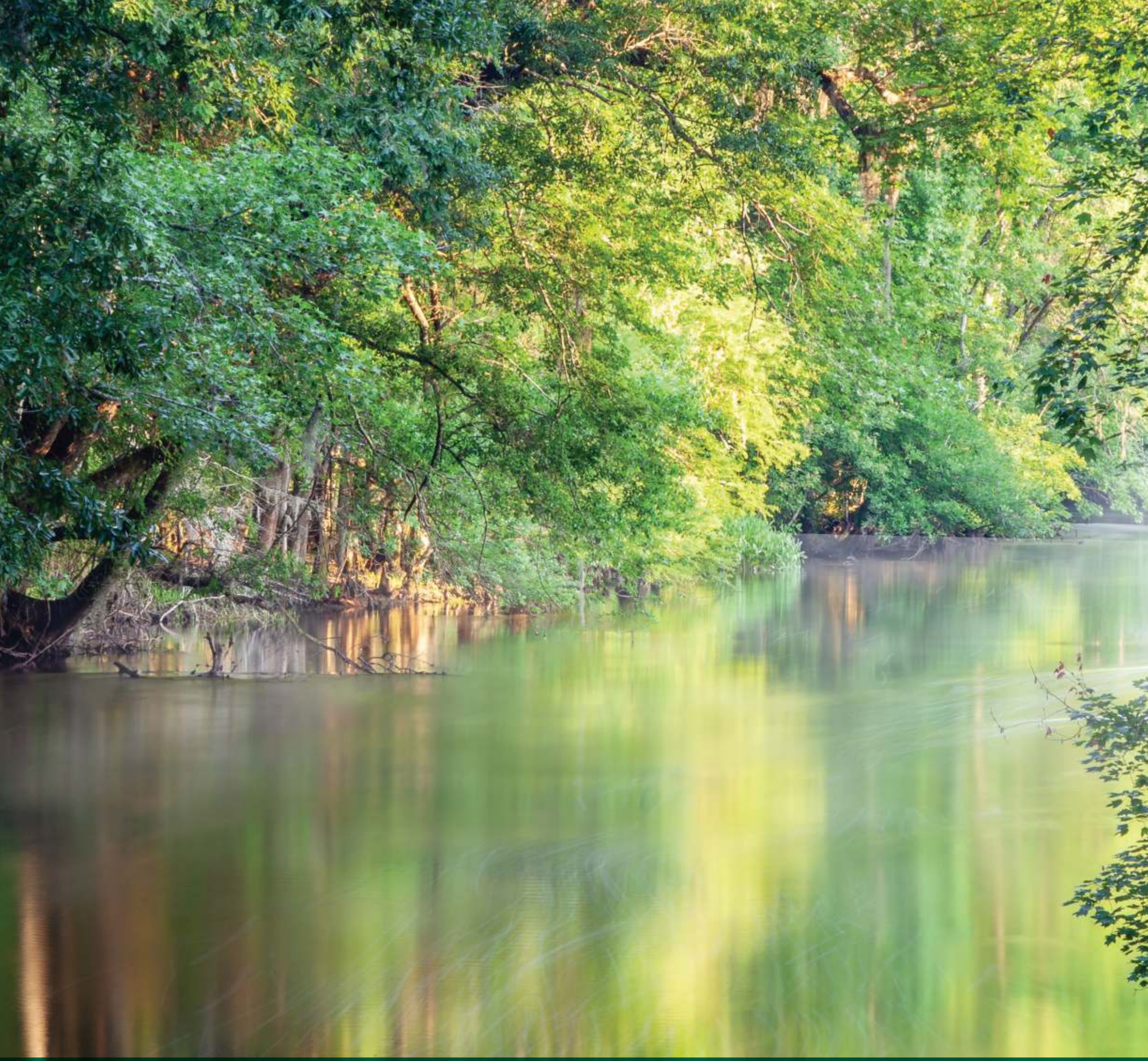

EDISTO RIVER BASIN PLAN 2023

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[i] Member left his position with Bamberg County BPW and resigned from the RBC prior to completion of the Final River Basin Plan.

Acronyms

Acronym	
ACE	Ashepoo-Combahee-Edisto
ACP	Atlantic Coastal Plain
AFTS	American Tree Farm System
bgy	billion gallons per year
BLS	Bureau of Labor Statistics
BMP	Best Management Practice
cfs	cubic feet per second
CUA	Capacity Use Area
CWS	Charleston Water System
DMA	Drought Management Area
DRC	Drought Response Committee
EDA	Economic Development Administration
EPA	U.S. Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FRED	Friends of the Edisto
FSA	Farm Service Agency
GIS	geographic information system
GDP	gross domestic product
gpf	gallons per flush
gpm	gallons per minute
IRA	Inflation Reduction Act
LEED	Leadership in Energy and Environmental Design
MGD	million gallons per day
MRLC	Multi-Resolution Land Characteristics Consortium
NLCD	National Land Cover Database
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
PPAC	Planning Process Advisory Committee
P&R	Permitted and Registered
RBC	River Basin Council
SCDA	South Carolina Department of Agriculture
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources

Acronym	
SCO	State Climatology Office
SEPA	Southeastern Power Administration
SPI	Standard Precipitation Index
SWAM	Simplified Water Allocation Model
UIF	unimpaired flows
USACE	United States Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
WWQA	Watershed Water Quality Assessment

Chapter 1
Introduction

1.1 Background

The South Carolina Water Resources Planning and Coordination Act mandates that the South Carolina Department of Natural Resources (SCDNR) develop a comprehensive water resources policy for the state of South Carolina. SCDNR developed the first state water plan—the *South Carolina Water Plan*—in 1998. In 2004, the plan was updated following what is recognized as one of the worst multi-year droughts on record, which ended in 2002. One of the recommendations from the *South Carolina Water Plan, Second Edition* was forming advisory committees to develop comprehensive water resource plans for each of the state's four major river basins—the Ashepoo-Combahee-Edisto (ACE), Pee Dee, Santee, and Savannah. In 2014, when the development of surface water quantity models to support the planning process began, SCDNR and the South Carolina Department of Health and Environmental Control (SCDHEC) decided to further subdivide the basins based on SCDHEC's delineations used for the Water Quality Assessments. The eight planning basins are the Broad, Catawba, Edisto, Pee Dee, Salkehatchie, Saluda, Santee, and Savannah, as shown in Figure 1-1. In 2016, SCDNR began working with the United States Geological Survey (USGS) to update the Coastal Plain Groundwater Model—another important tool to support development of water resource plans.

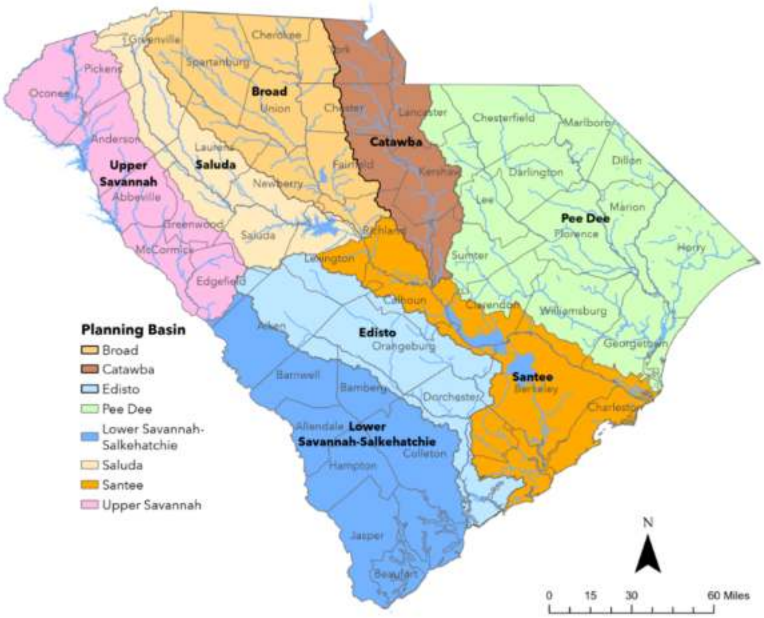


Figure 1-1. Planning basins of South Carolina.

Each of these water resource plans is called a River Basin Plan, which is defined in the *South Carolina State Water Planning Framework* (SCDNR 2019; referred to hereafter as the Planning Framework) as "a collection of water management strategies supported by a summary of data and analyses designed to ensure the surface water and groundwater resources of a river basin will be available for all uses for years to come, even under drought conditions." The next update to the State Water Plan will build on the analyses and recommendations developed in the eight River Basin Plans.

River basins are seen as a natural planning unit for water resources since surface water in each basin is relatively isolated from water in other basins by natural boundaries. Each River Basin Plan will include data, analysis, and water management strategies to guide water resource development in the basin for a planning horizon of 50 years. Specifically, a River Basin Plan answers four questions:

1. What is the basin's current available water supply and demand?
2. What are the current permitted and registered water uses within the basin?
3. What will be the water demand in the basin throughout the planning horizon, and will the available water supply be adequate to meet that demand?
4. What water management strategies will be employed in the basin to ensure the available supply meets or exceeds the projected demand throughout the planning horizon?

In each river basin, a River Basin Council (RBC) is established and tasked with developing a plan that fairly and adequately addresses the needs and concerns of all water users following a cooperative, consensus-driven approach. The Edisto River basin is the first of the eight river basins to begin and complete the process that culminated in developing this plan. River basin planning is expected to be an ongoing, long-term process, and this plan will be updated every 5 years.

1.2 Planning Process

The river basin planning process in South Carolina formally began with the development of the eight surface water quantity models starting in 2014 and the update of the Coastal Plain Groundwater Model in 2016. In March 2018, SCDNR convened the Planning Process Advisory Committee (PPAC). Over the next year and a half, SCDNR and the PPAC collaboratively developed the Planning Framework, which defines river basin planning as the collective effort of the numerous organizations and agencies performing various essential responsibilities, as described below. A more complete description of the duties of each entity are provided in Chapter 3 of the Planning Framework.

- River Basin Council: A group of a maximum of 25 members representing diverse stakeholder interests in the basin. Each RBC includes at least one representative from each of the eight broadly defined stakeholder interest categories showin in Figure 1-2. The RBC is responsible for developing and implementing the River Basin Plan, communicating with stakeholders, and identifying recommendations for policy, legislative, regulatory, or process changes.

- Planning Process Advisory Committee: The PPAC is a diverse group of water resource experts established to develop and help implement the Planning Framework for state and river basin water planning. The PPAC will amend the Planning Framework as needed, review draft and final River Basin Plans, ensure consistency between the eight River Basin Plans, and advise SCDNR on developing the new State Water Plan.

- State and Federal Agencies:
    - SCDNR is the primary oversight agency for the river basin planning processes. Key duties of SCDNR include appointing members to the PPAC and RBCs; educating RBC members on critical background information; providing RBCs and contractors with data, surface water models, and groundwater models; hiring contractors; and reviewing and approving the final River Basin Plans.

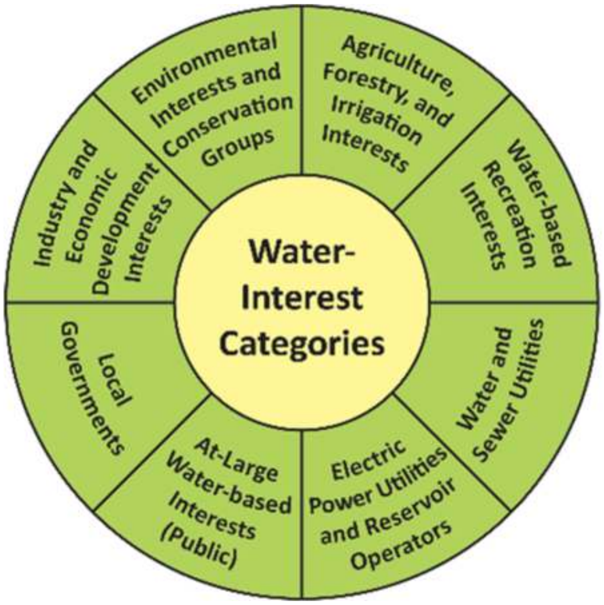


Figure 1-2. RBC water-interest categories.

  - SCDHEC is the regulatory agency that administers laws regarding water quality and use within the state. Key duties of SCDHEC include ensuring recommendations are consistent with existing laws and regulations and serving as an advisor for recommended changes to existing laws and regulations.
  - Other State Agencies: Representatives from other state agencies such as the Department of Agriculture, Department of Commerce, Forestry Commission, Rural Infrastructure Authority, and the Energy Office may be asked to attend RBC meetings in an advisory role.
  - Federal Agencies: Representatives from federal agencies such as the USGS, United States Army Corps of Engineers (USACE), and the Southeastern Power Administration (SEPA) may be asked to attend RBC meetings as formal advisors. Representatives from other federal agencies may be asked to attend RBC meetings in an advisory role.
- Contractors: SCDNR will hire contractors to perform administrative, facilitative, technical, authorship, and public outreach functions. Specific roles include:
  - Coordinator: Performs administrative functions. Coordination of RBC meetings and other activities has collectively been shared by representatives from CDM Smith and Clemson University, with assistance from SCDNR and SCDHEC, collectively forming the Planning Team. The Planning Team met at least monthly in between RBC meetings.
  - Facilitator and Author: Guides RBC meetings in a neutral manner to encourage participation and provides River Basin Plan authorship services. CDM Smith served in these roles for the Edisto RBC.
  - Public Outreach Coordinator: Engages stakeholders and the public in the planning process. Clemson University served in this role for the Edisto RBC.
- Groundwater and Surface Water Technical Advisory Committees: SCDNR-appointed groups with specific technical expertise intended to enhance the scientific and engineering aspects of the planning process.
- Subcommittees and Ad Hoc Groups: The Edisto RBC formed three subcommittees: a Groundwater Subcommittee, a Surface Water Subcommittee, and a River Basin Plan Subcommittee. Chairs and vice chairs were elected for each subcommittee.
- The Public and Stakeholders: The public was invited to attend and provide comments at RBC meetings and designated public meetings. Additional detail on public participation is described in Chapter 1.4.

The creation of the Edisto RBC began with two public meetings organized by SCDNR on November 18 and 21, 2019, in the Town of Blackville and Town of St. George, respectively. The goal of these meetings was to describe the need and process for river basin planning to stakeholders and solicit applications to join the Edisto RBC. SCDNR accepted applications through December 2019 and selected RBC appointees in March 2020 based on their credentials, knowledge of their interest category, and their connection to the basin (i.e., RBC members must live, work, or represent a significant interest in the water resources of the Edisto basin). The diverse membership of the RBC is intended to allow for a variety of perspectives during development of the River Basin Plan. Edisto RBC members (at the time the Final River Basin Plan was issued) are listed with their affiliations, appointment dates, and term lengths in Table 1-1. Term lengths are staggered to ensure continuity in the planning process.

Table 1-1. Edisto RBC members and affiliations.

Name	Organization	Position	Interest Category	Appointment Date and Term Length (Years)
Aakhus, Mark	Town of Edisto Beach	Assistant Town Administrator	Local Governments	March 2020 (2)
Bagwell, Laura	Aiken Soil and Water Conservation District	Commissioner	At-Large	March 2020 (2)
Bell, Glenn	RBM Forestry, LLC	Owner	Agriculture, Forestry, and Irrigation	March 2020 (4)
Dr. Bishop, David	The Nature Conservancy	Coastal Conservation Director	Environmental	March 2020 (2)
Dr. Bass, John	Retired	Citizen	At-Large	March 2020 (4)
Duke, Joel	Aiken County	Assistant County Administrator	Local Governments	March 2020 (4)
Haralson, Johney	Bamberg Soil and Water District	Vice Chair	Local Governments	March 2020 (4)
Jowers, J.J.	Public	Citizen	Water-Based Recreational	March 2020 (3)
Krispyn, Hugo	Friends of the Edisto and Edisto Riverkeeper	Executive Director	Environmental	March 2020 (3)
Marvin, Alta Mae	Edisto River Canoe and Kayak Trail Commission	Commissioner/ Property Owner	At-Large	March 2020 (2)
Odom, Eric	Orangeburg Department of Public Utilities	Water Division Director	Water and Sewer Utilities	March 2020 (3)
Sievers, Amanda[1]	Orangeburg County	Planning Director	Industry and Economic Development	March 2020 (3)
Stallworth, Hank (RBC Chair)	Retired (SCDNR Chief of Staff)	Citizen	Environmental	March 2020 (3)
Stutts, Brandon[2]	Dominion Energy South Carolina	Environmental Specialist	Electric-Power Utilities	March 2020 (3)
Thompson, Jason	Charleston Water System	Source Water Manager	Water and Sewer Utilities	March 2020 (4)
Tolbert, Alex	Orangeburg Country Club	Golf Course Superintendent	Agriculture, Forestry, and Irrigation	March 2020 (2)
Walther, Jeremy	Walther Farms	Owner/ Operator	Agriculture, Forestry, and Irrigation	March 2020 (3)
Waters, Jerry	Palmetto Realty and Land Co.	Owner/Broker	At-Large	March 2020 (4)
Weathers, Landrum (RBC Vice Chair)	Weathers Farms/Circle W Farms	Manager	Agriculture, Forestry, and Irrigation	March 2020 (3)
Williams, Will	Western South Carolina Economic Development Partnership	President/CEO	Industry and Economic Development	April 2021 (2)

[1] Replaced Richard Hall from Orangeburg County in October 2021

[2] Replaced Michael Mosley from Dominion Energy in August 2021

The Edisto RBC began meeting in June 2020. Because of the coronavirus pandemic, the first 11 meetings were held virtually via Zoom, at approximately 3- to 4-week intervals. Beginning in May 2021, in-person meetings were held at Clemson University's Edisto Research and Education Center in Blackville, with the option for RBC members and the public to attend virtually.

The planning process was completed in four phases, as specified in the Planning Framework. During the mostly informational Phase 1, RBC members heard presentations from subject matter experts representing SCDNR, SCDHEC, USGS, the University of South Carolina, The Nature Conservancy, and CDM Smith. Presentation topics included water legislation and permitting; hydrology, monitoring, and low-flow characteristics; climatology; the South Carolina Drought Response Act; coastal, freshwater aquatic, and cultural resources; and the relationships between streamflow and ecologic conditions and diversity.

Phase 2 of the planning process focused on assessing past, current, and future surface water and groundwater availability. The RBC reviewed historical and current water use, and 50-year planning scenario results from the surface water quantity model (refered to as the Simplified Water Allocation Model or SWAM) and the USGS's Coastal Plain Groundwater Model of South Carolina. Potential water shortages and issues were identified and discussed.

During Phase 3, water management strategies to address water availability issues were identified, evaluated, selected, and prioritized by the RBC based on their effectiveness, as determined by modeling and feasibility criteria such as cost, environmental impact, and socioeconomic impact.

Legislative, policy, technical, and planning process recommendations were considered during Phase 4 of the planning process, which culminated in developing this River Basin Plan.

Edisto RBC members participated in two field trips in spring and summer 2021 to better understand the Edisto River and how water is withdrawn and used to support agriculture and public water supply needs. In April, the RBC toured Walther Farms in the Town of Windsor (Figure 1-3) and learned about the numerous soil and water conservation strategies that are part of their everyday operations. In July, the RBC canoed the Edisto River near Colleton State Park (Figure 1-4), visited Charleston Water System's intake adjacent to Givhans Ferry State Park, and learned about the history and use of the Edisto River as one of three sources serving the residential, commercial, industrial, and wholesale customers of the Charleston Water System.

Figure 1-3. RBC field trip to Walther Farms, April 2021.

Figure 1-4. RBC members canoeing the Edisto River, July 2021.

1.3 Mission Statement, Vision, and Goals

During Phase 1 of the planning process, the Edisto RBC developed a mission statement identifying the RBC's purpose, a vision statement establishing the desired outcome of the planning process, and actionable goals supporting their vision for the Edisto River basin. The mission statement, vision statement, and goals are listed in Table 1-2. The first goal provides specifics on the purpose of the Edisto River Basin Plan, while the second goal focuses on the promotion and communication of the plan. The RBC stressed the importance of using best available science and considering the input of all stakeholders in executing these goals.

Table 1-2. Edisto RBC Mission Statement, Vision Statement, and Goals.

Mission Statement
To develop, update, and support implementation of a River Basin Plan for sustainable management of water resources in the Edisto River basin.
Vision Statement
A resilient and sustainably managed Edisto River basin where stakeholder and ecosystem needs are recognized, balanced, and protected.
Goals
1 Develop water use strategies, policies, and legislative recommendations for the Edisto River basin to: **1a Ensure water resources are maintained to support current and future human and ecosystem needs** **1b Improve the resiliency of the water resources and help minimize disruptions within the basin** **1c Promote future development in areas with adequate water resources** **1d Encourage responsible land use practices**
2 Develop and implement a communication plan to promote the strategies, policies, and recommendations for the Edisto River basin

1.4 Public Participation

Public participation is a vital component of the river basin planning process. All RBC meetings are open to the public. To promote visibility and encourage participation, meeting notices are posted on the SCDNR Water Planning web page (https://hydrology.dnr.sc.gov/water-planning.html) and are distributed to an email list. Meeting agendas, minutes, summaries, presentations, and recordings are posted on the SCDNR website and are available to the public.

In addition to the RBC meetings, dedicated public meetings were also held to distribute information and solicit feedback.

- The first two public meetings were held on November 18 and 21, 2019, in Blackville and St. George, respectively. At these meetings, the public was informed of the basin planning process and the plan for public participation. RBC membership applications were solicited at this meeting. There were 55 attendees at the November 18 meeting in Blackville, and 48 attendees at the November 21 meeting in St. George.

- The third public meeting was held on February 15, 2023, in Orangeburg. A summary of the plan was provided to attendees and a public comment period was opened, which included a verbal comment period at the meeting followed by a 30-day written comment period. Written comments received from the public, and RBC responses to those comments are included in Appendix F.

- The fourth public meeting was held after the River Basin Plan was finalized and released on May 12, 2023. The fourth public meeting was held on June 1, 2023, in Blackville. At this meeting, the public was apprised of any changes made to the draft plan.

1.5 Previous Water Planning Efforts

1.5.1 Edisto Basin Planning

The Edisto River basin has a decades-long history of data-centric, community-based resource planning. In 1996, SCDNR, in partnership with the South Carolina Department of Commerce and the South Carolina Department of Parks, Recreation, and Tourism, published the *Edisto River Basin Project Report* (SCDNR 1996). This report was the result of a multi-year research and planning effort to assess and provide recommendations for maintaining and improving the economic, ecological, cultural, and recreational resources of the Edisto River basin. The effort, known as the Edisto Project, was novel at the time because it developed and used a highly detailed geographic information system (GIS) database and it focused on basin residents as planners and decision-makers. The culmination of the project was the development of 176 recommendations that addressed specific needs and/or opportunities focusing on the following themes:

- conservation and sustainable use of resources
- economic development
- partnerships and cooperation
- education and access to information
- local planning and decision making
- best management practices
- incentives
- research and information needs

The first two themes – conservation and sustainable use of resources and economic development – addressed the primary objectives of the project and the remaining themes provided recommendations to to achieve the objectives. The project and resulting recommendations did not directly address issues related to surface water or groundwater availability, potential future shortages, water registration and permitting, or water quantity in general; however, many recommendations indirectly supported effective water resources management and sustainability of the basin's water resources.

The first step to implementing the recommendations put forth in the *Edisto River Basin Project Report* was creating an Edisto River Basin Task Force. The Friends of the Edisto (FRED) is a nonprofit organization established in 1998 in part to support implementing the Edisto River Basin Task Force recommendations. FRED's mission is to "protect and enhance the Edisto River basin's natural and cultural character and resources through conservation and responsible use." FRED plans and organizes numerous community events to promote education around the river basin's resources and advocate for its protection.

The Edisto River basin is one of three basins protected by the ACE Basin Task Force. This task force is made up of state and federal governmental representatives, nonprofit conservation organizations, and private landowners, and has been working to protect the natural and rural character of the three basins since 1988. The task force aims to balance the area's socioeconomic needs while protecting its natural systems and traditional uses (agriculture, timber production, hunting, fishing, etc.). Key partners of the ACE Basin Task Force include SCDNR, the U.S. Fish and Wildlife Service (USFWS), Ducks Unlimited, and The Nature Conservancy. As of December 2019, the task force has been credited with protecting over 300,000 acres of land through conservation easements, management agreements, and fee title purchases. The task force represents another example of public/private partnership in ecosystem planning and protection.

This Edisto River Basin Plan builds on the work of these groups and on the foundation laid in the 1996 *Edisto River Basin Project Report*, updating it with extensive, newly collected data, making use of advanced computer modeling capabilities, and drawing on 26 additional years of experience in sustainable resource planning. This River Basin Plan focuses on water resource management while recognizing and addressing the connection of water resources to the myriad of natural, economic, and cultural resources in the basin that must also be protected.

1.5.2 Groundwater Management Plans

The Groundwater Use and Reporting Act (S.C. Code Ann. §49-5-10 *et seq.*) establishes conditions for the designation of Capacity Use Areas (CUAs). These are areas where excessive groundwater withdrawal may have adverse effects on natural resources; may pose a threat to public health, safety, or economic welfare; or may pose a threat to the long-term integrity of the groundwater source. Once a capacity use area is designated, a Groundwater Management Plan must be developed to study the area's groundwater availability and demand, and offer strategies to promote the sustainability of the resource. The plan must balance the competing needs and interests of the area, including those of future generations. Additionally, all users within the capacity use area withdrawing more than 3 million gallons of groundwater in any month must obtain a groundwater permit. The Edisto River basin covers parts of three capacity use areas: the Low Country, the Trident, and the Western, as shown in Figure 1-5.

Although the Low Country and Trident Capacity User Areas were designated in 1981 and 2002 respectively, the initial Groundwater Management Plans were not completed until 2017. The Western Capacity Use Area was designated in 2018 and the Groundwater Management Plan was completed in November 2019. In preparing the intial plans, SCDHEC convened stakeholder workgroups and solicited public comments. The plans outline current best practices for groundwater management. They are intended to be updated as more data are collected and following the application of the USGS Coastal Plain Groundwater Model of South Carolina.

1.5.3 Drought Planning

The South Carolina State Climate Office is responsible for drought planning in the state. The South Carolina Drought Response Act and supporting regulations establish the South Carolina Drought Response Committee (DRC) as the drought decision-making entity in the state. The DRC is composed of state agencies and local members representing various stakeholder interests. Local members are organized into one of three drought management areas (DMAs). The Edisto River basin is within the Southern DMA. The DRC monitors drought indicators, issues drought status updates, determines nonessential water use, and issues declarations for water curtailment as needed. In addition to establishing the DRC, the South Carolina Drought Response Act also requires all public water suppliers to develop and implement their own drought plans and ordinances. Drought management plans developed by the public water suppliers in the Edisto River basin are further discussed in Chapter 8.

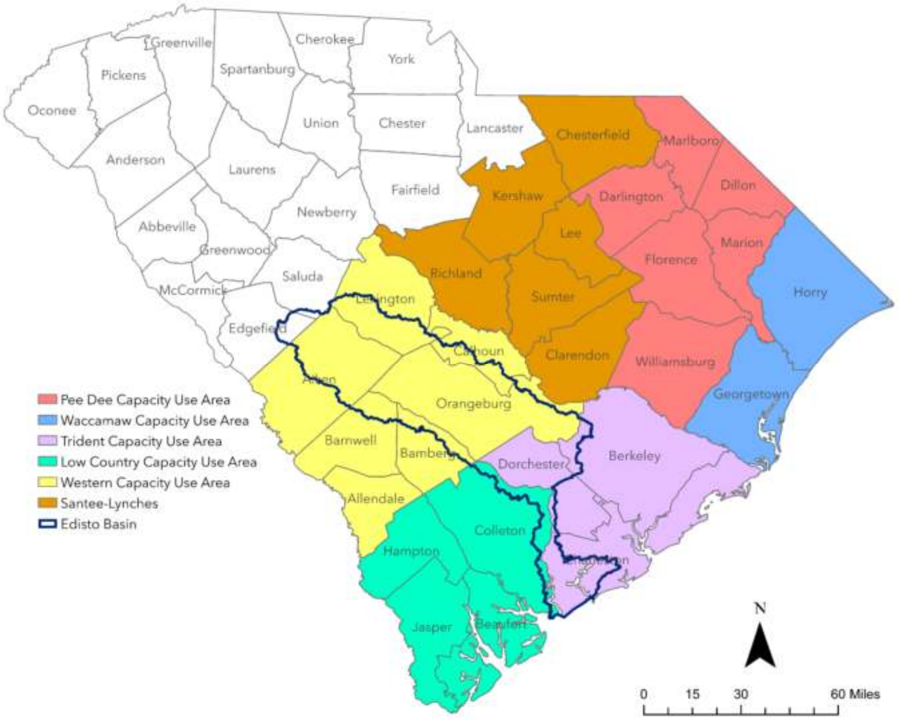


Figure 1-5. Capacity Use Areas.

1.5.4 Watershed-Based Plans

Watershed-based plans have been developed for various watersheds throughout South Carolina to document sources of pollution and present a course of action to protect and improve water quality within a watershed. While this first iteration of the Edisto River Basin Plan focuses on water quantity issues, previous planning efforts with the Edisto River basin that addressed water quality are worth noting. Water quality considerations may be more fully developed in future updates to the Edisto River Basin Plan.

In 1992, SCDHEC initiated its Watershed Water Quality Management program to better coordinate river basin planning and water quality management. Watershed-based management allows the SCDHEC to address Congressional and Legislative mandates and improve communication with stakeholders on existing and future water quality issues. In the Edisto basin, Watershed Water Quality Assessments (WWQA) were completed in 1995, 1998, 2004 and 2012. The WWQAs of the Edisto River basin describe, at the watershed level, water quality related activities that may potentially have an adverse impact on water quality. The Edisto River Basin was subdivided into 13 watersheds or hydrologic units. As of 2016, the WWQAs have been replaced by the S.C. Watershed Atlas (https://gis.dhec.sc.gov/watersheds/), which allows users to view watershed information and even add data, create layers from selected features, and export data for use outside of the application.

In 2017, a watershed-based plan was developed for the Shaws Creek watershed, which includes the Upper and Middle Shaws Creek subwatersheds. Shaws Creek, which drains to the South Fork Edisto River, is a vital resource as a recreational area and is a drinking water supply source for the City of Aiken. The *Shaws Creek Watershed Based Plan* (AMEC Foster Wheeler 2017) identifies nonpoint sources of pollution that have the potential to cause bacteria, sediment, and nutrient loadings in the watershed, and recommends best management practices (BMPs) to prevent or reduce these sources of pollution. Recommended BMPs include septic system repairs and replacements, a used cooking oil recycling program, pet waste stations, storm drain markers, urban stormwater retrofits, stream buffers, several agricultural BMPs, and an outreach effort. Efforts are underway to complete a similar watershed-based plan for the Caw Caw Swamp watershed in Orangeburg County.

1.6 Organization of this Plan

The Planning Framework outlines a standard format that all river basin plans are intended to follow, providing consistency in the organization and content. Consistency between river basin plans will facilate the eventual update of the State Water Plan. Following the format outlined in the Planning Framework, the Edisto River Basin Plan is divided into 10 chapters as described below.

- **Chapter 1: Introduction** – Chapter 1 provides an overview of the river basin planning purpose and process. Background on the basin-specific history and vision for the future is presented. The planning process is described, including the appointment of RBC members and the roles of the RBC, technical advisory committees, subcommittees, ad hoc groups, state and federal agencies, and contractors.

- **Chapter 2: Description of the Basin** – Chapter 2 presents a physical and socioeconomic description of the basin. The physical description includes a discussion of the basin's land cover, geography, geology, climate, natural resources, and agricultural resources. The socioeconomic section describes the basin's population, demographics, land use, and economic activity, as these factors influence the use and development of water resources in the basin.

- **Chapter 3: Water Resources of the Basin** – Chapter 3 describes the surface and groundwater resources of the basin and the modeling tools used to evaluate their availability. Monitoring programs, current projects, issues of concern, and trends are noted.

- **Chapter 4: Current and Projected Water Demand** – Chapter 4 summarizes the current and projected water demands within the basin. Demands for public water supply, thermoelectric power, industry, agriculture, and other uses are presented along with their permitted and registered withdrawals. The chapter outlines the methodology used to develop demand projections and the results of those projections.

- **Chapter 5: Comparison of Water Resource Availability** – Chapter 5 describes the methodology and results of the basin's surface water and groundwater availability analysis. This chapter presents planning scenarios that were developed and the performance measures used to evaluate them. Any water shortages, reaches of interest, or Groundwater Areas of Concern identified through this analysis are described. The shortages and areas of concern identified in this chapter serve as the basis for the water management strategies presented in Chapter 6.

- **Chapter 6: Water Management Strategies** – Chapter 6 presents the water management strategies developed as potential solutions to the shortages and areas of concern presented in Chapter 5. For each surface water or groundwater strategy considered, Chapter 6 includes a description of the measure, results from a technical evaluation (as simulated in the appropriate model, if applicable), feasibility for implementation, and a cost-benefit analysis.

- **Chapter 7: Water Management Strategy Recommendations** – Chapter 7 presents the final recommendations for water management strategies based on the analysis and results presented in Chapter 6. The chapter discusses the selection, prioritization, and justification for each of the recommended strategies. Any remaining shortages or concerns are also discussed in this chapter.

- **Chapter 8: Drought Response** – This chapter presents existing and proposed drought management plans. The first part of the chapter discusses existing drought management plans, ordinances, and drought management advisory groups. The second part presents drought response initiatives developed by the RBC.

- **Chapter 9: Policy, Legislative, Regulatory, Technical, and Planning Process Recommendations** – Chapter 9 presents overall recommendations intended to improve the planning process and/or the results of the planning process. Recommendations to address data gaps encountered during the planning process are presented along with recommendations for revisions to the state's water resources policies, legislation, and agency structure.

- **Chapter 10: River Basin Plan Implementation** – Chapter 10 presents a 5-year implementation plan and long-term planning objectives. The 5-year plan includes specific objectives, action items to reach those objectives, detailed budgets, and funding sources. The long-term planning objectives include other recommendations from the RBC that are less urgent than those in the implementation plan. There will be a chapter in future iterations of this plan that details progress made on planning objectives outlined in previous plan iterations.

The South Fork Edisto River Near Aiken State Park

Chapter 2

Description of the Basin

2.1 Physical Environment

2.1.1 Geography

The Edisto River basin covers approximately 3,120 square miles making up 10 percent of the state's total area. The basin extends from southeastern Edgefield County at its northern limit to the western portion of Charleston County at the coast (Figure 2-1). Most of Orangeburg County, approximately half of Dorchester and Aiken Counties, and smaller portions of Bamberg, Barnwell, Berkeley, Calhoun, Charleston, Colleton, Edgefield, Lexington, and Saluda Counties are within the basin boundary (Table 2-1). Extending approximately 130 miles from its landward to coastal extents, the basin is approximately 30 miles wide through most of its length with a thinner portion near the coast.

The Edisto River basin is drained by four main rivers: the North Fork Edisto River, the South Fork Edisto River, the Edisto River, and Four Hole Swamp. The North Fork Edisto River and the South Fork Edisto River originate in the upper Coastal Plain physiographic province near the Fall Line. The two forks merge near the Town of Branchville and form the Edisto River. Four Hole Swamp originates in Calhoun and Orangeburg Counties and follows a network of braided channels rather than a single main channel throughout its length (SCDNR 2009). Four Hole Swamp joins with the Edisto River above Givhans Ferry State Park, where the river turns from flowing southeast to south. As it nears the coast, the Edisto River splits around Edisto Island into the North Edisto River and the South Edisto River.

The Edisto River is one of the longest free-flowing blackwater rivers in North America. It develops its dark color from tannins leached into the water from decaying vegetation in the swamplands it flows through (SCDNR 2009).

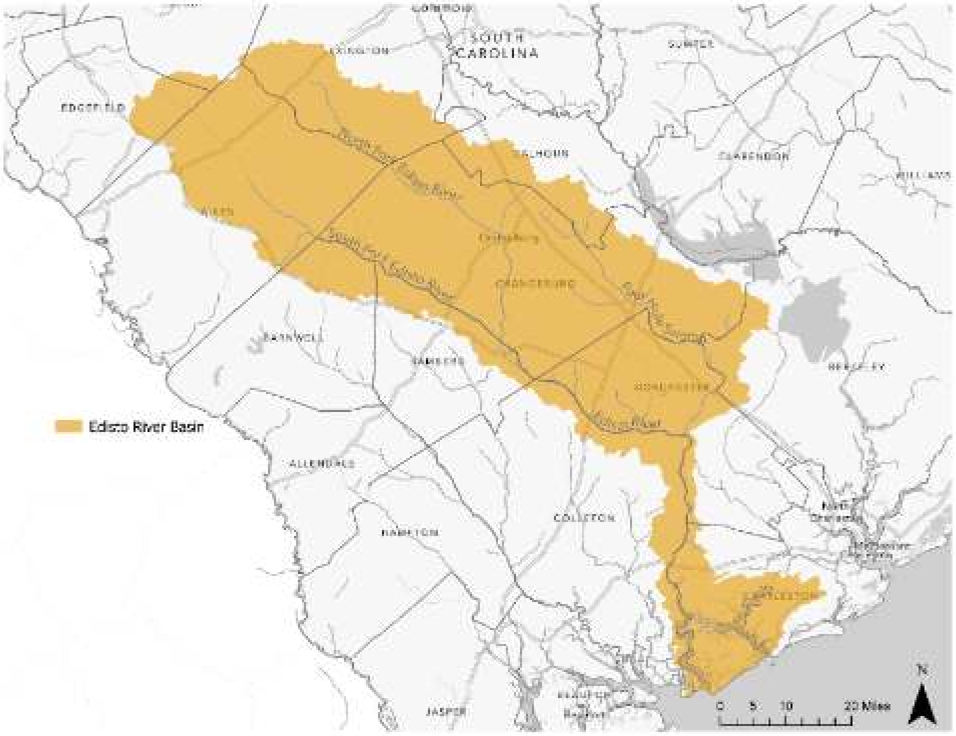


Figure 2-1. The Edisto River basin and surrounding counties.

Table 2-1. Counties of the Edisto River basin (SCDNR 1996).

County	Percentage of Edisto River Basin in County	Percentage of County in Edisto River Basin
Orangeburg	33.8%	92.9%
Aiken	17.6%	49.7%
Dorchester	11.1%	59.9%
Lexington	9.2%	37.7%
Charleston	8.5%	27.7%
Colleton	5.4%	18.4%
Calhoun	4.1%	32.5%
Bamberg	3.1%	24.3%
Barnwell	2.8%	15.4%
Edgefield	2.1%	15.3%
Berkeley	2.1%	5.2%
Saluda	0.4%	2.9%

2.1.2 Land Cover

The Edisto River basin is primarily rural in nature, with the City of Orangeburg the only notable, urban population center. The basin is dominated by wetlands, woodlands, and agricultural land cover types, as shown in Figure 2-2 (Multi-Resolution Land Characteristics Consortium [MRLC] 2019).

Table 2-2, derived from the MRLCs National Land Cover Database (NLCD), provides a more detailed summary of land use types in the basin and includes changes in land cover area from 2001 to 2019. Shrub land (composed of herbacesous and shrub/scrub land cover types) has seen the largest increase in area since 2001, at just over 70 square miles. Developed land has increased by approximately 15 square miles. Woodlands (composed of deciduous, evergreen and mixed forests) have decreased the most, losing 62 square miles, followed by a loss of approximately 26 square miles for the hay/pasture and woody wetlands cover types. Countering the loss of woody wetlands is a gain in herbaceous wetlands of nearly the same amount.

The *Edisto River Basin Project Report,* published in 1996, noted that the percentage of woodlands remained fairly stable over the previous 30 years but that the percentange of agricultural land had decreased. The report noted an even sharper decline in the number of farms, but an increase in the average size of farms. Between 2001 and 2019, the total area of cultivated crops in the basin has remained mostly unchanged at around 506 square miles, or 16 percent of the basin area.

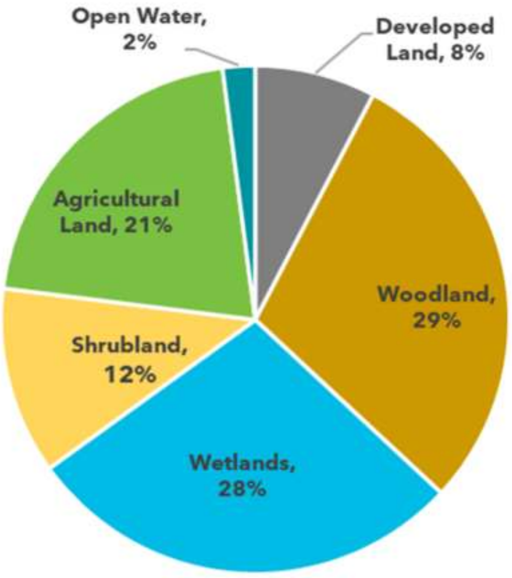


Figure 2-2. Edisto River basin land cover.

Table 2-2. Edisto River basin land cover and trends.

