Northwest Florida Water Management District

2023 Water Supply Assessment Update
Publication Number: WRA 23-01
December 2023

Sylvan Spring on Econfina Creek

2023 Water Supply Assessment Update

Water Resources assessment 23-01
December 2023

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ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
ARC	Area of Resource Concern
BEBR	Bureau of Economic and Business Research, University of Florida
bls	Below Land Surface
cfs	Cubic Feet per Second
DACS	Florida Department of Agriculture and Consumer Services
DEP	Florida Department of Environmental Protection
District	Northwest Florida Water Management District
DSAP	Detailed Specific Area Plan
DSS	Domestic Self Supply
EDR	Office of Economic & Demographic Research, Florida Legislature
F.A.C.	Florida Administrative Code
F.S.	Florida Statutes
FSAID	Florida Statewide Agricultural Irrigation Demand
ft	Feet
ft^2/day	Feet Squared Per Day
gpcd	Gallons Per Capita Per Day
gpm	Gallons Per Minute
gpm/ft	Gallons Per Minute per Foot
GWUP	General Water Use Permit
ICI	Industrial/Commercial/Institutional
in/yr	Inches per Year
IWUP	Individual Water Use Permit
MFL	Minimum Flows and Minimum Water Levels
mgd	Million Gallons per Day
mg/L	Milligrams per Liter
NAVD88	North American Vertical Datum 1988
NWF_ID	Northwest Florida Water Management District Station Identification Number
NWFWMD	Northwest Florida Water Management District
PS	Public Supply
Q_{xx}	Water Flow Exceedance Probability ($_{xx}$ percent)
RWSP	Regional Water Supply Plan
SWIM	Surface Water Improvement and Management
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
USGS	U.S. Geological Survey
WRCA	Water Resource Caution Area
WRF	Water Reclamation Facility
WSA	Water Supply Assessment
WWTF	Wastewater Treatment Facility
yr	Year

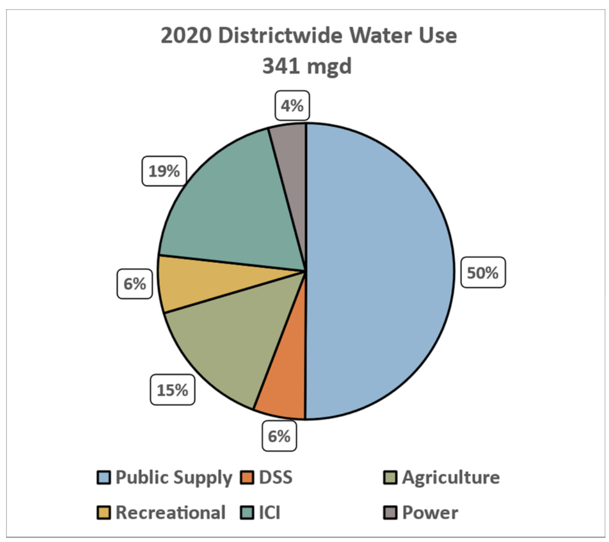
EXECUTIVE SUMMARY

The purpose of this Northwest Florida Water Management District (NWFWMD or District) Water Supply Assessment (WSA) update is to determine, per sub-subparagraph 373.036(2)(b)4.b., Florida Statutes (F.S.), *"Whether 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."* This determination is made for each water supply planning region on at least a 20-year planning horizon and is updated at least once every five years.

The District has seven water supply planning regions. The first Districtwide WSA was completed in 1998, and it was updated in 2003, 2008, 2013, and 2018. Methods used to estimate and project water use are similar to those used in previous WSAs. Enhancements made for this WSA include analyses of trends in aquifer levels, baseflows, and water quality for more than 300 datasets. Additionally, results of recent groundwater flow and saltwater intrusion modeling analyses have been incorporated into regional resource evaluations, where applicable.

The District has one regional water supply plan in effect, the Region II Regional Water Supply Plan (RWSP) for Santa Rosa, Okaloosa, and Walton counties. The RWSP was first developed in 2000, with updates approved in 2006, 2012 and 2019. A RWSP had been approved in 2008 for Region III (Bay County) but was discontinued in 2018 following construction of an alternate surface water intake for Deer Point Lake Reservoir. The Region V RWSP for Gulf and Franklin counties was approved in 2007 and discontinued in 2014 following the development of a new surface water supply for the city of Port St. Joe.

In 2020, Districtwide water use was estimated to be approximately 341 million gallons per day (mgd), which represents an increase of 17 mgd since 2015. The largest water use category was public supply (171 mgd), followed by industrial/commercial/institutional (ICI) use (65 mgd) and agriculture (50 mgd). Together these three categories comprised 84 percent of all water use. Most of the District's agricultural water use occurs in Jackson County, while most ICI and power generation water use is located in Region I, Escambia County, and Region III, Bay County. Groundwater provides over three-fourths of the water supplied, with the major aquifers being the Floridan aquifer system and the sand-and-gravel aquifer. Deer Point Lake Reservoir, in Bay County, is the largest surface water source in northwest Florida.



The 2045 projected water use is 384 mgd, which is an increase of 43 mgd or about 13 percent Districtwide from 2020 use. Public supply, ICI and agriculture are expected to remain the largest water use categories. For 1-in-10-year drought conditions, the 2045 projected water use is approximately 429 mgd. The increase in water use under drought conditions is due to higher agricultural and landscape and recreational irrigation demands.

The 2020 District population estimate based on University of Florida, Bureau of Economic and Business Research (BEBR) data was 1,492,875. The total estimated seasonally adjusted population was 1,598,919.

About 86 percent of District population was estimated to be served by public supply utilities, with the remaining 14 percent served by domestic self-supply. Comparing seasonally adjusted data, by 2045 there will be an estimated additional 316,874 residents, with more than half of this projected increase in Region II. Region III and Region VII are both anticipated to increase in population by about 19 percent by 2045. Estimated population increases by 2045 for other regions range from 2 to 16 percent.

Regional resource assessments identified continued water supply limitations in several planning regions, but water resources are generally anticipated to be sufficient to meet future needs across most of the District. Within Region I, Escambia County, the sand-and-gravel aquifer is the primary water source. Water demands are projected to increase by 15.35 mgd, from 83.06 mgd in 2020 to 98.41 mgd in 2045. Water level impacts and water quality issues related to groundwater pumping near Pensacola Bay are localized in scale, and existing and reasonably anticipated water sources are adequate to meet the projected demands through 2045 for average conditions and 1-in-10-year drought event, while sustaining water resources and related natural systems.

Region II spans Santa Rosa, Okaloosa, and Walton counties. In this region, the District worked with utilities during prior decades to develop inland wellfields and reduce Floridan aquifer withdrawals near the coast. Shifting pumpage inland allowed Floridan aquifer levels to partially recover and has slowed, but not eliminated, the risk of saltwater intrusion. A technical assessment to evaluate whether minimum aquifer levels were needed in Region II was completed in 2022. Although the establishment of minimum aquifer levels was not recommended at that time, concerns for water quality degradation and water resource sustainability continue. A significant cone of depression persists in the Upper Floridan aquifer. Region II has the fastest growth rate and demands are projected to increase by 28.32 mgd or 37.3 percent, from 75.98 mgd in 2020 to 104.31 mgd in 2045. Projected increases in pumping through 2045 may reverse the progress made in slowing saltwater intrusion, and the cone of depression in the Floridan aquifer could once again deepen and expand. Based on these findings, existing sources of water are not anticipated to be adequate to supply water for all existing and future reasonable-beneficial uses and to sustain the water resources and related natural systems through 2045. Therefore, pursuant to section 373.709, F.S., continued implementation of the regional water supply plan for Region II is recommended.

In Region III (Bay County), Deer Point Lake Reservoir is the primary source of water. Bay County Utilities has extended potable water from the reservoir to serve additional coastal service areas. To increase the resiliency of the reservoir to withstand storm surge impacts, an alternate upstream water intake was completed in 2015. Although groundwater is a secondary source of supply, the Floridan aquifer potentiometric surface has declined to approximately 20 feet below sea level along the coast, and continued management of groundwater withdrawals will be important to prevent saltwater intrusion. The District has initiated an MFL technical assessment to determine whether minimum aquifer levels are needed in Region III. The assessment will include enhanced data collection and groundwater flow and solute transport modeling to assess saltwater intrusion risks. Within Region III, surface water withdrawals are projected to decrease over the planning horizon and groundwater use is expected to remain near 2020 levels, thus existing and reasonably anticipated sources are considered adequate to meet projected 2045 average and 1-in-10 year drought event demands, while sustaining water resources and natural systems.

Region IV spans Calhoun, Holmes, Jackson, Liberty, and Washington counties. Within Planning Region IV, groundwater from the Floridan aquifer is the primary water source. Projected increase in demand total 5.6 mgd through 2045. Existing and reasonably anticipated water sources in Region IV are considered adequate to meet the projected 2045 average year and 1-in-10-year drought event demands, while sustaining water resources and related natural systems. Water withdrawals in Georgia have impacted the ecology of the Apalachicola River and Bay system, which spans planning regions IV, V, and VI.

Within Planning Region V, which encompasses Gulf and Franklin counties, the Floridan aquifer system and the Gulf County Freshwater Canal are the primary water sources. Water demands are projected to increase by 4.53 mgd or 21.4%, from 4.87 mgd in 2020 to 5.50 mgd in 2045. Continuing to limit coastal Floridan aquifer withdrawals, increasing the utilization of alternative water sources, and transitioning to inland groundwater sources will help ensure the long-term sustainability of the Floridan aquifer in Region V. Existing and reasonably anticipated water sources in Region V are considered adequate to meet the projected 2045 average year and 1-in-10-year drought event demands, while sustaining water resources and related natural systems.

Within Planning Region VI (Gadsden County), surface and groundwater supplies remain limited within the Upper Telogia Creek Water Resource Caution Area and the Area of Resource Concern. Water demands within Gadsden County are projected to increase by 0.68 mgd or 6%, from 11.42 mgd in 2020 to 12.11 mgd in 2045. These increases are relatively small and existing and reasonably anticipated sources are considered adequate to meet projected 2045 average and 1-in-10 year drought event demands, while sustaining water resources and natural systems.

Planning Region VII includes Leon, Wakulla, and a portion of Jefferson County. Groundwater is the primary water source. Most of the region is within the Woodville Karst Plain, where groundwater availability is high and withdrawals comprise a small portion of the water budget for the Floridan aquifer. The District has adopted minimum flows for three priority waterbodies in Region VII since the 2018 WSA Update: the St. Marks River Rise and the Wakulla Spring and Sally Ward Spring system. As of September 2023, these waterbodies are meeting their adopted minimum flows. An evaluation of the impact of projected withdrawals indicates that the minimum flows will continue to be met through the 2045 planning period. No prevention or recovery strategies are needed.

Due to large projected increases in demands and continued concerns regarding saltwater intrusion in Planning Region II, staff recommend that the Region II RWSP be continued and updated as needed. No additional regional water supply plans are recommended. The need for regional water supply plans will be re-evaluated following the District's next WSA update in 2028.

1. INTRODUCTION

Background

The mission of the Northwest Florida Water Management District is to implement the provisions of Chapter 373, Florida Statutes (F.S.), in a manner that best ensures the continued welfare of the residents and water resources of northwest Florida. The District works with state and federal agencies and local governments to achieve its mission through four primary functions and interrelated areas of responsibility: water supply, water quality, flood protection and floodplain management, and natural system protection.

The purpose of this Water Supply Assessment (WSA) is to determine, per section 373.036(2)(b)4.b., F.S., *"Whether 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."* The WSA makes this determination for each water supply planning region on a 20-year planning horizon once every five years to make recommendations to the District's Governing Board whether to initiate, continue and update, or discontinue regional water supply plans (RWSPs).

Water supply planning regions delineated for the District's first WSA were defined by county boundaries and similarity of water supply conditions that include primary water sources, the relative availability of water, and any water supply problems or issues (Figure 1-1).

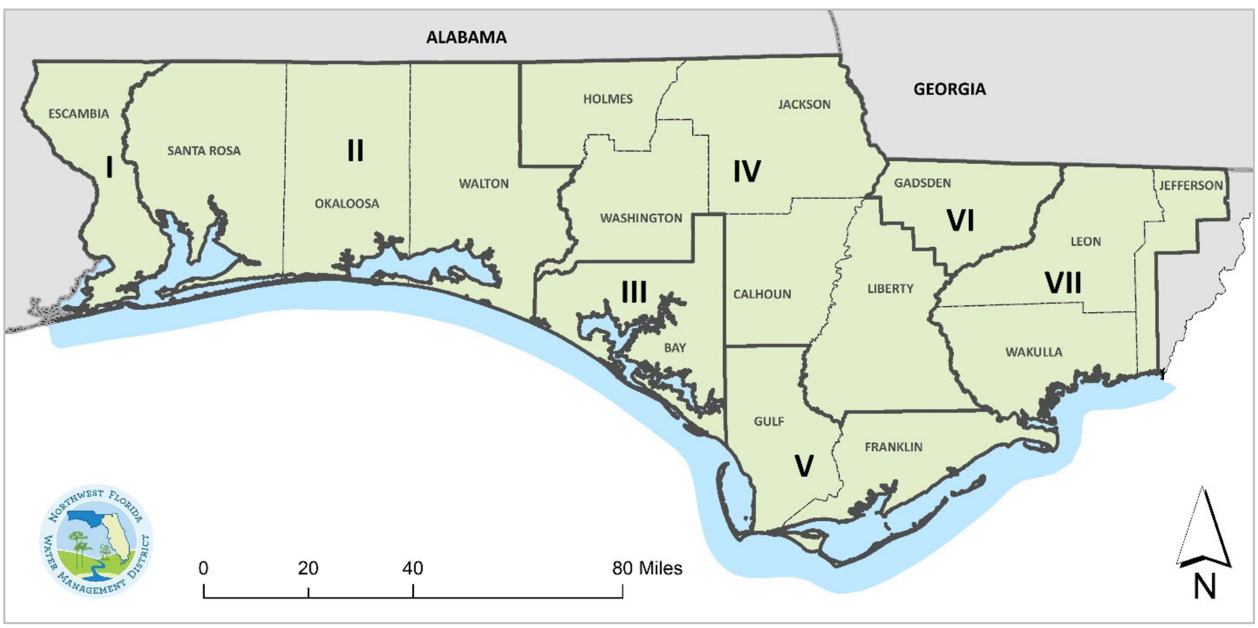


Figure 1-1. Water Supply Planning Regions

The District's first WSA in 1998, and subsequent updates in 2003, 2008, 2013, and 2018, provided recommendations for regional water supply planning, as summarized below.

- Region II RWSP for Okaloosa, Santa Rosa, and Walton counties: This RWSP was first established in 2000 due to coastal groundwater withdrawals, a decline in coastal Floridan aquifer levels and concern regarding saltwater intrusion. The Region II RWSP was recommended to be continued in the 2003, 2008, 2013, and 2018 WSA updates. The Region II RWSP was updated in 2006, 2012, and 2018.
- Region III RWSP for Bay County: This RWSP was established in 2008 to further transition groundwater production away from coastal areas. The Region III RWSP was updated in 2014 to address potential storm surge saltwater intrusion affecting the dependability of the Deer Point Lake Reservoir water supply. Following the construction of an alternate upstream surface water intake facility, a recommendation was made in the 2018 WSA Update to discontinue the RWSP. The RWSP was discontinued in 2019.
- Region V RWSP for Franklin and Gulf counties: This RWSP was established in 2007 due to potential saltwater intrusion concerns associated with existing and anticipated future coastal groundwater withdrawals. Following the development of a new surface water source and surface water treatment plant in Gulf County to offset groundwater use, a recommendation to discontinue the Region V RWSP was provided in the 2013 WSA Update. The Region V RWSP was discontinued in 2014.

WSA Process

The water supply assessment process has four basic steps:

1. Estimate water use for 2020 and project water demands for the 2025-2045 planning period,
2. Identify existing and reasonably anticipated sources of water and conservation efforts,
3. Evaluate the adequacy of water resources to meet future water demands, and
4. Make recommendations to the District's Governing Board to initiate, continue and update, or discontinue RWSPs.

Water use estimates are compiled for a base year (2020), and future demand projections are developed in five-year increments through a 20-year planning horizon (2025-2045). The level-of-certainty planning goal associated with identifying the water supply needs of existing and future reasonable-beneficial uses must be based upon meeting those needs for a 1-in-10-year drought. See Appendix 1 for a description of the methodologies used in this WSA.

Once the needs for RWSP(s) are established and approved by the Governing Board, the regional water supply planning process continues in coordination and cooperation with local governments, utilities, self-suppliers, and other affected and interested parties.

Regulatory Framework

Consumptive Use Permitting

The District issues Individual Water Use Permits (IWUPs), and General Water Use Permits (GWUPs) by rule[1] that authorize the withdrawal of water from surface and groundwater sources for reasonable-beneficial uses. Requirements for a water use permit vary spatially across the District based on resource concerns. Special permit conditions and lower thresholds triggering the requirement for an IWUP apply in areas designated as a Water Resource Caution Area or an Area of Resource Concern, as illustrated in Figure 1-2 and further defined below.

- Water Resource Caution Area: A geographic area, officially designated by the Governing Board by rule that is experiencing, or is anticipated to experience within the next 20 years, critical water resource problems as provided by the criteria in subsection 40A-2.801(1), F.A.C.

- Areas of Resource Concern: Areas delineated on the map contained in section 40A-2.902, F.A.C., where resource concerns exist related to water availability, water quality, high anticipated growth in demand, or other factors.

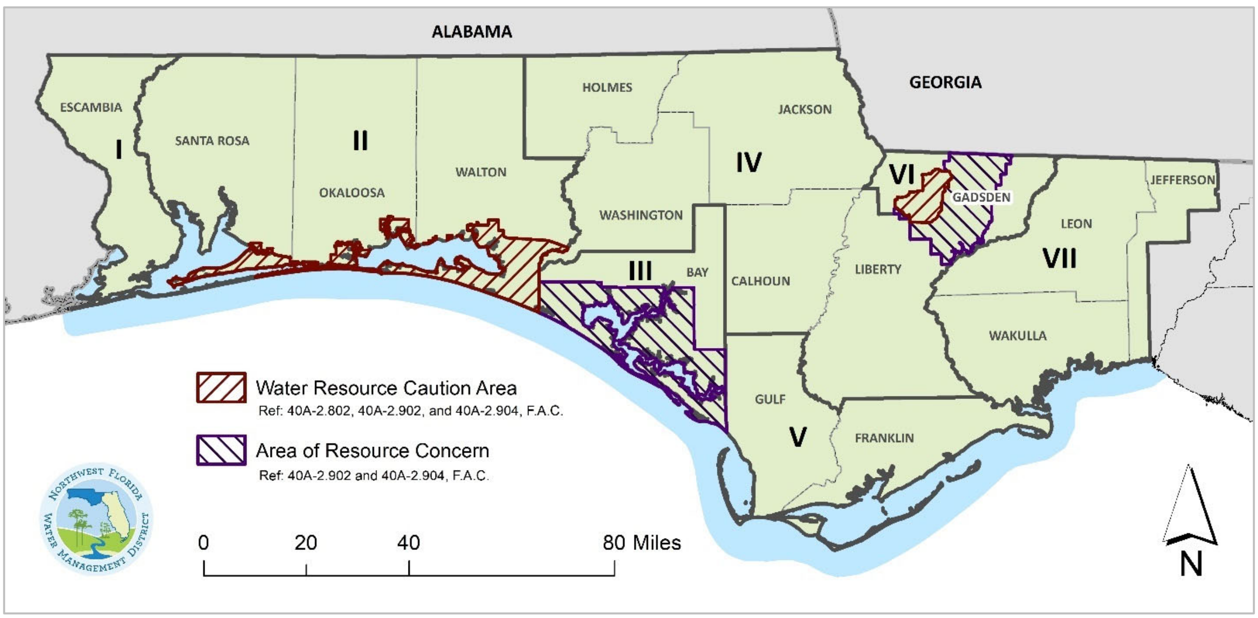


Figure 1-2. Water Resource Caution Areas and Areas of Resource Concern

Well Permitting

The District issues permits for the construction, repair, modification, and abandonment of wells, pursuant to Chapter 40A-3, F.A.C. There are more than 232,000 wells in the District. About one-third of all wells are non-consumptive, i.e., for testing, monitoring, remediation, or aquifer recharge. Test wells and monitoring wells are used for many purposes, including measuring and tracking changes in water levels and water quality. The number of wells withdrawing water for use is estimated to exceed 157,600, and 88 percent (more than 138,700 wells) are used for domestic self-supply or are associated with GWUPs for recreation or landscape irrigation. Many of these small diameter wells are located along coastal areas and in older developed inland areas, e.g., Pensacola and Tallahassee.

[1] Chapter 40A-2, Florida Administrative Code (F.A.C.).

Minimum Flows and Minimum Water Levels (MFLs)

Section 373.042, F.S., requires each water management district to develop minimum flows and minimum water levels (MFLs) for specific surface and ground waters within its jurisdiction. The MFL for a given waterbody is defined as the limit beyond which further withdrawals would be significantly harmful to the water resources or ecology of the area. The development and implementation of MFLs complement other water management initiatives, including consumptive use permitting and regional water supply planning. Section 62-40.473, F.A.C., specifies MFLs are to be established using the best available data, with consideration given to natural seasonal fluctuations, non-consumptive uses, and 10 water resource values (WRVs) associated with each MFL waterbody including:

1. Recreation in and on the water
2. Fish and wildlife habitats and the passage of fish
3. Estuarine resources
4. Transfer of detrital material
5. Maintenance of freshwater storage and supply
6. Aesthetic and scenic attributes
7. Filtration and absorption of nutrients and other pollutants
8. Sediment loads
9. Water quality
10. Navigation

To date, minimum flows have been adopted for the St. Marks River Rise (2019), a first magnitude spring in Leon County, and the Wakulla Spring (first magnitude spring and an Outstanding Florida Spring) and Sally Ward Spring (second magnitude spring) System (2021) in Wakulla County (NWFWMD 2019, NWFWMD 2021). All three springs are within Region VII. The status of minimum flows for the St. Marks River Rise, Wakulla Spring, and Sally Ward Spring were evaluated as part of this assessment. Results of the MFL status assessments are presented in the resource assessment for planning Region VII.

An additional technical assessment was completed in 2020 to assess the need for minimum aquifer levels for the Floridan aquifer along coastal Region II. The results of the assessment indicated that minimum aquifer levels were not needed at that time. Additional technical assessments are ongoing to determine minimum flows for Jackson Blue Spring, a first magnitude spring and Outstanding Florida Spring in Jackson County, and for the Middle Econfina Creek Springs which includes the Gainer Spring Group (first magnitude and Outstanding Florida Spring), the Sylvan Spring Group (second magnitude), and the Williford Spring Group (second magnitude). The District remains on schedule to adopt minimum flows for the Jackson Blue Spring and the Gainer Spring Group by July 1, 2026, as required by Section 373.042, F.S.

If needed at a future date, recovery or prevention strategies, and reservations of water will be integrated into water supply assessments and RWSPs, as and where appropriate. Recovery and prevention strategies may also be developed in areas outside of RWSPs. The District’s MFL Priority List and Schedule are updated annually and may be found on the District’s website: www.nwfwater.com.

2. Regional Resource Assessments

Introduction to Regional Assessments

The Northwest Florida Water Management District's unique hydrology, physiography, land use, and climate extend from Escambia County at the western end of the panhandle to Jefferson County, shared with Suwanee River WMD, on the east (Figure 2-1).

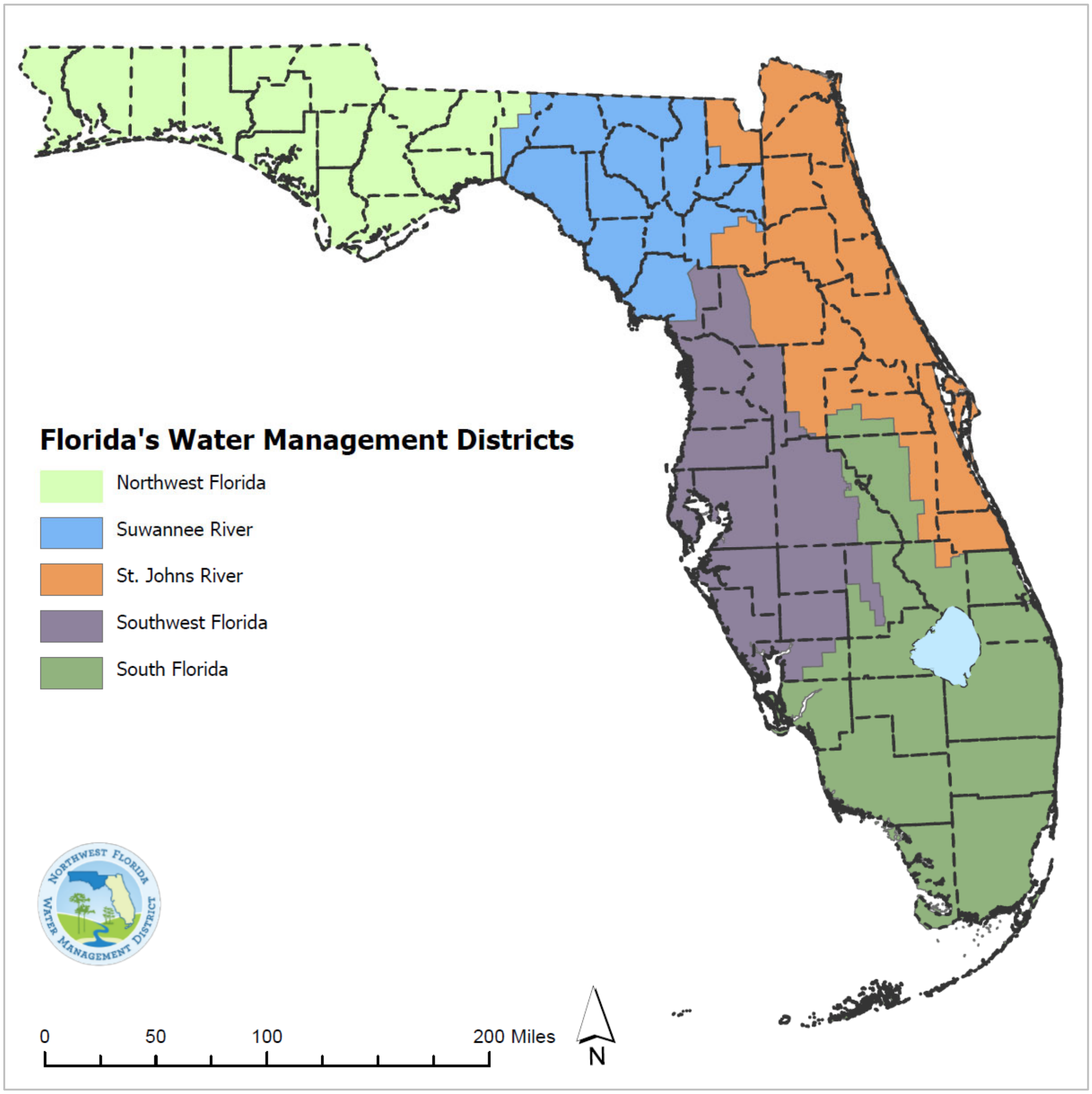


Figure 2-1. Florida's Water Management Districts

The District's geographical area is just under 20 percent of the land area of Florida, holding approximately seven percent of the total state population in 2020. Portions of the District have some of the lowest population densities in the state yet also some of the fastest growing areas, including Walton and Santa Rosa counties (2020 population in Figure 2-2.).

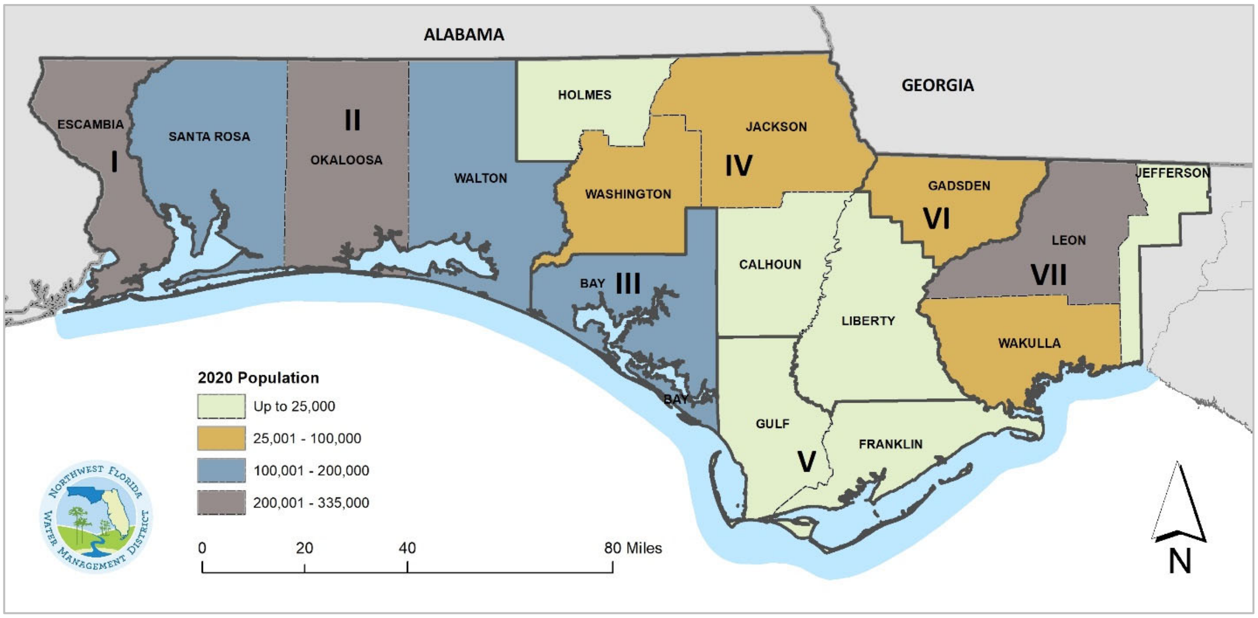


Figure 2-2. Population by County

Hydrology

There are seven major watersheds in northwest Florida, six of which extend into portions of Alabama and Georgia (Figure 2-3). The District has some of the state's largest rivers and most diverse estuaries, and more than 250 springs. The District's major rivers include the Apalachicola, Blackwater, Chipola, Choctawhatchee, Escambia, Ochlockonee, Shoal, St. Marks, Wakulla, and Yellow.

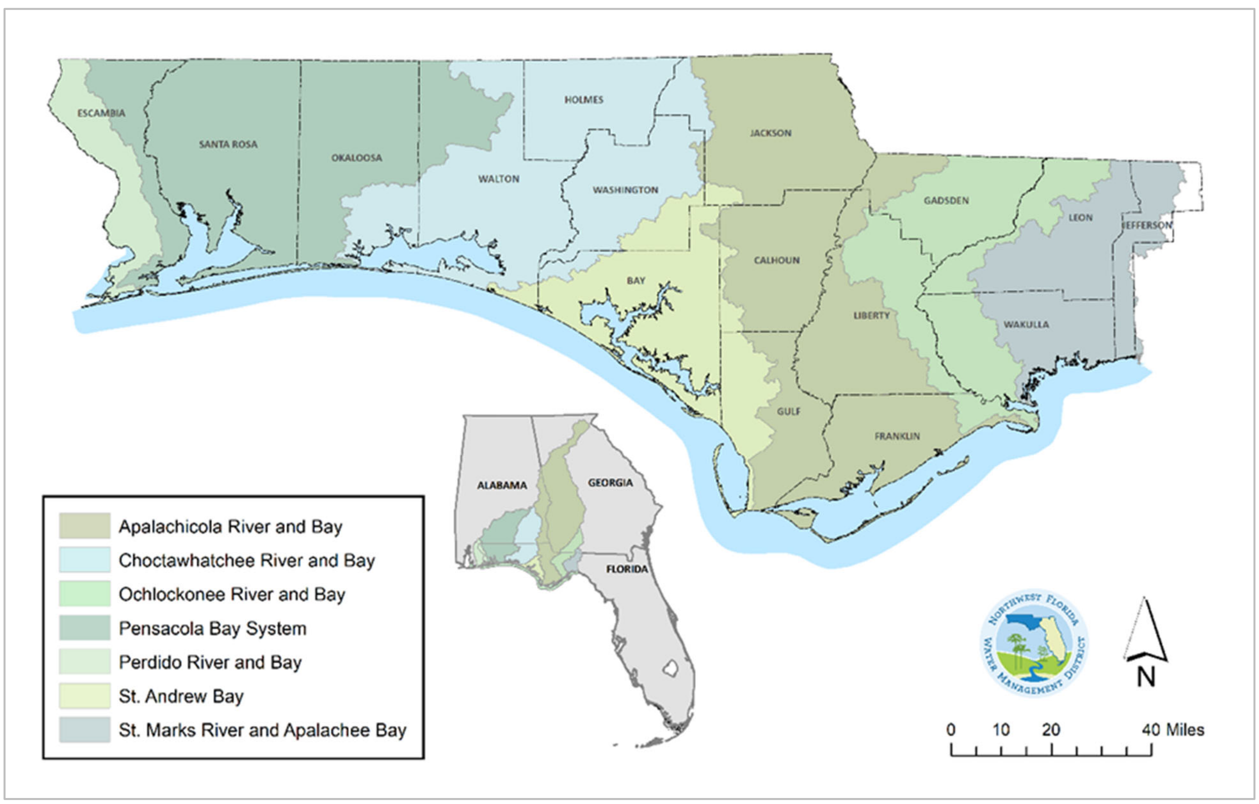


Figure 2-3. Major Watersheds within the District

Groundwater is the primary water source used throughout most of the District. Principal groundwater resources are the Floridan aquifer and, in the western portion of the District, the sand-and-gravel aquifer. Aquifer systems used to a lesser degree include the surficial aquifer, intermediate aquifer system, and the Claiborne aquifer. Groundwater resources in northwest Florida are characterized by four major groundwater regions: the Western Panhandle, Dougherty Karst, Apalachicola Embayment, and Woodville Karst (Figure 2-4). Groundwater resources within these regions vary in quantity and quality, and all but the Dougherty Karst Region have a near-coastal sub-region where the groundwater is highly influenced by the position of the freshwater and saltwater interface (Pratt, et al., 1996). Detailed descriptions of the primary aquifers used for water supply and groundwater region influence on resource development are provided for each planning region in the resources assessments presented within this report.

Deer Point Lake Reservoir is a major potable surface water source in Bay County, and a canal connecting the Chipola River to Port St. Joe supplies potable water in Gulf County. Telogia and Quincy creeks and their associated tributaries provide water for some agricultural uses in Gadsden County. Other surface water resources across the District serve agriculture, recreational, ICI, and power generation water uses.

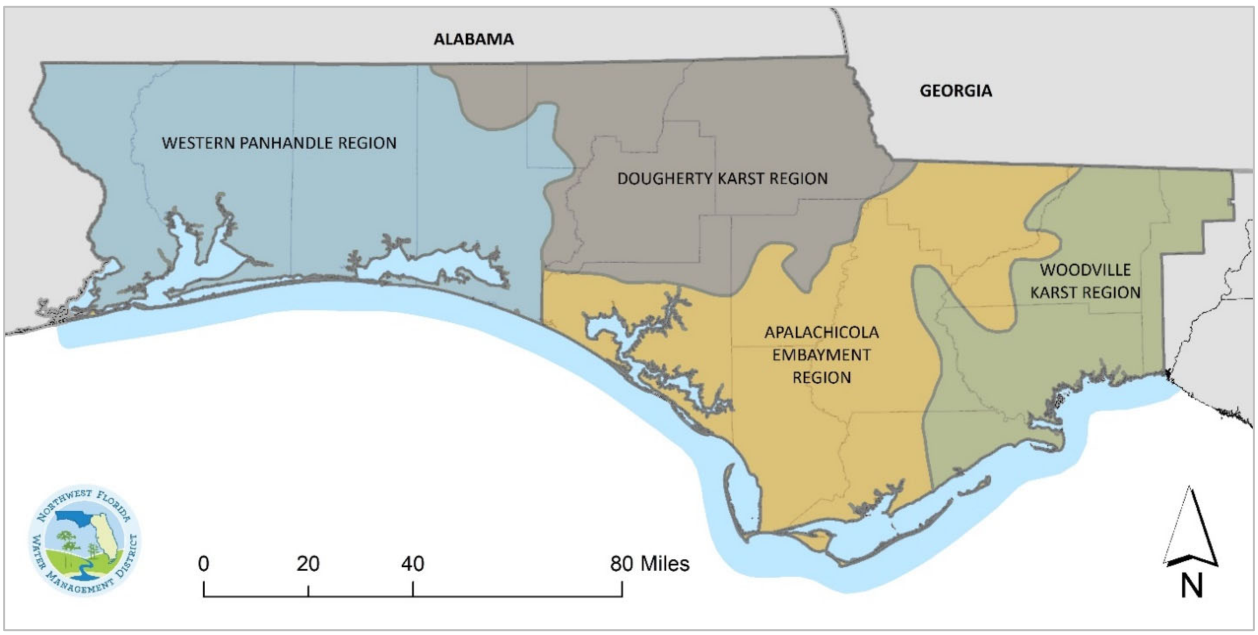


Figure 2-4. Groundwater Regions

Topography and Physiography

Major physiographic features include the Western Highlands and the Marianna Lowlands; and the Coastal Lowlands, which extend across all coastal areas of the District (Figure 2-5). Other landforms include the Tallahassee Hills, New Hope Ridge, and Grand Ridge.

Elevations in the highlands area range from about 50 to 345 ft NAVD88 (Figure 2-5). Coastal Lowland elevations range from below zero ft to about 100 ft NAVD88, and land in many coastal areas is poorly drained due to flat topography and a high, water table. The elevation values of the digital elevation model are based on 2019 and 2020 LiDAR (light detection and ranging) data.

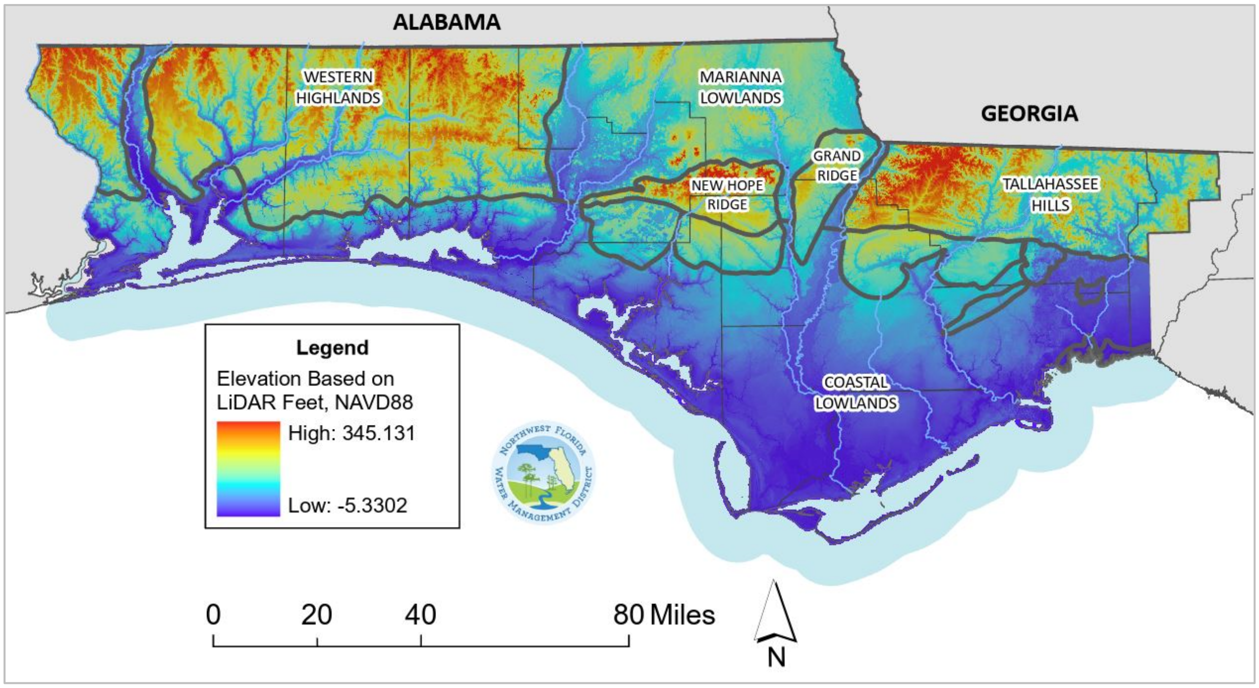


Figure 2-5. Topography and Physiography Based on 2019/2020 LiDAR Elevation Model

Climate and Drought

Northwest Florida is generally sub-tropical with warm humid summers, mild winters, and abundant rainfall. Normal precipitation levels range from approximately 52 to 69 inches per year but vary considerably across the panhandle with wetter areas in the west and drier locations around northeastern parts of the District, as illustrated in Figure 2-6. Recent drought periods in northwest Florida occurred during 2006-2007 and 2011-2012, which experienced about 12 and 14 inches below normal average precipitation, respectively. From 2014 through 2022, counties in the south-central portion of the District, notably Washington, Bay, and Gulf, received multiple years of above-average rainfall. The above average rainfall was exacerbated by precipitation that occurred during or following Hurricane Michael, Hurricane Sally, and four named tropical storm systems and resulted in localized flooding within these counties from 2018 to 2022. High groundwater levels, also caused by multiple years of cumulative rainfall, contributed to persistent flooding in some areas, such as those with closed basins with no surface water outlet.

Evapotranspiration (ET) comprises the second largest component of the water budget. Estimates of mean monthly actual evapotranspiration (ET) (January 2000 through December 2021) were retrieved from the U.S. Geological Survey Geodata Portal, https://cida.usgs.gov/thredds/dodsC/ssebopeta/monthly. Monthly values were compiled to derive annual totals and long-term averages. Due to impacts from Hurricane Michael on forested landcover types, which resulted in short-term decreases in ET rates in some areas, the 2000 to 2017 period was used to estimate average annual ET. Annual ET ranges from approximately 38 inches per year in Okaloosa County to 48 inches per year in Franklin County, with a Districtwide average of 42 inches per year.

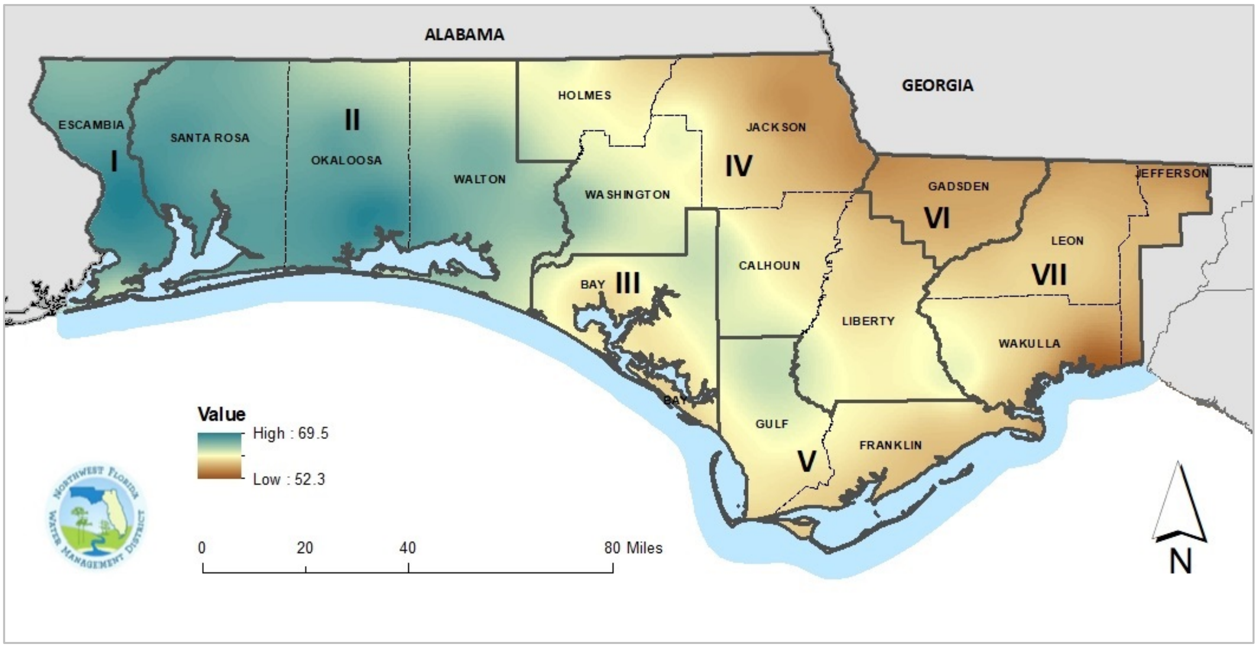


Figure 2-6. 30-Year Normal Average Annual Precipitation Inches Per Year (1991-2020)[2]

Land Use

Major human settlement and commercial-industrial centers in northwest Florida include the Pensacola metropolitan region in Escambia County, the city of Tallahassee in Leon County, and the Lynn Haven-Panama City metropolitan region in Bay County (Figure 2-7). There are also numerous urban and unincorporated developed areas across both coastal and inland areas of Region II: Okaloosa, Santa Rosa, and Walton counties. Local government sector plans are in regions I, II and III: the Escambia County Optional Sector Plan and the Bay-Walton Sector Plan. More information on sector plans follows below.

Agricultural lands, irrigated and non-irrigated, are concentrated in Jackson County, which has 27 percent of all agricultural land and 66 percent of all irrigated agricultural acreage Districtwide. The five counties of Region IV comprise 48 percent of all agricultural lands and 75 percent of all irrigated agricultural acreage in the District (DACS 2022). There are also agricultural lands in northern portions of regions I and II and throughout Gadsden County (Region VI). Open space and natural areas include national wildlife refuges, national and state forests, state parks, District lands, and large military landholdings.

[2] Source: PRISM Climate Group, Oregon State University, http://prism.oregonstate.edu.

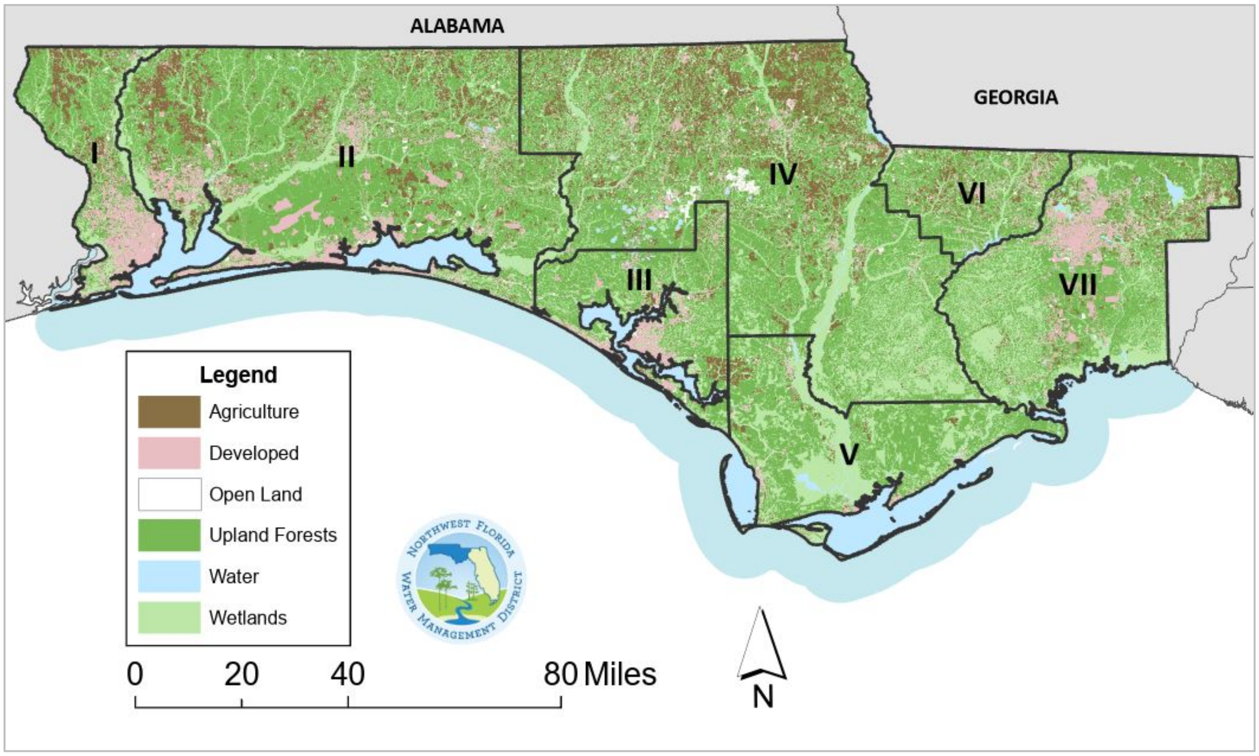


Figure 2-7. 2019 Land Use and Land Cover

Sector Plans

Section 163.3245, F.S., authorizes local governments to adopt sector plans into their comprehensive plans. Sector plans are substantial geographic areas of at least 5,000 acres that emphasize urban form and protection of regionally significant resources and public facilities. Sector plans are implemented in two main parts: adoption of a long-term master plan for the entire planning area, and detailed specific area plans (DSAPs) that implement the long-term master plan. County-adopted DSAPs are required before development can occur.[3]

Per section 163.3245, F.S., water management districts must account for the water needs, sources, and water resource and water supply development projects identified in adopted sector plans in their water supply assessments and regional water supply plans. Available data regarding water needs associated with sector plans are incorporated into this WSA.

