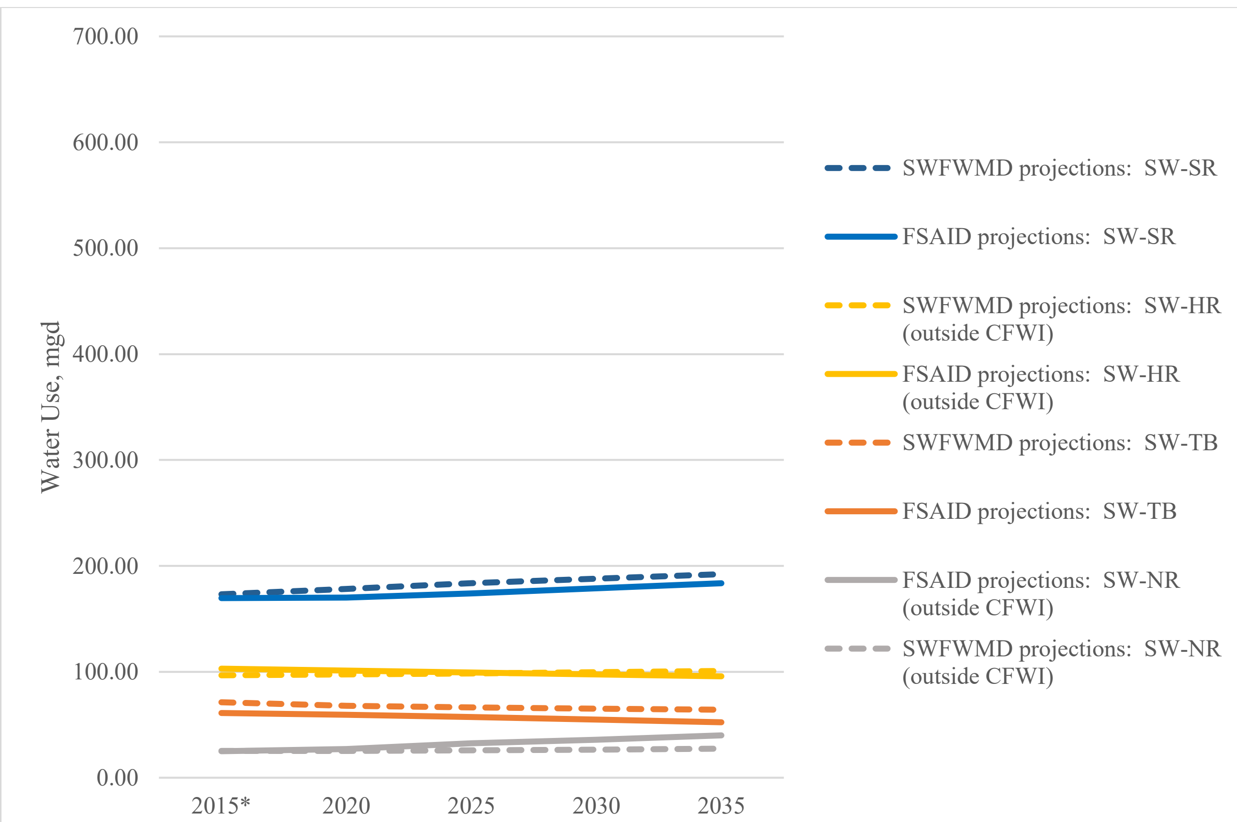


Figure A.7.5 Comparison of Agricultural Water Use Projections for SFWMD

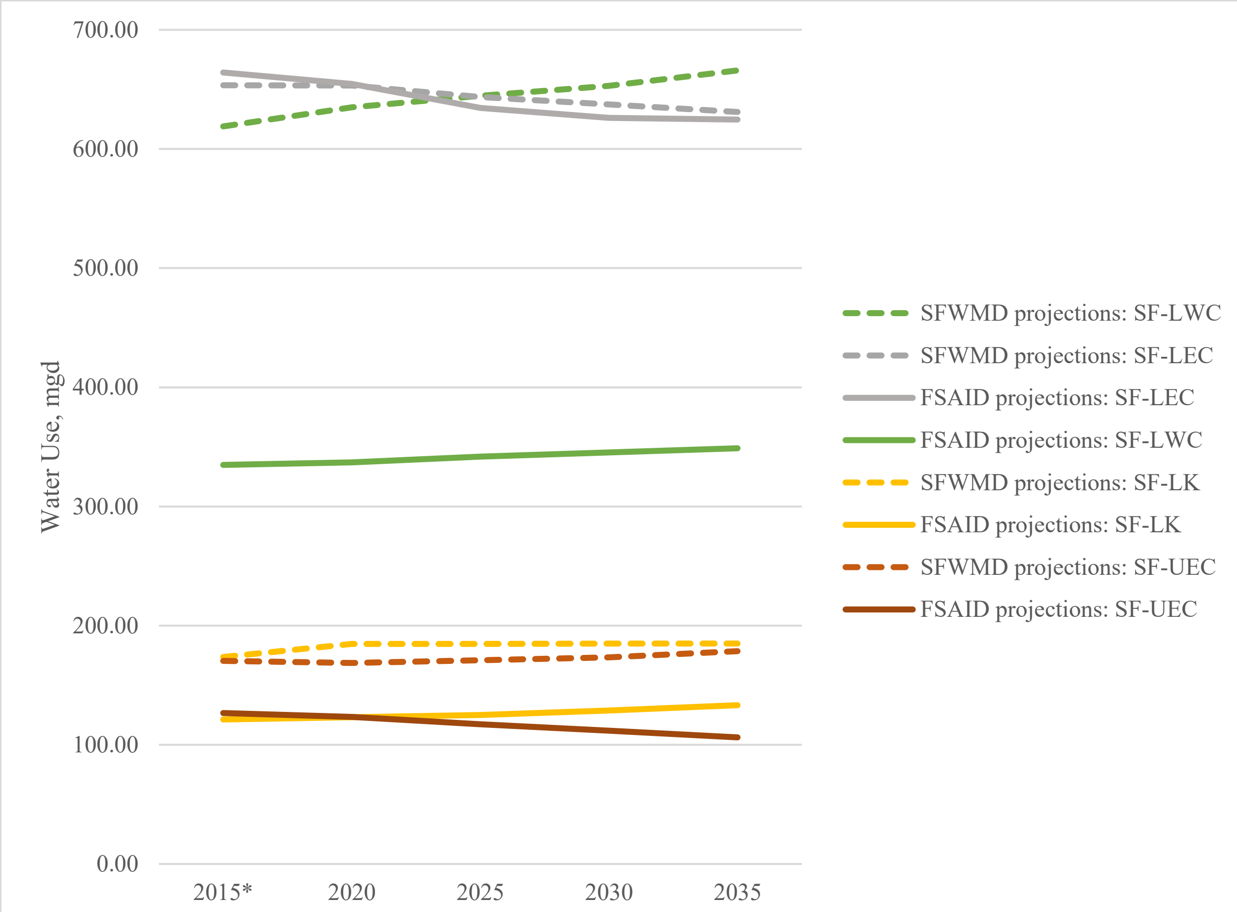


Figure A.7.6 Comparison of Agricultural Water Use Projections for NWFWMD

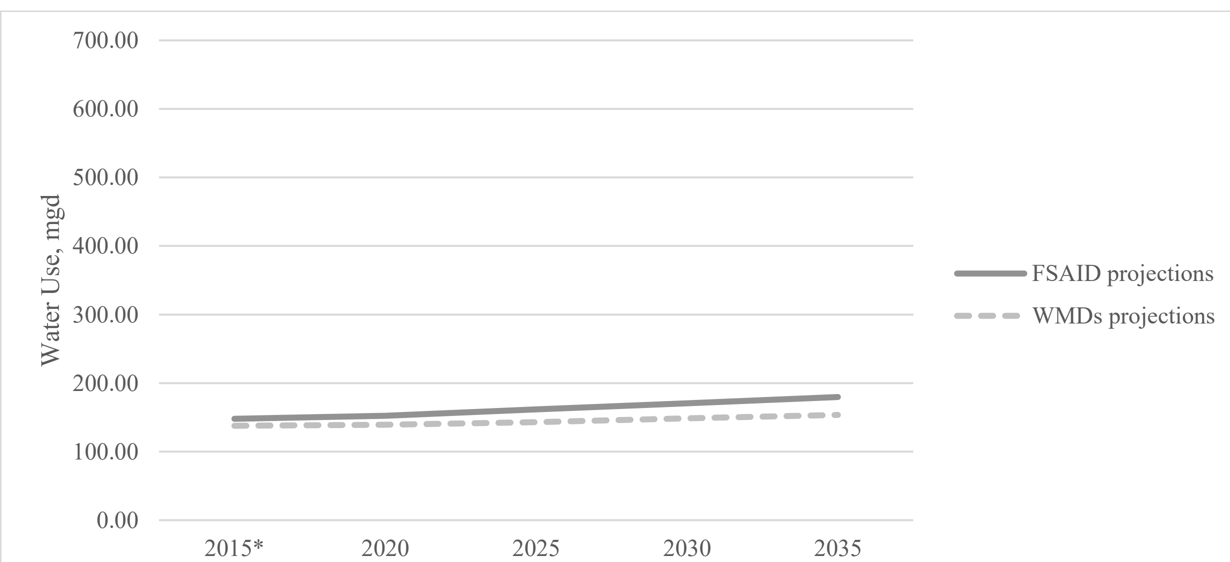
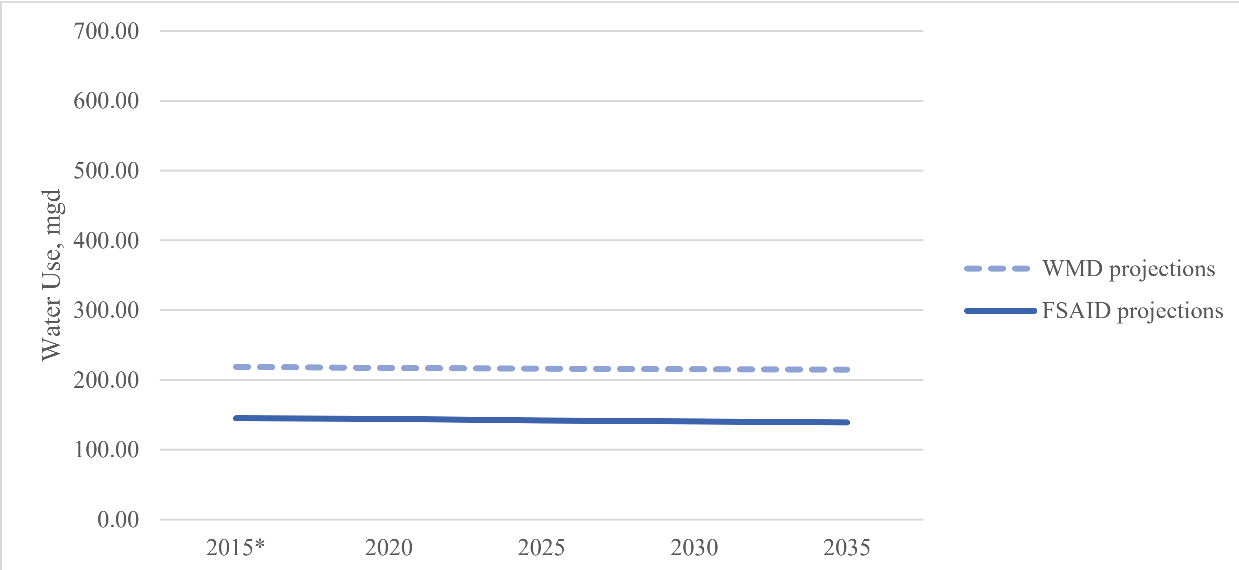


Figure A.7.7 Comparison of Agricultural Water Use Projections for CFWI



A.8 Accounting for inflation in "Project Total ($)" and integration of project phases

To account for the inflation and convert all "project total ($)" estimates to 2019 dollars, the consumer price index[461] was used. For each project item, EDR estimated the year for which "project total ($)" was developed. To do that, EDR categorized the project items by "Project Status" information. For "Complete" items, the "Construction Completion Year" was used to index "project total ($)" for inflation.[462] For "Design" and "Construction/Underway" items, "project total ($)" were assumed to be current as of 2019.[463] For "On-Hold" items, "Most recent fiscal year funded" or "RWSP or RPS Year Project Last Identified" was used.[464] For "RWSP or RPS Options Only" items, EDR relied on "RWSP or RPS Year Project Last Identified".[465] There were a few projects listed as "Canceled", and these were not indexed for inflation since these were disregarded from the analysis.

Next, EDR examined whether a project item on the list was a phase of a larger project. For example, the project appendix may list the stages of constructing water treatment, storage, and water distribution infrastructure as separate project items. Out of 1,623 project items, 349 included information in the column "Phased or Linked Project." Approximately 75 percent of these were from SFWMD (263 items), and for those, the "Comments" column explained whether the project items were standalone projects. For many of them, the "Comments" column also explained whether "project total ($)" and water flow or reuse flow should be aggregated among the items or whether specific project items should be disregarded because their costs and water or reuse flow are already considered in the other phases of the project. These comments were used to aggregate various items into larger projects when appropriate. Finally, if "project total ($)" for all items of a project was accounted for in only one of the items, EDR assumed the "project total ($)" was last revised when the last item was completed.[466]

Out of 349 project items identified as linked phases in the "Phased or Linked Project" column, nearly one-fourth (or 86 items) were from SRWMD or SWFWMD. Based on consultations with

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461 Like in the other parts of the 2020 Edition, BLS Series Id: CUUR0000AA0 is used.