NLCD Land Cover Class	2001 Area (sq. miles)	2019 Area (sq. miles)	Change from 2001 to 2019 (sq. miles)	Percentage of Total Land (2019)
Open Water	62.5	65.0	2.5	2%
Developed, Open Space	<0.001	152.0	152.0	5%
Developed, Low Intensity	60.9	65.0	4.1	2%
Developed, Medium Intensity	12.5	20.0	7.5	0.6%
Developed, High Intensity	4.1	5.6	1.5	0.2%
Barren Land	5.7	7.6	1.9	0.2%
Deciduous Forest	113.0	101.5	-11.5	3%
Evergreen Forest	830.9	788.8	-42.1	25%
Mixed Forest	39.2	30.8	-8.4	1%
Shrub/Scrub	167.2	182.2	15.0	6%
Herbaceous	131.0	186.1	55.1	6%
Hay/Pasture	179.6	154.1	-25.5	5%
Cultivated Crops	505.5	506.2	0.7	16%
Woody Wetlands	784.9	758.8	-26.1	24%
Emergent Herbaceous Wetlands	101.8	127.3	25.5	4%
Total Land Area	**3,151**	**3,151**	**0.0**	**100%**

2.1.3 Geology

South Carolina is divided into three major physiographic provinces based on geologic characteristics: the Blue Ridge, the Piedmont, and the Coastal Plain. The Edisto River basin lies completely within the Coastal Plain province. The Coastal Plain contains six major aquifers comprised of layers of clay, sand, and limestone. Approximately 4,000 feet thick near the coast, the Coastal Plain thins as it extends inward and crops out at the Fall Line, which divides the Coastal Plain and the Piedmont provinces. The Edisto River basin extends from the Fall Line through the upper, middle, and lower Coastal Plain subregions to the coast (Figure 2-3). Each subregion is successively lower, less dissected (i.e., less cut by erosion into hills and valleys), and younger toward the coast. The upper Coastal Plain extends from the Fall Line to the Orangeburg Scarp and has high relief and high drainage density compared to the lower regions. The middle coastal Plain is a gently rolling to flat terrain that starts at the Orangeburg Scarp and continues to Surry Scarp. The lower Coastal Plain is the area to the east of the Surry Scarp extending to the shoreline (SCDNR 2009).

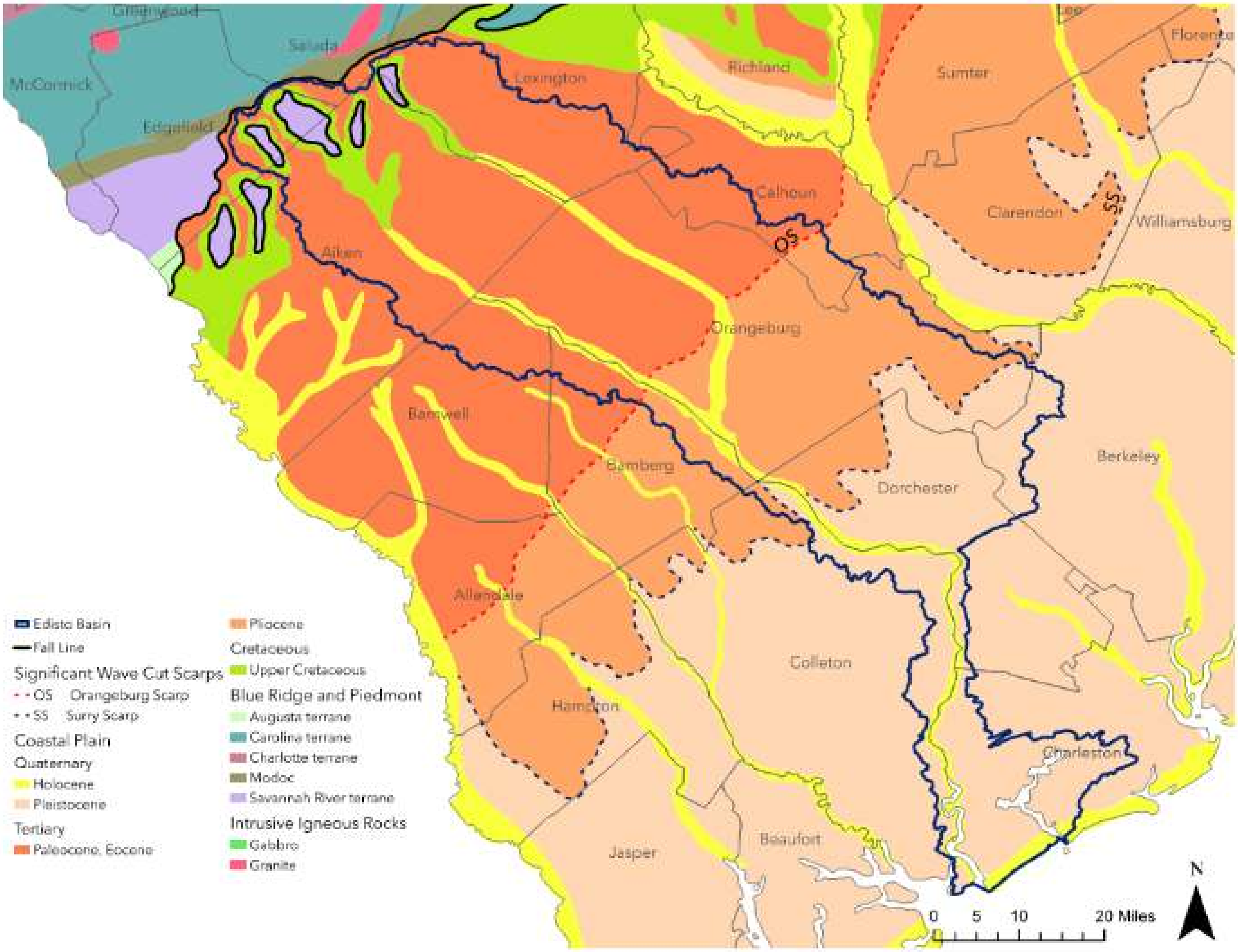


Figure 2-3. Generalized geologic map of the Edisto River basin (SCDNR).

2.2 Climate

2.2.1 General Climate

The climate of the Edisto River basin, much like the rest of South Carolina, is described as humid subtropical, with hot summers and mild winters. Figure 2-4 shows the average annual temperature and the annual average precipitation for the Edisto River basin, based on the current climate normal (1991-2020). Average annual temperature throughout the basin ranges from 60 to 68 degrees Fahrenheit, with temperature increasing from the top of the basin to the bottom. Annual average precipitation throughout the basin ranges from 45 to 51 inches, with the top and bottom parts of the basin generally receiving a few more inches of rain during the year than the middle portion of the basin (SCDNR State Climatology Office 2021).

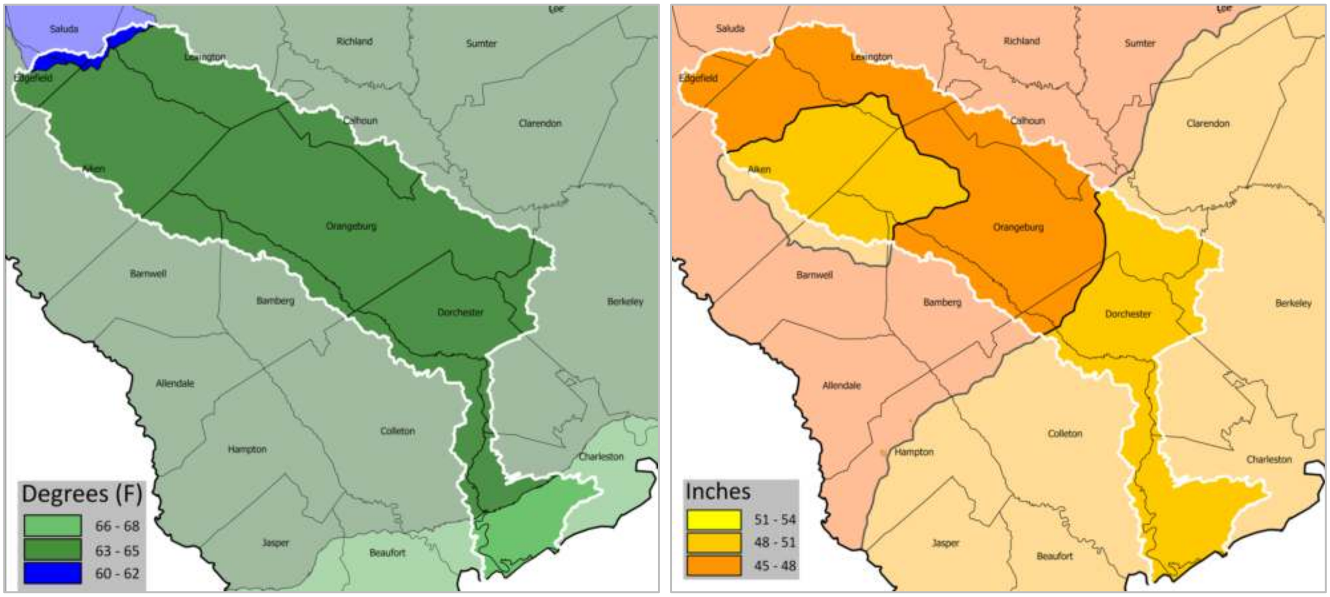


Figure 2-4. Normal annual average temperature and precipitation (1991-2020) for the Edisto River basin.

Temperature and precipitation values are not constant throughout the year. This is demonstrated in Figure 2-5, which shows monthly variation in temperature and precipitation for the meteorological station "Orangeburg 2" in the City of Orangeburg. Average temperature oscillates throughout the year, with July generally being the warmest month (average monthly temperature of 80.8 degrees Fahrenheit) and January generally being the coldest month (average monthly temperature of 45.4 degrees Fahrenheit). Precipitation also varies throughout the year. July is generally the wettest month (average monthly precipitation of 5.8 inches) and November is generally the driest month (average monthly precipitation of 2.7 inches) (SCDNR State Climatology Office 2022a). The Orangeburg 2 station is used here due to its central location in the basin, while also having the longest, active period of record for temperature and precipitation from 1954 to present (SCDNR State Climatology Office 2022a).

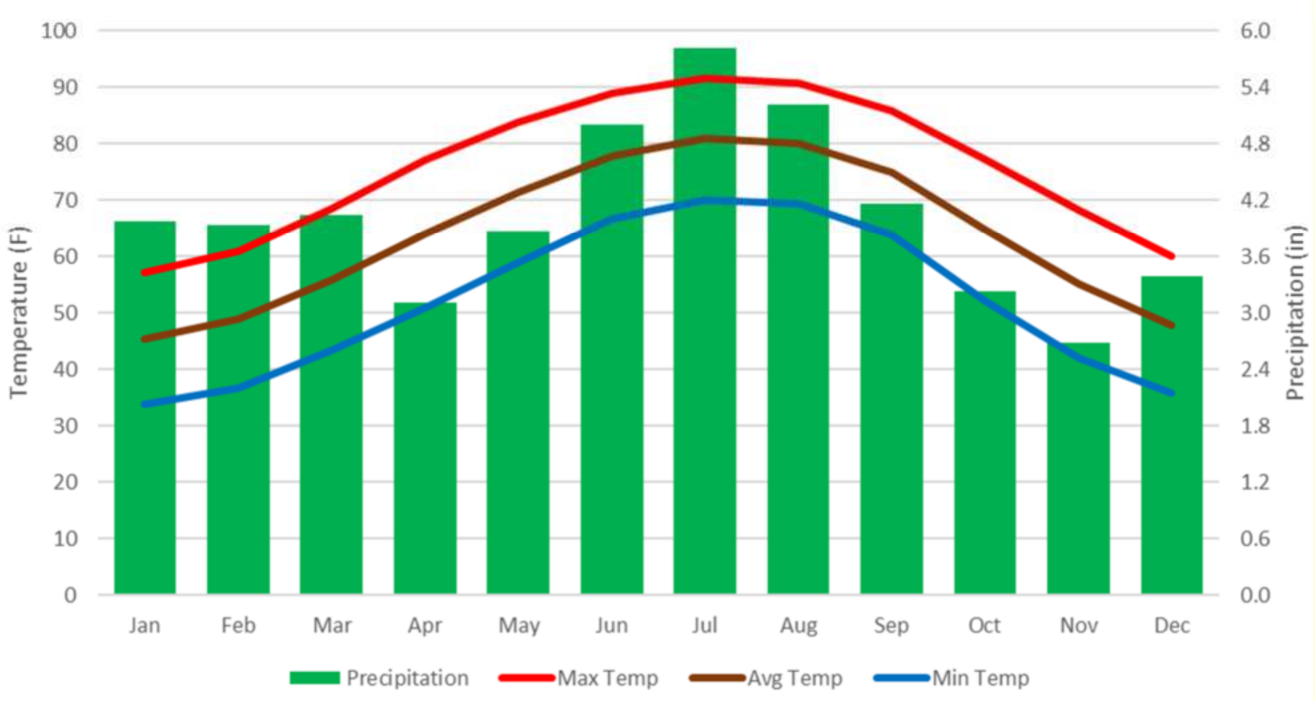


Figure 2-5. Orangeburg monthly climate averages 1954 to 2021 (SCDNR State Climatology Office **2022a).**

Through time, the annual average annual temperature and precipitation for the state and the Edisto River basin have varied (National Oceanic and Atmospheric Administration [NOAA], 2022; SCNDR State Climatology Office 2022a). Figure 2-6 shows the timeseries for the Orangeburg 2 station's period of record for temperature from 1954 to 2021, showing both years of above and below average annual temperature. For this period, annual average temperature is 63.9 degrees Fahrenheit, which differs slightly from the current climate normal (1991-2020). The warmest annual average temperature is 67.4 degrees Fahrenheit, occurring in 2017; while the coldest annual average temperature is 61.3 degrees Fahrenheit, occurring in both 1966 and 1979 (SCDNR State Climatology Office 2022a). The 10 warmest years on record have occurred since 1990, with four of these years occurring after 2010 and sequentially (2016, 2017, 2018, and 2019).

Figures 2-7 shows the timeseries for the Orangeburg 2 station for precipitation from 1954 to 2021, showing both years of above and below average annual precipitation. For this period, annual average precipitation is 48.3 inches. The highest annual average precipitation is 71.5 inches, occurring in 1964; while the lowest annual precipitation is 25.42, occurring in 1954. The wettest and driest year on record for this station, which is also true for the state-wide average, were only 10 years apart. In the last decade, the state has multiple years of above normal rainfall (2013, 2015, 2018, and 2020), with 2015 and 2020 being the third and fourth wettest years since 1954 for the state, respectively. 2013 was the eighth wettest year since 1954 for the state (SCNDR State Climatology Office 2022a). Similarly, the annual precipitation at the Orangeburg 2 station has generally been above normal in the last decade, with only 2017 and 2019 not receiving above normal rainfall. At the Orangeburg 2 station, four of the ten wettest years (2013, 2015, 2016 and 2020) have occurred over the last decade (SCDNR State Climatology Office 2022a)..

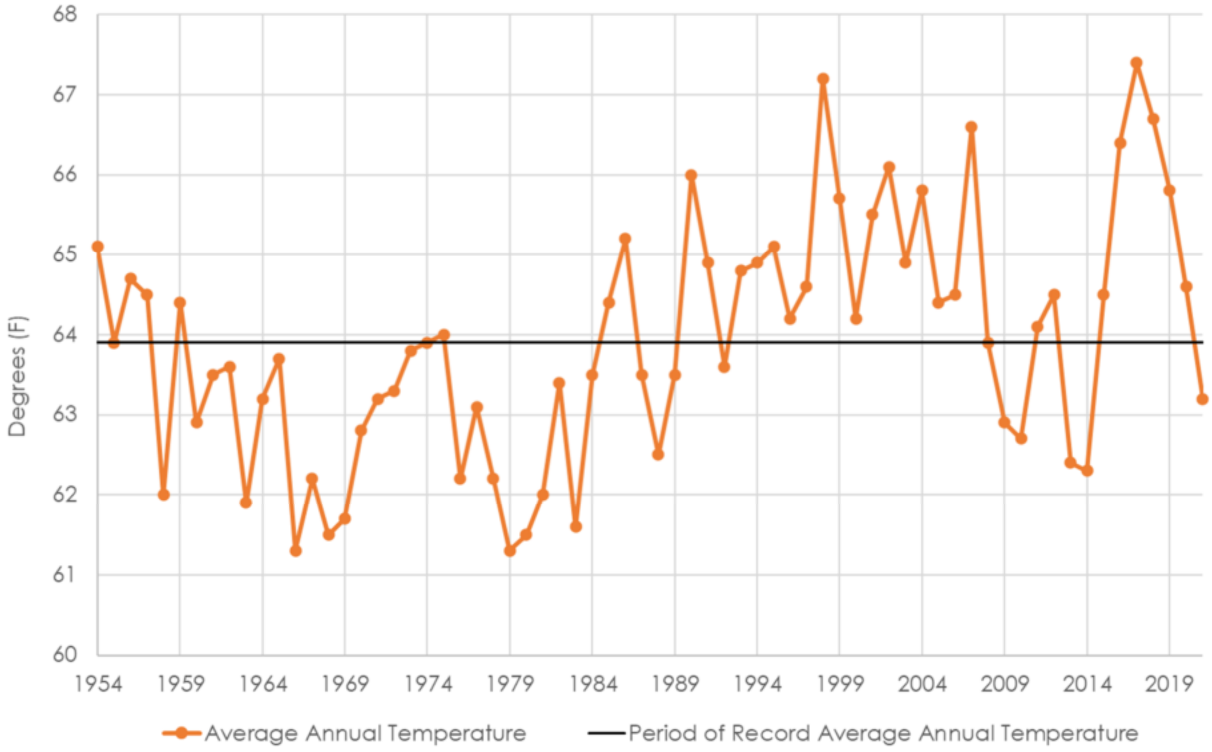


Figure 2-6. Annual average temperature for Orangeburg 1954 to 2021 (SCNDR State Climatology Office 2022a).

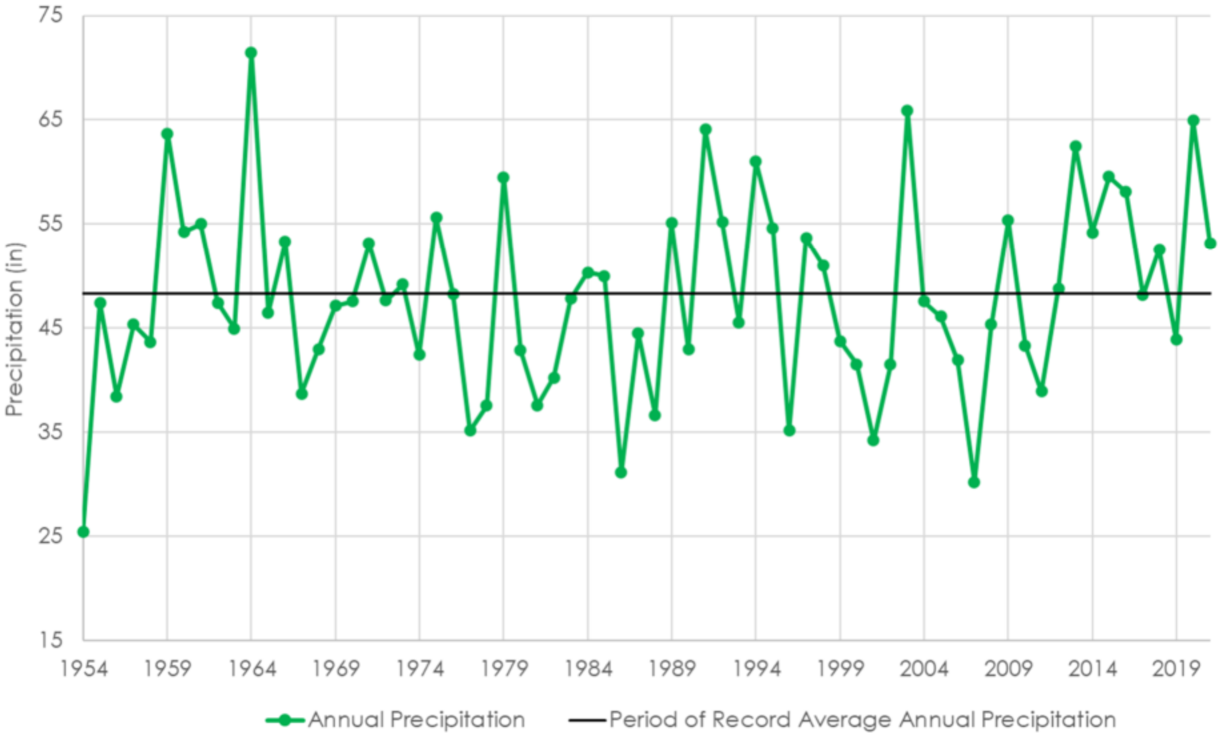


Figure 2-7. Annual precipitation for Orangeburg 1954 to 2021 (SCNDR State Climatology Office 2022a).

2.2.2 Severe Weather

Severe weather impacts the Edisto River basin in the form of thunderstorms, tornadoes, and tropical cyclones. Severe winter weather events are rare, occurring once every several years. Tornadoes are typically short-lived EF-0 and EF-1 tornadoes, the lowest strengths on the Enhanced Fujita Scale, with winds between 65 and 110 miles per hour. However, stronger tornadoes can occur (SCDNR 2022a). The strongest tornadoes reported in the basin were rated at F-3 or EF-3. Three tornadoes have caused damage rated at F-3 or EF-3 in the basin, occurring in 2004, 2008, and 2020. While no tornadoes have caused damage rated higher than F-3 or EF-3 in the basin, an EF-4 tornado occurred nearby to the west of the basin in April 2020. No F-5 or EF-5 tornadoes have ever been recorded in South Carolina. EF-3 tornadoes have wind speeds of 136-165 mph. EF-4 tornadoes have wind speeds of 166-200 mph. EF-5 tornadoes have wind speeds greater than 200 mph.

Tropical systems can cause wind damage, flooding, and tornadoes. On average, South Carolina has an 80 percent chance of being impacted by a tropical system each year, with August, September, and October being the most likely months for their occurrence. Since 1851, 260 tropical systems have impacted South Carolina,138 have tracked into the state, and 44 made direct landfall somewhere along the coast (SCDNR 2022a).

Figure 2-8 shows flooding that occurred in October 2015 along the Edisto River. An upper-level low pressure system over the Southeast combined with moisture from Hurricane Joaquin off the Atlantic coast to create historic rainfall across South Carolina. While several streamflow gages within the basin recorded record flows, the economic damage caused by the flood was not as severe in the Edisto River basin as elsewhere in the state. Thunderstorms not related to hurricanes, such as slow-moving or stationary storms, can also cause flooding in the basin. Based on the most recent 25 years of available daily data, flood stage (of 10 feet) was exceeded 6.9 percent of the time on the Edisto River at the Givhans Ferry USGS streamflow gaging station.

Figure 2-8. Edisto River flooding following Hurricane Joaquin in 2015 (photo courtesy of Mitchell West).

2.2.3 Drought

In South Carolina, droughts typically occur due to lack of adequate rainfall compared to normal. However, drought periods affect different sectors at various timescales. Short-term droughts (weeks to months) typically have more impact on the agricultural sector, while long-term droughts (months to years) generally impact hydrology and ecology, and has broader implications for society and the economy. Figure 2-9 shows the annual Standard Precipitation Index (SPI) value for the Orangeburg 2 station from 1954 to 2021. The SPI is a drought index that compares accumulated rainfall over a given period (here 12 months) to the historical average, where the index values are standard deviations from the mean. Anything equal to or less than -1.0 is considered a drought. The lower the number, the more severe the drought. Based on accumulated precipitation and the SPI, 1954 is the driest year on record for the Orangeburg 2 station. The last year that had an annual SPI value that met the drought threshold in the last 10 years was 2011 (-1.04). During the last 10-year period, the Orangeburg 2 station has had positive annual SPI values, except for 2011 and 2019, showing that conditions have been wetter than normal for the past decade. It should be noted that annual SPI values do not show short-term conditions, such a monthly or seasonal conditions. During a year with a negative annual SPI value, there can be months or seasons with positive SPI values, and vice versa. While the annual SPI timeseries is provided here for reference, it is not the only method for looking at wet and dry periods over time. Furthermore, the SPI only accounts for precipitation and does not consider wetness or dryness in terms of evapotranspiration, soil moisture, streamflow, or groundwater.

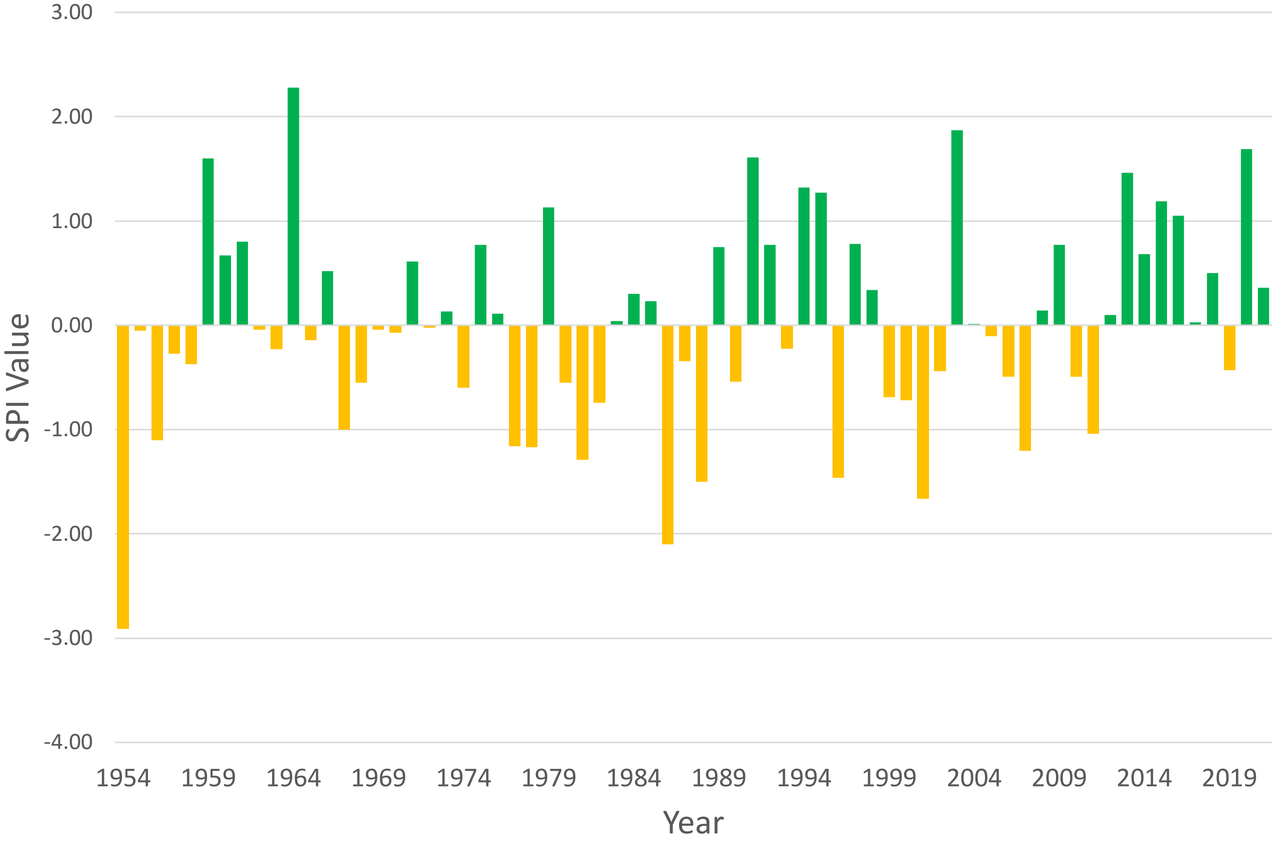


Figure 2-9. Annual Standard Precipitation Index (SPI) values for Orangeburg 1954 to 2021 (SCDNR State Climatology Office 2022b).

While 1954 might be the driest year for precipitation in the Edisto River basin, it is not the driest year regarding flows. Three stream gauges within different parts of the basin all recorded lowest monthly flows on record in 2002 (USGS, 2022). The North Fork Edisto River at Orangeburg had its lowest monthly flow in June (2002) of 159 cubic feet per second (cfs), compared to the mean June discharge of 587cfs. The Edisto River near Givhans also had its lowest monthly flow in June (2002) of 237cfs, compared to the mean June discharge of 1,680 cfs. Contrastingly, the South Fork Edisto River at Denmark had its lowest monthly flow in August (2002) of 175 cfs, compared to the monthly flow of 542 cfs.

The differences between the driest precipitation year (1954) and the driest year with record monthly average low flows (2002) shows the difficulty in articulating the severity of drought. Depending on the data parameter, drought severity can vary. While precipitation is the main driver for water availability in the Edisto River basin, multiple factors such as temperature, evapotranspiration, and water demands, to name a few, also need to be considered when evaluating how drought periods will impact stream and river flows in the basin.

2.3 Natural Resources

The Edisto River basin's natural resources include soils formed from marine sediments which support a variety of agricultural and mining operations and extensive forests and natural vegetative cover that support healthy wildlife populations and an exceptional system of riparian habitats. Showcasing some of these natural resources are three heritage preserves, a National Audubon Society Sanctuary, and four state parks. The natural resources of the basin are further described in the following sections.

2.3.1 Soils, Minerals, and Vegetation

The Natural Resources Conservation Service (NRCS) divided South Carolina into six land resource areas based on soil conditions, climate, and land use, as shown in Figure 2-10. These areas generally follow the boundaries of the physiographic provinces but are defined based on soil characteristics and their supported land use types. Moving from its landward to seaward extents, the Edisto River basin encompasses portions of the Carolina-Georgia Sandhills, Southern Coastal Plain, Atlantic Coast Flatwoods, and Tidewater land resource areas. The land resource area descriptions below were originally presented in the *South Carolina State Water Assessment* (SCDNR 2009).

- The Carolina-Georgia Sandhills Land Resource Area consists of strongly sloping, sandy soils underlain by sandy and loamy sediments. With well-drained to excessively drained soils, the region supports cotton, corn, and soybean growth. Approximately two-thirds of the region is covered by forest types dominated by mixed pine and scrub-oaks.

- The Southern Coastal Plain Land Resource Area is characterized by gently sloping terrain with increased dissection. The region is well suited for farming because of its loamy and clayey soils. The soils are mostly poorly drained except for the sandy slopes and ridges, which are excessively drained.

- The Atlantic Coast Flatwoods Land Resource Area and Tidewater Area are characterized as nearly level coastal plain with meandering streams in broad valleys. The region is two-thirds forested and supports truck crops (i.e., tomatoes, lettuce, melons, beets, broccoli, celery, radishes, onions, cabbage, and strawberries) and corn and soybean production. There are four general soil groups in the area:

1. The wet lowlands consist of loamy and clayey soils underlain by clayey sediment and soft limestone.
2. Broad ridges found in strips near the coast have wet, sandy soils.
3. Floodplains of rivers have well-mixed soils underlain by clayey and loamy sediments.
4. On the coast, salt marshes have clayey sediments and beaches have sandy sediments.

As of February 2022, there were 81 active mines in the Edisto River basin, most of which are in Dorchester (31), Orangeburg (13), and Aiken (12) Counties. They include 68 sand mines, 7 clay mines, and 6 lime mines (SCDHEC 2022a). According to the most recently published USGS Minerals Yearbook, South Carolina produced $771 million in nonfuel minerals in 2016 (USGS 2021). Since 81 of the states 516 active mines, or approximately 16 percent are in the Edisto River basin, a rough estimate of the annual value of minerals produced from the basin is $123 million. Principal commodities in South Carolina include cement (masonry and Portland), clay (kaolin), sand and gravel (construction), and stone (crushed).

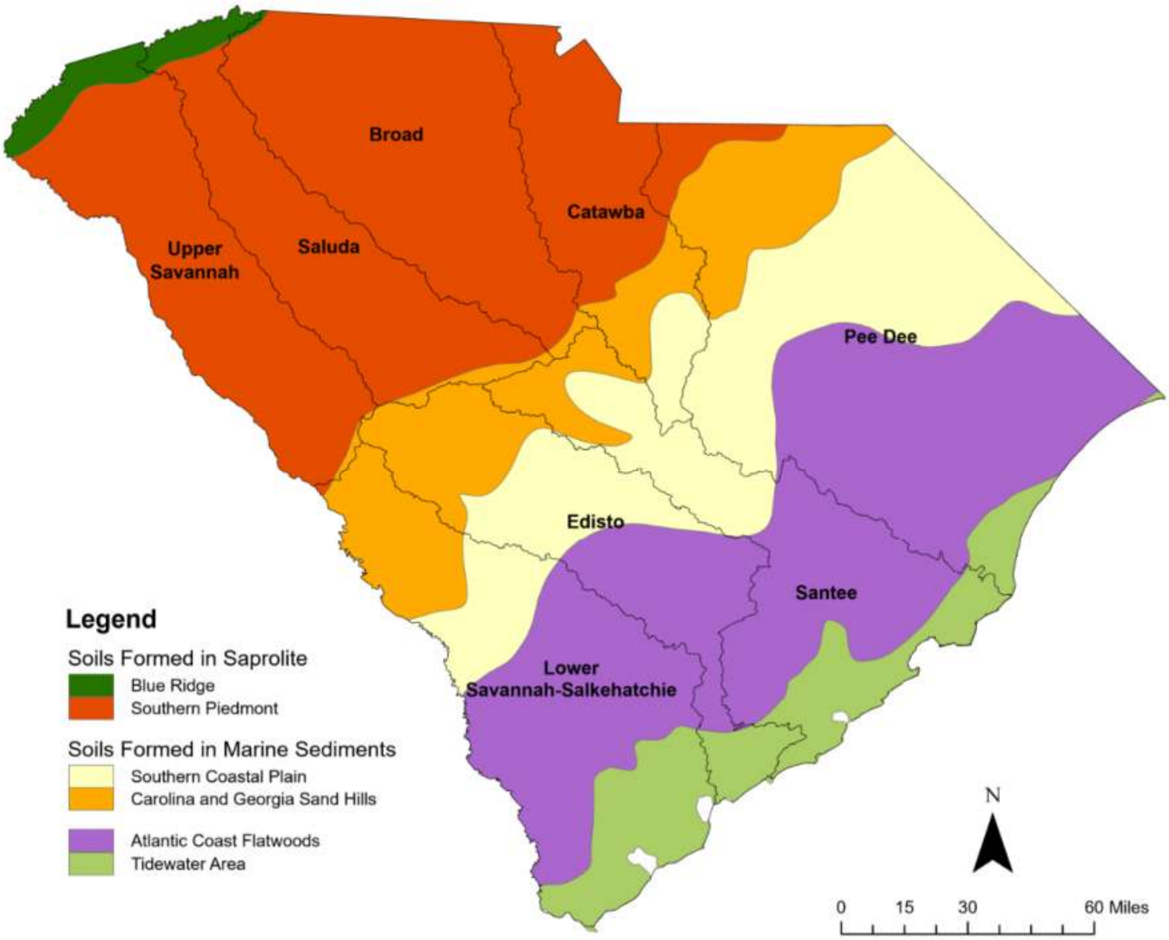


Figure 2-10. Generalized land resource and soils map of South Carolina.

2.3.2 Fish and Wildlife

The rivers and tributaries of the Edisto River basin are home to 87 native species and 3 introduced species of freshwater fish. The Edisto River is not known to have lost any of its native species. Striped sunfish are common in the river, namely the redbreast, bluegill, redear sunfish (shellcracker), spotted sunfish (stumpknocker), and warmouth species (Figure 2-11). An example of an introduced fish is the flathead catfish, which was first documented in 1989 in the Canadys area and had fully colonized by 2000 (Thomason 2020).

Figure 2-11. Striped sunfish of the Edisto River (Thomason 2020).

The Edisto River is important habitat for diadromous fish, those that migrate between freshwater and saltwater. Striped bass and Atlantic sturgeon can be found in various reaches of the Edisto River depending on the season (Thomason 2020). Striped bass migrate from winter habitat in the lower river reaches near the ocean up through the landward freshwater reaches in the summer for spawning. The eggs require adequate flow in the river to prevent them from settling to the bottom of the river during their incubation period (SCDNR 2015).

Within its estuary, the Edisto River is habitat to a variety of saltwater species. Primary species of interest include estuarine finfish such as spotted seatrout, southern flounder, sheepshead, black drum, red drum, and small and large coastal shark species such as Atlantic sharpnose, bonnethead, blacktip, and tiger (Ballenger 2020). In a 2010 trammel net survey of lower estuary, salt-marsh edge habitats across South Carolina, 72 unique species were observed in the ACE basin alone.

Oysters are also a valuable commercial and recreational resource in South Carolina. Of the 5,017 acres of oyster bed habitat mapped in the state, 381 acres (8 percent) are within the brackish and coastal waters fed by the Edisto River basin. Horseshoe crabs, white shrimp, and blue crabs can also be found in St. Helena Sound, a receiving water of the Edisto River (Ballenger 2020).

The Edisto River basin provides habitat to numerous rare, threatened, and endangered species. In the counties with at least a portion of their areas in the Edisto River basin, there are 11 federally endangered species, 10 federally threatened species, and 25 at-risk spices (SCDNR 2022b). Additionally, there are 70 species protected by the Migratory Bird Treaty Act. The bald eagle, protected by the Bald and Golden Eagle Protection Act, has been noted in 10 counties in the Edisto River basin. The basin is home to 12 state-listed endangered species, 8 state-listed threatened species, and 7 state-listed regulated species. State and federal endangered and threatened species in the counties covering the basin are listed in Table 2-3.

Table 2-3. Federal- and state-listed endangered and threatened species in Edisto River basin counties (SCDNR 2022b).

Federal Endangered	Federal Threatened	State Endangered	State Threatened
Shortnose sturgeon	Seabeach amaranth, dwarf amaranth	Shortnose sturgeon	Loggerhead sea turtle
Atlantic sturgeon	Frosted flatwoods salamander	Frosted flatwoods salamander	Wilson's plover
Golden sedge	Red knot	Rafinesque's big-eared bat	Spotted turtle
Red-cockaded woodpecker	Loggerhead sea turtle	Red-cockaded woodpecker	Bald eagle
Smooth purple coneflower	Pool-sprite, snorkelwort	swallow-tailed kite	Southern hog-nosed snake
Harperella	Black rail	Gopher tortoise	Broadtail madtom
Carolina heelsplitter	Wood stork	Carolina gopher frog	Northern dwarf siren
Southern spicebush, pondberry	Northern long-eared bat	Wood stork	Least tern
Chaffseed	Miccosukee gooseberry	Eskimo curlew	-
Canby's cowbane	West Indian manatee	Webster's salamander	-
Relict trillium	-	West Indian manatee	-
-	-	Bachman's warbler	-

2.3.3 Natural and Cultural Preserves

The South Carolina Heritage Trust program was founded in 1974 to protect critical natural habitats on which tracked species depend, and to protect significant cultural sites. There are three natural preserves designated by the South Carolina Heritage Trust program within the Edisto River basin:

- The Deveaux Bank Seabird Sanctuary lies at the mouth of the North Fork Edisto River in Charleston County. The dynamic island system has been submerged by erosion and reemerged since its first documentation in 1921. Partly because of its isolated nature and protection from predatory mammals, the sanctuary supports colonies of nesting seabirds and shorebirds (SCDNR 2016b).

- The Aiken Gopher Tortoise Heritage Preserve consists of 1,622 acres in Aiken County and provides protection to the state-listed endangered gopher tortoise (SCDNR 2016a).

- The Janet Harrison Highpond Heritage Preserve, also in Aiken County, serves to protect 30 acres of high pond, rare plant species (SCDNR 2016c).

There are no formal cultural preserves within the Edisto River basin; however, the shell rings on Fig Island in Botany Bay represent a focus of current archaeological research. The rings consist mainly of oyster shells, but include other shellfish, mammal, and avian species that were consumed then discarded in a circular manner (Taylor 2020). Although there is no definitive evidence as to why these rings were created, it is theorized the areas may have been for habitation, meeting, trading, or celebration.

Outside of the Heritage Trust program's designated natural preserves, the Edisto River basin contains Francis Beidler Forest, which is a National Audubon Society Sanctuary reported to contain the largest old-growth strand of tupelo-cypress in the United States (FRED n.d.). This bottomland-hardwood swamp is within the braided channels of Fore Hole Swamp in Dorchester and Orangeburg Counties. The basin has four state parks along its channels: Aiken State Park, Colleton State Park, Givhans Ferry State Park, and Edisto Beach State Park. In Orangeburg County, Edisto Memorial Gardens is along the North Fork Edisto River and is home to roses, wisteria, dogwoods, azaleas, crape myrtle, and a wetland park. Despite being almost 30 percent forested, there are no state forests or national forests within the basin boundaries.

2.4 Agricultural Resources

2.4.1 Agriculture and Livestock

Farming, incuding the production of both crops and livestock, is vitally important to the economy in the Edisto River basin. The basin contains some of the most productive agricultural land in the state. The U.S. Department of Agriculture's (USDA) NRCS, which inventories land that can be used for the production of the nation's food supply, has catagorized almost 50 percent of the basin as prime farmland or farmland of statewide importance, as shown in Table 2-4 (USDA NRCS n.d.). Prime farmland is defined as the land with the best combinations of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It has an adequate and dependable supply of moisture from precipitation or irrigation; a favorable temperature and growing season; a water supply that is dependable and of adequate quality; is not excessively erodible or saturated with water for long periods; and has slopes mainly ranging from 0 to 6 percent. Farmland of statewide importance is land that nearly meets the requirements of prime farmland and that can economically produce high-yield crops when treated and managed with acceptable farming methods. The distribution of the farmland types across the basin are shown in Figure 2-12. The prime farmland and farmland of statewide importance are found mostly in Orangeburg, Dorchester, and Colleton Counties.

There are currently 3,156 permitted livestock operations in the Edisto River basin (SCDHEC 2022b). Poultry accounts for over 87 percent of the total, followed by dairy and swine. Figure 2-13 shows that the highest concentrations of livestock operations in the Edisto River basin are in Aiken, Dorchester, Lexington, and Orangeburg Counties.

Table 2-4. Area of NRCS-categorized farmland in the Edisto River basin.