Bay-Walton Sector Plan

The Bay-Walton Sector Plan covers approximately 110,500 acres with a 50-year vision for directing growth, development, and environmental resource protection across Bay and Walton counties. Of the 110,500 acres, approximately 88 percent are located in Bay County and the remainder are located in Walton County (St. Joe Company, 2022). The long-term master plan includes commercial employment, 170,200 residential dwelling units, agriculture, and conservation lands extending from St. Andrew Bay and West Bay in Bay County to Choctawhatchee Bay in Walton County. In June 2015, the Bay-Walton Sector Plan was found to be in compliance with statute and was fully enacted. This plan supersedes the West Bay Sector Plan approved by Bay County in 2003. Regionally, this sector plan, together with multiple

[3] Florida Department of Economic Opportunity (DEO), Sector Planning Program.

developments of regional impact (DRIs), substantially defines the long-term plan and vision for future development within western Bay County and southeastern Walton County. To date seven DSAPs have been approved by Bay County. Collectively, the water demand associated with these seven DSAPs is more than 5.25 million gallons per day and reuse is estimated to be at least 0.29 mgd (Bay County, 2023). Within Walton County, one DSAP has been approved at the time of this writing, with an estimated average annual potable water demand of 1.87 mgd. Further information is in the Region II and Region III resource assessments that follow and at: http://bay-waltonsectorplan.com.

Escambia County Optional Sector Plan

The Escambia County Optional Sector Plan is approximately 15,000 acres of land north and west of Pensacola along the Perdido River north of I-10 and west of Cantonment. Further information is in the Region I Resource Assessment that follows and at: https://myescambia.com/our-services/development-services/planning-zoning/optional-sector-plan.

Additional analysis of water needs, and water resource and water supply development projects may be needed in Escambia, Bay and Walton counties in future water supply assessments, relevant regional water supply plans, development of applicable MFLs, and in permitting processes.

Water Supply Development, Conservation and Reuse

The District continues to work with local governments and utilities to pursue opportunities to further water conservation and reuse through program development and grant funding opportunities, technical assistance, data review and analysis of water reuse and conservation options, and public information and outreach. Water conservation resources for homeowners, businesses, agriculture, and industry are provided on the District's website. More targeted outreach conducted by the District includes responding to individual requests or providing information at public events.

The District provides funding assistance to support implementation of alternative water supply projects, including water reclamation and reuse, water conservation, and traditional water supply development. Since the 2018 WSA, the District has funded six new alternative water supply projects and two water meter replacement projects that advance water conservation. Alternative water supply projects funded include the Okaloosa County/Eglin AFB/Niceville Reclaimed Water Project, the South Santa Rosa County Reuse Initiative Phases I-IV, the Pace Water System Ground Storage Tank and Booster Pump Station, Bay County's North Bay Wastewater Reuse Project, the Panama City Beach Parkway Reuse Transmission Extension, and the Wastewater Treatment Plant Effluent Meters project with the city of Gretna. Grants were also awarded to the towns of Campbellton and Paxton for water meter replacement projects.

One commonly used metric for assessing water use efficiency is uniform gross per capita water use. This metric is calculated as the total water used divided by the population served, indicating the average amount of water used per person each day. A trending decrease in the per capita water use can suggest water conservation practices are being implemented. However, water conservation is not the only factor that affects the gross per capita water use. Factors such as rainfall, climate, economic conditions, population trends, and changes in ICI or other water use can also influence these values. For example, the District experienced droughts in 1999-2000, 2006-2007, and 2011-2012, which increased water use for irrigation during these years. Districtwide, there has been an overall decrease in the gross per capita water use from 1995 to 2020 as shown in Figure 2-8.

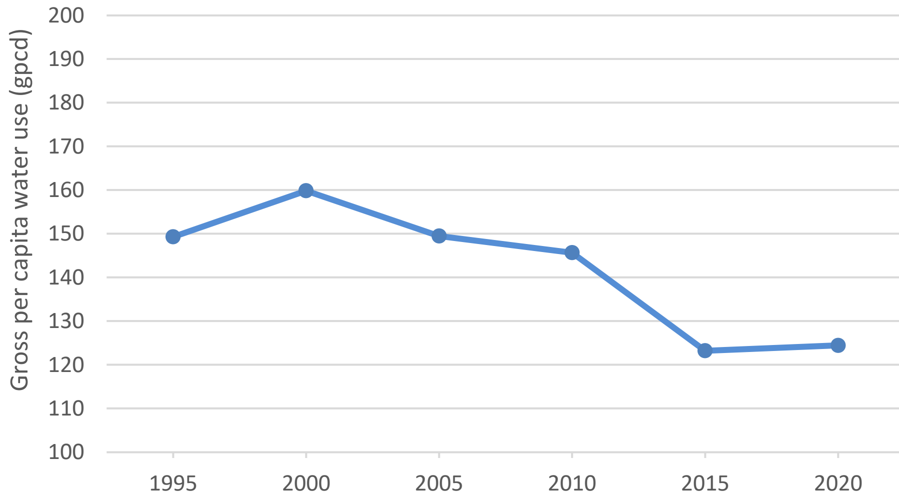


Figure 2-8. Districtwide Uniform Gross Per Capita Water Use

Overview of Planning Regions

The District's seven water supply planning regions each have unique water resources, hydrogeology, physiography, land use, water use, and climate characteristics. The seven planning regions are:

- Region I Escambia County
- Region II Okaloosa, Santa Rosa, and Walton counties
- Region III Bay County
- Region IV Calhoun, Holmes, Jackson, Liberty, and Washington counties
- Region V Franklin and Gulf counties
- Region VI Gadsden County
- Region VII Leon, Wakulla, and (portion of) Jefferson counties

The District share of Jefferson County is just under half of the county's total land area with the remainder in the Suwannee River Water Management District. Approximately 71 percent of the total Jefferson County population is estimated to be within the NWFWMD.

General notes for the seven regional assessments that follow:

- All population estimates are seasonally adjusted, except as noted. See Appendix 1, Methodologies, for more information.
- Population growth rates are calculated from 2020 BEBR population projection data.
- Agricultural estimates and projections are provided by DACS through the FSAID report (DACS, 2022).
- Data may contain minor differences due to rounding.

REGION I: ESCAMBIA COUNTY

Overview

Escambia County covers about 875 square miles and is the westernmost county in Florida's panhandle, bordered by the State of Alabama on the north and west (Figure 2-9).

Escambia County straddles two primary watersheds: Perdido River and Bay, and the Pensacola Bay System. Water management lands in the region include areas within the Perdido River and Escambia River water management areas. Public military lands near Pensacola include the Pensacola Naval Air Station, Corry Station, and Saufley Field.

Region I Snapshot

	2020	2045
Population	334,073	375,132
Water Use (mgd)	83.06	98.41

Primary Water Source(s):	Sand-and-gravel aquifer, Escambia River
MFL Waterbodies:	None
Water Reservations:	None
RWSP Status:	No RWSP Recommended

Other public lands located in the southern portion of the county include Escambia County's Jones Swamp Preserve; Gulf Islands National Seashore; and Big Lagoon, Perdido Key, and Tarkiln Bayou Preserve state parks.

Escambia's two incorporated areas are the city of Pensacola on Pensacola Bay and the Town of Century in the northeastern corner of the county. Unincorporated communities in the county include Bellview, Cantonment, Ensley, Gonzalez, Molino, Warrington, and Walnut Hill.

The Escambia County Optional Sector Plan was approved by Escambia County in April 2008. The Mid-West Sector Plan DSAP, encompassing the entire sector plan area (+/-15,000 acres), was adopted in September 2011. Approved land uses include regional employment districts, town and village centers, traditional urban neighborhoods, and suburban and conservation neighborhoods.

Population

The 2020 BEBR population estimate for Escambia County was 323,714. The 2020 seasonally adjusted population estimate was 334,073, reflecting an estimated seasonal population rate of 3.2 percent. Most seasonal populations are in the Pensacola Beach and Perdido Key coastal areas. Unless noted otherwise all population data are seasonally adjusted. The projected 2045 BEBR population is 375,132 persons, which represents a 12.3% increase from 2020.

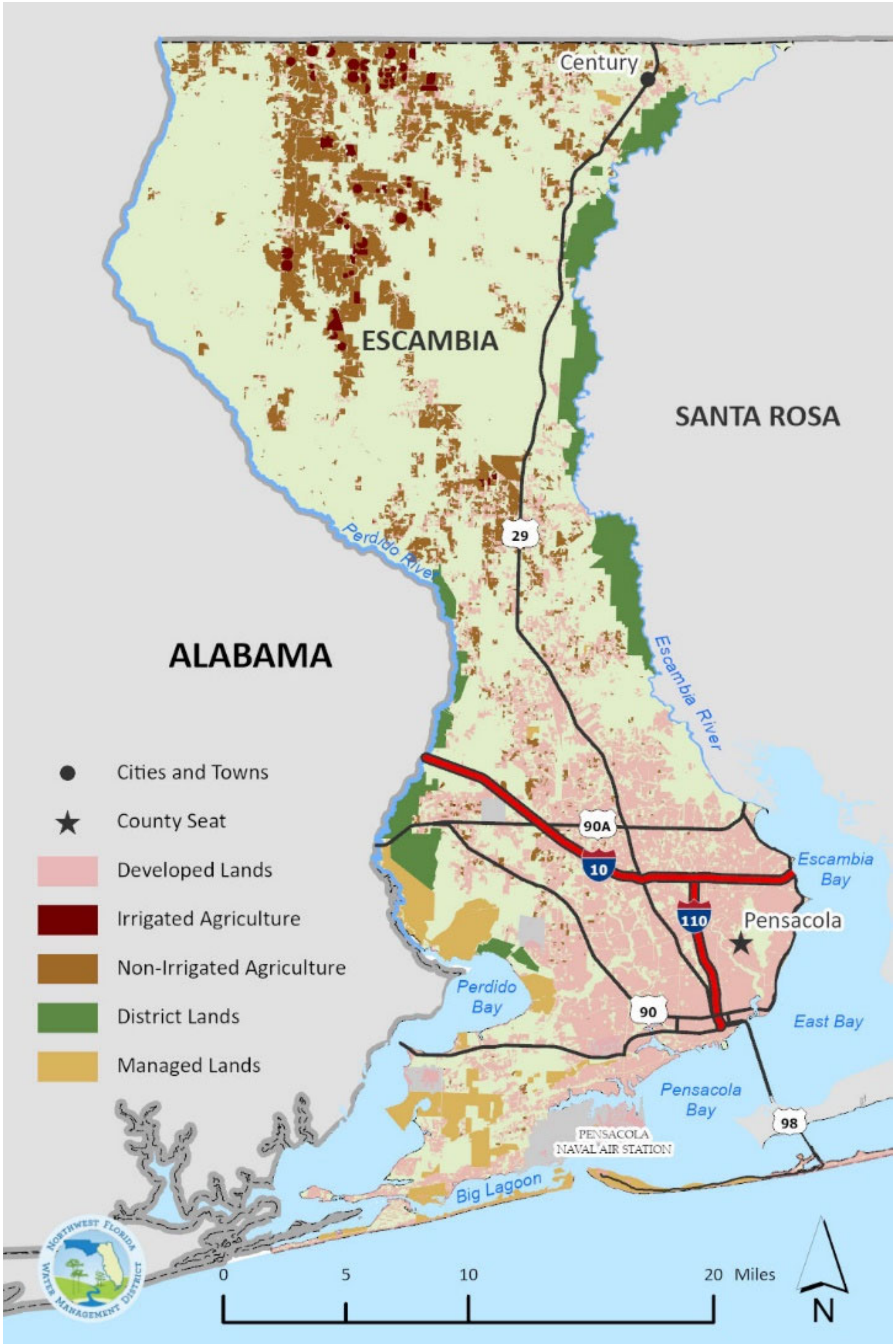


Figure 2-9. Region I - Escambia County

2020 Water Use Estimates and 2025-2045 Demand Projections

In 2020, Escambia had 21 percent of the District population and accounted for 24 percent of all water use Districtwide (Figure 2-10 and Table 2-1). The largest water use categories were public supply and ICI at 48 and 37 percent, respectively.

More than 90 percent of all water withdrawn came from the sand-and-gravel aquifer, with the remainder from surface water sources; primarily from Governor's Bayou and the Escambia River which provide cooling water for Florida Power & Light's Gulf Clean Energy Center Electrical Generating Plant. Thermoelectric power generation was 6.6 percent of all 2020 Region I water use.

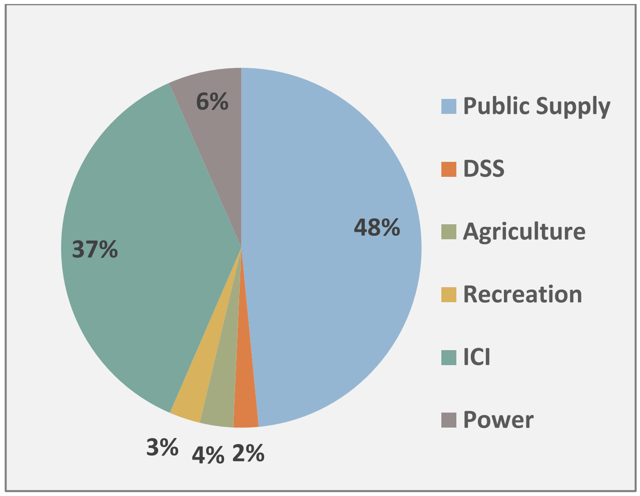


Figure 2-10. Region I - 2020 Water Use

Table 2-1. Region I - 2020 Water Use (mgd) and Population Estimates

County	Public Supply	DSS	Agriculture	Recreation	ICI	Power	TOTAL	BEBR Population	Adjusted Population
Escambia	40.091	1.853	2.998	2.138	30.530	5.453	83.063	323,714	334,073
TOTALS	**40.091**	**1.853**	**2.998**	**2.138**	**30.530**	**5.453**	**83.063**	**323,714**	**334,073**
% of total*	48.3%	2.2%	3.6%	2.6%	36.8%	6.6%	100%	21.7%	20.9%

*Percent per water use category in this region, and percent of Districtwide population.

Water use in Region I is projected to increase by nearly 18.5 percent over the planning period (Table 2-2). The largest projected percent increase in water demand is for the agricultural water use category, while ICI has the largest estimated water use increase of 6.58 mgd. Escambia County is expected to continue to account for one-fourth of all water Districtwide through the planning horizon.

Table 2-2. Region I - 2020 Estimated Water Use and 2025-2045 Demand Projections (mgd) - Average

Use Category	Estimates	Future Demand Projections - Average Conditions					2020-2045 Change	
	2020	2025	2030	2035	2040	2045	mgd	%
Public Supply	40.091	41.586	42.728	43.652	44.489	45.238	5.147	12.8%
DSS	1.853	1.844	1.861	1.875	1.885	1.892	0.039	2.1%
Agriculture	2.998	3.318	3.635	3.964	4.332	4.768	1.770	59.0%
Recreational	2.138	2.213	2.272	2.319	2.362	2.400	0.263	12.3%
ICI	30.530	33.055	36.678	36.823	36.968	37.113	6.583	21.6%
Power	5.453	7.000	7.000	7.000	7.000	7.000	1.547	28.4%
TOTALS	**83.063**	**89.017**	**94.174**	**95.633**	**97.036**	**98.412**	**15.349**	**18.5%**

Public Supply: The Emerald Coast Utilities Authority (ECUA) in Escambia County is the largest public supply utility in the District. The ECUA had a reported water use of nearly 34 mgd in 2020, representing 84 percent of all public supply water use in Region I. This utility serves the city of Pensacola and the greater metropolitan area spanning much of southern Escambia County. The ECUA population served is projected to grow from about 257,000 in 2020 to around 288,000 by the end of the 2045 planning period. Other public supply utilities in the region include People's Water Service, Cottage Hill Water Works, Farm Hill

Utilities, and Molino Utilities. Farm Hill Utilities service area currently includes the Mid-West Sector Plan DSAP area. Additional public supply utility data are provided in Appendix 4.

DSS and Small Public Systems: Domestic self-supply wells are fairly evenly distributed across Escambia County, with some concentrations in the central portion of the county. A slight projected increase in DSS water use is attributable to population growth.

Agriculture: A water demand increase of 1.77 mgd (59 percent) and 1,351-acre increase in irrigated agricultural lands are projected over the planning horizon. Additional fresh market vegetables and hay are projected within the region, along with minor increases in greenhouse/nursery and field crops.

Recreation: Escambia County has multiple golf courses and other recreational irrigation water uses primarily located in and around the Pensacola metropolitan region. Reported water use from IWUP permittees represents about half of the recreational water use estimate. The other half is estimated water use for residential irrigation and other small-scale irrigation uses from GWUPs with no water use reporting requirements. Most GWUPs are also in and around the Pensacola metropolitan region.

ICI: Large ICI water users include International Paper, Ascend Performance Materials, and the Navy Public Works Center. To substantiate projected increases in future water demand, International Paper projected annual production increases and the Navy Public Works Center is planning for additional populations.

Power: Florida Power & Light's Gulf Clean Energy Center Electrical Generating Plant located north of Pensacola, at an estimated 1229 megawatts, is the largest electric generating plant in the District. An increase in water demand from the base year is projected based on future increased generating capacity.

Table 2-3. Region I - 2020 Estimated Water Use and 2025-2045 Demand Projections (mgd) - Drought

Use Category	Estimates	Future Demand Projections - Average Conditions					2020-2045 Change	
	2020	2025	2030	2035	2040	2045	mgd	%
Public Supply	40.091	44.497	45.719	46.707	47.603	48.405	8.314	20.7%
DSS	1.853	1.973	1.991	2.006	2.017	2.025	0.171	9.2%
Agriculture	2.998	4.413	4.879	5.341	5.842	6.472	3.474	115.9%
Recreational	2.138	2.965	3.044	3.108	3.165	3.216	1.079	50.5%
ICI	30.530	33.055	36.678	36.823	36.968	37.113	6.583	21.6%
Power	5.453	7.000	7.000	7.000	7.000	7.000	1.547	28.4%
TOTALS	**83.063**	**93.904**	**99.311**	**100.985**	**102.595**	**104.231**	**21.168**	**25.5%**

Total Region I water demand is projected to be 98.41 mgd by 2045 in an average year (Table 2-2) and 104.23 mgd in a drought year event (Table 2-3), which reflects an estimated 6 percent increase in water demand over average conditions.

Assessment of Water Resources

Escambia County depends on both surface and groundwater, with groundwater supplying most of all fresh water used in the region. Due to highly mineralized water in the Floridan aquifer system in this region, the sand-and-gravel aquifer is the principal source of groundwater for Escambia County. Given the high availability of good quality water, this use pattern is anticipated to continue through 2045. Local rivers and bays in the region are part of large watersheds that extend into Alabama and other areas of northwest

Florida. The estuaries in the region are influenced substantially by surface water inflows, with only minor groundwater contributions.

Groundwater Resources

In order of increasing depth, the primary hydrostratigraphic units comprising the groundwater flow system within the region are the surficial aquifer system, the intermediate confining unit, and the Floridan aquifer system.

In Region I, the surficial aquifer system is referred to as the sand-and-gravel aquifer. It ranges in thickness from 350 to 530 ft. In Escambia County, the sand-and-gravel aquifer includes hydrostratigraphic zones that have distinctive characteristics. These zones are called the surficial zone, low-permeability zone, and main-producing zone. The uppermost zone is the surficial zone which includes the active water table. Flow in creeks and streams that intersect the water table are supported by groundwater seepage (baseflow). Discontinuous clay layers in the unsaturated zone above the active water table may locally cause perched water table conditions, which may support some surface water features during wetter periods. The surficial zone consists of fine to medium-grained sand, with gravel beds and lenses (Randazzo and Jones, 1997) and varies in thickness from a few feet to tens of feet.

Below the surficial zone is the low-permeability zone. The low-permeability zone consists of fine sand to clay and varies in thickness from 20 to 100 feet. The relatively leaky nature of the low-permeability zone enables water from the surficial zone to readily recharge the underlying main-producing zone to varying degrees. This vertical leakiness ranges from excessive, where the zone is thinner and contains more sand, to non-leaky, where the zone is thicker and consists almost entirely of clay. The low-permeability zone is typically much leakier in the southern half of the county.

Below the low-permeability zone is the main-producing zone. The main-producing zone consists of highly productive sand and gravel layers interbedded with clayey layers. This hydrostratigraphic zone is the primary production zone for public water supply. Well yields often exceed 1,000 gallons per minute (gpm) and may reach 2,500 gpm. Where the land surface elevations increase, and the relief is high, particularly in northern Escambia County, the main producing zone is divided by multiple low-permeability zones. Groundwater quality in the sand-and-gravel aquifer is good for most uses. The aquifer is recharged by local rainfall within the region, and groundwater moves naturally along flow paths to discharge as baseflow in creeks, rivers, and bays.

Underlying the sand-and-gravel aquifer is the intermediate confining unit. The intermediate confining unit is an effective, regional confining unit, that significantly restricts groundwater flow between the sand-and-gravel aquifer and the underlying Floridan aquifer system. The intermediate confining unit does contain a minor aquifer, the Escambia Sand. However, poor water quality, limited thickness, and depths of 600 to 900 ft to the top of the unit make the Escambia Sand an unviable groundwater source.

Below the intermediate confining unit is the Floridan aquifer system. The Bucatunna clay, a highly effective confining unit, separates the upper and lower Floridan aquifer system in this region. Both the upper and lower Floridan aquifer contain highly mineralized water. The top of the upper Floridan aquifer unit ranges from approximately 350 ft NAVD88 in northeast Escambia County to approximately -1,450 ft NAVD88 in the southwest. The lower Floridan aquifer is hydraulically isolated from the potable water flow system and is used for injection of industrial waste. Due to the depth of the upper Floridan aquifer and the poor quality of water, the sand-and-gravel aquifer, with its high availability of good-quality water in wells less than 300 ft deep, is a much-preferred source of potable water.

The estimated potentiometric surface of the main-producing zone for September 2019 is shown on Figure 2-11. During this time, water levels were above average but dropping as the region was experiencing abnormally dry conditions since early in the year.

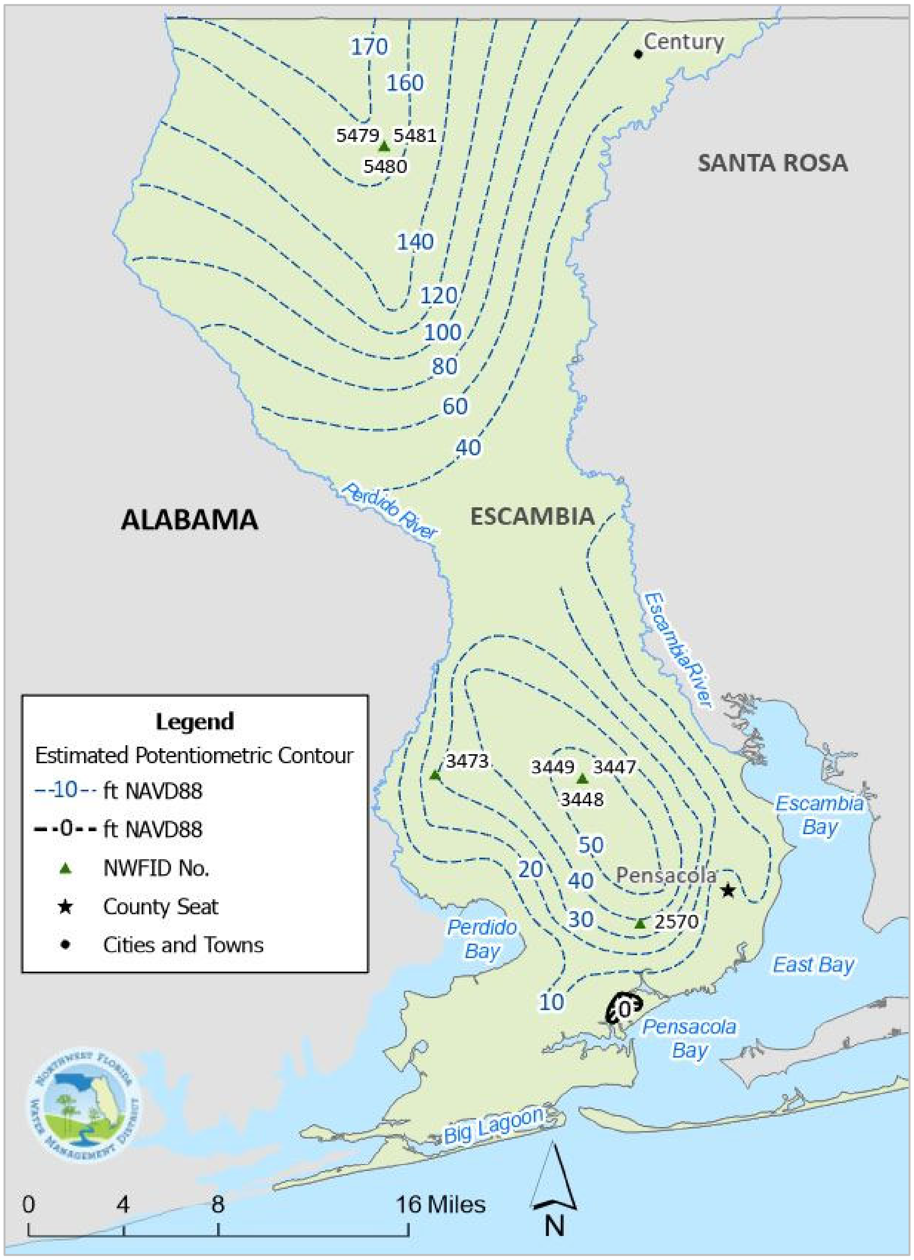


Figure 2-11. Potentiometric Surface (Estimated) of the Main-Producing Zone of the Sand-and-Gravel Aquifer, Escambia County, Florida, September 2019

The potentiometric surface is estimated to reach a height of more than 180 ft NAVD88 in northern Escambia County. From this high point, water levels decline to the east, west, and south. The Escambia and Perdido rivers, along with some wells, are major discharge points for the aquifer in the northern half of the region.

South of Cantonment water levels in the main-producing zone increase, reaching an elevation of about 55 ft NAVD88 near the intersection of Interstate 10 and U.S. Highway 29. From here, groundwater elevations decline in all directions. Groundwater moves to points of discharge, including wells, the Perdido and Escambia rivers, small streams, Perdido Bay, and the Pensacola Bay System. Monitoring well locations referenced in subsequent discussions are also illustrated in Figure 2-11. Locations are labeled with the well identification ("NWF_ID") number.

Groundwater Assessment Criteria

The criteria used to assess the impacts of groundwater withdrawals on water resources and associated natural systems include long-term depression of the potentiometric surface of the main-producing zone of the sand-and-gravel aquifer, trends in aquifer levels, alteration of groundwater quality, and reductions in regional groundwater discharge to streams. A regional groundwater budget was also used to evaluate the relative magnitude of groundwater withdrawals.

Impacts to Groundwater Resources and Related Natural Systems

The sand-and-gravel aquifer is recharged primarily by local rainfall, which directly affects water level trends. Hydrographs for two well clusters show water level trends and the difference in low permeability zone leakiness between northern and southern Escambia County (Figure 2-12). Each well cluster consists of three individual wells located at the same site and separately monitoring the surficial zone, the shallow main producing zone, and the deeper main producing zone, respectively. Data are presented for a well cluster near Oak Grove (Map IDs 5479, 5480, 5481) in northern Escambia County and along Nine Mile Road (Map IDs 3447, 3448, 3449) in southern Escambia County.

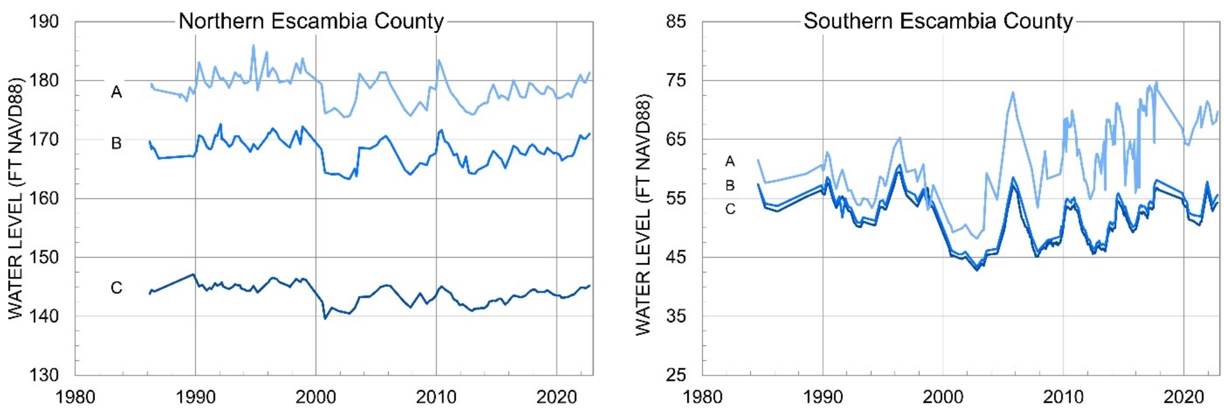


Figure 2-12. Hydrographs of Sand-and-Gravel Wells near Oak Grove (Northern Escambia County) and along Nine Mile Road (Southern Escambia County) in the A) Surficial Zone, B) Main Producing Zone, and C) Deep Main Producing Zone

In northern Escambia County, where low permeability zones in the sand-and-gravel aquifer are not as leaky, there is greater difference in measured water levels between the surficial zone and the underlying main producing zone. The water levels in the deeper part of the main producing zone at the Oak Gove site are a subdued reflection of the water levels in the surficial zone.

Leakage from the surficial zone to the underlying main producing zone is less in the northern part of the county. A slight declining trend in water levels is observed in the hydrographs for wells at the Oak Grove site between the mid-1980s and 2000. The hydrographs also show dips in water levels associated with drought conditions during 2000-2001, 2006-2007, and 2011-2012, and increasing levels since 2012. Analyses of long-term trends indicate small but significant declining water level trends in all hydrostratigraphic zones since the 1980s at the Oak Grove site. Although there is much less groundwater development in northern Escambia County, water levels should continue to be monitored as projected increases in agriculture water use in this area may increase the use of the aquifer.

It is expected southern Escambia County will continue to provide most of the groundwater used in this region during the 2025 to 2045 planning period. In southern Escambia County, the main producing zone is less confined by the low permeability zone creating a smaller head gradient between aquifer zones and allowing more recharge to the main producing zone. Large fluctuations in water levels are observed in the Nine Mile Road wells due to the site's location near the groundwater high of the southern-county recharge area and its proximity to several large supply wells. Water level trends like those observed in the northern half of the county are observed in the main producing zone at the Nine Mile Road site. However, trend analysis of the surficial zone shows an increase in water levels over the same period. The divergence of the Nine Mile Road hydrographs between the surficial zone and main producing zone, identified during the 2013 WSA update, continues to persist and suggests that development of groundwater in southern Escambia County has depressed the potentiometric surface of the main producing zone.

Additional long-term trends can be seen in the hydrographs below (Figure 2-13) for a well in Pensacola (USGS TH2, NWF_ID 2570) and a well near Beulah (USGS 032-7241A, NWF_ID 3473). Overall, the long-term fluctuation of water levels in these two wells appears to be primarily related to rainfall variations. Both hydrographs depict an increasing trend between 1975 and 1980. A regional drought between 1980 and 1983 caused groundwater levels to drop between five and seven feet. The hydrographs show recovering water levels throughout the rest of the decade as above normal rainfall occurred.

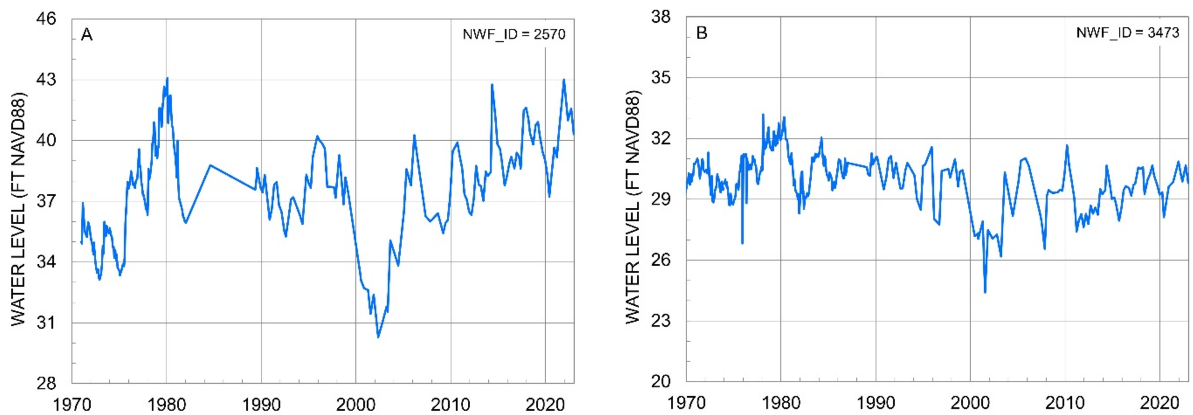


Figure 2-13. Hydrographs of Sand-and-Gravel Wells: A) USGU TH2 and B) USGS 032-7241A

Through most of the 1990s, alternating wet and dry years resulted in modest variations in water levels, with a slight negative trend through the decade. The effects of the 2000-2001 drought can be seen in the hydrographs. Although normal rainfall returned in mid-2001, groundwater levels continued to drop as infiltrating groundwater had yet to reach the water table. By late 2002, groundwater levels had dropped about 7 feet from 1999 levels. Since 2002, water levels have responded to three drought periods of varying severity, each time rebounding with the return of above average rainfall. Period-of-record trend analyses of water levels for these wells indicate no significant trend for the well in Pensacola and a slight negative trend for the well near Beulah.

In 2020, withdrawals from the sand-and-gravel aquifer were estimated at approximately 77.1 mgd. This is almost 7 mgd more than the 2015 demand estimate reported in the previous WSA. This increased use was primarily in the public supply and ICI categories. At this pumping level, most impacts to the potentiometric surface of the main producing zone are limited due to well spacing and the substantial aquifer recharge rate.

Localized impacts occur in areas of concentrated withdrawals in the southern half of Region I. These areas include Cantonment, areas adjacent to the Escambia River southeast of Cantonment, and areas adjacent to Pensacola Bay in Warrington. Pumpage effects on water levels in the northern half of the region are significantly less due to limited pumping in that area. Water levels below zero ft NAVD88 have been periodically measured adjacent to the Escambia River near the Gulf Clean Energy Center (formerly Crist Plant) and Ascend Performance Materials facility, and along Pensacola Bay in Warrington. Depressed water levels have been observed in these areas since the 1970s. These drawdowns are of concern due to their proximity to the saltwater interface, as discussed below. Water level and water quality monitoring are typically required of permitted users in these areas.

Most sand-and-gravel aquifer levels within Region I fluctuate primarily in response to rainfall, which can be observed from hydrographs for the drought periods of 2000-2002, 2006-2007, and 2011, and the period of above-average rainfall that extended from late 2013 through 2022. Appendix 6 provides the results of groundwater level trend analyses for sites having at least 20 years of record and recent data (2018 or later). Depending on the site, trend analyses may include an assessment of period of record linear monotonic trends, period of record nonlinear monotonic trends, or step trends. If groundwater levels are significantly correlated with antecedent rainfall, an assessment of trends may be performed on the rainfall-adjusted groundwater level residuals. The methods used to perform trend analyses are detailed in Appendix 1.

Groundwater Budget

The regional groundwater budget includes the major inflows (e.g., recharge) and outflows (e.g., pumping and baseflow to surface features) to the sand-and-gravel aquifer. Vecchioli et al. (1990) calculated the average total recharge to the sand-and-gravel aquifer (including the surficial zone) for select sites in nearby Okaloosa County and portions of Santa Rosa and Walton counties to be approximately 20 in/yr. This recharge rate can generally be applied to Region I, based on the similarity of topography and the sand-and-gravel aquifer between regions.

Given an estimated recharge rate of 20 in/yr to the entire aquifer within Escambia County, the 2020 groundwater withdrawals of 77.1 mgd represent approximately 12 percent of the total sand-and-gravel aquifer water budget (629.4 mgd). The projected 2045 groundwater demand (91 mgd) represents about 14.5 percent of the total sand-and-gravel aquifer water budget. The 2045 demand for a 1-in-10-year drought event represents approximately 15 percent of the total groundwater budget. Given the close hydraulic connection between the sand-and-gravel aquifer and surface waters, long-term groundwater withdrawals are expected to reduce discharge to surface waters by an amount somewhat less than the amount withdrawn (Barlow and Leake, 2012).

The Escambia and Perdido rivers have relatively large flows and are not likely to be adversely impacted by relatively small changes in baseflow even under low flow conditions. The Q_{90} flow is the low flow exceeded 90 percent of the time for the period of record. The median flow and the Q_{90} flow in the Escambia River near Molino are estimated to be 4,780 cfs (3,089 mgd) and 2,160 cfs (1,396 mgd), respectively, for the 1983-2022 period of record. The median flow and the Q_{90} flow in the Perdido River at Barrineau Park are estimated to be 506 cfs (327 mgd) and 284 cfs (184 mgd), respectively, for the 1941-2022 period of record. Relatively small changes in discharge to coastal bays are also not likely to have an adverse impact.

Given the relative magnitude of projected 2045 demands compared to the groundwater budget for the entire sand-and-gravel aquifer in Region I, significant regional impacts to water resources and related natural systems due to groundwater withdrawals are not anticipated.

Water Quality Constraints on Availability

Groundwater from the sand-and-gravel aquifer has a low mineral content and is suitable for all uses. However, water quality constrains the availability of water from the sand-and-gravel aquifer in localized areas. The high permeability of the sand-and-gravel aquifer, which contributes to the high groundwater availability, also facilitates the movement of contaminants. The sand-and-gravel aquifer is highly susceptible to contamination from surface spills and waste disposal practices. Because the main-producing zone is readily recharged by leakage from the surficial zone, contamination has spread to the main-producing zone (Roaza et al., 1991). Numerous public supply wells in the region have documented the presence of chlorinated solvent, petroleum hydrocarbon, and pesticide contamination (Ma et al., 1999). Water from these wells is treated to remove these contaminants before being introduced into the water distribution systems.

The District, ECUA, and other local utilities have worked together to limit future contamination of public supply wells (Richards et al., 1997). Wellhead protection areas (WHPA) have been incorporated into the Escambia County Land Development Code. The WHPAs are based on the regional groundwater flow model (Roaza et al., 1993) with updates to the model completed by ECUA. This updated model is being used for the delineation of WHPAs for current (and future) public supply wells as well as for the evaluation of potential saltwater intrusion and wetland impacts of pumping from the proposed ECUA Central wellfield. Much of this ongoing effort is supported with new and existing data provided by the District.

The potential for saltwater intrusion constrains pumping near saline surface waterbodies since withdrawals in the coastal fringe can induce the movement of saltwater towards these wells. Hydraulic heads in the main producing zone of the sand-and-gravel aquifer in southern Escambia County are 50 to 60 ft NAVD88 (Figure 2-11). This positive head gradient holds the saltwater interface just beyond the coastline beneath the bay system. Locating major supply wells away from coastal areas has prevented saltwater from migrating inland. However, the fresh water within the sand-and-gravel aquifer is in close hydraulic connection with saltwater beneath the coastal bays and estuaries.

An indication of saltwater intrusion can be seen in water quality data from a public supply well (NWF_ID 1660) located approximately 2,000 ft from Pensacola Bay in Warrington. Water levels averaged between -6 and -14 ft NAVD88 between July 2003 and July 2009. During this time, the annual average daily pumping rate for this well was approximately 0.5 mgd. Water quality data indicate that sodium, chloride, and total dissolved solids concentrations more than doubled between 2003 and 2011 (Figure 2-14).

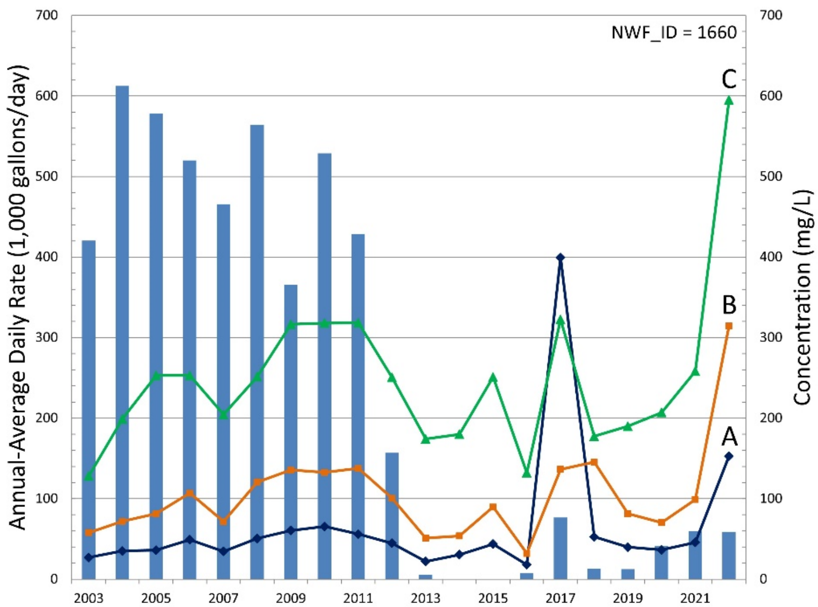


Figure 2-14. Peoples #4 Water Quality A) Sodium (Na^+), B) Chloride (Cl^-), and C) TDS

Since 2011, use of this well has decreased. In 2013, the annual average daily pumping rate was about 5,644 gallons per day. Records also show that no pumping was reported for this well in 2014 or 2015. An increase in use during 2017 produced a commensurate increase in saline indicators. Water levels currently average -2 ft NAVD88 and water quality is limiting the use of this well.

Surface Water Resources

Surface water in Region I is used primarily for industrial use and as cooling water for power production. The primary sources used are the Escambia River and Governor's Bayou.

The Escambia River is 240 miles long and has its headwaters in Alabama. The watershed area is 4,233 mi^2 (Fernald and Purdum, 1998). Near the Town of Century, the median streamflow is 3,630 cfs (2,346 mgd), based on 88 years of data from the USGS. The low flow (Q_{90}) for the same period is 1,290 cfs (834 mgd). The USGS gauging station further south near Molino has data from 1983 through 2022. The median and Q_{90} flows estimated for this site are 4,780 cfs (3,089 mgd) and 2,160 cfs (1,396 mgd), respectively. Thus, the median flow for the Escambia River increases by 1,150 cfs (743 mgd) between these two sites. From 2019 through 2021 annual precipitation totals increased from 55 in/yr (below average) to 85 in/yr (above average) resulting in increased surface water runoff and groundwater baseflow contributions to the Escambia River in recent years.

Governor's Bayou, a source of water for power generation, is located just north of the Gulf Clean Energy Center, approximately seven miles south of the Molino gage site. The bayou is formed by a diversion from the Escambia River that rejoins the main channel further downstream.

Surface Water Assessment Criteria

The primary assessment criterion for surface water availability is the sustainability of surface water resources and associated natural systems.

Impacts to Surface Water Resources and Related Natural Systems

Although approximately 195 mgd of surface water was withdrawn from the Escambia River and Governor's Bayou for industrial use and power production in 2020, only about 5.92 mgd was consumptively used. The remainder was returned to its source. This consumption represents only 0.4 percent of the Q_{90} flow at the Molino gage. The projected 2045 consumptive surface water withdrawals from the Escambia River represent 0.5% of the Q_{90} flow at the Molino gage.

Water Quality Constraints on Availability

Surface water quality is suitable for all intended uses and there are no current water quality constraints.

Alternative Water Supply and Conservation

The primary non-traditional source of water in Region I is reclaimed water. District support to water supply development projects have contributed to water conservation, leak detection, water use efficiencies, and expansion of reuse potential.

Water Conservation

Water conservation potential has not been estimated for Region I. District permit conditions that support water conservation measures include annual water use reporting; evaluation of water use practices to enhance water conservation and efficiency, reduce water demand and water losses; maximum water loss and residential per capita water use goals; and public education. There has been a steady decrease in the estimated gross per capita water use from the initial estimate in Region I 1995 WSA as shown in Figure 2-15. Conservation is not the only factor that affects the gross per capita water use. Factors such as climate, economic conditions, population trends, and changes in ICI or other water use can influence these values.

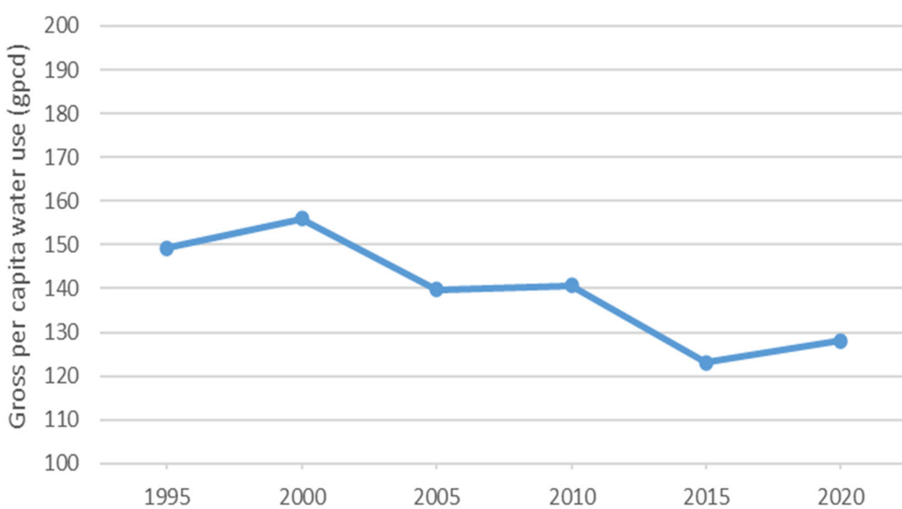


Figure 2-15. Region I Gross per capita water use

Reuse of Reclaimed Water

In 2020, within Escambia County there was 10.719 mgd of potable offset reuse or 53 percent of all wastewater treatment facility (WWTF) flows (Table 2-4). The ECUA owns and operates three large reuse systems in Escambia County. All three ECUA facilities have advanced treatment levels and disinfection levels range from basic to high. Potable offset reuse water was provided for power generation, industry, and for public access uses. The remaining wastewater flows were discharged to wetlands, rapid infiltration basins (RIBs), surface waters, and reuse at WWTFs. An ongoing Pensacola Beach WWTF reclaimed water system expansion project has an anticipated completion date of 2025. This project will support infrastructure improvements to expand access to reclaimed water for residential and commercial customers on Pensacola Beach and reduce or eliminate a discharge into Santa Rosa Sound.

Table 2-4. Region I - 2020 Reuse and Wastewater Flows (mgd)

County	Potable Offset Reuse Flow	Percent of Potable Offset Reuse to Total WWTF Flow	Total WWTF Flow	Total WWTF Capacity	Number of WWTFs	WWTFs Providing Potable Offset
Escambia	10.719	52.8%	20.283	33.775	4	2
TOTALS	**10.719**	**52.8%**	**20.283**	**33.775**	**4**	**2**

Based on population projections, additional future reuse availability is estimated to be 12.95 mgd by 2045. This additional availability added to existing 2020 potable offset reuse flows totals 23.67 mgd, or about 67 percent of the 2020 total facility capacities (Table 2-5).

Table 2-5. Region I - 2025-2045 Future Potential Reuse Availability (mgd)

County	2020 Potable Offset Reuse Flow	Future Reuse Estimated Availability					2045 Estimated Total Flow	
		2025	2030	2035	2040	2045	mgd	% of Capacity
Escambia	10.719	11.170	11.728	12.179	12.586	12.950	22.776	67.4%
TOTALS	**10.719**	**11.170**	**11.728**	**12.179**	**12.586**	**12.950**	**22.776**	**67.4%**

Future potable offset reuse assumptions are that WWTFs have treatment and disinfection levels suitable for the reuse end uses, and that transmission infrastructure is available to reuse customers.

Region I: RWSP Evaluation

The sand-and-gravel aquifer is the primary water source. Observed water level impacts and water quality issues related to groundwater pumping near Pensacola Bay are localized. The existing and reasonably anticipated water sources in Region I are considered adequate to meet the projected 2045 average and 1-in-10-year drought event demands, while sustaining water resources and related natural systems. Therefore, a regional water supply plan for Region I is not recommended.

REGION II: OKALOOSA, SANTA ROSA AND WALTON COUNTIES

Overview

At approximately 3,495 square miles in total area, Region II is the District's largest and fastest growing water supply planning region (Figure 2-16). Walton County has the fastest growing population in the District and is projected to have more than double the 2020 BEBR estimated population by the end of the planning period.

Most of the Pensacola Bay System watershed is in Region II, in addition to about half of the Choctawhatchee River and Bay watershed. Eglin Air Force Base (AFB) encompasses significant land across southern areas of all three counties.