462 For nine completed projects from NWFWMD, construction completion year was not reported (i.e., the projects with FDEP Unique ID values equal to NFWS00007A, NFWS00013A, NFWS00018A, NFWS00020A, NFWS00022A, NFWS00041A, NFWS00043A, NFWS00044A, and NFWS00049A). Three of the project items did not have data for "Project Total" ($), and therefore, no indexing for the inflation was needed. For the other six projects, "Most recent fiscal year funded" was used.

463 For a few projects described as "Design" and "Construction/Underway", construction completion dates in 2012 – 2019 were reported. Since the projects were listed as being designed or constructed, however, we assume that the estimates are current as of 2019.

464 For several "On Hold" projects, "Most Recent Fiscal Year Funded" and "RWSP or RPS Year Project Last Identified" were missing, and EDR assumed the "Project Total ($)" is current as of 2019.

465 For one project item, 2020 was identified as "RWSP or RPS Year Project Last Identified", so EDR assumed the cost estimates were current as of 2019. In addition, based on an e-mail discussion with SRWMD staff, the items that supported "SR NFRWSP" and "SJR NFRWSP" regions were assumed to be identified in 2016, rather than 2017, the year when RWSP was finalized.

466 For example, the "Phased or Linked Project" column identifies eight project items to belong to one project indexed as LRWTP2008. Construction of the first item was completed in 2006 (i.e., "Pahokee Floridan Aquifer Well (1)", with FDEP Unique ID = SFWS00020A). However, the "Quantity of Water Made Available on Completion (mgd)" and "Project Total" estimates for this item are aggregated with the information for other items, the last of which was completed in 2008 (i.e., "Completion/Startup of WTP", with FDEP Unique ID = SFWS00020G). Therefore, instead of 2006, EDR used 2008 to account for inflation in "project total ($)" estimates. Note that this approach to indexing for inflation can lead to underestimation of "project total ($)", if the "Project Total" estimates reported in the project appendix are assessed at the time when the initial items in the phased or linked projects are completed. This distortion is small, however, given that the inflation over the periods between the completions of the first and last items for most phased or linked projects is low.

the SRWMD, most of the District's phased projects were treated as independent projects. Examples include the projects implemented in various counties through the same agricultural cost-share program or future expansion of the reclaimed water distribution system to different subdivisions. Finally, based on consultations with SWFWMD, approximately one-half of the District's linked project items were assumed to be standalone. These were the items for which complete information regarding "project total ($)," water made available, storage, and distribution infrastructure were provided. For the items with incomplete information, all of the items were assumed to be part of one phased project.