Farmland Type	Acres	Square Miles	Percent of Basin
Prime farmland	397,758	621	19.7%
Prime farmland if drained	83,394	130	4.1%
Prime farmland if drained, and either protected from flooding or not frequently flooded during the growing season	868	1.4	0.04%
Prime farmland if protected from flooding or not frequently flooded during the growing season	7132	11.1	0.4%
Farmland of statewide importance	569,028	889	28.2%
Not prime farmland	958,432	1,497	47.5%
Total	2,016,611	3,151	100%

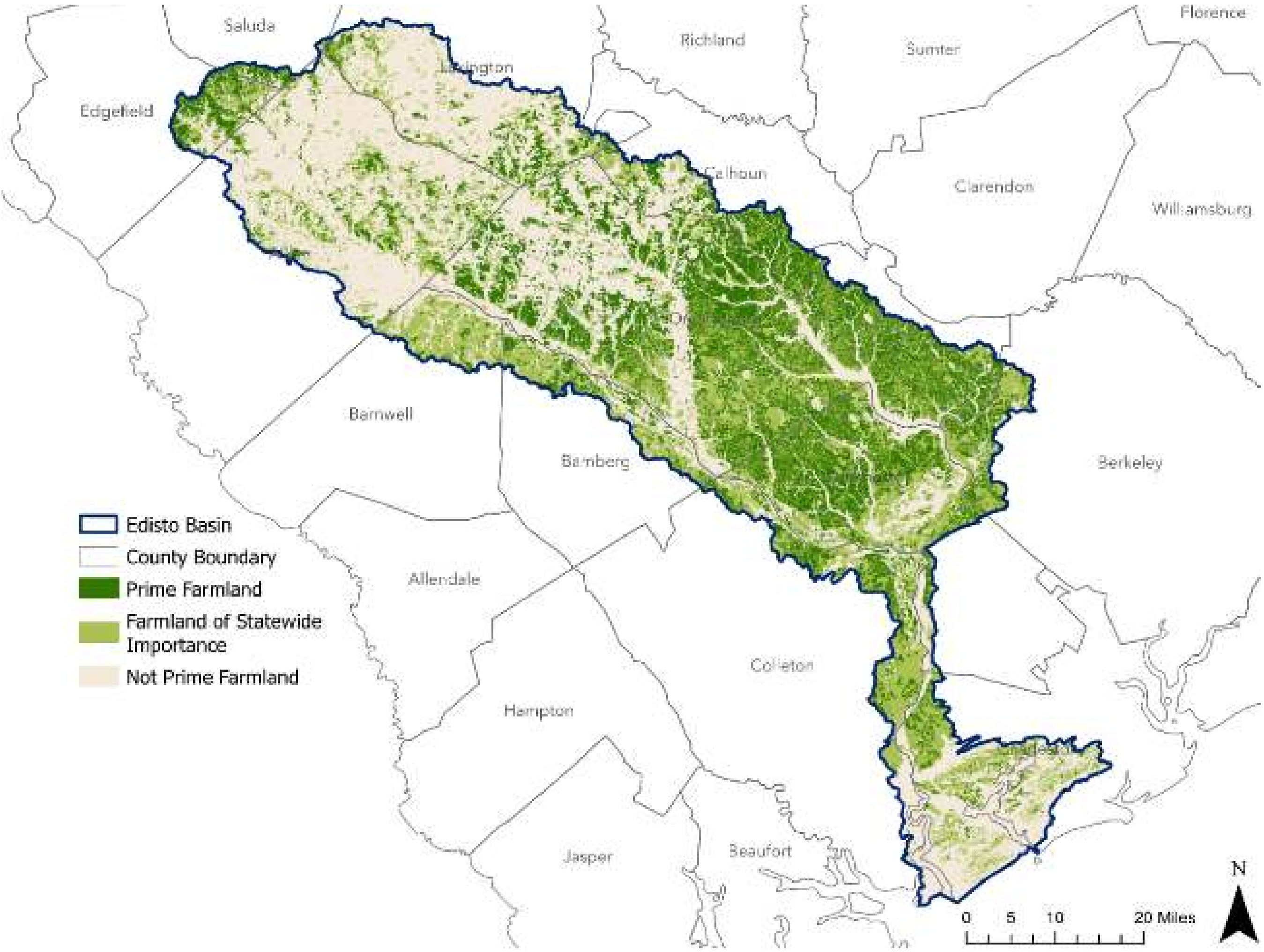


Figure 2-12. Location of NRCS-categorized farmland in the Edisto River basin.

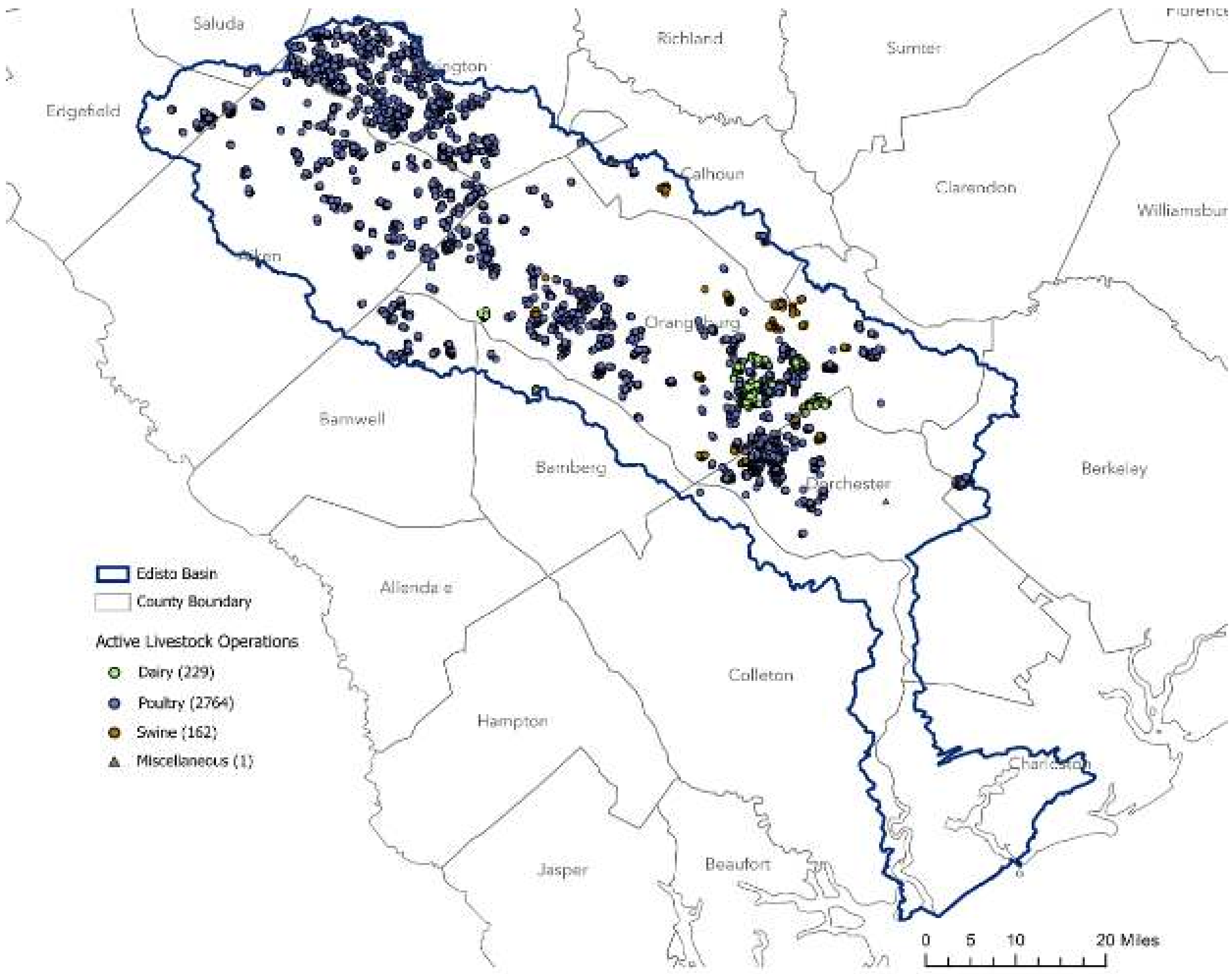


Figure 2-13. Active livestock operations in the Edisto River basin.

Data from the Census of Agriculture suggest that while the number of farm operations in South Carolina has increased only slightly since 2002, irrigated acreage has increased by about 30 percent, as shown on Figure 2-14. The reported number of farm operations and irrigated acreage in the three counties with approximately 50 percent or more of their area within the Edisto River basin are summarized in Figure 2-15. While the data suggests that Orangeburg County has experienced a 47 percent increase in number of farms and a 50 percent increase in irrigated acreage between 2012 and 2017, some of that difference is expected to be due to an increase in the number of farms reporting in 2017. In Dorchester County, the number of farms and irrigated acreage has been relatively steady between 2012 and 2017. Irrigated acreage in Aiken County remained relatively flat from 1992 to 2012, ranging from 1,270 (in 2012) to 3,153 (in 2007) but increased significantly in 2017 to 8,476 acres. Similar to Orangeburg County, the large increase in reported irrigated acreage in 2017 is likely due to an increase in the reporting.

Additional 2017 Census of Agriculture data for Orangeburg, Dorchester, and Aiken Counties is provided in Table 2-5. The largest harvested acreage in the three counties are corn, soybeans, cotton, hay, and peanuts. Aiken County also had a significant amount of acreage reported for growing vegetables and orchards. In Orangeburg County, sales from crops and animals were nearly equal, while in Dorchester County and Aiken County, animal sales exceeded crop sales.

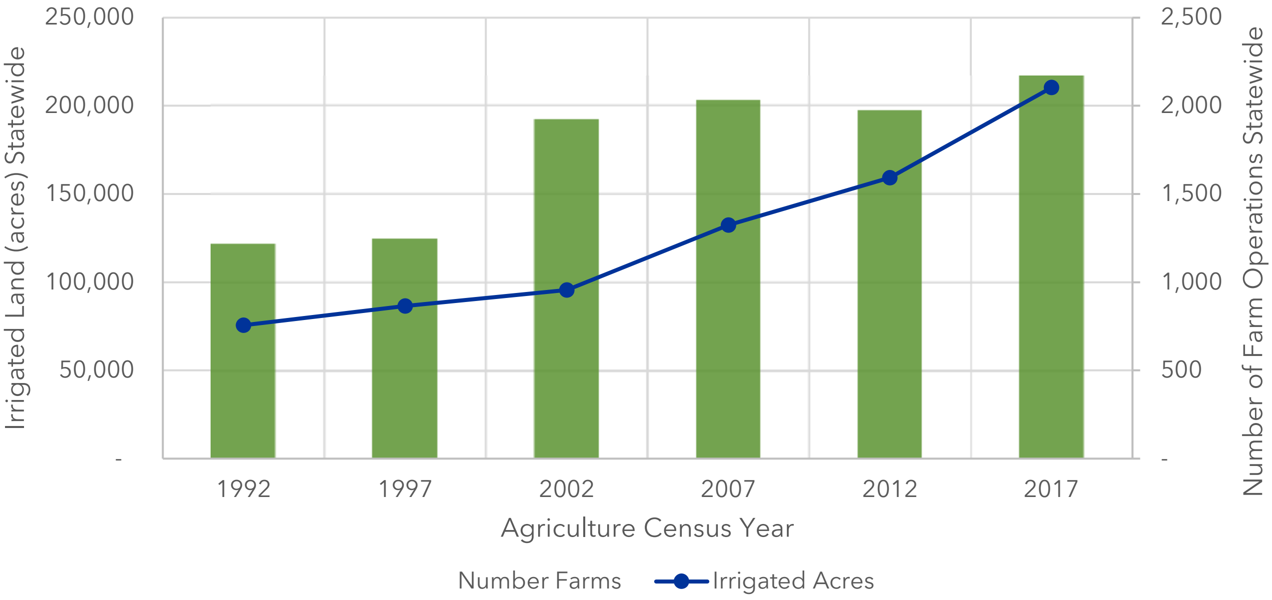


Figure 2-14. Number of farm operations and irrigated acreage statewide, 1992-2017 (USDA NASS 1997, 2007, and 2017).

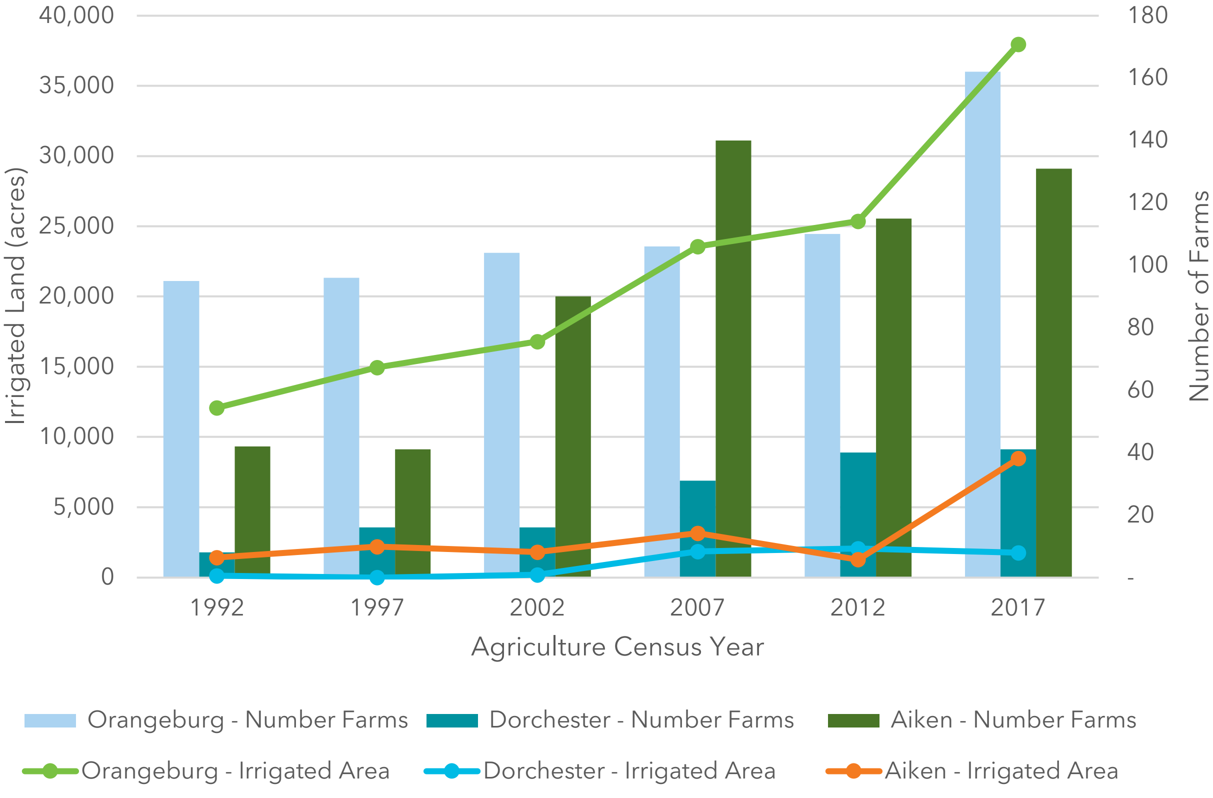


Figure 2-15. Number of farms and irrigated acreage in Aiken, Dorchester, and Orangeburg Counties, 1992-2017 (USDA NASS 1997, 2007, and 2017).

Table 2-5. Summary of 2017 Census of Agriculture for Aiken, Dorchester, and Orangeburg Counties (USDA NASS 2017).

	Aiken	Dorchester	Orangeburg
Percentage of County Area in Edisto River Basin	49.7%	59.9%	92.0%
Total Farm Operation (acres)	162,628	73,867	293,790
Total Cropland (acres)	62,880	32,381	165,516
Total Harvested Cropland (acres)	38,550	27,027	135,886
Total Irrigated Land (acres)	8,476	1,746	37,971
Total Corn (Grain) Harvested (acres)	6,322	7,148	37,577
Total Corn (Silage) Harvest (acres)	-	-	2,091
Total Wheat Harvested (acres)	606	-	3,903
Total Oats Harvested (acres)	461	175	403
Total Soybeans Harvested (acres)	3,122	4,790	21,810
Total Cotton Harvested (acres)	3,887	6,237	33,582
Total Hay and Haylage Harvested (acres)	18,242	3,045	8,557
Total Peanut Harvested (acres)	1,143	4,948	24,109
Total Vegetables Harvested (acres)	2,285	145	972
Total Orchards Harvested (acres)	1,462	43	394
Total Cattle Operations (#)	286	106	220
Total Cows/Beef Operations (#)	229	86	170
Total Cows/Milk Operations (#)	12	7	20
Total Hogs Operations (#)	58	26	48
Total Sheep Operations (#)	51	23	17
Total Chicken Layers (egg) Operations (#)	175	70	96
Total Chicken Broilers (meat) Operations (#)	47	12	45
Total Commodity Sales ($ million)	$137	$40	$214
Total Crop Sales ($ million)	$29	$15	$107
Total Animal Sales ($ million)	$108	$25	$107

Center pivot irrigation is the most common irrigation technique used in South Carolina (Pellett 2020). An agricultural water use survey conducted by Clemson in 2018 also demonstrated the most common irrigation method in the state is center pivot with a fixed rate, followed by drip surface irrigation (Sawyer et al. 2018). The water use survey represented a limited sample of South Carolina irrigation practices as it was based on responses from 167 participants representing practices used on 75,000 acres of irrigated land in the state. The majority of respondents noted groundwater as their source of irrigation water (141), with other sources being lake/pond (29), river/stream (14), municipal (7), and recycled (2). Table 2-6 lists the irrigation techniques used by survey respondents with farming operations in the Edisto River basin. Figure 2-16 shows a center pivot – fixed rate irrigation system with best nozzle technology in use at Walther Farms.

Table 2-6. Irrigation techniques used in the Edisto River basin (Sawyer 2018).

General	Precision	High Efficiency
Center Pivot – Fixed Rate	Center Pivot – Variable Rate	Center Pivot – Fixed Rate with best nozzle technology
Linear Move		Drip – Surface
Traveling Gun		Drip – Subsurface
Solid Set		Micro – Irrigation
Portable Pipe		
Other (not specified)		

Figure 2-16. Center pivot – fixed rate irrigation system with best nozzle technology in use at Walther Farms, April 2021.

2.4.2 Silviculture

With its heavily forested area, the Edisto River basin supports an important silviculture industry. Timber production values for 2019 are summarized inTable 2-7 (South Carolina Forestry Commission 2021). Harvested timber values are categorized as stumpage, which is the value of standing trees "on the stump," or delivered, which is the value of trees when they are delivered to the mill and considers all costs associated with cutting, preparing, and hauling timber to the plant. Of the 46 counties in South Carolina, Orangeburg County is ranked fourth for delivered timber value and Aiken County is ranked ninth.

Table 2-7. Value of timber in Aiken, Dorchester, and Orangeburg Counties and state total.

	Aiken	Dorchester	Orangeburg	State Total
Acres of Forestland	429,279	263,521	434,060	12,855,678
Percent Forest*	66%	73%	61%	66%
Harvested Timber Value – Stumpage	$16	$10	$21	$493
Harvested Timber Value – Delivered	$33	$22	$51	$1,056
Delivered Rank	9	20	4	--

*Based on 2018 estimates from the Forest Inventory and Analysis Program.

An example of a certified tree farm near Bamberg, in the Edisto River basin, is shown in Figure 2-17. The American Tree Farm System® (ATFS) works to sustain forests, watershed and healthy wildlife habitats. ATFS-certified forests meet eight standards of sustainability and are managed for water, wildlife, wood, and recreation.

Figure 2-17. A certified tree farm near Bamberg, South Carolina.

2.4.3 Aquaculture

Limited data are available on aquaculture in the basin; however, the 2017 Census of Agriculture lists Orangeburg as having four catfish farms, one "other food" fish farm, two crustacean farms, one mollusk farm, and two sports of game fish farms (USDA NASS 2017).

2.5 Socioeconomic Environment

2.5.1 Population and Demographics

The Edisto River basin is primarily rural in character with small cities and towns scattered throughout. Although the basin covers 10 percent of the state's total area, it accounts for only 4 percent of the total population. The basin's estimated 2020 population of 220,000 increased by about 5 percent since 2010.

The basin's largest urban area is Orangeburg which has a 2020 population of 12,654. Other urban areas include St. George and the eastern portion of Aiken. As shown in Figure 2-18, outside of Orangeburg, higher population densities tend to occur at the periphery of the basin.

Recent population growth in the basin has been disproportionate, with the coastal portion that lies on the outskirts of Charleston and the northern areas within Aiken and Lexington Counties experiencing significant growth. Elsewhere, small towns in the basin have experienced negative or little growth in past 10 years. Figure 2-19 shows the 10-year population change by census block group.

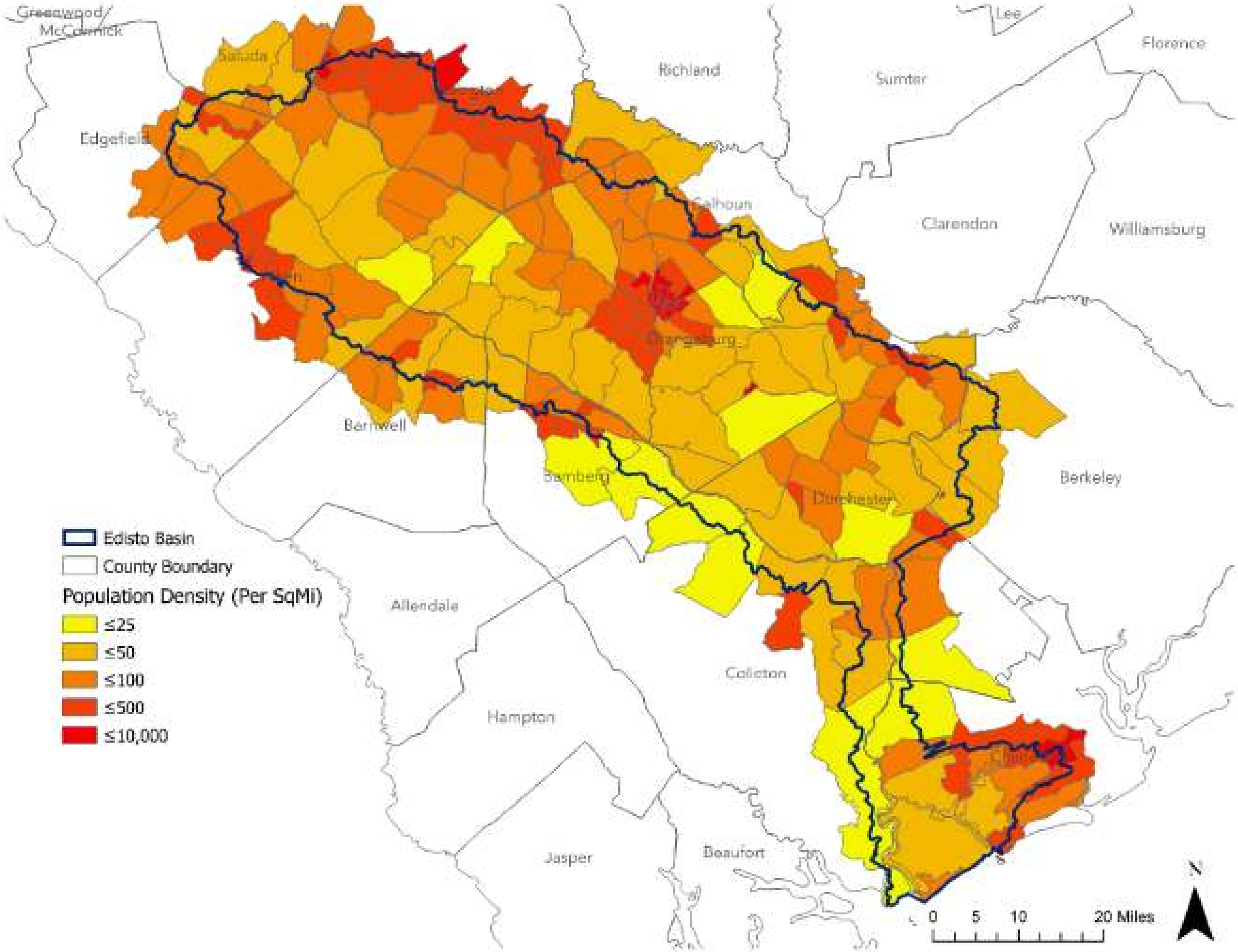


Figure 2-18. Population density of Edisto River basin by census block group (U.S. Census Bureau 2020).

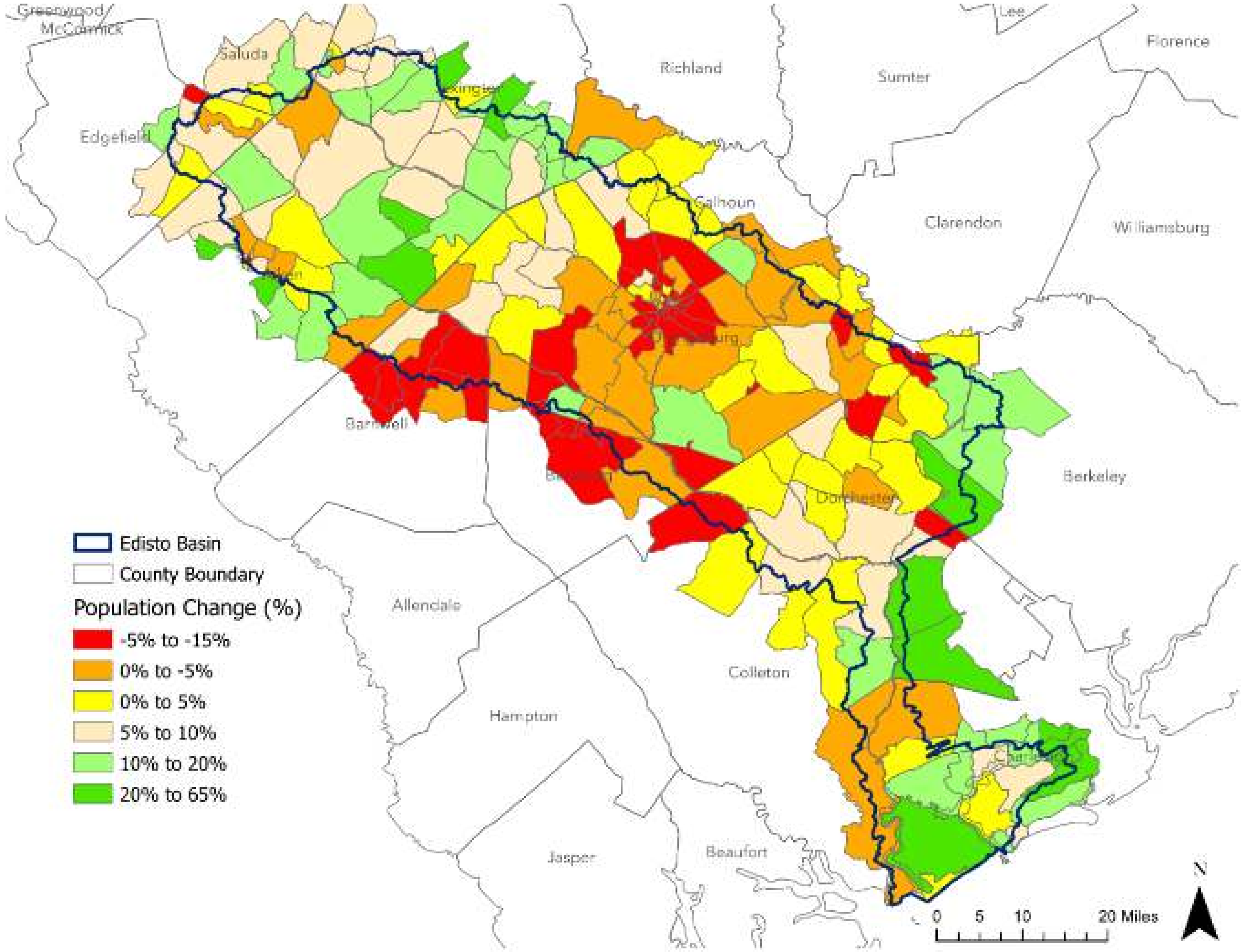


Figure 2-19. Population change from 2010 to 2020 by census block group (U.S. Census Bureau 2020).

The 2020 per capita income of counties that are partially or fully within the basin ranges from $37,596 for Bamberg (thirty-eighth highest out of 46 counties in the state) to $66,656 for Charleston (the highest in the state) (U.S. Bureau of Labor Statistics [BLS] 2021). The average per capita income of all counties that are partially or fully in the basin is $42,863, which is slightly below the statewide 2020 per capita income of $48,021 (BLS 2021). The percentage of population below the poverty line for counties that intersect the basin ranges from 24.9 percent for Barnwell (eleventh highest out of 46 counties) to 9.3 percent for Dorchester (second lowest in the state) (South Carolina Revenue and Fiscal Affairs Office 2020). The average percentage of population below the poverty line for all counties that intersect the basin is 16 percent, just above the state average at 13.9 percent.

2.5.2 Economic Activity

The 2018 gross domestic product (GDP) associated with the variety of industries present in Aiken, Dorchester, and Orangeburg Counties (which cover almost 63 percent of the Edisto River basin) is shown in Table 2-8. The GDP for all 12 counties which intersect the basin are provided in Appendix A. Intermediate goods, which are goods or services used in the production of final goods or services, are not included in the GDP. Several industries, such as agriculture and manufacturing, rely heavily on the water resources of the Edisto River basin. The distribution of employment by industry sector for counties that intersect the basin is shown in Table 2-9 (Bureau of Economic Analysis 2018).

Table 2-8. 2018 GDP for Aiken, Dorchester, and Orangeburg Counties (in millions of dollars).

Industry Type	Aiken	Dorchester	Orangeburg
All industry total	7,200	3,900	2,900
Private industries	6,500	3,400	2,300
Agriculture, forestry, fishing, and hunting	29	(D)	(D)
Mining, quarrying, and oil and gas extraction	38	8	8
Utilities	130	13	(D)
Construction	430	280	80
Manufacturing	1,360	750	650
Durable goods manufacturing	490	350	350
Nondurable goods manufacturing	870	300	300
Wholesale trade	160	140	(D)
Retail trade	430	290	220
Transportation and warehousing	160	(D)	92
Information	130	63	140
Finance, insurance, real estate, rental, and leasing	1,030	930	370
Finance and insurance	260	58	58
Real estate and rental and leasing	770	310	310
Professional and business services	1,840	350	100
Professional, scientific, and technical services	440	60	60
Management of companies and enterprises	14	7	7
Administrative and support and waste management and remediation services	1,380	190	41
Educational services, health care, and social assistance	400	190	210
Educational services	13	17	58
Health care and social assistance	390	180	150
Arts, entertainment, recreation, accommodation, and food services	220	160	120
Arts, entertainment, and recreation	43	27	12
Accommodation and food services	170	130	110
Other services (except government and government enterprises)	150	140	62
Government and government enterprises	650	520	590

D = Not shown to avoid disclosure of confidential information; estimates are included in higher-level totals

Table 2-9. Percentage of employment by sector for Aiken, Dorchester, and Orangeburg Counties combined, 2018.

Industry Sector	Percentage of Employment
Manufacturing	15%
Retail Trade	14%
Administrative and Waste Services	12%
Health Care and Social Assistance	12%
Accommodation and Food Services	11%
Educational Services	7%
Construction	6%
Public Administration	5%
Professional and Technical Services	4%
Transportation and Warehousing	4%
Other Services, Except Public Administration	2%
Finance and Insurance	2%
Wholesale Trade	2%
Arts, Entertainment, and Recreation	2%
Real Estate and Rental and Leasing	1%
Information	1%
Agriculture, Forestry, Fishing, and Hunting	1%
Utilities	1%
Management of Companies and Enterprises	<1%
Mining, Quarrying, and Oil and Gas Extraction	<1%

Chapter 3
Water Resources of the Edisto Basin

3.1 Surface Water Resources

3.1.1 Major Rivers and Lakes

The Edisto River is one of the longest freely flowing blackwater streams in the United States and the largest river system completely contained within the borders of South Carolina. No other river basins flow into the Edisto River basin. The basin is drained by four main rivers: the South Fork Edisto River, North Fork Edisto River, Edisto River, and Four Hole Swamp. The four main branches total 250 miles in length and are fed by over 6,800 miles of perennial and intermittent streams.

The North and South Fork Edisto Rivers, which are within the upper Coastal Plain region, are characterized by having strong surface-groundwater interactions and high baseflow contribution, leading to well sustained flows (SCDNR 2009). The two rivers combine near the Town of Branchville to form the Edisto River. Tributaries that feed the Edisto River in the middle and lower Coastal Plain regions are more dependent on rainfall and direct runoff. These tributaries have limited surface water availability during periods of low rainfall (SCDNR 2009). As evidenced by its name, Four Hole Swamp, which originates in Calhoun County, is heavily braided and largely undeveloped. It is characterized by the lack of a well-defined primary channel, but instead has multiple channels.

There are no major reservoirs within the basin, however small lakes and ponds are prevalent on tributary headwaters, especially in the upper and lower portions of the North Fork Edisto and South Fork Edisto subbasins. Many farmers have created small impoundments on streams that cross their land to provide storage and maintain adequate head for irrigation pumping.

Figure 3-1 shows the location of the four major subbasins, the major estuarine and riverine wetland types, and small lakes and ponds. Near the coast, where the Edisto River splits to form the North and South Edisto Rivers, estuarine and deepwater wetlands are present. These tidally influenced saltwater streams receive drainage from bordering salt marshes and tidal creeks. Freshwater forested/shrub wetlands dominate in the lower and middle Coastal Plain region. Rivers and streams in the upper Coastal Plain, conversely, are generally perennial and are well-supplied by both groundwater and direct runoff.

3.1.2 Surface Water Monitoring

There are 17 active gaging stations operated by the USGS in the Edisto River basin. Fifteen of the stations collect stage (stream height) and discharge (flow) data and the remaining three stations collect only stage data. An additional four gaging stations are no longer active but collected streamflow ranging from a period of 2 to 26 years. Table 3-1 lists the streamflow gaging stations and provides their period of record, drainage area, and select streamflow statistics through August of 2022 (where available). Gaging stations that only measure stream stage are not listed. The locations of all the active and inactive streamflow and stage-only gaging stations are shown in Figure 3-2. The lack of a single channel in the Four Hole Swamp subbasin has prevented the ability to establish a streamflow gaging station there.

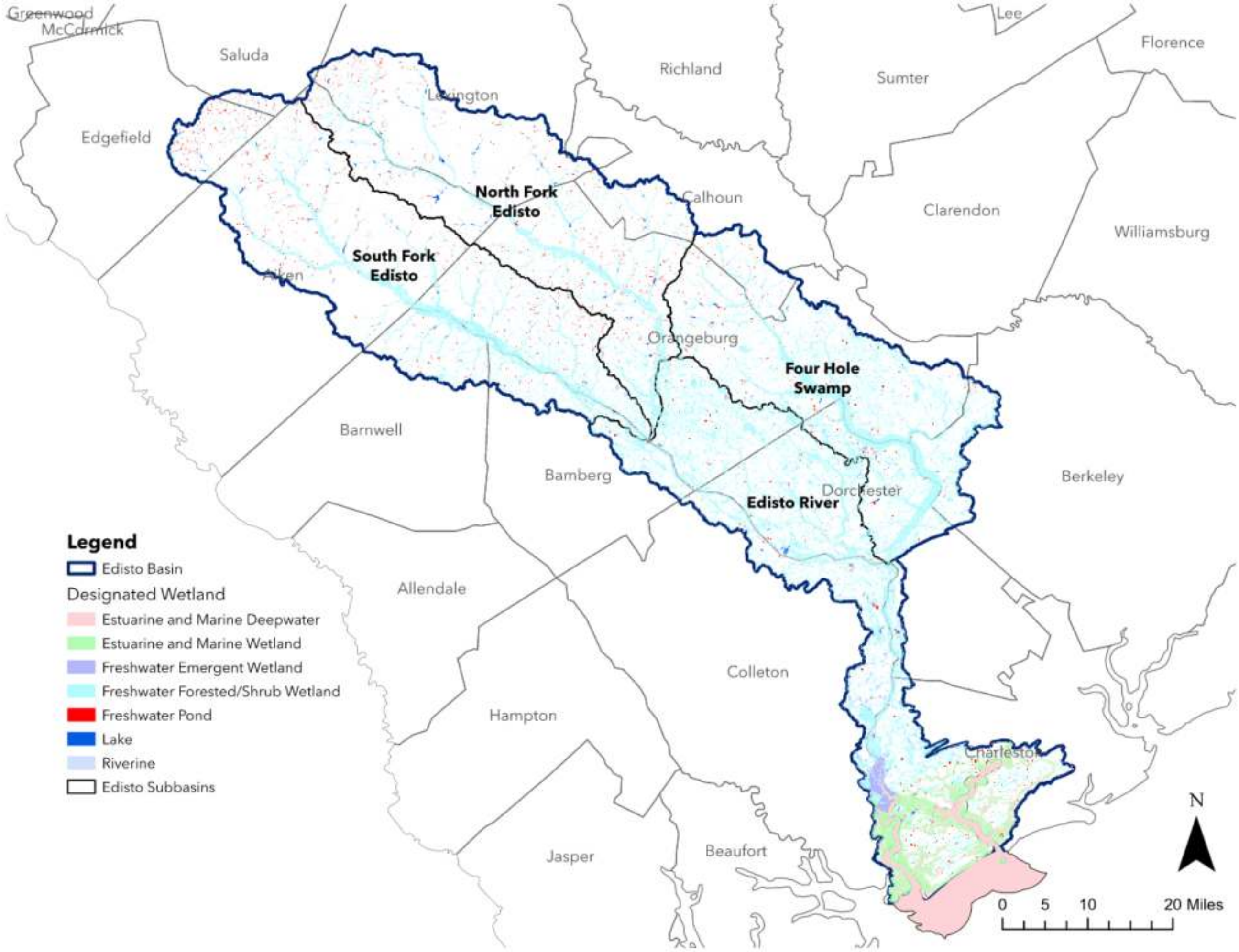


Figure 3-1. Wetland types of the Edisto River basin (USFWS 2022).

Table 3-1. Streamflow characteristics at USGS gaging stations in the Edisto River basin.

Gaging Station Name	Station Number	Period of Record	Drainage [mi²]	Average Daily Flow [cfs]	90% Exceeds Flow [cfs]	Minimum Daily Flow [cfs], (year)	Max Daily Flow [cfs], (year)
South Fork Edisto River Subbasin							
McTier Creek Near Monetta	2172300	1995-present	15.6	15.8	4	0.82 (2012)	502 (2015)
McTier Creek Near New Holland	2172305	2007-2009	30.7	21.6	7	2.61 (2008)	163 (2008)
South Fork Edisto River near Montmorenci	2172500	1940-1966	198	243	110	40 (1954)	4,260 (1964)
Dean Swamp Creek near Salley	2172640	1980-2000	31.2	24.8	18	11 (1990)	114 (1990)

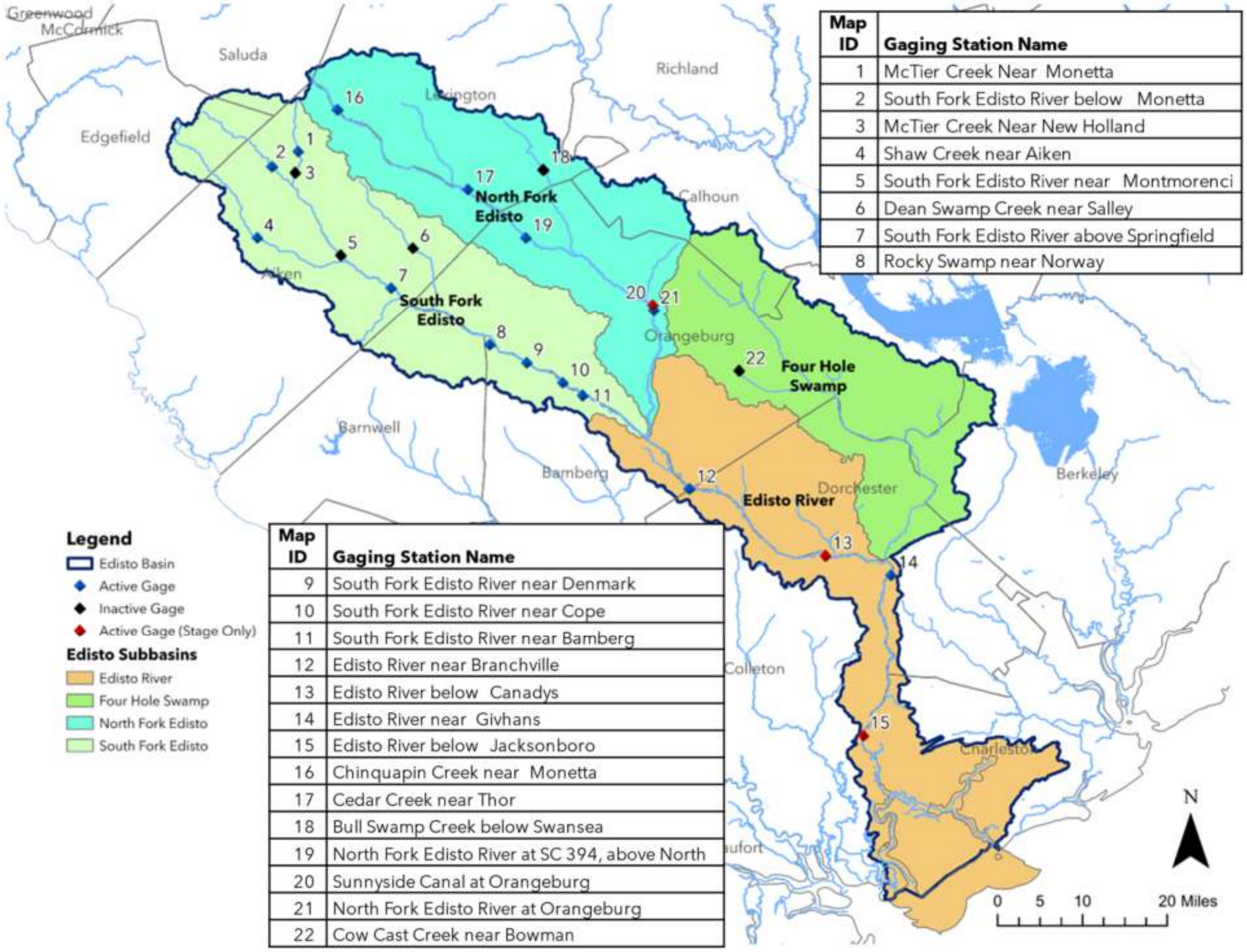
Table 3-1. Streamflow characteristics at USGS gaging stations in the Edisto River basin. (Continued)

Gaging Station Name	Station Number	Period of Record	Drainage [mi²]	Average Daily Flow [cfs]	90% Exceeds Flow [cfs]	Minimum Daily Flow [cfs], (year)	Max Daily Flow [cfs], (year)
South Fork Edisto River Subbasin (continued)							
South Fork Edisto River below Moneta	21722801	2021-present	73	NA	NA	NA	NA
Shaw Creek near Aiken	2172525	2021-present	72.2	NA	NA	NA	NA
South Fork Edisto River above Springfield	2172558	2014-present	399	325	148	82.7 (2015)	2,450 (2015)
Rocky Swamp near Norway	21727610	2020-present	22.5	NA	NA	NA	NA
South Fork Edisto River nr. Denmark	2173000	1931-present	720	713	293	110 (2002)	12,700 (1936)
South Fork Edisto River near Cope	2173030	1990-present	757	671	244	86.6 (2002)	6,510 (1998)
South Fork Edisto River nr. Bamberg	2173051	1991-present	807	811	257	110 (2002)	8,080 (1998)
Edisto River Subbasin							
Edisto River near Branchville	2174000	1945-1996, 2020-Present	1,720	1,991	820	325 (1990)	14,400 (1964)
Edisto River near Givhans	2175000	1939-present	2,730	2,429	630	150 (2002)	26,300 (2015)
North Fork Edisto River Subbasin							
Cedar Creek near Thor	2173212	2008-present	44.1	19.2	11	5.8 (2012)	157 (2015)
Bull Swamp Creek below Swansea	2173351	2001-2003	34.4	7.4	3	2.7 (2003)	54 (2003)
Chinquapin Creek near Monetta	21731105	2021-present	23.7	NA	NA	NA	NA
North Fork Edisto River at SC 394, above North	2173299	2020-present	364	419	275	146 (2022)	1,900 (2021)
North Fork Edisto River at Orangeburg	2173500	1938-present	683	718	323	113 (2002)	8,850 (1945)
Four Hole Swamp Subbasin							
Cow Cast Creek near Bowman	2174250	1970-1980 & 1995-2013	23.4	17.6	1	0 (2002)	1,030 (2003)

NA = Not available (these gages only report stream stage and not flow)

Duration hydrographs showing average daily streamflow throughout the year at select gaging stations in the North Fork, South Fork, and Edisto River subbasins are shown in Figure 3-3. Mean daily flows in the North and South Fork Edisto Rivers exhibit nearly identical seasonal patterns and are at their highest in March and lowest from June through September. Mean daily flows in the Edisto River exhibit greater seasonal differences than in the North and South Fork. At all stations, median flows are lower than mean flows owing to the influence of occasional short duration flood events which can exceed ten times the mean daily flows.