Region II Snapshot

	2020	2045
Population	521,991	691,940
Water Use (mgd)	75.98	104.32

Primary Water Source(s):	Floridan aquifer system, sand-and-gravel aquifer
MFL Waterbodies:	None
Water Reservations:	None
RWSP Status:	Update and Continue RWSP Recommended

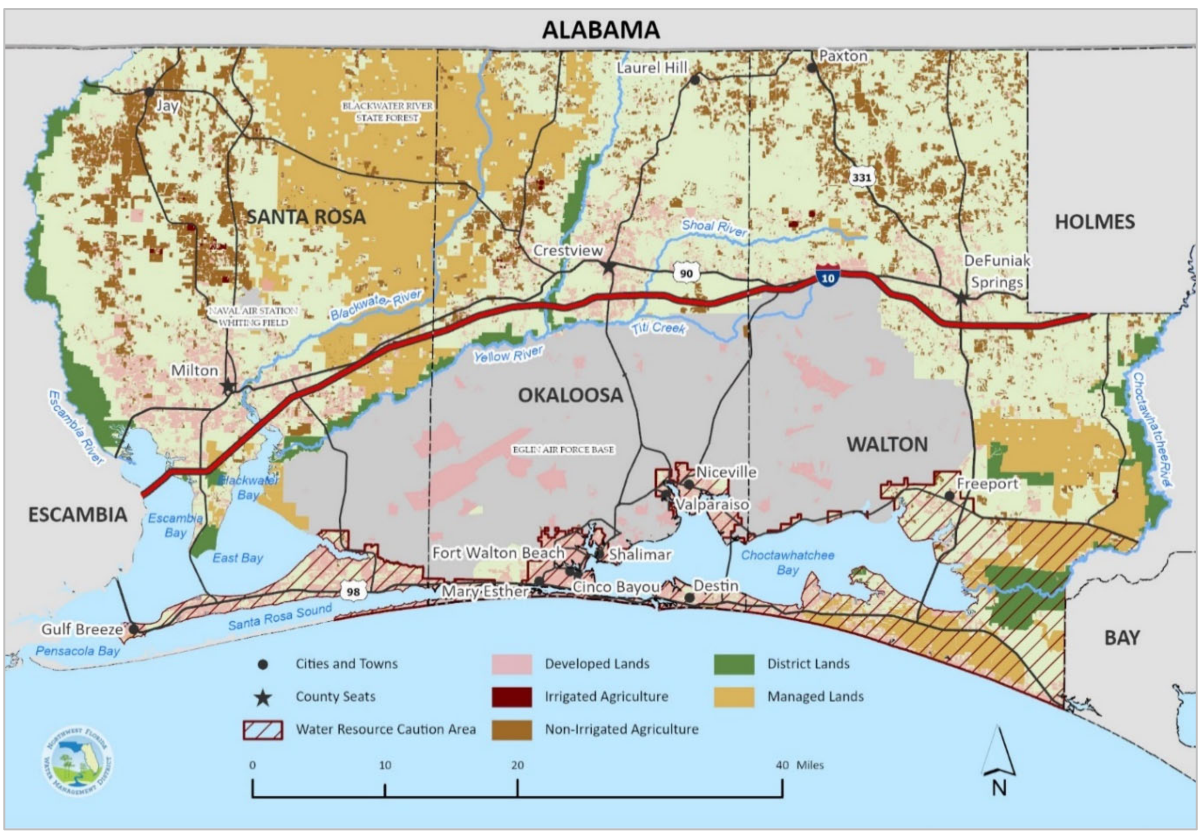


Figure 2-16. Region II – Okaloosa, Santa Rosa, and Walton Counties

Region II has several growing municipalities and unincorporated communities. Many of the coastal communities are affected by substantial seasonal populations. Expanding public water utilities include Florida Community Services Corporation of Walton County, DBA Regional Utilities; South Walton Utility

Company, Inc., in Walton County; the Chumuckla, East Milton, and Holley-Navarre water systems, Pace Water System, and Okaloosa County Water and Sewer System. A complete list of Region II public supply utilities is provided in Appendix 4. The regional population is projected to grow at an average of 1.28 percent annually over the planning period.

Public lands in Region II include large federal and military lands, as well as state-owned lands. The Blackwater River State Forest covers more than 210,000 acres in northeastern Santa Rosa and northwestern Okaloosa counties. The Gulf Islands National Seashore is on Santa Rosa Island, Santa Rosa County. Point Washington State Forest encompasses more than 15,400 acres on both sides of State Road 30A in southern Walton County. State parks in Walton County include Deer Lake, Grayton Beach, and Topsail Hill Preserve. The District manages lands adjacent to the Escambia River, Garcon Point, and Blackwater River in Santa Rosa County; the Yellow River in Santa Rosa and Okaloosa counties; and the Choctawhatchee River and Live Oak Point in Walton County.

In May 2015, Walton County adopted the Bay-Walton Sector Plan. About 12 percent of the Bay-Walton Sector Plan (13,284 acres) is in Walton County. Water use needs in that area of Walton County will likely be supplied by Regional Utilities. The plan shows potable water supplies are sufficient through 2040, but further evaluation will be needed during development of the Detailed Area Specific Plans (DSAPs) and during the District's next water supply assessment.

Population

The 2020 BEBR population estimate for Region II was 463,328. The 2020 seasonally adjusted population estimate was 521,991, reflecting a regional average seasonal rate of 20 percent. However, county average seasonal population rates in Region II range from a low of two percent in Santa Rosa County up to 49 percent in Walton County. Moreover, seasonal rates in individual water supply service areas sometimes vary considerably from the countywide average. For example, seasonal rates in Walton County service areas range from about two percent to more than 100 percent. Most seasonal residents are in coastal areas such as Destin, Navarre Beach, and in unincorporated coastal areas in Walton and Okaloosa counties. Unless noted otherwise, all population data are seasonally adjusted.

2020 Water Use Estimates and 2025-2045 Demand Projections

In 2020, Region II had more than 30 percent of the District population and accounted for an estimated 22 percent of all water use Districtwide (Table 2-6). Public supply comprised 71 percent of all water use and collectively with DSS, nearly three-fourths of all Region II water use (Figure 2-17).

Region II recreational water use was 16 percent of the regional total. Agricultural water use is relatively minor but growing in northern Santa Rosa County. There are no thermoelectric power generating facilities in Region II.

The seasonally adjusted 2020 population estimate of 521,991 is expected to climb by nearly 33 percent to 691,940 by the year 2045.

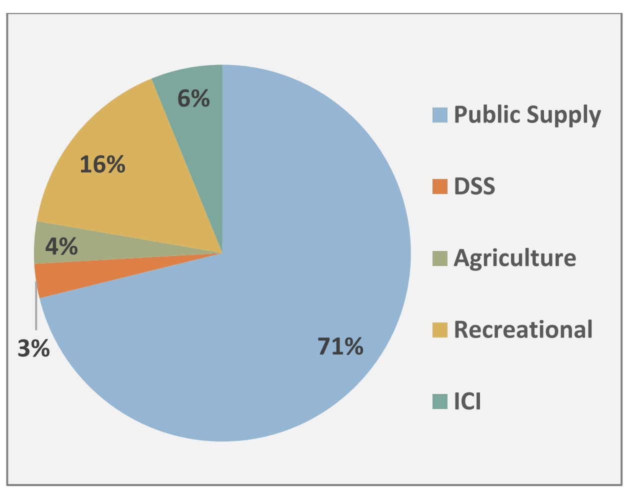


Figure 2-17. Region II - 2020 Water Use

Table 2-6. Region II - 2020 Water Use (mgd) and Population Estimates

County	Public Supply	DSS	Agriculture	Recreation	ICI	Power	TOTAL	BEBR Population	Adjusted Population
Okaloosa	24.103	0.888	0.408	5.453	1.671	-	32.523	203,951	222,307
Santa Rosa	18.391	0.753	1.894	2.208	2.925	-	26.172	184,653	188,346
Walton	11.675	0.425	0.613	4.483	0.094	-	17.290	74,724	111,339
TOTALS	**54.169**	**2.065**	**2.915**	**12.144**	**4.690**	**-**	**75.984**	**463,328**	**521,991**
% of total*	71.3%	2.7%	3.8%	16.0%	6.2%	0%	100%	31.1%	32.7%

*Percent per water use category in this region, and percent of Districtwide population.

Water demand is projected to increase by 37.3 percent over the planning period (Table 2-7). The largest percentage increase in water demand is projected in the agricultural water use category, followed by recreation and public supply. The largest total water use increase of 20.73 mgd, 73 percent of total increases over the planning period, is in the public supply category. In total, the share of Region II water use to Districtwide total is expected to increase from 22 percent to 27 percent by 2045.

Table 2-7. Region II - 2020 Estimated Water Use and 2025-2045 Demand Projections (mgd) - Average

Use Category	Estimates	Future Demand Projections – Average Conditions					2020-2045 Change	
	2020	2025	2030	2035	2040	2045	mgd	%
Public Supply	54.169	59.697	64.056	67.878	71.460	74.899	20.729	38.3%
DSS	2.065	1.798	1.739	1.618	1.461	1.270	-0.795	-38.5%
Agriculture	2.915	3.354	3.897	4.441	4.976	5.579	2.664	91.4%
Recreational	12.145	13.305	14.279	15.089	15.818	16.492	4.347	35.8%
ICI	4.690	4.993	5.553	5.867	6.067	6.067	1.377	29.4%
Power	-	-	-	-	-	-	n/a	n/a
TOTALS	**75.984**	**83.146**	**89.525**	**94.894**	**99.783**	**104.307**	**28.323**	**37.3%**

Public Supply: Walton and Santa Rosa counties are estimated to have the fastest growing populations in the District and Walton County also has the highest estimated seasonal population rate Districtwide. Projected increases in public water supply reflect these trends. Steady growth is projected regionwide and in particular in the following utility service areas: Navarre Beach, Regional Utilities, South Walton Utility Company, city of Freeport, and Inlet Beach.

DSS and Small Public Systems: Known domestic self-supplied wells are fairly evenly distributed across northern portions of Santa Rosa, Okaloosa, and Walton counties with some concentrated areas in southern portions of the counties not served by public supply. Decreases in DSS water use are likely due to population growth in and expansion of public supply service areas.

Agriculture: Agricultural water use is projected to increase, largely in Santa Rosa County, with slight increases in Walton and Okaloosa counties. Agricultural water use in Santa Rosa County is projected to increase by 2.63 mgd. This reflects a projected 2,087-acre increase in irrigated land area by 2045 with increases in production of fresh market vegetables, fruit (non-citrus), field crops and hay.

Recreation: More than half of all recreational water use Districtwide is in Region II, most of it in coastal areas. Of this 12.14 mgd, about 65 percent was reported by golf course and other recreational permittees and the remaining 35 percent was estimated from residential and other small-scale recreational irrigation wells that have GWUPs with no water use reporting requirements.

ICI: Region II has multiple large military, correctional, commercial, and industrial facilities. The Santa Rosa Energy Center in Santa Rosa County projected increasing water use associated with operational increases.

Table 2-8. Region II - 2020 Estimated Water Use and 2025-2045 Demand Projections (mgd) - Drought

Use Category	Estimates	Future Demand Projections – Average Conditions					2020-2045 Change	
	2020	2025	2030	2035	2040	2045	mgd	%
Public Supply	54.169	63.876	68.540	72.630	76.462	80.142	25.972	47.9%
DSS	2.065	1.924	1.860	1.731	1.564	1.359	(0.706)	-34.2%
Agriculture	2.915	4.100	4.897	5.711	6.507	7.345	4.430	152.0%
Recreational	12.144	17.828	19.134	20.220	21.196	22.099	9.955	82.0%
ICI	4.690	4.993	5.553	5.867	6.067	6.067	1.377	29.4%
Power	-	-	-	-	-	-	n/a	n/a
TOTALS	**75.984**	**92.721**	**99.985**	**106.159**	**111.797**	**117.012**	**41.028**	**54.0%**

Total Region II water demand is projected to be 104.3 mgd by 2045 in an average year (Table 2-7) and 117.0 mgd in a drought year event (Table 2-8), an estimated 12.2 percent increase over average conditions.

Assessment of Water Resources

The Floridan aquifer system, especially in the coastal area in Region II, has been historically affected by groundwater withdrawals from the Upper Floridan aquifer. Groundwater pumping along the coast reached its peak in 2000, causing a depression of the Upper Floridan aquifer potentiometric surface and increasing the potential to induce saltwater intrusion. Based on the results of the 1998 WSA, the District developed a RWSP for Region II (Bartel et al., 2000) that has been updated several times with the most recent update in 2019 (NWFWMD, 2020). Several water supply development projects identified in the RWSP have been implemented, reducing Upper Floridan aquifer withdrawals along the coast. Although surface water has been evaluated as an alternative water supply, it is reasonable to anticipate significant reliance on groundwater will continue through 2045. In addition to regional water supply planning efforts, a detailed assessment of the continued saltwater intrusion threat was completed in 2020 as part of a minimum flows and minimum levels (MFL) technical evaluation. The purpose of the evaluation was to determine the need to set minimum aquifer levels for the Upper Floridan aquifer along the coastal portion of Region II.

Groundwater Resources

In order of increasing depth, the primary hydrostratigraphic units that comprise the groundwater flow system within the region are the surficial aquifer system, the intermediate aquifer system/intermediate confining unit, and the Floridan aquifer system. In most of Region II, the surficial aquifer system is referred to as the sand-and-gravel aquifer. The sand-and-gravel aquifer is the primary water source for Santa Rosa County, while the Upper Floridan aquifer is the primary source for Okaloosa and Walton counties.

In 2020, groundwater from the sand-and-gravel aquifer system provided about 36 percent of the water used in the region, while the coastal Floridan aquifer provided about 20 percent, and the inland Floridan aquifer provided about 38 percent. The remaining 6 percent consisted of surface water and water from the undifferentiated surficial and intermediate aquifers.

The sand-and-gravel aquifer consists of unconsolidated quartz sand, gravel, silt, and clay ranging in thickness from less than 50 ft in Walton County to more than 400 ft in Santa Rosa County. Considerable local variation in the thickness of the sand-and-gravel aquifer occurs due to local topography and the somewhat irregular surface of the intermediate system. The sand-and-gravel aquifer exists under unconfined to semi-confined conditions. Discontinuous layers of silt and clay provide for semi-confined conditions in the lower portions of the aquifer.

Recharge to the sand-and-gravel aquifer originates as rainfall. Based on hydrograph separation techniques applied to nine streams with at least 10 years of continuous flow records, recharge in and around Okaloosa County averages approximately 20 in/yr (Vecchioli et al., 1990). Because the intermediate system acts as a confining unit, most recharge to the sand-and-gravel aquifer discharges to local streams forming the stream baseflow component. Stream baseflow in this region is substantial and generally exceeds one cfs/mi^2 (Vecchioli et al., 1990). Sand-and-gravel aquifer wells in Santa Rosa County yield as much as 1,440 gpm. East of Santa Rosa County, the sand-and-gravel aquifer is less productive and is generally used for non-potable purposes. In coastal Okaloosa County, the sand-and-gravel aquifer was evaluated as an alternative water supply with as much as 2.4 mgd potentially available within the Fort Walton Beach area (DeFosset, 2004), where the aquifer is used primarily for landscape irrigation. Current permitted water use allocations from the sand-and-gravel aquifer in this area are approximately 2.3 mgd and indicate that future demands may need to be met by alternative sources.

Where present, the intermediate confining unit restricts the vertical flow of water between the overlying sand-and-gravel aquifer and the underlying Floridan aquifer. The intermediate confining unit consists of fine-grained clastic sediments along with clayey limestone and shells, ranging in thickness from about 50 ft in northeast Walton County to greater than 800 ft in southwestern Santa Rosa County. However, sandy limestone formations of limited thickness and areal extent form the intermediate aquifer system and serve locally as a minor source of water for domestic and landscape irrigation uses. Withdrawals from the intermediate aquifer system are mostly limited to the coastal area of southeastern Walton County and well yields are quite low.

Underlying the intermediate confining unit/intermediate aquifer system, the Floridan aquifer system consists of a thick sequence of carbonate sediments of varying permeability and a regionally extensive clay confining unit. The top of the Floridan aquifer system dips from the northeast to the southwest, with the elevation of the top of the system ranging from approximately 100 ft NAVD88 to more than -1,200 ft NAVD88. In Santa Rosa County and the western and coastal portions of Okaloosa County, the Floridan aquifer system is split into the Upper and Lower Floridan aquifers by the Bucatunna Clay middle confining unit. Where present, the Bucatunna Clay is highly effective at restricting vertical flow of groundwater between the Upper and Lower Floridan aquifers.

To the east, where the Bucatunna Clay is not present, the Floridan aquifer is one hydrogeologic unit. Where the Bucatunna Clay is present, the upper Floridan aquifer thickness varies from about 50 ft in northern Santa Rosa County to more than 400 ft in southern Okaloosa and Walton counties. Where the Bucatunna Clay is absent, the Floridan aquifer reaches a total thickness of more than 700 ft. Well yields for the Floridan aquifer are highly variable; the most productive areas are the central portions of Okaloosa and Walton counties, the Midway area, and the Destin area, while poor well yields occur in the coastal fringe of Okaloosa and Walton counties.

Figure 2-18 shows the estimated Floridan aquifer potentiometric surface under September 2019 hydrologic conditions. In northwest Walton County, the potentiometric surface reaches an elevation of greater than 200 ft NAVD88. From this point, water levels decline generally to the south. Under non-pumping, pre-development conditions, groundwater flow was downgradient to discharge areas in southern Okaloosa and Walton counties, as well as to the Choctawhatchee River. Floridan aquifer water levels in the Fort Walton Beach area were historically about 50 ft NAVD88 under predevelopment conditions. A steady decline in water levels between the early 1940s and 2000 resulted in a loss of as much as 185 ft of head pressure in the Floridan aquifer along the coast. A large cone of depression in the potentiometric surface, centered in the Fort Walton Beach/Mary Esther area, is evident on the map. This changed the coast from an area of natural discharge for the Floridan aquifer to an area of induced recharge. This has created the conditions for potential saltwater intrusion along coastal Region II.

Over the last 23 years, regulatory limits on the use of the Floridan aquifer in coastal Region II and the redistribution of those withdrawals to newly developed inland wellfields have succeeded in recovering approximately 65 ft of head in the center of the cone of depression. Figure 2-18 shows water levels in the Fort Walton Beach area were between -60 and -70 ft NAVD88 under September 2019 pumping conditions. However, increased Floridan aquifer pumping around Crestview and in the central Walton County wellfield have drawn down and flattened the potentiometric surface in those areas. A small cone of depression in the Upper Floridan aquifer potentiometric surface is observed in the central Walton County wellfield area with water levels below zero ft NAVD88 recorded.

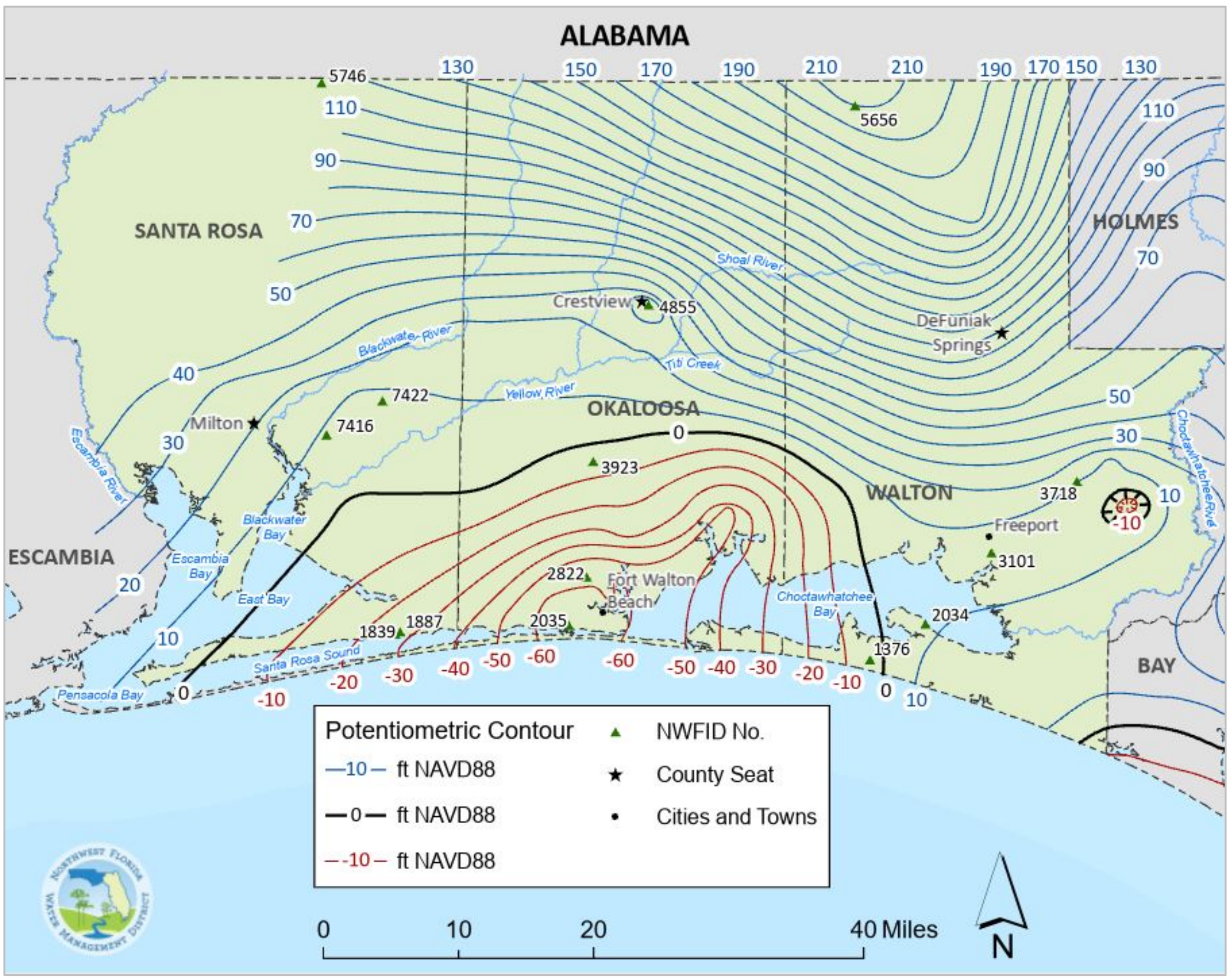


Figure 2-18. Potentiometric Surface of the Upper Floridan Aquifer in Region II for September 2019

Groundwater Assessment Criteria

Criteria used to assess impacts to the sand-and-gravel aquifer and the Floridan aquifer system included long-term depression of the potentiometric surface, trends in aquifer levels, and changes in groundwater quality.

The 1998 WSA describes the history of water supply development in Region II and the resulting impacts to water resources (Ryan et al., 1998). Since 1998, water supply initiatives implemented and led by the District and project partners have successfully stabilized and partially recovered the coastal Floridan aquifer water levels and reduced the saltwater intrusion threat to coastal Floridan aquifer wells. This includes the development of inland sand-and-gravel aquifer and Upper Floridan aquifer wellfields. Data collected since the last WSA were combined with historical data to evaluate changing trends in groundwater levels and quality. Some results of the Upper Floridan aquifer MFL technical evaluation are also presented as part of this updated assessment.

Sand-and-Gravel Aquifer

As previously discussed, the sand-and-gravel aquifer is a productive unconsolidated clastic aquifer, contiguous with land surface and includes the water table. The sand-and-gravel aquifer provided approximately 93 percent of the groundwater used in Santa Rosa County in 2020. Since 2004, Fairpoint Regional Utility System (FRUS) has been operating an inland sand-and-gravel aquifer wellfield in Santa Rosa County as an alternative water source to coastal withdrawals from the Upper Floridan aquifer. This wellfield was developed in the vicinity of East Milton. In 2020, public supply withdrawals from the FRUS wellfield averaged approximately 6.09 mgd and were provided to coastal utilities, thus reducing coastal Floridan aquifer withdrawals. East Milton Water System (EMWS) also operates public supply wells in the area and in 2020 pumped approximately 1.66 mgd from the sand-and-gravel aquifer. Except for 2015, withdrawals from the inland sand-and-gravel aquifer in the East Milton area have steadily increased between 2004 and 2020, as described below.

For all water use categories, a total of approximately 23.9 mgd was withdrawn from the sand-and-gravel aquifer in Santa Rosa County in 2020. This is an approximate 21 percent increase from the last WSA. These withdrawals took place with little impact to the water resources due to high sand-and-gravel aquifer recharge rates and adequate well spacing. No significant regional sand-and-gravel aquifer water level declines have been observed in Santa Rosa County. Hydrographs show that drawdown impacts are generally limited to the immediate vicinity of individual pumping wells and that water levels are influenced more by local recharge rates.

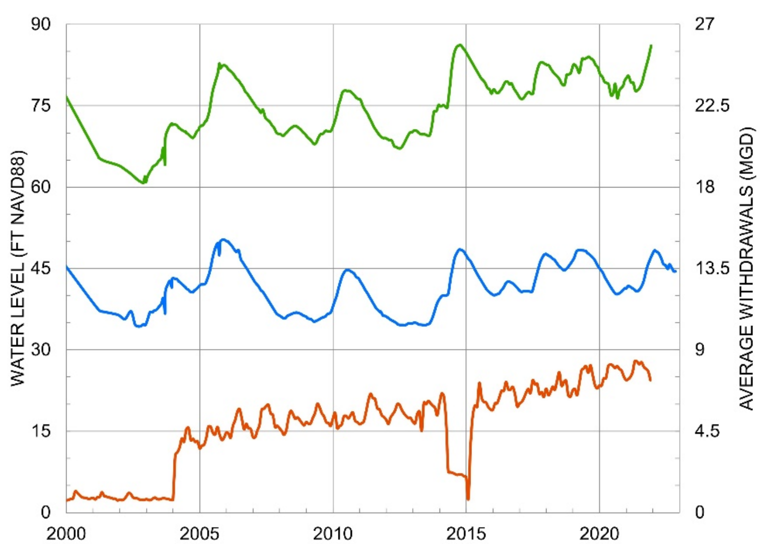


Figure 2-19. Water Levels in Sand-and-Gravel Aquifer Wells P3A (Blue) and P5A (Green) vs. Monthly Pumpage from Nearby Public Supply Wells (Orange)

The highly productive nature of the sand-and-gravel aquifer is illustrated by the hydrographs shown in Figure 2-19. The locations of these monitor wells, east of Milton in Santa Rosa County, are shown in Figure

2-18. Nine public supply wells (East Milton Water System and the FRUS wellfield) are within 2.5 miles of well P3A (NWF_ID 7416). Monitoring well P5A (NWF_ID 7422) is located approximately five miles northeast of well P3A, more than three miles from the nearest supply well, and is less influenced by pumping.

A comparison of the hydrographs for P3A, which is within the wellfield zone of influence, and P5A, outside the immediate vicinity of pumping, indicates water levels in the sand-and-gravel aquifer are more affected by variations in recharge than current pumping levels. Between 2000 and 2004, the East Milton Water System pumped approximately 0.8 mgd. During this time, the region was experiencing a drought (starting in 1999) and groundwater levels declined until late summer 2002. The water levels rose during 2003 in response to increased recharge from above average rainfall.

In February 2004, the FRUS wellfield came online and by June 2004 withdrawals from the wellfield increased to 3.8 mgd. Between 2004 and 2014 pumping steadily increased to between five and six mgd. Despite the increased pumping, water levels in well P3A fell in response to 2006-2007 and 2011-2012 drought conditions and rebounded during periods of above normal rainfall. Water levels in both P3A and P5A follow very similar trends in response to recharge and show no significant water level response to the increased pumping.

In April 2014, the water main supplying water from the FRUS inland wellfield to utilities along the coast was damaged. While the water line was being repaired, withdrawals from the FRUS wellfield area were dramatically reduced as can be seen in Figure 2-19. Water levels in the sand-and-gravel aquifer rose and fell during this time in response to rainfall recharge and appear to be little affected when regular pumping resumed in 2015. Sand-and-gravel aquifer withdrawals steadily increased to approximately 7.74 mgd in the East Milton area by the end of 2022 without the commensurate decrease in groundwater levels that might be expected if significantly influenced by pumping. The impact on coastal Floridan aquifer water levels due to the FRUS water main break is discussed below.

Floridan Aquifer System

Water levels in the coastal Floridan aquifer have shown some recovery over the past two decades due to efforts by the District and utilities to reduce withdrawals along the coast. Initiatives included the 1989 designation of coastal Santa Rosa, Okaloosa, and Walton counties as a Water Resource Caution Area (WRCA) for water use permitting. This designation, in part, prohibits new and expanded uses of the Floridan aquifer for non-potable purposes, mandates water conservation measures, and requires permittees to evaluate the feasibility of using reclaimed water. For statewide consistency and for the purposes of section 403.064, F.S., all of Region II is considered a WRCA for planning purposes only. This statute is within the jurisdiction of DEP and refers to permitting for wastewater treatment and the need for feasibility studies.

The formation of the Walton/Okaloosa/Santa Rosa Regional Utility Authority (RUA) and cooperative efforts by member utilities in all three counties have resulted in the establishment of inland wells and water transmission pipelines, moving the primary water supply sources from the coastal Floridan aquifer to the inland Floridan aquifer in Okaloosa County (2006) and Walton County (2001) and the inland sand-and-gravel aquifer in Santa Rosa County (2004). Public supply withdrawals from the Floridan aquifer on Santa Rosa Island have been eliminated. Other water supply initiatives have included development of reclaimed water systems and improved water conservation within the WRCA.

Figure 2-20 shows the effect of these initiatives on coastal Floridan aquifer withdrawals. In 1998, coastal withdrawals averaged 28 mgd and accounted for 78 percent of the estimated Floridan aquifer pumping in the region. By 2010, coastal withdrawals were reduced by 36 percent to approximately 17 mgd.

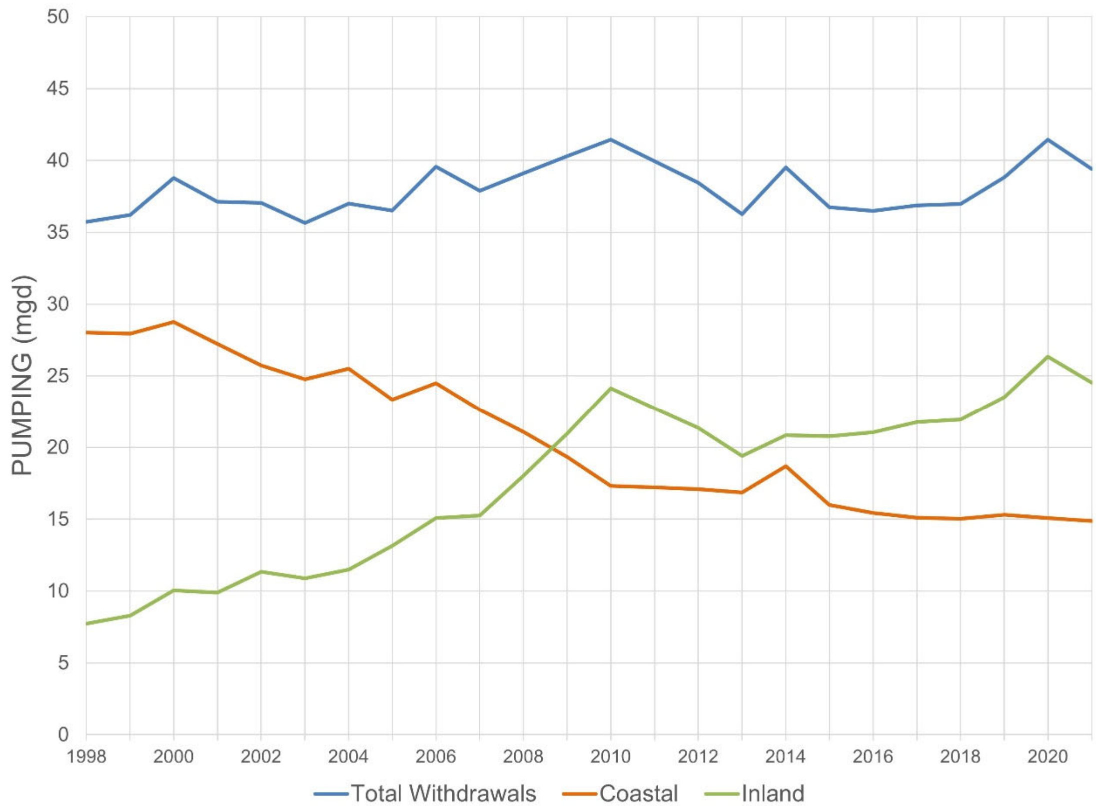


Figure 2-20. Region II Floridan aquifer pumping 1988 - 2021

Between 2010 and 2014, reductions in coastal withdrawals continued but at a slower rate. That trend was reversed in April 2014 when the disruption in water supply from the FRUS inland sand-and-gravel wellfield (described above) required a temporary increase in pumping from Floridan aquifer wells in southern Santa Rosa County to make up for lost water production. This resulted in an approximate 10 percent increase in coastal withdrawals for 2014.

By early 2015 the FRUS water main was repaired, and inland sand-and-gravel aquifer pumping resumed. Since 2015, coastal pumping has remained relatively constant with a slight decrease of 1.1 mgd through 2021. In 2020, coastal withdrawals averaged approximately 15 mgd and accounted for 34 percent of the estimated Floridan aquifer pumping in the region. Although coastal Floridan aquifer pumping has been reduced by almost half since 2000, groundwater levels are still well below zero ft NAVD88 within the cone of depression along coastal Okaloosa County (Figure 2-19). Coastal Floridan aquifer withdrawals are projected to increase approximately 5.95 mgd by 2045. These projected increases in coastal pumping are associated with utility public supply and some minor institutional use on Eglin AFB. Further reductions in coastal pumping enabled through the implementation of water conservation, reuse, and the continued development of alternative and inland water sources may prolong the usefulness of the Upper Floridan aquifer as a potable water supply. The MFL technical evaluation completed in 2020 provided an assessment of the current and future threat of saltwater intrusion and up-coning to major public supply wells along the coast in Region II. Results of the MFL evaluation are summarized later in this section.

Hydrographs from Region II show the development history of the cone of depression and the beneficial effect of reducing Floridan aquifer coastal withdrawals. The locations of the discussed hydrographs are indicated on Figure 2-19 by a point marker labeled with the District's well identifier (NWF_ID). It should be noted water level declines illustrated in hydrographs for wells located near the coast in Region II also extend over an unknown area offshore beneath the Gulf of Mexico.

Historical Floridan aquifer water level trends along coastal Santa Rosa County are represented by the hydrograph for the Navarre Cement Plant well (Figure 2-21, NWF_ID 1839) and show a significant water level decline over 30 years of groundwater development. This well was located just north of Santa Rosa Sound and was abandoned in the early 1990s. This negative trend continues through 2002 in the hydrograph for the nearby Midway #1 well (Figure 2-21, NWF_ID 1887).

Between 2002 and 2014, water levels in the Midway #1 well recovered approximately 50 ft. However, Floridan aquifer water levels rapidly declined after the FRUS water main break and sand-and-gravel aquifer supply disruption in April 2014. While the water line was being repaired, several coastal utilities temporarily increased the use of Floridan aquifer wells to ensure adequate water supply for their customers. Repairs to the water line were not completed for several months and the effects of the additional Floridan aquifer pumping can be seen on the hydrograph for Midway #1 (Figure 2-21). While the inland wellfield was offline, water levels in the Upper Floridan aquifer along the coast declined approximately 23 ft. However, once the inland wellfield was back in service and the utilities returned to normal well operation, the positive trend in water level recovery continued.

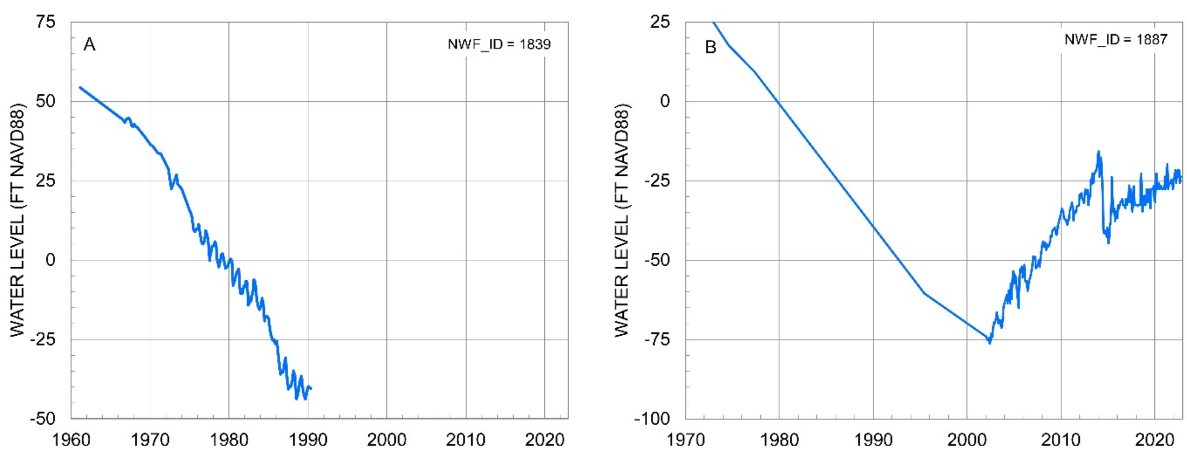


Figure 2-21. Hydrographs of the A) Navarre Cement Plant and B) Midway #1 Floridan Aquifer Wells in Southern Santa Rosa County

In Okaloosa County, hydrographs also show the mitigating effect of reduced withdrawals along the coast as Floridan aquifer pumping was moved inland. Hydrographs are presented for wells along a south to north transect from the coast to the mid-county area (Figure 2-22 and Figure 2-23). The Mary Esther #2 well (NWF_ID 2035) is located just west of Fort Walton Beach, near the center of the potentiometric surface cone of depression. Water levels have been observed in this well as low as -140 ft NAVD88 (Figure 2-22, NWF_ID 2035). However, reductions in coastal Floridan aquifer withdrawals increased water levels approximately 80 ft between 2000 to 2017. Since 2017, water levels in the Mary Esther #2 well have declined slightly but remained stable. Water levels in the Wright Upper Floridan well (Figure 2-22, NWF_ID 2822), located approximately two miles north of Fort Walton Beach, have increased about 54 ft over the same period and leveled off through 2021. The recovery of water levels in these coastal areas has reduced the rate of saltwater intrusion.

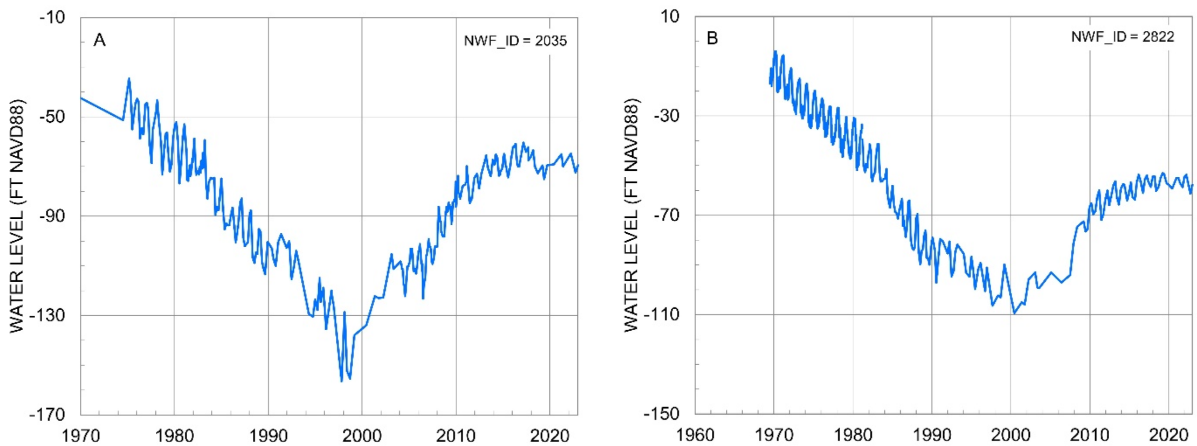


Figure 2-22. Hydrographs of the A) Mary Esther #2 and B) Wright Upper Floridan in Southern Okaloosa County

Further north, the effect of reductions in coastal Floridan aquifer pumping is lessened by the effects of increased pumping further inland. Well #2 at Field #5 on Eglin AFB (Figure 2-23, NWF_ID 3923) is located about halfway between the reduced pumping along the coast and the increased pumping in the mid-county region. Water levels have stabilized in this well and have recovered approximately 20 ft since 2009.

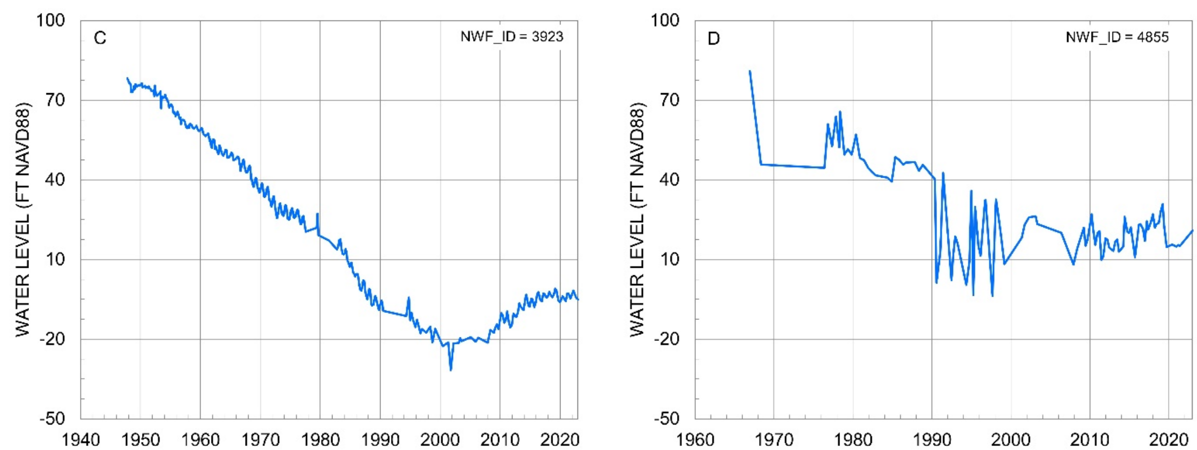


Figure 2-23. Hydrographs of the C) Eglin AFB Field #5/Well #2 and D) Crestview #4 in Central Okaloosa County

The hydrograph for the Crestview #4 well shows the slow decline in Floridan aquifer water levels in the Crestview area (Figure 2-23, NWF_ID 4855) in response to increased inland withdrawals. These declines continued through 2007 but have stabilized.

A similar shifting of impacts from coastal to inland areas is observed in Walton County. Regional Utilities has abandoned coastal Floridan aquifer wells and moved pumping north of Freeport. Destin Water Users and South Walton Utilities also obtain some of their supplies from inland wells and have reduced coastal withdrawals as required by their permits.

Hydrographs are presented for a well located less than two miles east of South Walton Utility's coastal wells (West Hewett Street, NWF_ID 1376), a well approximately five miles to the northeast along the south side of Choctawhatchee Bay (S.L. Matthews, NWF_ID 2034), a well north of Choctawhatchee Bay in

Freeport (USGS Freeport #17, NWF_ID 3101), and a monitor well at the former First American Farms (FAF #47, NWF_ID 3718) site north of Freeport (Figure 2-24). The historical loss in potentiometric head is evident in the coastal West Hewett Street and S.L. Matthews wells. These drawdowns are not as great as observed in the western part of Region II due to the thinner, leakier intermediate system along the eastern end of Choctawhatchee Bay. Since coastal Floridan aquifer pumping has been reduced, water levels in the West Hewett Street well have recovered approximately 15 ft and water levels in the S.L. Mathews well have recovered about four ft to just above zero ft NAVD88.

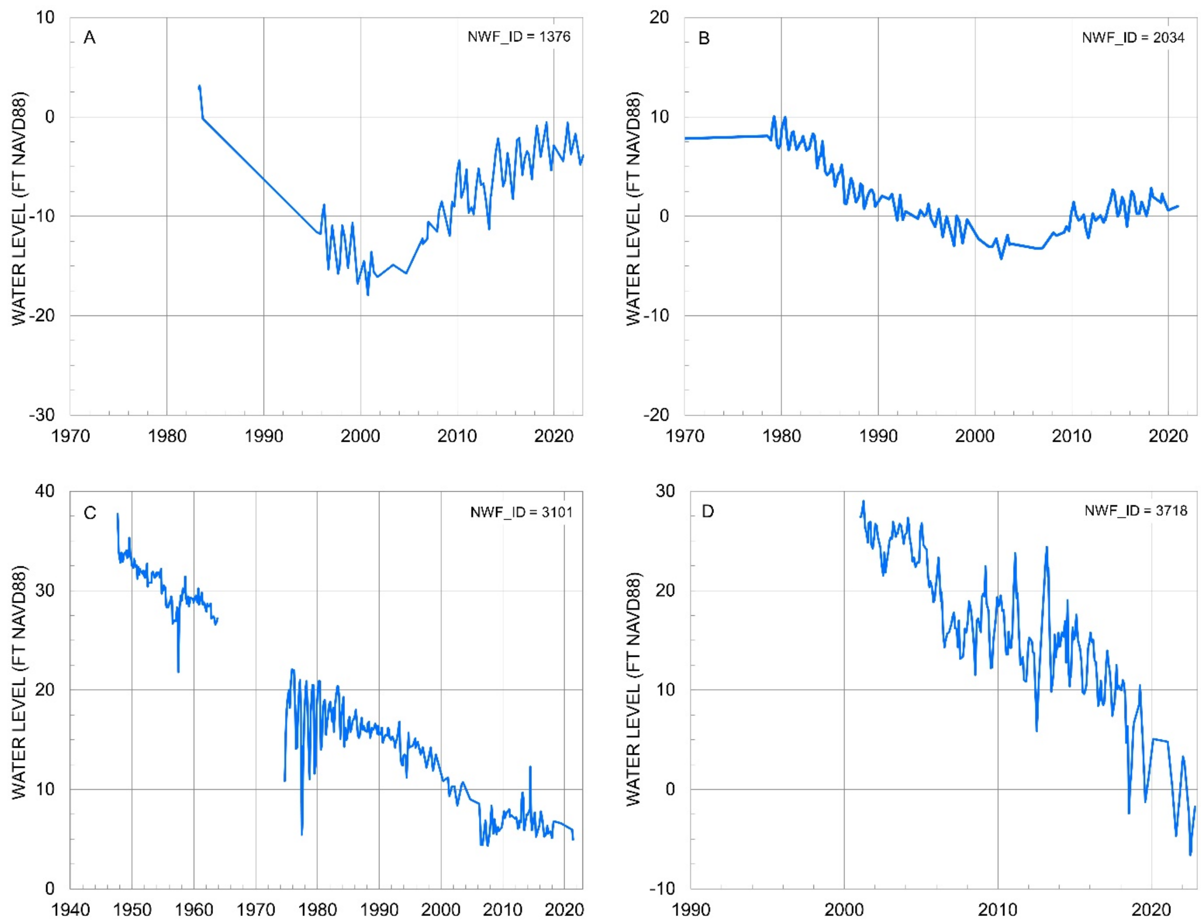


Figure 2-24. Hydrographs of the A) West Hewett Street, B) S.L. Matthews, C) USGS Freeport #17, and D) FAF #47 Floridan Aquifer Wells in Walton County

Water levels in the USGS Freeport #17 well show seasonal fluctuations in the 1960s and 1970s due to the large-scale agricultural irrigation at the former First American Farms, historically located approximately five miles to the north. The long-term decline in water levels is evident in the Freeport area. Since 1948, about 30 ft of head has been lost in the Floridan aquifer at this well location. Declines in the potentiometric surface increased between 2001 and 2007 due to increased withdrawals by Freeport and the development of the inland Floridan aquifer wellfield in 2001 at the location of the former First American Farms. Since about 2007, water levels have averaged around 7 ft NAVD88. Drawdown in the potentiometric surface around Freeport is also evident in Figure 2-24.

The FAF #47 well is located northeast of Freeport, about one mile east of the first central Walton inland wellfield wells. Between 2001 and 2017, additional public supply wells were installed to the east and the wellfield expanded to include the area around FAF #47. This hydrograph shows the effect of the inland wellfield withdrawals. Since 2000, water levels have declined approximately 30 ft and levels below zero ft NAVD88 have been reported more frequently since 2018. Water quality data and modeling results from the MFL technical evaluation indicate groundwater that exceeds drinking water standards is present in the production zone of the Upper Floridan aquifer, south of the central Walton inland wellfield area. Groundwater model simulations predict northward movement of the potable water interface due to projected increases in Upper Floridan aquifer withdrawals. The position of the potable water interface was defined as the 500 mg/L total dissolved solids iso-concentration line. However, predicted rates of movement are slow.

Along the northern boundary of Region II, far from the coast, two separate responses to historical pumping are evident in the hydrographs for the Paxton and Camp Henderson wells (Figure 2-25). The Paxton well (NWF_ID 5656) is in northernmost Walton County on the region's potentiometric high. Water levels do not appear to be significantly affected by the coastal Floridan aquifer pumping occurring approximately 40 miles to the south. In this area, recharge rates are expected to be somewhat greater than elsewhere in the region due to the intermediate system being relatively thin. This well exhibits no long-term water level declines, but short-term effects of the droughts between 1999 and 2011 are evident. Water levels have increased since the end of 2012.

In contrast, the Camp Henderson well (NWF_ID 5746), located approximately 40 miles west in northern Santa Rosa County and slightly further from the coastal pumping center, lost more than 20 ft of head between 1968 and 2013 (Figure 2-25). As is the case with the Paxton well, little pumping from the Floridan aquifer occurs in this area. Effects of coastal pumping have extended nearly 40 miles to the state line, due to the presence of a thick, effective confining unit and low rate of Floridan aquifer recharge in Santa Rosa County. Since 2013, water level drawdowns appear to have stabilized.

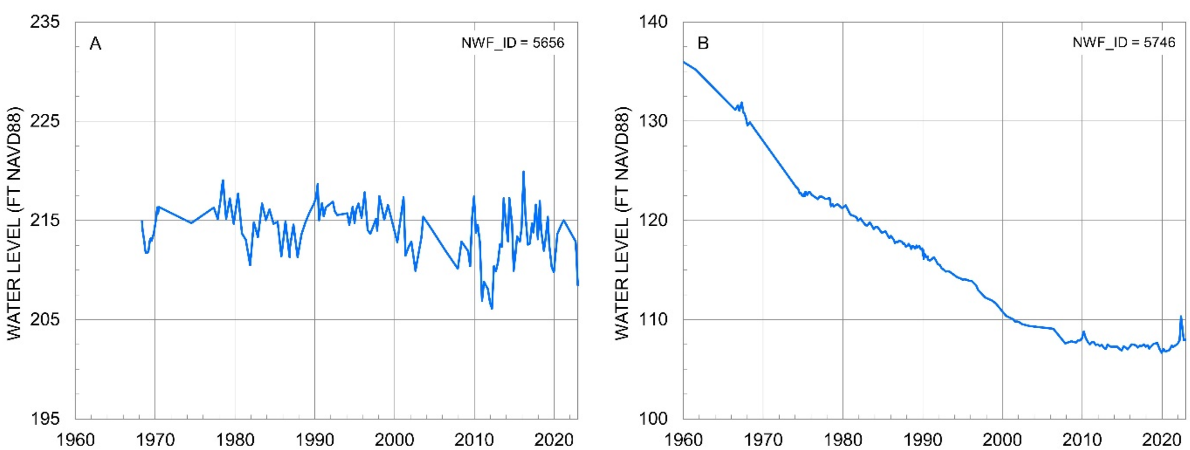


Figure 2-25. Hydrograph of the A) Paxton Floridan Aquifer Well in Northern Walton County and B) Camp Henderson Floridan Aquifer Well in Northern Santa Rosa County

Most surficial and Floridan aquifer levels within Region II fluctuate primarily in response to rainfall, which can be observed from the hydrographs for the drought periods of 2000-2002, 2006-2007, and 2011 and the period of above average rainfall, which extended from late 2013 through 2022. Appendix 6 provides the results of groundwater level trend analyses for sites having at least 20 years of record and recent data (2018 or later). Depending on the site, trend analyses may include an assessment of period of record linear monotonic trends, period of record nonlinear monotonic trends, or step trends. If groundwater levels are significantly correlated with antecedent rainfall, an assessment of trends may be performed on the rainfall-adjusted groundwater level residuals. The methods used to perform the trend analyses are detailed in Appendix 1.