After this review and integration of related project items, 1,417 projects were identified.

A.9 Total Volume of Water and Total Reuse Flow for Projects Other Than Conservation Projects

Table A.9.1 Total Volume of Water and Total Reuse Flow for the Projects Completed in 2015–2019, or Being Designed, Constructed / Underway, or Identified as RWSP or RPS Option Only, by Water Supply Planning Regions (N = 461 Projects)*

Planning Regions	Total Volume of Water and Total Reuse Flow (mgd)*												Inferred Supply Shortage (mgd)**
	Aquifer Storage and Recovery	Brackish Groundwater	Desalination	Groundwater Recharge	Other Non-Traditional Source	Other Project Type	Reclaimed Water (for potable offset)	Stormwater	Surface Water	Surface Water Storage	Combination	**Total**	
NW-II	–	–	–	–	–	0.00	1.00	–	–	–	–	**1.00**	**1.4**
NW-III	–	–	–	–	–	–	–	–	–	–	–	**0.00**	**0**
NW-I, NW-IV, NW-V, NW-VI, & NW-VII	–	–	–	–	–	–	1.45	–	–	–	–	**1.45**	**0**
SJ-CSEC	–	–	–	5.50	16.40	8.15	21.78	4.00	44.50	23.00	–	**123.33**	**28**
SR-outside NFRWSP	–	–	–	–	–	–	–	–	–	–	–	**0.00**	**0**
SW-NR (excluding CFWI)	–	–	15.00	–	–	–	12.94	12.40	60.08	–	–	**100.42**	**27.8**
SW-TB	–	9.00	35.00	2.40	–	–	169.03	12.40	67.85	7.10	–	**302.78**	**0**
SW-HR (excluding CFWI)	–	–	–	–	–	–	2.53	12.40	18.20	–	–	**33.13**	**2.5**
SW-SR	4.00	29.53	40.00	6.00	–	–	27.69	13.40	74.30	–	–	**194.92**	**3.4**
SF-LKB	–	–	–	–	–	–	–	–	–	–	–	**0.00**	**0**
SF-UEC	–	37.53	–	–	–	2.04	22.35	–	122.40***	–	30.00	**214.32**	**3.8**
SF-LEC	9.00	45.50	–	–	–	8.10	53.80	10.00	16.16	13.00	12.45	**168.01**	**49.6**
SF-LWC	9.93	29.00	–	–	–	7.25	71.25	1.00	1.80	151.77	–	**271.99**	**9.3**
CFWI	0.66	105.87	–	–	–	–	112.94	9.50	25.10	17.00	–	**271.07**	**233.6**
NFRWSP	–	3.17	–	65.59	1.37	4.75	48.80	7.20	0.05	–	–	**130.93**	**112.2**
Total	**23.59**	**259.60**	**90.00**	**79.49**	**17.77**	**30.29**	**545.56**	**82.30**	**430.44**	**211.87**	**42.45**	**1,813.35**	**471.6**

* Water conservation projects are excluded from this analysis. For the reclaimed water projects, total volume of reuse flow was estimated (the offset coefficient of 0.55 was not applied). The projects in the sample exclude "Reclaimed Water (for groundwater recharge or natural system restoration)", "Flood Control Works", and "Distribution / Transmission Capacity" projects.

** The mgd demand is based on DEP and WMD projections.

*** This volume is associated with one RWSP or RPS Option Only project – Grove Land Reservoir and Stormwater Treatment Area. While this project is listed as a surface water project and is not linked with any MFL PRS, additional review and discussions with SFWMD staff revealed that the project is intended for environmental restoration.

A.10 Project Size Used in Expenditure Forecast

EDR examined project sizes by project type, water supply planning region, and implementation status. Mean and median volume of reuse flow for "Reclaimed Water (for potable offset)" projects varied significantly among the regions (e.g., median total reuse flow in SF-UEC was 6 mgd but only 0.42 mgd in NFRWSP). EDR selected the median project sizes in each region (see highlighted values in Table A.10.1.) [467] Similarly, for brackish groundwater projects, the median size of the projects differed among the regions, with EDR focusing on the median for each region (Table A.10.2.)[468]

Table A.10.1 Mean and Median Size of "Reclaimed Water (for potable offset)" Projects, by Planning Region and Project Status (with highlighted values indicating EDR assumption about the most common project sizes)

Planning Regions	Project Status	N Obs	Total Reuse Flow (mgd)		Estimated Offset (mgd)**	
			Mean	Median	Mean	Median
CFWI	Complete*	15	5.02	3.00	2.82	1.65
	Construction/Underway	9	0.93	0.30	0.51	0.17
	Design	4	0.88	0.24	0.48	0.13
	RWSP or RPS Option Only	24	1.07	0.55	0.68	0.30
	All Projects	52	**2.17**	**0.60**	**1.25**	**0.33**
NFRWSP	Complete*	21	1.61	1.00	0.88	0.55
	Construction/Underway	10	0.39	0.36	0.21	0.20
	Design	5	0.39	0.36	0.21	0.20
	RWSP or RPS Option Only	7	1.32	0.40	0.72	0.22
	All Projects	43	**1.13**	**0.42**	**0.62**	**0.23**
NWF Region II	Complete*	2	**0.50**	**0.50**	**0.28**	**0.28**
Regions I, IV, V, VI, & VII	Construction/Underway	1	0.85	0.85	0.47	0.47
	Design	1	0.60	0.60	0.33	0.33
	All Projects	2	**0.73**	**0.73**	**0.40**	**0.40**
SF Lower East Coast	Complete*	5	5.16	2.00	2.84	1.10
	RWSP or RPS Option Only	6	4.67	4.00	2.57	2.20
	All Projects	11	**4.89**	**3.10**	**2.69**	**1.71**
SF Lower West Coast	Complete*	2	7.35	7.35	4.04	4.04
	Construction/Underway	2	12.00	12.00	6.60	6.60
	RWSP or RPS Option Only	7	4.65	3.30	2.56	1.82
	All Projects	11	**6.48**	**5.00**	**3.56**	**2.75**
SF Upper East Coast	RWSP or RPS Option Only	4	**5.59**	**6.00**	**3.07**	**3.30**
SJR Central Springs East Coast	Complete*	14	1.13	0.98	0.63	0.54
	Construction/Underway	5	0.90	0.56	0.50	0.31
	Design	5	0.29	0.20	0.16	0.11
	All Projects	24	**0.91**	**0.53**	**0.50**	**0.29**
SWF Heartland (excluding CFWI)	Construction/Underway	2	0.40	0.40	0.22	0.22
	RWSP or RPS Option Only	6	0.29	0.11	0.16	0.06

[467] Procedure *npar1way* implemented in SAS was used; statistical tests produced by this procedure implied the medians could differ among regions and statuses. To simplify the expenditure analysis, the difference among project statuses was disregarded.

[468] Statistical tests produced by *npar1way* procedure implemented in SAS implied the median project size is different among regions and statuses. For CFWI, difference in median sizes among some statuses seemed to be especially drastic, but for other regions, the total number of projects was too small to draw a conclusion. To simplify the analysis, EDR focused on the differences in project sizes among regions only and disregarding the differences among the statuses of project completion.