Mean monthly flows at the North and South Fork gaging stations over the previous 30 years (1992 to 2022) are plotted in Figure 3-4. The fifth percentile of the mean monthly flows over the 82-year period beginning in 1940 is 250 cfs at the North Fork Edisto River near Denmark station and 291 cfs at the South Edisto River at Orangeburg station. The fifth percentile flows are used in the graph to distinguish the periods of drought, most of which occurred during the period 2007 to 2013. Figure 3-5 shows the mean monthly flow at the Edisto River gaging station near Givhans for the same 30-year period. The fifth percentile of the mean monthly flows recorded since 1940 is 517 cfs. The lowest flows at these, and most other gaging stations in the Edisto River basin, were recorded during the end of the multi-year drought of 1998-2002. Prior to that, the 1950s had been considered the drought of record in the basin.



Map ID	Gaging Station Name
1	McTier Creek Near Monetta
2	South Fork Edisto River below Monetta
3	McTier Creek Near New Holland
4	Shaw Creek near Aiken
5	South Fork Edisto River near Montmorenci
6	Dean Swamp Creek near Salley
7	South Fork Edisto River above Springfield
8	Rocky Swamp near Norway

Map ID	Gaging Station Name
9	South Fork Edisto River near Denmark
10	South Fork Edisto River near Cope
11	South Fork Edisto River near Bamberg
12	Edisto River near Branchville
13	Edisto River below Canadys
14	Edisto River near Givhans
15	Edisto River below Jacksonboro
16	Chinquapin Creek near Monetta
17	Cedar Creek near Thor
18	Bull Swamp Creek below Swansea
19	North Fork Edisto River at SC 394, above North
20	Sunnyside Canal at Orangeburg
21	North Fork Edisto River at Orangeburg
22	Cow Cast Creek near Bowman

Figure 3-2. USGS streamflow gaging stations.

Apart from the USGS gaging stations which measure stage and flow, there are numerous sites throughout the basin where SCDHEC collects water quality data as part of their ongoing Ambient Surface Water Physical and Chemical Monitoring program to assess the water's suitability for aquatic life and recreational use. The program includes ongoing fixed-location monitoring and statewide statistical survey monitoring. The fixed-location monitoring includes monthly collection and analysis of water from Base Sites in a uniform manner for the purpose of providing solid baseline water quality data. The Statistical Survey Sites are sampled once per month for one year and moved from year to year (SCDHEC 2022c).

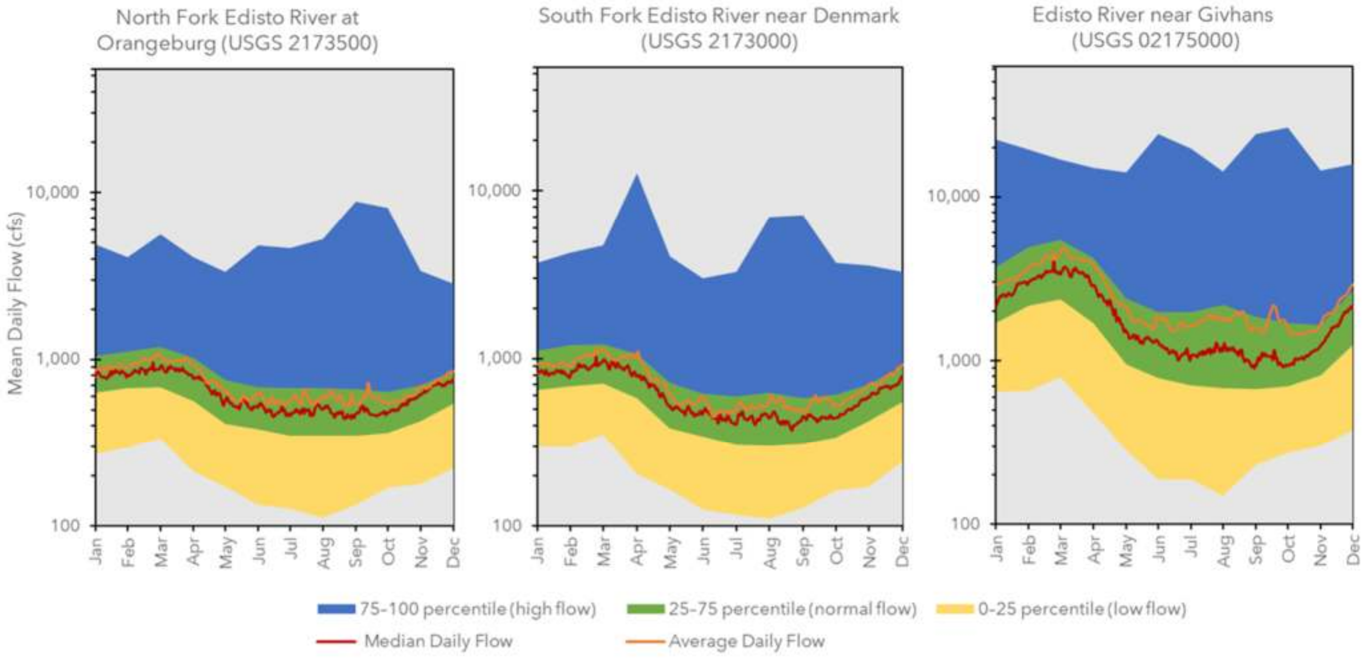


Figure 3-3. Duration hydrographs for select gaging stations on the North Fork Edisto River, South Fork Edisto River, and Edisto River.

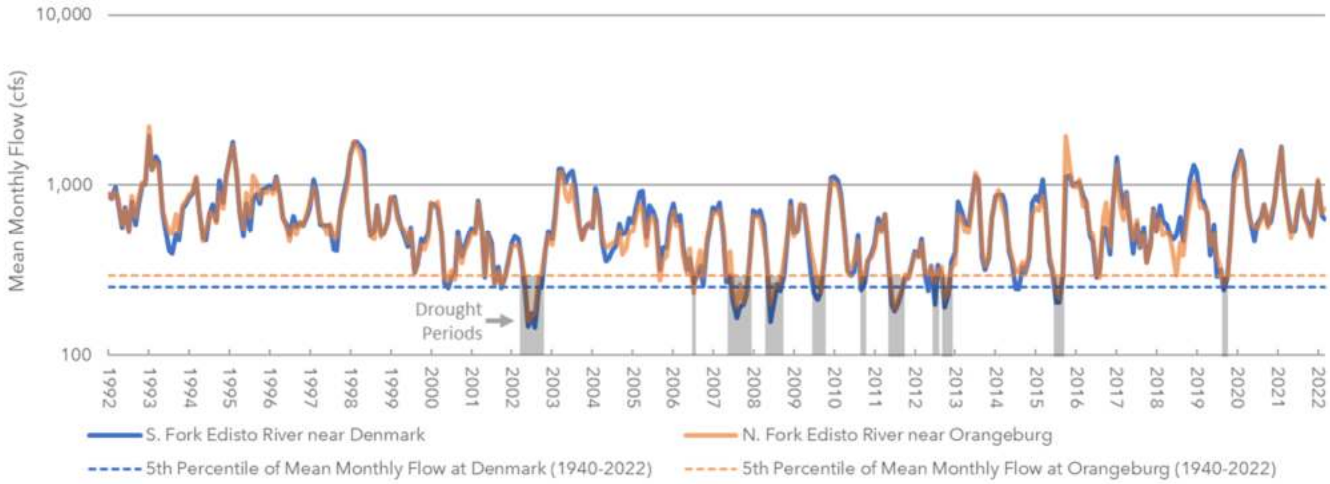


Figure 3-4. Mean monthly flows at select gaging stations in the North and South Fork Edisto Rivers.

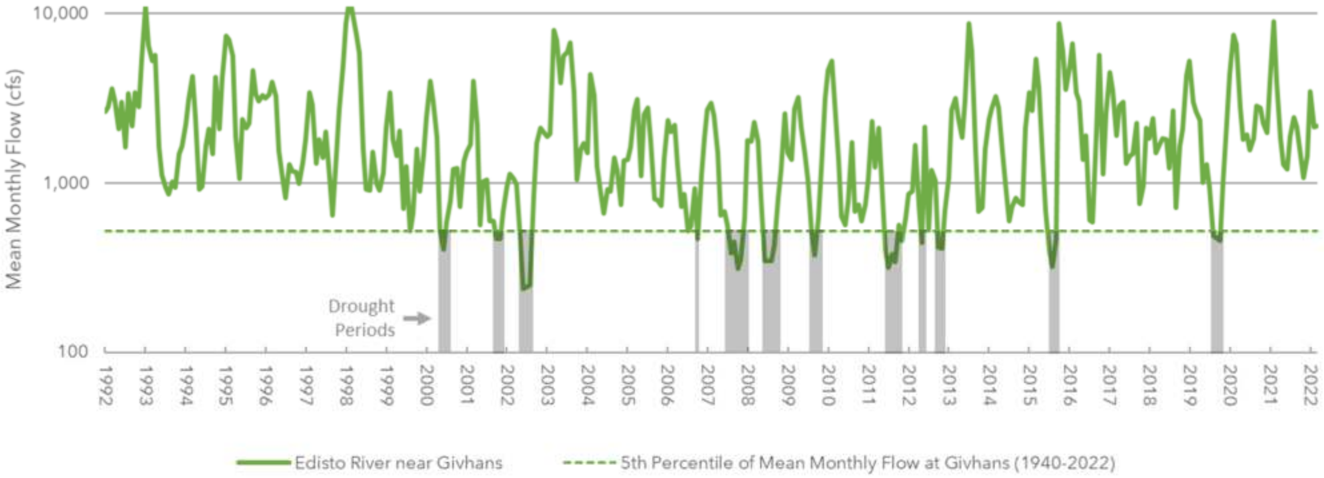


Figure 3-5. Mean monthly flows on the Edisto River near Givhans.

3.1.3 Surface Water Development

The four major rivers of the basin (North Fork Edisto, South Fork Edisto, Edisto, and Four Hole Swamp) are free flowing; however, numerous regulated and unregulated dams have been constructed on tributaries feeding the four major rivers. Dams that are less than twenty-five feet in height or impound less than fifty-acre feet are generally exempt from regulation in South Carolina. There are 349 SCDHEC-regulated dams in the Edisto River basin, most of which are classified as Low Hazard, Class 3 dams, as shown in Table 3-2. Nearly all the regulated dams are in the upper half of the basin on tributaries to the North and South forks, as shown in Figure 3-6. The impoundments created by both regulated and unregulated dams support irrigation needs by storing water, which may otherwise not be available to withdrawers during low streamflow conditions. Several water suppliers in the basin also rely on impoundments to augment stream flow (when needed) for a downstream intake, as the City of Aiken has done with the Mason Branch Reservoir, or to create a storage reservoir with a water supply intake, as the Town of Batesburg-Leesville has done with Batesburg Reservoir. The impoundment of water, while providing storage and improving resilience to drought, also increases the overall evaporative losses from the basin.

Table 3-2. Regulated dams in the Edisto River basin.

Dam Type	Number of Dams	Description
High Hazard, Class 1	71	Structure where failure will likely cause loss of life and/or serious damage to infrastructure
Significant Hazard, Class 2	44	Structure where failure will not likely cause loss of life but infrastructure may be damaged
Low Hazard, Class 3	234	Structure where failure may cause limited property damage
Total	**349**	

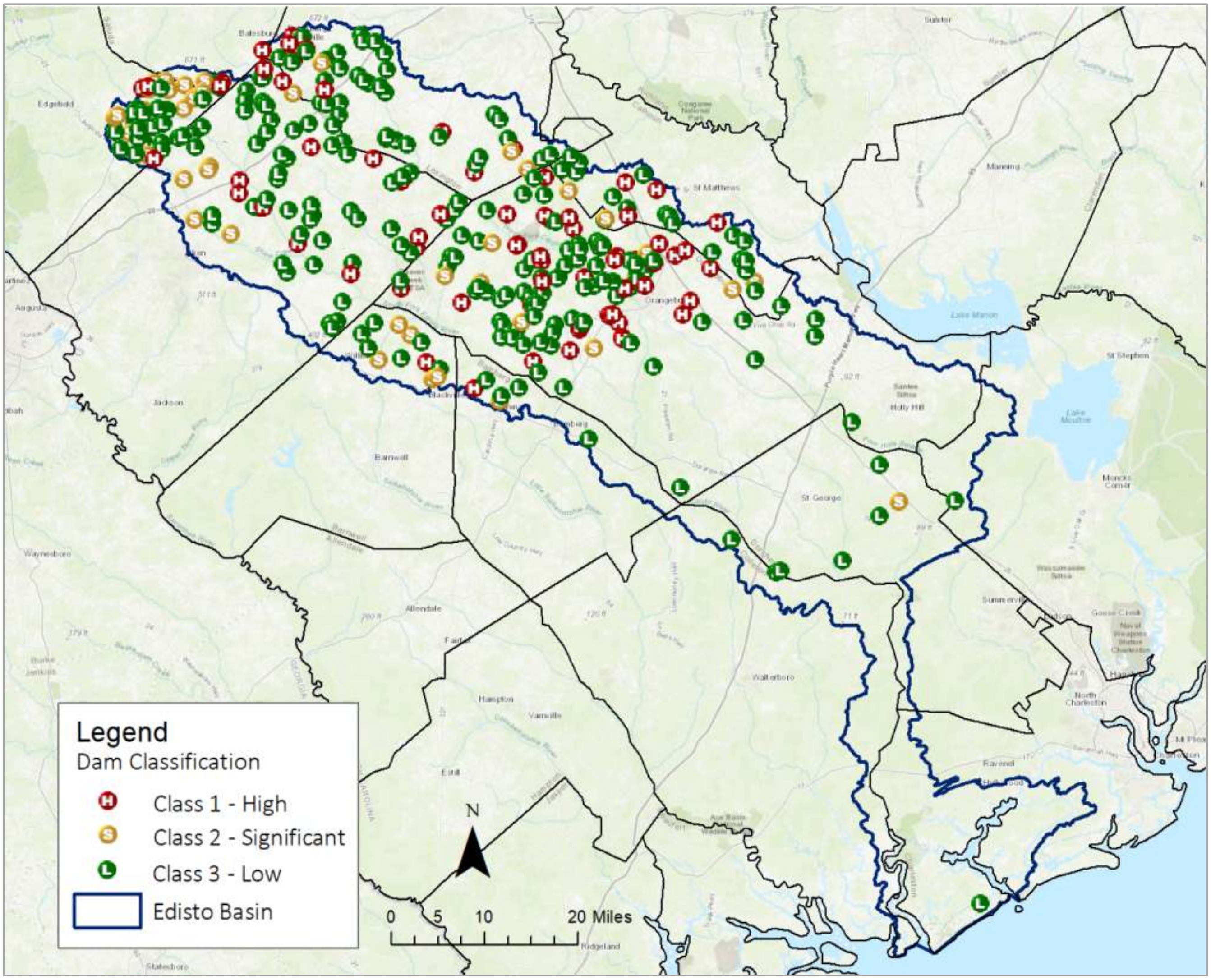


Figure 3-6. Regulated dams in the Edisto River basin.

The United States Army Corps of Engineers (USACE) has been involved in four navigation and three flood control projects in the Edisto River basin (SCDNR 2009). One of these projects was completed in 1975 and involved improving 20 miles of channel on Horse Range Swamp. The NRCS also contributed to a flood control project near the Town of Holly Hill in Orangeburg County in the late 2000s. As of 2022, there are no active projects in the basin.

3.1.4 Surface Water Concerns

The major rivers of the Edisto River basin are free-flowing andcompletely contained within the borders of the state. Consequently, the basin is absent of many of the surface water concerns common to other river basins of the state such as out-of-state withdrawals and flow regulation from major reservoirs or Federal Energy Regulatory Commission (FERC)-licensed hydroelectric projects.

The lack of adequate surface water supply for withdrawal has not been a major concern in the basin as river flows are typically well-sustained by groundwater baseflow; however, tributary streams in the middle and lower Coastal Plain are less connected to groundwater. Consequently, supplies from these streams may be unreliable during periods of low rainfall (SCDNR 2009).

Water quality concerns have been associated with stream and river reaches in the basin that do not meet water quality standards and do not support designated uses. Water quality monitoring conducted by SCDHEC from 1997 to 2001 demonstrated that aquatic-life uses were fully supported at 72 percent (58 out of 80 sites) sampled in the basin (SCDHEC, 2004). Most sites that were not fully supporting of aquatic-life uses were impaired by low dissolved oxygen. Recreational use was fully supported at 76 percent of sampled sites. Sites not supportive of recreational use were largely impaired by high levels of fecal coliform bacteria. More recently, the 2018 Section §303(d) Clean Water Act list of impaired waters documented impairments at 95 sampling stations that impacted 47 different streams in the basin, including the four major rivers (SCDHEC 2018). A summary of the causes of impairments and the associated non-supported designated uses is provided in Table 3-3.

Table 3-3. 2018 303d Edisto River basin impairment summary.

Designated Use	Number of Stations with Impairments[1]	Causes of Impairments (Number of Impairments)
Aquatic Life	40	Macroinvertebrate (7) Dissolved Oxygen (16) Turbidity (13) Ammonia-nitrogen (2) pH (4)
Fish Consumption	24	Mercury (24)
Recreational Use	8	Escherichia coli (3) Enterococci (5)
Shellfish Harvesting	28	Fecal Coliform Bacteria (28)

[1] Five stations had multiple impairments

Other surface water-related concerns have been raised by the RBC members during the planning process. At the third RBC meeting held on August 19, 2020, RBC members identified their initial concerns and priorities. Initial concerns included:

- Limited knowledge and data on the interaction of surface water and groundwater in the basin
- Clarifying the meaning of "reasonable use" of surface water
- The definition of "regulatory safe yield" as it applies to surface water in the basin, and fuller understanding of the Surface Water Withdrawal, Permitting, Use and Reporting Act.
- Ensuring that enough water remains in streams and rivers to support healthy ecosystems
- Having enough data on surface water to perform analysis and make informed decisions

Near the end of the planning process, after surface water availability had been assessed and water management strategies had been identified, the RBC began discussing potential recommendations spanning technical, policy, regulatory, and legislative topics, among others. Additional surface water-related concerns were raised during the debate and discussion leading up to the recommendations. These concerns, which were not held unanimously by all RBC members, included:

- The need to incorporate future climate projections into surface water modeling and analyses.
- The use of mean flow instead of median flow in the regulations to establish safe yield at the point of withdrawal may result in an overallocation of surface water and lead to shortages.
- The use of mean flow in the regulations to establish minimum instream flow at a point of withdrawal. Median was deemed to be more representative of typical flow conditions.
- The law and regulations do not allow for the application of reasonable use criteria for agricultural surface water withdrawals or existing (pre-2011), non-agricultural surface water withdrawals.
- Some existing surface water permits and agricultural registrations are for a quantity of water that withdrawers have no intention of ever using or needing. Existing regulations provide varying or no authority to review and revise withdrawal quantities.
- All water withdrawers are not subject to the same set of rules.

These issues are further discussed in Chapter 9 - Policy, Legislative, Regulatory, Technical, and Planning Process Recommendations.

3.2 Surface Water Assessment Tools

3.2.1 SWAM Model

The SWAM model was used to assess current and future surface water availability and to evaluate the effectiveness of proposed water management strategies. From 2014 to 2017, all eight South Carolina surface water quantity models were built in the SWAM platform, including the Edisto basin model. The Edisto basin SWAM model was updated in 2020. Updates included extending the period of record to 2018, adding new permits and registrations, and removing inactive users.

SWAM utilizes a framework composed of a network of river reaches, impoundments, withdrawals, and returns, in which water is routed hydrologically between nodes. The model focuses principally on mainstem rivers, along with primary and secondary tributaries, and often does not include smaller order tributaries, whose flows are aggregated into flow estimates for primary and secondary tributaries. The model simulates basin hydrology at a daily or monthly timestep.

Inputs to the model include:

- Calculated and estimated “unimpaired flows” for the headwaters of the mainstem and tributary included in the model. Unimpaired flows were calculated by mathematically removing historical influence of storage, withdrawals, and return flows from measured flow at USGS streamflow gaging stations. This allows the model to simulate either historical or hypothetical water use patterns for evaluating future conditions. Many of the unimpaired flow records were synthesized using standard statistical techniques where measured data were not explicitly available for river reaches or time periods.
- Reach Gain/Loss Factors: Calibrated values used to increase flow as it moves downstream based on additional drainage area or decrease flow for losing river reaches
- Locations of all withdrawals, return flows, and interbasin transfers (values of which are discussed below as user-adjusted variables)

- Reservoir characteristics, such as capacity, bathymetry, constraints, and flexible operating rules (less relevant in the Edisto basin than in other basins)
- USGS daily flow records are embedded in the model for comparative purposes – simulation results can be compared with historical records

Model variables, which can be modified by users to explore future conditions, include:

- Withdrawal targets (municipal, industrial, thermoelectric, agricultural, golf courses, hatcheries)
- Consumptive use, wastewater discharge, and other return flows (which can be estimated automatically)
- Interbasin transfers
- Reservoir operating rulesand storage characteristics, if applicable (though this generally does not apply to the Edisto River basin)
- Environmental flow targets

Using this information, the SWAM model calculates available water (physically available based on full simulated flows, and legally available based on permit conditions and other uses), withdrawals, storage, consumption, and return flows at user-defined nodes. The flow from the main river stem, as well as major branches and tributaries, are discretely quantified. Figure 3-7 shows the Edisto River basin SWAM model framework.

The model can be used to simulate current and future demands based on defined scenarios and identify potential shortages in water availability when compared to demands for withdrawals or instream flow targets. The scenarios that were evaluated specifically for the Edisto River basin are discussed in further detail in Section 4 - Current and Projected Water Demand and Chapter 5 - Comparison of Water Resource Availability and Water Demand.

As with all eight of the SWAM models for South Carolina, the Edisto model was calibrated and then tested to demonstrate reasonable ability to recreate historical hydrology and operational conditions. Historic water uses were added into the model to alter the estimated unimpaired flows, and simulated versus gaged flows were compared at key locations throughout the basin. An example verification test result is shown in Figure 3-8. Full verification results and methods are discussed in the South Carolina Surface Water Quantity Models: Edisto Basin Model report (CDM Smith 2017).

While the SWAM model is capable of quantifying water balance calculations for free-flowing streams and reservoirs based on a number of inputs, it does have limitations. The model is not capable of performing rainfall-runoff or hydraulic routing calculations and cannot be used (by itself) to calculate natural flow in tidally-influenced reaches. Groundwater and its impacts are not explicitly modeled by the SWAM model; however, groundwater inputs and losses to streams and rivers are implicitly accounted for through incorporation of gage records and model calibration and verification. Water quality metrics also cannot be modeled by SWAM. Future climate scenarios can be explored with SWAM by adjusting the tributary input flows.

The model, as well as its Users Guide and the full report on the Edisto Basin Model development and calibration are publicly available for download at SCDNR's website. At the time of this writing, the models and associated documentation can be found at: https://hydrology.dnr.sc.gov/swam-models.html.

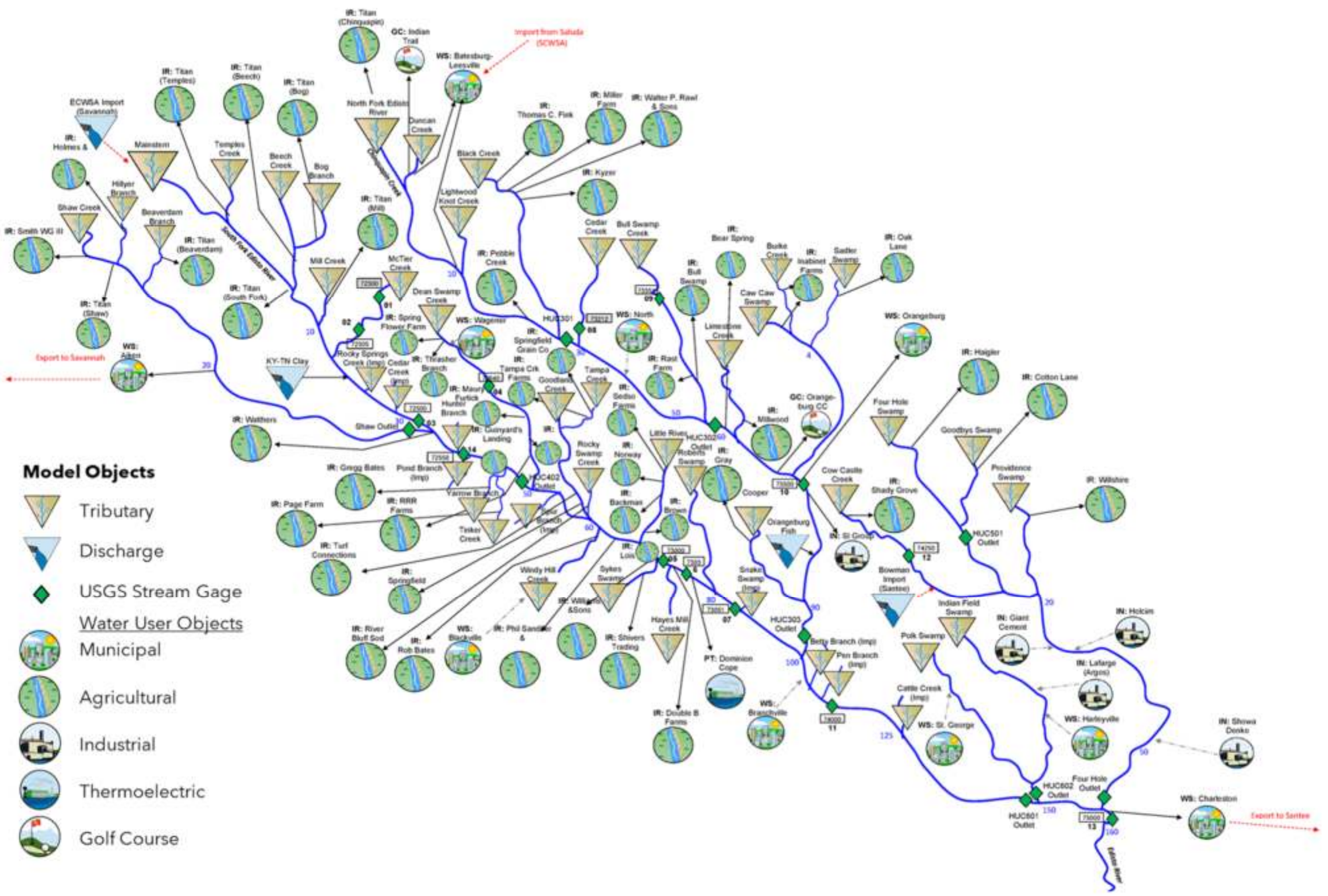


Figure 3-7. SWAM Model interface for the Edisto River basin.

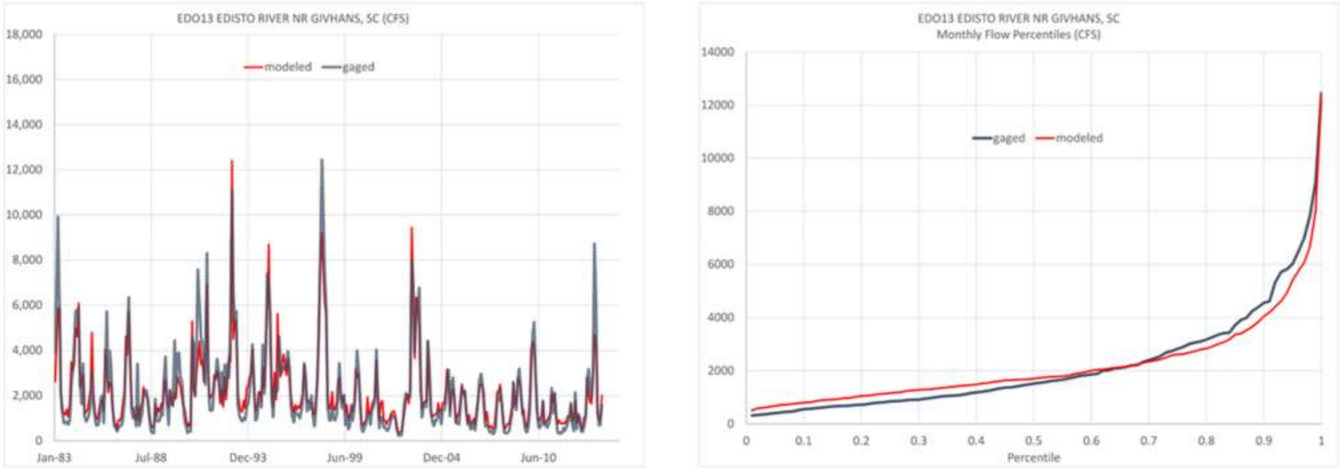


Figure 3-8. Representative Edisto River basin SWAM model verification graphs (CDM Smith 2017).

3.2.2 Other Surface Water Analyses

While the SWAM models focus on the hydrology of larger mainstem rivers and primary tributaries in the Edisto River basin and other South Carolina basins, other work has focused on the hydrology and flow characteristics in smaller headwater streams, specifically those that are classified as “wadeable.” In part of an effort to formulate relationships between hydrologic metrics (flow patterns, statistics, and variability in these streams for both pulses and long-term averages) with ecological suitability metrics, daily rainfall-runoff modeling of small headwater streams throughout the state was accomplished with the WaterFALL® model (Watershed Flow ALLocation model), as described in Eddy et al (2022) and Bower et al (2022). Separately, as discussed in Bower et al (2022), biological response metrics were developed and combined with the hydrologic metrics from WaterFALL® to identify statistically significant correlations between flow characteristics and ecological suitability for fish and macroinvertebrates. The results are intended to help guide scientific decisions on maintaining natural hydrologic variations while also supporting consumptive water withdrawals. As a component in the analysis, the WaterFALL® hydrologic modeling results augment the SWAM modeling results by providing similar hydrologic understanding of the smaller headwater streams not simulated explicitly or individually in SWAM. The use of the ecological flow metrics as performance measures in the Edisto RBC planning process is further discussed in Chapter 5 – Comparison of Water Resources Availability and Water Demand.

3.3 Groundwater Resources

3.3.1 Groundwater Aquifers

The aquifer system underlying the Edisto River basin is the Coastal Plain aquifer system, which is a wedge of layered aquifers and confining units that begins at the Fall Line and thickens towards the coast, as shown in Figure 3-9. Aquifers in the Coastal Plain are largely comprised of sand or limestone. The most productive aquifers in the Edisto River basin are the surficial, Middle Floridan, Gordon, Crouch Branch, and McQueen Branch. These aquifers are separated by confining units that bear the same name as the underlying aquifer. An older version of South Carolina hydrostratigraphic nomenclature referred to the Upper and Middle Floridan aquifers as the upper Tertiary sand aquifer, the Gordon aquifer as the lower Tertiary sand aquifer, the Crouch Branch aquifer as the Black Creek aquifer, and the McQueen Branch aquifer as the Middendorf aquifer (SCDNR 1995). This alternative naming convention may be used in some publications, particularly those before 2010.

Surficial Aquifer

The surficial aquifer typically occurs under water table conditions throughout the basin and is comprised of quartz, gravel, sand, silt, clay, and shelly sand (USGS 2010). The flow direction and flow rate of the surficial aquifer largely follow topography of the ground surface (SCDNR 2009). The thickness of the aquifer is typically tens of feet or less. Well depths range from 20 to 100 feet and have yields of 5 to 20 gallons per minute (gpm), although yields up to 250 gpm are reported in unique conditions (SCDNR 2009). Water levels in the surficial aquifer show more seasonal fluctuation than the deeper confined aquifers due to their limited drawdown depths. Surficial aquifer wells are typically used for domestic and light commercial purposes. Ponds that are hydraulically connected to the surficial aquifer may also be used as water supply to golf courses or for agricultural irrigation (SCDNR 2009).

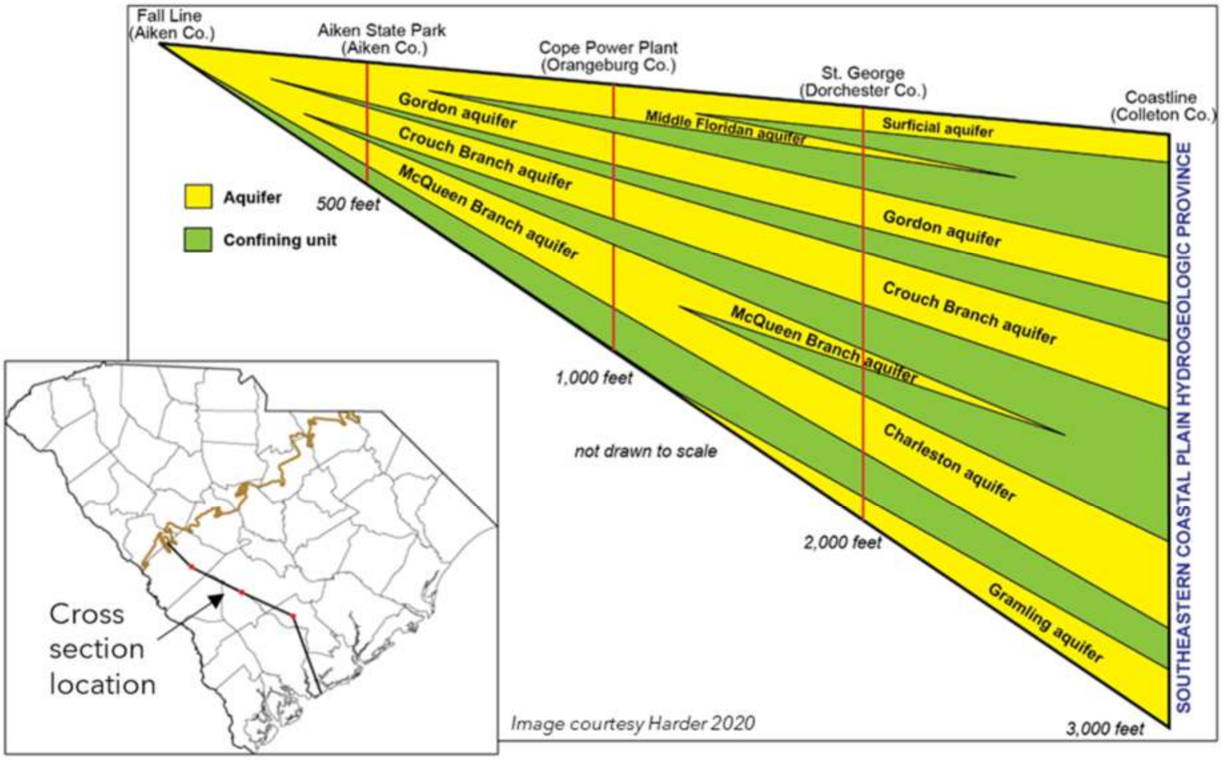


Image courtesy Harder 2020

Figure 3-9. Coastal Plain aquifer system schematic cross sections (Harder 2020).

Middle Floridan Aquifer

The Floridan aquifer system is one of the most productive aquifer systems in the United States and has substantial volume pumped from it in southern South Carolina and coastal Georgia. The Middle Floridan aquifer represents the northernmost extent of this system and is present in the Edisto River basin (Figure 3-10). The aquifer consists of unconsolidated quartz sand and clay in the upper reaches of the basin and transitions to a mixture of sand and limestone and pure limestone in the middle and lower reaches of the basin. The top of the aquifer generally occurs within 200 feet of land surface but can be as deep as 350 feet in coastal areas. Thickness of the aquifer ranges from about 0 to 100 feet and yields of up to 200 gpm can be obtained where it is thick and permeable. Used mainly as a domestic supply, it is also used for small public supply systems and light industry and irrigation. It is not uncommon for wells in the basin to be open to both the Middle Floridan and the underlying Gordon aquifer to increase yields.

Recharge areas for the Floridan aquifer occur in southern Aiken County, throughout most of Barnwell and Orangeburg Counties, and in northern Bamberg and Calhoun Counties. In those regions, the aquifer is open to the atmosphere and is under water table conditions. Potentiometric maps of the aquifer (SCDNR 2019b) indicate hydraulic connection between the aquifer and surface water bodies in recharge areas, with groundwater being discharged as baseflow to local streams and other surface water bodies. Southeast of the recharge areas, the aquifer is overlain by clay and marl beds that confine the aquifer and create artesian conditions. Less interaction between groundwater and surface water is thought to occur in those areas.

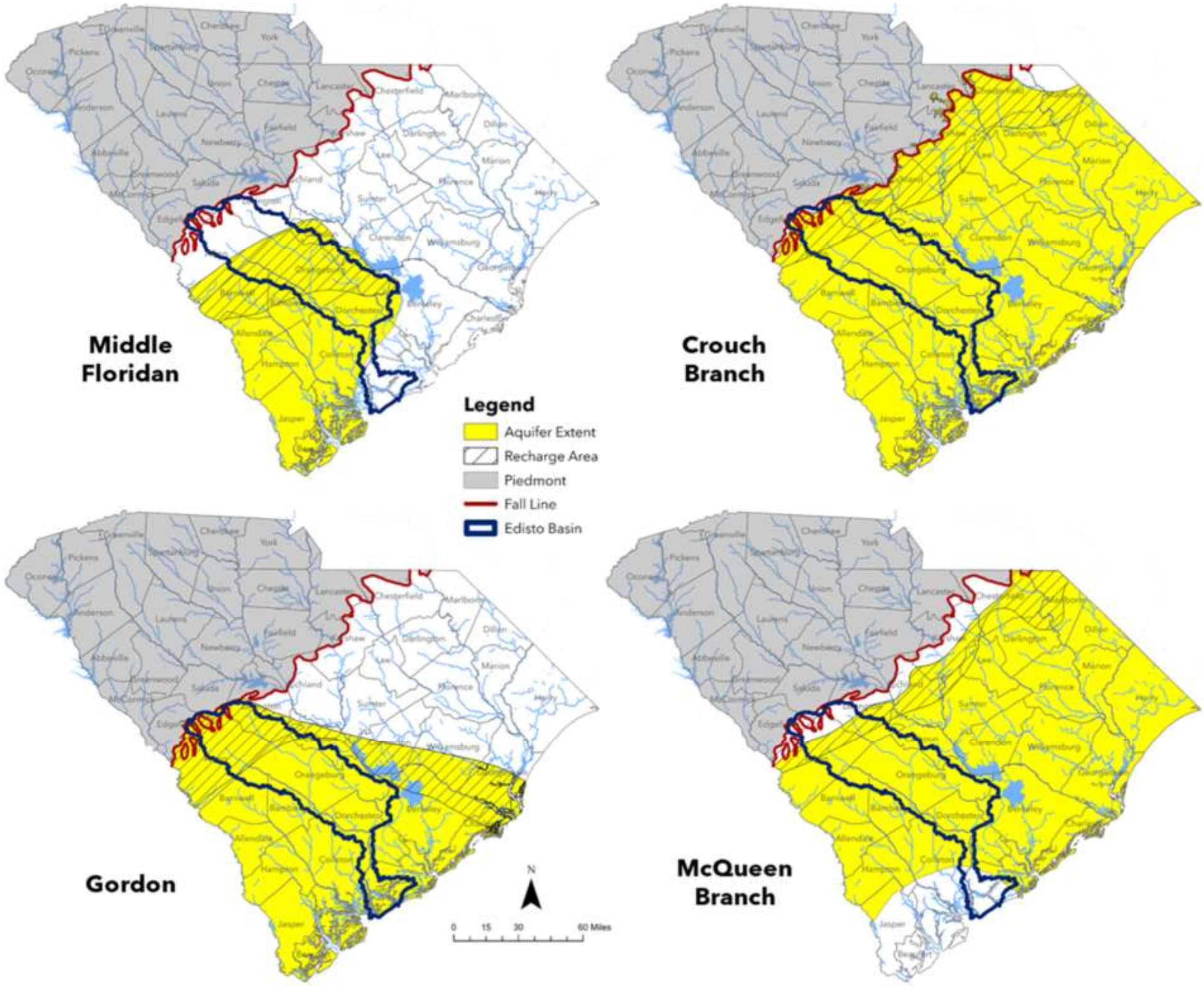


Figure 3-10. Aquifers underlying the Edisto River basin (Harder 2020).