Water Quality in the Floridan Aquifer

Water quality data show poor quality, non-potable water present in the Upper Floridan aquifer in southern Santa Rosa County and in south Walton County near the eastern extent of Choctawhatchee Bay (Pratt, 2001). Non-potable, saline water also occurs offshore beneath the Gulf of Mexico. Floridan aquifer water becomes increasingly mineralized to the west. Sodium and chloride concentrations exceed the drinking water standard just west of the Midway area and near Navarre Beach.

Moving east across the Santa Rosa-Okaloosa County line, the quality of water in the Floridan aquifer improves. Water quality in the Fort Walton Beach area meets drinking water standards with no increasing trends in constituents that are indicative of saltwater intrusion. Sampling from a well on Santa Rosa Island across from Fort Walton Beach indicates water quality near the center of the cone of depression has not changed in 40 years. Sodium, chloride, and total dissolved solids concentrations for samples collected in the late 1970’s averaged 126 mg/L, 64 mg/L, and 368 mg/L, respectively. Pumped sampling results from 2022 show concentrations of 123 mg/L, 62 mg/L, and 302 mg/L, respectively. In addition, discrete borehole sampling and geophysical logging performed in 2022 indicate the upper Floridan Aquifer at this location is freshwater across 324 ft of open hole with little variation in water quality.

Further east near Destin, water quality continues to be good based on sampling performed by the local utilities. The best water quality in the Floridan aquifer, along the coastal fringe, is found east of Destin in the South Walton Utility Company service area. However, immediately east of this area, the Floridan aquifer water quality deteriorates. This area of naturally occurring poor quality water is extensive, covering much of coastal Walton County near the eastern extent of Choctawhatchee Bay. The average constituent concentrations for the 1990s are representative of conditions prior to development of groundwater resources. Throughout most of eastern coastal Walton County, the quality of water withdrawn has remained stable over time. Data, beginning in the 1950s and 1960s, shows no significant change in water quality in most areas. Increasing concentrations of sodium and chloride in the Floridan aquifer are generally limited to wells located in or very near the saltwater interface in southeast Santa Rosa County and near the eastern extent of Choctawhatchee Bay.

In July 1997, a Lower Floridan aquifer monitoring well was constructed in Destin to determine the feasibility of reverse osmosis treatment of water from the lower Floridan aquifer for potable use. The well was drilled to a total depth of 1,460 ft, and water quality samples were taken from the lower Floridan aquifer at 11 intervals between 928 ft to 1,422 ft. Just below the Bucatunna Clay, a sodium concentration of 690 mg/L and a chloride concentration of 1,200 mg/L yielded a sodium/chloride ratio of 0.58, approximately that of seawater (0.55). Water in this well became progressively more mineralized with depth, but the sodium/chloride ratio remained between 0.50 and 0.71. The results of the 1997 study concluded the quality of groundwater in the Lower Floridan aquifer below the Bucatunna Clay is non-potable.

The well was subsequently back-plugged to a depth of 1,083 ft for long-term monitoring of water quality. Annual water quality monitoring between 2008 and 2022 shows pumped concentrations of sodium, chloride, and total dissolved solids have varied little from the original sampling in 1997. In August 2022, geophysical logging and discrete-interval sampling of the open borehole performed for the District revealed water quality stratification of the denser more saline water. Samples were collected at 955 ft and 1,070 ft below land surface (bls). Pumped and discrete interval sampling results are summarized in Table 2-9, below.

Table 2-9. Destin Lower Floridan Aquifer Monitoring Well Water Quality Summary

Sample type	Specific conductance (µg/L)	Sodium (mg/L)	Chloride (mg/L)	Total Dissolved Solid (mg/L)	Na/Cl ratio
1997 pumped sample	6,160	1,010	1,700	3,220	0.59
2008-2022 average pumped sample (n = 16)	6,166	1,217	1,850	3,187	0.66
Aug 2022 discrete sample - 955 ft bls	3,933	610	1,200	1,900	0.51
Aug 2022 discrete sample - 1,070 ft bls	11,748	1,900	4,200	7,500	0.45

n = number of samples averaged

The discrete sampling results provide a conceptual understanding of how water quality-based density variations are distributed within the aquifer. This understanding may guide improvements to the regional solute transport model developed to support the Region II coastal Upper Floridan minimum aquifer level evaluation and regional water supply planning.

Prior MFL Technical Evaluation Findings

To assess the continued threat of saltwater intrusion into the Upper Floridan aquifer, a technical evaluation of the position and movement of the potable water interface was conducted to assess the need to establish minimum aquifer levels along the coastal portion of Planning Region II (NWFWMD, 2022). The evaluation included a review of water level and water quality data from existing monitoring wells, expansion of monitoring well networks, construction of new monitoring wells, and enhancement of monitoring methods. More than 125 wells were included in the expanded network. Enhanced monitoring was performed at select wells to evaluate the vertical position of the saltwater interface, if present, within the well's open borehole. Geologic, hydrologic, and water quality data collected from the new and existing wells were used to improve the conceptual understanding of the groundwater resources and update regional groundwater flow and solute transport models.

Predictive simulations were performed using the groundwater flow and solute transport model to evaluate the effect of pumping on the rate and direction of saltwater movement (Tetra Tech, 2021). Public water supply wells along the coast of Region II are susceptible to saltwater intrusion through several routes: lateral movement from beneath the Gulf of Mexico, upward movement from below and around the Bucatunna Clay confining unit pinch-out zone, up-coning from deeper formations within the undifferentiated Upper Floridan, and downward leakage through the intermediate system. For the evaluation, the potable water interface as defined by state drinking water standards was used as an analog for the saltwater interface. Simulated 2015 groundwater heads and relative salinity unit concentrations were used as initial conditions. The models simulated the effects of 2020 to 2040 projected major Upper Floridan aquifer pumping in the model domain. Projected 2040 major pumping for Region II was approximately 47.5 mgd, based on projections from the 2018 WSA.

Simulated 2040 water levels for the middle of the Upper Floridan aquifer production zone showed depression centers around Fort Walton Beach and Niceville to be approximately -102 and -69 ft NAVD88, respectively, and increases in drawdown associated with inland wellfield areas. Twenty feet of additional drawdown compared to the 2015 starting conditions was simulated south of Crestview. Simulated water levels for the middle of the Lower Floridan aquifer indicate drawdowns in the vicinity of Fort Walton Beach and Niceville to be on the order of -40 ft NAVD88 in 2015 and even lower in 2040 with an expansion of the depression north and east toward towards inland areas.

Changes in total dissolved solids (TDS) concentrations were evaluated as an indication of saltwater movement. Two areas of greatest change in simulated Upper Floridan aquifer TDS concentrations were coincident with areas of large water level drawdown. Area 1 is located between Ft. Walton Beach and Niceville/Valparaiso along the Bucatunna Clay formation pinch-out zone. Area 2 is located near Freeport south of the central Walton wellfield area. Under 2040 projected pumping conditions, the predicted rate of horizontal interface movement within the middle of the Upper Floridan aquifer is approximately 54 ft/yr north toward the wellfield based on simulated TDS concentrations.

A supply well was considered at risk if groundwater exceeding water quality standards was modeled to be present in the Upper Floridan aquifer at any depth below the production interval. The secondary water quality standard of 500 mg/L TDS (Rule 62-550, Florida Administrative Code) was used as the criteria for determining which Upper Floridan aquifer supply wells were at risk from up-coning. The results indicated that 13 active public supply wells were at risk of exceeding the TDS standard under 2015 pumping conditions. Eleven of the 13 wells are located along the coast in areas previously described as being vulnerable to up-coning. These 13 wells represented approximately 4.56 mgd, or 13 percent, of the estimated 2015 major withdrawals from the Upper Floridan aquifer in Region II. Although the 13 wells were identified as being at risk based on modeling results, water quality data from the wells showed the TDS drinking water standard was being met in all but one well, with no increasing trend in concentrations. By 2040, three additional supply wells were identified as being at risk due to the projected increase in pumping. These additional wells are currently meeting drinking water standards for TDS and do not exhibit increasing trends in TDS concentrations. Similar evaluations were performed to determine the number of wells at risk of up-coning and potentially exceeding sodium and chloride drinking water standards. The modeling results indicated that under 2015 pumping conditions, 12 wells were at risk from up-coning of poor-quality water and exceeding the primary drinking water standard for sodium and 25 wells were at risk of exceeding the secondary drinking water standard for chloride. Data indicate one well at risk exceeds the sodium primary drinking water standard of 160 mg/L, with a concentration of 217 mg/L, and one well currently meeting the sodium standard has an increasing trend in concentration. Data also indicate one well at risk currently exceeds the chloride secondary drinking water standard of 250 mg/L, with a concentration of 640 mg/L, and three wells currently meeting the chloride standard have increasing trends in concentrations. Both the sodium and chloride evaluations indicate one additional well to be at risk by 2040. Simulation results also indicate the wells at risk for sodium and TDS exceedances were also at risk for chloride exceedances.

Maximum movement of the 500 mg/L TDS iso-concentration line due to projected 2040 pumping is less than a mile in the vicinity of Fort Walton Beach (Area 1). The new position of the 500 mg/L TDS iso-concentration line at the end of the projected pumping simulation indicated three public supply wells, in addition to the 13 identified in 2015, would be at risk of exceeding the 500 mg/L TDS water quality standard by 2040. Under 2040 simulated pumping conditions, the 16 wells at risk represent approximately 5.15 mgd, or 11 percent, of the projected 2040 withdrawals from the Upper Floridan aquifer in Region II.

Trend analyses were performed on water quality data from 75 wells to determine if saline parameter concentrations were increasing over time. Specific conductance, sodium, chloride, and TDS data were reviewed. One-hundred eighty-one parameter datasets were selected for trend analysis with one of two statistical methods: the Mann-Kendall monotonic trend test or the two-sample t-test (step trend test). One hundred sixty-two parameter datasets met the criteria for analysis by the Mann-Kendall test and 19 parameter datasets met the criteria for the two-sample t-test. Of the 181 tests run, 46 showed significant increasing trends in saline parameters, 34 showed significant decreasing trends, and 102 showed no trends. Spatial patterns in significant trends were observed along the pinch-out zone of the Bucatunna Clay confining unit. Increasing and decreasing trends appear randomly interspersed landward of the coast where the Bucatunna Clay is present and increasing trends dominate in the vicinity of Niceville where the Bucatunna Clay is absent. This may be due to the lack of underlying confinement which separates the Upper Floridan aquifer from the Lower Floridan aquifer and the potential for up-coning of poorer quality water from below the water supply production zone.

Due largely to the slow rate of movement of the potable interface and relatively localized areas with increasing trends in saline indicators, the establishment of minimum aquifer levels for the Upper Floridan aquifer along the coast of Region II was not recommended. It is anticipated that the groundwater flow and solute transport modeling simulations will be refined using the projected 2045 water demands as part of the Region II Regional Water Supply Plan update in 2024.

Groundwater Budget

To further assess withdrawals from the Upper Floridan aquifer, groundwater budgets were prepared using the results from the numerical modeling performed as part of the MFL technical evaluation. Simulated flows under projected 2020 and 2040 major pumping conditions, as estimated in the 2018 WSA, were used to evaluate the impact of increased and redistributed pumping on the regional water budget. The water budget presents an order-of-magnitude approximation of the major inputs to and discharges from the Floridan aquifer system in Santa Rosa, Okaloosa, and Walton counties. At the time of the MFL technical evaluation, the actual 2020 water use from the Floridan aquifer in Region II was unknown and estimated to be approximately 39.2 mgd. Since then, actual 2020 water use has been refined to be approximately 44.1 mgd with similar spatial distribution. Potential impacts to the regional water budget are expected to be comparable. Figure 2-26 presents the simulated 2020 water budget broken out by components.

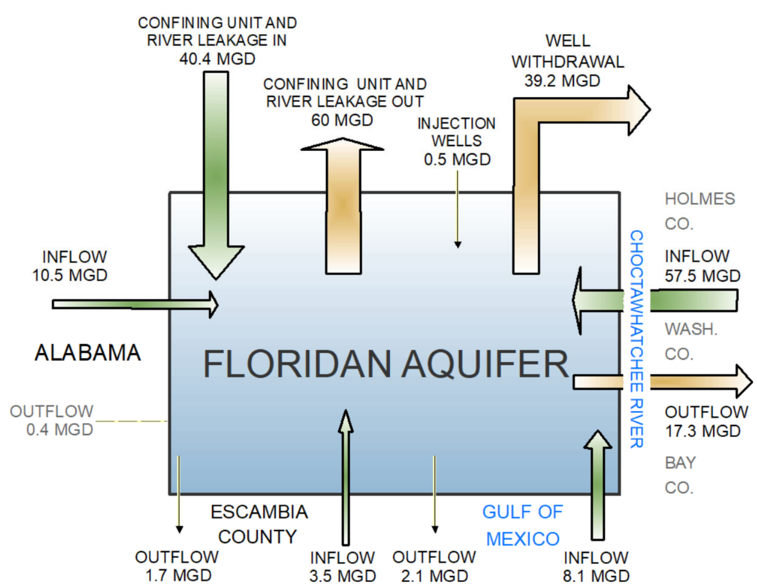


Figure 2-26. Simulated Region II Floridan Aquifer Groundwater Budget for 2020

The largest simulated inflow component to the Floridan aquifer is approximately 57.5 mgd of subsurface flow from the regions to the east. The largest simulated outflow component from the Floridan aquifer is approximately 60 mgd of combined leakage upward through the intermediate confining unit (7.8 mgd) and baseflow to the Choctawhatchee River (52.2 mgd). Except for leakage to the Choctawhatchee River, there is net inflow to the Upper Floridan aquifer within the region for all other non-pumping, water budget components. The water budget shows the simulated 2020 Region II Upper Floridan aquifer withdrawals of 39.2 mgd represent approximately 33 percent of all inflows. The projected 2040 pumpage from the 2018 WSA was estimated to be 47.4 mgd and represents 38 percent of the simulated water budget inflows. The simulated increase in pumping from the Upper Floridan aquifer resulted in an associated increase in induced flow into the aquifer and reduction in outflow from the aquifer for all components. The largest simulated increase in inflow to the aquifer in the region between 2020 and 2040 was approximately 1.9 mgd of induced leakage from the Choctawhatchee River. The largest simulated reduction in outflow from the aquifer in the region was approximately 1.2 mgd of baseflow to the Choctawhatchee River. Simulated changes in flow modeled as part of the MFL technical evaluation make conceptual sense as a larger percentage of future regional Upper Floridan aquifer pumping is anticipated to be coming from the central Walton County wellfield area closer to the Choctawhatchee River. Increases in these water budget components suggest an increased risk of saltwater intrusion into the production zone of the Upper Floridan aquifer.

Regional Upper Floridan aquifer pumping is projected to increase to approximately 60.8 mgd by 2045 and the net groundwater inflow into the region is anticipated to increase as well. Both the magnitude and the spatial distribution of Floridan aquifer withdrawals are important within this region. Although pumpage accounts for a relatively large fraction of the water budget, District and utility projects have successfully shifted Floridan aquifer withdrawals away from the coast and reduced the risk of saltwater intrusion. Efforts to manage groundwater withdrawals and develop alternative water sources in Region II, including conservation and reuse, will continue.

Inflow to the Floridan aquifer from beneath the Gulf of Mexico remains a concern. Simulated results based on 2018 WSA projections indicate an increase of approximately 1.2 mgd of flow from beneath the Gulf of Mexico between 2020 and 2040. Although the exact distribution of saltwater in the Floridan aquifer beneath the Gulf of Mexico is uncertain, saltwater is certainly present. The 2040 simulated inflow of 8.1 mgd from the Gulf of Mexico can potentially have a significant effect on the quality of groundwater withdrawn from the Floridan aquifer (Tetra Tech, 2021). In addition, model results show simulated leakage into the Floridan aquifer through the intermediate system may represent induced saltwater recharge. This induced recharge is due to the aquifer drawdown beneath Choctawhatchee Bay. Although the induced recharge is only a small fraction of the total leakage into the aquifer, it has the potential to degrade the quality of water being withdrawn. This issue is of greatest concern in the Choctawhatchee Bay area of Walton County where the intermediate system is leakier.

Pumpage from the sand-and-gravel aquifer in Region II totaled approximately 27.57 mgd in 2020, with approximately 24 mgd of this pumpage occurring in the northern two-thirds of Santa Rosa County. Withdrawals in this area account for nearly all the public supply and ICI water use, and most of the domestic self-supply and agricultural water use, of the sand-and-gravel aquifer in Region II. Based on a model-simulated recharge of 688 mgd in this area, the pumpage (24 mgd) represents approximately 3.5 percent of the sand-and-gravel aquifer water budget. Local streams and major rivers are the primary discharge areas for the sand-and-gravel aquifer. Other discharge components include leakage (recharge) to the underlying Floridan aquifer, pumpage, and outflow to surrounding areas such as the coastal bays.

Water Quality Constraints on Groundwater Availability

High recharge rates and the leaky nature of the sand-and-gravel aquifer make it susceptible to anthropogenic contamination that may constrain use locally or necessitate water treatment. Potential deterioration of Floridan aquifer water quality within the cone of depression constrains water availability along the coast. Water quality has very slowly degraded where the saltwater interface has been identified as a transition zone from freshwater to saltwater, including areas near Navarre Beach and Midway to the west; in the coastal area to the south of the easternmost Choctawhatchee Bay to the east; and the lower Floridan aquifer near north Fort Walton Beach where the underlying Bucatunna Clay confining unit pinches out.

As previously discussed, water quality in the Upper Florida aquifer is at continued risk for saltwater intrusion in many areas along the coast. Predictive simulations used in the MFL assessment included Floridan aquifer withdrawals of approximately 47.4 mgd by the year 2040. Based on current estimates, Upper Floridan aquifer pumping is projected to be approximately 60.8 mgd by 2045 with an additional 5.8 mgd along the coast. These projected demands will further increase the risk of up-coning and saltwater intrusion along the coast. The District will continue monitoring water quality in coastal areas. Collected data will be used to periodically update trend analyses, verify modeling results, and better understand and quantify uncertainty regarding the movement of the saltwater interface.

Surface Water Resources

Historically, surface water has not played a major water supply role in Region II. Surface water withdrawals totaled approximately 3.94 mgd in 2020 and largely reflect water withdrawn from streams and ponds for golf course and agricultural irrigation uses. Surface water withdrawals are projected to increase to approximately 5.25 mgd by 2045. At the same time, because of the Region II RWSP, surface water continues to be evaluated as a future alternative source.

Alternative Water Supply and Conservation

Non-traditional sources of water used in 2020 include reuse of reclaimed water and aquifer storage and recovery (ASR). Surface water in Okaloosa County is also under evaluation and is proposed for development as an alternative source for future uses. District support to water supply development projects have advanced water conservation efforts such as leak detection and water use efficiencies. Past projects include development of inland sources of groundwater and associated infrastructure to offset coastal pumping.

Water Conservation

Water conservation potential in Region II was previously estimated to range between 6 to 14 mgd by the year 2040 (NWFWMD 2018). Water conservation best management practices in Region II include annual water loss audits, water loss targets, leak detection programs, water meter calibration and replacement, residential water use per capita targets, conservation or inclining block rate structures, educational materials and public outreach, Florida Friendly Landscaping and irrigation efficiency ordinances, and plumbing fixture retrofits. Water conservation potential is anticipated to be re-evaluated for the 2024 Region II Regional Water Supply Plan Update. There has been a steady decrease in the estimated gross per capita water use from the initial Region II estimate in the 1995 WSA as shown in Figure 2-27. Conservation is not the only factor that affects the gross per capita water use. Factors such as climate, economic conditions, population trends, and changes in ICI or other water use categories can influence these values.

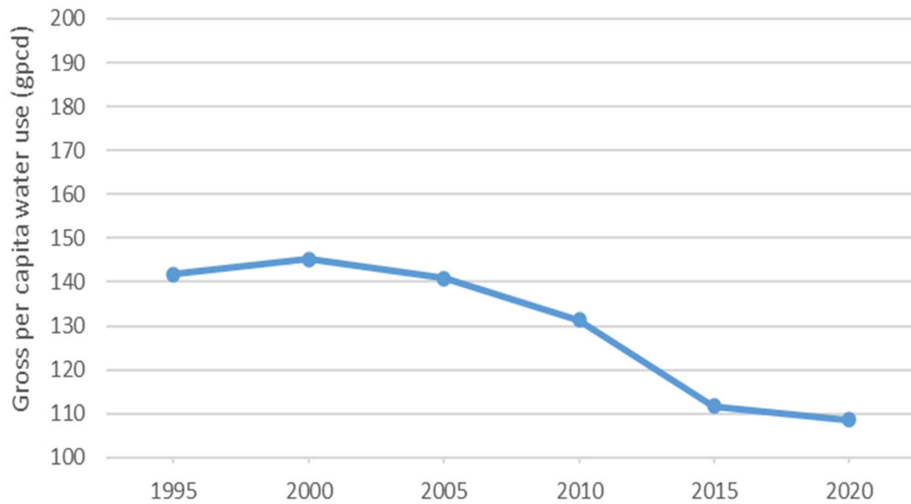


Figure 2-27. Region II Gross per capita water use

Reuse of Reclaimed Water

In 2020, Region II was utilizing 9.2 mgd of potable-offset reuse or about 32 percent of the total wastewater treatment facility (WWTF) flows of 29.3 mgd (Table 2-10). Okaloosa County and other regional utilities are major reuse contributors in Region II. All of the facilities included have secondary treatment levels except for South Walton Utility Company in Walton County, which has an advanced treatment level.

Table 2-10. Region II - 2020 Reuse and Wastewater Flows (mgd)

County	Potable Offset Reuse Flow	Percent of Potable Offset Reuse to Total WWTF Flow	Total WWTF Flow	Total WWTF Capacity	Number of WWTFs	WWTFs Providing Potable Offset
Okaloosa	3.623	22.5%	16.136	32.996	9	4
Santa Rosa	3.279	48.0%	6.826	12.610	8	3
Walton	2.341	37.0%	6.333	17.325	8	3
TOTALS	**9.243**	**31.6%**	**29.295**	**62.931**	**25**	**10**

Based on population projections, future reuse availability is estimated to be an additional 29.0 mgd by 2045 (Table 2-11). These additional flows added to existing 2020 reuse flows total 38.3 mgd, or 61 percent of the 2020 total facility capacities. Future potable offset reuse flow assumptions are that WWTF's have treatment and disinfection levels suitable for reuse and that transmission infrastructure is available to reuse customers.

The District currently manages three Alternative Water Supply projects that conserve water in Region II. The South Santa Rosa Reuse Initiative Phases I – IV, and the Pace Water System Ground Storage Tank and Booster Pump Station project. The Okaloosa County/Eglin AFB/Niceville Reclaimed Water Project was completed in the summer of 2023 and promptly initiated operations. These projects focus on the construction of reuse water infrastructure to offset the demand on potable water.

Table 2-11. Region II - 2025-2045 Future Potential Reuse Availability (mgd)

County	2020 Potable Offset Reuse Flow	Future Reuse Estimated Availability					2045 Estimated Total Flow	
		2025	2030	2035	2040	2045	Mgd	% of Capacity
Okaloosa	3.623	13.356	14.036	14.574	15.049	15.452	19.075	57.8%
Santa Rosa	3.279	4.181	4.702	5.142	5.545	5.907	9.186	72.8%
Walton	2.341	4.939	5.753	6.439	7.058	7.651	9.992	57.7%
TOTALS	**9.243**	**22.476**	**24.491**	**26.155**	**27.652**	**29.011**	**38.254**	**60.8%**

Other Alternative Water Sources

Region II has the only aquifer storage and recovery (ASR) system in the District. Destin Water Users in Okaloosa County has an IWUP with 1.06 mgd of permitted withdrawals from the surficial aquifer for landscape and recreational use, and an associated ASR injection well. Additional conservation initiatives in Region II include water supply development projects that support increased water use efficiencies. For example, the District has provided funding assistance for a Water Meter Replacement with the city of Paxton to install up to 350 water meters.

Region II: RWSP Evaluation

In summary, water demands are projected to increase by 28.32 mgd or 37.3%, from 75.98 mgd in 2020 to 104.31 mgd in 2045. The primary water sources currently are the sand-and-gravel aquifer and the Floridan aquifer system. The sand-and-gravel aquifer in Santa Rosa County is a productive aquifer system and, due to its high rate of recharge, is capable of providing regionally significant quantities of water to meet demands for a portion of the planning region. However, a significant cone of depression persists in the Upper Floridan aquifer. District and utility initiatives have successfully reduced coastal pumping in the Floridan aquifer along the coast. The reduction in Floridan aquifer pumpage has enabled water levels to partially recover and has slowed, but not eliminated, the threat of saltwater intrusion.

Projected increases in pumping may reverse the progress made during the last twenty years in slowing the rate of saltwater intrusion in the Floridan aquifer and the cone of depression could once again deepen and expand. Efforts to further stabilize or reduce coastal withdrawals and develop alternative water sources continue to be a challenge as indicated by the projected minor increase in coastal pumping by 2045. Based on these findings, existing sources of water are not anticipated to be adequate to supply water for all existing and future reasonable-beneficial uses and sustain the water resources and related natural systems through 2045. Therefore, pursuant to section 373.709, F.S., continued implementation of the Regional Water Supply Plan for Region II is recommended.

REGION III: BAY COUNTY

Overview

Region III Snapshot

	2020	2045
Population	195,339	232,512
Water Use (mgd)	65.53	50.47

Primary Water Source(s):	Deer Point Lake Reservoir, Floridan Aquifer
MFL Waterbodies:	Gainer, Sylvan, and Williford Spring Groups, Coastal Floridan Aquifer
Water Reservations:	None
RWSP Status:	No RWSP

Bay County covers approximately 1,033 square miles. The primary water sources in the region include Deer Point Lake Reservoir and the Floridan aquifer system. The District's Econfina Creek Water Management Area, which extends into Washington County in Region IV, encompasses the primary recharge area for Deer Point Lake Reservoir. The Gainer Springs Group and spring run in northern Bay County is a first magnitude spring and Outstanding Florida Spring. Region III is primarily within the St. Andrew Bay watershed. Tyndall AFB encompasses a coastal peninsula in southern Bay County (Figure 2-28).

Region III has fast growing cities and water supply service areas, e.g., Panama City Beach, Lynn Haven, and Bay County Utilities; and others such as Mexico Beach that are growing more slowly but are affected by substantial seasonal populations. Water demands through the planning period are anticipated to be met primarily by Deer Point Lake Reservoir. Groundwater resources will continue to be limited, particularly in coastal areas, where there is a risk of saltwater intrusion. The District delineated approximately the southern half of Bay County as an Area of Resource Concern (ARC), effective May 29, 2014 (Figure 2-28).

Due to concerns regarding the vulnerability of the Deer Point Lake Reservoir to storm surge, a regional water supply plan was developed for Region III in 2008 and updated in 2014. The RWSP's primary water supply development project, construction of an alternative, upstream water intake facility, has been completed. Following completion of this facility, the District Governing Board discontinued the Region III RWSP in December 2018.

May 2015, Bay County adopted the Bay-Walton Sector Plan. About 88 percent (97,233 acres) of the plan is in Bay County. To date, seven Detailed Specific Area Plans (DSAPs) have been approved, with a projected water demand of more than 5.26 mgd. The seven DSAPs include a combined total of 16,440 dwelling units, 650 hotel rooms, a hospital, golf course, commercial development, and light manufacturing. Development is ongoing for all seven DSAPs. Depending on the BEBR growth rate assumed for public supply demand and future ICI water use estimates, projected water demands for Bay County Utilities are estimated to be approximately 42.5 mgd by 2045. Surface water from the Deer Point Lake Reservoir is anticipated to remain the primary water source utilized to meet water demands for the Bay County portion of the Section Plan through the 2045 planning period.

Population

The 2020 BEBR population estimate for Bay County was 174,410. The 2020 seasonally adjusted population estimate is 195,339, reflecting an estimated seasonal population rate of 12 percent. Most seasonal populations are in Panama City Beach and in Mexico Beach.

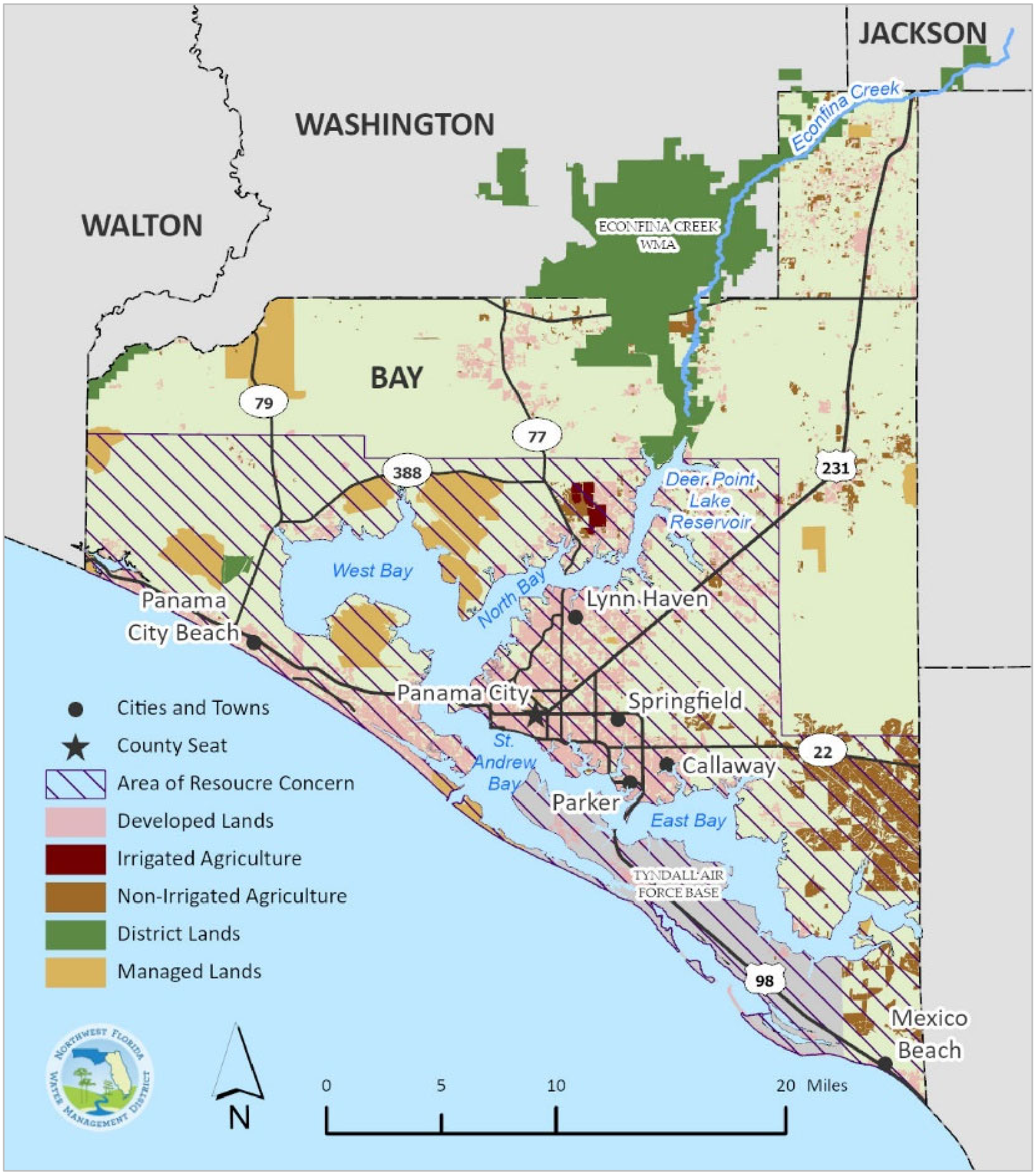


Figure 2-28. Region III - Bay County

2020 Water Use Estimates and 2025-2045 Demand Projections

In 2020, Bay County accounted for 12 percent of the District population and 19 percent of all water use Districtwide. Public supply, ICI, and power generation are the largest water use categories in Region III, and collectively represent 92 percent of all Bay County water use (Figure 2-29 and Table 2-12). Approximately 83 percent of all water used in Bay County in 2020 was supplied by the Deer Point Lake Reservoir. Other surface waters are North Bay via Alligator Bayou, which was used in power generation cooling processes and stormwater, recycling, and reclaimed water for other power operation water needs.

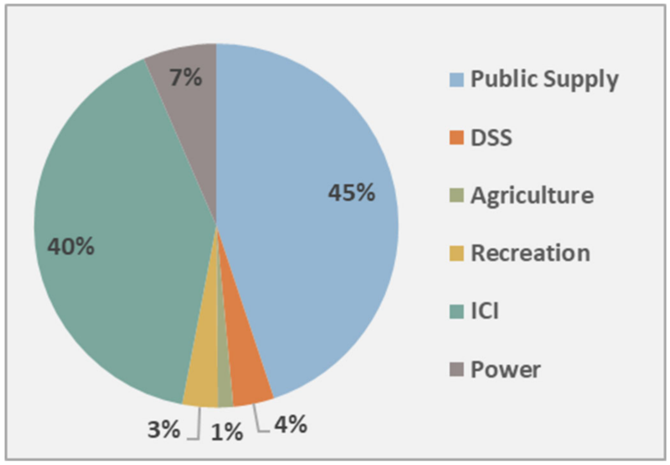


Figure 2-29. Region III – 2020 Water Use

Table 2-12. Region III - 2020 Water Use (mgd) and Population Estimates

County	Public Supply	DSS	Agriculture	Recreation	ICI	Power	TOTAL	BEBR 2020 Population	Adjusted Population
Bay	29.359	2.386	0.884	2.151	26.480	4.271	65.531	174,410	195,339
TOTALS	**29.359**	**2.386**	**0.884**	**2.151**	**26.480**	**4.271**	**65.531**	**174,410**	**195,339**
% of total*	44.8%	3.6%	1.3%	3.3%	40.4%	6.5%	100.0%	11.7%	12.2%

*Percent per water use category in this region, and percent of Districtwide population.

Projected water demands through 2045 are provided in Table 2-13. The largest increase (4.3 mgd) is projected for public supply use. Modest increases in water use are projected for recreation and power generation. A large decrease is projected in ICI due to the closure of an industrial manufacturing facility.

Table 2-13. Region III - 2020 Estimated Water Use and 2025-2045 Demand Projections (mgd) - Average

Use Category	Estimates	Future Demand Projections - Average Conditions					2020-2045 Change	
	2020	2025	2030	2035	2040	2045	mgd	%
Public Supply	29.359	30.015	31.321	32.273	33.026	33.653	4.294	14.6%
DSS	2.386	2.125	2.129	2.100	2.069	2.024	(0.362)	-15.2%
Agriculture	0.884	0.889	0.889	0.891	0.892	0.893	0.009	1.0%
Recreational	2.151	2.282	2.381	2.454	2.512	2.560	0.410	19.0%
ICI	26.480	5.116	6.103	6.111	6.619	6.538	(19.943)	-75.3%
Power	4.271	4.650	4.700	4.750	4.803	4.803	0.532	12.5%
TOTALS	**65.531**	**45.077**	**47.523**	**48.579**	**49.920**	**50.471**	**(15.060)**	**-23.0%**

Public Supply: Bay County provides surface water from the Deer Point Lake Reservoir to multiple municipal water systems, including Panama City, Panama City Beach, Lynn Haven, Mexico Beach, Springfield, and Callaway, as well as for portions of unincorporated Bay County. Lynn Haven also pumps groundwater from the Floridan aquifer. Moderate population growth is expected to continue over the planning horizon. Considerable seasonal populations in Panama City Beach and other coastal areas are also projected to continue. The highest growth rates are in Panama City Beach, Lynn Haven, and the North Bay and Lake Merial areas. Bay County's population is expected to increase by about 37,000 over the planning horizon with an estimated 95 percent of the population in public supply service areas by 2045. Additional public supply utility data are in Appendix 4.

DSS and Small Public Systems: Known domestic self-supply wells are clustered around Lynn Haven, Panama City, northern Bay County near Southport, and communities around Highway 231. Decreases in DSS water use are likely due to population growth in and expansion of public supply service areas.

Agriculture: Region III is projected to have 1,103 irrigated acres over the planning horizon for fresh-market vegetables and field crops. About 1,100 acres of sod production are expected to continue through the planning horizon.

Recreation: Sixty-five percent of Bay County's recreational water use is reported by golf course and other recreational permittees, with the remaining 35 percent estimated from residential and other small-scale recreational irrigation wells that have GWUPs with no water use reporting requirements. Most recreational irrigation uses are in coastal areas and in the Panama City metropolitan region. Both surface water and groundwater are used to meet recreation water use demands.

ICI: Large ICI water users in 2020 included WestRock paper mill, Arizona Chemical, and Tyndall Air Force Base. All three have individual water use permits for groundwater consumption and obtain surface water from Bay County via the Deer Point Lake Reservoir. Surface water meets the majority of ICI water demands, with groundwater from the Floridan aquifer accounting for 0.49 mgd in 2020. WestRock ceased operations at its Bay County plant in 2022 leading to a large projected decrease in surface water use throughout the planning horizon.

Power Generation: The primary water source for power generation is surface water, with slightly less than 1 mgd withdrawn from the Floridan aquifer in 2020. The second largest power generating facility in the District at more than 1,000 MW is Florida Power & Light's Lansing Smith Plant. Projections provided by the permittee referenced the cessation of coal operations in 2016 with slight increases in water use throughout the planning horizon.

Table 2-14. Region III - 2020 Estimated Water Use and 2025-2045 Demand Projections (mgd) - Drought

Use Category	Estimates	Future Demand Projections - Drought Year Events					2020-2045 Change	
	2020	2025	2030	2035	2040	2045	mgd	%
Public Supply	29.359	32.116	33.513	34.533	35.338	36.009	6.650	22.65%
DSS	2.386	2.274	2.278	2.247	2.214	2.166	(0.220)	(9.24%)
Agriculture	0.884	1.177	1.177	1.180	1.181	1.182	0.298	33.71%
Recreational	2.150	3.057	3.191	3.289	3.366	3.431	1.281	59.55%
ICI	26.480	5.116	6.103	6.111	6.619	6.538	(19.943)	(75.31%)
Power	4.271	4.650	4.700	4.750	4.803	4.803	0.532	12.46%
TOTALS	**65.530**	**48.391**	**50.963**	**52.109**	**53.520**	**54.128**	**(11.403)**	**(0.174)**

Due largely to WestRock paper mill ceasing operation, the total Region III average year water demand is projected to decrease from 65.53 mgd in 2020 to 50.47 mgd in 2045 (Table 2-13). The projected 2045 drought year demand is estimated to be 54.13 mgd (Table 2-14).

Assessment of Water Resources

Prior to 1961, Bay County was dependent on groundwater for potable and industrial water supplies (Ryan et al., 1998). Following the construction of Deer Point Lake Reservoir in 1961, several entities reduced groundwater pumpage and began using surface water. Additional details regarding the history of groundwater use are provided in the "Groundwater Resources" section. Surface water is the principal source of supply and is anticipated to remain so through 2045. Future groundwater availability is limited in this region. The potentiometric surface of the Floridan aquifer system continues to be below zero ft NAVD88 near the coast and as a result, the aquifer remains vulnerable to saltwater intrusion.

Surface Water Resources

The primary criterion used to assess the sustainability of surface water resources and associated natural systems was a review of trends in mean monthly baseflows and discharge that could potentially be indicative of withdrawal-related impacts.

Deer Point Reservoir is the primary source of water for Bay County. The four principal tributaries contributing to the Deer Point Lake Reservoir are Econfina, Bear, Bayou George, and Big Cedar creeks. Between 1998 and 2008, these tributaries contributed an average of 423 mgd (654 cfs) based on data collected by the District. Econfina Creek contributes approximately 60 percent of the inflow to Deer Point Lake Reservoir under average conditions and almost 80 percent under low flow conditions (Richards, 1997). The long-term flow in Econfina Creek at Highway 388 (Figure 2-30) averages 343 mgd (535 cfs) (10/1/1935 to 9/30/2021). This streamflow results, in large part, from significant Floridan aquifer inflows along middle Econfina Creek. The largest spring is the Gainer Spring Group, a first magnitude spring group with a median discharge of 107 mgd (165 cfs). An assessment of long-term trends in discharge from the Gainer Spring Group indicates a slight increase from 1962 through 2021. There are minimal groundwater withdrawals within the groundwater contribution area and the District has purchased and manages more than 41,000 acres of land along Econfina Creek and within its recharge area.

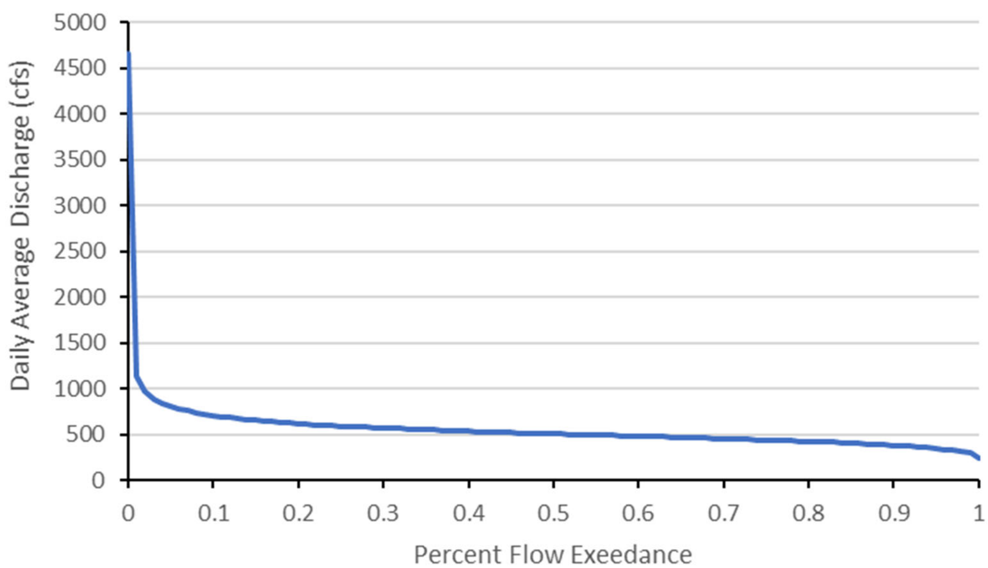


Figure 2-30. Flow Duration Curve for Econfina Creek Near Bennett, Fla. (U.S. Hwy 388)

Monthly baseflows estimated at USGS Station 02359500, Econfina Creek Near Bennett, FLA, were assessed for long-term trends. Rainfall-adjusted residuals were used in the analysis to minimize the effects of climatic variation. Residuals displayed a noticeable reduction between 2001 and 2011 during periods of several documented droughts; however, these values have largely recovered since this time. A nonlinear trend test (LOESS) showed no significant trends were observed in Econfina Creek baseflow which is consistent with the extremely low volume of groundwater being extracted in the watershed. Surface water withdrawals from Deer Point Lake are located downstream of the USGS Econfina Creek Near Bennett, FLA station and have no effects on streamflow at this location. Details on trend analyses methodology can be found in Appendix 1.

Because of the high percentage of spring inflow and the District's protection of the recharge area, discharge from Econfina Creek into Deer Point Lake Reservoir is stable. To ensure continued protection of the system, the District is developing minimum flow recommendations for Gainer, Sylvan, and Williford spring groups located along Econfina Creek. The MFLs for the District's Outstanding Florida Springs, including the Gainer Spring Group, are statutorily required to be established by July 1, 2026. The District is on schedule to meet this deadline.

The District previously performed an assessment of freshwater inflows into Deer Point Lake Reservoir and the potential impacts of reservoir withdrawals on the salinity of North Bay (Crowe et al., 2008). The study concluded that the increases in withdrawals from the reservoir up to 98 mgd and periodic drawdowns of lake levels will not adversely affect the salinity of the North Bay estuarine system. Surface water withdrawals from Deer Point Lake Reservoir were approximately 54.1 mgd in 2020 and are projected to decline to 38.7 mgd by 2045. The projected 2045 surface water demands for a 1-in-10 year drought event are 41.2 mgd. The reductions in projected surface water demand are associated with the cessation of pumpage by WestRock. The projected 2045 demands are within Bay County Utilities' allocation agreement and are consistent with the District's impact assessment (Crowe et al., 2008).

Water Quality Constraints on Surface Water Availability

Deer Point Lake Reservoir and its tributary creeks are classified as Class I Waters of the State due to their designation as the major potable water supply for Bay County. Water quality within the system has thus far been adequate for the designated uses. Past hurricane seasons highlighted concern regarding the susceptibility of the reservoir to storm surge. Based on the National Hurricane Center's Tropical Cyclone Reports, the Gulf Coast experienced a 10 to 15-foot storm surge from Hurricane Ivan (2004) and a 24 to 28-foot storm surge from Hurricane Katrina (2005). These two storms were Category 3 hurricanes at landfall. To increase the resiliency of Deer Point Lake Reservoir to withstand storm surge impacts and assure safe drinking water, Bay County completed the development of an alternative upstream water intake at Econfina Creek and associated transmission infrastructure in 2015. These efforts proved useful as Hurricane Michael produced storm surge between 17 and 19 feet above normal during October 2018. The water supply at Deer Point Lake Reservoir was not adversely impacted by Hurricane Michael storm surge.

Groundwater Resources

In order of depth, the three primary hydrostratigraphic units within Bay County are the surficial aquifer system, the intermediate aquifer system/intermediate confining unit, and the Floridan aquifer system. The surficial aquifer system consists of unconsolidated sediments and quartz sands ranging in age from Pliocene to present day (Holocene). The thickness of the surficial aquifer generally ranges between 50 ft and 150 ft (Williams and Kuniansky, 2015; Florida Geological Survey, 2016). In low-lying areas along Econfina Creek, the surficial aquifer is absent. Along the coastal fringe, the saturated thickness and permeability of the surficial aquifer are sufficient to form a locally important source of groundwater that is used to meet some water needs, particularly for non-potable uses such as landscape irrigation. Well yields range from 200 to 500 gpm. Groundwater in the surficial aquifer generally exists under unconfined conditions.

The intermediate aquifer system/intermediate confining unit consists of fine-grained low permeability sediments and functions primarily as a confining or leaky confining unit restricting vertical movement of groundwater between the surficial aquifer and Floridan aquifer system. In central and northern Bay County, the intermediate confining unit is typically 80 to 100 feet thick or less. Along Econfina Creek, the unit is thin to absent. Where sufficiently thick, permeable limestone formations serve locally as a minor aquifer for domestic and landscape irrigation supply. In coastal Bay County, the thickness can approach 200 ft or more. Well yields are on the order of 200 to 300 gpm. Although not as productive as the surficial aquifer, the intermediate aquifer system in coastal Bay County can yield significant quantities of water.