Planning Regions	Project Status	N Obs	Total Reuse Flow (mgd)		Estimated Offset (mgd)**	
			Mean	Median	Mean	Median
	All Projects	8	**0.32**	**0.25**	**0.17**	**0.14**
SWF Northern (excluding CFWI)	Complete*	1	0.60	0.60	0.33	0.33
	Construction/Underway	1	1.70	1.70	0.94	0.94
	Design	3	0.98	0.50	0.54	0.28
	RWSP or RPS Option Only	14	0.55	0.30	0.30	0.16
	All Projects	19	**0.68**	**0.44**	**0.37**	**0.24**
SWF Southern	Complete*	1	0.00	0.00	0.00	0.00
	Construction/Underway	4	0.96	0.68	0.53	0.37
	Design	1	0.10	0.10	0.06	0.06
	RWSP or RPS Option Only	15	1.58	1.00	0.94	0.55
	All Projects	21	**1.32**	**1.00**	**0.77**	**0.55**
SWF Tampa Bay	Complete*	10	0.14	0.09	0.08	0.05
	Construction/Underway	6	0.59	0.56	0.32	0.31
	Design	2	0.07	0.07	0.04	0.04
	RWSP or RPS Option Only	30	5.47	1.10	3.99	0.61
	All Projects	48	**3.52**	**0.75**	**2.55**	**0.41**
All Regions	Complete*	71	2.37	0.75	1.32	0.41
	Construction/Underway	40	1.29	0.47	0.71	0.26
	Design	21	0.51	0.35	0.28	0.19
	RWSP or RPS Option Only	113	2.79	0.80	1.82	0.47
	All Projects	245	**2.23**	**0.60**	**1.36**	**0.33**

* Construction completion dates in 2015–2019 only.
** The offset is calculated using the 0.55 offset coefficient.

Table A.10.2 Mean and Median Size of Brackish Groundwater Projects, By Planning Region and Project Status (with highlighted values indicating the EDR assumption about the most common project size)

Planning Region	Project Status	N Obs	Mean	Median
CFWI	Complete*	2	3.70	3.70
	Construction/Underway	4	10.50	7.50
	RWSP or RPS Option Only	33	1.71	0.17
	All Projects	39	**2.71**	**0.21**
NFRWSP	Complete*	2	**1.59**	**1.59**
SF Lower East Coast	RWSP or RPS Option Only	12	**3.79**	**3.50**
SF Lower West Coast	RWSP or RPS Option Only	6	**4.83**	**2.75**
SF Upper East Coast	RWSP or RPS Option Only	7	**5.36**	**4.00**
SWF Southern	Construction/Underway	1	4.00	4.00
	RWSP or RPS Option Only	8	3.19	2.75
	All Projects	9	**3.28**	**2.00**
SWF Tampa Bay	Complete*	2	4.00	4.00
	RWSP or RPS Option Only	1	1.00	1.00
	All Projects	3	**3.00**	**3.00**
All Regions	Complete*	6	3.10	3.00
	Construction/Underway	5	9.20	5.00
	RWSP or RPS Option Only	67	2.91	2.00
	All Projects	78	**3.33**	**2.12**

* Construction completion dates in 2015–2019 only.

The project sample included only 44 "Surface Water" projects. Further, after reviewing the project description, eight projects were assumed to aim at the goals other than the water supplies and excluded from the project size analysis.[469] The remaining number of surface water projects (i.e., 36) was insufficient to detect a statistically significant difference in project size among regions.[470] Therefore, the same project size was assumed for all regions (Table A.10.3.) Similarly, no statistically significant difference in project sizes among regions was detected for the remaining project types (Table A.10.4), and the same project size was assumed for all regions in the EDR analysis.

Table A.10.3 Mean and Median Size of Surface Water Projects, By Planning Region and Project Status (with highlighted values indicating the EDR assumption about the most common project size)

Planning Region	Project Status	N Obs	Mean	Median
CFWI	RWSP or RPS Option Only	3	**8.37**	**10.00**
NFRWSP	Complete*	1	**0.05**	**0.05**
SF Lower East Coast	RWSP or RPS Option Only	1	**16.16**	**16.16**
SF Lower West Coast	RWSP or RPS Option Only	1	**1.80**	**1.80**
SJR Central Springs East Coast	Construction/Underway	1	1.50	1.50
	Design	1	8.80	8.80
	RWSP or RPS Option Only	1	4.00	4.00
	All Projects	3	**4.77**	**4.00**
SWF Heartland (excluding CFWI)	RWSP or RPS Option Only	4	**4.55**	**2.55**
SWF Northern (excluding CFWI)	RWSP or RPS Option Only	4	**15.02**	**17.50**
SWF Southern	Complete*	1	3.00	3.00
	Construction/Underway	1	0.00	0.00
	RWSP or RPS Option Only	9	7.92	5.00
	All Projects	11	**6.75**	**3.80**
SWF Tampa Bay	RWSP or RPS Option Only	8	**5.91**	**4.45**
All Regions	Complete*	2	1.53	1.53
	Construction/Underway	2	0.75	0.75
	Design	1	8.80	8.80
	RWSP or RPS Option Only	31	7.87	5.00
	All Projects	36	**7.15**	**4.50**

* Construction completion dates in 2015–2019 only.

[See table on following page]

469 The projects included STAs, dispersed water storage, regenerative stormwater conveyances, wetlands, and surface water diversions for stormwater retention. EDR concluded that these projects were intended for nutrient load reduction, groundwater recharge, and river restoration.

470 Based on the *npar1way* procedure implemented in SAS.

Table A.10.4 Mean and Median Sizes for Selected Project Types (with highlighted values indicating the EDR assumption about the most common project size)

Project Type	N Obs	Mean	Median
Aquifer Storage and Recovery	16	1.47	0.60
Stormwater	13	6.33	4.50
Groundwater Recharge	19	4.18	3.40
Other Non-Traditional Source	7	2.54	0.34
Other Project Type	20	1.51	0.97
Surface Water Storage*	7	23.54	3.00

* Several projects were excluded from the analysis: construction of water management area to treat agricultural discharges, restoring levee to increase reservoir water level, dispersed water storage on agricultural lands, and construction of control gate for a reservoir dam. It was unclear if these projects were intended for water supply (as opposed to natural system restoration or pollution reduction).

To summarize, in its expenditure forecast, EDR assumed that the stormwater and surface water projects tended to be larger (i.e., 4.50 mgd per project), while the projects relying on other nontraditional sources tended to be smaller (i.e., 0.34 mgd per project). The size of brackish groundwater and reclaimed water (for potable offset) is assumed to vary among the regions (Table A.10.5.)

Table A.10.5 Project Sizes Assumed in EDR Expenditure Forecast Analysis

Project Type	Project Size (water or offset mgd)
Aquifer Storage and Recovery	0.60
Brackish Groundwater	0.21–4.00*
Groundwater Recharge	3.40
Reclaimed Water (for potable offset)	0.14–3.30*
Stormwater	4.50
Other Non-Traditional Source	0.34
Other Project Type	0.97
Surface Water	4.50
Surface Water Storage*	3.00

* The size differs among water supply planning regions.

A.11 Regression Analysis for "Project Total ($)" for Projects Other Than Conservation Projects