Gordon Aquifer

The Gordon aquifer underlies the Middle Floridan across most of the basin (Figure 3-10) and is an important source of water for domestic supply, small public supply, and for light irrigation and industry. The aquifer consists of unconsolidated quartz sand and clay in the upper reaches of the basin and transitions to a mixture of sand and limestone in the middle and lower reaches. The aquifer occurs at or near land surface in areas of Aiken and Lexington County and reaches depths of over 600 feet in coastal areas. Aquifer thickness ranges from 0 feet near the Fall Line to about 200 feet near the coastline. Yields of up to 500 gpm can be obtained from the aquifer although yields of over 1,000 gpm have recently been reported from wells drilled at Edisto Island.

Recharge areas for the Gordon aquifer occur in Aiken and Lexington Counties and in the northern regions of Orangeburg and Calhoun Counties. In those regions, the aquifer is under water table conditions and discharges groundwater to local streams and other surface water bodies. Southeast of recharge areas, starting in the middle part of Orangeburg County, the aquifer is overlain by clay beds that confine the aquifer, create artesian conditions, and hydraulically separate the aquifer from the overlying Middle Floridan aquifer. Less interaction between groundwater and surface water is thought to occur in those areas.

Crouch Branch Aquifer

The Crouch Branch aquifer underlies the Gordon aquifer (Figure 3-10) and is the most heavily utilized aquifer in the basin. An important source of water for crop irrigation, the aquifer is also used for public supply, industry, and thermoelectric energy production. The aquifer consists largely of unconsolidated quartz sand and clay throughout the basin. It occurs at or near the surface in the northern parts of Aiken and Lexington County and reaches depths of over 1,000 feet in coastal areas; aquifer thickness ranges from 0 feet near the Fall Line to about 500 feet along the coast. Yields of up to 1,500 gpm can be obtained from the aquifer in areas where the aquifer is thick and permeable but yields in the range of 500 to 1,000 gpm are more typical of the aquifer in the Edisto basin. Although the aquifer tends to thicken towards the coast, sediments composing the aquifer in the southern reaches of the basin are fine-grained, thereby reducing the permeability and productivity of the aquifer.

Recharge areas of the Crouch Branch aquifer occur in Aiken and Lexington Counties where the aquifer is under water table conditions. The Crouch Branch confining unit, which normally separates the Gordon and Crouch Branch aquifers, is generally thin and discontinuous in the recharge areas and the Crouch Branch is often in direct contact with the overlying Gordon aquifer. Precipitation moves downward through the Gordon and recharges the underlying Crouch Branch. In low lying areas of Aiken and Lexington Counties, the Gordon aquifer is eroded, and the Crouch Branch is directly recharged by precipitation. Potentiometric maps of the aquifer (SCDNR 2021b) indicate hydraulic connection between the aquifer and surface water in recharge areas. Southeast of the recharge areas, starting in northern Barnwell and Orangeburg Counties, the aquifer is overlain by continuous clay beds that confine the aquifer and create artesian conditions. Less interaction between groundwater and surface water is thought to occur in those areas.

McQueen Branch Aquifer

The McQueen Branch aquifer underlies the Crouch Branch aquifer (Figure 3-10) and consists largely of unconsolidated quartz sand and clay. It is an important source of water for crop irrigation and is also used

for public supply, industry, and thermoelectric energy production in the basin. The aquifer occurs at or near the surface in the northern parts of Aiken and Lexington County and reaches depths of over 1,400 feet in coastal areas, with aquifer thickness ranging from 0 feet near the Fall Line to about 300 feet in Barnwell and Orangeburg Counties. Yields of up to 2,000 gpm can be obtained from the aquifer in areas where the aquifer is thick and permeable. Yields in the range of 500 to 1,000 gpm are more typical of the aquifer in the Edisto basin.

Sediments composing the aquifer in the southern reaches of the basin are fine-grained, thereby reducing the permeability and productivity of the aquifer. In addition, clay beds in the overlying McQueen Branch confining unit and in the aquifer itself thicken significantly while sand beds in the aquifer thin, resulting in a marked decrease in the transmissivity of the aquifer. For these reasons, Gellici (Gellici and Lautier 2010) pinched out the aquifer in coastal areas of the basin interpreting the aquifer as no longer being transmissive enough to warrant being mapped as a viable aquifer.

Recharge of the McQueen Branch aquifer occurs in Aiken and Lexington Counties where confining units are thin and discontinuous. In those areas, the aquifer is thought to be under water table conditions. Because the McQueen Branch confining unit, which normally separates the Crouch Branch and McQueen Branch aquifers, and the Crouch Branch confining unit are generally both thin and discontinuous in these areas, the McQueen Branch is hydraulically connected with the Gordon and Crouch Branch aquifers. Precipitation moves downward through the Gordon and Crouch Branch aquifers and recharges the underlying McQueen Branch. In low lying areas of Aiken and Lexington Counties, the Gordon and Crouch Branch aquifers are eroded, and the McQueen Branch is directly recharged by precipitation. Potentiometric maps of the aquifer (SCDNR 2020) suggest hydraulic connection between the aquifer and surface water in these recharge areas. Southeast of the recharge areas, starting in northern Barnwell and Orangeburg Counties, the aquifer is overlain by continuous clay beds that confine the aquifer, hydraulically isolate the aquifer from the overlying aquifers, and create artesian conditions. Less interaction between groundwater and surface water is thought to occur in those areas.

3.3.2 Groundwater Monitoring

Groundwater monitoring is performed by the USGS, SCDNR, and SCDHEC. Statewide, the groundwater monitoring network operated by SCDNR has more than 180 wells as of 2022 (SCDNR 2022c). Of these wells, only 15 are located in the Piedmont and Blue Ridge physiographic provinces, with the majority of the monitoring wells in the Coastal Plain province (SCDNR 2022c). Most wells have hourly data automatically recorded while some are measured manually four to six times per year (SCDNR 2022c). The USGS maintains a groundwater-level monitoring network of an additional 20 wells in South Carolina. Groundwater monitoring wells are used to identify short- and long-term trends in groundwater levels and aquifer storage, and to monitor drought conditions. The majority of the wells have water level records dating to the 1990s with some dating back to as late as 1955 (SCDNR 2022c). The SCDNR and USGS groundwater monitoring wells in and nearby the Edisto River basin are shown in Figure 3-11.

The Lexington County monitoring well, LEX-0844, in the McQueen Branch aquifer has limited influence from area pumping making it suitable for use in examining the relationship between precipitation, recharge, and groundwater levels. Figure 3-12 shows groundwater levels in this well with precipitation trends recorded at nearby Columbia Metropolitan Airport. The figure illustrates how the lower than average precipitation from 1999 through 2001 correlates to declining water levels over this same period. Similarly, the normal to above average precipitation from 2013 through 2021 corresponds to an increase in water levels.

Other wells can be used to show the influence of increased groundwater pumping on groundwater levels. For example, in Aiken and Barnwell Counties, seasonal groundwater level variations have increased because of pumping in the last decade, as shown in Figure 3-13. The McQueen Branch aquifer monitoring well AIK-0826 in Aiken County demonstrates that although there are seasonal drawdowns of approximately 10 feet, water levels recover to pre-drawdown levels when pumping ceases. Seasonal high water levels measured in AIK-0826 have increased year to year because of the higher precipitation patterns observed since 2013. The Barnwell well in the McQueen Branch aquifer, BRN-0349 also exhibits seasonal drawdown and recovery, but groundwater levels have declined over the last decade.

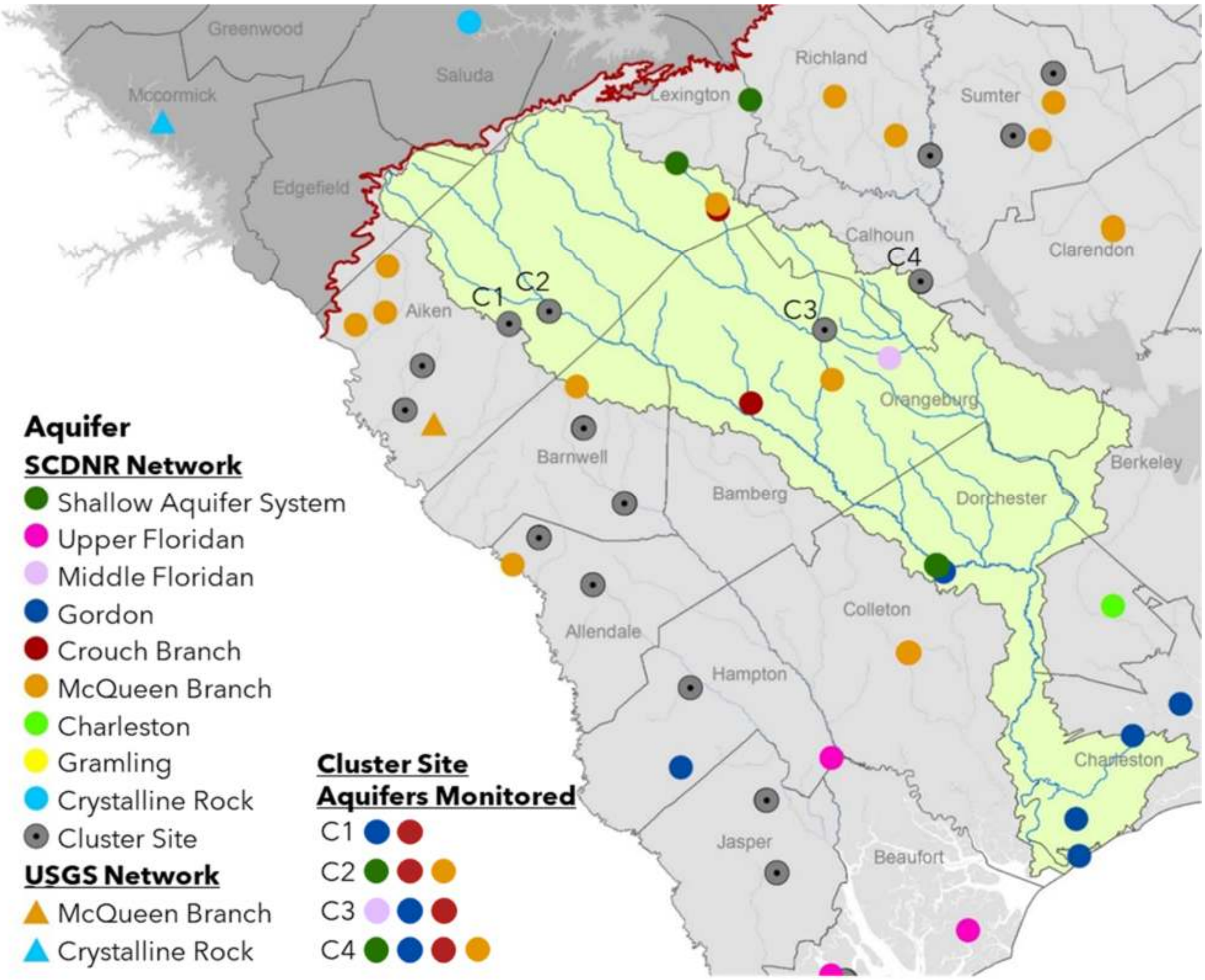


Figure 3-11. SCDNR and USGS groundwater monitoring wells (SCDNR 2021).

Monitoring wells in the Crouch Branch aquifer in Aiken and Barnwell counties demonstrate a similar increase in seasonal groundwater water level variation over the last decade, as shown in Figure 3-14. The Aiken monitoring well reflects a slight recovery in past wet years while the Barnwell monitoring well demonstrates a minor but continual decline.

Potentiometric maps, which illustrate the levels to which groundwater will rise in wells, indicate a general groundwater flow direction towards the coast. There are no notable cones of depression in the Edisto River basin; however, water levels are influenced by cones of depression outside the basin, including examples near Charleston and Beaufort (SCDNR 2017). Potentiometric surfaces of the major aquifers present in the basin are shown in Figure 3-15, based on SCDNR interpretation of groundwater-level data from November through December 2016.

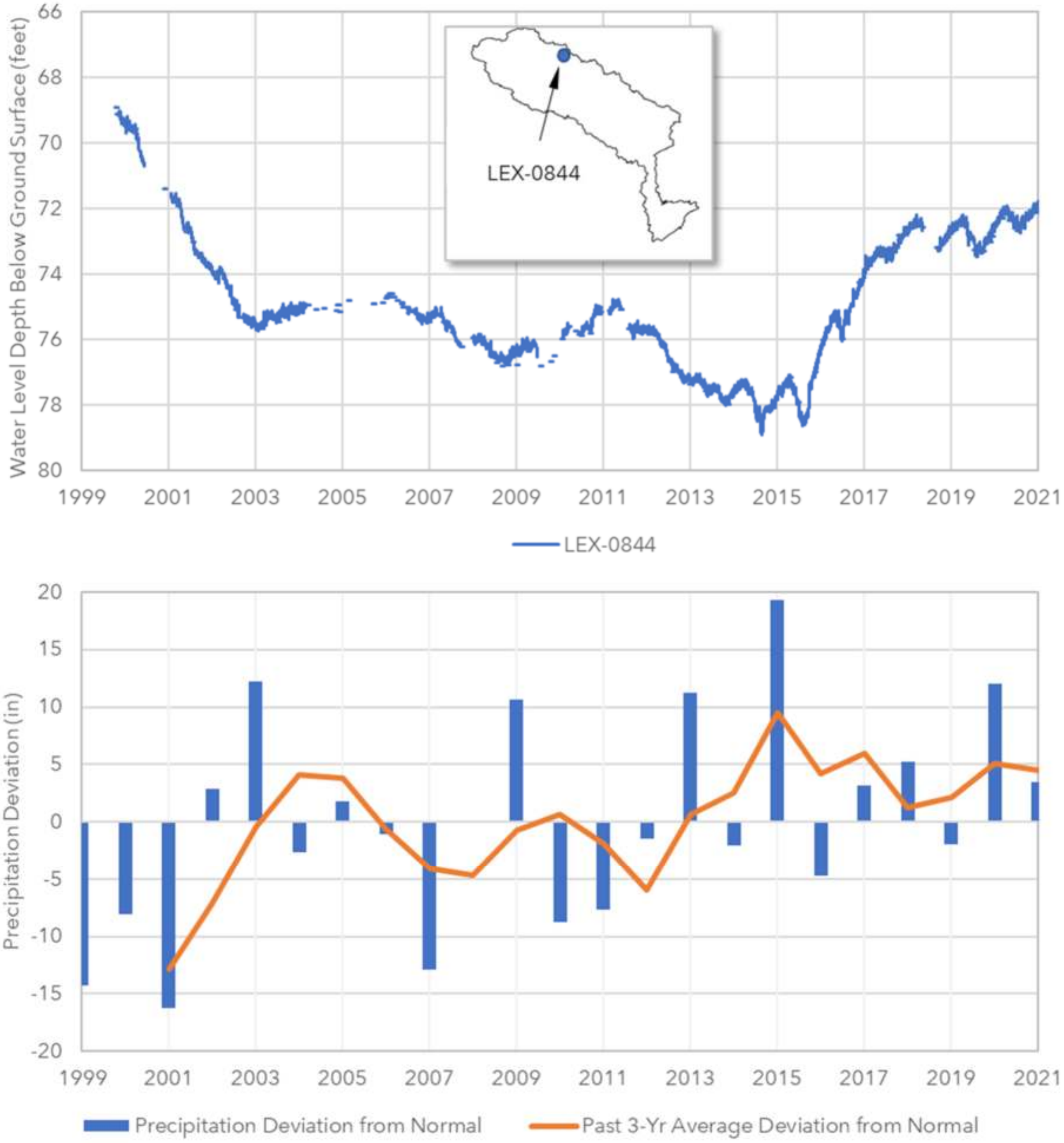


Figure 3-12. Groundwater levels in McQueen Branch aquifer (top graph) and precipitation deviation from normal (bottom graph).

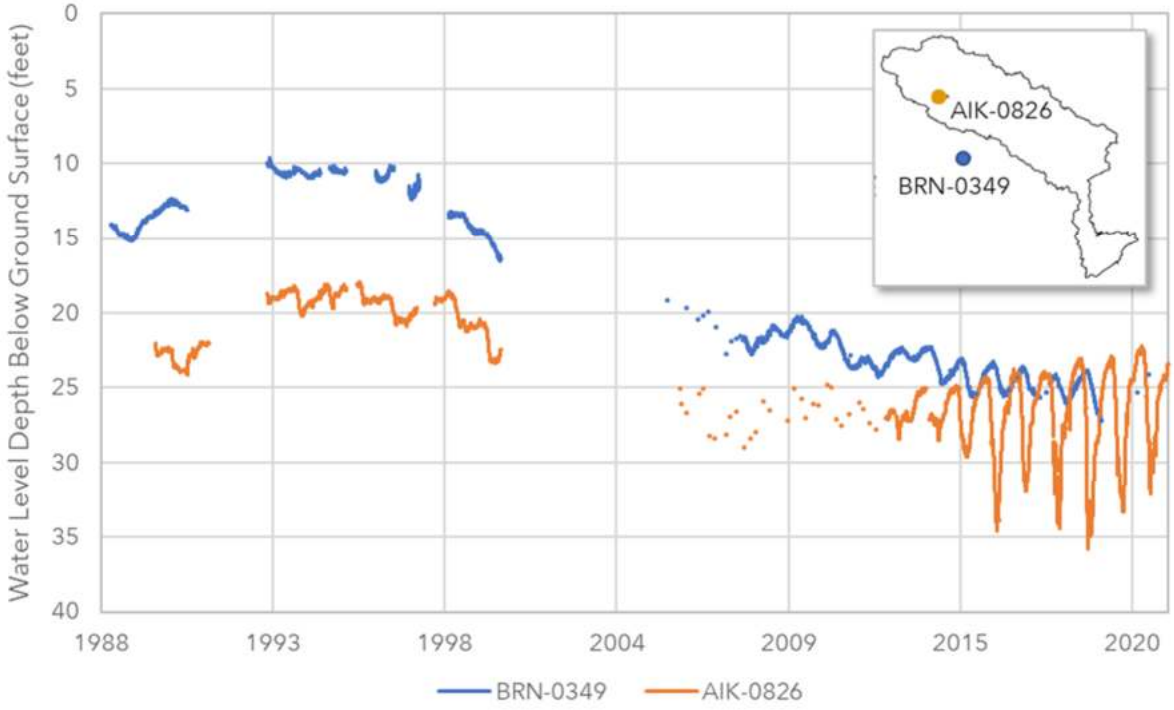


Figure 3-13. Groundwater levels in McQueen Branch aquifer in Aiken and Barnwell Counties.

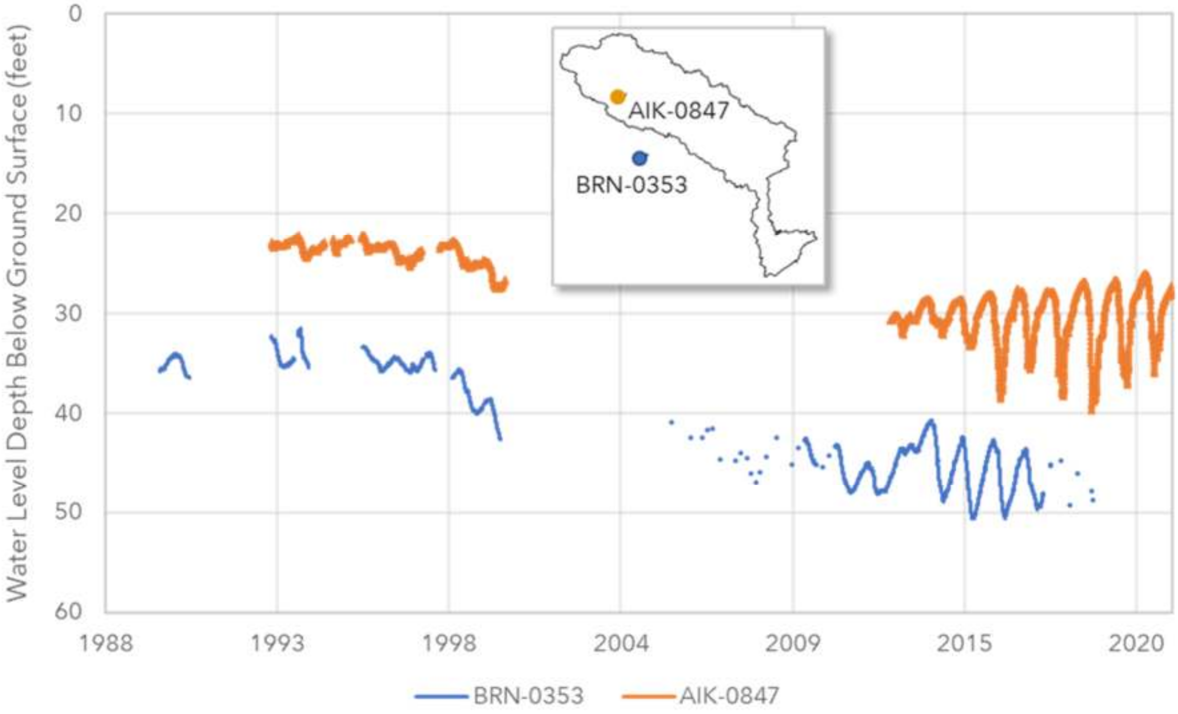


Figure 3-14. Groundwater levels in Crouch Branch aquifer in Aiken and Barnwell Counties.

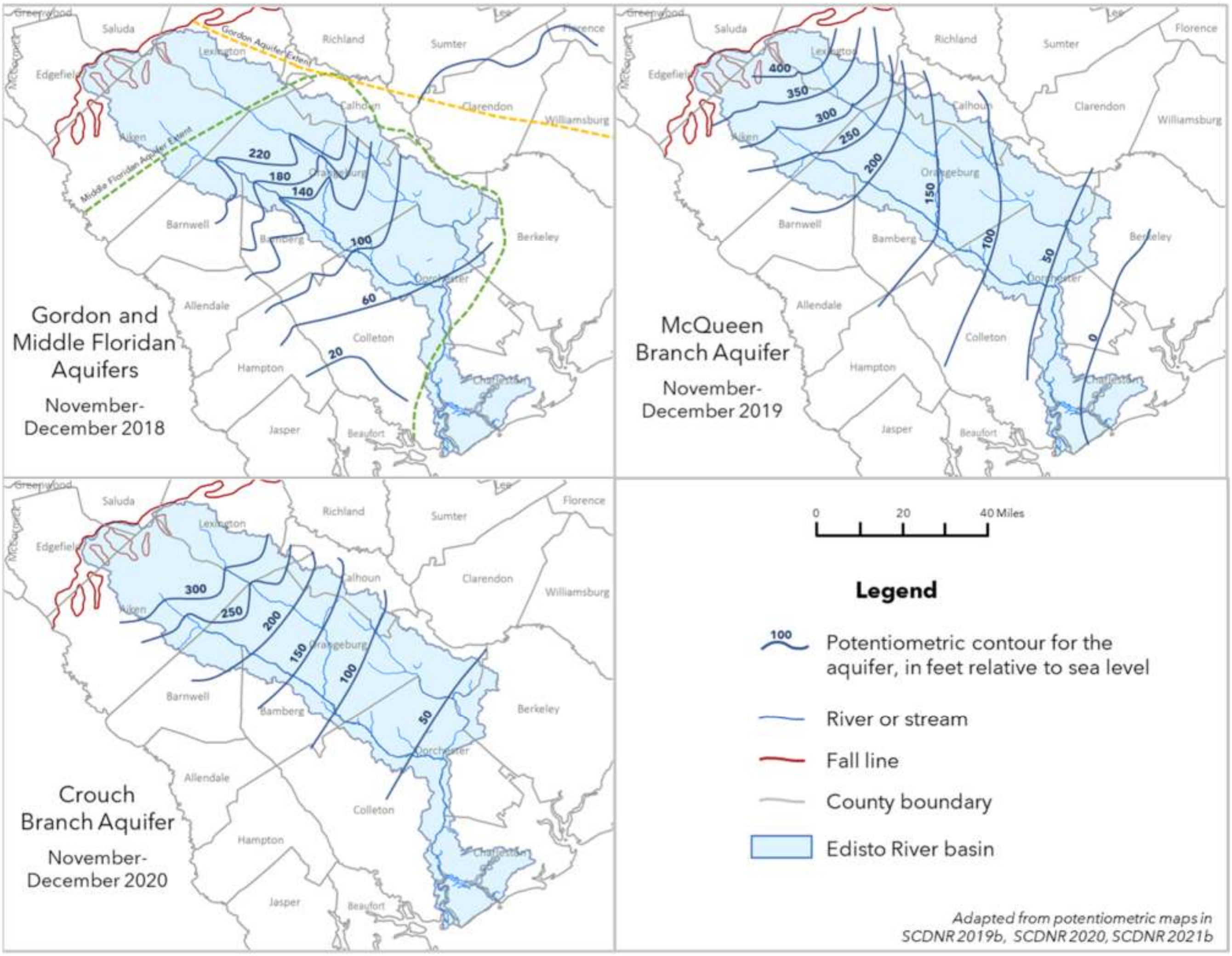


Figure 3-15. Potentiometric surface maps of the major aquifers present in the Edisto River basin.

3.3.3 Groundwater Development

The total, current average annual withdrawal of groundwater in the Edisto River basin for municipal water supply, agriculture and golf course irrigation, industry, mining, thermoelectricity, and other minor uses is approximately 27.0 billion gallons (73.9 million gallons per day [MGD]) (Pellett 2021). This does not include relatively minor withdrawals from domestic and other wells which are below the reporting limit of 3 million gallons per month (mgm).

The agricultural sector is the largest user of groundwater, with current withdrawals ranging from 20 to 27 billion gallons per year (bgy). Public water supply withdrawals account for 1.9 to 2.3 bgy; withdrawals for thermoelectric cooling account for 1.3 to 1.7 bgy; and industrial (manufacturing) withdrawals account for 0.8 to 1.2 bgy. Mining, which are effectively dewatering operations, account for a variable amount of withdrawal. Certain operations have pumped up to 500 mgm (Pellet 2021).

Dominion Energy's Cope Station, which is the sole thermoelectric water withdrawer in the basin, is transitioning from using 100 percent groundwater to a combination of surface and groundwater by 2028. The Cope Station will eventually meet 90 percent of its total demand from surface water. During low flow conditions (i.e., flows less than 192 cfs in the South Fork Edisto River), the station will switch to all groundwater use.

The City of Orangeburg installed two aquifer storage and recovery (ASR) wells in 2008. ASR #1 well has a total depth of 895 feet and is screened in the McQueen Branch aquifer. The shallower ASR #2 well is screened in the Crouch Branch aquifer is 478 feet in depth. From a water production standpoint, the wells perform as designed, providing the ability to withdraw between 2 to 3 mgd each. The ASR system has experienced mounding while recharging, which reduces the capability to effectively store water in shorter time periods. Elevated iron has also been an issue in water that is stored and later withdrawn (Odom 2022).

3.3.4 Capacity Use Areas

Groundwater in South Carolina is regulated by SCDHEC in areas designated as Capacity Use Areas (CUAs). Under South Carolina's Groundwater Use and Reporting Act (Chapter 5, Section 49-5-60), a CUA is designated where excessive groundwater withdrawals present potential adverse effects to natural resources, public health, safety, or economic welfare. SCDHEC then coordinates with affected governing bodies and groundwater withdrawers to develop a groundwater management plan for the CUA.

Despite the overall absence of major cones of depression within the Edisto River basin, the basin includes parts of three CUAs: the Western Capacity Use Area (Western CUA) in the upper Coastal Plain; the Lowcountry Capacity Use Area (Lowcountry CUA) in the western lower Coastal Plain; and the Trident Capacity Use Area (Trident CUA) in the eastern lower Coastal Plain. The capacity use areas are shown in Chapter 1, Figure 1-4.

The Western CUA was designated on November 8, 2018 and includes counties of the upper Coastal Plain in the Edisto River basin. Groundwater monitoring wells in the area illustrate long-term water level declines of up to 15 feet in the Floridan/Gordon, Crouch Branch, and McQueen Branch aquifers; however, there are no major cones of depression (Foxworth and Hughes 2019). Irrigation is the major water use (67 percent) in the Western CUA, followed by public supply (20 percent). Aquifers experience seasonal declines during summer months from increased pumping.

The Lowcountry CUA was designated on July 24, 1981. Only a small portion of the Edisto River basin in Colleton County overlaps with this CUA. The CUA was established because water level declines were observed in the Upper Floridan aquifer near Savannah, Georgia, and Hilton Head (Berezowska and Monroe 2017b). Much of the updip area of the Upper Floridan aquifer is unaffected by this pumping and groundwater levels are close to predevelopment conditions (USGS 2010). There has been a decline in groundwater use since 2004 that has resulted in a rebound in groundwater levels (Berezowska and Monroe 2017b). Groundwater in the Lowcountry CUA is mostly used for public supply and irrigation, at 49 and 42 percent of total reported use, respectively.

The Trident CUA was designated on August 8, 2002 (Berezowska and Monroe 2017a). The Trident CUA covers Dorchester, Charleston, and Berkeley counties, all of which have a portion of their area in the Edisto River basin. Groundwater levels in the Charleston aquifer have declined significantly compared to predevelopment levels, largely due to public supply and industrial usage in the area (Berezowska and Monroe 2017a). Between 1879 and 2000, water levels in the Charleston aquifer were estimated to have fallen over 180 feet. An initial general shift towards surface water use in the 1990s and a shift in public supply use towards surface water in 2006 eventually led to a recovery of 10 to 50 feet in the Charleston aquifer. The public supply and industrial sectors are the largest withdrawers of groundwater in the Trident CUA, with 46 and 35 percent of reported groundwater use, respectively.

3.3.5 Groundwater Concerns

The Edisto River basin has a robust groundwater supply due to the highly transmissive aquifers to depths of 2,000 feet below ground surface (SCDNR 2009). Groundwater resources have been adequate for agricultural irrigation and the myriad of other uses. In the upper part of the basin, water levels are close to predevelopment levels likely due to the proximity of the sandhills region recharge zone. Many monitoring wells, particularly in the middle and lower Coastal Plain, show that artesian levels have declined as the coastal population and demand for water has increased (SCDNR 2009). A potentiometric low exists in the Gordon aquifer near the coast, where several water levels are at or below sea level, and some of these wells in southern Charleston and Colleton Counties are experiencing saltwater intrusion (SCDNR 2019). Declining groundwater levels can lead to reduced well yields, and in extreme cases where the water level drops below the top of an aquifer, compaction and land subsidence may occur.

The surficial aquifer is threatened by chemical introduction from land-use practices and from chemical releases such as petroleum leaks from underground storage tanks. Another source of contamination to groundwater can come from improper well construction where surface water enters the well bore and introduces surface water contaminants to the drinking water supply (SCDNR 2009).

During RBC meetings, it was noted that groundwater is not always the optimum quality for irrigation use. Groundwater may have a lower pH than is ideal for irrigation, and hardness may shorten the lifespan of irrigation equipment due to mineral precipitation. These water quality concerns may limit the expansion of groundwater development for irrigation, where alternatives to surface water are explored.

Also notable of the groundwater resources in the Edisto River basin is that there is significant interaction between groundwater and surface water, particularly in the northern portion. In the upper Coastal Plain, streams are fed by groundwater which contributes to steady stream and river flows. Reductions in groundwater levels may lead to reduced baseflow to streams in these areas.

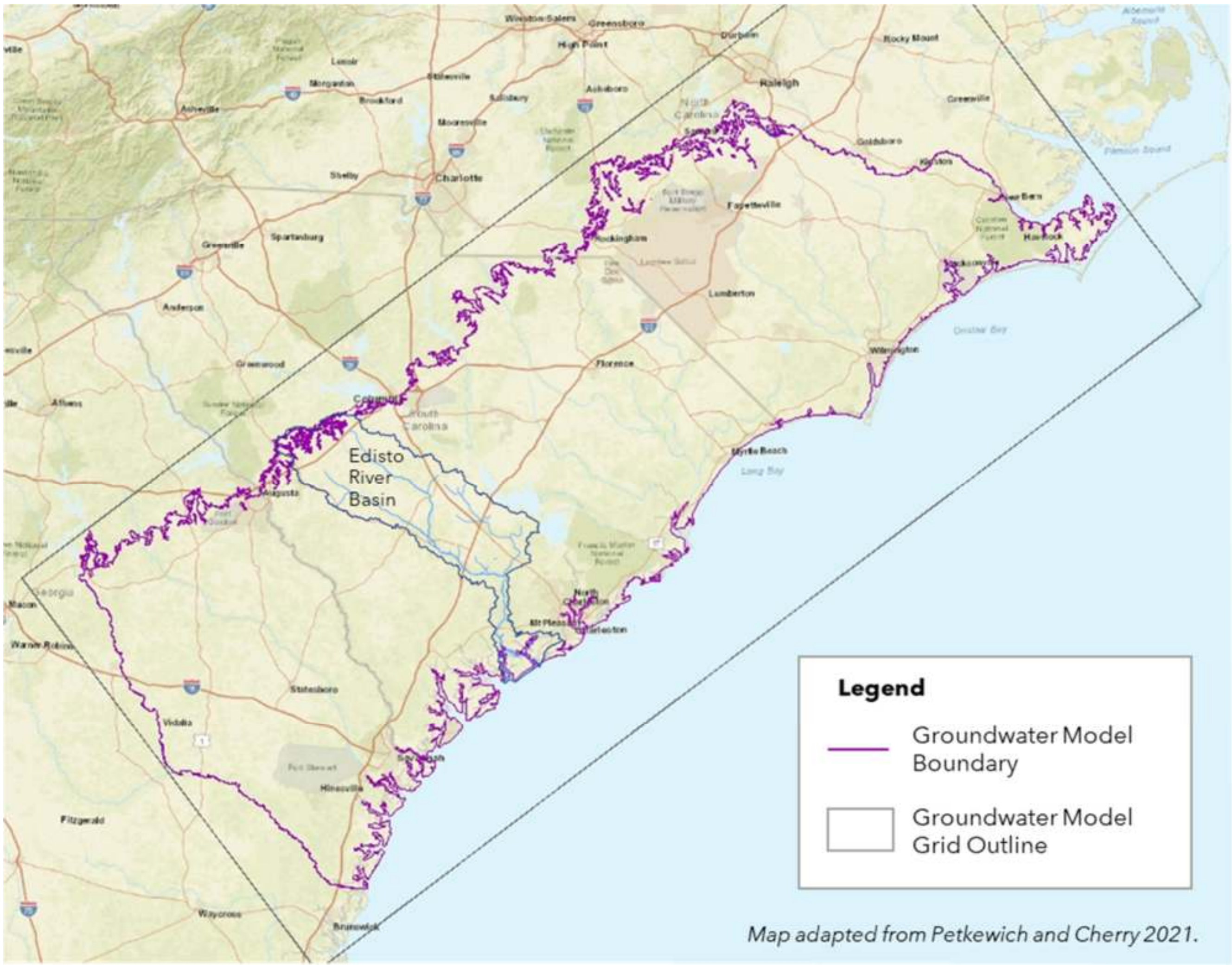
3.4 Groundwater Assessment Tools

3.4.1 Coastal Plain Groundwater Model

To support water planning in the river basins extending into the Coastal Plain of South Carolina, the USGS with assistance from SCDNR updated and re-calibrated the three-dimensional numerical groundwater flow model of the Atlantic Coastal Plain (ACP) aquifers and confining units. The original model, documented in the 2010 USGS report *Groundwater Availability in the Atlantic Coastal Plain of North and South Carolina* (USGS 2010) is a MODFLOW-2000 model that simulates single-density groundwater flow in three dimensions by using a block-centered, finite-difference method. The model covers approximately 70,500 square miles including the entire South Carolina Coastal Plain, and extends into North Carolina and Georgia, as shown in Figure 3-16. Numerous updates and improvements were made to support water availability assessments and river basin planning in South Carolina. The major model updates included:

- Activating the entire surficial aquifer model layer

- Incorporating recharge from the Soil-Water Balance (SWB) Model (discussed below)
- Updating the hydrogeologic framework and adding groundwater-related data collected from 2005 to 2020
- Refining the model grid from approximately 2 by 2 miles spacing to 2,000 by 2,000 foot spacing
- Incorporate a more detailed representation of the Fall Line area
- Incorporate new MODFLOW packages, including the Newton Formulation and Multi-Node Well Package
- Extending the stress periods that were originally from 1900 to 2004, to 2070.



Map adapted from Petkewich and Cherry 2021.

Figure 3-16. Coastal Plain groundwater model boundary and grid outline.

The updated model was then re-calibrated to more recent groundwater levels and estimated stream baseflows. Approximately 37,000 observed groundwater levels from 1904 through 2015 were available to use as calibration targets. Additionally, 1,685 baseflow calculations from 46 stream gages with data extending from the 1930s to 2015 were used in the calibration process. Model updates and recalibration are being documented in a USGS professional paper for future release.

To support water planning in the Edisto River basin, demand estimates representing the various planning scenarios were incorporated into the model, and simulations were performed to evaluate changes in water levels and discharge to streams and to support development of water budgets. The results of these simulations are summarized in Chapter 5 – Comparison of Water Resources Availability and Water Demand. While the model serves as a useful tool to assist in planning efforts, there are several model limitations that must be considered when evaluating model results, including:

- Like all models, the groundwater flow model is based on limited data and inferences are made in areas where data is absent
- The model represents a simplification of the actual groundwater flow system, which can limit the ability to closely predict actual hydraulic conditions over time
- The accuracy and prediction capabilities of this model are affected (and limited) by the finite-difference discretization, boundary conditions, hydraulic properties, and observations used in the model calibration
- Groundwater withdrawals simulated in the model under-represent actual historical water use because pumping rates less than 3 million gallons per month are not required to be reported to the State agencies and, therefore, are unknown. No attempt was made to include un-reported groundwater withdrawals.

3.4.2 Soil-Water Balance Model

The groundwater flow model was updated using estimates of groundwater recharge derived from the USGS-developed SWB computer code (Westenbroek et al 2010). The SWB calculates spatial and temporal variations in groundwater recharge and is based on a modified Thornthwaite-Mather soil-water-balance approach. Recharge calculations are made on a rectangular grid, which are then imported into the groundwater flow model. The SWB model incorporates precipitation, temperature, soil characteristics, slopes, land use, and land cover. Recharge rates from the SWB model for the years 1979 to 2020 were used as input into the groundwater flow model.

Chapter 4

Current and Projected Water Demand

This chapter summarizes current and projected water demands over the 50-year planning horizon from 2020 to 2070 in the Edisto River basin. Demand projections are based on historical demands and published projection datasets for variables that influence water demand including population, economic development, and irrigated acreage. A statistical model was built to develop demand projections for each major water use category using the current demands and driver variables. Two demand projections were developed: a Moderate Demand Scenario using median rates of water use and moderate growth, and a High Demand Scenario using high rates of water use and high growth. The demand projections were used in the surface and groundwater models to assess future water availability as summarized in Chapters 5 and 6.

4.1 Current Water Demand

Current water demands reflect the most recent withdrawal data, as reported to SCDHEC, that were available during development of the surface water and groundwater models. Surface water demands are based on data available through 2020 and were developed to reflect average withdrawals over the last 10 years (in most cases). Groundwater demands are based on withdrawals reported for the years 2016 through 2020.

The withdrawals used for this demand characterization were reported to SCDHEC by permitted and registered water users in the Edisto River basin, as required by state regulation. All users withdrawing more than 3 million gallons of surface water or groundwater in any month must either obtain a permit or register their use and report withdrawals to SCDHEC annually. Users withdrawing less than this threshold are not required to report their withdrawals; however, they may choose to report voluntarily. For surface water withdrawals over the threshold, agricultural water users must register their use while all other users must permit their use in accordance with SCDHEC's regulation 61-119, Surface Water Withdrawal, Permitting, Use and Reporting. For groundwater withdrawals over the threshold, users withdrawing within a CUA must permit their use while those withdrawing outside of a CUA must only register their use.

The current permitted and registered water withdrawals in the Edisto River basin are just under 150 MGD on average. Of this total withdrawal, approximately 74 MGD is from groundwater and 76 MGD is from surface water. The agriculture and water supply sectors account for 53 percent and 42 percent of total withdrawals, respectively. Thermoelectric sector withdrawals are about 2.6 percent of the total and manufacturing sector withdrawals are 2.2 percent. Minimal water withdrawals are associated with golf course irrigation, mining, and aquaculture. Some of these withdrawals are too small to be reported to SCDHEC. Distribution by sector is summarized in Table 4-1 and shown in Figure 4-1. Appendix B includes a table of all water users along with the user's source (surface water or groundwater), withdrawals, and discharges. For surface water modeling purposes, consumptive use percentages (i.e., the amount of water withdrawn that is not returned to surface water or groundwater) for each water user were calculated by comparing withdrawal and discharge amounts, as reported to SCDHEC.

Table 4-1. Current water demand in the Edisto River basin.