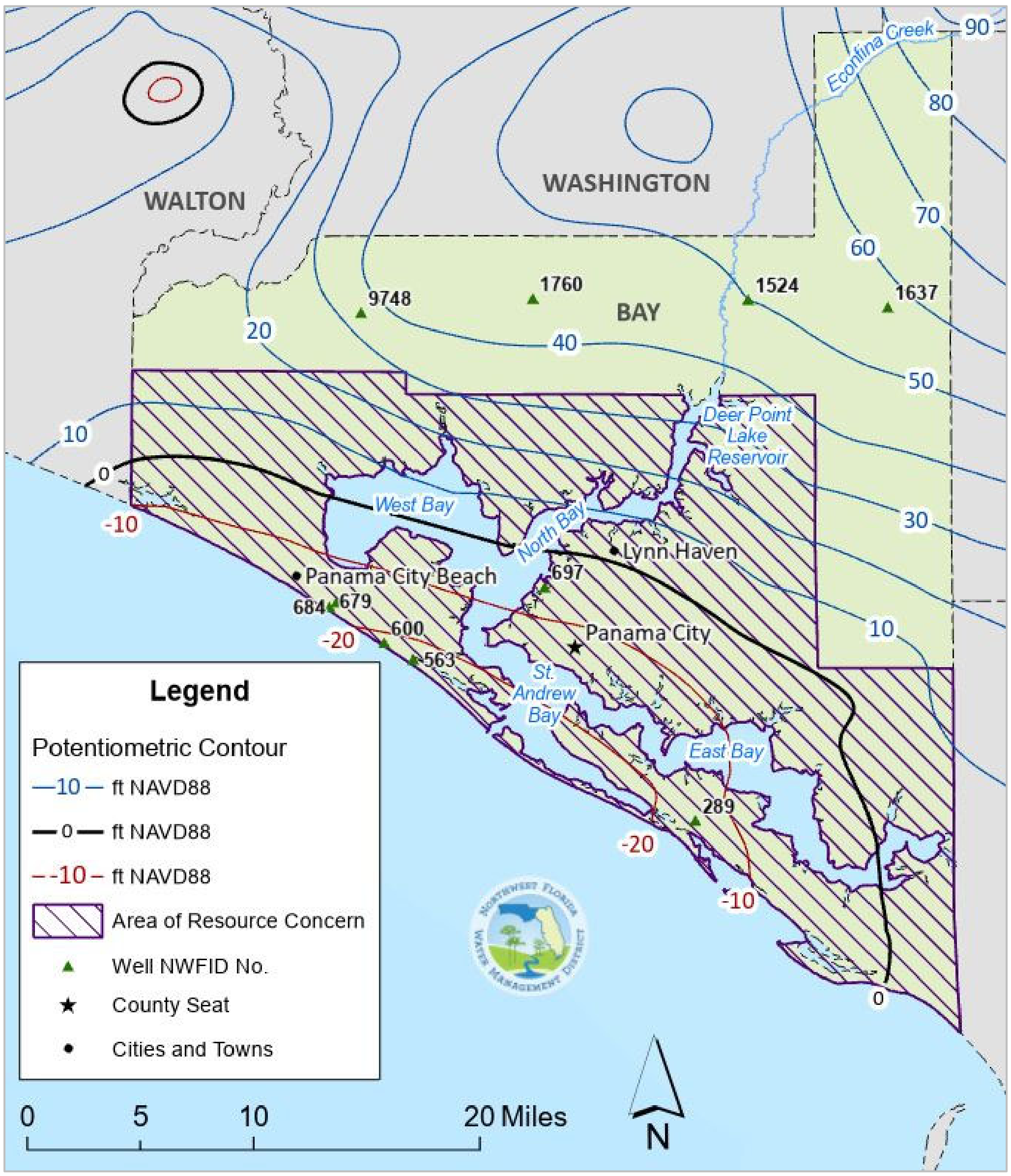


Figure 2-31. Potentiometric Surface of the Floridan Aquifer System in Bay County, September 2019

The Floridan aquifer system is the primary source of groundwater in Region III. It consists of a sequence of carbonate sediments, generally ranging in thickness from 550 to 850 ft across most of Bay County. The thickness is slightly less than 450 ft in northeast Bay County, and increases to the south, reaching a thickness of approximately 800 ft in southwestern Bay County and 1350 ft in southeastern Bay County (HydroGeoLogic, 2011, Figure 2.2). The hydraulic conductivity is quite variable. In northwest Bay County, results of aquifer performance testing were on the order of 45,000 ft^2/day and specific capacity values averaged 120 gpm/ft. This is an area that borders the Dougherty Karst groundwater region where active recharge, flow, and dissolution of the Floridan aquifer system are characteristic.

Reported Floridan aquifer transmissivities in central Bay County range from 8,333 ft^2/day near Lynn Haven to 13,333 ft^2/day several miles north of West Bay. In the southern Bay County, the hydraulic conductivity is lower, with estimated Floridan aquifer transmissivities along the coast ranging from less than 1,000 ft^2/d to 7000 ft^2/d. The southern half of Bay County is relatively removed from the active part of the flow system. This has implications for the vulnerability of the Floridan aquifer to saltwater intrusion and up-coning impacts from pumping. Being in a relatively sluggish, low-velocity part of the flow system, with a natural background of elevated sodium, chloride, and TDS concentrations, the coastal area is vulnerable to both lateral saltwater intrusion and vertical up-coning of saline water.

The Floridan aquifer system's zone of contribution for Region III extends into southern Washington and eastern Calhoun and Gulf counties (Richards, 1997). In the northeast corner of Bay County, the potentiometric surface of the Upper Floridan aquifer reaches a maximum elevation of approximately 100 ft NAVD88 (Figure 2-31). From this high point, water levels decline in all directions, with the general direction of groundwater flow being toward the south and southwest.

Assessment Criteria

The Floridan aquifer is the predominant groundwater source, with much smaller amounts pumped from the intermediate system and surficial aquifer system. Accordingly, this assessment focuses on the sustainability of the Floridan aquifer system. A review of changes in the potentiometric surface of the Floridan aquifer, and long-term trends in groundwater levels and groundwater quality were the primary criteria used to assess groundwater sustainability. Potential changes in groundwater contributions to streams (e.g., baseflow) also were assessed and are discussed under *Surface Water Resources*.

Example hydrographs are provided within this section to illustrate hydrologic conditions in various parts of Bay County. The locations of these wells are depicted on Figure 2-31, where the well Identification number (e.g., "NWF_ID") indicates the location. Most surficial and Floridan aquifer levels within Region III fluctuate primarily in response to rainfall, which can be observed during the drought periods of 2000-2002, 2006-2007, and 2011 and the period of above average rainfall that extended from late 2013 through 2022. Appendix 6 provides the results of groundwater level trend analyses for sites having at least 20 years of record and recent data (2018 or later). Depending on the site, trend analyses may include an assessment of period of record linear monotonic trends, period of record nonlinear monotonic trends, or step trends. If groundwater levels are significantly correlated with antecedent rainfall, an assessment of trends may have been performed on rainfall-adjusted groundwater level residuals. The methods used for the trend analyses are detailed in Appendix 1.

There is a long history of groundwater development in Region III, dating back to the early 1908 when the first deep well was drilled (Musgrove et al. 1965). Historically, the Floridan aquifer was the primary source of water and by 1964, withdrawals totaled 22.7 mgd (Musgrove et al. 1965). International Paper was the largest single use with pumpage totaling about 15 mgd. By 1963, water levels in the Floridan aquifer had declined by 200 ft near Panama City due to cumulative groundwater withdrawals (Musgrove et al. 1965).

In 1964, International Paper began using water from Deer Point Lake Reservoir and ceased using groundwater. By late 1967, Tyndall AFB and Panama City also began using surface water (Ryan et al., 1998). Significant recovery in Floridan aquifer levels subsequently occurred. The Tyndall AFB #10 well (Figure 2-32A) and Fannin Airport well (Figure 2-32B) depict the historically low groundwater levels of the early 1960s and the subsequent rebound in the mid-1960s following the shift from groundwater to a surface water source.

From the mid-1960s through the 1980s, withdrawals from the Floridan aquifer again increased, with much of this pumpage for public supply use in the Panama City Beach area. Data from both the St. Thomas Square well (Figure 2-32C) and the Argonaut Street 02 well (Figure 2-32D), located along the coast, show Floridan aquifer levels declined to below -80 ft NAVD88 during the late 1980s. By 1991, a large cone of depression existed in the Floridan aquifer near Panama City Beach.

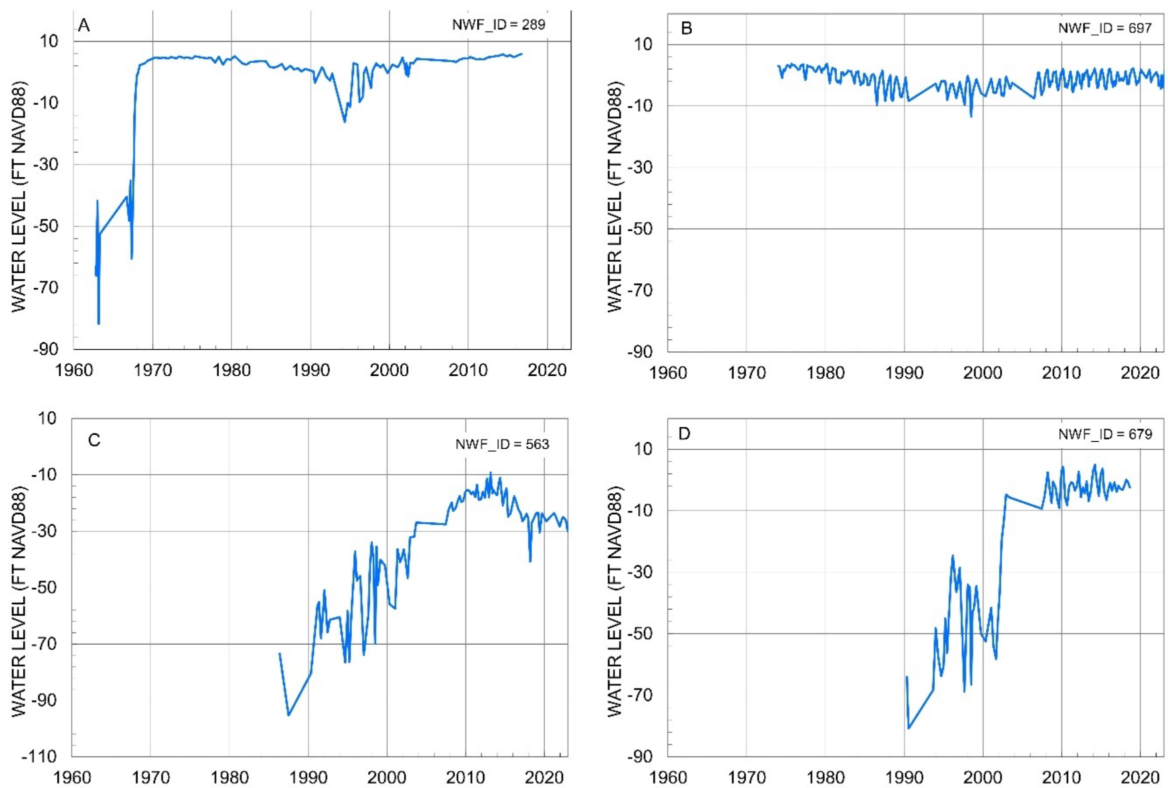


Figure 2-32. Hydrographs of the A) Tyndall AFB #10, B) Fannin Airport, C) St. Thomas Square, and D) Argonaut Street Floridan Aquifer Wells

Data from some Panama City Beach production wells exhibited increasing trends in chloride, sodium, and TDS during the mid- to late 1990s, consistent with saltwater intrusion (Figure 2-33). As part of the 1998 Water Supply Assessment, the District designated portions of northern and central coastal Bay County, including Panama City Beach, as an Area of Special Concern. The District recommended Panama City Beach utilize alternative water sources, preferably the Deer Point Lake Reservoir (Ryan et al, 1998). Between 1998 and 2001, Panama City Beach pumped between 3.3 mgd and 3.9 mgd of groundwater from the Floridan aquifer along the coast and also purchased between 8 mgd and 9 mgd of treated surface water from Bay County (NWFWMD, unpublished data).

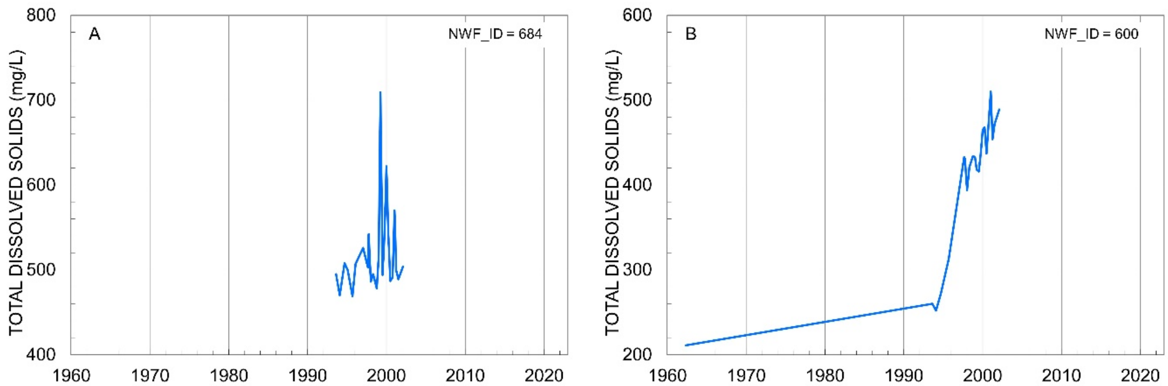


Figure 2-33. Total dissolved solids concentrations at former Panama City Beach production wells

Due to the deteriorating water quality, Panama City Beach phased out its coastal production wells and, beginning in January of 2002, relied solely on surface water purchased from Bay County. Floridan aquifer levels at the St. Thomas Square (NWF_ID 563) and Argonaut Street (NWF_ID 679) wells increased following the cessation of pumping by Panama City Beach. Aquifer levels at the St. Thomas Square well partially recovered and fluctuated between approximately -15 ft NAVD88 and -10 ft NAVD88 during 2010 to 2015. Aquifer levels have subsequently declined, and recent values are approximately -25 ft NAVD88 (Figure 2-32C). Aquifer levels at the Argonaut Street wells recovered to approximately 5 ft NAVD88 by 2010 (Figure 2-32D).

Pumpage from the Floridan aquifer for domestic self-supply, landscape irrigation, and other minor uses has continued along the coast. The District designated approximately the southern half of Bay County as an Area of Resource Concern (ARC), effective May 29, 2014 (Figure 2-31). The designation of the ARC is a regulatory designation that was incorporated into the District’s Water Use Permitting rules (Chapter 40A-2, F.A.C.). Within the Bay County ARC, the thresholds that necessitate an Individual Water Use Permit, versus a General Permit, are lower. For example, production wells within the Bay County ARC must have a diameter of less than six inches to potentially qualify for a General Permit, compared to a threshold of eight inches or less for production wells located outside the ARC in Bay County.

Total groundwater pumpage in Bay County was estimated as 8.03 mgd in 2020. Floridan aquifer pumpage was estimated to total 6.47 mgd in 2020. Of this amount, 4.46 mgd was reported pumpage associated with Individual Water Use Permits and the remainder represented estimated pumpage for domestic self-supply and other uses below reporting thresholds. The Floridan aquifer withdrawals of 6.47 mgd represents a decrease since the year 2000 when reported pumpage from the Floridan aquifer totaled 9.5 mgd. Year 2020 reported and estimated withdrawals from the intermediate system totaled 0.41 mgd and withdrawals from the surficial aquifer totaled 1.16 mgd.

Despite the reductions in pumpage from the Floridan aquifer relative to historical quantities, the potentiometric surface remains in the range of -10 to -25 ft NAVD88 near the coast. Aquifer levels are lowest near the southern Panama City Beach and the incorporated areas of Upper Grand Lagoon and Lower Grand Lagoon (Figure 2-31). Most Floridan aquifer wells in this area are used for landscape irrigation, although some water is also withdrawn for domestic self-supply, heat pump supply, and ICI uses.

Floridan aquifer levels in northeast Bay County are relatively stable and appear to primarily reflect the influence of climatic variation. Aquifer levels at the Eddie Barnes well (NWF_ID 1524) located in northern Bay County exhibit a slight decreasing trend of -0.06 ft/yr (95% CI: -0.11, -0.03), after adjusting for rainfall effects, although there is relatively little pumpage in this part of the county (Figure 2-34A). The trend may be due to the pumpage in more distant areas, uncertainties associated with the estimation of rainfall effects or other factors affecting groundwater levels. Aquifer levels at the Couch Construction well (NWF_ID 1637) located in northeast Bay County do not exhibit any long-term trends (Figure 2-34B).

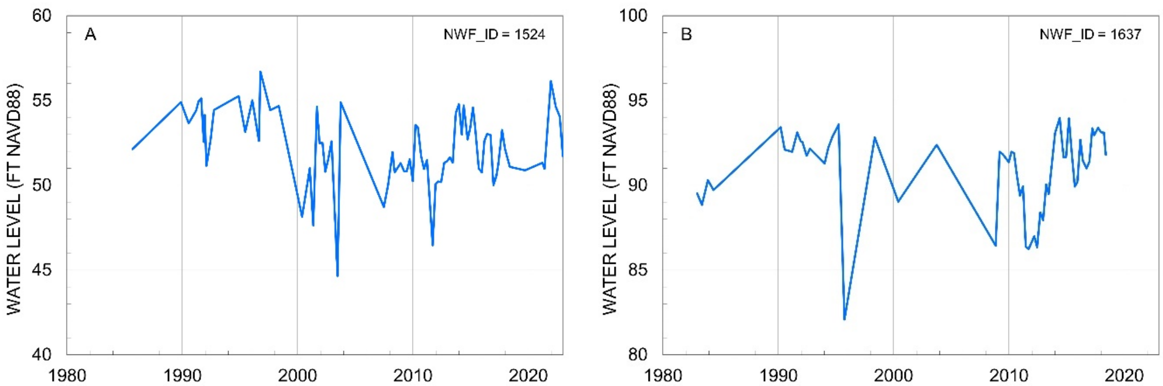


Figure 2-34. Hydrographs for A) Eddie Barns (NWF_ID 1524) and B) Couch Construction (NWF_ID 1637) wells

Water Quality Constraints on Groundwater Availability

Within northern Bay County, the quality of groundwater is suitable for most uses. However, as discussed previously, poor water quality and the continued potential for saltwater intrusion constrain the availability of the Floridan aquifer near the coast. Some production wells located in central Bay County exhibit increasing trends in some saline indicators, likely associated with site-specific variations in the pumpage rather than being indicative of larger-scale changes.

Summary of Groundwater Availability

Total groundwater use in Bay County is projected to decrease slightly from 8.03 mgd in 2020 to 7.99 mgd in 2045. The projected use of the Floridan aquifer is similarly projected to decrease slightly from 6.47 mgd in 2020 to 6.26 mg in 2045. Despite this decrease, the Floridan aquifer remains susceptible to saltwater intrusion along the coast due to the persistent cone of depression in the potentiometric surface. For this reason, the Floridan aquifer in coastal Bay County is included on the District’s MFL Priority List and Schedule. Enhanced data collection and groundwater flow and solute transport modeling are anticipated to be performed to better assess the location of freshwater-saltwater interface and the long-term risk of saltwater intrusion.

Alternative Water Supply and Conservation

Non-traditional sources of water in Region III include reuse of reclaimed water and surface water. District support for alternative water supply development projects have expanded reuse potential and contributed to water conservation.

Water Conservation

Water conservation potential in Region III was estimated to range between 3.8 to 6 mgd by the year 2040 (NWFWMD 2018). District permit conditions that support water conservation measures include annual water use reporting; evaluation of water use practices to enhance water conservation and efficiency, reduce water demand and water losses; maximum water loss and residential per capita water use goals; and public education campaigns. The gross per capita water use has fluctuated in Region III from 1995 to

2020 as shown in Figure 2-35. Conservation is not the only factor that affects the gross per capita water use. Factors such as climate, economic conditions, population trends, and changes in ICI or other water use categories can influence these values.

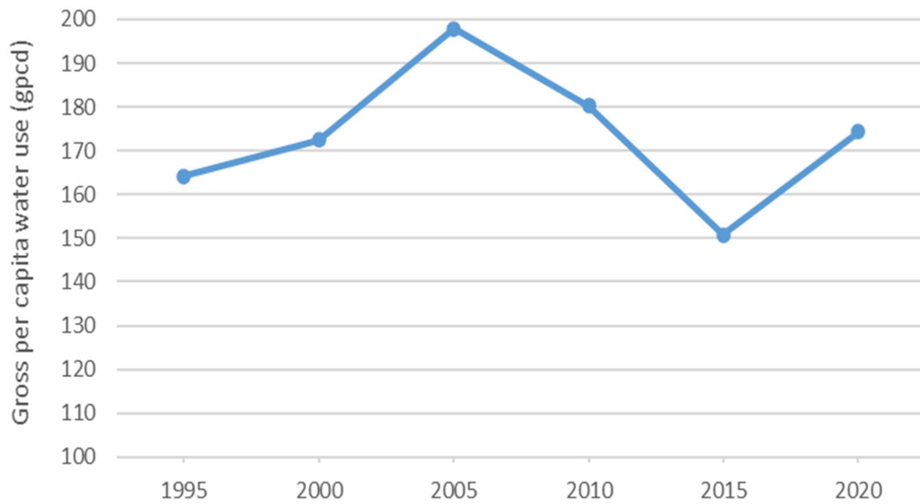


Figure 2-35. Region III Gross per capita water use

Reuse of Reclaimed Water

In 2020, two wastewater treatment facilities (WWTFs) in Region III utilized 3.7 mgd of potable offset reuse or 23 percent of the total WWTF flows, which totaled 16.5 mgd (Table 2-15). Four facilities currently discharge all or a portion of treated wastewater to St. Andrew Bay. Panama City Beach, Lynn Haven, the St. Andrews, and the county's Military Point AWT facilities have advanced treatment levels. Other systems in the county have secondary treatment levels. The District has recently funded two Alternative Water Supply projects in Region III, — the North Bay Reuse project and the Panama City Beach Parkway Reuse project. Both projects focus on reclaimed-water infrastructure to offset the demand for potable water. Panama City Beach plans to further expand its reuse system, including extending reclaimed water lines and (1) adding up to 455 connections and providing approximately 0.08 mgd of reclaimed water in the Laguna Beach area, (2) adding 89 connections along Front Beach Road east of State Road 79 and, (3) adding 45 connections along Front Beach Road east of Hills Road to serve commercial and residential properties. Bay County is developing reclaimed water systems associated with the North Bay WWTF, and the city of Lynn Haven operates a reclaimed water system providing beneficial public access reuse. These projects have the potential to offset some groundwater withdrawals from the Floridan and surficial aquifers near the coast.

Table 2-15. Region III - 2020 Reuse and Wastewater Flows (mgd)

County	Potable Offset Reuse Flow	Percent of Potable Offset Reuse to Total WWTF Flow	Total WWTF Flow	Total WWTF Capacity	Number of WWTFs	WWTFs Providing Potable Offset
Bay	3.736	22.6%	16.544	33.750	6	2
TOTALS	**3.736**	**22.6%**	**16.544**	**33.750**	**6**	**2**

Based on population projections, future reuse availability is estimated to be an additional 16.0 mgd by 2045. This additional availability added to existing 2020 reuse flows totals 19.7 mgd, or 58 percent of the 2020 total facility capacities (Table 2-16). Future potable offset reuse assumptions are that WWTF's have treatment and disinfection levels suitable for the reuse end uses, and that transmission infrastructure is available to reuse customers.

Table 2-16. Region III - 2025-2045 Future Potential Reuse Availability (mgd)

County	2020 Potable Offset Reuse Flow	Future Reuse Estimated Availability					2045 Estimated Total Flow	
		2025	2030	2035	2040	2045	Mgd	% of Capacity
Bay	3.736	13.812	14.581	15.140	15.586	15.956	19.692	58.3%
TOTALS	**3.736**	**13.812**	**14.581**	**15.140**	**15.586**	**15.956**	**19.692**	**58.3%**

Region III: RWSP Evaluation

Deer Point Lake Reservoir is the primary water source in Region III. Bay County has increased the resilience of the reservoir to withstand storm-surge impacts by constructing an alternate upstream intake. Groundwater resources continue to be limited within the Area of Resource Concern, and the Floridan aquifer potentiometric surface has declined to approximately 20 feet below sea level along the coast. The District has initiated an MFL technical assessment to determine whether minimum aquifer levels are needed. As part of the assessment, enhanced data collection and groundwater flow and solute transport modeling will be performed to better assess the risk of saltwater intrusion and the long-term sustainability of the Floridan aquifer. As of this 2023 WSA update, the existing and reasonably anticipated water sources in Region III are considered adequate to meet the projected 2045 average and 1-in-10-year drought event demands, while sustaining water resources and related natural systems. Therefore, a regional water supply plan is not recommended for Region III.

REGION IV: CALHOUN, HOLMES, JACKSON, LIBERTY, AND WASHINGTON COUNTIES

Overview

Region IV Snapshot

	2020	2045
Population	118,550	126,133
Water Use (mgd)	52.99	58.58

Primary Water Source(s):	Floridan aquifer system
MFL Waterbodies:	Jackson Blue Spring
Water Reservations:	Apalachicola and Chipola rivers
RWSP Status:	No RWSP Recommended

Region IV consists of Calhoun, Holmes, Jackson, Liberty, and Washington counties (Figure 2-36). At about 3,477 square miles, Region IV is the District's second largest water supply planning region. All Region IV counties have low population densities and slow growth rates. The region is primarily rural and agricultural in land use and economy.

Jackson Blue Spring, an Outstanding Florida Spring, is located in Jackson County. There are numerous second magnitude and smaller springs located on Econfina and Holmes creeks and the Chipola River. The District manages several water management areas that include important surface water and springs resources in Region IV. The Apalachicola River, which forms the southeast boundary of Region IV, and the Chipola River near Altha are subject to water reservations, whereby "the magnitude, duration, and frequency of observed flows are reserved for the protection of fish and wildlife of the river, floodplain, and Apalachicola Bay" (section 40A-2.223, F.A.C.).

The largest municipality in Region IV is the city of Marianna in Jackson County, with a 2020 estimated population of 7,095. Region IV has multiple smaller municipalities and public supply service areas, most with a population under 1,000 and with little to no growth projected.

Jackson County and other northern portions of Region IV continue to comprise the District's largest agricultural region and in 2020 accounted for 72 percent of all agricultural water use Districtwide. The Apalachicola National Forest covers more than half of southern Liberty County. The updated Jackson Blue Spring and Merritts Mill Pond BMAP, which includes a TMDL of 0.35 mg/L nitrate and measures to reduce nitrate loading, was adopted in 2018.

Population

The 2020 BEBR population estimate for Region IV is 114,986. Region IV has relatively low estimated seasonal population rates of one to three percent, apart from a nine-percent rate in Liberty County. The 2020 seasonally adjusted population estimate is 118,550, an increase of 3,564 from the BEBR permanent population estimate. Seasonal populations include migratory workers employed in agricultural work during crop seasons.

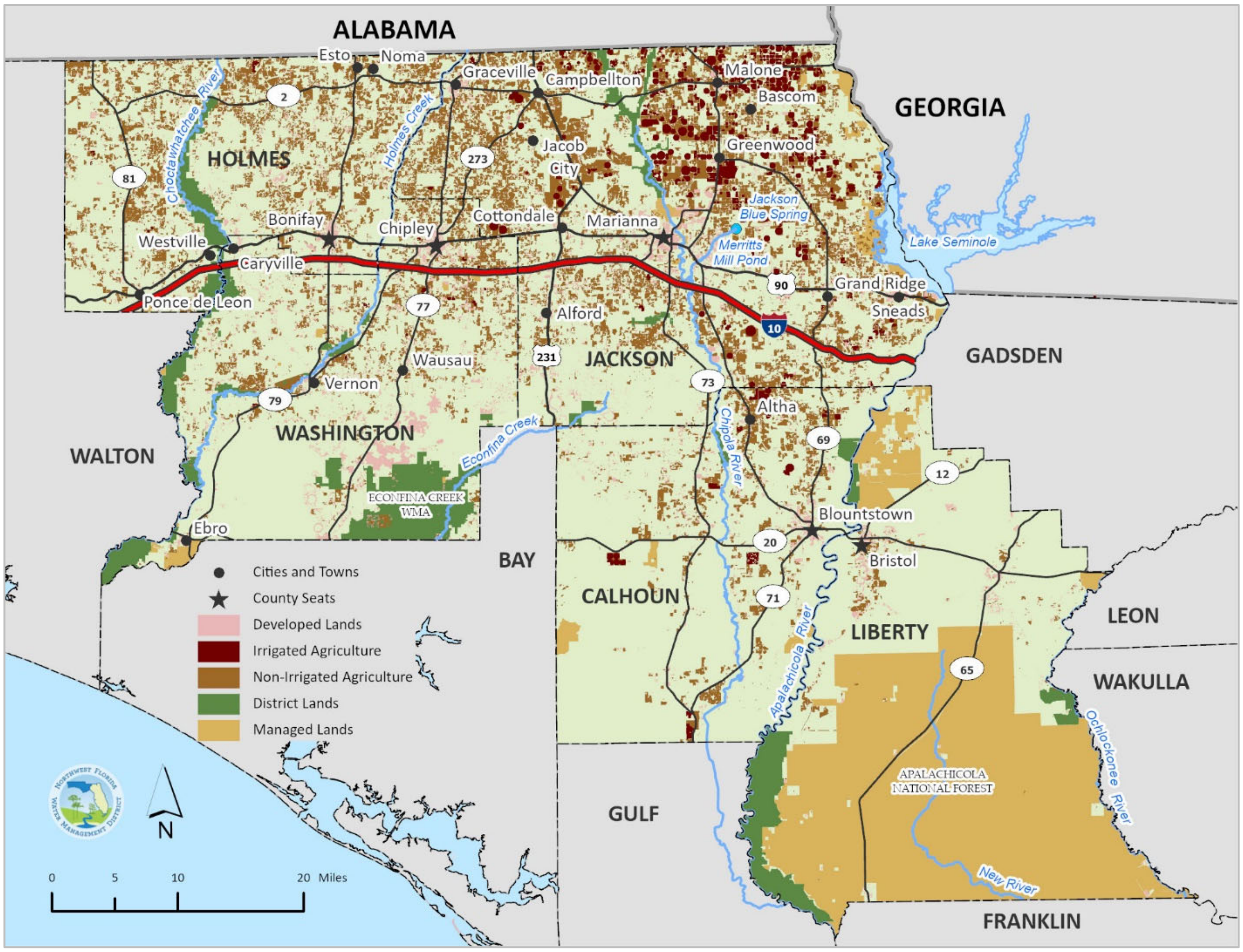


Figure 2-36. Region IV - Calhoun, Holmes, Jackson, Liberty, and Washington Counties

Water Use 2020 Estimates and Demand Projections 2025-2045

In 2020, Region IV had nearly eight percent of the District population and approximately 15 percent of all water use Districtwide. Agriculture (68%) and domestic self-supply (13%) are the largest water use categories and together comprise more than three-fourths of all water use in Region IV (Figure 2-37 and Table 2-17).

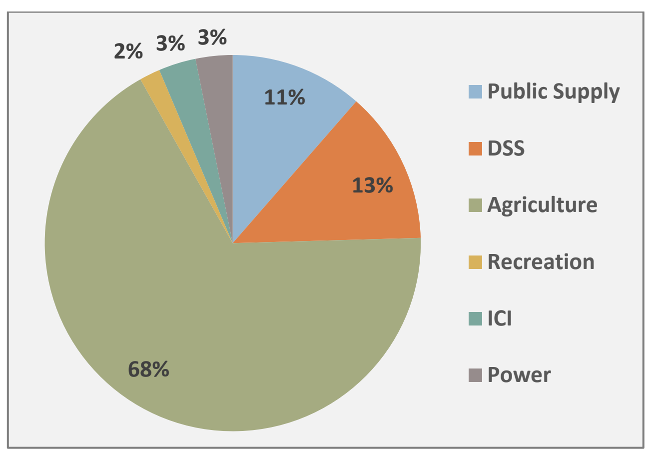


Figure 2-37. Region IV - 2020 Water Use

Public Supply: Calhoun, Holmes, and Jackson counties have some of the lowest projected population growth rates in the District. Jackson County has the largest number of public utility systems in Region IV. Most of the projected public supply growth is in Calhoun, Jackson, and Liberty counties. Additional public supply utility data are in Appendix 4.

Table 2-17. Region IV - 2020 Water Use (mgd) and Population Estimates

County	Public Supply	DSS	Agriculture	Recreation	ICI	Power	TOTAL	BEBR Population	Adjusted Population
Calhoun	0.546	0.993	3.171	0.004	0.244	-	4.958	14,489	14,924
Holmes	1.222	1.216	1.119	0.191	-	-	3.747	20,001	20,201
Jackson	2.613	2.407	30.929	0.398	0.898	1.431	38.677	46,587	47,985
Liberty	0.482	0.452	0.114	0.001	0.259	0.206	1.515	8,575	9,347
Washington	1.013	1.698	0.790	0.307	0.282	-	4.091	25,334	26,094
TOTALS	**5.876**	**6.767**	**36.123**	**0.907**	**1.684**	**1.637**	**52.994**	**114,986**	**118,550**
% of total*	11.1%	12.8%	68.2%	1.7%	3.2%	3.1%	100%	7.7%	7.4%

*Percent per water use category in this region, and percent of Districtwide population.

DSS and Small Public Systems: Known domestic self-supply wells are fairly evenly distributed across Holmes, Jackson, and Washington counties. In Calhoun and Liberty counties, DSS wells are concentrated around urban areas, road infrastructure, and residential areas near rivers and streams. The greater percentage of DSS increases are in Calhoun, Liberty, and Washington counties.

Agriculture: Over the planning horizon, Region IV is projected to have more than 43,000 acres of irrigated land, and water withdrawals are estimated to increase by an additional 3.8 mgd (10 percent). Projected crop changes include increases in fresh market vegetables and non-citrus fruits.

Recreation: Recreational water use in Region IV is about two percent of the total regional water use. Estimates are based on reported pumpage from golf course and other recreational water use permittees, and from residential and other small-scale recreational irrigation wells that have GWUPs with no water use reporting requirements.

ICI: Region IV has several correctional and industrial facilities, with many of them in Jackson and Liberty counties. The projected increase of 52 percent over the planning horizon totals 0.9 mgd.

Power: Two power generating facilities in Region IV are Florida Power & Light's Scholtz Plant in Jackson County and Telogia Power in Liberty County. The Scholz Plant was substantially decommissioned in 2015 and Telogia Power ceased energy production in 2020; both have nominal withdrawals to keep essential components in service.

Table 2-18. Region IV - 2020 Estimated Water Use and 2025-2045 Demand Projections (mgd) - Average

Use Category	Estimates	Future Demand Projections – Average Conditions					2020-2045 Change	
	2020	2025	2030	2035	2040	2045	mgd	%
Public Supply	5.876	5.982	6.061	6.117	6.156	6.195	0.319	5.4%
DSS	6.767	6.887	7.021	7.122	7.194	7.273	0.506	7.5%
Agriculture	36.123	37.086	37.658	38.367	39.157	39.888	3.765	10.4%
Recreational	0.901	0.917	0.928	0.937	0.943	0.949	0.048	5.4%
ICI	1.684	1.907	2.207	2.374	2.467	2.566	0.882	52.4%
Power	1.637	1.706	1.706	1.706	1.706	1.706	0.068	4.2%
TOTALS	**52.988**	**54.486**	**55.581**	**56.623**	**57.621**	**58.576**	**5.588**	**10.5%**

Table 2-19. Region IV - 2020 Estimated Water Use and 2025-2045 Demand Projections (mgd) - Drought

Use Category	Estimates	Future Demand Projections - Drought Year Events					2020-2045 Change	
	2020	2025	2030	2035	2040	2045	mgd	%
Public Supply	5.876	6.401	6.485	6.545	6.587	6.628	0.752	12.8%
DSS	6.767	7.369	7.513	7.621	7.697	7.782	1.015	15.0%
Agriculture	36.123	50.057	50.892	51.875	52.980	54.022	17.899	49.6%
Recreational	0.901	1.229	1.244	1.255	1.263	1.272	0.371	41.2%
ICI	1.684	1.907	2.207	2.374	2.467	2.566	0.882	52.4%
Power	1.637	1.706	1.706	1.706	1.706	1.706	0.068	4.2%
TOTALS	**52.988**	**68.670**	**70.046**	**71.376**	**72.699**	**73.976**	**20.988**	**39.6%**

Total Region IV water demand is projected to increase to 58.6 mgd by 2045 in an average year (Table 2-18) and 74 mgd in a drought year event by 2045 (Table 2-19). Drought year use is 26 percent higher than average year conditions. Most of this projected increase is in the agricultural water use category.

Assessment of Water Resources

Groundwater withdrawals in Region IV totaled 51 mgd in 2020. Approximately 1.3 mgd of surface water was withdrawn for power generation uses and 0.7 mgd for agricultural use. Because surface water use is minor (three percent of total use in 2020), this assessment focuses largely on groundwater resources. Criteria used to assess the potential impacts of groundwater withdrawals on regional water resources include evaluating changes in aquifer levels, the Floridan aquifer potentiometric surface, and spring flow, and examination of a Floridan aquifer groundwater budget.

Surface Water Resources

Surface water use in Region IV during 2020 was estimated to be 2 mgd which comprised less than four percent of the total water use in the region. By 2045, surface water use is projected to increase slightly to 2.5 mgd during a normal year. Surface water use during drought years in Region IV is not projected to increase significantly over normal conditions.

Water reservations were established in 2006 for the Apalachicola and Chipola Rivers which protect the magnitude, duration, and frequency of flows for fish and wildlife of the rivers, their floodplains, and Apalachicola Bay (section 40A-2.223, F.A.C.). To help ensure the continued protection of water resources in the region, the District is developing MFL recommendations for Jackson Blue Spring located in Jackson County. The MFLs for Outstanding Florida Springs, such as Jackson Blue Spring, are statutorily required to be established by July 1, 2026. The District is on schedule to meet this deadline.

Sufficient data to evaluate trends in baseflow from streams and rivers within Planning Region IV were available at seven locations. Data was available at two locations along the Ochlockonee River, which is the boundary between Region IV and Region VII. Linear trend tests performed on rainfall-adjusted baseflow residuals indicated that a long-term decline is present at USGS Station 2330100, Telogia Creek NR Bristol, FLA. Changes within the Telogia Creek basin are discussed further within the Planning Region VI resource assessment. Telogia Creek will continue to be observed to monitor long-term trends in streamflow. No other significant trends in baseflow were observed at any location associated with Region IV. Results of analyses of long-term trends in baseflow are provided in Appendix 7.

Groundwater Resources

Region IV has two primary hydrogeologic settings: the Dougherty Karst groundwater region and the Apalachicola Embayment (Figure 2-38). Holmes, Washington, Jackson and northern Calhoun counties are within the Dougherty Karst region, while southern Calhoun and Liberty counties are within the Apalachicola Embayment.

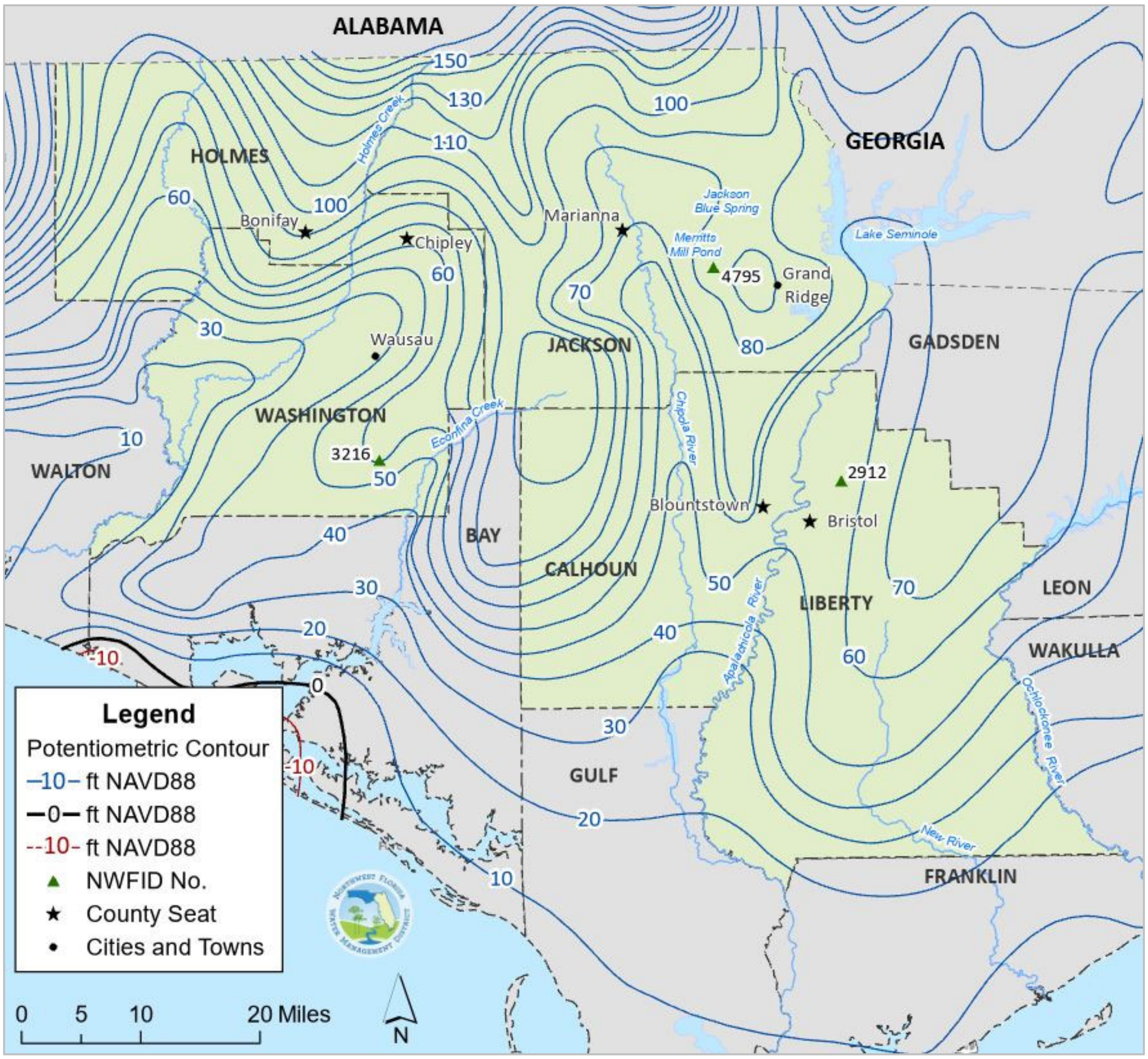


Figure 2-38. Potentiometric Surface of the Upper Floridan Aquifer in Region IV, September 2017

In both regions, the groundwater flow system consists of three major hydrostratigraphic units: the surficial aquifer system, the intermediate system, and the Floridan aquifer system. The Claiborne aquifer is also present in the Dougherty Karst region. The Floridan aquifer system is the primary water source of water throughout Region IV.

The potentiometric surface of the Floridan aquifer is strongly influenced by groundwater discharging to local springs, creeks, and rivers (Figure 2-38). The potentiometric surface reaches a maximum elevation of approximately 160 ft NAVD88 in northern Holmes and Jackson counties. Major discharge features include the Chipola, Choctawhatchee, and Apalachicola rivers; Holmes and Econfina creeks, one first magnitude spring, 16 second magnitude springs, and 13 third magnitude springs (Barrios, 2005; Barrios and Chelette, 2004).

Dougherty Karst Groundwater Region

The Dougherty Karst region has a groundwater flow system characterized by a strong hydraulic connection between ground and surface waters, high aquifer recharge rates, and karst features such as springs and sinkholes. The surficial system is generally thin to absent. The intermediate system is between 50 and 100 feet thick across most of the Dougherty Karst region, is breached by sinkholes, and functions as a semi-confining unit.

The Floridan aquifer system consists of a carbonate sequence that ranges in thickness from less than 100 feet in northern Jackson County to nearly 600 feet in southern Washington County. The Floridan aquifer includes the Chattahoochee Formation (where present), the Marianna and Suwannee limestones, and the Ocala Limestone. The aquifer is highly transmissive and well yields can be up to 1,500 gpm.

Due to high recharge and transmissivity, withdrawals from the Floridan aquifer have not resulted in any discernible depressions in the potentiometric surface. Hydrographs for two wells are presented to illustrate fluctuations in the Floridan aquifer levels (Figure 2-39). Data are presented for a well located near Marianna in Jackson County (International Paper well) and a well near Wausau in Washington County (USGS 422A well). The locations of these wells are shown on Figure 2-38 and identified on the map by the NWF_ID numbers in the upper left-hand corner of each graph. At both wells, aquifer levels vary in response to seasonal and annual variations in rainfall and groundwater withdrawals. The effects of droughts on water levels are evident during 2000-2001, 2006-2007, and 2011-2012. No significant long-term trends are present at these wells.

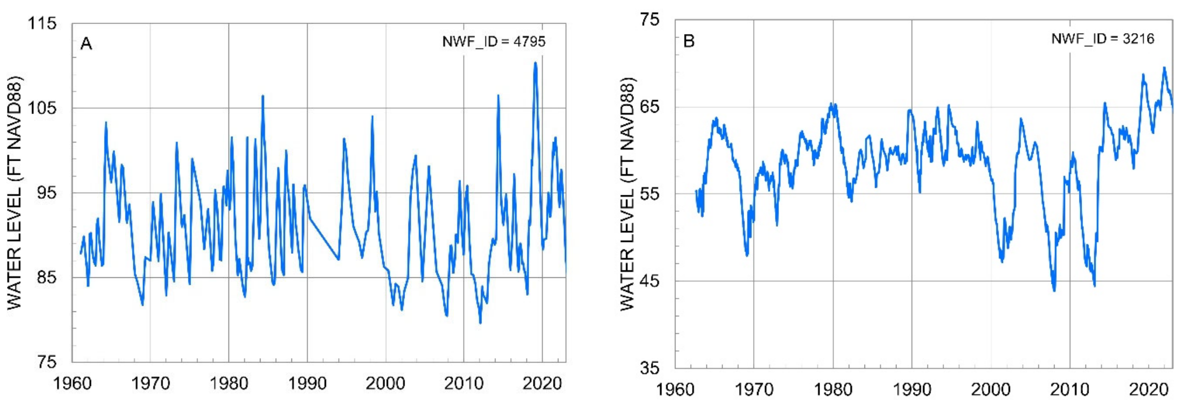


Figure 2-39. Hydrographs of Wells Located in the Dougherty Karst Area at A) International Paper Company Well, Jackson County, and B) USGS-422A Well, Washington County

The discharge of Jackson Blue Spring averages 105 cfs. There are no long-term declines in springflow indicative of persistent groundwater withdrawal effects. Seasonal pumpage can influence spring flows, particularly during low rainfall and high pumpage periods. Numerous second and third magnitude springs occur along Merritts Mill Pond (Jackson County), the Chipola River, Holmes Creek (Holmes County), and the Choctawhatchee River (Washington County).

The middle to early Eocene-aged Claiborne aquifer is also present in northern Jackson County. It is a minor source of, and provides groundwater for, some agricultural and public supply uses. The aquifer consists of the permeable portions of the Lisbon and Tallahatta Formations. The aquifer is comprised of low to highly consolidated sandstones and siltstones with varying amounts of clay and small intervals of moderately to highly consolidated carbonates. The District performed an aquifer performance test in 2018 north of the town of Malone to assess the yield of the Claiborne aquifer and to estimate aquifer properties. The estimated transmissivity of the Claiborne aquifer is approximately 3,600 ft^2/day. The aquifer test analysis showed the Claiborne aquifer is not hydraulically connected with the Floridan aquifer and exhibits fully confined conditions in this area. No impacts from Claiborne aquifer withdrawals have been identified.

Apalachicola Embayment Groundwater Region

In contrast to the Dougherty Karst region, the Apalachicola Embayment region is characterized by a poor connection between ground and surface waters, low recharge rates, and groundwater quality that deteriorates with depth. Within the Apalachicola Embayment, the intermediate system is generally 100 to 200 feet thick and functions as an effective confining unit that significantly restricts recharge to the underlying Floridan aquifer.

There is limited development of secondary porosity, aquifer transmissivities are lower, and water quality decreases with depth. Only the upper few hundred feet of the Floridan aquifer is utilized in Liberty County and well yields are generally less than 250 gpm. The St. Joe Tower well (NWF_ID = 2912) is located within the Apalachicola Embayment in northern Liberty County. This well exhibits a gradual long-term water level decline of approximately 2 ft over the 1977 to 2007 period of record but has exhibited a gradual increase in water level from 2007 to present (Figure 2-40). This well is proximal to pumpage totaling approximately 0.5 mgd. Three other wells in Liberty County with data spanning 1975 to 2022 exhibited no water level trends.

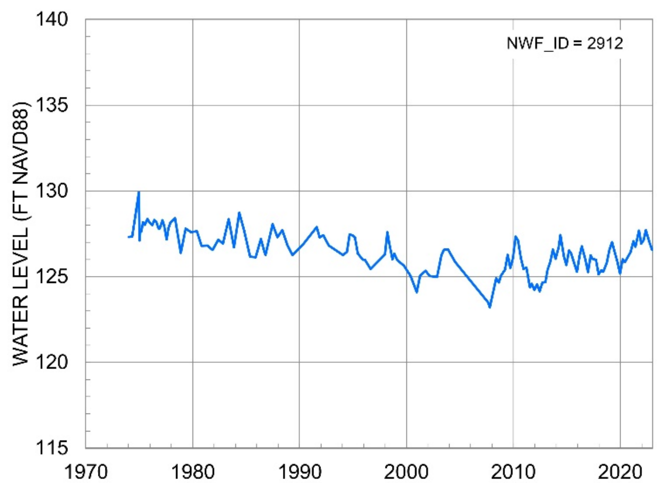


Figure 2-40. Hydrograph of St. Joe Paper Tower Well

Most Floridan aquifer levels within Region IV fluctuate primarily in response to rainfall, which can be observed from the hydrographs for the drought periods of 2000-2002, 2006-2007, and 2011 and the period of above average rainfall, which extended from late 2013 through 2022. Appendix 6 provides the results of groundwater level trend analyses for sites having at least 20 years of record and recent data (2018 or later). Depending on the site, trend analyses may include an assessment of period of record linear monotonic trends, period of record nonlinear monotonic trends, or step trends. If groundwater levels are significantly correlated with antecedent rainfall, an assessment of trends may be performed on the rainfall-adjusted groundwater level residuals. Appendix 1 describes methods used for the trend analyses.

Trend tests were performed on 34 wells with long-term water level measurements within planning Region IV. Of the 34 linear trend tests, 20 were insignificant and 14 were statistically significant. Of the 14 significant trends, 13 were decreasing trends and one was an increasing trend. Most of the variation in aquifer levels were found to be associated with rainfall. Wells that had significant decreasing trends in aquifer levels include NWF_ID 748 (Baker/McCollum), NWF_ID 2145 (Okaloosa Asphalt), and NWF_ID 5603 (Graceville #3). Three wells with decreasing water level trends are located within two miles of pumping wells. The declines at these wells range from 0.11 ft per year at NWF_ID 748 to 0.20 ft per year at NWF_ID 2145.

Groundwater Budget

A region-wide groundwater budget (Figure 2-41) was prepared to estimate the relative magnitude of the inflows to and outflows from the Floridan aquifer in Region IV (Ryan et al. 1998). Major inflows to the Floridan aquifer are leakage, recharge, and subsurface inflow. Major discharges from the Floridan aquifer are discharges to rivers and springs (1,154.8 mgd) and groundwater withdrawals. In 2020, withdrawals totaled approximately 50 mgd and represent 4.3 percent of the groundwater budget outflows.