Table A.11.1 Variables Used in the Regression Analysis

Variable	Notation	N	Mean	Std. Dev.	Min	Max
Dependent variable, natural log of "project total (million $)"	logprojectt	636	1.41	1.79	-3.28	6.49
Project Size:						
Volume of water or estimated potable water offset, mgd	q	636	2.76	4.62	0.00	30.00
Volume of water or estimated offset, centered around the average value (i.e., 2.76 mgd), and squared	qcentered2	636	21.29	71.94	0.00	742.02
Project Status Dummy Variables:						
Complete projects (**omitted category**)	complete	636	0.47	0.50	0.00	1.00
Projects in design, construction/underway, or on hold	dcuoh	636	0.14	0.35	0.00	1.00
RWSP or RPS Option Only	option	636	0.39	0.49	0.00	1.00
Project Type Dummy Variables:						
Aquifer Storage and Recovery (ASR)	asr	636	0.03	0.17	0.00	1.00
Brackish groundwater	bgw	636	0.19	0.39	0.00	1.00
Projects with phases of different types	comb	636	0.00	0.07	0.00	1.00
Desalination	desal	636	0.01	0.09	0.00	1.00
Groundwater recharge	gwr	636	0.03	0.17	0.00	1.00
Other Nontraditional Source	onts	636	0.01	0.11	0.00	1.00
Other Project Type	opt	636	0.02	0.15	0.00	1.00
Reclaimed Water (for potable offset) (**omitted category**)	reclaimed	636	0.59	0.49	0.00	1.00
Stormwater	stw	636	0.04	0.19	0.00	1.00
Surface water	sw	636	0.07	0.25	0.00	1.00
Surface water storage	sws	636	0.01	0.09	0.00	1.00
Project Region Dummy Variables:						
NWF-I, NWF-II, NWF-IV, NWF-V, NWF-VI, & NWF-VII	nwf	636	0.02	0.14	0.00	1.00
CFWI, NFRWSP, SR-Outside NFRWSP, and SF-LKB (**omitted category**)	centrfl	636	0.35	0.48	0.00	1.00
SF-LEC	lec	636	0.12	0.32	0.00	1.00
SF-LWC	lwc	636	0.09	0.29	0.00	1.00
SF-UEC	uec	636	0.04	0.20	0.00	1.00
SJR-CSEC	csec	636	0.09	0.29	0.00	1.00
SW-HR (outside CFWI)	hr	636	0.02	0.15	0.00	1.00
SW-SW	sr	636	0.09	0.29	0.00	1.00
SW-NR (outside CFWI)	nr	636	0.05	0.22	0.00	1.00
SW-TB	tb	636	0.12	0.33	0.00	1.00
Interaction between Project Type Dummy Variable and Project Size (mgd)						
Project size for ASR projects	qasr	636	0.10	0.83	0.00	14.25
Project size for brackish groundwater projects	qbgw	636	0.74	2.65	0.00	30.00
Project size for projects with stages of different types	qcomb	636	0.08	1.31	0.00	30.00
Project size for desalination projects	qdesal	636	0.14	1.65	0.00	25.00
Project size for groundwater recharge projects	qgwr	636	0.12	0.86	0.00	10.00
Project size for other non-traditional sources	qonts	636	0.05	0.76	0.00	15.10
Project size for other project types	qopt	636	0.06	0.60	0.00	12.50
Project size for "Reclaimed Water (for potable offset)" projects	qreclaimed	636	0.77	2.17	0.00	25.00
Project size for stormwater projects	qstw	636	0.16	1.18	0.00	12.40
Project size for surface water projects	qsw	636	0.53	2.73	0.00	25.00
Project size for surface water storage projects	qsws	636	0.02	0.27	0.00	5.00
Interaction between Project Status Dummy Variable and Project Size						
Project size for complete projects (**omitted category**)	qcomplete	636	1.10	2.84	0.00	25.00
Project size for projects in design, construction/underway, or on hold	qdcuoh	636	0.24	1.39	0.00	23.00
Project size for "RWSP or RPS Option Only"	qoption	636	1.42	3.96	0.00	30.00
Interaction between Project Region Dummy Variable and Project Size						
Project size for projects in NWF-I, NWF-II, NWF-IV, NWF-V, NWF-VI, & NWF-VII	qnwf	636	0.04	0.65	0.00	15.10
Project size for projects in CFWI, NFRWSP, SR-Outside NFRWSP, and SF-LKB (**omitted category**)	qcentrfl	636	0.62	2.29	0.00	30.00
Project size for projects in SF-LEC	qlec	636	0.46	1.84	0.00	16.70
Project size for projects in SF-LWC	qlwc	636	0.40	1.78	0.00	20.00
Project size for projects in SF-UEC	quec	636	0.20	1.64	0.00	30.00

Project size for projects in SJR-CSEC	qcsec	636	0.13	0.74	0.00	8.90
Project size for projects in SW-HR (outside CFWI)	qhr	636	0.05	0.70	0.00	12.40
Project size for projects in SW-SW	qsr	636	0.31	1.86	0.00	20.00
Project size for projects in SW-NR (outside CFWI)	qnr	636	0.15	1.65	0.00	25.00
Project size for projects in SW-TB	qtb	636	0.41	2.40	0.00	25.00

Table A.11.2 Model Estimation Results*

Independent Variables	Notation	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
Project Size:							
Volume of water or estimated potable water offset, mgd	q	**0.51**	0.04	12.61	0.00	0.43	0.59
Volume of water or estimated offset, centered around the average value (i.e., 2.76 mgd), and squared	qcentered2	**-0.03**	0.00	-13.33	0.00	-0.03	-0.02
Project Status Dummy Variables:							
Complete projects (**omitted category**)	complete	-	-	-	-	-	-
Projects in design, construction/underway, or on hold	dcuoh	**0.34**	0.17	2.03	0.04	0.01	0.67
RWSP or RPS Option Only	option	**0.84**	0.14	6.10	0.00	0.57	1.11
Project Type Dummy Variables:							
Aquifer Storage and Recovery (ASR)	Asr	0.28	0.40	0.70	0.49	-0.51	1.07
Brackish groundwater	Bgw	-0.25	0.18	-1.38	0.17	-0.62	0.11
Projects with phases of different types	Comb	**-3.38**	1.51	-2.25	0.03	-6.34	-0.43
Desalination	Desal	-3.70	2.04	-1.81	0.07	-7.71	0.30
Groundwater recharge	Gwr	**-1.27**	0.41	-3.08	0.00	-2.08	-0.46
Other Nontraditional Source	Onts	-0.13	0.55	-0.23	0.82	-1.21	0.96
Other Project Type	opt	-0.68	0.41	-1.64	0.10	-1.49	0.13
Reclaimed Water (for potable offset) (**omitted category**)	reclaimed	-	-	-	-	-	-
Stormwater	stw	-0.62	0.36	-1.71	0.09	-1.32	0.09
Surface water	sw	**-0.96**	0.32	-3.03	0.00	-1.58	-0.34
Surface water storage	sws	-0.22	1.08	-0.21	0.84	-2.35	1.91
Project Region Dummy Variables:							
NWF-I, NWF-II, NWF-IV, NWF-V, NWF-VI, & NWF-VII	nwf	**0.89**	0.41	2.16	0.03	0.08	1.71
CFWI, NFRWSP, SR-Outside NFRWSP, and SF-LKB (**omitted category**)	centrfl	-	-	-	-	-	-
SF-LEC	lec	**0.48**	0.23	2.12	0.04	0.03	0.92
SF-LWC	lwc	**0.77**	0.26	3.01	0.00	0.27	1.28
SF-UEC	uec	**0.68**	0.33	2.06	0.04	0.03	1.33
SJR-CSEC	csec	**0.43**	0.22	1.97	0.05	0.00	0.86
SW-HR (outside CFWI)	hr	-0.18	0.38	-0.48	0.63	-0.93	0.57
SW-SR	sr	**0.55**	0.21	2.57	0.01	0.13	0.96
SW-NR (outside CFWI)	nr	0.29	0.26	1.13	0.26	-0.22	0.80
SW-TB	tb	**0.48**	0.18	2.58	0.01	0.11	0.84
Interaction between Project Type Dummy Variable and Project Size							
Volume for ASR projects	qasr	**-0.20**	0.09	-2.31	0.02	-0.37	-0.03
Volume for brackish groundwater projects	qbgw	**0.08**	0.04	2.01	0.05	0.00	0.17
Volume for projects with stages of different types	qcomb	**0.50**	0.12	4.29	0.00	0.27	0.72
Volume for desalination projects	qdesal	0.22	0.11	1.88	0.06	-0.01	0.44
Volume for groundwater recharge projects	qgwr	0.03	0.09	0.38	0.70	-0.14	0.21
Volume for other non-traditional sources	qonts	-0.22	0.13	-1.65	0.10	-0.48	0.04
Volume for other project types	qopt	0.01	0.11	0.10	0.92	-0.20	0.22
Volume for "Reclaimed Water (for potable offset)" projects (**omitted category**)	qreclaimed	-	-	-	-	-	-
Volume for stormwater projects	qstw	**-0.30**	0.06	-4.77	0.00	-0.43	-0.18
Volume for surface water projects	qsw	0.07	0.04	1.71	0.09	-0.01	0.15
Volume for surface water storage projects	qsws	0.09	0.36	0.25	0.80	-0.61	0.79
Interaction between Project Status Dummy Variable and Project Size							
Volume for complete projects (**omitted category**)	qcomplete	-	-	-	-	-	-
Volume for projects in design, construction/underway, or on hold	qdcuoh	**-0.13**	0.05	-2.65	0.01	-0.22	-0.03
Volume for "RWSP or RPS Option Only"	qoption	-0.04	0.03	-1.37	0.17	-0.10	0.02
Interaction between Project Region Dummy Variable and Project Size							
Volume for projects in NWF-I, NWF-II, NWF-IV, NWF-V, NWF-VI, & NWF-VII	qnwf	0.08	0.14	0.60	0.55	-0.19	0.36
Volume for projects in CFWI, NFRWSP, SR-Outside NFRWSP, and SF-LKB (**omitted category**)	qcentrfl	-	-	-	-	-	-