Water Use Category	Groundwater (MGD)	Surface Water (MGD)	Total (MGD)
Agriculture	61.3	17.7	79.0
Public Supply	6.1	57.1	63.2
Manufacturing	2.4	0.9	3.3
Thermoelectric	3.9	0.0	3.9
Other	0.19	0.025	0.21
Total	**73.9**	**75.8**	**149.7**

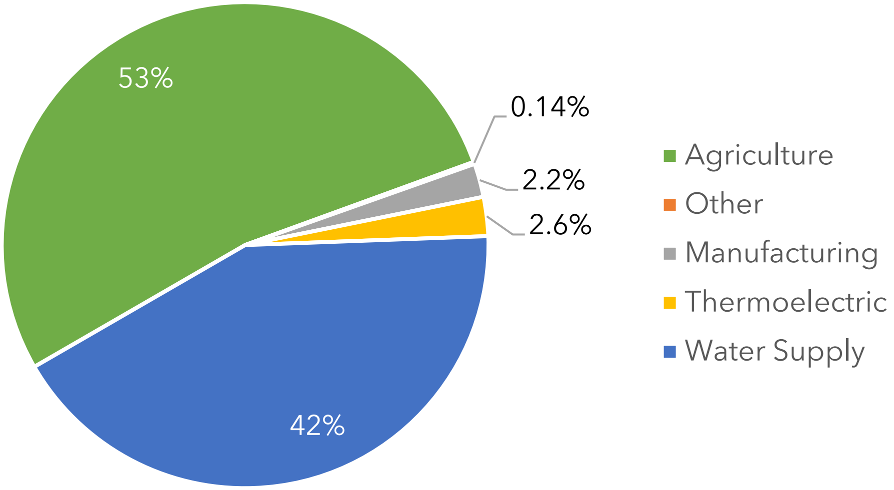


Figure 4-1. Current water use categories percent of total demand.

4.2 Permitted and Registered Water Use

As of the development of this River Basin Plan, 866.4 MGD has been permitted or registered from the Edisto River basin. Of this total, 628.5 MGD has been permitted and 237.9 MGD has been registered. Currently, only 17 percent (149.7 MGD) of the total permitted and registered amount is withdrawn, and only 16 percent (141.3 MGD) is used consumptively within the basin.

These low percentage use rates are in part due to the fact that agricultural surface water registrations and existing (prior to the enactment of Surface Water Regulation 61-119 in 2011), nonagricultural surface water permits do not require the user to demonstrate that the withdrawal is “reasonable” for the use. Such registrations and permits were granted prior to the river basin planning efforts, which represent an attempt to better understand and balance the actual availability of resources with the needs of current users and for future growth. Comparatively, new surface water permits and all groundwater permits must demonstrate reasonable use for the permitted withdrawal amount. Additionally, agricultural surface water registrations have no review period and are granted in perpetuity. Comparatively, surface water permits are reviewed every 20 to 50 years and groundwater permits are reviewed every 5 years. The lack of reasonable use criteria and authority to revisit registered surface water withdrawals has resulted in permitted and registered withdrawal amounts that greatly exceed current use rates. Scenarios for both the current use patterns and the fully allocated river basin are explored with the modeling exercises discussed in Chapter 5, as are scenarios that represent moderate to substantial demand growth within this range. Details of the permitting and registration process for withdrawals in South Carolina can be found in Table 9-1 in Chapter 9.

In the Edisto River basin, a total of 237.5 MGD of surface water has been registered for agricultural use and 509.7 MGD of surface water has been permitted for other use, for a total of 747.2 MGD allocated from surface water.

For groundwater, 118.8 MGD has been permitted for use. Registrations for groundwater in the basin total 0.38 MGD. Some groundwater registrations included in this total are water users in CUAs that are below the 3 MGM permitting threshold but who chose to be registered and report their groundwater use to SCDHEC. Figure 4-2 shows the location of all permitted and registered withdrawal intakes in the basin. Table 4-2 summarizes permitted and registered withdrawals by water use category. Appendix B includes a table of all permitted or registered withdrawals for each user.

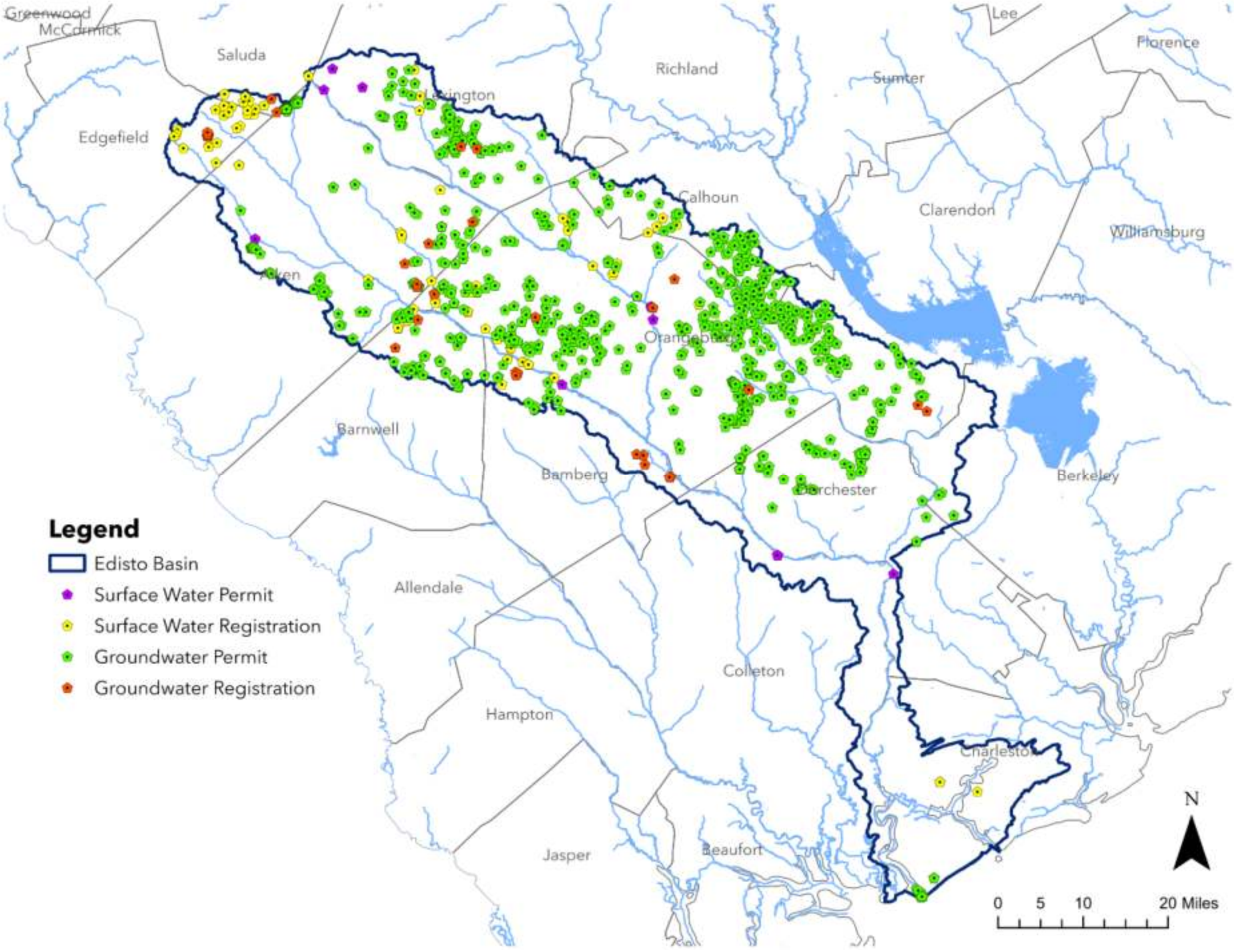


Figure 4-2. Location of all permitted and registered water intakes in the Edisto River basin.

Table 4-2. Permitted and registered use in the Edisto River basin.

	Surface Water (MGD)			Groundwater (MGD)			Total (MGD)		
Water Use Category	**Permit**	**Registration**	**Total**	**Permit**	**Registration**	**Total**	**Permit**	**Registration**	**Total**
Agriculture	NA	237.5	237.5	97.3	0	97.3	97.3	237.5	334.8
Public Supply	354.6	NA	354.6	10.8	0.4	11.2	365.4	0.4	365.8
Manufacturing	90.8	NA	90.8	4.3	0	4.3	95.1	0	95.1
Thermoelectric	63.9	NA	63.9	6.0	0	6.0	69.9	0	69.9
Other	0.5	NA	0.5	0.4	0	0.4	0.9	0	0.9
Total	**509.7**	**237.5**	**747.2**	**118.8**	**0.4**	**119.2**	**628.5**	**237.9**	**866.4**

Water Use Category	Percent of Total Permitted and Registered Surface Water Currently in Use	Percent of Total Permitted and Registered Groundwater Currently in Use	Percent of Total Permitted and Registered Water Currently in Use
Agriculture	7.5%	63.0%	23.6%
Public Supply	16.1%	54.8%	17.3%
Manufacturing	1.0%	56.6%	3.5%
Thermoelectric	0%	65.0%	6.0%
Other	5.3%	43.2%	23.8%
Total	**10.1%**	**62.0%**	**17.3%**

NA – not applicable

4.3 Projection Methodology

The methodology to calculate demand projections followed guidance set forth in *Projection Methods for Off-Stream Water Demand in South Carolina* (SCDNR 2019). SCDNR developed this document over several years in collaboration with the South Carolina Water Resources Center at Clemson University and with the U.S. Army Corps of Engineers, with additional input from stakeholders including:

- South Carolina Water Works Association Water Utility Council
- South Carolina Farm Bureau Water Committee
- South Carolina Chamber of Commerce Environmental Committee
- South Carolina Water Quality Association
- PPAC

The methodology for developing projected demands varies by water use category. Each water use category has an associated driver variable that influences demand growth, as shown in Table 4-3. Projections for these driver variables come from a variety of published sources. Published values were extrapolated to 2070 to match the planning horizon of the River Basin Plan.

Table 4-3. Driver variables for each water use category.

Water Use Category	Driver Variable	Driver Variable Data Source	Moderate Scenario	High Demand Scenario
Agriculture	Irrigated acreage	National-scale studies: ▪ Brown et al. 2013 ▪ Crane-Droesch et al. 2019	Assume irrigated acreage increases with an annual growth rate of 0.65%	Assume irrigated acreage increases with an annual growth rate of 0.73%
Public Supply	Population	South Carolina Office of Revenue and Fiscal Affairs	Extend straight-line growth or assume constant population if the population projection is negative	Project using statewide or countywide growth rate, increased by 10%
Manufacturing	Economic production	Subsector growth rates from the U.S. Energy Information Agency	Manufacturing subsector growth with the minimum adjusted to 0%	Manufacturing subsector growth with the minimum adjusted to 2%
Thermoelectric	Electricity demand	2020 Integrated Resource Plan published by Dominion Energy	Extend straight-line demand growth of “base forecast”, from report	Extend straight-line demand growth of “high scenario”, from report,
Other (golf courses, aquaculture and mining)	Not applicable	Not applicable	Assumed constant	Assumed constant

Two demand projections were developed: (1) the Moderate Water Demand Scenario (Moderate Scenario) and the High Water Demand Scenario (High Demand Scenario). The Moderate Scenario was originally referred to as the Business-as-Usual Scenario in the Framework. For the Moderate Scenario, median monthly withdrawal rates were projected using driver variables from published sources. The High Demand Scenario used surface water withdrawal rates calculated as the 90th percentile for each month and each user along with elevated projections of driver variables (within the ranges of estimates and uncertainty from published sources). For groundwater, the High Demand Scenario uses the median rates of water use. This approach was used for groundwater demands because the cumulative impact of very high rates of water use would become unrealistic in the context of aquifer storage. While it is unlikely that the conditions of the High Demand Scenario would occur for an extended time or universally across the basin, the scenario is useful for establishing an upper bound for the projected demand. The following subchapters present additional details on the calculation of demand for each water use category.

4.3.1 Agriculture Demand Projection Methodology

Water demand projections for agriculture were developed using existing unit use rates and projections of increases in irrigated area. Moderate Scenario projections were based on a historical expansion of irrigated area in the Southeast region of 0.65 percent per year (Brown et al 2013). High Demand Scenario demand projections were based on an annual irrigated area growth of 0.73 percent per year (Crane-Droesch et al 2019).

For input to the SWAM model, projected growth of irrigation water use was assigned to subbasin outlets in the model. This method represents a relatively robust assumption that irrigation will expand somewhere in each subbasin, but it might underrepresent expansion of irrigation withdrawals on small tributaries within each subbasin.

For input to the groundwater model, projected growth of irrigation was assigned to existing wells. This method maintains a consistent distribution of irrigation withdrawals across geography and across aquifers, but it could overestimate the increase of withdrawals in areas where irrigation is already occurring.

SCDNR also worked with the Edisto RBC members, representing agriculture, forestry, and irrigation interests, to verify that the projected irrigated acreage increase was feasible given certain constraints: developed areas, conservation easements, wetlands, and slopes (Pellett 2021). The results of this analysis did not indicate that these constraints would limit the projected growth of irrigated areas in either projection scenario. Some irrigators face additional constraints on expansion (e.g., the logistical issues of moving heavy equipment between wide-reaching fields). The feasibility of continued expansion of irrigated areas depends entirely on irrigators' abilities to profitably meet such challenges (e.g., justify cultivation of high-value specialty crops; justify irrigating smaller, separated fields).

4.3.2 Public Supply Demand Projections Methodology

Demand projections for public supply were developed based on county-level population and water use projections. Population projections for the Moderate Scenario were taken from the South Carolina Office of Revenue and Fiscal Affairs. These projections, which end in 2035, were extrapolated linearly to 2070 (Pellet 2020). Counties with projected declining populations through 2035 were held constant with zero growth after 2035. The High Demand Scenario used exponential growth with growth rates varying by county from 0.89 percent to 2 percent (Pellett 2020). As seen in Figure 4-3, some counties are projected to experience population declines while others may experience substantial growth in both the Moderate and High Demand Scenarios. Charleston Water System, Orangeburg City Department of Public Utilities, and the City of Aiken are the largest public supply users in the basin. Approximately 90 percent of current public supply demand is met by surface water withdrawals.

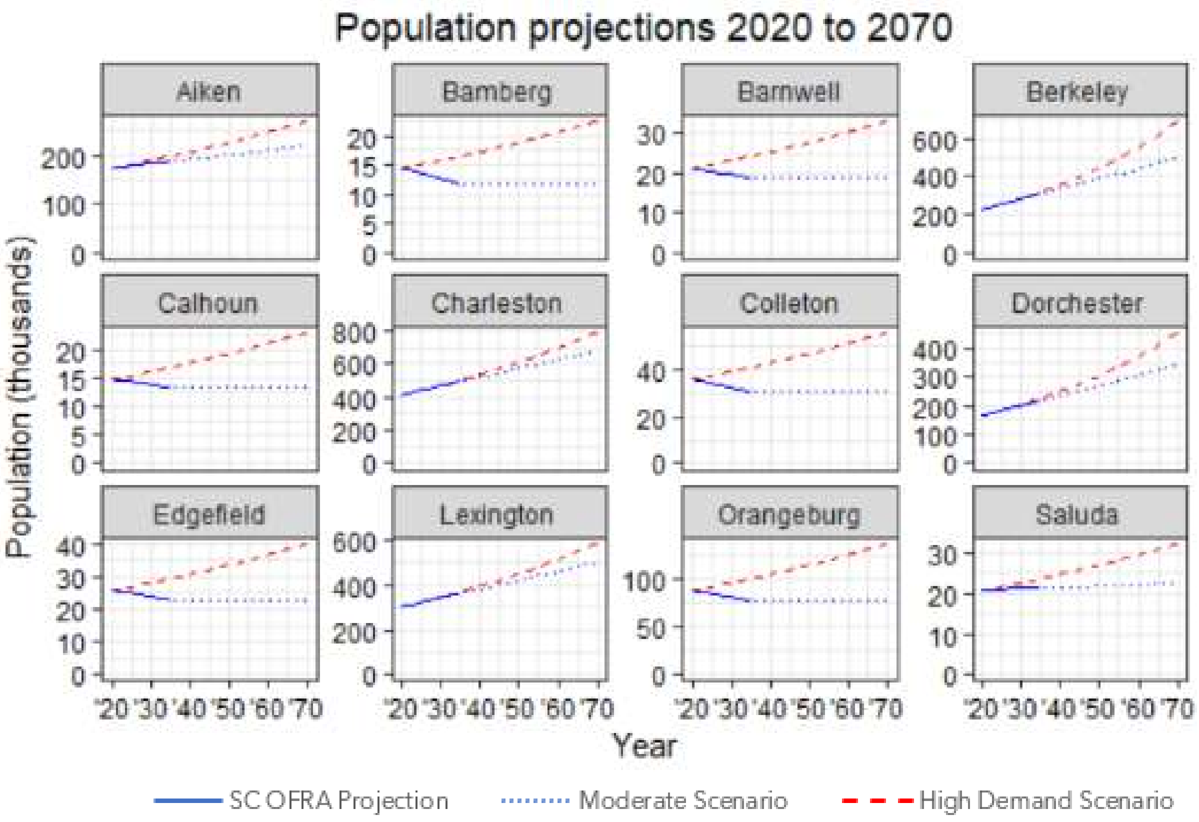


Figure 4-3. Population projections for counties withdrawing water from the Edisto River basin (adapted from Figure 4 in Pellett 2021).

4.3.3 Manufacturing Demand Projections Methodology

Water is used for manufacturing in the Edisto River basin to produce cement, organic chemicals, carbon and graphite, and fluid power valve and hose fittings (Pellett 2021). Some of this water use comes from dewatering operations and can be highly variable depending on operations in a given year. Manufacturing demand projections were based on projected subsector growth rates from the U.S. Energy Information Agency, which ranged from 1.9 to 2.3 percent (United States Energy Information Agency 2020). The High Demand Scenario uses higher growth projections and use rates. Most of the manufacturing water use in the Edisto River basin is from groundwater.

4.3.4 Thermoelectric Demand Projections Methodology

Water is used for thermoelectric power plants to generate steam and to cool power-producing equipment. In the Edisto River basin, Cope Generating Station, operated by Dominion Energy, accounts for most of the thermoelectric water demand, with Dorchester Biomass making up the remainder. Cope Generating Station is currently estimated to use 54 percent of withdrawals consumptively, returning 46 percent to surface water. Thermoelectric demand projections were developed by extending projections from the Dominion Energy 2020 Integrated Resource Plan from 2034 out to 2070. Currently all thermoelectric demands in the Edisto River basin are met by groundwater, although Cope Generating Station plans to use primarily surface water by 2027, or soon thereafter. During periods of low flow, the station will switch to meeting most of its demand from groundwater.

4.3.5 Other Demand Projections Methodology

Other water withdrawals in the Edisto River basin support mining, golf course irrigation, and aquaculture. Water use for these categories is low (less than 100 million gallons per year) and assumed constant into the future (Pellett 2021).

4.4 Projected Water Demand

By 2070, total withdrawals are projected to reach from 233.9 MGD under the Moderate Scenario to 303.1 MGD under the High Demand Scenario, an increase of 48 to 73 percent, respectively, from 2025. Projected annual withdrawals for the Moderate Scenario in 2025 are 65.4 MGD of groundwater and 92.4 MGD of surface water. For the High Demand Scenario, 2025 projected withdrawals are 66.8 MGD of groundwater and 108.5 MGD of surface water. By 2070, groundwater withdrawals are projected to reach 88 to 96 MGD and surface water withdrawals are projected to reach 146 to 207 MGD, for the Moderate and High Demand Scenarios, respectively. This is an increase of 35 to 44 percent for groundwater and 58 to 91 percent for surface water between 2025 and 2070. Demand for surface water is projected to increase faster than demand for groundwater over the planning horizon. This trend is present in both the Moderate Scenario and the High Demand Scenarios. Despite the increase, these projections show surface water demand reaching only 19 to 28 percent of currently permitted and registered surface water withdrawals, and groundwater demand reaching 74 to 81 percent of permitted and registered groundwater withdrawals by 2070.

Table 4-4 and Figure 4-4 summarize projected surface water and groundwater demands over the planning horizon. Figure 4-4 represents a stacked area graph where total demand is plotted as a thick black line and shaded areas illustrate which portion of that demand comes from groundwater or surface water. For example, in 2025, the Moderate Scenario total demand is 157.8 MGD. Of that, 92.4 MGD is from surface water and 65.4 MGD is from groundwater. Projected demands by water use category are summarized in Figure 4-5 and further described below.

Table 4-4. Projected surface water and groundwater demands.

Year	Moderate Scenario Demand (MGD)			High Demand Scenario Demand (MGD)		
	Surface Water	Groundwater	Total	Surface Water	Groundwater	Total
2025	92.4	65.4	157.8	108.5	66.8	175.3
2030	97.9	67.5	165.4	116.0	69.5	185.5
2035	103.5	69.8	173.2	124.3	72.4	196.7
2040	109.4	72.1	181.5	133.3	75.3	208.6
2050	121.4	77.2	198.5	153.7	81.7	235.4
2060	133.4	82.5	216.0	177.9	88.7	266.6
2070	145.6	88.3	233.9	206.8	96.4	303.1
% Increase 2025–2070	58%	35%	48%	91%	44%	73%

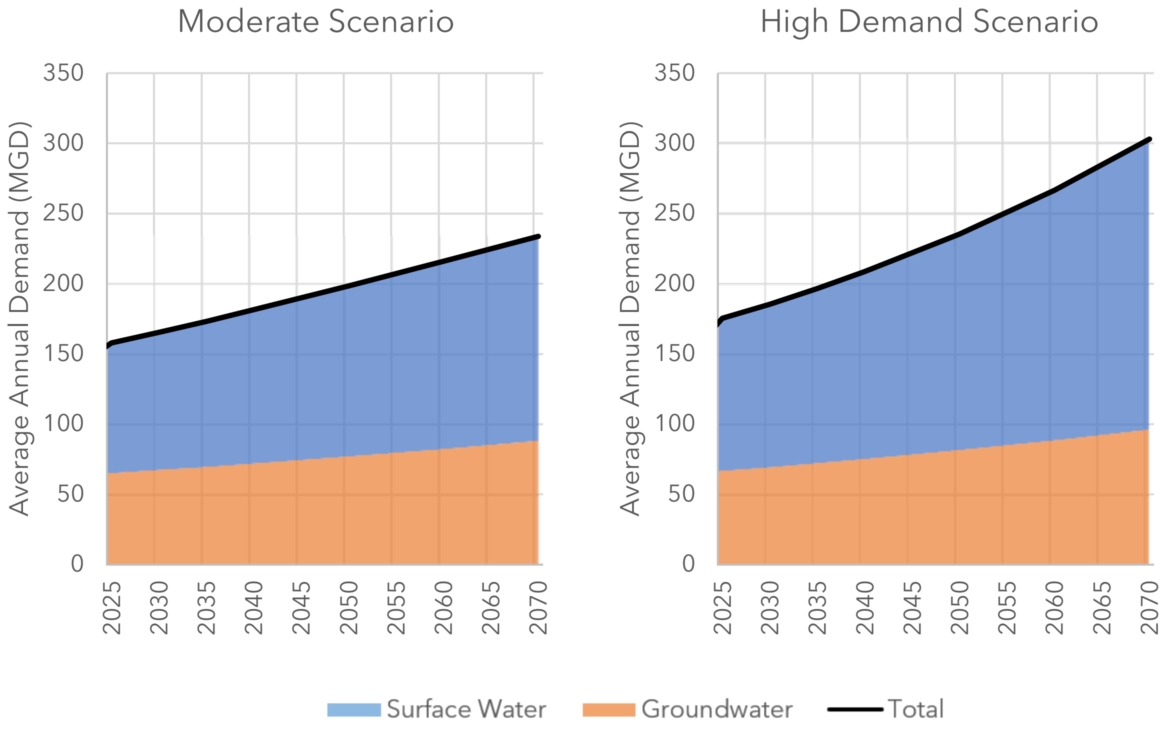


Figure 4-4. Demand projections by water source.

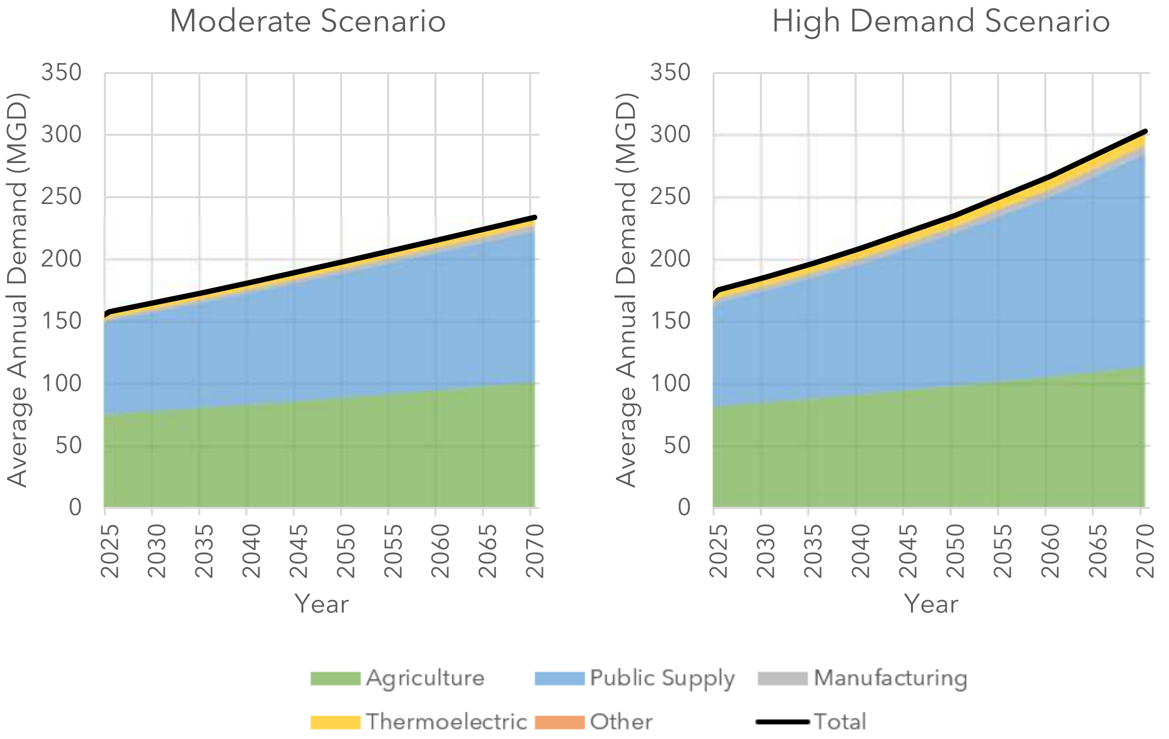


Figure 4-5. Demand projections by water use category.

4.4.1 Agriculture Demand Projections

Agricultural demands are expected to increase between 34 to 39 percent between 2025 (75.5 to 82.0 MGD) to 2070 (101 to 114 MGD) in the Moderate and High Demand Scenarios, respectively. Groundwater is expected to supply 70 to 76 percent of projected agricultural water demands. Projected 2070 agricultural groundwater withdrawals for the Moderate and High Demand Scenarios are approximately 79 to 82 percent of permitted agricultural withdrawals, respectively. Projected 2070 agricultural surface water withdrawals for the Moderate and High Demand Scenarios are approximately 10 to 14 percent of registered agricultural withdrawals. Agricultural demand projections by water source are shown in Figure 4-6 and summarized in Table 4-5.

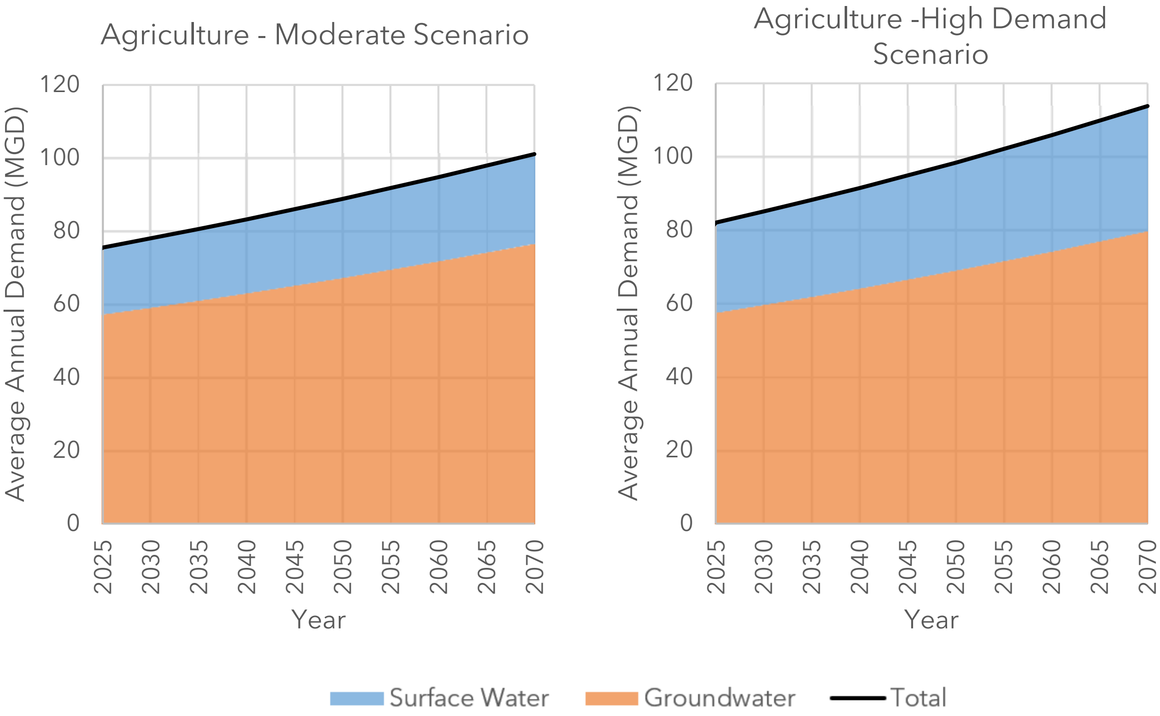


Figure 4-6. Projected agriculture water demands.

Table 4-5. Projected agriculture water demands.

Year	Moderate Scenario Demand (MGD)			High Demand Scenario Demand (MGD)		
	Surface Water	Groundwater	Total	Surface Water	Groundwater	Total
2025	18.4	57.1	75.5	24.6	57.4	82.0
2030	19.0	59.0	78.0	25.5	59.5	85.0
2035	19.6	61.0	80.6	26.4	61.8	88.2
2040	20.3	63.0	83.2	27.4	64.0	91.4
2050	21.6	67.2	88.8	29.5	68.9	98.3
2060	23.1	71.7	94.7	31.7	74.1	106.0
2070	24.6	76.5	101.0	34.1	79.7	114.0
% Increase 2025–2070	34%	34%	34%	39%	39%	39%

4.4.2 Public Supply Demand Projections

The largest projected increase in demand is expected in the public supply category. This increase is driven by increasing population in urbanized areas, particularly in Charleston. Projected population increases are presented in Table 4-6. Public supply demands are projected to increase between 62 to 105 percent between 2025 (74.9 to 83.4 MGD) to 2070 (121.1 to 170.8 MGD) in the Moderate and High Demand Scenarios, respectively. Most of this increase will be met by surface water, which will serve 92 to 95 percent of demand. Projected 2070 public supply groundwater withdrawals for the Moderate and High Demand Scenarios are approximately 59 to 81 percent of permitted and registered public supply groundwater withdrawals, respectively. Projected 2070 public supply surface water withdrawals for the Moderate and High Demand Scenarios are approximately 32 to 46 percent of permitted public supply surface water withdrawals, respectively. Public supply demand projections by water source are shown in Figure 4-7 and summarized in Table 4-6.

Table 4-6. Projected population increases (in thousands) (Pellett 2021).

	County	2020	2025	2030	2035	2040	2050	2060	2070
Moderate Scenario	Aiken	173.5	179.2	183.9	187.5	192.2	201.5	210.9	220.3
	Bamberg	14.4	13.6	12.8	11.8	11.8	11.8	11.8	11.8
	Barnwell	21.2	20.4	19.6	18.7	18.7	18.7	18.7	18.7
	Berkeley	228.0	253.7	280.6	308.4	335.2	388.8	442.4	496.0
	Calhoun	14.8	14.4	13.9	13.2	13.2	13.2	13.2	13.2
	Charleston	415.2	443.8	470.2	494.9	521.5	574.6	627.7	680.8
	Colleton	35.9	34.3	32.5	30.5	30.5	30.5	30.5	30.5
	Dorchester	167.3	184.1	201.7	219.8	237.3	272.3	307.3	342.3
	Edgefield	25.7	25.0	24.1	22.9	22.9	22.9	22.9	22.9
	Lexington	302.8	323.3	343.1	362.1	381.9	421.4	461.0	500.5
	Orangeburg	87.5	84.3	80.7	76.8	76.8	76.8	76.8	76.8
	Saluda	20.8	21.1	21.3	21.3	21.5	21.8	22.2	22.5
High Demand Scenario	Aiken	173.5	181.3	189.5	198.1	207.0	226.2	247.1	270.0
	Bamberg	14.4	15.1	15.8	16.5	17.2	18.8	20.6	22.5
	Barnwell	21.2	22.1	23.1	24.2	25.3	27.6	30.2	33.0
	Berkeley	228.0	254.7	284.5	317.8	354.9	442.8	552.4	689.2
	Calhoun	14.8	15.4	16.1	16.8	17.6	19.2	21.0	23.0
	Charleston	415.2	442.8	472.2	503.6	537.1	610.8	694.6	790.0
	Colleton	35.9	37.5	39.2	41.0	42.9	46.8	51.2	55.9
	Dorchester	167.3	184.9	204.3	225.8	249.6	304.8	372.3	454.7
	Edgefield	25.7	26.9	28.1	29.4	30.7	33.6	36.7	40.1
	Lexington	302.8	323.3	345.2	368.6	393.6	448.7	511.6	583.3
	Orangeburg	87.5	91.4	95.6	99.9	104.4	114.1	124.7	136.2
	Saluda	20.8	21.7	22.7	23.7	24.8	27.1	29.6	32.4

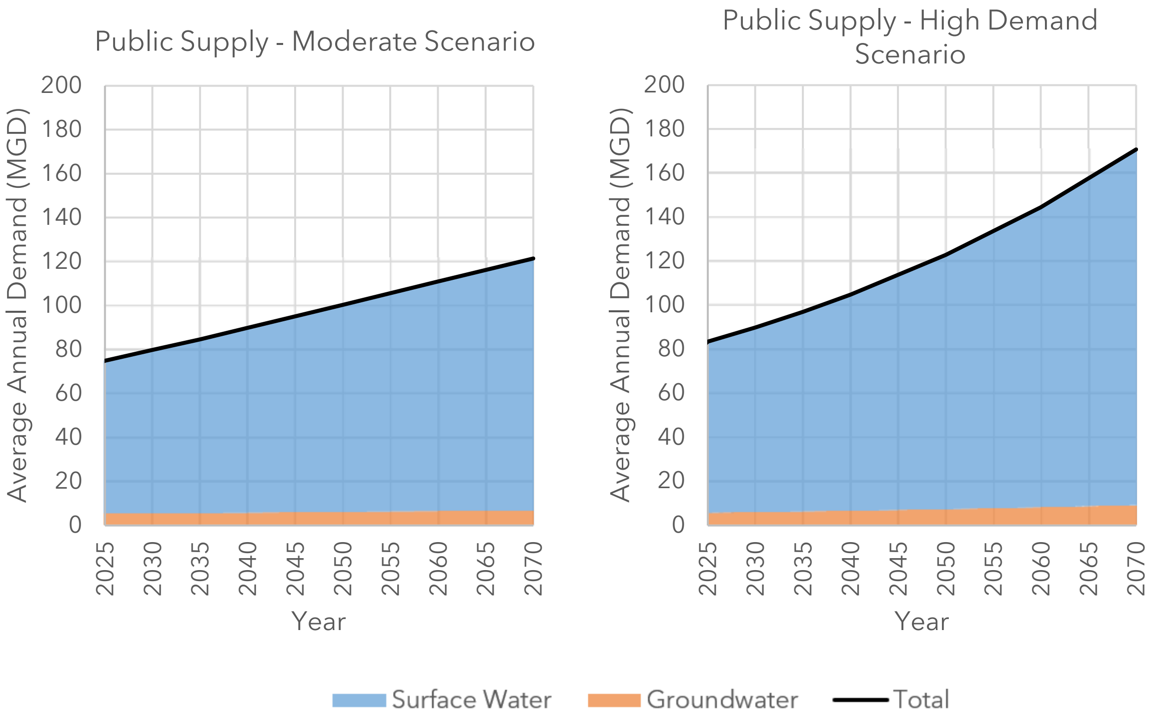


Figure 4-7. Projected public supply water demands.

Table 4-7. Projected public supply water demands.

Year	Moderate Scenario Demand (MGD)			High Demand Scenario Demand (MGD)		
	Surface Water	Groundwater	Total	Surface Water	Groundwater	Total
2025	69.5	5.4	74.9	77.8	5.6	83.4
2030	74.3	5.5	79.8	84.0	5.9	89.9
2035	79.1	5.5	84.6	90.8	6.2	97.0
2040	84.2	5.7	89.9	98.3	6.5	104.8
2050	94.4	6.0	100.4	115.5	7.3	122.8
2060	104.6	6.3	110.9	136.4	8.1	144.5
2070	114.8	6.6	121.4	161.8	9.1	170.8
% Increase 2025-2070	65%	23%	62%	108%	62%	105%

4.4.3 Manufacturing Demand Projections

The manufacturing sector's use is highly variable because of the inclusion of dewatering operations, which vary monthly and yearly depending on operations. Manufacturing demands are projected to increase between 95 to 98 percent between 2025 (2.41 to 3.66 MGD) to 2070 (4.71 to 7.23 MGD) in the Moderate and High Demand Scenarios, respectively. Less than 11 percent of manufacturing demand is from surface water, as most of the manufacturing demand is associated with dewatering operations. Projected 2070 manufacturing groundwater withdrawals for the Moderate and High Demand Scenarios are approximately 105 and 156 percent of currently permitted manufacturing groundwater withdrawals, respectively. Projected 2070 manufacturing surface water withdrawals for the Moderate and High Demand Scenarios are approximately 0.2 and 0.6 percent of currently permitted manufacturing surface water withdrawals, respectively. Manufacturing demand projections by water source are shown in Figure 4-8 and summarized in Table 4-8.

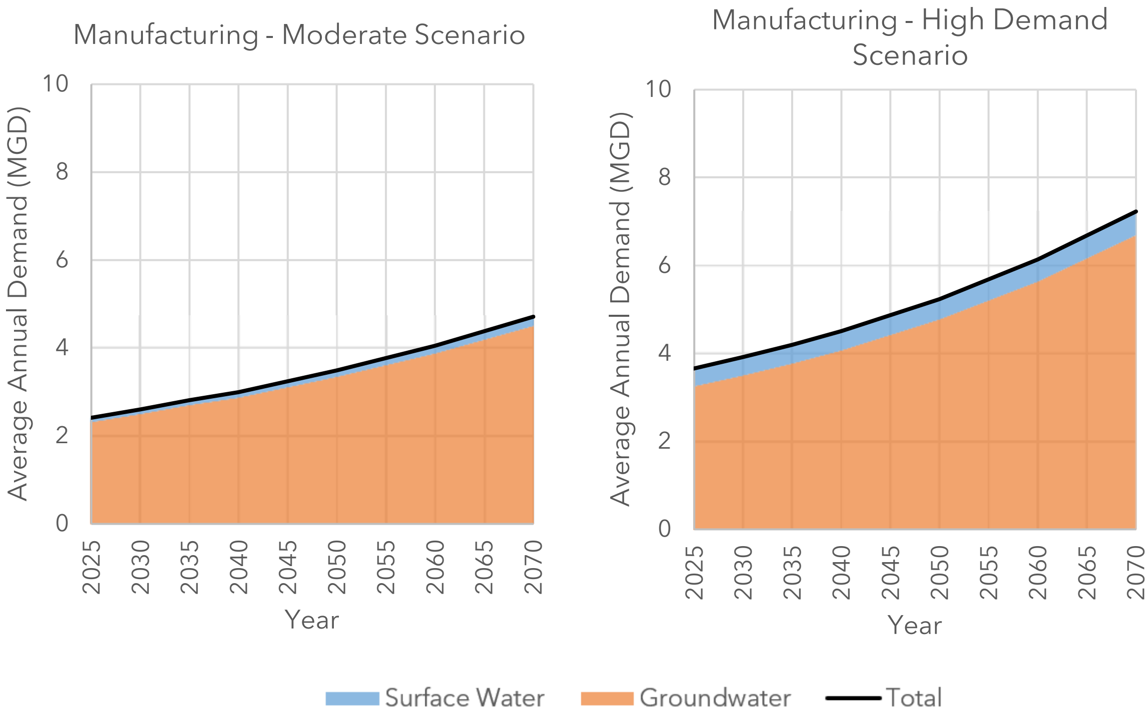


Figure 4-8. Projected manufacturing water demands.

Table 4-8. Projected manufacturing water demands.

Year	Moderate Scenario Demand (MGD)			High Demand Scenario Demand (MGD)		
	Surface Water	Groundwater	Total	Surface Water	Groundwater	Total
2025	0.11	2.30	2.41	0.41	3.24	3.66
2030	0.12	2.49	2.61	0.42	3.49	3.91
2035	0.13	2.69	2.82	0.43	3.76	4.19
2040	0.14	2.86	3.00	0.44	4.06	4.50
2050	0.16	3.33	3.49	0.47	4.76	5.23
2060	0.19	3.86	4.05	0.51	5.62	6.13
2070	0.23	4.49	4.71	0.55	6.68	7.23
% Increase 2025–2070	107%	95%	95%	35%	106%	98%

4.4.4 Thermoelectric Demand Projections

Thermoelectric demands are projected to increase between 36 to 84 percent between 2025 (4.72 to 6.02 MGD) to 2070 (6.44 to 11.1 MGD) in the Moderate and High Demand Scenarios, respectively. Dorchester Biomass uses strictly groundwater to meet demands. Cope Generating Station currently uses strictly groundwater but plans to convert to surface water by 2027, or soon thereafter. Although some demand will be met by groundwater during periods of low flow, all Cope Generating Station demand after 2025 was assumed to be met with surface water for demand projection and modeling purposes. Projected 2070 thermoelectric groundwater withdrawals for the Moderate and High Demand Scenarios are approximately 8 to 13 percent of currently permitted thermoelectric groundwater withdrawals, respectively. Projected 2070 thermoelectric surface water withdrawals for the Moderate and High Demand Scenarios are approximately 9 to 16 percent of currently permitted thermoelectric surface water withdrawals, respectively. Thermoelectric demand projections by water source are shown in Figure 4-9 and summarized in Table 4-9.