The projected 2045 Floridan aquifer demand of approximately 54.9 mgd in Region IV represents 4.7 percent of the groundwater budget outflows. The projected 2045 demand of approximately 69.9 mgd for a 1-in-10-year drought condition represents about six percent of the regional groundwater budget outflows for the Floridan aquifer.

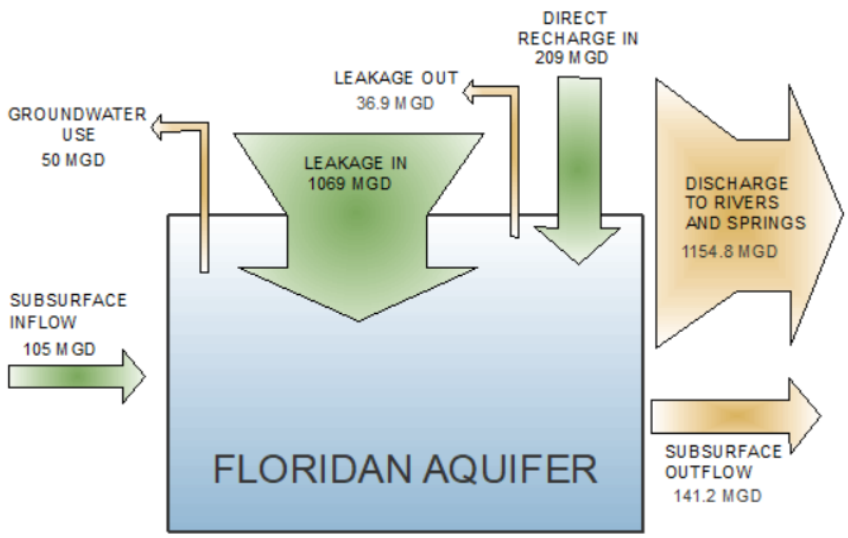


Figure 2-41. Region IV Floridan Aquifer Steady-State Groundwater Budget

Water Quality Constraints on Availability

Water quality issues may locally constrain groundwater availability in Region IV. Up-coning of mineralized water may occur in response to large pumping rates and associated drawdowns. Mineralized water may also occur in wells that are open to deeper geologic formations in the Apalachicola Embayment region of Calhoun and Liberty counties. Highly mineralized water also occurs in a limited area where Holmes Creek joins the Choctawhatchee River.

In the Dougherty Karst region, karst topography and high recharge rate makes the Floridan aquifer system susceptible to contamination by land use practices. Groundwater has been affected by historical agrichemical contamination, primarily ethylene dibromide. Contamination is generally of low concentration and is primarily limited to areas in northeast Jackson County (Roaza, 1989). In some areas, water treatment may be necessary for potable use. Elsewhere, groundwater quality is generally good in the Dougherty Karst region.

Alternative Water Supply and Conservation

In 2020, non-traditional sources of water in Region IV include reuse of reclaimed water. District support for water supply development projects has contributed to water conservation, leak detection, water use efficiencies, and expanded reuse potential.

Water Conservation

District permit conditions that support water conservation measures include annual water use reporting; evaluation of water use practices to enhance water conservation and efficiency, reduce water demand and water losses; maximum water loss and residential per capita water use goals; and public education campaigns. There has been a steady decrease in the estimated gross per capita water use from 1995 through 2020 as shown in Figure 2-42. Factors such as climate, economic conditions, population trends, and changes in ICI or other water use categories can influence these values.

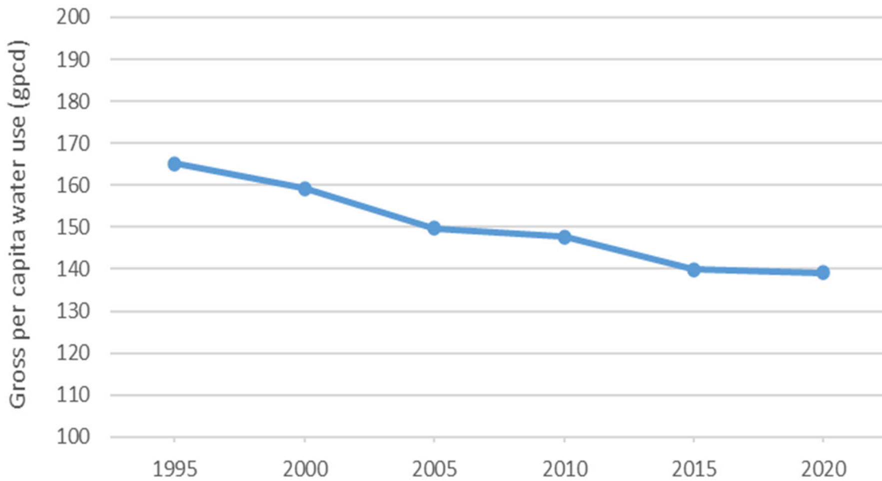


Figure 2-42. Region IV Gross per capita water use

The District has participated in a cost-share program with agricultural producers since 2013 that is intended to both minimize the risk of excess nutrients being discharged offsite, as well as to enhance the efficiency of irrigation systems to minimize the irrigation water necessary for agricultural crops. The projects are intended to assist the producer in protecting natural resources while maintaining commercial agricultural production. Since 2013, 144 projects have been implemented with 83 unique producers to date. Of the 144 projects implemented, 138 projects have been completed on 69,935 acres (includes multiple phases/projects). Contracting efforts are ongoing. Examples include irrigation nozzle packages for overhead pivot irrigation systems, pump upgrades to a low-pressure system, control panels with remote access technology, zone control packages for irrigation systems that minimize non-target applications, and GPS Systems. Estimated water savings are summarized in Table 2-20.

Table 2-20. Region IV - 2015-2016 Fiscal Year to 2020-2021 Fiscal Year Water Savings Estimate (mgd) for Precision Agriculture Systems and Solutions Cost Share Projects

Fiscal Year	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
Water Savings (mgd)	0.94	1.00	1.30	1.23	1.19	0.89

Additional conservation initiatives in Region IV water supply development projects support increased water use efficiencies. For example, the District has provided funding assistance for a Water Meter Replacement with the town of Campbellton to install up to 130 water meters.

Reuse of Reclaimed Water

In 2020, Region IV utilized 0.7 mgd of potable offset reuse or 13 percent of the wastewater treatment facility (WWTF) flows, which totaled 5.2 mgd (Table 2-21). Based on population projections, future reuse availability is estimated to be an additional 4.8 mgd by 2045 (Table 2-22). This additional availability added to existing 2020 reuse flows totals 5.5 mgd, or 46 percent of the 2020 total facility capacities. Future potable offset reuse assumptions are that WWTF's have treatment and disinfection levels suitable for the reuse end uses and that transmission infrastructure is available to reuse customers.

Table 2-21. Region IV - 2020 Reuse and Wastewater Flows (mgd)

County	Potable Offset Reuse Flow	Percent of Potable Offset Reuse to Total WWTF Flow	Total WWTF Flow	Total WWTF Capacity	Number of WWTFs	WWTFs Providing Potable Offset
Calhoun	0.000	0%	0.387	1.500	1	0
Holmes	0.000	0%	0.514	1.400	1	0
Jackson	0.000	0%	2.913	6.613	6	0
Liberty	0.000	0%	0.300	0.530	2	0
Washington	0.689	65.4%	1.053	1.871	3	1
TOTALS	**0.689**	**13.3%**	**5.167**	**11.914**	**13**	**1**

Table 2-22. Region IV - 2025-2045 Future Potential Reuse Availability (mgd)

County	2020 Potable Offset Reuse Flow	Future Reuse Estimated Availability					2045 Estimated Total Flow	
		2025	2030	2035	2040	2045	mgd	% of Capacity
Calhoun	0.000	0.403	0.417	0.427	0.433	0.441	0.411	29.4%
Holmes	0.000	0.517	0.517	0.519	0.519	0.522	0.522	37.3%
Jackson	0.000	2.945	2.970	2.983	2.989	2.995	2.995	45.3%
Liberty	0.000	0.308	0.318	0.322	0.329	0.332	0.332	62.7%
Washington	0.689	0.400	0.425	0.446	0.462	0.479	1.168	62.4%
TOTALS	**0.689**	**4.573**	**4.647**	**4.697**	**4.732**	**4.769**	**6.124**	**45.8%**

Region IV: RWSP Evaluation

The existing and reasonably anticipated water sources in Region IV are considered adequate to meet the projected 2045 average year and 1-in-10-year drought event demands, while sustaining water resources and related natural systems. Therefore, a regional water supply plan is not recommended for Region IV.

REGION V: FRANKLIN AND GULF COUNTIES

Overview

The Floridan aquifer is the primary water source in Franklin and Gulf counties, which comprise Region V. With a total of 1,782 square miles, Region V is the District's third largest water supply planning region (Figure 2-43). The Apalachicola River and Bay watershed encompasses the majority of these two counties. Region V has several small coastal communities with seasonal populations. Most coastal areas in Region V and many barrier islands are state forests, parks, or preserves. The District's Apalachicola River Water Management Area extends across Gulf and Liberty counties, with 13,134 acres, or about 36 percent, of WMA lands in Gulf County.

Region V Snapshot

	2020	2045
Population	34,455	39,261
Water Use (mgd)	4.53	5.50

Primary Water Source(s):	Floridan aquifer system, Chipola River
MFL Waterbodies:	None
Water Reservations:	Apalachicola and Chipola rivers
RWSP Status:	No RWSP Recommended

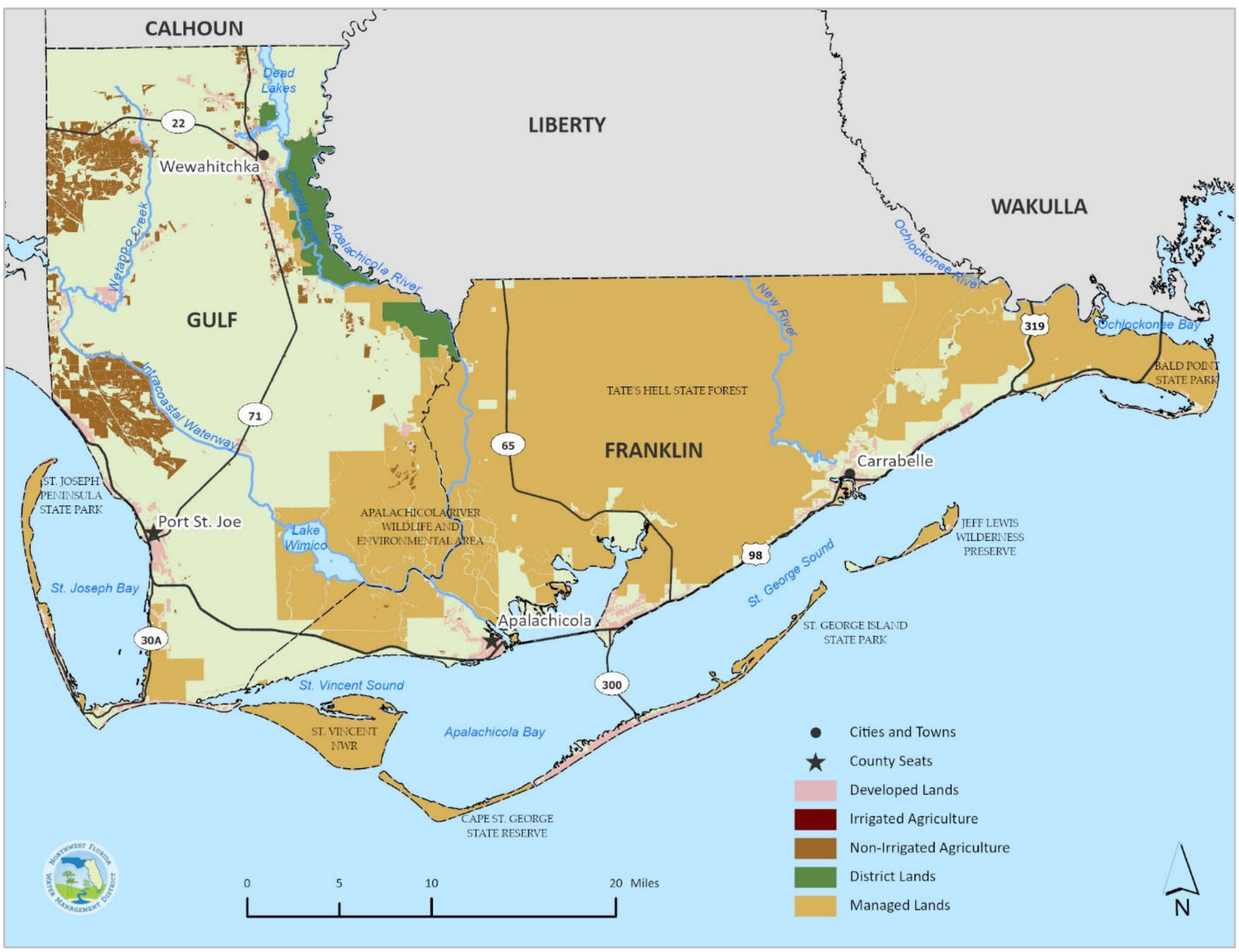


Figure 2-43. Region V - Franklin and Gulf Counties

Region V has several small municipalities and public supply service areas. Except for Port St. Joe, with a 2020 estimated service area population of about 8,750, the remainder all have service area populations under 4,250. The annual average projected growth rate in Region V is 0.27 percent over the 2025-2045 planning period.

Population

The 2020 BEBR population estimate for Region V is 26,588. Region V had high estimated seasonal population rates across all public supply utility service areas and among DSS water users: an average of 22 percent in Gulf County and 39 percent in Franklin County. The highest percentage of seasonal populations were estimated in St. George Island, Alligator Point, and Cape San Blas.

2020 Water Use Estimates and 2025-2045 Demand Projections

In 2020, Region V had 1.8 percent of the District population and accounted for less than two percent of all water use Districtwide. Nearly three-fourths of water use is in the public supply sector and more than 82 percent of Region V water use is collectively in public supply and domestic self-supply (Figure 2-44 and Table 2-23). There are no thermoelectric power generating facilities in Region V.

About 51 percent of water used came from the coastal Floridan aquifer, with the remainder from the inland Floridan aquifer, intermediate system, and surficial aquifer in addition to surface water sources. Surface water accounted for roughly 25% of the total water use.

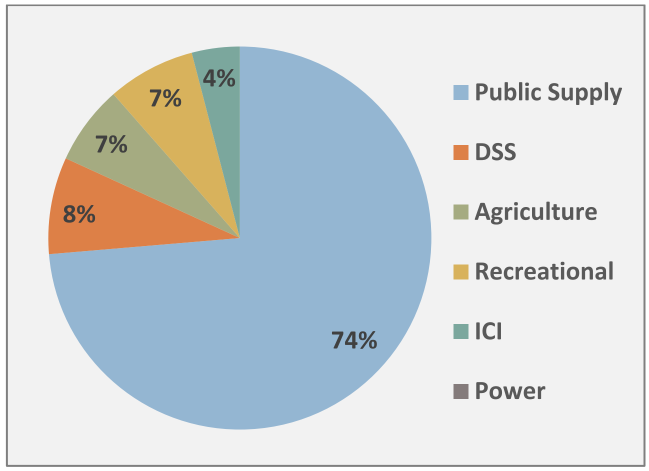


Figure 2-44. Region V - 2020 Water Use

Table 2-23. Region V - 2020 Water Use (mgd) and Population Estimates

County	Public Supply	DSS	Agriculture	Recreation	ICI	Power	TOTAL	BEBR Population	Adjusted Population
Franklin	1.886	0.066	0.006	0.248	0.017	-	2.222	11,864	16,491
Gulf	1.451	0.304	0.297	0.089	0.166	-	2.307	14,724	17,964
TOTALS	**3.337**	**0.370**	**0.303**	**0.337**	**0.183**	**-**	**4.530**	**26,588**	**34,455**
% of total*	73.7%	8.2%	6.7%	7.4%	4.0%		100%	1.8%	2.2%

*Percent per water use category in this region, and percent of Districtwide population.

Projected water demands are provided in Table 2-24. The largest projected increase is in the ICI water use sector.

Public Supply: Franklin and Gulf counties are projected to be some of the slower growing counties in the District in terms of permanent population. Both, however, are significantly affected by seasonal populations. Additional public supply utility data are in Appendix 4.

DSS and Small Public Systems: Known domestic self-supply wells in Gulf County are clustered in and around Wewahitchka. In Franklin County, DSS wells are primarily in coastal areas. Slight increases in DSS water use are similar to those in other mostly rural counties without larger population centers.

Table 2-24. Region V - 2020 Estimated Water Use and 2025-2045 Demand Projections (mgd) - Average

Use Category	Estimates	Future Demand Projections -- Average Conditions					2020-2045 Change	
	2020	2025	2030	2035	2040	2045	mgd	%
Public Supply	3.337	3.516	3.645	3.746	3.825	3.898	0.562	16.8%
DSS	0.370	0.437	0.479	0.514	0.539	0.562	0.192	51.8%
Agriculture	0.303	0.303	0.304	0.304	0.304	0.304	0.001	0.3%
Recreational	0.337	0.352	0.363	0.372	0.378	0.383	0.047	13.9%
ICI	0.183	0.259	0.297	0.352	0.352	0.352	0.169	92.1%
Power	-	-	-	-	-	-	n/a	n/a
TOTALS	**4.530**	**4.868**	**5.087**	**5.288**	**5.399**	**5.499**	**0.970**	**21.4%**

Agriculture: There are no reported and very little estimated agricultural water uses in Franklin County. Gulf County includes small acreage tracts of non-citrus fruit and greenhouse/nursery crops. Little to no changes are anticipated over the planning horizon.

Recreation: Recreational water use in Region V accounts for seven percent of the total regional water use. More than 70 percent of the estimates are based on reported pumpage from golf course and other recreational permittees, and the remainder from residential and other small-scale recreational irrigation wells that have GWUPs with no water use reporting requirements.

ICI: There are multiple correctional facilities in Region V. Water use is projected to increase over the 2020 to 2045 planning period.

Table 2-25. Region V - 2020 Estimated Water Use and 2025-2045 Demand Projections (mgd) - Drought

Use Category	Estimates	Future Demand Projections - Drought Year Events					2020-2045 Change	
	2020	2025	2030	2035	2040	2045	mgd	%
Public Supply	3.337	3.763	3.900	4.008	4.093	4.171	0.834	25.0%
DSS	0.370	0.467	0.512	0.550	0.577	0.601	0.231	62.4%
Agriculture	0.303	0.331	0.332	0.332	0.333	0.333	0.030	9.9%
Recreational	0.337	0.472	0.487	0.498	0.506	0.514	0.177	52.6%
ICI	0.183	0.259	0.297	0.352	0.352	0.352	0.169	92.1%
Power	-	-	-	-	-	-	n/a	n/a
TOTALS	**4.530**	**5.292**	**5.528**	**5.741**	**5.862**	**5.971**	**1.441**	**31.8%**

Total Region V water demand is projected to be 5.5 mgd by 2045 in an average year (Table 2-24) and 6 mgd in a drought year event 2045 (Table 2-25).

Assessment of Water Resources

Groundwater continues to be the primary water source in Franklin County. Historically, Gulf County also depended upon groundwater for both public and industrial water supplies. Withdrawals began in the 1930s to supply water to the St. Joe Paper Company Mill and associated industries. By the early 1950s, groundwater withdrawals totaled approximately 9 mgd. Most of this water was pumped from the Floridan aquifer system. Recognizing that sufficient groundwater was not available to meet the expanding needs of the paper mill, an 18.5-mile-long canal was constructed in 1953 between the city of Port St. Joe and the Chipola River to provide a surface water supply. The surface water pumping capacity was 51.48 mgd before the mill closed in 1998. Prior to the mill closing, surface water provided an average of 28 mgd for industrial use.

Due to historical groundwater withdrawals, the water levels in Floridan aquifer declined to more than -15 ft NAVD88 near Port St. Joe in the 1990s. Drawdowns in the immediate vicinity of some public supply wells were even greater. In addition, deeper water supply wells along coastal Franklin County had been experiencing increases in salinity parameters since the early 1980s. Because of the potential for saltwater intrusion into the Floridan aquifer, coastal areas in Region V were identified as Areas of Special Concern for water supply in the District's 1998 WSA.

Regional population increases and proposed development in the 2000s heightened concerns over resource sustainability. In 2001, the District assisted the city of Port St. Joe in the acquisition of the Port St. Joe Canal as a public water supply source and contributed funding to construct a surface water treatment facility. A RWSP was developed for Region V in 2007 which described how this surface water project and a proposed inland Floridan aquifer wellfield could meet regional water supply needs through 2025. The city of Port St. Joe began using the newly renamed Gulf County Fresh Water Supply Canal to meet public supply needs in late 2009. The city simultaneously reduced its use of the Floridan aquifer allowing depressed water levels to recover. With the new surface water source online and the anticipated population and development not materializing, the RWSP was discontinued through the WSA 2013 process.

Total Region V water use estimates for 2020 are approximately 5.08 mgd and projections show an additional 0.4 mgd will be needed by 2045. Groundwater from the Floridan aquifer, primarily from the coast, represents the largest contribution to those estimates. The potential for saltwater intrusion still exists along the coast. Limiting or reducing coastal Floridan aquifer withdrawals and transitioning to inland groundwater sources is important to the long-term sustainability of the Floridan aquifer. Gulf County purchased the Lighthouse Utilities water system in 2020. The existing water system includes three Floridan aquifer public supply wells located along the coast, south of Port St. Joe. In 2022, the District completed testing of the intermediate aquifer in the White City area to evaluate its suitability as an alternative potable groundwater source to the coastal Floridan aquifer.

Groundwater Resources

In order of depth, the major hydrostratigraphic units that comprise the groundwater flow system in Region V are the surficial aquifer, the intermediate system (intermediate aquifer/intermediate confining unit), and the Upper Floridan aquifer.

The surficial aquifer consists of undifferentiated sands and clays. In Gulf County, the saturated thickness and permeability of the surficial aquifer are sufficient to form a locally important water source. Groundwater from the surficial aquifer tends to be less mineralized than water from the underlying Floridan aquifer. The average well yield is approximately 200 gpm. In Franklin County, the surficial aquifer is generally less than 50 feet thick. On the barrier islands, wells yielding up to 50 gpm are utilized for landscape irrigation and other small-scale domestic uses.

In Region V where sufficiently thick, the intermediate system includes a modestly permeable aquifer unit and upper and lower semi-confining units. Collectively, the intermediate system functions largely as a confining or semi-confining unit restricting vertical groundwater flow between the surficial aquifer and the Upper Floridan aquifer. In general, it consists of soft, fossiliferous limestone sandwiched between thinner layers of shelly, sandy, clay and clayey, weathered limestone. The intermediate system is approximately 400 feet thick near Port St. Joe, thins to 50 to 100 feet in western Franklin County and is less than 50 feet thick in eastern Franklin County. As the intermediate system thins, leakage across it increases. In southern Gulf and Franklin counties, the intermediate aquifer is used as a source of water for some domestic and landscape irrigation wells.

In 2022, the District evaluated the intermediate aquifer in the White City area just northeast of Port St. Joe to determine if the aquifer could be used as a source of potable water. The evaluation included geophysical logging and sampling of a deep exploratory boring to 920 ft below land surface, the construction of one test production and multiple monitoring wells in the intermediate and adjacent aquifers, and the performance of a multiday aquifer pumping test. The results of the evaluation indicate the intermediate aquifer is approximately 250 feet thick at the test site and consists of two primary limestone units. The upper unit is softer and consists of trace shell and clay. The lower unit is phosphatic with trace sand and shell. The specific capacity of the test production well at the end of the three-day test was calculated to be approximately 2 gallons/min/ft of drawdown. This result suggests that even a modest amount of pumping can cause considerable drawdown in the well and surrounding aquifer. The average hydraulic properties based on measured drawdowns during the pumping test are estimated to be 754 ft^2/day and 0.0005 for transmissivity and storativity, respectively (Cardno, 2022).

The Upper Floridan aquifer is the main source of groundwater in Region V. The aquifer is a sequence of carbonate sediments ranging in thickness from about 1,000 ft in the northwestern Gulf County to more than 2,000 feet thick in southern Franklin County, although the freshwater portion of the aquifer is less. Region V lies primarily within the Apalachicola Embayment groundwater region. As a result, water availability from the Upper Floridan aquifer is constrained by the presence of an effective upper confining unit, very low aquifer recharge, low aquifer transmissivities, and poor water quality at depth. Aquifer testing has yielded transmissivities of 6,000 ft^2/d in Apalachicola, 2,000 ft^2/d in coastal Gulf County (Wagner et al., 1980), and 6,500 ft^2/d 15 miles north of Port St. Joe (Barr and Pratt, 1981).

During the District's resource evaluation in White City, approximately 600 feet of the Upper Floridan aquifer were penetrated during the drilling of a deep exploratory boring (Cardno, 2022). Drill stem sampling was performed for salinity parameters as the borehole advanced. Sampling results indicated a transition zone of increasing chlorides concentrations beginning around 625 feet below land surface. Water quality quickly exceeded drinking water standards with depth across the transition zone. Drilling logs did not indicate the presence of a significant middle confining unit at depth that would restrict vertical movement of water below the shallow freshwater production zone. Based on the increasing chloride concentration with depth trend, the base of the underground source of drinking water (USDW) is estimated to be approximately 1,200 feet below land surface. The low aquifer transmissivities and poor water quality at depth create the potential for up-coning by larger supply wells. These results support the understanding that groundwater availability from the Upper Floridan aquifer is limited within the Apalachicola Embayment groundwater region.

In eastern Franklin County, the Floridan aquifer transitions from the Apalachicola Embayment region toward the Woodville Karst plain region. Within this transition zone, the intermediate confining unit becomes thinner and leakier and the Floridan aquifer is more transmissive and occurs at a shallower depth. Test wells in Tate's Hell State Forest, located in inland Franklin County, yielded transmissivities of 20,000 to 40,000 ft^2/day. In coastal Franklin County, transmissivities and well yields are lower.

In September 2019, the potentiometric surface of the Upper Floridan aquifer ranged from greater than 20 ft NAVD88 in northern Gulf County to less than 10 ft NAVD88 at Port St. Joe and along coastal Franklin County (Figure 2-45). However, groundwater levels in the immediate vicinity of large supply wells may be regularly drawn down below zero ft NAVD88 when pumping. Groundwater flows south and discharges at the coast. Approaching the coastline, the freshwater portion of the aquifer thins considerably, reflecting the loss of fresh water to the Gulf of Mexico discharge boundary.

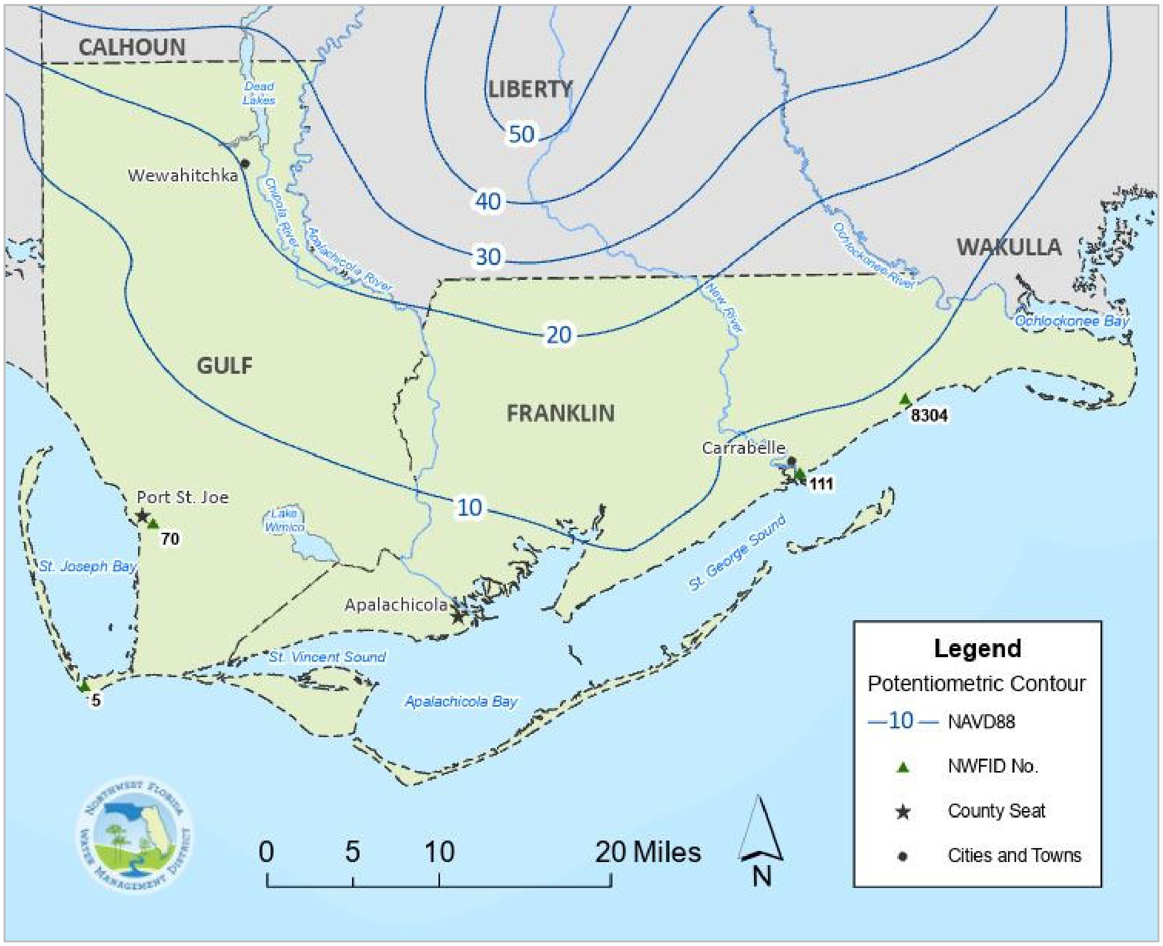


Figure 2-45. Potentiometric Surface of the Floridan Aquifer System in Region V, September 2019

In the coastal areas of Region V, the potential for lateral intrusion and vertical up-coning of saltwater influences groundwater availability and water supply development. Groundwater quality degrades with increasing depth and the freshwater portion of the Upper Floridan aquifer thins towards the coast. The thickness of the freshwater zone where the total dissolved solids concentration is less than 10,000 mgd/L, is thickest in Gulf and western Franklin County where aquifer confinement is the greatest and thins toward the east where the aquifer is less confined. The estimated depth to the bottom of the freshwater zone decreases toward the east, from 657 ft below land surface in Apalachicola (Well No. 5) to 512 ft in St. James Bay (NWF_ID 8304) to less than 210 ft below land surface at Alligator Point.

To assess impacts on groundwater resources, changes in Upper Floridan aquifer water levels and the associated potentiometric surface, water quality data, and a regional groundwater budget were evaluated. Approximately 3.45 mgd of groundwater was withdrawn to meet water demands in Region V in 2020. Figure 2-46 presents examples of hydrographs for Upper Floridan aquifer monitor wells located in Port St. Joe and Carrabelle. The locations of these monitor wells are shown in Figure 2-45 and are identified on the map by their ID number located in the upper right-hand corner of each graph.

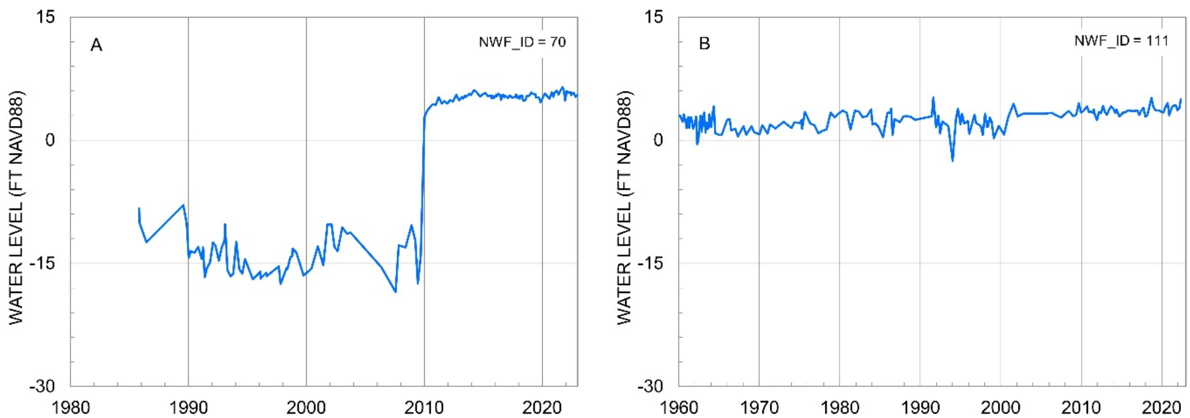


Figure 2-46. Hydrographs of the A) Port St. Joe and the B) Ice Plant Wells

The Port St. Joe well (Figure 2-46A) is located about one mile from the historical center of coastal groundwater pumping in Gulf County. Prior to the development of the surface water supply, water levels averaged approximately -15 ft NAVD88 and reflected an estimated 20 ft of drawdown caused by withdrawals of about 1.5 mgd in this area of low transmissivity. Once Port St. Joe began using the surface water supply, groundwater pumping was reduced, and water levels recovered. As of 2023, water levels have stabilized at approximately 5 ft NAVD88. Water quality data for this well do not show any increasing trends in sodium, chloride, or total dissolved solids. The Ice Plant well in Carrabelle (Figure 2-46B) appears to exhibit a slight increasing water level trend over the 1957 to 2022 period of record. Withdrawals near Carrabelle are relatively small and increased slightly from about 0.2 mgd to 0.45 mgd between 1996 and 2020.

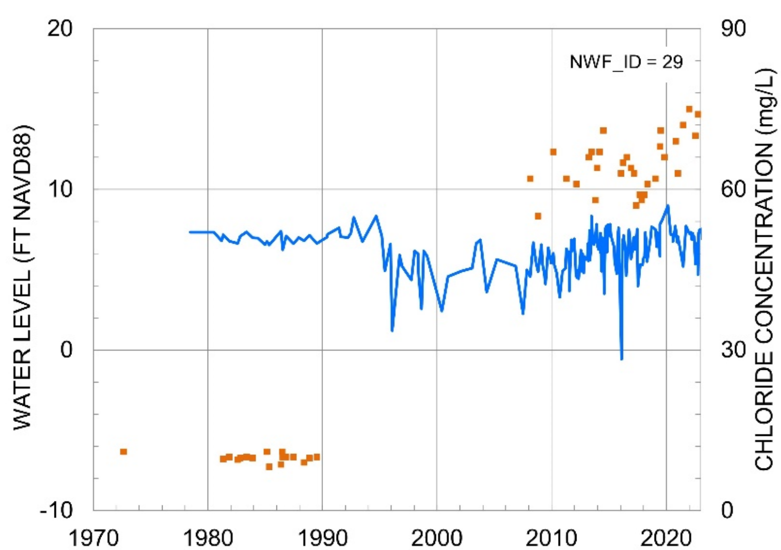


Figure 2-47. Hydrograph (blue) and Chloride Concentration (orange) for McCulloch #1

Long-term data show a slight declining trend in aquifer levels and a slight increasing trend in chloride at McCulloch Well #1, which is located at the southern tip of the East Point peninsula and has data extending back to about 1980 (Figure 2-47). This monitor well is close to the Gulf of Mexico and located south of an area of concentrated groundwater withdrawals. Chloride concentrations in this well averaged approximately 10 mg/L in the 1980s (orange markers). Data collected since 2008 indicate average chloride concentrations of 65 mg/L with an increasing trend of approximately 0.58 mg/L/year. However, projected increases in groundwater withdrawals for the two public supply utilities on the Eastpoint peninsula total less than 0.3 mgd and water supplies are anticipated to be adequate through 2045.

On the peninsula encompassing Bald Point and Alligator Point, the depth to non-potable water is shallow and estimated to be between 210 and 230 ft (Alligator Point Well No. 8). Water quality data collected by reverse-air sampling during the drilling of Well No. 8 suggest that the vertical transition zone between potable and saline water approximates a sharp interface. Chloride concentrations increased from 124 mg/L at a depth of 189 ft to 1,861 mg/L at a depth of 209 ft and 7,267 mg/L at a depth of 229 ft. Well No. 8 was subsequently abandoned.

Additional Water Quality Constraints on Groundwater Availability

Coastal Gulf County has naturally occurring elevated levels of fluoride and iron in the Floridan aquifer. Drinking water standards require a fluoride concentration of less than 4.0 mg/L and an iron concentration of less than 0.3 mg/L. Floridan aquifer water in this area can have fluoride levels as high as 10 mg/L (Ryan et al., 1998) and iron levels between 1.0 and 7.0 mg/L, thus treatment may be required in some areas. Water quality sampling during the District's 2022 resource evaluation in the White City area indicated elevated TDS concentrations in the intermediate (389 mg/L) and shallow Upper Floridan (406 mg/L) aquifers.

Surface Water Resources

Significant use of surface water is limited to diversions from the Chipola River and withdrawals from the canal by the city of Port St. Joe. The diversion location is 2.5 miles above the confluence of the Chipola and Apalachicola rivers. The Chipola and Apalachicola rivers flow into the region from the north. Long-term records (1913 to 2023) from the USGS for a station near Altha in Calhoun County indicate that the mean flow in the Chipola River is 1,451 cfs, the median flow is 1,100 cfs, and the flow exceeds 765 cfs 75 percent of the time. The station at Altha includes about 65 percent of the basin, or 781 mi^2. Further downstream in Region V, the Chipola River flow increases as the contributing drainage area increases.

At Wewahitchka, about 12 miles above the confluence of the Chipola and Apalachicola rivers, a natural floodplain channel (the Chipola Cutoff) connects the two rivers and diverts flow from the Apalachicola River to the Chipola River. At the Chipola Cutoff, the flow of the Chipola River increases significantly due to the diverted flow. The drainage basin for the Chipola River is approximately 1,200 mi^2.

The flow in the Apalachicola River at Sumatra, which is located seven miles below the confluence of the Apalachicola River and the Chipola River, is much higher than at the Chipola Cutoff due to its larger contributing basin (19,200 mi^2) which extends into Alabama and northern Georgia. At the USGS Apalachicola River NR Sumatra, FL station, the flow of the Apalachicola River includes the flow of the Chipola River. The USGS records (1978 to 2023) indicate that the mean flow at the Sumatra gage is 22,970 cfs, the median flow is 19,400 cfs, and the flow exceeds 10,900 cfs 75 percent of the time. Although it is evident significant surface water resources exist in the region, water from the Apalachicola and Chipola rivers are reserved and precluded from unauthorized consumptive use. Except for authorized water withdrawals by the city of Port St. Joe, the District's Governing Board has established water reservations for the Chipola and Apalachicola rivers (40A-2.223, F.A.C.). This reservation was established in 2006 for the Apalachicola and Chipola Rivers to protect the magnitude, duration, and frequency of flows for fish and wildlife of the rivers, their floodplains, and Apalachicola Bay. The city of Port St. Joe is currently authorized to withdrawal 3.15 mgd (4.87 cfs) from the Chipola River. The current authorization represents approximately 0.6 percent of the Chipola River flow exceeded 75 percent of the time at the USGS station near Altha and an even smaller percentage of the flow further downstream at the diversion into the Gulf County Fresh Water Supply Canal.

Surface water withdrawals from the freshwater canal by the city of Port St. Joe for public supply use totaled 0.90 mgd in 2020. The current permitted average annual daily withdrawal from the canal for public supply use is 1.64 mgd. The projected 2045 withdrawals are approximately 1.15 mgd for average conditions and 1.24 mgd for a 1-in-10-year drought event. Even including approximately 1 mgd of evaporative loss from the canal in the total diversion amount from the Chipola River, surface water resources are adequate to meet future demands.

Alternative Water Supply and Conservation

Non-traditional sources of water used in Region V in 2020 include reuse of reclaimed water and surface water. District support to water supply development projects have contributed to water conservation, leak detection, water use efficiencies, and expanding reuse potential.

Water Conservation

Water conservation potential has not been estimated for Region V. District permit conditions that support water conservation measures include annual water use reporting; evaluation of water use practices to enhance water conservation and efficiency, reduce water demand and water losses; maximum water loss and residential per capita water use goals; and public education campaigns. Overall, in Region V there has been a decline in the gross per capita water use from 1995 to 2020 as shown in Figure 2-48. Factors such as climate, economic conditions, population trends, and changes in ICI or other water use categories can influence these values. Droughts occurred during 1999-2000, 2006-2007, and 2011-2012, which influenced irrigation quantities during these years. Additionally, changes in ICI water use have occurred over time.

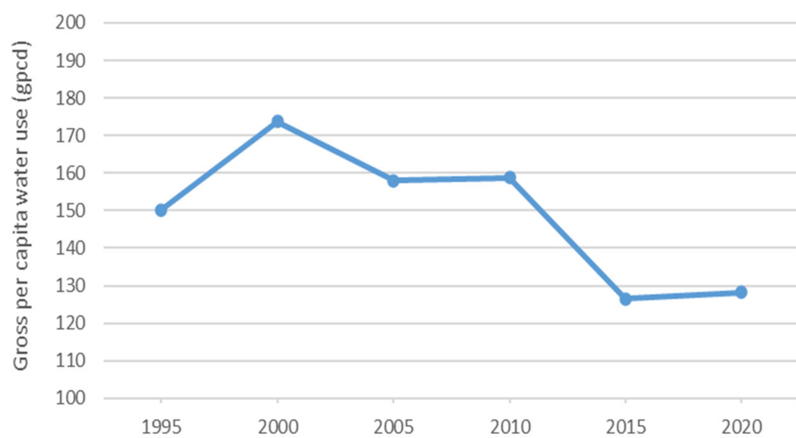


Figure 2-48. Region V Gross Per Capita Water Use

Reuse of Reclaimed Water

In 2020, Region V utilized 0.4 mgd of potable offset reuse or 30 percent of their wastewater treatment facility (WWTF) flows, which totaled 1.5 mgd (Table 2-26).

Table 2-26. Region V - 2020 Reuse and Wastewater Flows (mgd)

County	Potable Offset Reuse Flow	Percent of Potable Offset Reuse to Total WWTF Flow	Total WWTF Flow	Total WWTF Capacity	Number of WWTFs	WWTFs Providing Potable Offset
Franklin	0.431	59.4%	0.725	2.500	3	2
Gulf	0.000	0%	0.715	3.690	3	0
TOTALS	**0.431**	**30.2%**	**1.506**	**6.190**	**6**	**2**

Based on population projections, future reuse availability in Region V is estimated to be an additional 1.2 mgd by 2045. This additional availability added to existing 2020 reuse flows totals 1.6 mgd, or 27 percent of the 2020 total facility capacities (Table 2-27). Future potable offset reuse assumptions are that WWTFs have treatment and disinfection levels suitable for the reuse end uses, and that transmission infrastructure is available to reuse customers.

Table 2-27. Region V - 2025-2045 Future Potential Reuse Availability (mgd)

County	2020 Potable Offset Reuse Flow	Future Reuse Estimated Availability					2045 Estimated Total Flow	
		2025	2030	2035	2040	2045	mgd	% of Capacity
Franklin	0.431	0.327	0.351	0.370	0.382	0.394	0.825	33.0%
Gulf	0.000	0.748	0.772	0.792	0.806	0.816	0.816	22.1%
TOTALS	**0.431**	**1.075**	**1.123**	**1.161**	**1.188**	**1.210**	**1.641**	**26.5%**

Region V: RWSP Evaluation

Continuing to limit coastal Floridan aquifer withdrawals, increasing the utilization of alternative water sources, and transitioning to inland groundwater sources will help ensure the long-term sustainability of the Floridan aquifer in Planning Region V. As of this 2023 WSA update, the existing and reasonably anticipated water sources in Region V are considered adequate to meet the projected 2045 average year and 1-in-10-year drought event demands, while sustaining water resources and related natural systems. Therefore, a regional water supply plan is not recommended for Region V.

REGION VI: GADSDEN COUNTY

Overview

Region VI Snapshot

	2020	2045
Population	47,335	48,742
Water Use (mgd)	11.42	12.11

Primary Water Source(s):	Floridan aquifer system, Surface Water
MFL Waterbodies:	None
Water Reservations:	Apalachicola River
RWSP Status:	No RWSP Recommended

At about 529 square miles in total area, Gadsden County is the District's smallest planning region (Figure 2-49). The Floridan aquifer is the primary water source in Gadsden County. Surface water accounted for 38 percent of withdrawals for agricultural uses in 2020. Due to limited surface water sources, the District designated the Upper Telogia Creek basin as a Water Resource Caution Area. There is also an Area of Resource Concern due to limited groundwater availability.

Most of Gadsden County is within the Ochlockonee River and Bay watershed except for the northwestern area near the city of Chattahoochee that is within the Apalachicola River and Bay watershed. The Apalachicola River, which forms the northwest boundary of Gadsden County, is subject to water reservations, whereby "the magnitude, duration, and frequency of observed flows are reserved for the protection of fish and wildlife of the river, floodplain, and Apalachicola Bay" (section 40A-2.223, F.A.C.).

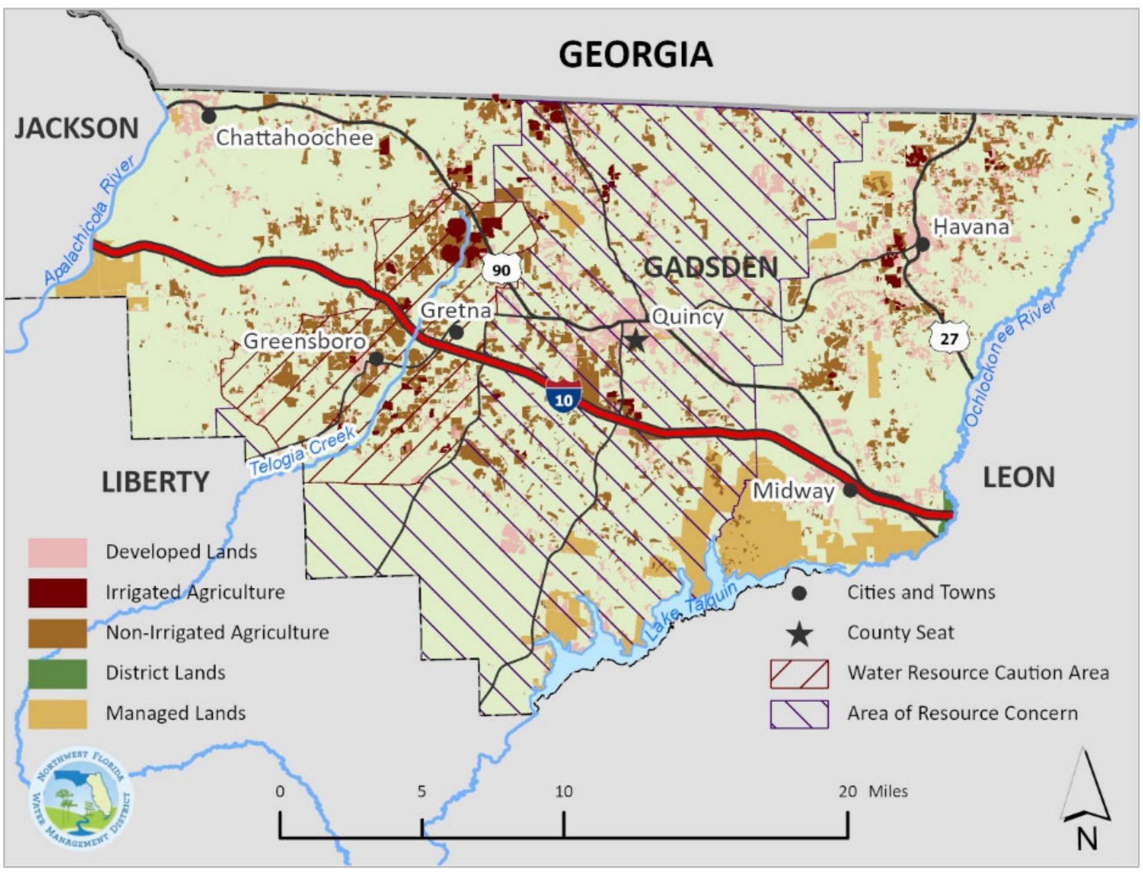


Figure 2-49. Region VI - Gadsden County

Gadsden County has a low projected annual growth rate of about 0.34 percent over the planning horizon. The city of Quincy is the largest incorporated area in the county with an estimated 2020 population of under 8,000. Smaller urban communities include the towns of Havana, Gretna, Greensboro, and Midway, and the city of Chattahoochee.

Population

The 2020, BEBR population estimate for Gadsden County is 46,226. The 2020 seasonally adjusted estimate is 47,335. Seasonal residents include migratory workers employed in seasonal agricultural work, and the estimated seasonal rate is 2.4 percent.

2020 Water Use Estimates and 2025-2045 Demand Projections

In 2020, Gadsden County had 3.1 percent of the total District population and 3 percent of water use Districtwide. Agriculture use comprised close to half (43 percent) of all water use. Public supply and domestic self-supply together were 51 percent of all Region VI water use (Figure 2-50 and Table 2-28). There are no thermoelectric power generating facilities in Gadsden County. 83 percent of water used came from the Floridan aquifer with the remainder from surface and other water sources. Estimated future projected reasonable-beneficial water use demands are in Table 2-29, below.