Independent Variables	Notation	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Volume for projects in SF-LEC	qlec	**-0.16**	0.05	-3.56	0.00	-0.26	-0.07
Volume for projects in SF-LWC	qlwc	-0.09	0.05	-1.92	0.06	-0.19	0.00
Volume for projects in SF-UEC	quec	-0.10	0.06	-1.54	0.12	-0.22	0.03
Volume for projects in SJR-CSEC	qcsec	0.07	0.10	0.70	0.48	-0.13	0.27
Volume for projects in SW-HR (outside CFWI)	qhr	0.08	0.09	0.90	0.37	-0.09	0.25
Volume for projects in SW-SW	qsr	0.09	0.05	1.80	0.07	-0.01	0.18
Volume for projects in SW-NR (outside CFWI)	qnr	**0.16**	0.05	3.13	0.00	0.06	0.26
Volume for projects in SW-TB	qtb	**0.13**	0.04	3.27	0.00	0.05	0.21
Constant	const	0.07	0.12	0.56	0.58	-0.17	0.30
Robust Regression Measures of Fit**							
R-squared = .52							
AICR = 642.66							
BICR = 862.05							
deviance = 672.68							
F(44, 591) = 20.04 (Prob > F = 0.0000)							

* The dependent variable is the natural logarithm of "project total (million $)". The model is estimated with rreg procedure implemented in STATA 13.1. Robust regression measures of fit are produced by the *rregfit* procedure in STATA 13.1. Model coefficients that were statistically significant at α = 0.05 are in **bold**. The regression results were compared for the ordinary least squares (OLS) and the robust regression. OLS regression showed that a few observations can be classified as outliers or influential observations (based on Cook's D measure). As a result, robust regression results are reported in this EDR report. The difference between the regression coefficients estimated with OLS and the robust regression methods was generally small.

A.12 Conservation Projects

While conservation is often cited as the least expensive method of meeting future water demand, conservation is not costless. In the project appendix, 471 projects were either "PS and CII Conservation" or "Agricultural Conservation".[471] After those with no or zero "Water Quantity Made Available on Project Completion (mgd)" were omitted, 424 conservation projects remained in the sample. More than two-thirds of the projects were completed, generating 21.50 mgd (Table A.12.1.) Only 6.60 percent of the projects were "RWSP or RPS Option Only" projects; however, they were expected to create 19.55 mgd if completed, primarily supporting recovery strategies for the Lower Santa Fe and Ichetucknee Rivers.

Table A.12.1 "Water Quantity Made Available on Project Completion (mgd)" for Conservation Projects

Project Status	N	Sum
Complete	297	21.50
Construction/Underway	65	78.96
Design	29	3.96
On Hold	5	7.48
RWSP or RPS Option Only	28	19.55
Total	424	131.45

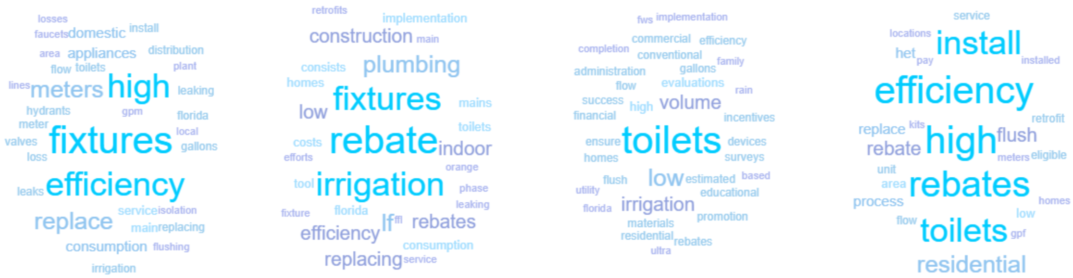
Overall, 84.91 percent of the conservation projects were "PS and CII Conservation" (i.e., 360 projects). Most of these were in the SFWMD and SWFWMD (158 and 126 projects, respectively). Since conservation could include a variety of projects and programs, EDR performed a word cloud analysis using "Project Description." For PS and CII conservation projects, SFWMD and SWFWMD emphasized the installation of more efficient toilets, while SJRWMD and SRWMD emphasized the installation of high-efficiency fixtures (Figure A.12.1.) Improving irrigation efficiency was also a major target for the projects in SJRWMD and SWFWMD. No "PS and CII Conservation" projects with quantified "Water Quantity Made Available on Project Completion" were reported for NWFWMD.

[See figure on following page]

[471] Out of the total, 47 projects had no or zero values reported for "Water Quantity Made Available on Project Completion (mgd)", and most of these projects were complete "PS and CII Conservation" projects.

Figure A.12.1 World Clouds Analysis Based on PS and CII Conservation Project Description, by WMD (N Refers to the Number of Projects Used in the Analysis)*

A.SRWMD (N=47) B.SJRWMD (N=29) C.SWFWMD (N=126) D.SFWMD (N=158)

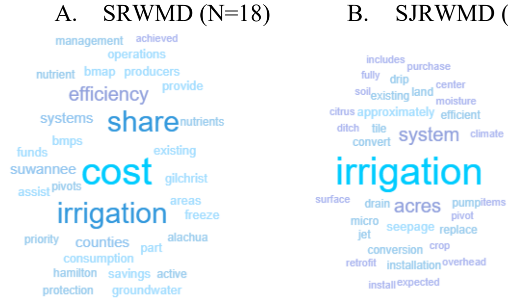


* The word clouds were produced using the world cloud Add-On in Google Docs. Words removed: water, project, conserve, quantified, mgd, savings, reduce, conservation, program, includes, provide, county, city, customers, customer, approximately, included, include, installation, purchase, approve, pre, built, system, existing, replacement, achieved.

Among the 64 agricultural conservation projects, two-thirds were listed for SJRWMD (41 projects), and one-fourth were from SRWMD, with all the projects focusing on agricultural irrigation (Figure A.12.2.) Three SFWMD projects described a weather station for a citrus farm and hydro-stackers for a vertical farming system.[472] Two SWFWMD projects were, in fact, programs funding multiple projects for Facilitated Agricultural Resource Management Systems (FARMS) and mini-FARMS. FARMS offers cost-share reimbursement for projects that reduce groundwater withdrawals from the Upper Floridan Aquifer through conservation and best management practices (SWFWMD 2019). In turn, mini-FARMS is a similar cost share program with a different target audience – agricultural operations of 100 acres or less (SWFWMD 2018). Finally, NWFWMD did not list any agricultural water conservation projects.

Figure A.12.2 World Clouds Analysis Based on Agricultural Conservation Project Description, by WMD (N Refers to the Number of Projects Used in the Analysis)*

A. SRWMD (N=18) B. SJRWMD (N=41)



* For SFWMD and SWFWMD, only a few agricultural water conservation projects are listed, which is insufficient to generate a word cloud. No NWFWMD districts with quantified "Water Quantity Made Available on Project Completion" are reported**.** The word clouds were produced using the world cloud Add-On in Google Docs. Words removed: water, conservation, agricultural, program, implement, implementation, improvements, reduce, reduces, project, projects, assess, and increase.

[472] One of the projects describes showerheads and toilet rebates, and therefore, may have been classified as "agricultural conservation" by mistake.