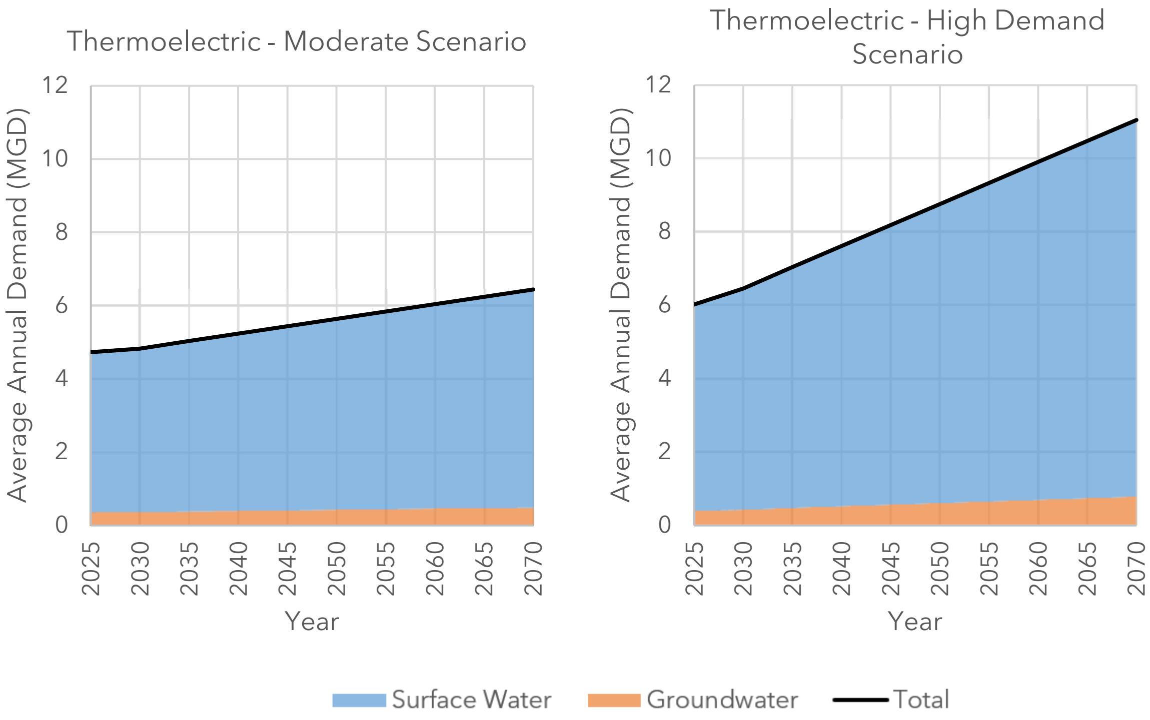


Figure 4-9. Projected thermoelectric water demands.

Table 4-9. Projected thermoelectric water demands.

Year	Moderate Scenario Demand (MGD)			High Demand Scenario Demand (MGD)		
	Surface Water	Groundwater	Total	Surface Water	Groundwater	Total
2025	4.36	0.36	4.72	5.63	0.39	6.02
2030	4.45	0.37	4.83	6.03	0.42	6.45
2035	4.65	0.39	5.04	6.57	0.46	7.04
2040	4.83	0.40	5.24	7.10	0.51	7.61
2050	5.20	0.43	5.64	8.16	0.60	8.76
2060	5.57	0.46	6.04	9.22	0.68	9.91
2070	5.95	0.49	6.44	10.28	0.77	11.10
% Increase 2025-2070	36%	36%	36%	82%	100%	84%

4.4.5 Other Demand Projections

Other demands are held constant into the future, as described in Chapter 4.3.5. Other uses are too small to be reported and were not included in the demand projections.

Chapter 5
Comparison of Water Resource Availability and Water Demand

This chapter describes the methods used to assess surface water and groundwater availability in the Edisto River basin and underlying aquifers. Surface and groundwater models were used to evaluate water availability using current and projected water demands. Water availability was also assessed assuming surface and groundwater withdrawals at permitted and registered amounts. The results of these assessments are presented and compared, and potential shortages, issues, and areas of concern are identified.

5.1 Methodology

5.1.1 Surface Water

Surface water planning scenarios were constructed and simulated using the previously developed Edisto River basin surface water quantity model (CDM Smith 2017). This model was developed with CDM Smith's SWAM software. It simulates river basin hydrology, water availability, and water use across a dendritic network and over an extended timeseries.

SWAM was designed to provide efficient planning-level analyses of surface water supply systems. Beginning with naturally-occurring water flowing in the river reaches, it calculates physically and permitted or allowable water, diversions, storage, consumption, and return flows at user-defined nodes in a networked river system. A range of water user types can be represented in the model, including municipal water suppliers, agricultural irrigators, and industrial water users, with time-variable demands either prescribed by the user or, in some cases, calculated internally. Multiple layers of complexity are available as options in SWAM to allow for easy development of a range of systems, from the very simple to the more complex. As an example, SWAM's reservoir object can include only basic hydrology-dependent calculations (storage as a function of inflow, outflow, and evaporation) or can include operational rules of varying complexity: prescribed monthly releases, a set of prioritized monthly releases or storage targets, or a set of conditional release rules (dependent on hydrology). Municipal water conservation programs can similarly be simulated with sets of rules of varying complexity. The model user chooses the appropriate level of complexity given the modeling objectives and data availability.

The Edisto River basin SWAM model simulates 88 years of variable historic hydrology (1931 – 2018) with either a monthly or daily user-specified calculation timestep (the surface water scenarios presented in this chapter represent monthly analyses, unless noted otherwise). It is designed for three primary purposes:

- accounting of current and past basin inflows, outflows, and consumptive uses;
- simulating streamflow and lake storage (if applicable) across a range of observed historical climate and hydrologic conditions, given current water use and operations; and

- simulating future "what if" scenarios associated with changes in basin water use, management, and/or operations.

The Edisto River basin model includes 8 municipal, 5 industrial, 2 golf courses, 1 thermoelectric, and 50 discrete agricultural (irrigation) water users, some of which represent the aggregation of multiple smaller irrigators. Some of the included water users only withdraw groundwater but discharge to surface water, thus their inclusion in the model. All water users with permitted withdrawals greater than 0.1 MGD are represented, either explicitly or implicitly. In the model, which represents current conditions, monthly water use is set equal to the average of a recent 10-year period (2009 – 2018) of reported use, with several exceptions. Exceptions include new surface water users and surface water users with recent demands that are significantly different than demands in the early part of the 10-year period. Water use patterns can also be adjusted by model users to explore future water management scenarios, as discussed in this chapter.

A total of 46 "tributary objects" (rivers and streams) are represented discretely in the model, including the mainstem South Fork Edisto River. Boundary condition (headwater) flows for each tributary object are prescribed in the model based on external analyses (see CDM Smith 2017), which estimated naturally-occurring historical flows "unimpaired" by human uses. Historic, current, and/or future uses can then be simulated against the same natural hydrology of the basin. Hydrologic flow gains (or losses) for each tributary are simulated in SWAM using lumped gain (or loss) factors, which are set based on a model calibration exercise, using gaged flow data, and/or guided by changes in reach drainage area. While there is no direct linkage between the SWAM model and the groundwater model (discussed below), SWAM implicitly accounts for interaction between groundwater and surface water through the assignment of the gain/loss factors.

The Edisto River basin SWAM model was used to simulate current and potential future scenarios to evaluate surface water availability. Detailed descriptions of the surface water scenarios and their results are provided in Chapter 5.3.

Several key terms are used throughout this section, when presenting results of the surface water modeling. These key terms are introduced and defined below.

- **Physically Available Surface Water Supply** – the maximum amount of water that occurs 100 percent of the time at a location on a surface water body with no defined Surface Water Conditions applied on the surface water body.

- **Reach of Interest** – a stream reach defined by the RBC which experiences undesired impacts, environmental or otherwise, determined from current or future water-demand scenarios or proposed water management strategies. Such reaches may or may not have identified Surface Water Shortages. The Edisto RBC did not identify any Reaches of Interest in the Edisto River basin.

- **Strategic Node** – a location on a surface water body or aquifer designated to evaluate the cumulative impacts of water management strategies for a given model scenario and which serves as a primary point of interest from which to evaluate a model scenario's Performance Measures. Strategic Nodes are defined by the RBC.

- **Surface Water Condition** – a limitation, defined by the RBC, on the amount of water that can be withdrawn from a surface water source and which can be applied to evaluate Surface Water Supply for planning purposes. The Edisto RBC did not establish a Surface Water Condition for any location in the Edisto River basin.

- **Surface Water Shortage** – a situation in which water demand exceeds the Surface Water Supply for any water user in the basin.
- **Surface Water Supply** – the maximum amount of water available for withdrawal 100 percent of the time at a location on a surface water body without violating any applied Surface Water Conditions on the surface water source and considering upstream demands.

5.1.2 Groundwater

To support the assessment of current and future groundwater availability in the Edisto River basin, groundwater withdrawals representing current and future demands were incorporated into the updated USGS Atlantic Coastal Plain Groundwater Model (Campbell et al. in press), and simulations were performed to evaluate changes in water levels and discharge to streams and to support development of water budgets. Additional withdrawals incorporated into the USGS model include historic water use reported to SCDHEC from 2016 to 2020 and projections of water use for various scenarios to 2070.

While the focus of the groundwater modeling was on the Edisto River basin, groundwater generally does not follow river basin boundaries. As such, the model simulations account for pumping and simulated conditions over the entire Coastal Plain of South Carolina. For this investigation, over 3,700 wells were simulated to represent all groundwater withdrawals in South Carolina. In the Edisto River basin, the following number of wells were simulated: 113 wells withdrawing from the Gordon aquifer; 493 wells withdrawing from the Crouch Branch aquifer; 97 wells withdrawing from the McQueen Branch aquifer; and 91 wells withdrawing from multiple aquifers (Petkewich and Cherry 2022). Historical pumping rates, as reported to SCDHEC, were assigned to the wells for the years 1983 to 2020. The groundwater demand projections, as described in Chapter 4 – Current and Projected Water Demand, were applied to the model for the period 2021 through 2070. Since the location of potential future wells that may account for the projected increase in demands over the 50-year planning horizon are unknown, all future demands were assigned to existing wells.

Estimates of groundwater recharge derived from the USGS-developed SWB computer code were applied to the model for each annual stress period. Spatially varying recharge rates were assigned for the years 1979 through 2020, based on SWB model calculations which account for precipitation, temperature, soil characteristics, slopes, land use, and land cover. Model applied recharge rates varied from 0.09 to 1.22 feet per year. Recharge from 2010, which was an average recharge year, was applied for the simulation years 1900 through 1978 to represent a consistent, long-term average recharge rate. Recharge for the water demand projection scenarios, which extend from 2021 through 2070, use a repeating annual series based on the estimated annual recharge calculated by the SWB model for the years 1979 through 2020 (Westenbroek et al 2010).

Several key terms are used throughout this section, when presenting results of the groundwater modeling. These key terms are introduced and defined below.

- **Groundwater Area of Concern** – an area in the Coastal Plain, designated by the RBC, where groundwater withdrawals from a specified aquifer are causing or are expected to cause unacceptable impacts to the resource or to the public health and well-being.

- **Groundwater Condition** – a limitation, defined by the RBC, on the amount of groundwater that can be withdrawn from an aquifer and which can be applied to evaluate Groundwater Supply for planning purposes. The Edisto RBC did not establish any Groundwater Conditions; however, the RBC did elect to identify a desired future condition (discussed later in this Chapter).

- **Groundwater Shortage** – a state in which groundwater withdrawals from a specific aquifer violate a Groundwater Condition applied on that aquifer.

- **Groundwater Supply** – the volume of water that can be withdrawn annually from a specified aquifer in a designated location without violating any applied Groundwater Conditions on the groundwater source.

5.2 Performance Measures

Performance measures were developed as a means for comparing water resource impacts (negative and positive) of each scenario. A performance measure is defined as a quantitative measure of change in a user-defined condition from an established baseline, used to assess the performance of a proposed water management strategy or combination of strategies. Performance measures establish an objective means with which to compare scenarios. Performance measures were selected in collaboration with the RBC.

5.2.1 Surface Water Performance Measures

Hydrologic-based Performance Measures

The hydrologic surface water performance measures used to evaluate and compare simulation results are presented in Table 5-1. For each simulated scenario, performance measures were calculated as a post-processing step in the modeling. All metrics were calculated for the entire simulation period. As noted above, changes in performance measures between scenarios were particularly useful for the planning process. The first set of performance metrics were calculated for model output nodes that were identified by the RBC as Strategic Nodes. These Strategic Nodes are distributed throughout the river basin. Strategic Nodes include all active streamflow gaging stations plus five additional locations at the downstream end of streams or hydrologic units. These additional Strategic Nodes were selected in collaboration with the RBC. All strategic node locations are shown in Figure 5-1.

Table 5-1. Surface water performance measures.

Strategic Node Metrics (generated for each model output node)	Basin-wide Metrics (generated in aggregate for the entire modeled river basin)
Mean flow (cfs)	Total basin annual mean shortage (MGD) - Sum of the average shortage for all users over the simulation period
Median flow (cfs)	Maximum water user shortage (MGD) - The maximum monthly shortage experienced by any single user over the simulation period
25th percentile flow (cfs)	Total basin annual mean shortage (% of demand) - Sum of the average shortage for all users over the simulation period divided by the sum of the average demand for all users over the simulation period

Table 5-1. Surface water performance measures. (Continued)

Strategic Node Metrics (generated for each model output node)	Basin-wide Metrics (generated in aggregate for the entire modeled river basin)
5th percentile flow (cfs)	Average frequency of shortage (%) - The average frequency of shortage of all users who experience a shortage, where each user's frequency of shortage is calculated as the number of months with a shortage divided by the total months in the simulation (for a monthly timestep simulation)
Comparison to Minimum Instream Flows (MIFs)[1]	

[1] MIFs are discussed and used as performance measures in Chapter 6 – Water Management Strategies.

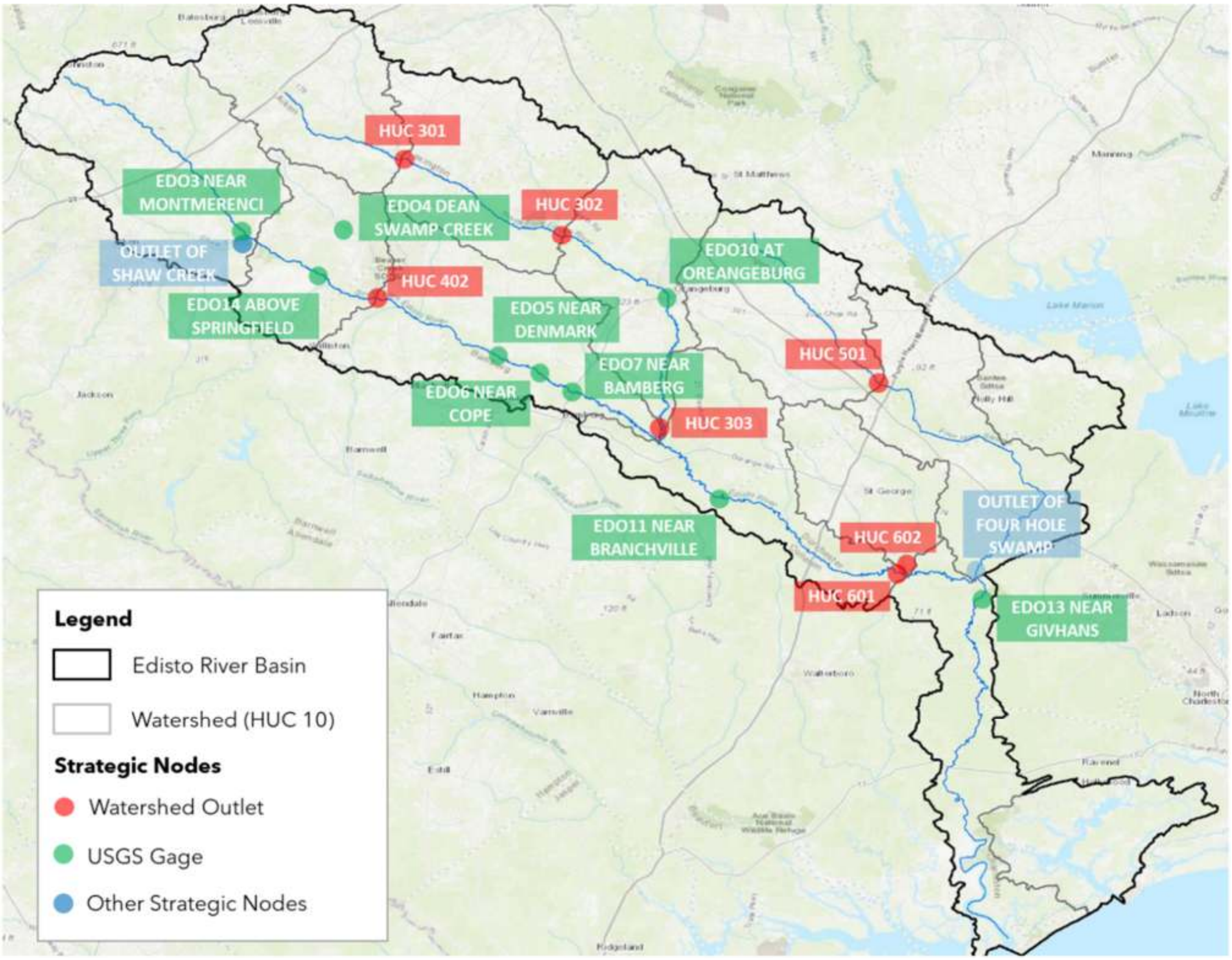


Figure 5-1. Strategic node locations.

Biological Response Metrics

As referenced in Chapter 3.2.2 and discussed in Bower et al (2022), biological response metrics were developed and combined with hydrologic metrics to identify statistically significant correlations between flow characteristics and ecological suitability for fish and macroinvertebrates. Select flow-ecology metrics (hydrologic metrics found to be most correlated to biological suitability) were then used as performance measures to help guide RBC discussions and recommendations for the Edisto River basin. The relevant, selected biological response metrics and related hydrologic metrics (sometimes referred to as the "flow-ecology metrics") are discussed in this section, and their values and interpretation in the context of the Edisto River basin are presented in Chapter 5.3.6.

The metrics were calculated at key downstream nodes in the three primary tributary subbasins of the Edisto River basin (North Fork, South Fork, and Four Hole Swamp) and thus represent a general assessment of how aquatic life will be impacted by changes in flow. Additional metrics were computed in select secondary tributaries. The results should not be considered as necessarily uniform throughout each subbasin. Not only may conditions vary along stream reaches, but metrics were based on relationships in small "wadeable" headwater streams and extrapolated to larger tributaries. For these reasons, variations in actual values are expected throughout the basin.

Of the fourteen biological response metrics identified in Bower et al (2022), the following five were used in the Edisto River basin due to relevance and strong correlation to hydrologic statistics that could be readily extracted from the SWAM Model (descriptions from Bower et al, 2022):

- Fish Metrics Richness, a measure of taxa richness for fish
- Benthic Macroinvertebrate Metrics Richness, a measure of taxa richness for macroinvertebrates
- Tolerance (macroinvertebrates), an average tolerance index for macroinvertebrate taxa
- Tolerance (fish), a proportional representation of tolerant individuals
- M-O Index, the average of an index indicative of Odonata and Megaloptera taxa preference for lotic or lentic conditions

The hydrologic statistics that correlated well to these biological metrics included four metrics that could be easily extracted from SWAM model results. These metrics, intended to support flow-ecology relationships, expand on the hydrologic metrics discussed in Chapter 5.2.1, which were used specifically for hydrologic comparisons. The four metrics are:

- **Mean daily flow** is the mean (average) daily flow of the stream in cfs.
- **Base flow index** is the minimum of a 7-day moving average flow divided by the mean annual flow for each year.
- **Duration of low flow** is the average pulse for flow events below a threshold equal to the 25th percentile value for the entire flow record.

- **Timing of low flow** is the (Julian) date of the annual minimum flow. The Julian date is a 5-digit number where the first two digits are the last numbers of the year and the three digits after the hyphen are the day of that year (e.g., June 1, 2022 is 22152).

Mapped together, these hydrologic metrics were used to predict changes in the biological response metrics, which in turn characterized the ecological integrity and tolerance of the four subbasins. Table 5-2 helps illustrate the flow-ecology relationships but is not necessarily exhaustive. Actual results for the Edisto River basin are presented and discussed in Chapter 5.3.6.

Table 5-2. Relationship of hydrologic and biological response metrics.

Hydrologic Metric (from SWAM Scenarios)	Correlated Biological Response Metric (Bower et al, 2022)	Type of Evaluation
Mean Daily Flow	Fish Richness	Ecological Integrity
Base Flow Index	Macroinvertebrate Richness and Tolerance	Ecological Integrity and Tolerance
Duration of Low Flow	Fish Richness and Tolerance	Ecological Integrity and Tolerance
Timing of Low Flow	Fish Richness, M-O Index, Tolerance	Ecological Integrity and Tolerance

5.2.2 Groundwater Performance Measures

Performance measures used to compare the results from groundwater simulations and evaluate potential groundwater management strategies were generally limited to changes in water levels of the major aquifers and changes in the water budgets, including groundwater discharge to streams from the surficial aquifer. Changes in water levels were simulated at existing monitoring wells or as represented on potentiometric maps. A groundwater level decline to near or below the top of an aquifer was also used as a performance measure, especially when comparing the effectiveness of strategies that were intended to prevent such declines. Table 5-3 summarizes the performance measures used to compare results from groundwater simulations and evaluate groundwater management strategies.

Table 5-3. Groundwater performance measures.

Groundwater Performance Measures
Changes in simulated water levels in the Gordon, Crouch Branch, and McQueen Branch aquifers
Changes in water budgets, including groundwater discharge to streams from the Surficial aquifer
Water level declines below the top of an aquifer

5.3 Scenario Descriptions and Surface Water Simulation Results

Four scenarios were used to evaluate surface water availability and to identify any anticipated Surface Water Shortages: the Current Surface Water Use Scenario (Current Scenario); the Permitted and Registered Surface Water Use Scenario (P&R Scenario); the Moderate Water Demand Scenario

(Moderate Scenario); and the High Water Demand Scenario (High Demand Scenario). The Moderate Scenario was originally referred to as the Business-as-Usual Scenario in the Framework. A fifth scenario, the Unimpaired Flow Scenario (UIF Scenario) was requested by the RBC and a model simulation was completed. The UIF Scenario removes all surface water withdrawals and discharges and simulates conditions prior to any surface water development. The scenarios described below were simulated over the approximately 87-year period of variable climate and hydrology spanning August 1931 to December 2018. All simulation results, except where noted, are based on model simulations using a monthly timestep.

5.3.1 Current Surface Water Use Scenario

The Current Scenario represents current operations, infrastructure, and water use in the Edisto River basin. Water demands were generally set based on reported water usage in the 10-year period spanning 2009 to 2018, with several minor exceptions. This simulation provides information on the potential for Surface Water Shortages that could immediately result under a repeat of historic drought conditions in the basin and highlights the need for short-term planning initiatives including the development of strategies to mitigate shortages and/or increase surface water supply.

Simulation results for the Current Scenario are summarized in Tables 5-4 through 5-6. Table 5-4 lists only the surface water users with one or more months of a simulated Surface Water Shortage over the 87-year (1,049-month) simulation. Also shown are the average annual demand for each water user; the minimum physically available (monthly average) flow at the point of withdrawal; the maximum (monthly average) shortage; and the frequency of shortage. The locations of these water users, as depicted on the SWAM model framework, are shown in Figure 5-2. Water users with a simulated shortage are identified with a box (color coded to represent the frequency of shortage) placed around the water user object.

Table 5-4. Identified Surface Water Shortages, Current Scenario.

Water User Name	Source Water	Average Annual Demand (MGD)	Minimum Physically Available Flow (MGD)	Maximum Shortage (MGD)	Frequency of Shortage (%)
IR: Titan - South Fork	Mainstem	1.53	3.43	0.07	0.1%
IR: Titan - Temples	Temples Creek	1.97	0.41	3.49	35.1%
IR: Titan - Bog	Bog Branch	1.78	0.22	3.66	38.8%
IR: Titan - Beech	Beech Creek	0.79	1.11	0.91	2.2%
IR: Titan - Mill	Mill Creek	0.66	0.71	0.61	3.3%
IR: Titan - Beaverdam	Beaverdam Branch	0.22	0.18	0.68	17.9%
IR: Shivers Trading	Sykes Swamp	0.23	0.15	0.35	19.1%
IR: Millwood	Limestone Creek	2.74	2.04	4.11	6.7%
IR: Gray	Cooper Swamp	0.12	0.50	0.21	25.0%
IR: Titan - Chinquapin	North Fork Edisto River	0.50	0.86	0.88	4.0%
IR: Cotton Lane	Goodbys Swamp	0.14	0.13	0.20	1.7%
IR: Shady Grove	Cow Castle Creek	0.44	0.02	0.59	46.2%

IR = agricultural (irrigation) water user

The water users with simulated Surface Water Shortages have several things in common: all are agricultural water users; nearly all are located on a (relatively) small, ungaged tributary; and all are located near the headwater of their source water stream or river. Additionally, many of these agricultural water users have multiple intake locations, which are aggregated in the model to just one or two locations. The ability of the model to estimate low flows on the smaller, ungaged tributaries is limited, and there is increased model uncertainty on these streams. Furthermore, inspection of aerial imagery shows that nearly all these water users have created small ponds, or made use of existing ones, for their surface water intake. These small ponds are not included in the SWAM model. The ponds provide much-needed storage during low flow conditions that occur during a drought. For these reasons, the identified Surface Water Shortages are not likely to occur at the same frequency and amount as simulated in the model. Many, if not nearly all the simulated shortages in Table 5-4 are likely to be significantly tempered or avoided because of the on-site storage available with the ponds.

Table 5-5 presents the mean flow, median flow, and Surface Water Supply at each strategic node. Also presented are the 25th, 10th, and 5th percentile flows, which are useful in characterizing low flows. Table 5-6 presents the basin wide performance metrics. As noted above, the model very likely over-predicts the number, degree, and frequency of Surface Water Shortages on the small, ungaged tributaries, where multiple intake locations have been aggregated and where ponds, which are not simulated in the model, provide water storage that would often prevent a shortage.

Table 5-5. Surface water model simulation results at Strategic Nodes, Current Scenario.

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
EDO03 S. Fork Edisto Riv. nr Montmorenci	185	168	35	122	95	78
EDO14 S. Fork Edisto River ab. Springfield	367	329	59	237	180	145
HUC402 Outlet	451	402	69	276	206	166
EDO05 S. Fork Edisto River near Denmark	714	631	117	428	317	252
EDO06 S. Fork Edisto River near Cope	774	654	119	435	322	256
EDO07 S. Fork Edisto River near Bamberg	949	801	125	472	339	270
EDO11 Edisto River near Branchville	1,890	1,452	318	979	725	614
HUC601 Outlet	2,021	1,468	267	899	642	521
EDO13 Edisto River near Givhans	2,593	1,751	217	994	658	520
EDO01 McTier Creek near Monetta	24	18	2	12	8	6
EDO02 McTier Creek near New Holland	49	37	5	26	17	13
Shaw Creek Outlet	132	116	23	83	59	48
EDO04 Dean Swamp Creek near Salley	25	25	10	21	18	16
EDO09 Bull Swamp Creek below Swansea	10	9	2	7	5	5
EDO08 Cedar Creek near Thor	19	18	8	15	13	12
HUC301 Outlet	254	229	62	169	125	107
HUC302 Outlet	447	405	115	301	226	196
EDO10 N. Fork Edisto Riv. at Orangeburg	724	653	172	479	354	306
HUC303 Outlet	760	684	185	503	373	322

Table 5-5. Surface water model simulation results at Strategic Nodes, Current Scenario. (Continued)

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
HUC602 Outlet	152	81	8	41	24	19
EDO12 Cow Castle Creek near Bowman	21	10	1	5	2	2
HUC501 Outlet	98	65	3	30	16	12
Four Hole Outlet	451	296	28	148	87	68

Table 5-6. Basin-wide surface water model simulation results, Current Scenario.

Performance Measure	Result
Total basin annual mean shortage (MGD)	1.5
Maximum water user shortage (MGD)	4.1
Total basin annual mean shortage (% of demand)	1.7%
Percentage of water users experiencing shortage	18%
Average frequency of shortage (%)	17%

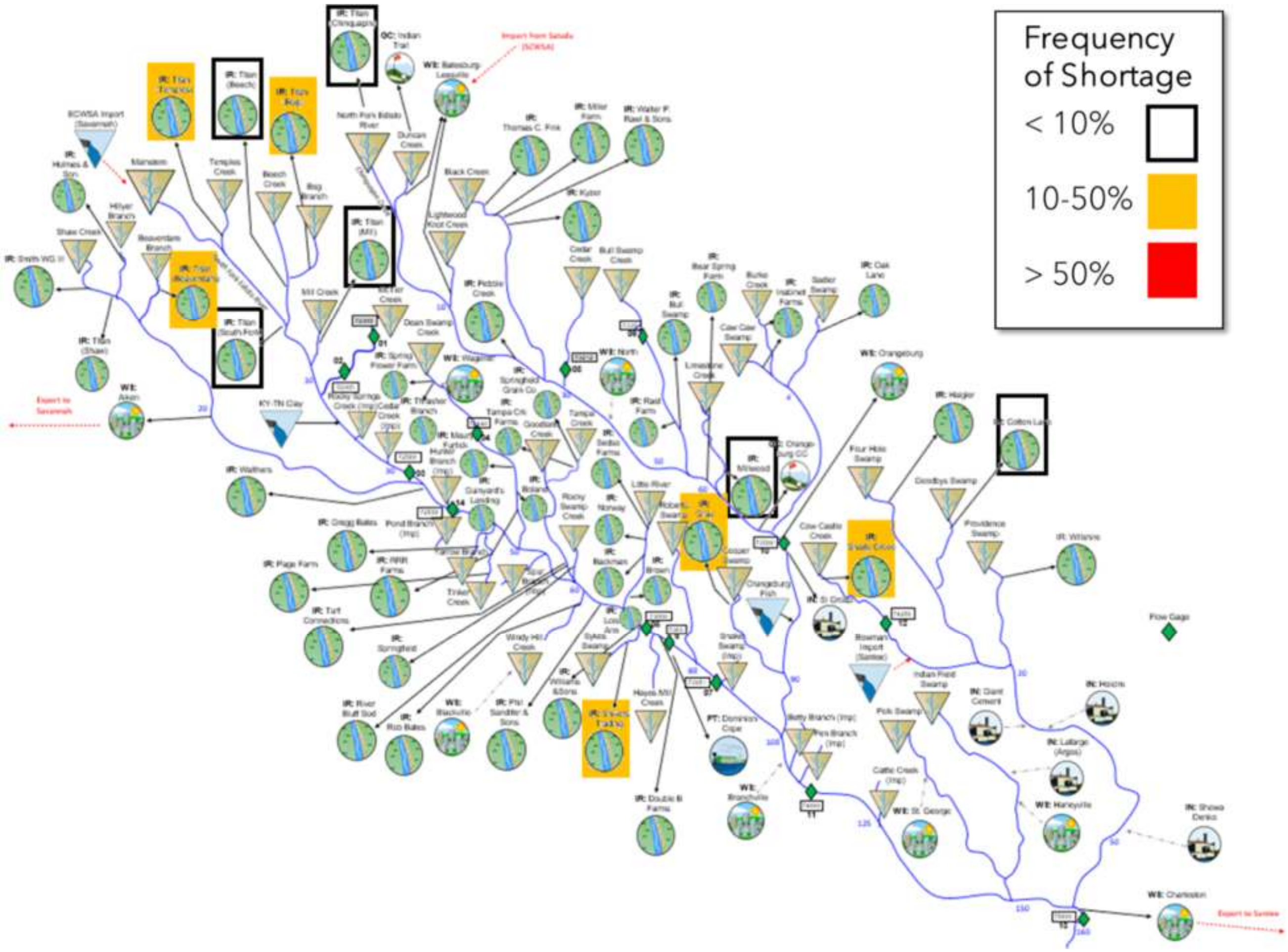


Figure 5-2. Water users with Surface Water Shortages and frequency of shortages, Current Scenario.

5.3.2 Permitted and Registered Surface Water Use Scenario

In the P&R Scenario, modeled demands were set to permitted or registered values for all water users. In other words, this simulation explored the question of, "what if all water users used the full volume of water allocated through permits and registrations?". The scenario provides information to determine whether surface water is currently over-allocated in the basin.

Simulation results for the P&R Scenario are summarized in Tables 5-7 through 5-10. In this scenario, river flows are predicted to decrease, compared to the Current Scenario, throughout the basin, resulting in Surface Water Shortages for nearly half of the surface water users. Table 5-7 lists only the surface water users with one or more months of a simulated Surface Water Shortage. The locations of these water users are shown on the SWAM model framework in Figure 5-3.

The percent decrease in P&R Scenario flow statistics compared to the Current Scenario are shown in Table 5-9. Modeled reductions are most pronounced during low flow periods. Mean and median flows at the most downstream site of the mainstem (Edisto River near Givhans) are predicted to decrease by approximately 23 to 36 percent respectively, if all upstream users withdrew water from the system at their permitted or registered amount. The impact of full allocation withdrawals on downstream water users is evident in the predicted increase in mean annual water shortage and the increase in the number and frequency of water users experiencing a shortage during the simulation period, as shown in Table 5-10. As explained in Chapter 4, the fully permitted and registered withdrawal rates greatly exceed current use rates. Despite the low likelihood of the P&R Scenario, the results demonstrate both that the surface water resources of the basin are over-allocated based on existing permit and registration amounts and that the current safe yield calculations allow for overallocation of the resource.

Table 5-7. Identified Surface Water Shortages, P&R Scenario.

Water User Name	Source Water	Average Annual Demand (MGD)	Minimum Physically Available Flow (MGD)	Maximum Shortage (MGD)	Frequency of Shortage (%)
IR: Titan - South Fork	Mainstem	4.41	3.43	0.93	0.5%
IR: Lois Ann	Mainstem	105.29	30.77	73.94	5.1%
IR: Williams & Sons	Mainstem	1.61	0.00	1.63	5.3%
WS: Charleston	Mainstem	287.23	58.53	231.47	12.4%
IR: Titan - Temples	Temples Creek	5.03	0.41	4.36	88.3%
IR: Titan - Bog	Bog Branch	6.88	0.22	6.41	99.9%
IR: Titan - Beech	Beech Creek	3.13	1.11	2.03	21.0%
IR: Titan - Mill	Mill Creek	1.32	0.71	0.61	5.1%
IR: Holmes & Son	Hillyer Branch	1.60	0.14	1.48	97.9%
IR: Titan - Beaverdam	Beaverdam Branch	0.86	0.18	0.68	60.0%
IR: Smith WG III	Shaw Creek	1.03	0.42	0.61	13.7%
WS: Aiken[1]	Shaw Creek	14.58	7.72	0.39	16.7%
IR: Page Farm	Tinker Creek	0.14	0.11	0.03	0.4%
IR: Thrasher Branch	Dean Swamp Creek	5.86	2.03	3.71	10.2%
IR: Springfield Grain Co	Tampa Creek	3.16	0.33	2.86	94.8%

Table 5-7. Identified Surface Water Shortages, P&R Scenario. (Continued)

Water User Name	Source Water	Average Annual Demand (MGD)	Minimum Physically Available Flow (MGD)	Maximum Shortage (MGD)	Frequency of Shortage (%)
IR: Tampa Creek Farms	Tampa Creek	1.99	0.27	1.74	86.7%
IR: Sedso Farms	Little River	14.81	2.68	12.26	72.3%
IR: Brown	Little River	0.57	0.03	0.54	64.5%
IR: Norway	Little River	0.99	0.17	0.83	72.4%
IR: Backman	Little River	1.99	0.06	2.03	78.1%
IR: Shivers Trading	Sykes Swamp	0.78	0.15	0.64	70.0%
WS: Batesburg-Leesville	Lightwood Knot Creek	2.47	4.23	0.60	50.0%
IR: Bull Swamp	Bull Swamp Creek	1.41	1.25	0.18	0.1%
IR: Millwood	Limestone Creek	8.93	2.04	5.59	24.5%
IR: Oak Lane	Sadler Swamp	1.29	0.36	0.94	51.3%
IR: Inabinet Farms	Caw Caw Swamp	1.60	4.69	0.69	10.0%
IR: Titan - Chinquapin	North Fork Edisto River	2.34	0.86	1.50	27.8%
IN: SI Group	North Fork Edisto River	90.91	55.45	35.99	1.0%
IR: Cotton Lane	Goodbys Swamp	1.85	0.13	1.74	39.3%
IR: Shady Grove	Cow Castle Creek	3.31	0.02	3.47	95.9%
IR: Willshire	Providence Swamp	0.60	0.40	0.20	0.1%
IR: Haigler	Four Hole Swamp	4.85	0.39	4.53	33.7%

IR = agricultural (irrigation) water user; WS = water supply water user; IN = industrial/manufacturing water user

[1] Aiken's average annual demand includes their combined demand from groundwater and surface water.

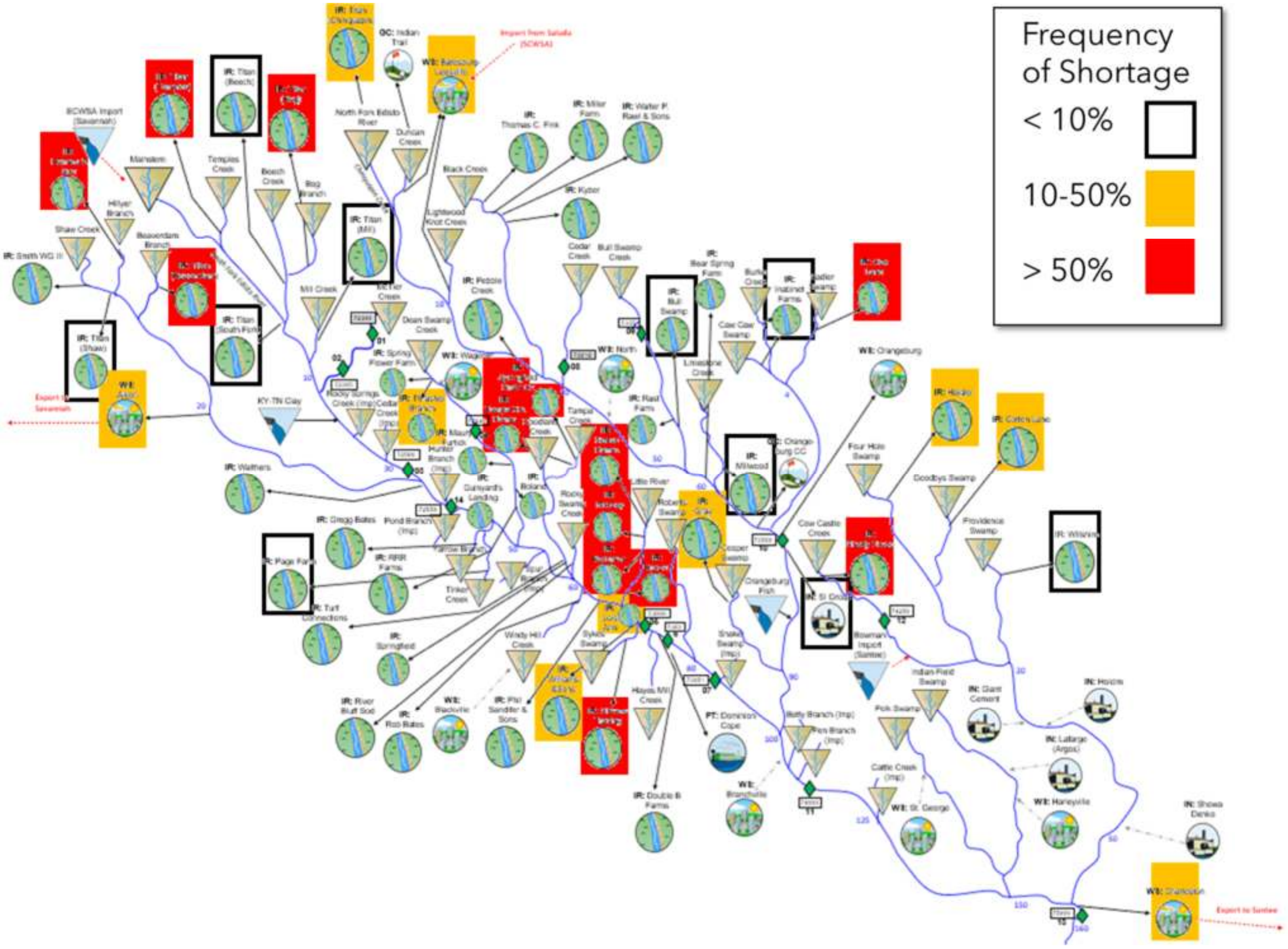


Figure 5-3. Water users with Surface Water Shortages and frequency of shortages, P&R Scenario.

Table 5-8. Surface water model simulation results at Strategic Nodes, P&R Scenario.