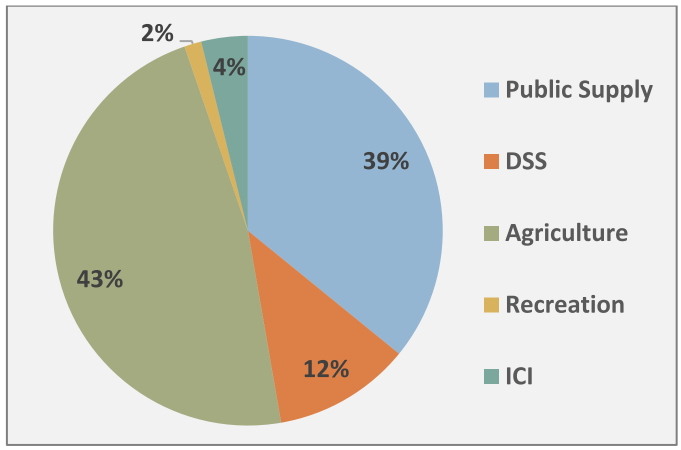


Figure 2-50. Region VI – 2020 Water Use

Table 2-28. Region VI - 2020 Water Use (mgd) and Population Estimates

County	Public Supply	DSS	Agriculture	Recreation	ICI	Power	TOTAL	BEBR Population	Adjusted Population
Gadsden	4.395	1.397	4.938	0.220	0.472	-	11.423	46,226	47,335
TOTALS	**4.395**	**1.397**	**4.938**	**0.220**	**0.472**	**-**	**11.423**	**46,226**	**47,335**
% of total*	38.5%	12.2%	43.2%	1.9%	4.1%		100%	3.1%	3.0%

*Percent per water use category in this region, and percent of Districtwide population.

Public Supply: Projected increases in water demand are consistent with medium population growth projections. Additional public supply utility data are in Appendix 4.

DSS and Small Public Systems: Known domestic self-supply wells appear to be fairly evenly distributed across Gadsden County.

Agriculture: Projected increases in water demand are attributed to 4,169 irrigated acres. Projected crops include non-citrus fruits, hay, and fresh market vegetable production. Field crops and greenhouse/nursery production are expected to remain constant over the planning horizon.

Recreation: Recreational water use in Region VI is 2 percent of the total regional water use. Estimates are based on reported pumpage from golf course and other recreational permittees, and from residential and other small-scale recreational irrigation wells that have GWUPs with no water use reporting requirements.

ICI: There are few industrial, commercial, or institutional facilities in Region VI. Most of the projected increase in demand is attributed to trends in water use at the Florida State Hospital in Chattahoochee.

Table 2-29. Region VI - 2020 Estimated Water Use and 2025-2045 Demand Projections (mgd) - Average

Use Category	Estimates	Future Demand Projections – Average Conditions					2020-2045 Change	
	2020	2025	2030	2035	2040	2045	mgd	%
Public Supply	4.395	4.462	4.504	4.528	4.550	4.556	0.160	3.7%
DSS	1.397	1.417	1.431	1.438	1.444	1.444	0.047	3.4%
Agriculture	4.938	4.952	4.966	4.964	4.979	4.992	0.054	1.1%
Recreational	0.220	0.223	0.225	0.226	0.227	0.227	0.007	3.0%
ICI	0.472	0.486	0.639	0.744	0.844	0.886	0.414	87.7%
Power	-	-	-	-	-	-	n/a	n/a
TOTALS	**11.423**	**11.539**	**11.765**	**11.900**	**12.045**	**12.105**	**0.682**	**6.0%**

Table 2-30. Region VI - 2020 Estimated Water Use and 2025-2045 Demand Projections (mgd) - Drought

Use Category	Estimates	Future Demand Projections - Drought Year Events					2020-2045 Change	
	2020	2025	2030	2035	2040	2045	mgd	%
Public Supply	4.395	4.774	4.819	4.845	4.868	4.874	0.479	10.9%
DSS	1.397	1.516	1.531	1.538	1.546	1.546	0.149	10.6%
Agriculture	4.938	6.540	6.560	6.557	6.576	6.593	1.655	33.5%
Recreational	0.220	0.299	0.302	0.303	0.304	0.304	0.084	38.0%
ICI	0.472	0.486	0.639	0.744	0.844	0.886	0.414	87.7%
Power	-	-	-	-	-	-	n/a	n/a
TOTALS	**11.423**	**13.615**	**13.851**	**13.987**	**14.139**	**14.204**	**2.780**	**24.3%**

Total Region VI water demand is projected to be 12.1 mgd by 2045 in an average year (Table 2-29) and 14.2 mgd in a drought year (Table 2-30), an estimated 17 percent increase in water demand over average conditions. Agricultural water use is 61 percent of the projected increase in drought conditions.

Assessment of Water Resources

Numerous farm ponds and in-stream impoundments constructed throughout the Telogia Creek watershed during past decades have altered the historical flow regime. The District designated the northern portion of the Telogia Creek watershed as a Water Resource Caution Area (WRCA) in 1990. Additionally, most of the remainder of central Gadsden County is within an Area of Resource Concern. Within the WRCA and ARC, the thresholds for which an Individual Water Use Permit is required are lower. Additional water conservation requirements may apply within the WRCA.

Both surface water and groundwater are used as water sources in Region VI. Water demands have not increased appreciably over time. The 2020 total water use of 11.38 mgd is less than the 1995 total water use of 12.50 mgd (Ryan et al, 1998). Projected water use is expected to increase slightly, to 11.91 mgd by 2045. To date, the most significant historical change in water use has been a shift from surface water to groundwater by the city of Quincy during 2001-2002.

Groundwater Resources

Groundwater accounted for 9.49 mgd or approximately 83 percent of the total water used in 2020 and is the source for all public supply use. In order of depth, the major hydrostratigraphic units are the surficial aquifer system, the intermediate system, and the Floridan aquifer system. Groundwater availability is limited across most of Region VI due to the low water-yielding properties of the Floridan aquifer and poorer water quality with increasing depth, particularly within the WRCA and the ARC.

The surficial aquifer system consists primarily of interbedded layers of clayey sands and sandy clays and is negligible as a source of water supply in Region VI. Its importance derives from its role as a source of water for underlying units and its discharge to streams throughout the region, which sustains streamflow during drought periods. The thickness is spatially variable across the county. In most areas, the surficial aquifer system is less than 50 feet thick. In northwest Gadsden County where topographic elevations are higher and surficial deposits are thicker, the thickness ranges from approximately 45 feet to 100 feet.

The intermediate system consists of low permeability sediments, which form an effective confining unit and restricts recharge to the Floridan aquifer in most areas. The intermediate system is generally between 200 and 300 feet thick in central Gadsden County, 100 feet or less in the northwestern Gadsden County, and 150 feet or less in eastern Gadsden County. Although the intermediate system functions primarily as a confining unit, carbonates within the intermediate system form minor water-bearing zones that are utilized for some domestic self-supply. These carbonate units also supply some recharge to the underlying Floridan aquifer system.

The Floridan aquifer system consists of a sequence of carbonates ranging in thickness from 450 to 650 feet across Gadsden County. In order of depth, the Floridan aquifer system includes the Chattahoochee Formation, the Suwannee Limestone, and the Ocala Limestone. Typically, only the upper portion of the Floridan aquifer system is utilized for water supply due to increasingly mineralized water with depth.

The Apalachicola Embayment is a geological structural trough, which is deepest along its northeast to southwest trending axis in central Gadsden County. Within the Apalachicola Embayment, the Floridan aquifer is overlain by a thick intermediate system and recharge to the Floridan aquifer system is limited. As a result, very little secondary dissolution of the carbonates has taken place and transmissivities are low. Northwest of the Embayment near Chattahoochee and southeast in Leon County are the structural high areas of the Chattahoochee Anticline and Ocala Arch, respectively, where intermediate system is thinner and the Floridan aquifer is closer to land surface and is more productive (Richards and Dalton, 1987).

Estimated Floridan aquifer transmissivities near the center of the Embayment are relatively low and range from 1,590 ft^2/day to 4,700 ft^2/day near Quincy (Barksdale, 1988). Values estimated from specific capacity tests were lower, and generally less than 1,000 ft^2/day, except at Quincy #4, where the estimated transmissivity was 5,543 ft^2/day. In the WRCA, wells typically exhibit low yields, with specific capacities less than 3 gpm/ft. Wells open to deeper formations may have specific capacities of up to 15 gpm/ft.

In northwest and eastern Gadsden County on the outer edges of the Embayment, the Floridan aquifer system is more permeable and well yields are higher. A transmissivity of 12,500 ft^2/day was estimated from an aquifer performance test near Chattahoochee, and a transmissivity of 54,000 ft^2/day was estimated at a site near Havana (Richards and Dalton, 1987). These values reflect the more productive Suwannee Limestone and Ocala Group formations in this area. An aquifer performance test conducted north of U.S. Highway 90 and 1.7 miles east of State Road 269A had an exceptionally high value of 473,600 ft^2/day (Jim Stidham and Associates, 2000).

The groundwater contribution area for the Floridan aquifer system in Region VI extends into southwest Georgia (Davis, 1996). The potentiometric surface of the Floridan aquifer reaches an elevation of 70 ft

NAVD88 in northwest Gadsden County (Figure 2-51). From this potentiometric high, groundwater flow flows west towards the Apalachicola River and southeast toward Leon and Wakulla counties. Principal discharge areas include the Apalachicola River and, to the south, Wakulla Spring and other springs in the Woodville Karst Region, and the Gulf of Mexico.

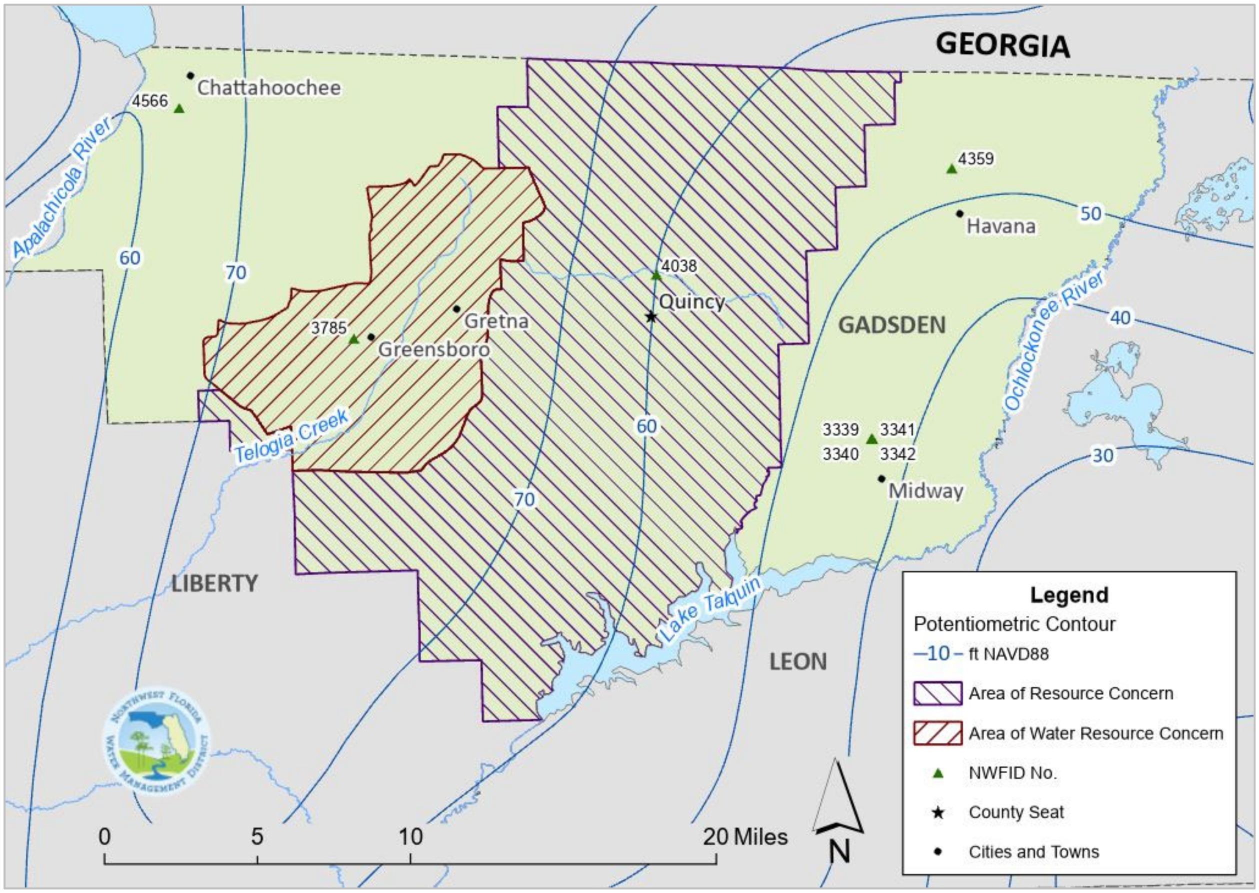


Figure 2-51. Potentiometric Surface of the Floridan Aquifer System in Gadsden County, September 2017

Water levels within the upper part of the Floridan aquifer historically were about 40 ft higher than the water levels in the middle and lower portions of the aquifer throughout Gadsden County (Wagner, 1982). The higher aquifer levels in the upper portion of the Floridan aquifer are due to the presence of marl and other low-permeability sediments that retard the downward movement of water. This upper portion of the Floridan aquifer is utilized by most domestic supply wells. The middle, higher yielding portion of the Floridan aquifer is primarily utilized by agriculture and public water supply utilities.

The Midway monitor wells are located southeast of the ARC. This cluster of monitor wells illustrates the hydraulic head variations among hydrostratigraphic units (Figure 2-52D). The uppermost monitoring well is open to the surficial aquifer system (well depth = 29 ft, cased depth = 20 ft) and water levels are 20 to 25 feet greater than the water levels in the intermediate system well (well depth = 85 ft, cased depth = 77 ft). The lower two hydrographs represent wells open to the upper Floridan (well depth = 356, cased depth = 232) and lower Floridan aquifers (well depth = 435, cased depth = 366). There is a consistent 5-to-10-foot difference in water levels between the upper and lower Floridan aquifers. There is relatively little pumping in the Midway area.

Criteria used to assess the adequacy of groundwater resources to meet projected demands through 2045 included an evaluation of trends in aquifer levels and associated changes in the potentiometric surface and a review of a regional water budget for the Floridan aquifer system.

Appendix 6 provides the results of groundwater level trend analyses for sites having at least 20 years of record and recent data (2018 or later). Depending on the site, trend analyses may include an assessment of period of record linear monotonic trends, period of record nonlinear monotonic trends, or step trends. If groundwater levels are significantly correlated with antecedent rainfall, an assessment of trends may have been performed on the rainfall-adjusted groundwater level residuals. The methods used for the trend analyses are detailed in Appendix 1.

Water levels at most Floridan aquifer wells within Region VI declined during the 1980s and 1990s, reaching period of record minimums during the 2000-2001, 2006-2007, or 2011-2012 drought events, followed by a period of water level recovery coinciding with above-average rainfall from 2013 through 2022. This general pattern can be observed at wells within the ARC and WRCA, such as the Premier Enterprise #2 well (NWF_ID 3636), Buck Register well (NWF_ID 3653), Quincy #3 well (NWF_ID 4026), Carl Fryer Well (NWF_ID 3692), and wells outside the ARC and WRCA such as the Register/Old Garland well (NWF_ID 4359).

Within Region VI, 13 wells had sufficient data for trend analyses. These include nine Floridan aquifer wells, two intermediate system wells, and two surficial aquifer wells. To minimize the effects of climatic variability, trend analyses were performed on rainfall-adjusted aquifer level residuals except for the Buck Register (NWF_ID 3653), Premier #2 (NWF_ID 3636), and Quincy #3 (NWF_ID 4026) wells, which had large residuals relative to the water level range. Aquifer levels at Quincy MO #1 (NWF_ID 8152) did not exhibit a significant correlation with antecedent cumulative rainfall and unadjusted aquifer levels were used for trend analysis at this site.

The Greensboro #3 well (NWID 3785) is completed in the upper portion of the Floridan aquifer (total depth 420 ft and cased depth 264 ft) and is representative of the primary interval utilized for water supply in the WRCA. In the mid-1970s, water levels were about 110 ft NAVD88. Due to the limited amount of data in the 1970s and a large data gap, trend analysis was not performed for this site, but aquifer levels were reviewed. Between the mid-1970s and the mid-1990s, water levels declined by about 30 feet despite only a modest increase in groundwater use near Greensboro (Figure 2-52B). Due to the low transmissivities and limited aquifer recharge in this area, modest withdrawals can result in the propagation of relatively large drawdowns. Following the droughts of 2000-2001, 2006-2007, and 2011-2012, aquifer levels increased in response to above-average rainfall during 2013 to 2022 but remain approximately 20 feet below historical levels.

Wells within the ARC and WRCA showed mixed patterns. Of the four Floridan aquifer wells in these areas of resource concern, water levels in two wells exhibited an increase for the period of record while data from the other two wells exhibited a decrease. Aquifer levels at the Register/Old Garland Well (NWF_ID 4359) located northeast of the ARC did not exhibit a trend.

Floridan aquifer levels in northwest and southeast Gadsden County generally appear to be stable. Neither of the two Floridan aquifer wells located in southeast Gadsden County near Midway exhibit trends. The "Unused South of Chattahoochee" well (NWF_ID = 4266) is located in northwest Gadsden County where the Floridan aquifer is more permeable. Aquifer levels at this well do not exhibit a long-term trend, despite nearby withdrawals for public supply and institutional uses.

Data are limited for the surficial and intermediate systems. Data from one surficial aquifer well, located in the Midway Area (NWF_ID 3341) exhibits a decreasing trend of approximately -0.04 ft/yr (95% CI: -0.07, 0.01) while data from another surficial aquifer well, located within the WRCA, did not exhibit any trend. No trends were detected at the intermediate system wells.

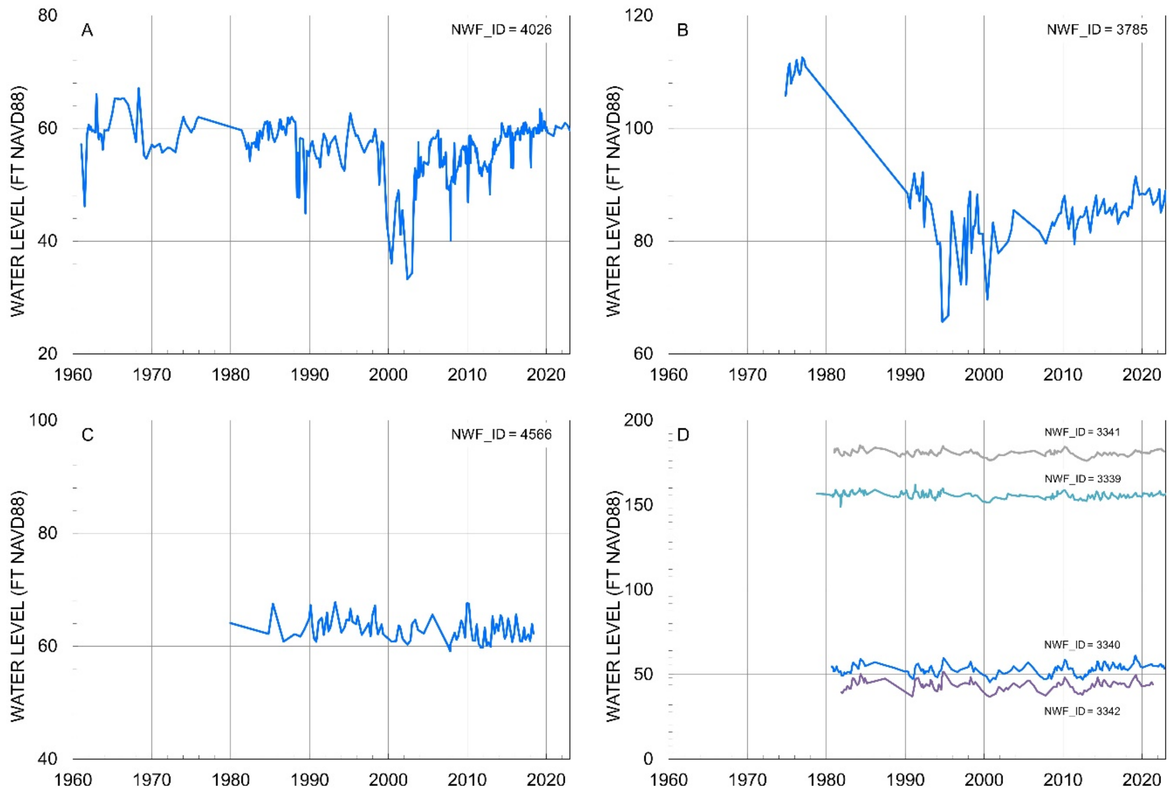


Figure 2-52. Hydrographs of Wells A) Quincy #3, B) Greensboro #3, C) Chattahoochee, and D) Midway

Water Quality Constraints on Groundwater Availability

Naturally occurring highly mineralized water in the lower portion of the Floridan aquifer can affect the development of groundwater resources in the region. Figure 2-53 presents data collected during the testing and construction of the city of Quincy Well #2 (NWF_ID 4038), which shows the decreasing water quality with increasing depth (Wagner, 1982). The well was completed with a cased depth of 340 ft and a total depth of 506 ft but is not in use. The District is monitoring groundwater quality at several wells in Region VI, but the available periods of record are less than 20 years, and no trend analyses were performed for water quality parameters.

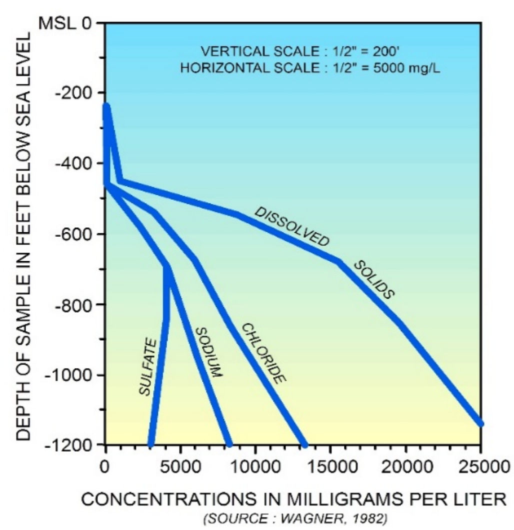


Figure 2-53. Water quality variations with depth at city of Quincy Well #2 (NWF_ID 4038)

Groundwater Budget

A regional groundwater budget (Figure 2-54) provides an order-of-magnitude approximation of inflows to and outflows from the Floridan aquifer in Region VI (Ryan et al., 1998). The water budget was based on output from a steady-state three-dimensional groundwater flow model (Davis, 1996). The model was calibrated to conditions in October and November of 1991. Major inflows to the Floridan aquifer include flow from upgradient areas, leakage from the overlying intermediate system, surface infiltration, and direct recharge. Recharge and leakage to the Floridan aquifer was estimated to equate to an annual rate of less than 0.5 inches per year.

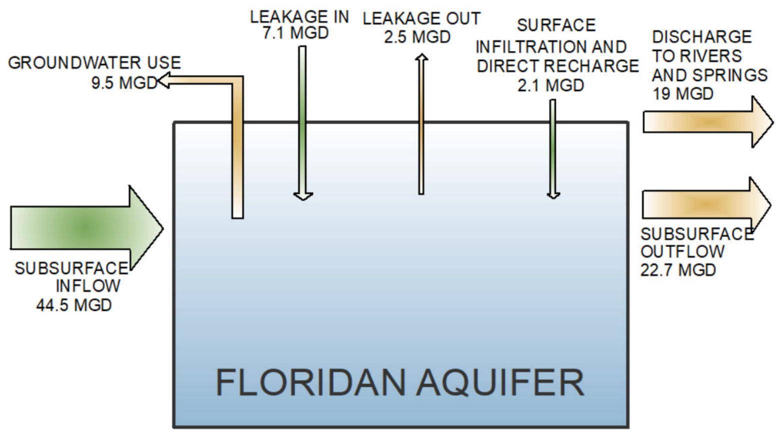


Figure 2-54. Region VI Floridan Aquifer Steady-State Groundwater Budget

The total inflow into the Floridan aquifer in Region VI was estimated to be 53.7 mgd (Ryan et al., 1998). The 2020 groundwater use of 9.49 mgd is about 18 percent of the estimated Floridan aquifer inflow in Region VI. The projected 2045 average year groundwater demand of 10.15 mgd represents approximately 19 percent of the total inflow. The project 2045 drought year groundwater demand is 11.62 mgd or about 22 percent of the estimated Floridan aquifer inflow.

Surface Water Resources

Surface water resources consist of a well-developed stream network, wetlands, and manmade stream impoundments. No natural lakes occur in the region. As indicated previously, surface water sources are limited within Region VI. Impoundments were constructed for agricultural irrigation, water-based recreation, power generation, and aesthetic uses. Lake Talquin, the largest impoundment, was created by the construction of the C.H. Corn Hydroelectric Dam (formerly Jackson Bluffs Hydroelectric Dam).

Clayey soils in Gadsden County limit infiltration rates and streams generally exhibit high runoff rates compared to baseflow. However, this may not be evident on hydrographs for impounded streams since upstream storage may dampen water level responses to rainfall events. In Gadsden County, surface water supplies may be limited during periods of low rainfall or drought. Due to concern for limited water supplies, the Upper Telogia Creek Drainage Basin was designated as a Water Resource Caution Area in October 1990. The central portion of Gadsden County was designated as an Area of Resource Concern (Figure 2-51) on May 29, 2014. In the WRCA and ARC, the thresholds at which an Individual Water Use Permit is required are lower. Also, there are additional water conservation requirements for permittees located within the WRCA.

Surface water is used to meet some agricultural and recreational water use demands. Quincy Creek, Telogia Creek, the Little River, and their tributaries are the primary surface water sources. Surface water withdrawals totaled 1.94 mgd in 2020, with 98 percent of this amount used for agriculture. Projected surface water withdrawals are estimated to increase only slightly to 1.96 mgd in 2045. Under drought conditions, the projected surface water use in 2045 is estimated to be 2.59 mgd. Current and projected future withdrawals reflect a large decrease since 1998 when surface water withdrawals totaled approximately 6 mgd (Ryan et al. 1998). Both the current and the projected 2045 surface water withdrawals are less than the historical withdrawal amounts in 1995, 2005, and 2010.

The Quincy and Telogia Creek watersheds are relatively small, with their headwaters located within the region. Quincy Creek is a tributary to the Little River, which discharges to the Ochlockonee River. Historically, the city of Quincy withdrew surface water from Quincy Creek to meet public supply demands but discontinued this use in late 2002 due to high turbidity levels in the creek following storm events. By 2003, the City relied solely on groundwater from the Floridan aquifer. The USGS maintained a gauging station on Quincy Creek at SR 267 from 1974 to 1992. From 1992 to present, a station at this location has been maintained by the District. Low-flow statistics for Quincy Creek are presented in Table 2-31. Analyses of trends in monthly average baseflows in Quincy Creek at SR 267 revealed no long-term decline that may be indicative of potential withdrawal-related impacts. A trend analysis was also performed on average monthly baseflows for the USGS station 02329600 Little River Near Midway, which is downstream of the confluence of Quincy Creek and the Little River. No trends were detected for the 1985 to 2022 period of record.

The District has maintained a gauging station on Telogia Creek at County Road 65D since 1991. This is the most upstream long-term station in the watershed and is downstream of some surface water withdrawals. Flows at this location range from zero (no flow) to 1,827 cfs. Low flow statistics are provided in Table 2-31. Days with flows less than 1 cfs have occurred during multiple years. This condition has reportedly occurred for at least 60 years, extending back to the region's tobacco farming era (NWFWMD 2018). There are no long-term trends for the 1990 to 2022 period of record. However, a decline in baseflow of 0.56 cfs/yr is present at the USGS Station 2330100, Telogia Creek NR Bristol, which has a period of record extending from 1950 through 2021. The Bristol station is located downstream within Planning Region IV.

Table 2-31. Low Flow Statistics for Quincy and Telogia Creeks

Statistic (cfs)	Quincy Creek at SR 267 Oct. 1974 – Nov. 2022	Telogia Creek at County Road 65D May 1990 – Nov. 2022
Minimum Average Daily Flow	2.54	0.0
Q90 (10^{th} percentile) Flow	7.77	5.71
Mean Daily Baseflow	12.15	9.46

Water Quality Constraints on Surface Water Availability

Surface water quality varies throughout the region and may affect its suitability for some uses. Water quality standards for iron have been exceeded at Quincy Creek and the Little River (FDEP 2022), and as noted previously, turbidity levels can be high in Quincy Creek following storm events.

Alternative Water Supply and Conservation

Non-traditional sources of water in Region VI include reuse of reclaimed water. District support to water supply development projects have contributed to water conservation, leak detection, water use efficiencies, and expanding reuse potential.

Water Conservation

Water conservation potential has not been estimated for Region VI. District permit conditions that support water conservation measures include annual water use reporting; evaluation of water use practices to enhance water conservation and efficiency, monitoring and reduction of water losses; maximum water loss and residential per capita water use goals; and public education campaigns. In the past five years the District has managed projects with the city of Gretna to replace effluent meters at the wastewater treatment plant. In Region VI there has not been a significant trend in the gross per capita water use from the 1995 WSA to the current 2023 WSA estimates as shown in Figure 2-55. Factors such as climate, economic conditions, population trends, and changes in ICI or other water use categories can influence these values. Droughts occurred during 1999-2000, 2006-2007, and 2011-2012, which influenced irrigation quantities during these years.

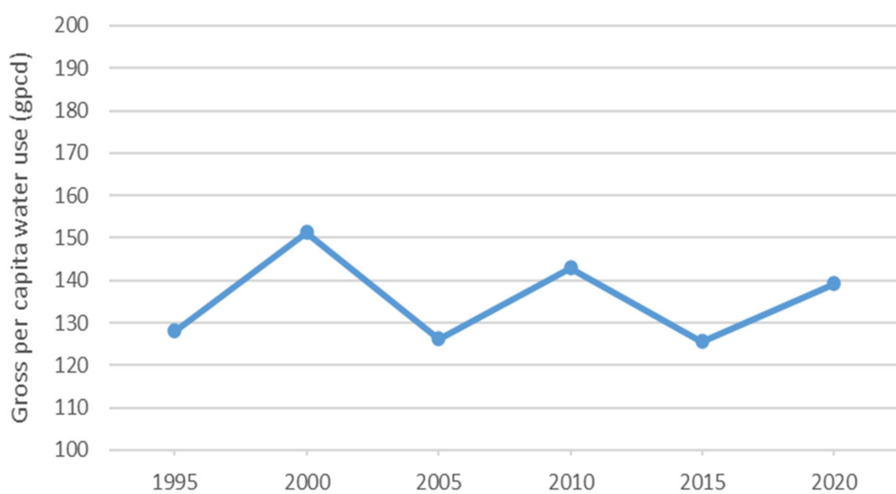


Figure 2-55. Region VI Gross per capita water use

Reuse of Reclaimed Water

In 2020, Region VI utilized 0.3 mgd of potable offset reuse or 13 percent of their wastewater treatment facility (WWTF) flows, which totaled 2.2 mgd (Table 2-32).

Table 2-32. Region VI - 2015 Reuse and Wastewater Flows (mgd)

County	Potable Offset Reuse Flow	Percent of Potable Offset Reuse to Total WWTF Flow	Total WWTF Flow	Total WWTF Capacity	Number of WWTFs	WWTFs Providing Potable Offset
Gadsden	0.270	12.6%	2.151	4.250	6	1
TOTALS	**0.270**	**12.6%**	**2.151**	**4.250**	**6**	**1**

Based on population projections, future reuse availability is estimated to be an additional 1.9 mgd by 2045. This additional availability added to existing 2020 reuse flows totals 2.2 mgd, or 52 percent of the 2020 total facility capacities (Table 2-33).

Table 2-33. Region VI - 2020-2040 Future Potential Reuse Availability (mgd)

County	2020 Potable Offset Reuse Flow	Future Reuse Estimated Availability					2040 Estimated Total Flow	
		2025	2030	2035	2040	2045	mgd	% of Capacity
Gadsden	0.270	1.908	1.926	1.936	1.945	1.945	2.215	52.1%
TOTALS	**0.270**	**1.908**	**1.926**	**1.936**	**1.945**	**1.945**	**2.215**	**52.1%**

Future potable offset reuse assumptions are that WWTF's have treatment and disinfection levels suitable for the reuse end uses, and that transmission infrastructure is available to reuse customers.

Region VI: RWSP Evaluation

Both groundwater and surface water resources continue to be limited, particularly in the Telogia Creek WRCA and the Area of Resource Concern in Gadsden County. However, the existing and reasonably anticipated water sources in Region VI are considered adequate to meet the projected 2045 average year and 1-in-10-year drought event demands, while sustaining water resources and related natural systems. Therefore, a regional water supply plan is not recommended for Region VI.

REGION VII: JEFFERSON, LEON, AND WAKULLA COUNTIES

Overview

Region VII covers approximately 1,617 square miles and includes Leon and Wakulla counties and western Jefferson County (Figure 2-56). The eastern portion of Jefferson County is within the Suwannee River Water Management District. The Floridan aquifer is the primary water source in Region VII.

The St. Marks River and Apalachee Bay watershed covers most of Region VII, although western Leon and Wakulla counties are within the Ochlockonee River and Bay watershed. Region VII has three first-magnitude springs: Wakulla Spring, an Outstanding Florida Spring, the St. Marks River Rise, and the submarine Spring Creek Spring Group.

Region VII Snapshot

	2020	2045
Population	347,175	402,073
Water Use (mgd)	47.86	55.09

Primary Water Source(s):	Floridan aquifer system
MFL Waterbodies:	St. Marks River Rise, Wakulla and Sally Ward Spring System
Water Reservations:	None
RWSP Status:	No RWSP Recommended

Region VII's major urban area and state capital, the city of Tallahassee, is in Leon County. In 2020, Tallahassee accounted for more than half of the total population in the region. The Apalachicola National Forest covers large areas of Wakulla and Leon counties, and the St. Marks National Wildlife Refuge encompasses much of coastal Wakulla County. The 1,325-square mile Upper Wakulla River and Wakulla Springs BMAP was adopted in 2015 and updated in 2018, with numerous springs restoration projects being implemented to reduce nitrate levels to the Total Maximum Daily Load of 0.35 mg/L. The BMAP area covers portions of Gadsden, Jefferson, Leon, and Wakulla counties.

Population

The 2020 BEBR population estimate for Region VII is 343,623. Region VII has relatively low estimated seasonal populations in all three counties with estimated seasonal rates ranging from 0.5 percent in Leon County to five percent in Wakulla County. The 2020 seasonally adjusted population estimate is 347,175. Seasonal population estimates exclude group quarters, for example, college and university housing and correctional facilities. Coordination with the Suwannee River Water Management District (SRWMD) substantiated the assumptions regarding the share of Jefferson County population in each water management district.

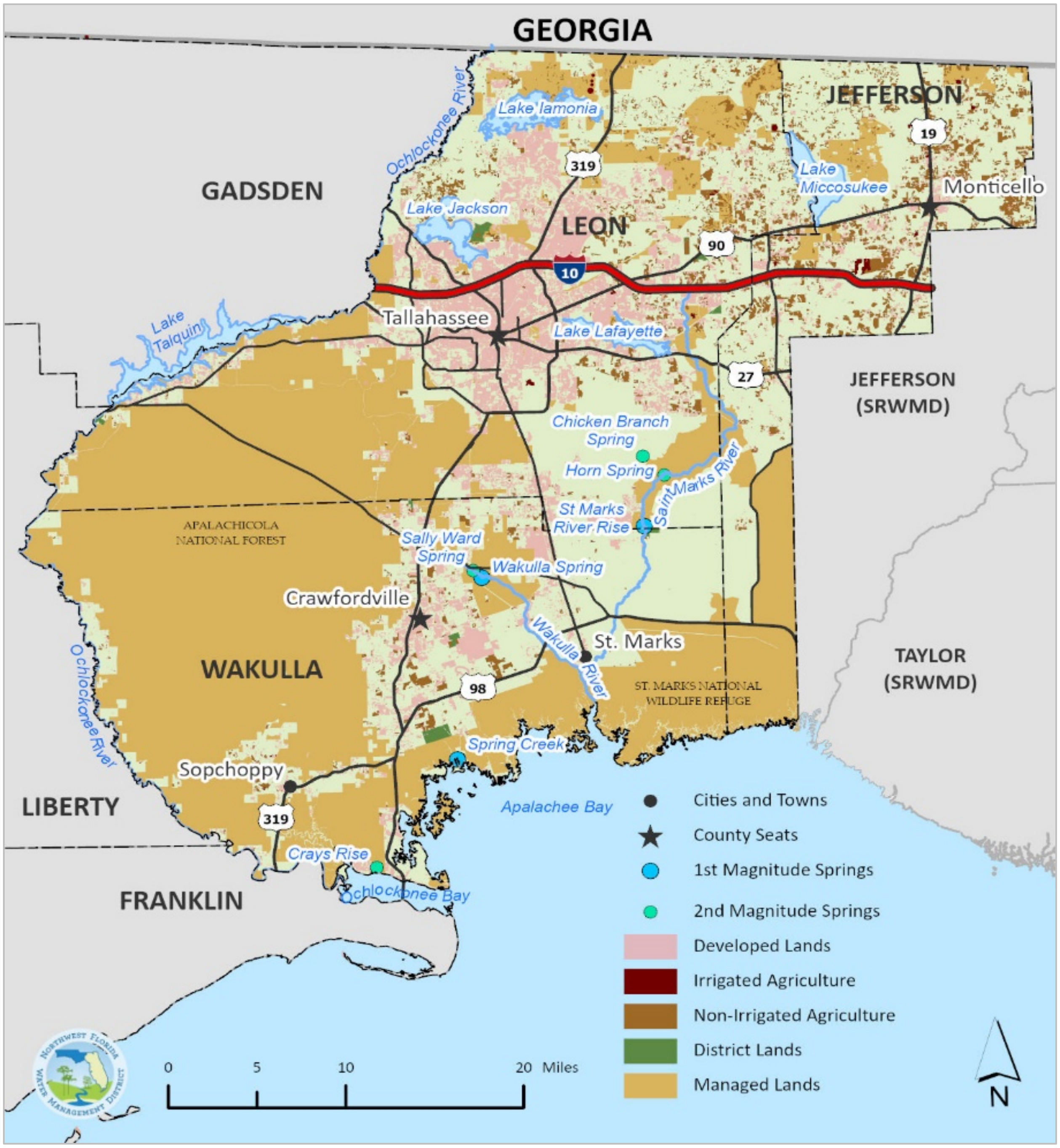


Figure 2-56. Region VII – Jefferson, Leon, and Wakulla Counties

2020 Water Use Estimates and 2025-2045 Demand Projections

In 2020, Region VII had approximately 23 percent of the population and accounted for 14 percent of all water use Districtwide (Figure 2-57 and Table 2-34). Approximately 70% of the region's water use was attributed to public supply use, and over three-fourths of all Region VII water use is reported by the city of Tallahassee.

Approximately half of the city of Tallahassee's reported pumpage is for residential public supply with the remainder serving commercial, industrial, and other non-residential water uses. Domestic self-supply and recreation comprise about 10 percent and eight percent, respectively, of the region's water use. Power generation accounts for six percent.

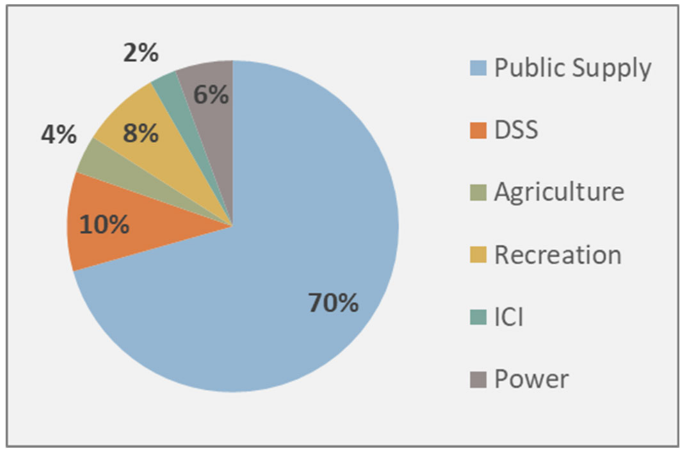


Figure 2-57. Region VII - 2020 Water Use

Table 2-34. Region VII - 2020 Water Use (mgd) and Population Estimates

County	Public Supply	DSS	Agriculture	Recreation	ICI	Power	TOTAL	BEBR Population	Adjusted Population
Jefferson	0.556	0.422	1.091	0.791	-	-	2.859	10,158	10,514
Leon	30.309	3.446	0.547	2.689	0.084	2.500	39.575	299,484	300,981
Wakulla	2.934	0.789	0.134	0.197	1.166	0.207	5.428	33,981	35,680
TOTALS	**33.823**	**4.656**	**1.772**	**3.678**	**1.250**	**2.707**	**47.862**	**343,623**	**347,175**
% of total*	70.6%	9.7%	3.7%	7.7%	2.6%	5.7%	100%	23.0%	21.7%

*Percent per water use category in this region, and percent of Districtwide population.

The future projected reasonable-beneficial water use demands in Region VII are summarized in Table 2-35, below.

Table 2-35. Region VII - 2020 Estimated Water Use and 2025-2045 Demand Projections (mgd) - Average

Use Category	Estimates	Future Demand Projections – Average Conditions					2020-2045 Change	
	2020	2025	2030	2035	2040	2045	mgd	%
Public Supply	33.799	35.225	36.491	37.500	38.345	39.078	5.279	15.6%
DSS	4.656	4.148	3.934	3.732	3.518	3.311	(1.345)	-28.9%
Agriculture	1.772	1.793	1.816	1.823	1.829	1.831	0.059	3.3%
Recreational	3.678	3.796	3.890	3.966	4.035	4.092	0.414	11.3%
ICI	1.250	1.272	1.350	1.420	1.495	1.538	0.288	23.0%
Power	2.707	5.240	5.240	5.240	5.240	5.240	2.533	93.6%
TOTALS	**47.862**	**51.474**	**52.721**	**53.681**	**54.462**	**55.089**	**7.227**	**15.1%**

Public Supply: Both Leon and Wakulla counties are projected to have relatively high population growth rates over the planning horizon. Projected future public supply demand is consistent with these growth trends. Additional public supply utility data are in Appendix 4.

DSS and Small Public Systems: Known domestic self-supply wells are fairly evenly distributed across the northern part of Jefferson County. In Leon County, DSS wells are adjacent to Lake Talquin on the west, near the Wakulla County border on the south, and in more rural parts of Leon County east, northeast, and north of Tallahassee. Wakulla County DSS wells are concentrated around the north-central part of the county between and around Crawfordville, St. Marks, and the Leon County border.

Agriculture: There is a projected decline in Wakulla County agricultural water use and crop production and slight increases in Jefferson and Leon counties.

Recreation: Over half of all recreational water use in Region VII was reported by golf courses and other permittees. The remaining 34 percent of recreational water use was estimated from residential and other small-scale recreational irrigation wells that have GWUPs with no water use reporting requirements.

ICI: There are three IWUP reporting ICI facilities in Wakulla County, one in Leon County, and none in Jefferson County. Numerous industrial, commercial, and institutional enterprises in Region VII are served by public supply.

Power Generation: The Sam O. Purdom Generating Station in Wakulla County and the Arvah B. Hopkins Generating Station in Leon County are both owned by the city of Tallahassee. Future demand projections are primarily attributed to the estimated water use of the Arvah B. Hopkins plant.

Table 2-36. Region VII - 2020 Estimated Water Use and 2025-2045 Demand Projections (mgd) - Drought

Use Category	Estimates	Future Demand Projections – Average Conditions					2020-2045 Change	
	2020	2025	2030	2035	2040	2045	mgd	%
Public Supply	33.799	37.691	39.045	40.125	41.029	41.813	8.014	23.7%
DSS	4.656	4.439	4.210	3.993	3.764	3.542	(1.113)	-23.9%
Agriculture	1.772	2.259	2.297	2.305	2.313	2.314	0.542	30.6%
Recreational	3.678	5.086	5.212	5.314	5.407	5.483	1.805	49.1%
ICI	1.250	1.272	1.350	1.420	1.495	1.538	0.288	23.0%
Power	2.707	5.240	5.240	5.240	5.240	5.240	2.533	93.6%
TOTALS	**47.862**	**55.987**	**57.355**	**58.397**	**59.248**	**59.931**	**12.069**	**25.2%**

Total Region VII water demand is projected to increase to 55.09 mgd by 2045 in an average year (Table 2-35) and 59.93 mgd in a drought year event (Table 2-36).

Assessment of Water Resources

Based on water demand projections, the Floridan aquifer will continue to be the primary water source through the year 2045 in Region VII. The projected 2045 Floridan aquifer demand is 53.9 mgd, an increase of 15 percent from the 2020 estimate of 46.9 mgd. There is little consumptive use of surface water within the region, other than small amounts used for power generation. Accordingly, the resource assessment focuses primarily on groundwater resources. Criteria used to assess the sustainability of groundwater resources include assessment of long-term trends in aquifer levels, stream baseflows, and groundwater quality; a review of a regional groundwater budget; and an evaluation of whether springs with adopted minimum flows are meeting these flows and whether these flows are anticipated to be met through the 20-year planning horizon.

Groundwater Resources

Region VII lies within the Woodville Karst region (Pratt et al., 1996). The groundwater flow system consists of three hydrostratigraphic units. In descending order, the units are the surficial aquifer system (where present), the intermediate system (where present), and the Floridan aquifer system. The Cody Escarpment, or Cody Scarp, is a prominent topographic feature that runs east-west along southern Leon County and is the erosional edge of the Hawthorn Group (Figure 2-58). The Hawthorn Group, where present, acts as a confining unit for the Floridan aquifer. North of the Cody Scarp, Plio-Pleistocene and Miocene-aged sediments are relatively thick and act as a semi-confining unit for the Floridan aquifer. South of the Cody Scarp, these sediments are largely thin or absent and the Floridan aquifer system is unconfined.

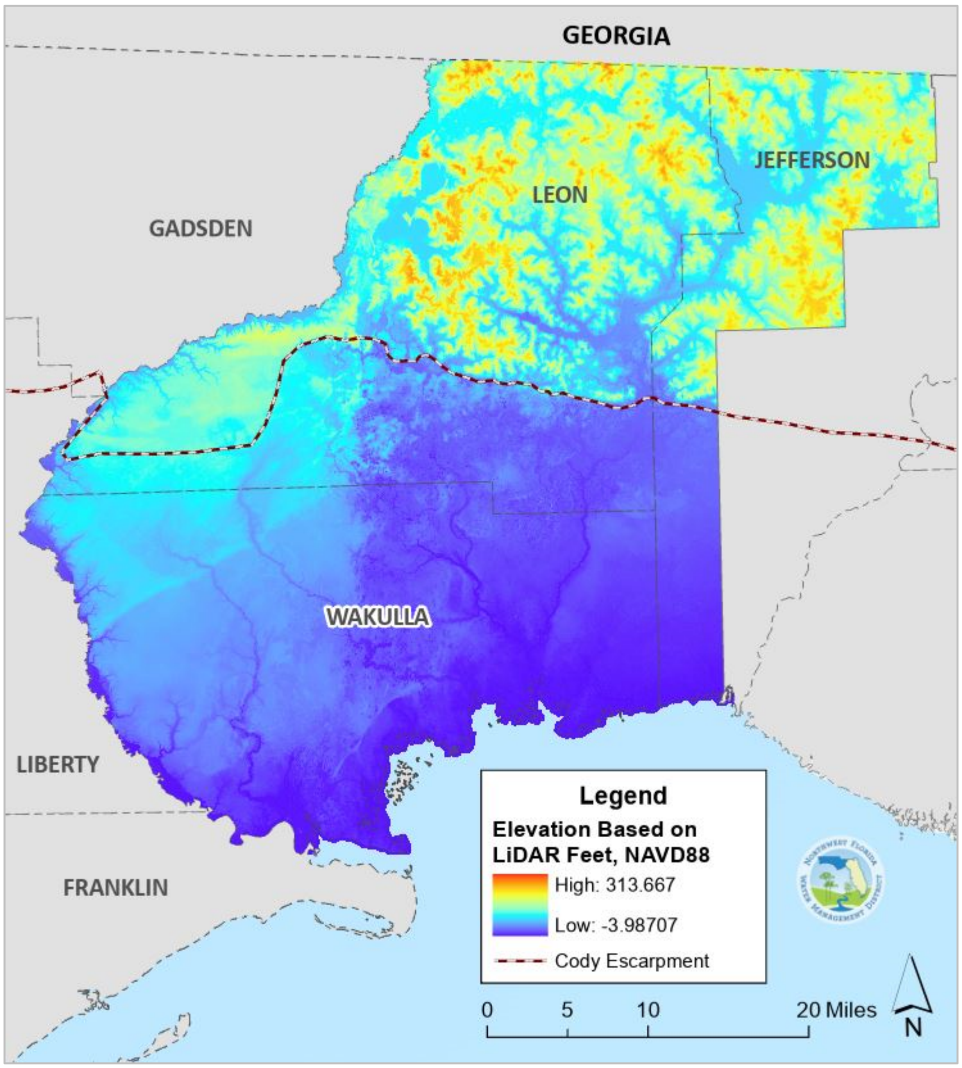


Figure 2-58. Land Elevation and Cody Escarpment in Region VII, based on LiDAR Data

Where present, the surficial aquifer is generally 10 to 50 feet thick and comprised of undifferentiated sands and clays. The surficial aquifer is a source of recharge to the Floridan aquifer system. The surficial aquifer is negligible as a water source in Region VII. The intermediate system is generally comprised of low permeability, Miocene sands, and clays. Where present in southern Leon County and Jefferson counties, the intermediate system is generally less than 100 feet thick, breached by sinkholes, and functions as a semi-confining unit for the Floridan aquifer. However, the thickness of the intermediate may reach 150 feet in some areas of northern Leon County. In eastern Wakulla County, southern Jefferson County, and southeastern Leon County, the intermediate system is absent. The intermediate system thickens and is breached by fewer karst features in the western portion of Region VII. In western Leon and Wakulla counties, the intermediate system can be 100 to 150 feet thick and functions as a confining unit. The intermediate system is negligible as a water source in Region VII.