EDR focused on 169 "PS and CII Conservation" projects and 62 "Agricultural Conservation" projects completed since 2015, and the projects in design, construction/underway, on hold, and "RWSP or RPS Option Only." The medians for the projects completed since 2015 were $5.68 million per mgd and $7.87 million per mgd, respectively (Table A.12.2.) These funding needs were comparable with that for the reclaimed water for potable offset projects.

Table A.12.2 Median Project Funding Needs, in Million Dollars per mgd, by Project Type and Status

Project Type	Complete*		Design, Construction or Underway		On Hold		RWSP or RPS Options Only	
	Funding Needs (million $ / mgd)	Number of Projects with Relevant Information	**Funding Needs (million $ / mgd)**	Number of Projects with Relevant Information	**Funding Needs (million $ / mgd)**	Number of Projects with Relevant Information	**Funding Needs (million $ / mgd)**	Number of Projects with Relevant Information
PS and CII Conservation	**5.68**	75	**5.53**	68	**6.41**	1	**5.61**	25
Agricultural Conservation	**7.87**	29	**3.02**	26	**8.11**	4	**9.21**	3

* Completed since 2015

In several water supply planning regions water conservation could completely offset the projected increase in water demand. The total inferred supply for these regions is 148.1 mgd, based on WMDs inferred supply shortage. Based on the median funding needs of the conservation projects completed since 2015, such offset could cost $0.84–$1.17 billion over the next 20 years. These estimates point to the fact that for water conservation initiatives to be successful, sufficient funding should be made available.

The funding split analysis was based on 206 conservation project items completed and funded since 2008, for which the funding split information was available. None of these project items reported state funding. On average, the district's funding share was 49.45 percent and cooperative entities contributed 50.42 percent (with the medians being 49.98 percent and 50.02 percent, respectively).

Appendix B: Miscellaneous Tables

Table B.1 Natural Resource Survey Response Rate and Shares Used for Non-Responding Governments

Account	Gov. Type	Responded	Surveyed	Share Responded	Land Management	Land Acquisition	Water Supply	Water Quality
343.700	County	8	25	32.00%	2.78%	4.44%	4.25%	30.83%
	Municipality	10	62	16.13%	0.41%	0.00%	0.00%	15.81%
	Local SD	11	27	40.74%	0.77%	0.00%	6.82%	3.07%
	Regional SD	3	5	60.00%	0.00%	0.00%	0.00%	0.00%
537	County	22	66	33.33%	16.95%	6.57%	2.61%	22.07%
	Municipality	18	63	28.57%	18.81%	0.20%	11.76%	42.09%
	Local SD	22	60	36.67%	0.88%	0.00%	11.82%	59.77%
	Regional SD	6	6	100.00%	33.10%	0.00%	1.83%	37.29%
572	County	21	63	33.33%	1.99%	0.00%	0.06%	0.75%
	Municipality	105	362	29.01%	3.65%	0.31%	0.35%	0.67%
	Local SD	8	174	4.60%	0.68%	0.00%	0.00%	0.00%
	Regional SD	1	2	50.00%	0.00%	0.00%	0.00%	0.00%

Note: All governmental entities with revenues or expenditures reported in the listed accounts were surveyed except for the City of Hastings which recently dissolved. Overall response rates were as follows: Counties 22/66 (33.33%), Municipalities 106/367 (28.88%), Local Special Districts 31/242 (12.81%), and Regional Special Districts 8/10 (80%).

Table B.2 Remaining Financial Account Data Not Allocated to Water Resources or Conservation Lands (in $millions)

Revenue Account 343.700	LFY 12-13	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17
County	$5.29	$6.60	$7.29	$7.75	$8.18
Municipality	$51.44	$50.90	$57.68	$52.14	$56.14
Local SD	$1.90	$8.48	$1.00	$0.76	$1.04
Regional SD	$0.59	$0.87	$0.16	$0.13	$0.17
Expenditure Accounts 537 + 572	**LFY 12-13**	**LFY 13-14**	**LFY 14-15**	**LFY 15-16**	**LFY 16-17**
County	$832.92	$851.59	$864.38	$922.71	$923.35
Municipality	$996.64	$1,013.29	$1,091.71	$1,250.64	$1,267.69
Local SD	$97.23	$98.86	$105.97	$115.42	$144.85
Regional SD	$2.48	$2.66	$2.85	$3.43	$3.78

Table B.3 Survey Results for Account 343.700 Revenues Historically Allocated to Conservation Land Acquisition and Management (in $millions)

Conservation Land Acquisition	LFY 12-13	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17
County	$0.33	$0.34	$0.52	$0.84	$0.68
Municipality	$-	$-	$-	$-	$-
Local SD	$-	$-	$-	$-	$-
Regional SD	$-	$-	$-	$-	$-

Conservation Land Management	LFY 12-13	LFY 13-14	LFY 14-15	LFY 15-16	LFY 16-17
County	$0.29	$0.18	$0.27	$0.41	$0.54
Municipality	$0.25	$0.28	$0.26	$0.25	$0.26
Local SD	$0.01	$0.07	$0.01	$0.01	$0.01
Regional SD	$-	$-	$-	$-	$-

Figure B.1 Northwest Florida Potential Conservation Land Acquisition

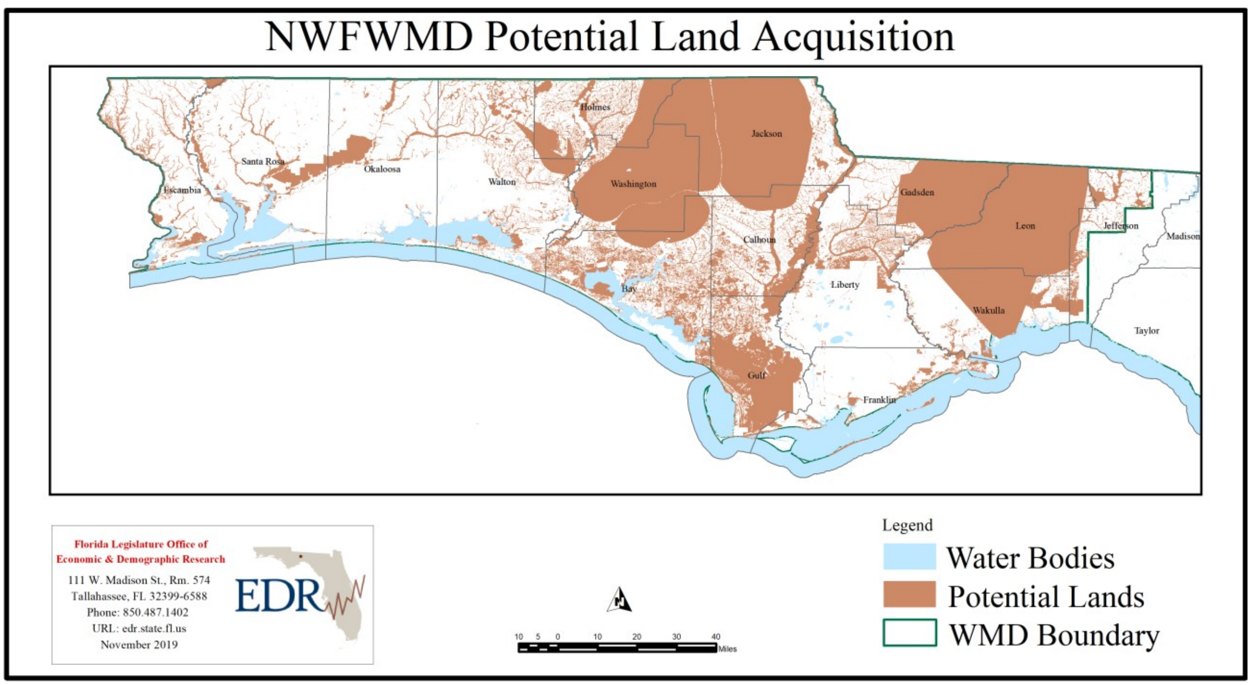


Table B.4 Millage Rates of Water Management Districts and Basin Boards

Millage Rate	15-16	16-17	17-18	18-19	19-20
SFWMD	0.1459	0.1359	0.1275	0.1209	0.1152
Okeechobee Basin	0.1586	0.1477	0.1384	0.1310	0.1246
Everglades Construction	0.0506	0.0471	0.0441	0.0417	0.0397
Big Cypress Basin	0.1429	0.1336	0.1270	0.1231	0.1192
NWFWMD	0.0378	0.0366	0.0353	0.0338	0.0327
SWFWMD	0.3488	0.3317	0.3131	0.2955	0.2801
SRWMD	0.4104	0.4093	0.4027	0.3948	0.3840
SJRWMD	0.3023	0.2885	0.2724	0.2562	0.2414

Table B.5 Cost of BMAP-Related Land Acquisition (in $millions)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Land Acquisition	$0.74	$-	$6.38	$1.42	$2.45	$0.26	$11.62	$46.87	$7.61	$1.32

Note: These values represent calendar year expenditures on BMAP related land acquisitions for nine of ten occurrences in the most recent ten years. There was one land acquisition in 2016 for which a cost estimate was not provided.

Appendix C: Acronyms

Table C.1 List of All Acronyms Used in this Report

Acronym/Label	Meaning
AFR	Annual Financial Report
AG	Agricultural Self-Supply
ARC	Acquisition and Restoration Council
ASR	Aquifer Storage and Recovery
AWS	Alternative Water Supply
AWWA	American Water Works Association
BEBR	The University of Florida's Bureau of Economic and Business Research
BMAP	Basin Management Action Plan
BMP	Best Management Practices
BOARD OF TRUSTEES	Board of Trustees of the Internal Improvement Trust Fund
BODS	Biochemical Oxygen Demand
CAMA	Coastal and Aquatic Managed Areas
CARL	Conservation and Recreation Lands
CBO	The Congressional Budget Office
CEPP	The Central Everglades Planning Project
CERP	Comprehensive Everglades Restoration Plan
CFWI	The Central Florida Water Initiative
CII CONSERVATION	Water Conservation Projects by Commercial, Industrial, or Institutional Entities
CIIM	Commercial-Industrial-Institutional-Mining Self-Supply
CIP	Capital Improvement Plans
CTV	County Taxable Value

Acronym/Label	Meaning
CUP	Consumptive Use Permit
CWA	The Clean Water Act
CWNS	The Clean Watersheds Needs Survey
CWS	Community Water Systems
CWSRF	Clean Water State Revolving Fund
CY	Calendar Year
DACS	The Florida Department of Agriculture and Consumer Services
DACSI&A	The list of Florida Forest Service Inholdings and Additions
DEAR	The Division of Environmental Assessment and Restoration
DEP	The Florida Department of Environmental Protection
DEP (2019A)	The Regional Water Supply Planning 2018 Annual Report
DEP (2019B)	Reuse Inventory Database and Annual Report
DFS	The Florida Department of Financial Services
DO	Dissolved Oxygen
DOR	The Florida Department of Revenue
DOS	Department of State
DRP	The Division of Recreation and Parks
DSL	The Division of State Lands
DSS	Domestic Self-Supply
DWINSA	The Drinking Water Infrastructure Needs Survey and Assessment
DWRA	Division of Water Restoration Assistance
DWSRF	The Drinking Water State Revolving Fund
EAA	Everglades Agricultural Area
EDR	The Legislative Office of Economic and Demographic Research

Acronym/Label	Meaning
EEL	Environmentally Endangered Lands
EFA	Everglades Forever Act
EPA	The United States Environmental Protection Agency
FFCNA	Florida Forever Conservation Needs Assessment
FFPL	Florida Forever Priority List
FFS	Florida Forest Service
FFY	Federal Fiscal Year (October 1 through September 30)
FLP	The Forest Legacy Program
FNAI	Florida Natural Areas Inventory
FRDAP	Florida Recreation Development Assistance Program
FSAID	The Florida Statewide Agricultural Irrigation Demand
FWC	The Florida Fish and Wildlife Conservation Commission
FWCI&A	The Florida Fish and Wildlife Conservation Commission's list of Inholdings and Additions
FY	State Fiscal Year (July 1 through June 30)
IRL	Indian River Lagoon
JV	Just Value
LATF	Land Acquisition Trust Fund
LFY	Local Fiscal Year (October 1 through September 30)
LMUAC	Land Management Uniform Accounting Council
LSFIR	Lower Santa Fe and Ichetucknee River
LSJR	Lower Saint Johns River
LSL	Long Service Life
LTF	Less than fee simple land acquisition
MDWASD	Miami-Dade County Water and Sewer Department

Acronym/Label	Meaning
MFL	Minimum Flows and Minimum Water Levels
MG	Millions of Gallons
MGD	Million Gallons Per Day
MS4	Municipal Separate Storm Sewer System
MSJR	Middle Saint Johns River
N	The number of observations in a statistical sample
NEEPP	The Northern Everglades and Estuaries Protection Program
NFRWSP	The North Florida Regional Water Supply Partnership
NOAA	The National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPNCWS	Not-for-profit Noncommunity Water Systems
NWFWMD	The Northwest Florida Water Management District
NW-I	Region 1 of the Northwest Florida Water Management District
NW-II	Region 2 of the Northwest Florida Water Management District
NW-III	Region 3 of the Northwest Florida Water Management District
NW-IV	Region 4 of the Northwest Florida Water Management District
NW-V	Region 5 of the Northwest Florida Water Management District
NW-VI	Region 6 of the Northwest Florida Water Management District
NW-VII	Region 7 of the Northwest Florida Water Management District
O&M	Operations and Maintenance
OFS	Outstanding Florida Spring
OSTDS	Onsite Sewage Treatment and Disposal System
P2000	Preservation 2000
PG	Power Generation

Acronym/Label	Meaning
POTW	Publicly Owned Treatment Works
PS	Public Supply
PSC	The Florida Public Service Commission
REC	Recreational-Landscape Irrigation
RFLPP	Rural and Family Lands Program
RPS	Recovery and Prevention Strategy
RWSP	Regional Water Supply Plan
SDWA	The Safe Drinking Water Act
SF-LEC	The Lower East Coast Region of the South Florida Water Management District
SF-LKB	The Lower Kissimmee Basin Region of the South Florida Water Management District
SF-LWC	The Lower West Coast Region of the South Florida Water Management District
SF-UEC	The Upper East Coast Region of the South Florida Water Management District
SFWMD	The South Florida Water Management District
SJR-CSEC	The Central Springs East Coast Region of the Saint Johns River Water Management District
SJRWMD	The Saint Johns River Water Management District
SOLARIS	The Florida State Owned Lands and Records Information System
SR-OUTSIDE NFRWSP	The portion of the Suwannee River Water Management District outside the boundaries of the North Florida Regional Water Supply Partnership
SRWMD	The Suwannee River Water Management District
SSL	Short Service Life
STA	Stormwater Treatment Area
STAR REPORT	2018 Statewide Annual Report on Total Maximum Daily Loads, Basin Management Action Plans, Minimum Flows or Minimum Water Levels, and Recovery or Prevention Strategies
STV	School-district Taxable Value
SWFWMD	The Southwest Florida Water Management District

Acronym/Label	Meaning
SW-HR	The Heartland Region of the Southwest Florida Water Management District
SWIM	The Surface Water Improvement and Management Program
SW-NR	The Northern Region of the Southwest Florida Water Management District
SW-SR	The Southern Region of the Southwest Florida Water Management District
SW-TB	The Tampa Bay Region of the Southwest Florida Water Management District
TMDL	Total Maximum Daily Loads
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
USDA	The United States Department of Agriculture
USGS	United States Geological Survey
WIFIA	The Water Infrastructure Finance and Innovation Act
WMD	Water Management District
WRDA 2000	The Water Resources Development Act of 2000
WRRDA	The Water Resources Reform and Development Act
WSA	Water Supply Assessment
WUCA	Water Use Caution Area