The Floridan aquifer system within Region VII is primarily comprised of carbonate and dolomitic rocks, ranging in thickness from approximately 1,250 feet in northern Leon County to greater than 1,700 feet thick in Wakulla County. Most water production in the Floridan aquifer occurs from the St. Marks/Chattahoochee formations, the Suwannee Limestone, and the Ocala Formation, which comprise the upper productive portion of the Floridan aquifer.

The hydrogeology throughout most of Region VII is characterized by a strong hydraulic connection between surface water and groundwater, high aquifer recharge, and high groundwater availability. Local rainfall and direct recharge of surface water through swallets resulted in dissolution of carbonate minerals within the aquifer and the widespread development of karst features such as sinkholes, springs, swallets, and phreatic caves.

The Floridan aquifer exhibits a high capacity for transmitting water and is generally understood to be a dual-flow system, particularly south of the Cody Scarp where matrix and conduit flow processes occur. Approximately 45 miles of phreatic caves have been mapped in the Wakulla cave system by Woodville Karst Plain Project and an additional 10 miles have been mapped in nearby systems such as Sally Ward, Indian Spring, and Shepherd Spring (C. McKinlay, personal communication, March 14, 2023). Estimated transmissivities in Leon and Wakulla counties are some of the highest in the panhandle ranging from 10,000 ft^2/day to 1,300,000 ft^2/day (NWFWMD, unpublished data; William and Kuniansky, 2015). Exceptions are western Wakulla County and the southwestern corner of Leon County where the hydraulic properties of the Floridan aquifer system begin transitioning toward those more characteristic of the Apalachicola Embayment and transmissivities are generally less than 10,000 ft^2/day (NWFWMD, unpublished data).

In northern Leon and Jefferson counties, the potentiometric surface of the Floridan aquifer is approximately 60 ft NAVD88 (Figure 2-59). Groundwater generally flows to the south and discharges to springs, rivers, and the Gulf of Mexico. South of the Cody Scarp, the potentiometric surface is flatter. Near Wakulla Spring and the Spring Creek Spring Group, the aquifer transmissivity is very high due to secondary dissolution. The gradient is relatively flat, and aquifer water levels near these springs are generally less than 10 ft NAVD88 (Figure 2-59).

Regional discharge features include at least 51 springs (Barrios, 2006), three of which are first magnitude springs. Wakulla Spring is an Outstanding Florida Spring with a mean discharge of 588 cfs (October 23, 2004, to December 31, 2022) and is the primary source of inflow for the Wakulla River. Similarly, the St. Marks River Rise, which has a mean discharge of 438 cfs (October 19, 1992 to October 18, 2021), is the primary source of inflow to the St. Marks River. Additionally, the Spring Creek Spring Group is a first magnitude submarine spring comprised of 14 known offshore vents that discharge into Apalachee Bay.

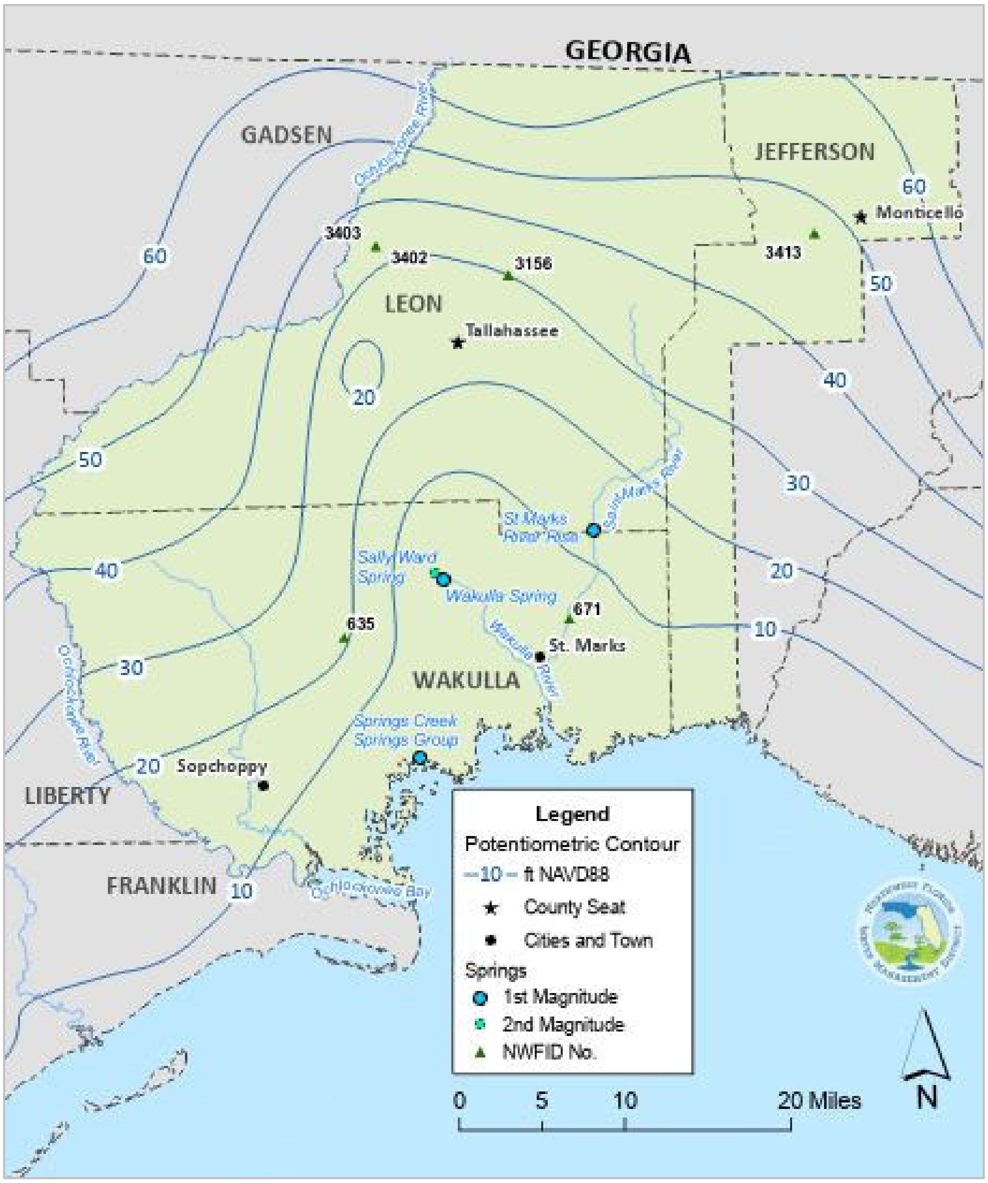


Figure 2-59. Potentiometric Surface of the Floridan Aquifer System in Region VII, September 2019

Complex groundwater flow dynamics exist between Wakulla Spring and the Spring Creek Spring Group (Davis and Verdi, 2014). Following periods of low rainfall, freshwater discharge and Floridan aquifer head pressure is not great enough to overcome the equivalent freshwater head of seawater at the coast. As a result, the equivalent freshwater head in the Floridan aquifer increases at the coast and the head gradient and direction of groundwater flow reverses, resulting in brackish or saline groundwater flowing inland. Data indicates that saline water from the Spring Creek Spring Group is transported to and discharges from the Wakulla Spring vent, causing an increase in salinity. Additionally, some groundwater that would have flowed south toward the coast appears to be redirected toward Wakulla Spring in response to changes in head gradients. An increase in discharge is typically observed at Wakulla Spring following the reversal of Spring Creek Spring Group, although there is a time lag between the initiation of the flow reversal at Spring Creek Spring Group and subsequent changes in flow and salinity at Wakulla Spring. The durations of the Spring Creek reversal events range from days to months. This is a natural process that has been occurring for at least several decades.

Appendix 6 provides the results of groundwater level trend analyses for sites having at least 20 years of record and recent data (2018 or later). Depending on the site, trend analyses may include an assessment of period of record linear monotonic trends, period of record nonlinear monotonic trends, or step trends. If groundwater levels are significantly correlated with antecedent rainfall, trend analysis was generally performed on the rainfall-adjusted groundwater level residuals. Methods used for the trend analyses are detailed in Appendix 1.

A total of 26 wells had sufficient data for trend analysis in Region VII. Most aquifer levels are significantly correlated with rainfall and trend analyses were performed on rainfall-adjusted water level residuals. Decreasing trends in the residuals, which reflect the water level variations not explained by rainfall, were present at six wells. Wells exhibiting declines in aquifer levels include the Olsen Road well (NWF_ID 3166), Lake Jackson Floridan well (NWF_ID 3402), Lake Jackson Intermediate well (NWF_ID 3404), C. Donahue Deep well (NWF_ID 978), and the Tom Brown Test well (NWF_ID 2415) in Leon County and the Newport Recreation well (NWF_ID 671) in Wakulla County. Declines range from 0.01 ft/yr (95% CI: -0.02, -0.009) at the Newport Recreation well to -0.11 ft/yr (95% CI: -0.17, -0.05) at the Olsen Road well. All wells exhibiting water level declines are located within three miles of one or more production wells. No trends were detected at the remaining 20 wells suggesting impacts may be localized rather than regional in extent.

Figure 2-60 provides example hydrographs for two Floridan aquifer wells in Region VII. Water levels at the Olsen Road well (NWF_ID 3156), located in central Leon County, exhibit relatively large fluctuations in response to climatic variation and nearby pumping as well as a long-term decline. In contrast, water levels at the Newport Recreation well (NWF_ID 671), located in southern Wakulla County, exhibit small fluctuations due to the high transmissivity and the relatively flat gradient of the potentiometric surface in this area.

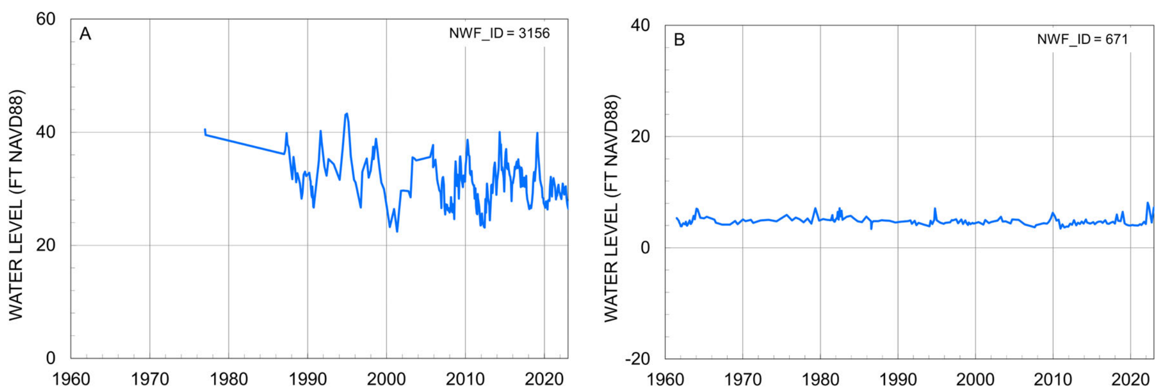


Figure 2-60. Hydrographs of the A) Olsen Road and B) Wakulla Parks and Recreation Wells

A water budget for the Florian aquifer water estimated for Region VII used the District's Eastern District Model, which is a regional numerical groundwater flow model. Figure 2-61 shows the simulated inflows and outflows to the Floridan aquifer for Region VII. The major inflows are direct recharge to the Floridan aquifer, leakage into the upper Floridan aquifer through the overlying intermediate system, and subsurface inflow. For the 2014 model calibration period, the total inflow into the Floridan aquifer in Planning Region VII was estimated to be 2,050 mgd. Major outflows from the Floridan aquifer include discharge to rivers and springs, subsurface outflow to the Gulf of Mexico and groundwater pumpage. The 2020 groundwater demand of 46.9 mgd for Region VII represents 2.3 percent of the water budget of the

Floridan aquifer for Planning Region VII. The projected 2045 groundwater use of 53.9 mgd represents 2.6 percent of the water budget.

Land application of treated wastewater returns a relatively large percentage of groundwater to the Floridan aquifer system as recharge in Region VII. The Florida Department of Environmental Protection defines the recharge fraction as the portion of reclaimed water used in a reuse system that recharges an underlying potable quality groundwater that is used for potable supply or augments a Class I surface water, expressed as a percentage of the total reclaimed water used (FDEP 2013). In 2020, the city of Tallahassee applied 18.64 mgd of reclaimed water at their Southeast Farm Sprayfield. The high permeability of the local soils results in a significant local groundwater recharge, with rates at the sprayfield estimated to be as large as 100 to 200 in/yr (Davis 2010).

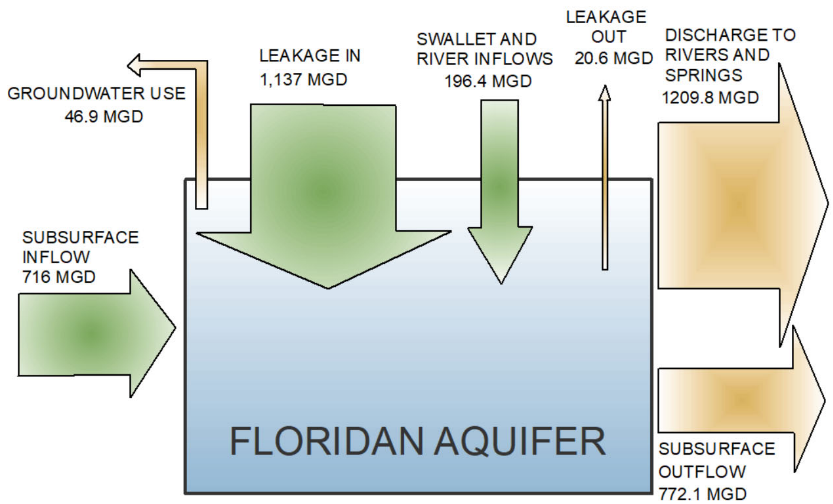


Figure 2-61. Floridan Aquifer Water Budget for Planning Region VII

Status of Waterbodies with Adopted Minimum Flows and Minimum Water Levels

Minimum flows have been established for the Wakulla and Sally Ward Spring System and for the St. Marks River Rise. The Minimum Flow and Levels Technical Assessment for the Wakulla Spring and Sally Ward Spring System was completed in 2021 (NWFWMD 2021). The minimum flow adopted for the Wakulla and Sally Ward Springs System states a long-term combined average spring flow of 539 cfs is required to maintain the water resources and ecology of the Wakulla River (section 40A-8.041, F.A.C.). The most recent (October 23, 2004, to April 24, 2021) combined long-term average springflow for the Wakulla Spring and Sally Ward Spring System is 612 cfs which is 73 cfs greater than the established minimum flow. Therefore, the minimum flow is being met. This also indicates that 73 cfs of springflow is available for future consumptive use.

The Minimum Flow and Levels Technical Assessment for the St. Marks River Rise was completed in 2019 (NWFWMD 2019). The established MFL for the St. Marks River Rise is specified as "an allowable reduction of 33 cfs from the baseline period average daily spring flow" (section 40A-8.031, F.A.C.). The baseline period is October 1, 1956, to November 27, 2017, for which the average springflow is 452 cfs. Therefore, if the long-term average spring flow is greater than 419 cfs, the minimum flow is being met. The rule specifies the most recent 30-year period of average daily spring flows shall be used to evaluate whether the minimum flow is being met. The average springflow for the most recent 30-year period of available data (October 19, 1991 to October 18, 2021) is 438 cfs. Therefore, the minimum flow is being met. This further suggests 19 cfs of springflow is available for future consumptive uses.

The projected increase in consumptive surface water use from St. Marks River between 2020 and 2045 for power generation is 0.09 mgd. This withdrawal occurs downstream of the St. Marks River Rise and will not impact the minimum flow or amount of water available for future consumptive uses. The analysis of projected increases in groundwater uses is provided below.

To confirm a prevention strategy is not needed for the St. Marks River Rise or the Wakulla and Sally Ward Spring System, groundwater modeling evaluations were performed. The eastern District groundwater flow model ("Eastern District Model" or "EDM") was developed and calibrated to support water supply planning, minimum flows and minimum water levels, and water use permitting evaluations (Tetra Tech 2018, Countryman et al. 2019, Tetra Tech 2021, Grubbs et al. 2022). The model domain extends east into the Suwannee River Water Management District, north into southwest Georgia, and west to the Apalachicola River (Figure 2-62). The domain encompasses the groundwater contribution areas for Wakulla Spring, Sally Ward Spring, and the St. Marks River Rise. Part of the groundwater contribution areas for Wakulla Spring and the St. Marks River Rise are within Region VII and part of the groundwater contribution areas are outside Region VII.

The EDM was applied to simulate the response of spring flow to changes in groundwater pumpage. Model simulations were developed to quantify the sensitivity of St. Marks River Rise, Wakulla Spring, and Sally Ward springflow to changes in pumpage within the Planning Region VII counties (Leon, Wakulla, and Jefferson counties, including that part of Jefferson County outside of Region VII) and also to pumpage changes in areas of the EDM outside these counties. The results indicated that for each one mgd increase in pumpage within Leon, Wakulla, and Jefferson counties, the simulated spring flow at the St. Marks River Rise decreases by 0.17 cfs. Additionally, for each one mgd increase in pumpage outside these counties but within the EDM domain, the simulated spring flow at the St. Marks River Rise decreases by 0.03 cfs.

For the Wakulla and Sally Ward Spring system, the model results indicated for each one mgd increase in pumpage within Leon, Wakulla, and Jefferson counties, the simulated flow at the Wakulla Spring and Sally Ward Spring System decreases by 0.24 cfs. Additionally, for each one mgd increase in pumpage outside of the counties but within the EDM domain, the flow for Wakulla and Sally Ward Spring System decreases by 0.02 cfs.

The projected increase in groundwater use between 2020 and 2045 in Region VII (7.04 mgd) plus the portion of Jefferson County in the SRWMD (0.11 mgd) is approximately 7.15 mgd (11 cfs). The projected increase in groundwater use outside of these counties but within the EDM domain from 2020 to 2045 is approximately 25.17 mgd (38.9 cfs). Pumpage data outside of the Northwest Florida Water Management District were obtained from the SRWMD (Emily Ducker, digital communication, May 17, 2023). Applying the sensitivities discussed above, the estimated additional impact to the St. Marks River Rise associated with pumpage increases in Region VII plus the portion of Jefferson County in the SRWMD between 2020 and 2045 is approximately 1.22 cfs. Similarly, the estimated additional impact to the St. Marks River Rise due to pumpage increases outside of these counties and within the EDM domain between 2020 and 2045 is approximately 0.76 cfs. Therefore, the estimated total impact on the St. Marks River due to changes in pumpage between 2020 and 2045 is estimated to be approximately 2 cfs. This value is less than the 19 cfs of spring flow available, therefore a prevention strategy is not needed for the St. Marks River Rise.

Applying the sensitivities discussed above to the Wakulla and Sally Ward Spring System, the estimated additional impact between 2020 and 2045 due to pumpage increases within Region VII (7.04 mgd) plus the portion of Jefferson County in the SRWMD (0.11 mgd) is approximately 1.72 cfs. Similarly, the additional impact due to pumpage increases outside of these counties but within the EDM domain between 2020 and 2045 is approximately 0.5 cfs. Therefore, the total impact on the Wakulla and Sally Ward Spring System due to changes in pumpage between 2020 and 2045 is estimated to be approximately 2.22 cfs. This value is less than the 73 cfs of available flow, therefore a prevention strategy is not needed for the Wakulla and Sally Ward Spring System.

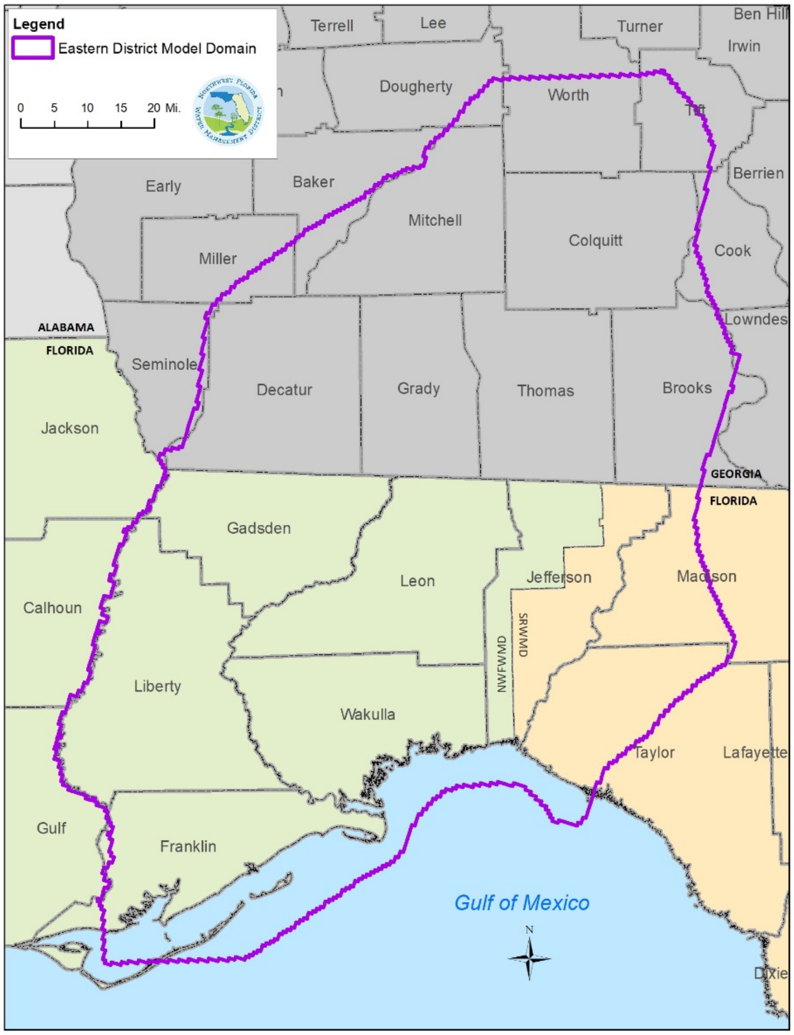


Figure 2-62. Extent of Eastern District Model Domain

Water Quality Constraints on Groundwater Availability

Only the upper several hundred feet of the Floridan aquifer are utilized for water supply due to high groundwater availability and potable water quality in this interval. Data indicate reduced water yields and increased mineralization in the Floridan aquifer with depth. The estimated elevation of the top of the freshwater-saline water interface, where the total dissolved solids concentration exceeds 10,000 mg/L, ranges from approximately -600 ft NAVD88 in northern Leon County (Williams and Kuniansky, 2015) to shallower than -400 ft NAVD88 in southern Wakulla County (NWFWMD, 2023, unpublished data). A well at Florida State University (FSU #43, NWF_ID 2591) has an open hole interval from -265 ft NGVD29 to -375 ft NGVD29. The specific capacity is 54 gpm/ft, which is much lower than nearby wells open to the shallower zones of the Floridan aquifer. Drinking water standards were exceeded at this well, with a reported chloride concentration of 648 mg/L, a sulfate concentration of 1,330 mg/L, and a TDS of 3,290 mg/L (NWFWMD consumptive use permit files). In Wakulla County, at a District monitoring well located south of U.S. Highway 98 near Spring Creek Highway, the TDS values exceed the drinking water standard of 500 mg/L at a depth of approximately 250 ft below land surface. Additionally, divers exploring the Wakulla Cave System have reported a halocline at a depth of 300 feet below the water surface (JSA 2016).

Trends in saline indicators (chloride and TDS) were assessed for three Floridan aquifer wells in Region VII with more than 20 years of water quality data within the District's database. The wells include Panacea #3 (NWF_ID 264) and Panacea #4 (NWF_ID 263), which are production wells located in southern Wakulla County, and the Charles Donahue/Nitrate Pot. Map well (NWF_ID 977), a monitoring well located in south-central Leon County. No long-term trends were present in chloride or TDS concentrations at these three wells.

Surface Water Resources

Consumptive use of surface water is minimal within Region VII, with net 2020 surface withdrawals comprising approximately 2 percent of water use in the region. Surface water is withdrawn from the St. Marks River for power generation in Wakulla County; however, the net consumptive use during 2020 was estimated to be 0.21 mgd. This volume is anticipated to increase slightly to 0.30 mgd by 2045. The intake location for this withdrawal is located in a coastal area where water in the St. Marks River is largely saline. In addition to power generation, an estimated 0.77 mgd of surface water is used for recreation in Leon County. By 2045, net surface water use in Leon County is predicted to increase to 1.19 mgd.

Trend tests in long-term baseflow were conducted at seven locations in Region VII. A nonlinear trend test of baseflows from USGS Station 2326900, St. Marks River Near Newport, resulted in a statistically significant decrease in baseflow from the beginning to the end of the approximately 67-year period of record at the station. However, this estimated difference between rainfall-corrected baseflows at the beginning and end of the record was only marginally significant, as indicated by a wide confidence interval for this difference and lower confidence limit that was close to zero. The trend in rainfall-corrected baseflows at this location appears to be largely the result of lower rainfall-corrected baseflows beginning in approximately 2015. This is evident in the time-series plot of baseflow residuals computed by fitting a simple, ordinary-least regression model to baseflows and antecedent rainfall (Figure 2-63). This plot also indicates that baseflow residuals along the St. Marks River are highly variable over the broader period of record, with periods of reduced and enhanced baseflow. It should be noted the USGS has reported large changes in vegetation in the St. Marks River Rise spring pool and run where this station is located. During this time period, river stage at the station has been elevated, resulting in decreased spring flow from the St. Marks River Rise which contributes most flows to Station 232690 (Figure 2-64). In addition, this station is located in and surrounded by public lands with little pumping in the area and no surface water withdrawals upstream from the river rise. As a result, it is thought decreases in the baseflow residuals at this location are caused primarily by environmental factors and not a symptom of consumptive uses. No other locations displayed significant trends in stream/river baseflow residuals.

Additional information regarding the lower St. Marks, Wakulla, and Apalachee Bay systems can be found in the St. Marks River Watershed SWIM plan (NWFWMD, 2017), the St. Marks River Rise MFL Technical Evaluation (NWFWMD 2019), and the Wakulla Spring and Sally Ward Spring System MFL Technical Evaluation (NWFWMD 2021).

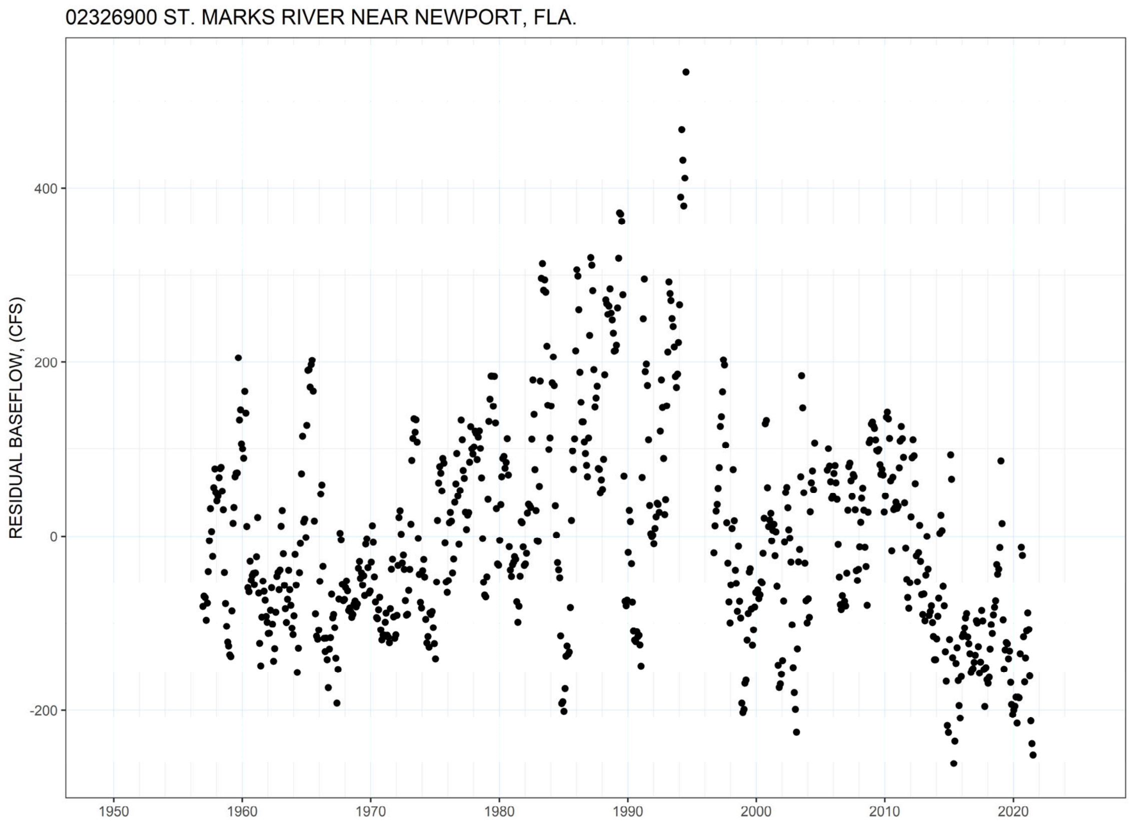


Figure 2-63. Trends in Baseflow Residuals at USGS Station 2326900 St. Marks River Near Newport, FLA.

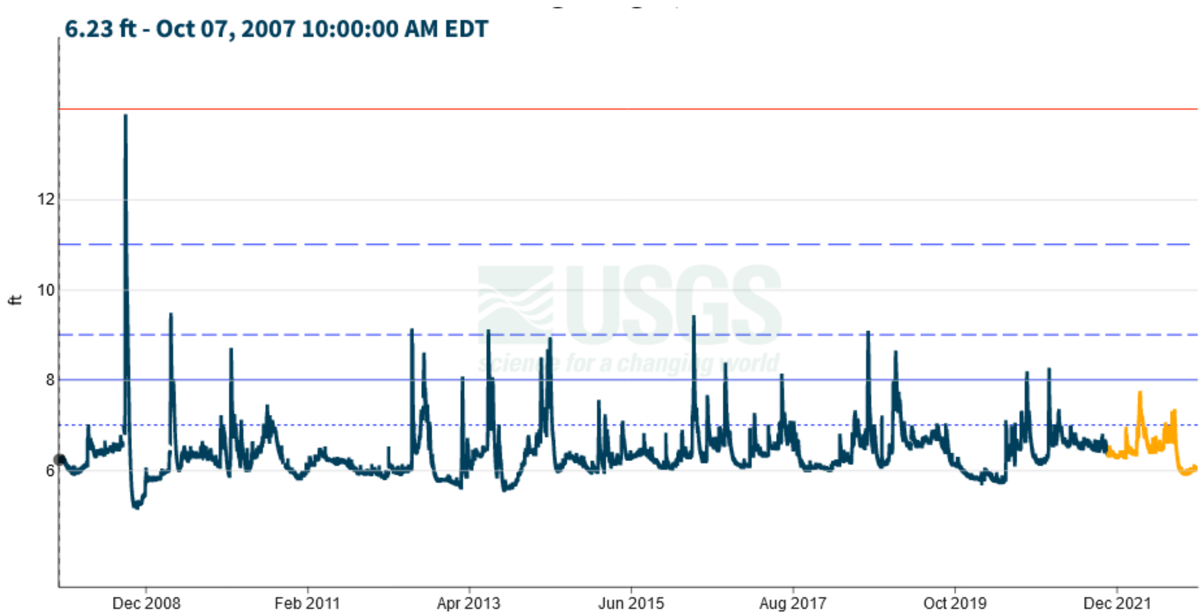


Figure 2-64. Stage as Measured at USGS Station 2326900 St. Marks River Near Newport, FL. Period of Record for stage data extends from 10/1/2007 through Present. Blue line represents accepted data, while the orange line represents provisional data

Alternative Water Supply and Conservation

Non-traditional sources of water in Region VII are reuse of reclaimed water. District support for water supply development projects has contributed to water conservation, leak detection, water use efficiencies, and expanding reuse potential.

Water Conservation

The potential for additional water conservation has not been estimated for Region VII. District permit conditions that support water conservation measures include annual water use reporting; evaluation of water use practices to enhance water conservation and efficiency, reduce water demand and water losses; maximum water loss and residential per capita water use goals; and public education campaigns. In Region VII there has been an overall decrease in the gross per capita water use from 1995 to 2020 as shown in Figure 2-65. Factors such as climate, economic conditions, population trends, and changes in ICI or other water use categories can influence these values. Droughts occurred during 1999-2000, 2006-2007, and 2011-2012, and influenced irrigation quantities during these years.

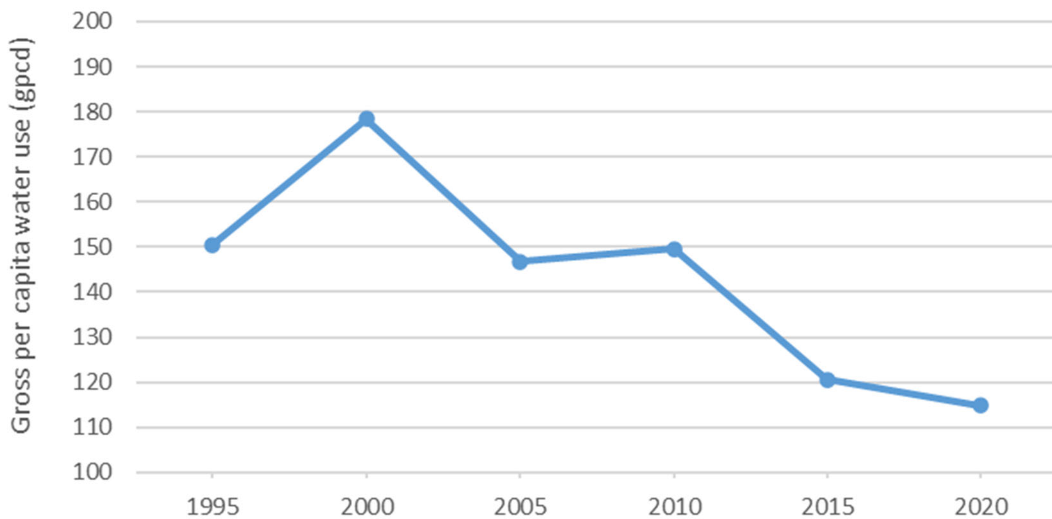


Figure 2-65. Region VII Gross per capita water use

Reuse of Reclaimed Water

In 2020 Region VII utilized 1.0 mgd of potable offset reuse or 5 percent of the wastewater treatment facility (WWTF) flows, which totaled 20.7 mgd (Table 2-37).

Table 2-37. Region VII - 2020 Reuse and Wastewater Flows (mgd)

County	Potable Offset Reuse Flow	Percent of Potable Offset Reuse to Total WWTF Flow	Total WWTF Flow	Total WWTF Capacity	Number of WWTFs	WWTFs Providing Potable Offset
Jefferson	0.292	100.0%	0.292	0.800	1	1
Leon	0.702	3.6%	19.476	27.995	5	1
Wakulla	0.041	4.3%	0.962	1.795	3	1
TOTALS	**1.035**	**5.0%**	**20.730**	**30.590**	**9**	**3**

Based on population projections, future reuse availability is estimated to be an additional 22.9 mgd by the year 2045. This additional availability added to existing 2020 reuse flows totals 23.9 mgd, or 78 percent, of the 2020 total facility capacities (Table 2-38). Future potable offset reuse assumptions are that WWTF's have treatment and disinfection levels suitable for the reuse end uses, and that transmission infrastructure is available to reuse customers.

Table 2-38. Region VII - 2025-2045 Future Potential Reuse Availability (mgd)

County	2020 Potable Offset Reuse Flow	Future Reuse Estimated Availability					2045 Estimated Total Flow	
		2025	2030	2035	2040	2045	mgd	% of Capacity
Jefferson	0.292	0.004	0.006	0.008	0.012	0.014	0.306	38.3%
Leon	0.702	19.607	20.303	20.850	21.311	21.708	21.708	80.1%
Wakulla	0.041	0.989	1.046	1.094	1.131	1.165	1.206	67.2%
TOTALS	**1.035**	**20.601**	**21.356**	**21.952**	**22.455**	**22.887**	**23.922**	**78.2%**

Region VII: RWSP Evaluation

In summary, water demands are projected to increase by 7.23 mgd, from 47.86 mgd in 2020 to 55.09 mgd in 2045. Groundwater from the Floridan aquifer is the primary water source in Region VII. Pumpage represents a small fraction of the Floridan aquifer water budget and water level drawdowns are localized. Established MFLs are projected to be met for the St. Marks River Rise and for the Wakulla and Sally Ward Spring system through the 2045 planning horizon. Existing and reasonably anticipated water sources in Region VII are considered adequate to meet the projected 2045 demands for both an average year and 1-in-10-year drought event, while sustaining water resources and related natural systems. Therefore, a regional water supply plan is not recommended for Region VII.

3. Summary and Recommendations

Water use totaled approximately 341 million gallons per day Districtwide in 2020. The largest water use category was public supply, followed by ICI use and agriculture. Together these three categories comprised 84 percent of all water use. Most agricultural water use occurs within Jackson County, while most ICI and power generation water uses are located in Escambia and Bay counties. Groundwater provides over three-fourths of the water supplied, with the primary aquifers being the Floridan aquifer system and the sand-and-gravel aquifer. Deer Point Lake Reservoir is a major potable surface water source for Bay County.

The 2045 projected water use totals approximately 384 mgd, which is an increase of 43 mgd, or about 13 percent (Table 2-39). Public supply, ICI, and agriculture uses are expected to remain the largest categories. For a 1-in-10 year drought, the 2045 projected water use is 432 mgd, reflecting higher irrigation demands under low rainfall conditions. The largest increase in water use is projected to occur in Region II, where water use is projected to increase by 28.32 mgd or 37.3 percent, from 75.98 mgd in 2020 to 104.31 mgd in 2045 (Table 3-2).

Table 3-1. Districtwide Total Water Use by Category, 2025-2045 (mgd)

Use Category	Estimates	Future Demand Projections					2020-2045 Change	
	2020	2025	2030	2035	2040	2045	mgd	%
Public Supply	171.03	180.48	188.81	195.69	201.85	207.52	36.49	21.3%
DSS	19.49	18.66	18.59	18.40	18.11	17.78	-1.72	-8.8%
Agriculture	49.93	51.69	53.16	54.75	56.47	58.25	8.32	16.7%
Recreational	21.57	23.09	24.34	25.36	26.28	27.10	5.54	25.7%
ICI	65.29	47.09	52.83	53.69	54.81	55.06	-10.23	-15.7%
Power	14.07	18.60	18.65	18.70	18.75	18.75	4.68	33.3%
TOTALS	**341.38**	**339.61**	**356.38**	**366.60**	**376.27**	**384.46**	**43.08**	**12.6%**

Based on BEBR data, the 2020 District population was 1,492,875. The seasonally adjusted population was 1,598,919. About 86 percent of District population was served by public supply utilities, with the remaining 14 percent served by domestic self-supply. Based on seasonally adjusted population estimates, by 2045 there will be an estimated additional 316,874 residents, with more than half of this projected increase in Region II. By 2045, Region II will account for the largest percentage of water use with a projected demand of 104 mgd (Table 2-40). Region III and Region VII are both projected to increase in population by about 19 percent by 2045. Estimated population increases by 2045 for other regions range from 2 to 16 percent.

The findings of water resource assessments for each of the seven planning regions are summarized below:

Region I. Water demands are projected to increase by 15.35 mgd, from 83.06 mgd in 2020 to 98.41 mgd in 2045. The sand-and-gravel aquifer is anticipated to continue as the primary water source. Observed water level impacts and water quality issues related to groundwater pumping near Pensacola Bay are localized. Existing and reasonably anticipated water sources in Region I are considered adequate to meet the projected 2045 average and 1-in-10- year drought event demands, while sustaining water resources and related natural systems. Therefore, a regional water supply plan is not recommended for Region I.

Region II. Water demands are projected to increase by 28.32 mgd or 37.3%, from 75.98 mgd in 2020 to 104.31 mgd in 2045. The primary water sources are the sand-and-gravel aquifer and the Floridan aquifer system. The sand-and-gravel aquifer in Santa Rosa County is a productive aquifer system and, due to its high rate of recharge, is capable of providing regionally significant quantities of water to meet demands for a portion of the planning region. However, a significant cone of depression persists in the Upper Floridan aquifer. District and utility initiatives have successfully reduced coastal pumping in the Floridan aquifer along the coast. The reduction in Floridan aquifer pumpage has enabled water levels to partially recover and has slowed, but not eliminated, the threat of saltwater intrusion.

Projected increases in pumping may reverse the progress made during the last twenty years in slowing the rate of saltwater intrusion in the Floridan aquifer, and the cone of depression could once again deepen and expand. Efforts to further stabilize or reduce coastal withdrawals and develop alternative water sources continue to be a challenge as indicated by the projected minor increase in coastal pumping by 2045. Based on these findings, existing sources of water are not anticipated to be adequate to supply water for all existing and future reasonable-beneficial uses and sustain the water resources and related natural systems through 2045. Therefore, pursuant to section 373.709, F.S., continued implementation of the Regional Water Supply Plan for Region II is recommended.

Region III. Water demands are projected to decrease by 15.06 mgd, from 65.53 mgd in 2020 to 50.47 mgd in 2045. Deer Point Lake Reservoir is the primary water source in Region III. Bay County has increased the resilience of the reservoir to withstand storm-surge impacts by constructing an alternate upstream intake. Groundwater resources continue to be limited within the Area of Resource Concern, and the Floridan aquifer potentiometric surface has declined to approximately 20 feet below sea level along the coast. The District has initiated an MFL technical assessment to determine whether minimum aquifer levels are needed. As part of the assessment, enhanced data collection and groundwater flow and solute transport modeling will be performed to better assess the risk of saltwater intrusion and the long-term sustainability of the Floridan aquifer. As of this 2023 WSA update, existing and reasonably anticipated water sources in Region III are considered adequate to meet the projected 2045 average and 1-in-10 year drought event demands, while sustaining water resources and related natural systems. Therefore, a regional water supply plan is not recommended for Region III.

Region IV. Water demands are projected to increase by 5.58 mgd, from 52.99 mgd in 2020 to 58.58 mgd in 2045. Within Planning Region IV, groundwater from the Floridan aquifer is the primary water source. Existing and reasonably anticipated water sources in Region IV are considered adequate to meet the projected 2045 average year and 1-in-10 year drought event demands, while sustaining water resources and related natural systems. Therefore, a regional water supply plan is not recommended for Region IV.

Region V. Water demands are projected to increase by 4.53 mgd or 21.4%, from 4.87 mgd in 2020 to 5.50 mgd in 2045. The Floridan aquifer system and the Gulf County Freshwater Canal are the primary water sources. Continuing to limit coastal Floridan aquifer withdrawals, increasing the utilization of alternative water sources, and transitioning to inland groundwater sources will help ensure the long-term sustainability of the Floridan aquifer in Region V. Existing and reasonably anticipated water sources in Region V are considered adequate to meet the projected 2045 average year and 1-in-10 year drought event demands, while sustaining water resources and related natural systems. Therefore, a regional water supply plan is not recommended for Region V.

Region VI. Water demands are projected to increase by 0.68 mgd or 6%, from 11.42 mgd in 2020 to 12.11 mgd in 2045. The primary source is the Floridan aquifer, along with minor withdrawals from small streams for agricultural uses. Both groundwater and surface water resources continue to be limited, particularly in the Telogia Creek WRCA and the Area of Resource Concern. However, existing and reasonably anticipated water sources in Region VI are considered adequate to meet the projected 2045 average year and 1-in-10 year drought event demands, while sustaining water resources and related natural systems. Therefore, a regional water supply plan is not recommended for Region VI.

Region VII. Water demands are projected to increase by 7.23 mgd, from 47.86 mgd in 2020 to 55.09 mgd in 2045. Groundwater from the Floridan aquifer is the primary water source in Region VII. Pumpage represents a small fraction of the water budget and water level drawdowns are localized. Established MFLs are projected to continue to be met for the St. Marks River Rise and for the Wakulla and Sally Ward Spring system through the 2045 planning horizon. Existing and reasonably anticipated water sources in Region VII are considered adequate to meet the projected 2045 demands for both an average year and 1-in-10 year drought event, while sustaining water resources and related natural systems. Therefore, a regional water supply plan is not recommended for Region VII.

In summary, it is recommended that the Region II RWSP be continued and updated as needed. No additional regional water supply plans are recommended. The need for regional water supply plans will be re-evaluated following the District's next WSA update in 2028.

Table 3-2. 2020 Estimated Water Use and 2025-2045 Projected Water Use by County and Region

Planning Region	County / Region	2020 WATER USE (mgd)	Future Demand Projections Average / Normal Conditions					2020-2045 Change	
			2025	2030	2035	2040	2045	Mgd	%
I	Escambia	83.063	89.017	94.174	95.633	97.036	98.412	15.349	18.5%
	Region I Total	**83.063**	**89.017**	**94.174**	**95.633**	**97.036**	**98.412**	**15.349**	**18.5%**
II	Okaloosa	32.523	34.048	35.764	36.903	37.768	38.516	5.993	18.4%
	Santa Rosa	26.172	28.713	30.936	32.928	34.839	36.475	10.303	39.4%
	Walton	17.290	20.385	22.825	25.063	27.176	29.317	12.027	69.6%
	Region II Total	**75.984**	**83.146**	**89.525**	**94.894**	**99.783**	**104.307**	**28.323**	**37.3%**
III	Bay	65.531	45.077	47.523	48.579	49.920	50.471	-15.060	-23.0%
	Region III Total	**65.531**	**45.077**	**47.523**	**48.579**	**49.920**	**50.471**	**-15.060**	**-23.0%**
IV	Calhoun	4.958	5.104	5.258	5.456	5.657	5.855	0.897	18.1%
	Holmes	3.747	3.768	3.770	3.779	3.781	3.796	0.049	1.3%
	Jackson	38.677	39.633	40.143	40.693	41.187	41.626	2.949	7.6%
	Liberty	1.515	1.622	1.721	1.782	1.853	1.913	0.398	26.3%
	Washington	4.091	4.360	4.689	4.912	5.143	5.386	1.295	31.7%
	Region IV Total	**52.988**	**54.486**	**55.581**	**56.623**	**57.621**	**58.576**	**5.588**	**10.5%**
V	Franklin	2.222	2.333	2.403	2.469	2.510	2.550	0.327	14.7%
	Gulf	2.307	2.534	2.684	2.819	2.889	2.950	0.642	27.8%
	Region V Total	**4.530**	**4.868**	**5.087**	**5.288**	**5.399**	**5.499**	**0.970**	**21.4%**
VI	Gadsden	11.423	11.539	11.765	11.900	12.045	12.105	0.682	6.0%
	Region VI Total	**11.423**	**11.539**	**11.765**	**11.900**	**12.045**	**12.105**	**0.682**	**6.0%**
VII	Jefferson[(1)]	2.859	2.923	2.967	2.992	3.028	3.054	0.195	6.8%
	Leon	39.575	42.798	43.744	44.500	45.106	45.585	6.010	15.2%
	Wakulla	5.428	5.754	6.011	6.188	6.327	6.450	1.022	18.8%
	Region VII Total	**47.862**	**51.474**	**52.721**	**53.681**	**54.462**	**55.089**	**7.227**	**15.1%**
	TOTALS	**341.381**	**339.607**	**356.376**	**366.597**	**376.266**	**384.460**	**43.079**	**12.6%**

GLOSSARY

List of hydrologic and technical terms. Some terminology is as defined by USGS, from the USGS Glossary of Hydrologic Terms: https://or.water.usgs.gov/projs_dir/willgw/glossary.html.

Baseflow — That part of the stream discharge that is not directly attributable to runoff from precipitation; it is sustained by groundwater discharge (USGS, et al.).

Clastic — Rocks composed of broken pieces of older rock.

Dissolution — The action or process of dissolving or fragmentation or of being dissolved.

Drawdown — (1) The vertical distance the water elevation is lowered or the reduction of the pressure head due to the removal of water (after ASCE, 1985). (2) The decline in potentiometric surface at a point caused by the withdrawal of water from a hydrogeologic unit (USGS, et al.).

Ethylene Dibromide — Hazardous chemical (EPA has classified ethylene dibromide as a Group B2, probable human carcinogen).

Fossiliferous — Containing fossils.

Hydrogeologic Unit — (1) Any soil or rock unit or zone which by virtue of its hydraulic properties has a distinct influence on the storage or movement of groundwater (after ANS, 1980). (2) Any soil or rock unit or zone which by virtue of its porosity or permeability, or lack thereof, has a distinct influence on the storage or movement of groundwater (USGS, et al.).

Hydrostratigraphic Unit — See *Hydrogeologic Unit*.

Karst or **Karst Features** — Terrain usually characterized by barren, rocky ground, caves, sinkholes, underground rivers, and the absence of surface streams and lakes resulting from the excavating effects of underground water on massive soluble limestone.

Leakage — (1) The flow of water from one hydrogeologic unit to another. The leakage may be natural, as through semi-impervious confining layer, or human-made, as through an uncased well (USGS, et al.). (2) The natural loss of water from artificial structures as a result of hydrostatic pressure (USGS).

Marl — A friable earthy deposit consisting of clay and calcium carbonate, used especially as a fertilizer for soils deficient in lime.

Physiography — Geography dealing with physical features of the earth. Physical geography.

Storage Coefficient — The volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head (virtually equal to the specific yield in an unconfined aquifer) (USGS, et al.). The coefficient or *storativity* is a dimensionless quantity, and ranges between 0 and the effective porosity of the aquifer.

Storativity — See *Storage Coefficient*.

Transmissivity — The rate at which water of the prevailing kinematic viscosity is transmitted through a unit width of the aquifer under a unit hydraulic gradient. It is equal to an integration of the hydraulic conductivities across the saturated part of the aquifer perpendicular to the flow paths (USGS, et al.).

Up-coning — Process by which saline water underlying freshwater in an aquifer rises upward into the freshwater zone as a result of pumping water from the freshwater zone (USGS).

Upgradient — A location that is the source groundwater for another location, similar to upstream.

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