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
EDO03 S. Fork Edisto Riv. nr Montmorenci	172	154	35	112	88	73
EDO14 S. Fork Edisto River ab. Springfield	322	286	43	196	145	114
HUC402 Outlet	405	356	25	236	171	134
EDO05 S. Fork Edisto River near Denmark	617	535	2	345	244	190
EDO06 S. Fork Edisto River near Cope	675	554	2	351	248	193
EDO07 S. Fork Edisto River near Bamberg	831	678	20	366	245	215
EDO11 Edisto River near Branchville	1,718	1,276	169	818	570	489
HUC601 Outlet	1,798	1,238	63	689	441	351
EDO13 Edisto River near Givhans	1,987	1,126	0	411	89	0
EDO01 McTier Creek near Monetta	24	18	2	12	8	6

Table 5-8. Surface water model simulation results at Strategic Nodes, P&R Scenario. (Continued)

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
EDO02 McTier Creek near New Holland	49	37	5	26	17	13
Shaw Creek Outlet	116	99	14	68	46	36
EDO04 Dean Swamp Creek near Salley	12	11	2	7	4	4
EDO09 Bull Swamp Creek below Swansea	10	9	2	7	5	5
EDO08 Cedar Creek near Thor	19	18	8	15	13	12
HUC301 Outlet	248	224	59	164	120	103
HUC302 Outlet	437	393	109	292	218	187
EDO10 N. Fork Edisto Riv. at Orangeburg	622	548	86	382	260	211
HUC303 Outlet	705	627	142	446	319	267
HUC602 Outlet	152	81	8	41	24	19
EDO12 Cow Castle Creek near Bowman	20	10	1	5	2	2
HUC501 Outlet	89	55	2	24	13	10
Four Hole Outlet	441	286	27	141	83	65

Table 5-9. Percent change in P&R Scenario flows at Strategic Nodes relative to Current Scenario flows.

Strategic Node	Mean Flow	Median Flow	Surface Water Supply	Percentile Flows		
				25th	10th	5th
EDO03 S. Fork Edisto Riv. nr Montmorenci	-7%	-9%	-1%	-8%	-7%	-6%
EDO14 S. Fork Edisto River ab. Springfield	-12%	-13%	-27%	-17%	-20%	-21%
HUC402 Outlet	-10%	-11%	-64%	-15%	-17%	-19%
EDO05 S. Fork Edisto River near Denmark	-14%	-15%	-99%	-19%	-23%	-25%
EDO06 S. Fork Edisto River near Cope	-13%	-15%	-98%	-19%	-23%	-25%
EDO07 S. Fork Edisto River near Bamberg	-12%	-15%	-84%	-23%	-28%	-20%
EDO11 Edisto River near Branchville	-9%	-12%	-47%	-16%	-21%	-20%
HUC601 Outlet	-11%	-16%	-76%	-23%	-31%	-33%
EDO13 Edisto River near Givhans	-23%	-36%	-100%	-59%	-87%	-100%
EDO01 McTier Creek near Monetta	0%	0%	0%	0%	0%	0%
EDO02 McTier Creek near New Holland	0%	0%	0%	0%	0%	0%
Shaw Creek Outlet	-12%	-14%	-41%	-18%	-22%	-26%
EDO04 Dean Swamp Creek near Salley	-54%	-55%	-76%	-65%	-76%	-76%
EDO09 Bull Swamp Creek below Swansea	0%	0%	0%	0%	0%	0%
EDO08 Cedar Creek near Thor	0%	0%	0%	0%	0%	0%
HUC301 Outlet	-2%	-3%	-4%	-3%	-4%	-4%
HUC302 Outlet	-2%	-3%	-5%	-3%	-4%	-4%
EDO10 N. Fork Edisto Riv. at Orangeburg	-14%	-16%	-50%	-20%	-27%	-31%

Table 5-9. Percent change in P&R Scenario flows at Strategic Nodes relative to Current Scenario flows. (Continued)

Strategic Node	Mean Flow	Median Flow	Surface Water Supply	Percentile Flows		
				25th	10th	5th
HUC303 Outlet	-7%	-8%	-24%	-11%	-14%	-17%
HUC602 Outlet	0%	0%	0%	0%	0%	0%
EDO12 Cow Castle Creek near Bowman	-3%	-1%	0%	0%	0%	0%
HUC501 Outlet	-9%	-15%	-18%	-22%	-22%	-20%
Four Hole Outlet	-2%	-4%	-3%	-5%	-5%	-5%

Table 5-10. Basin-wide surface water model simulation results, P&R Scenario.

Performance Measure	Result
Total basin annual mean shortage (MGD)	23.9
Maximum water user shortage (MGD)	178.7
Total basin annual mean shortage (% of demand)	3.7%
Percentage of water users experiencing shortage	44%
Average frequency of shortage (%)	48%

5.3.3 Moderate Water Demand Projection Scenario

For the Moderate Scenario, modeled demands were set to projected future levels based on an assumption of moderate population and economic growth, as described in Chapters 4.3. Three different planning horizons–2030, 2050, and 2070–were targeted using the demand projections developed by SCDNR and presented in Chapter 4.4. The Moderate Scenario explores a plausible future where water demands increase with moderate population growth and agricultural expansion, and climate change impacts are negligible, in both the short and long term. For agricultural expansion, the specific locations for future new or expanded farms are not known, so a lumped spatial representation was applied in the model. Existing agricultural users' current demands were kept constant, and projected increases in demands for the agricultural sector were aggregated at the base of each subwatershed. The increase in demands was assigned proportionally to each subwatershed node according to the distribution of 2020 agricultural demands.

The Moderate Scenario simulation results for the 2070 planning horizon are summarized in Tables 5-11 through 5-13. Results for the 2030 and 2050 planning horizons are provided in Appendix C. The agricultural water users with shortages in the Current Scenario (Table 5-4) had the exact same shortages in the Moderate Scenario because their monthly demands were not increased. As noted above, new agricultural withdrawals were applied at the outlet to certain watersheds (not to existing agricultural water users). All new agricultural withdrawals are downstream of existing agricultural water users that experienced a simulated shortage. Furthermore, there are no non-agricultural withdrawals upstream of any of the agricultural water users that experienced a simulated shortage. Other than the agricultural users listed in Table 5-4, no other (or new aggregate) agricultural water user, or any non-agricultural water user experienced a shortage in the Moderate Scenario simulations.

In the Moderate Scenario, flows are predicted to decrease modestly, compared to the Current Use Scenario, throughout the basin. Modeled reductions are most pronounced during low flow periods. At the most downstream Strategic Node (EDO13 Edisto River near Givhans), mean and median flows are predicted to decrease by approximately 5 percent, and low flows by about 20 percent, by 2070 if population and economic growth is moderate and climate change impacts are negligible. Calculated water user shortages remain essentially unchanged, relative to the Current Scenario. Given current climate conditions and existing basin management and regulatory structure, basin surface water supplies are predicted to be adequate to meet increased demands resulting from moderate economic and population growth, and assuming the continued use of farm ponds that, while not simulated, are likely to prevent many of the observed Current and Moderate Scenario agricultural shortages.

Table 5-11. Surface water model simulation results at Strategic Nodes, Moderate 2070 Scenario.

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
EDO03 S. Fork Edisto Riv. nr Montmorenci	185	168	35	122	95	78
EDO14 S. Fork Edisto River ab. Springfield	359	322	45	229	169	132
HUC402 Outlet	441	394	49	268	195	151
EDO05 S. Fork Edisto River near Denmark	704	623	96	415	304	236
EDO06 S. Fork Edisto River near Cope	764	644	98	422	309	240
EDO07 S. Fork Edisto River near Bamberg	932	783	106	452	319	245
EDO11 Edisto River near Branchville	1869	1433	286	954	698	586
HUC601 Outlet	1999	1446	234	872	611	493
EDO13 Edisto River near Givhans	2475	1633	89	863	539	393
EDO01 McTier Creek near Monetta	24	18	2	12	8	6
EDO02 McTier Creek near New Holland	49	37	5	26	17	13
Shaw Creek Outlet	128	112	19	79	55	44
EDO04 Dean Swamp Creek near Salley	25	25	10	21	18	16
EDO09 Bull Swamp Creek below Swansea	10	9	2	7	5	5
EDO08 Cedar Creek near Thor	19	18	8	15	13	12
HUC301 Outlet	253	229	59	167	123	105
HUC302 Outlet	446	405	112	299	224	195
EDO10 N. Fork Edisto Riv. at Orangeburg	722	652	168	476	352	305
HUC303 Outlet	755	681	176	497	366	316
HUC602 Outlet	150	79	6	39	22	17
EDO12 Cow Castle Creek near Bowman	21	10	1	5	2	2
HUC501 Outlet	97	64	3	30	16	12
Four Hole Outlet	441	287	19	139	77	59

Table 5-12. Percent change in Moderate 2070 Scenario flows at Strategic Nodes relative to Current Scenario flows.

Strategic Node	Mean Flow	Median Flow	Surface Water Supply	Percentile Flows		
				25th	10th	5th
EDO03 S. Fork Edisto Riv. nr Montmorenci	0.0%	0.0%	0%	0.0%	0.0%	0.0%
EDO14 S. Fork Edisto River ab. Springfield	-2.2%	-2.2%	-24%	-3.4%	-6.2%	-9.0%
HUC402 Outlet	-2.2%	-2.0%	-30%	-2.8%	-5.7%	-9.0%
EDO05 S. Fork Edisto River near Denmark	-1.4%	-1.2%	-18%	-3.1%	-4.0%	-6.5%
EDO06 S. Fork Edisto River near Cope	-1.3%	-1.5%	-17%	-3.1%	-4.1%	-6.4%
EDO07 S. Fork Edisto River near Bamberg	-1.8%	-2.2%	-16%	-4.2%	-5.7%	-9.1%
EDO11 Edisto River near Branchville	-1.2%	-1.4%	-10%	-2.5%	-3.6%	-4.6%
HUC601 Outlet	-1.1%	-1.5%	-12%	-3.0%	-4.7%	-5.4%
EDO13 Edisto River near Givhans	-4.6%	-6.7%	-59%	-13.1%	-18.1%	-24.3%
EDO01 McTier Creek near Monetta	0.0%	0.0%	0%	0.0%	0.0%	0.0%
EDO02 McTier Creek near New Holland	0.0%	0.0%	0%	0.0%	0.0%	0.0%
Shaw Creek Outlet	-2.9%	-3.3%	-18%	-5.0%	-7.1%	-8.7%
EDO04 Dean Swamp Creek near Salley	0.1%	0.1%	0%	0.1%	0.1%	0.1%
EDO09 Bull Swamp Creek below Swansea	0.0%	0.0%	0%	0.0%	0.0%	0.0%
EDO08 Cedar Creek near Thor	0.0%	0.0%	0%	0.0%	0.0%	0.0%
HUC301 Outlet	-0.4%	-0.3%	-4%	-1.3%	-1.3%	-1.4%
HUC302 Outlet	-0.3%	-0.1%	-2%	-0.5%	-1.0%	-0.5%
EDO10 N. Fork Edisto Riv. at Orangeburg	-0.2%	-0.2%	-2%	-0.4%	-0.6%	-0.5%
HUC303 Outlet	-0.5%	-0.4%	-5%	-1.1%	-1.7%	-1.9%
HUC602 Outlet	-1.4%	-2.5%	-23%	-5.0%	-7.4%	-11.1%
EDO12 Cow Castle Creek near Bowman	0.0%	0.0%	0%	0.0%	0.0%	0.0%
HUC501 Outlet	-0.3%	-0.7%	-15%	-1.3%	-2.4%	-4.0%
Four Hole Outlet	-2.2%	-3.1%	-32%	-6.4%	-11.1%	-13.5%

Table 5-13. Basin-wide surface water model simulation results, Moderate 2070 Scenario.

Performance Measure	Result
Total basin annual mean shortage (MGD)	1.5
Maximum water user shortage (MGD)	4.1
Total basin annual mean shortage (% of demand)	1.0%
Percentage of water users experiencing shortage	18%
Average frequency of shortage (%)	17%

5.3.4 High Water Demand Projection Scenario

For the High Demand Scenario, modeled demands are set to the 90th percentile of variability in reported withdrawals for each user, and the projections are based on aggressive growth within the range of uncertainty of the referenced driver variable projections, as described in Chapter 4. Like the Moderate Scenario, three different planning horizons–2030, 2050, and 2070–were targeted using the demand projections developed by SCDNR. This set of scenarios represents the combined impacts of all sectors experiencing high growth and all water users experiencing conditions of high water demand. These assumptions are intended to represent an unlikely maximum for total water demand; it is very unlikely these demands would occur month after month and year after year for all water users. The purpose of this scenario is to provide the RBC with information on which to base conservative management strategies. Other methods and assumptions used in constructing the High Demand Scenario were the same as for the Moderate Scenario.

The High Demand Scenario simulation results for the 2070 planning horizon are summarized in Tables 5-14 through 5-17. Results for the other two planning horizons are provided in Appendix C. The agricultural water users with shortages in the Current Scenario (Table 5-4) had the exact same shortages in the High Demand Scenario because their monthly demands were not increased. However, unlike the Moderate Scenario, there were three new shortages in the High Demand Scenario, as shown in Table 5-14. CWS, Aiken, and Batesburg-Leesville each had shortages ranging from 1 to 2 months during the 2002 drought of record. Due to the additional users experiencing infrequent shortages, the average frequency with shortage metric is slightly lower than that of the Current Use Scenario. Similarly, the total basin annual mean shortage as a percent of total demand is also slightly lower for the High Demand Scenario than the Current Use Scenario because the increase in total basin demand is larger than the increase in shortages.

Table 5-14. Identified Surface Water Shortages, High Demand 2070 Scenario[1].

Water User Name	Source Water	Average Annual Demand (MGD)	Minimum Physically Available Flow (MGD)	Maximum Shortage (MGD)	Frequency of Shortage (%)
WS: Charleston	Mainstem	133	142	5.1	0.2%
WS: Aiken	Shaw Creek	13	8	0.3	0.1%
WS: Batesburg-Leesville	Lightwood Knot Crk.	4	4	0.7	0.2%

[1] The same agricultural water user shortages identified in Table 5-4 were also present in the High Demand 2070 Scenario.

In the High Demand Scenario, river flows are predicted to decrease modestly, compared to the Current Scenario, throughout the basin. Modeled reductions are most pronounced during low flow periods. Mean and median flows at the most downstream site of the mainstem (Edisto River near Givhans) are predicted to decrease by approximately 10 percent, and low flows by upwards of 40 percent, by 2070. Calculated water user shortages increase slightly, in terms of both duration and intensity, for the 2070 planning horizon, as compared to the Current Scenario results.

Table 5-15. Surface water model simulation results at Strategic Nodes, High Demand 2070 Scenario.

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
EDO03 S. Fork Edisto Riv. nr Montmorenci	185	168	35	122	95	78
EDO14 S. Fork Edisto River ab. Springfield	352	316	34	223	160	123
HUC402 Outlet	429	382	30	254	176	134
EDO05 S. Fork Edisto River near Denmark	692	613	78	404	288	219
EDO06 S. Fork Edisto River near Cope	752	635	80	412	293	223
EDO07 S. Fork Edisto River near Bamberg	917	769	90	435	301	226
EDO11 Edisto River near Branchville	1,843	1,411	247	924	666	541
HUC601 Outlet	1,973	1,407	196	845	573	452
EDO13 Edisto River near Givhans	2,396	1,570	0	780	451	299
EDO01 McTier Creek near Monetta	24	18	2	12	8	6
EDO02 McTier Creek near New Holland	49	37	5	26	17	13
Shaw Creek Outlet	123	107	14	74	49	38
EDO04 Dean Swamp Creek near Salley	25	25	10	21	18	16
EDO09 Bull Swamp Creek below Swansea	10	9	2	7	5	5
EDO08 Cedar Creek near Thor	19	18	8	15	13	12
HUC301 Outlet	252	228	58	166	122	104
HUC302 Outlet	445	403	111	299	222	194
EDO10 N. Fork Edisto Riv. at Orangeburg	710	640	155	464	340	292
HUC303 Outlet	747	675	161	485	356	303
HUC602 Outlet	151	80	7	40	23	18
EDO12 Cow Castle Creek near Bowman	21	10	1	5	2	2
HUC501 Outlet	97	64	2	29	15	11
Four Hole Outlet	443	290	21	141	79	61

Table 5-16. Percent change in High Demand 2070 Scenario flows at Strategic Nodes relative to Current Scenario flows.

Strategic Node	Mean Flow	Median Flow	Surface Water Supply	Percentile Flows		
				25th	10th	5th
EDO03 S. Fork Edisto Riv. nr Montmorenci	0.0%	0.0%	0%	0.0%	0.0%	0.0%
EDO14 S. Fork Edisto River ab. Springfield	-4.0%	-4.0%	-43%	-5.7%	-11.1%	-14.7%
HUC402 Outlet	-5.0%	-4.8%	-56%	-7.7%	-14.7%	-19.3%
EDO05 S. Fork Edisto River near Denmark	-3.1%	-2.8%	-33%	-5.5%	-9.2%	-13.0%
EDO06 S. Fork Edisto River near Cope	-2.8%	-2.9%	-33%	-5.4%	-9.1%	-12.8%
EDO07 S. Fork Edisto River near Bamberg	-3.3%	-3.9%	-28%	-7.7%	-11.2%	-16.3%
EDO11 Edisto River near Branchville	-2.5%	-2.9%	-22%	-5.6%	-8.1%	-11.8%
HUC601 Outlet	-2.4%	-4.1%	-27%	-6.0%	-10.6%	-13.2%

Table 5-16. Percent change in HD 2070 Scenario flows at Strategic Nodes relative to Current Scenario flows. (Continued)

Strategic Node	Mean Flow	Median Flow	Surface Water Supply	Percentile Flows		
				25th	10th	5th
EDO13 Edisto River near Givhans	-7.6%	-10.3%	-100%	-21.5%	-31.5%	-42.5%
EDO01 McTier Creek near Monetta	0.0%	0.0%	0%	0.0%	0.0%	0.0%
EDO02 McTier Creek near New Holland	0.0%	0.0%	0%	0.0%	0.0%	0.0%
Shaw Creek Outlet	-6.5%	-7.5%	-40%	-11.1%	-16.6%	-20.1%
EDO04 Dean Swamp Creek near Salley	0.3%	0.2%	1%	0.3%	0.4%	0.4%
EDO09 Bull Swamp Creek below Swansea	0.0%	0.0%	0%	0.0%	0.0%	0.0%
EDO08 Cedar Creek near Thor	0.0%	0.0%	0%	0.0%	0.0%	0.0%
HUC301 Outlet	-0.8%	-0.8%	-7%	-2.0%	-2.4%	-2.6%
HUC302 Outlet	-0.5%	-0.5%	-4%	-0.8%	-1.6%	-1.0%
EDO10 N. Fork Edisto Riv. at Orangeburg	-1.8%	-1.9%	-10%	-3.0%	-4.1%	-4.5%
HUC303 Outlet	-1.7%	-1.3%	-13%	-3.4%	-4.4%	-5.8%
HUC602 Outlet	-0.7%	-1.1%	-9%	-2.4%	-3.0%	-5.3%
EDO12 Cow Castle Creek near Bowman	0.0%	0.0%	0%	0.0%	0.0%	0.0%
HUC501 Outlet	-0.7%	-1.7%	-38%	-3.1%	-6.1%	-6.8%
Four Hole Outlet	-1.7%	-2.2%	-24%	-4.9%	-8.5%	-10.3%

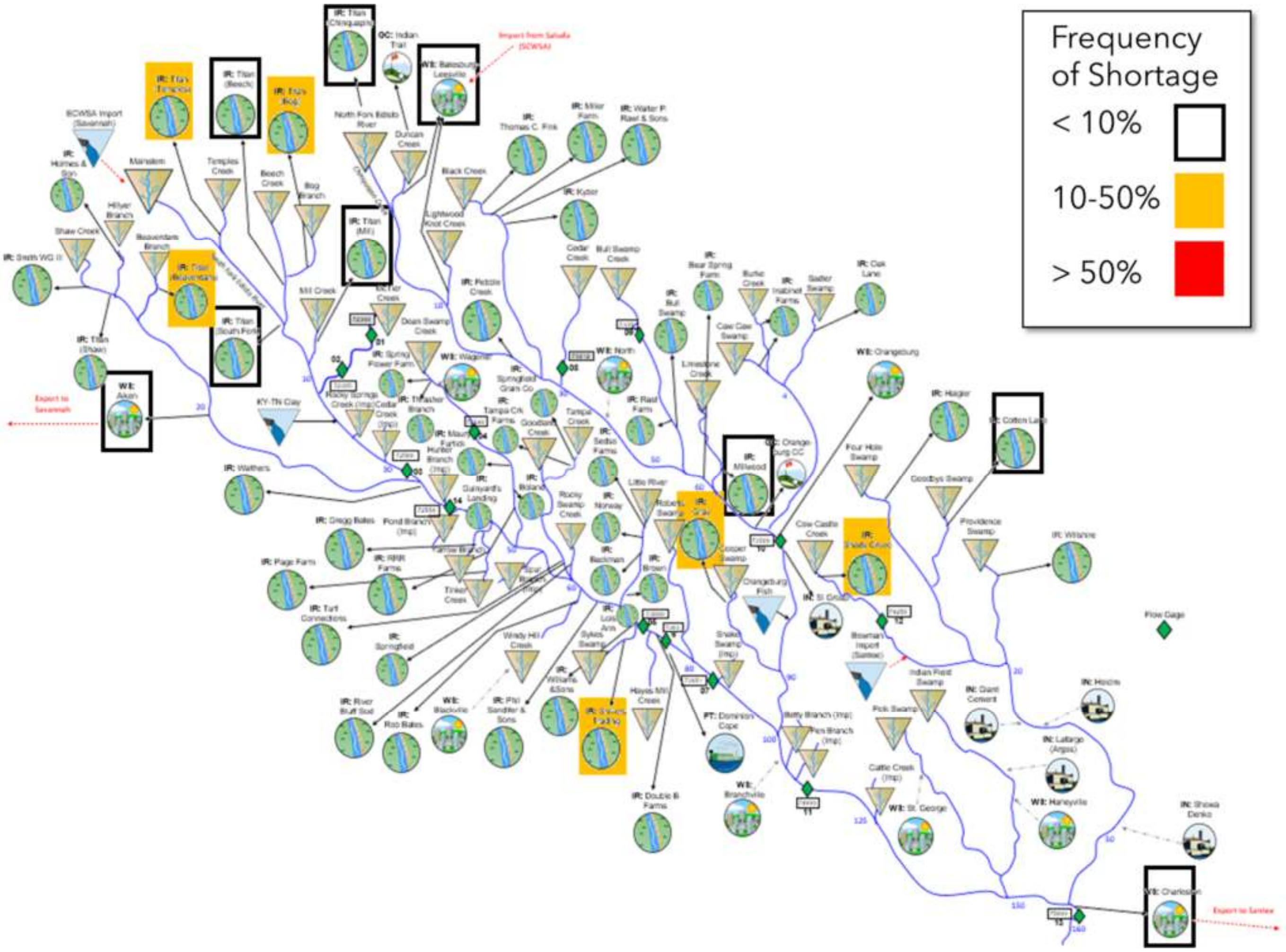


Figure 5-4. Water users with Surface Water Shortages and frequency of shortages, High Demand 2070 Scenario

Table 5-17. Basin-wide surface water model simulation results, High Demand 2070 Scenario.

Performance Measure	Result
Total basin annual mean shortage (MGD)	1.6
Maximum water user shortage (MGD)	5.1
Total basin annual mean shortage (% of demand)	0.7%
Percentage of water users experiencing shortage	20%
Average frequency of shortage (%)	13%

Daily simulation results of the high demand scenario, for the 2070 planning horizon, are summarized in Table 5-18 through 5-20. Not surprisingly, mean modeled flows are similar for the two different calculation timesteps, but modeled extreme low flows (5th percentile) are lower for the daily timestep model compared to the monthly timestep model. A greater range of flow variability is simulated with the higher resolution daily model, compared to the monthly model. Due to the higher temporal resolution, the daily model captures a basin maximum daily water user shortage that is significantly higher than that quantified by the monthly timestep model. Further details on the daily simulation of the drought of record are provided below.

Table 5-18. Daily timestep surface water model simulation results at Strategic Nodes, High Demand 2070 Scenario.

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
EDO03 S. Fork Edisto Riv. nr Montmorenci	184	159	28	113	85	69
EDO14 S. Fork Edisto River ab. Springfield	351	303	26	205	141	109
HUC402 Outlet	428	365	21	234	155	116
EDO05 S. Fork Edisto River near Denmark	688	584	63	372	256	197
EDO06 S. Fork Edisto River near Cope	750	605	64	379	261	201
EDO07 S. Fork Edisto River near Bamberg	919	731	74	401	267	209
EDO11 Edisto River near Branchville	1,851	1,352	185	865	602	482
HUC601 Outlet	1,994	1,356	145	787	523	400
EDO13 Edisto River near Givhans	2,397	1,459	0	697	375	222
EDO01 McTier Creek near Monetta	24	16	1	10	6	5
EDO02 McTier Creek near New Holland	49	33	2	22	14	11
Shaw Creek Outlet	123	102	11	67	44	33
EDO04 Dean Swamp Creek near Salley	25	24	8	20	17	15
EDO09 Bull Swamp Creek below Swansea	10	9	1	6	4	4
EDO08 Cedar Creek near Thor	19	18	6	15	12	11
HUC301 Outlet	252	218	42	155	113	92
HUC302 Outlet	445	386	81	279	208	172
EDO10 N. Fork Edisto Riv. at Orangeburg	709	612	107	432	314	255
HUC303 Outlet	746	644	108	454	330	266
HUC602 Outlet	151	65	5	31	19	14
EDO12 Cow Castle Creek near Bowman	21	8	0	4	2	1
HUC501 Outlet	91	52	0	22	12	7
Four Hole Outlet	419	235	13	110	62	45

Table 5-19. Percent change in High Demand 2070 Scenario daily flows at Strategic Nodes relative to Current Scenario daily flows.

Strategic Node	Mean Flow	Median Flow	Surface Water Supply	Percentile Flows		
				25th	10th	5th
EDO03 S. Fork Edisto Riv. nr Montmorenci	0.0%	0.0%	0%	0.0%	0.0%	0.0%
EDO14 S. Fork Edisto River ab. Springfield	-4.1%	-4.3%	-39%	-7.0%	-12.3%	-16.1%
HUC402 Outlet	-5.0%	-4.9%	-54%	-8.9%	-16.4%	-22.3%
EDO05 S. Fork Edisto River near Denmark	-3.1%	-3.2%	-30%	-6.4%	-10.1%	-14.2%
EDO06 S. Fork Edisto River near Cope	-2.9%	-3.1%	-29%	-6.3%	-10.0%	-13.8%
EDO07 S. Fork Edisto River near Bamberg	-3.3%	-4.1%	-24%	-8.5%	-12.5%	-14.8%
EDO11 Edisto River near Branchville	-2.5%	-3.2%	-19%	-6.1%	-9.5%	-11.1%
HUC601 Outlet	-2.3%	-3.8%	-23%	-6.6%	-11.0%	-13.6%
EDO13 Edisto River near Givhans	-7.6%	-11.9%	-70%	-23.0%	-36.7%	-49.8%
EDO01 McTier Creek near Monetta	0.0%	0.0%	0%	0.0%	0.0%	0.0%
EDO02 McTier Creek near New Holland	0.0%	0.0%	0%	0.0%	0.0%	0.0%
Shaw Creek Outlet	-6.5%	-7.7%	-31%	-12.1%	-18.4%	-22.9%
EDO04 Dean Swamp Creek near Salley	0.3%	0.3%	0%	0.4%	0.4%	0.4%
EDO09 Bull Swamp Creek below Swansea	0.0%	0.0%	0%	0.0%	0.0%	0.0%
EDO08 Cedar Creek near Thor	0.0%	0.0%	0%	0.0%	0.0%	0.0%
HUC301 Outlet	-0.8%	-0.9%	-5%	-1.7%	-2.6%	-3.5%
HUC302 Outlet	-0.5%	-0.5%	-3%	-1.0%	-1.5%	-1.7%
EDO10 N. Fork Edisto Riv. at Orangeburg	-1.8%	-2.1%	-9%	-3.1%	-4.5%	-5.4%
HUC303 Outlet	-1.7%	-1.9%	-14%	-3.4%	-5.3%	-7.2%
HUC602 Outlet	-0.7%	-1.7%	-9%	-2.7%	-4.5%	-6.8%
EDO12 Cow Castle Creek near Bowman	0.0%	0.0%	0%	0.0%	0.0%	0.0%
HUC501 Outlet	-0.8%	-1.0%	-33%	-3.5%	-6.8%	-12.4%
Four Hole Outlet	-1.8%	-3.0%	-24%	-6.3%	-10.3%	-14.1%

Table 5-20. Basin-wide surface water model daily simulation results, High Demand 2070 Scenario.

Performance Measure	Result
Total basin annual mean shortage (MGD)	1.8
Maximum water user shortage (MGD)	48
Total basin annual mean shortage (% of demand)	0.8%
Percentage of water users experiencing shortage	22%
Average frequency of shortage (%)	13%

The model's daily simulation results presented in Figures 5-5 and 5-6 focus on the 2002 drought of record (i.e., the worst recorded drought in the basin since data collection began). Shown are the 2070 High Demand Scenario demands and simulated shortages for Charleston Water System (CWS) on the Edisto River (Figure 5-5) and Aiken on Shaw Creek (Figure 5-6). The demands and shortages are plotted (on a logarithmic scale) along with the river or creek flow at the point of withdrawal, which represents the physically available water supply (not accounting for limitations on withdrawal due to intake height or other factors). The shorter timestep results highlight the risk of future short duration water shortages, as projected by the model for the 2070 High Demand Scenario. The model projects that a combination of 2002 hydrologic conditions and the 2070 High Demand Scenario demands would result in 33 days of shortages for CWS and 41 days of shortages for Aiken. Further, the model simulates short term water shortages for CWS and Aiken (as selected examples) of approximately 30 percent and 10 percent, respectively, of their total projected demands.

Both CWS and Aiken have multiple sources of water. CWS may also withdraw from the Bushy Creek and Goose Creek reservoirs in the Santee River basin. Aiken can release water from the Mason Branch reservoir to augment flows in Shaw Creek, if necessary. The release of flow from Mason Branch reservoir was not simulated in the model. Aiken also uses groundwater wells to meet a portion of its demand; however, the ability to rely on groundwater to make up for shortages in its surface water supply is unknown.

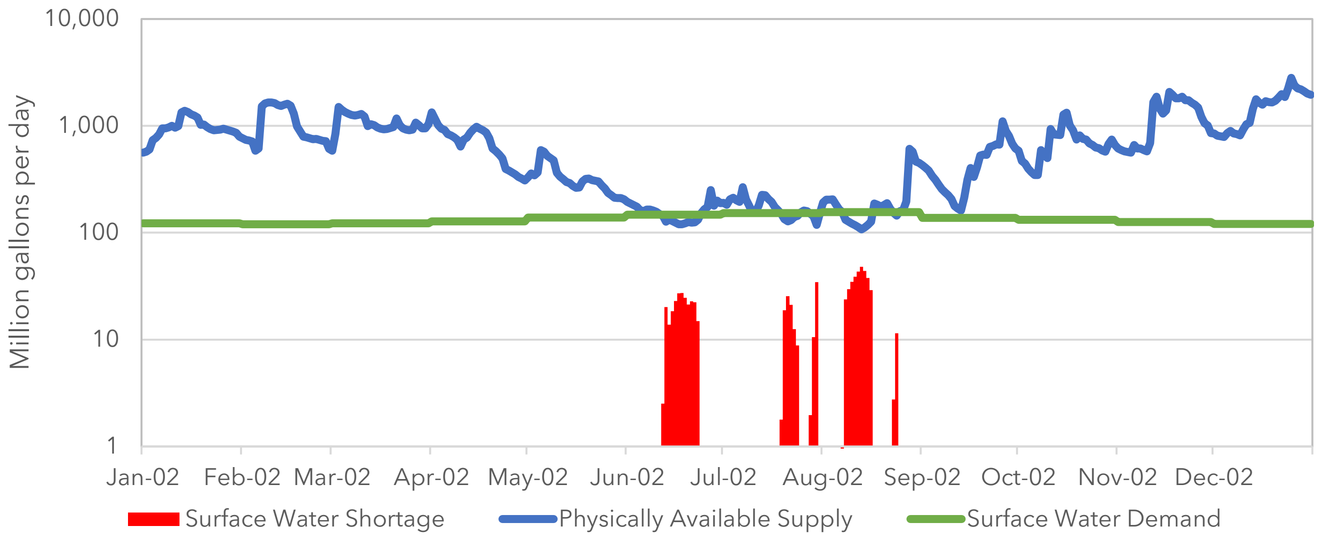


Figure 5-5. High Demand 2070 Scenario daily simulation results during the 2002 drought of record for the CWS withdrawal on the Edisto River.

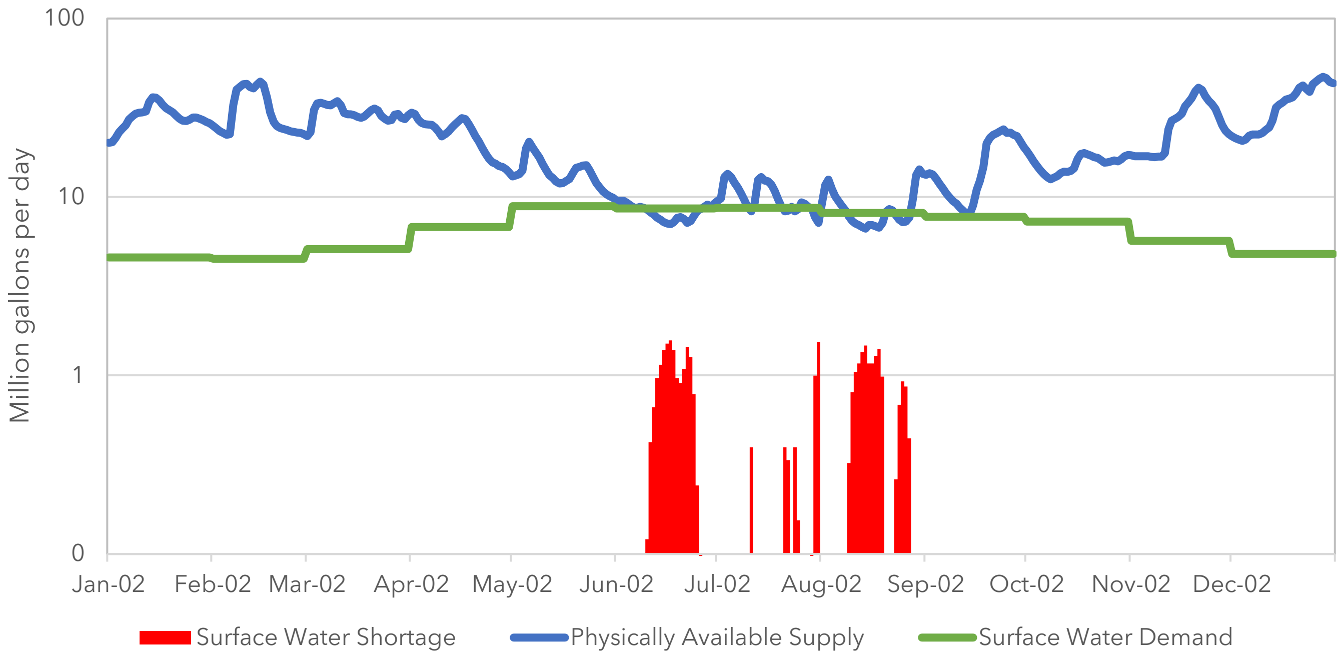


Figure 5-6. High Demand 2070 Scenario daily simulation results during the 2002 drought of record for the Aiken withdrawal on Shaw Creek.

5.3.5 Unimpaired Flow Scenario

At the request of the RBC, the SWAM model was used to simulate unimpaired flows (UIFs) throughout the Edisto River basin. For this simulation, all water demands and discharges in the model were set to zero. Simulation results represent river hydrologic conditions without the impact of surface water users, dischargers, or water imports, as modeled. In other words, results represent "naturalized" surface water conditions in the basin. The scenario does not represent fully unimpaired basin conditions, however, because a cessation in groundwater pumping would impact baseflows in some portions of the basin, and that interaction was not explicitly simulated in this scenario.

UIF Scenario monthly simulation results are summarized in Tables 5-21 and 5-22. Simulated UIFs are generally higher than simulated Current Scenario flows, as expected. This reflects the removal of consumptive water use for the UIF Scenario simulation. However, in some locations, simulated UIFs are lower than Current Scenario flows (e.g., HUC602 outlet). This reflects the removal of pumped groundwater returns in the system for the UIF simulation. The lack of groundwater returns in these locations more than offsets the lack of consumptive surface water use. Near Givhans, mean and median unimpaired flows are approximately 3 and 4 percent higher than Current Scenario flows, respectively. At this same location, UIF low flows (25th – 5th percentile) are approximately 10 to 20 percent higher than Current Scenario flows.

Table 5-21. Surface water model simulation results at Strategic Nodes, UIF Scenario.

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
EDO03 S. Fork Edisto Riv. nr Montmorenci	193	176	45	131	104	88
EDO14 S. Fork Edisto River ab. Springfield	382	346	87	252	199	166
HUC402 Outlet	467	417	98	293	226	187
EDO05 S. Fork Edisto River near Denmark	732	649	148	449	340	281
EDO06 S. Fork Edisto River near Cope	792	669	151	456	345	285
EDO07 S. Fork Edisto River near Bamberg	964	816	154	490	360	295
EDO11 Edisto River near Branchville	1,916	1,476	370	1,009	757	641
HUC601 Outlet	2,047	1,490	319	932	676	551
EDO13 Edisto River near Givhans	2,667	1,826	333	1,095	755	618
EDO01 McTier Creek near Monetta	24	18	2	12	8	6
EDO02 McTier Creek near New Holland	49	37	5	26	17	13
Shaw Creek Outlet	134	117	28	86	63	52
EDO04 Dean Swamp Creek near Salley	25	24	10	21	18	16
EDO09 Bull Swamp Creek below Swansea	10	9	2	7	5	5
EDO08 Cedar Creek near Thor	19	18	8	15	13	12
HUC301 Outlet	257	232	66	172	128	110
HUC302 Outlet	450	406	120	305	230	199
EDO10 N. Fork Edisto Riv. at Orangeburg	742	670	195	502	376	325
HUC303 Outlet	770	694	202	517	388	336
HUC602 Outlet	148	77	4	37	20	15
EDO12 Cow Castle Creek near Bowman	21	11	1	5	3	2
HUC501 Outlet	98	65	3	31	17	13
Four Hole Outlet	437	284	14	136	74	56

Table 5-22. Percent change in UIF Scenario flows at Strategic Nodes relative to Current Scenario flows.

Strategic Node	Mean Flow	Median Flow	Surface Water Supply	Percentile Flows		
				25th	10th	5th
EDO03 S. Fork Edisto Riv. nr Montmorenci	4.5%	4.5%	27%	7.4%	9.9%	13.7%
EDO14 S. Fork Edisto River ab. Springfield	4.1%	4.9%	49%	6.5%	10.3%	14.6%
HUC402 Outlet	3.4%	3.7%	41%	6.2%	9.4%	12.9%
EDO05 S. Fork Edisto River near Denmark	2.5%	2.8%	27%	4.8%	7.3%	11.3%
EDO06 S. Fork Edisto River near Cope	2.4%	2.3%	27%	4.8%	7.0%	11.2%
EDO07 S. Fork Edisto River near Bamberg	1.6%	1.9%	23%	3.8%	6.4%	9.4%
EDO11 Edisto River near Branchville	1.4%	1.6%	16%	3.0%	4.4%	4.4%
HUC601 Outlet	1.3%	1.5%	20%	3.7%	5.3%	5.7%

Table 5-22. Percent change in UIF Scenario flows at Strategic Nodes relative to Current Scenario flows. (Continued)

Strategic Node	Mean Flow	Median Flow	Surface Water Supply	Percentile Flows		
				25th	10th	5th
EDO13 Edisto River near Givhans	2.9%	4.3%	53%	10.2%	14.7%	18.8%
EDO01 McTier Creek near Monetta	0.0%	0.0%	0%	0.0%	0.0%	0.0%
EDO02 McTier Creek near New Holland	0.0%	0.0%	0%	0.0%	0.0%	0.0%
Shaw Creek Outlet	2.0%	1.0%	21%	3.5%	6.0%	8.6%
EDO04 Dean Swamp Creek near Salley	-0.4%	-0.4%	-1%	-0.4%	-0.5%	-0.5%
EDO09 Bull Swamp Creek below Swansea	0.0%	0.0%	0%	0.0%	0.0%	0.0%
EDO08 Cedar Creek near Thor	0.0%	0.0%	0%	0.0%	0.0%	0.0%
HUC301 Outlet	0.9%	1.1%	7%	1.7%	2.6%	3.2%
HUC302 Outlet	0.6%	0.4%	4%	1.5%	1.7%	1.4%
EDO10 N. Fork Edisto Riv. at Orangeburg	2.5%	2.6%	14%	4.8%	6.2%	6.1%
HUC303 Outlet	1.4%	1.5%	9%	2.9%	4.2%	4.2%
HUC602 Outlet	-2.9%	-5.3%	-51%	-10.3%	-17.1%	-22.7%
EDO12 Cow Castle Creek near Bowman	2.5%	6.0%	7%	7.1%	7.1%	7.1%
HUC501 Outlet	0.4%	0.6%	8%	3.0%	3.4%	5.7%
Four Hole Outlet	-3.0%	-4.2%	-48%	-8.4%	-15.3%	-18.6%

5.3.6 Application of Biological Response Metrics

The biological response metrics developed by Bower et al (2022) were correlated to model-simulated flows from the various planning scenarios to assess the potential for ecological risk. The results of this assessment are not presented in their entirety, but rather illustrated by example for the various biological response metrics used (as discussed in Chapter 5.2.2). Generally, the study demonstrated that the simulated flow regimes of the Moderate, HD, and P&R Scenarios are likely to result in low ecological risk in most primary and secondary tributaries of the Edisto River basin.

The consistent methodology employed is discussed in Bower et al (2022) and summarized in this plan in Chapters 3.2.2 and 5.2.1. Fundamentally, the four selected hydrologic metrics (mean daily flow, base flow index, duration of low flow, and timing of low flow) are compared to current conditions and expressed as a percent change. This percent change is converted into a percent change in the biological response metric using the pre-developed correlation relationships between these factors, and ultimately plotted on a risk scale. Table 5-23 and Figure 5-7 illustrate how the process works.

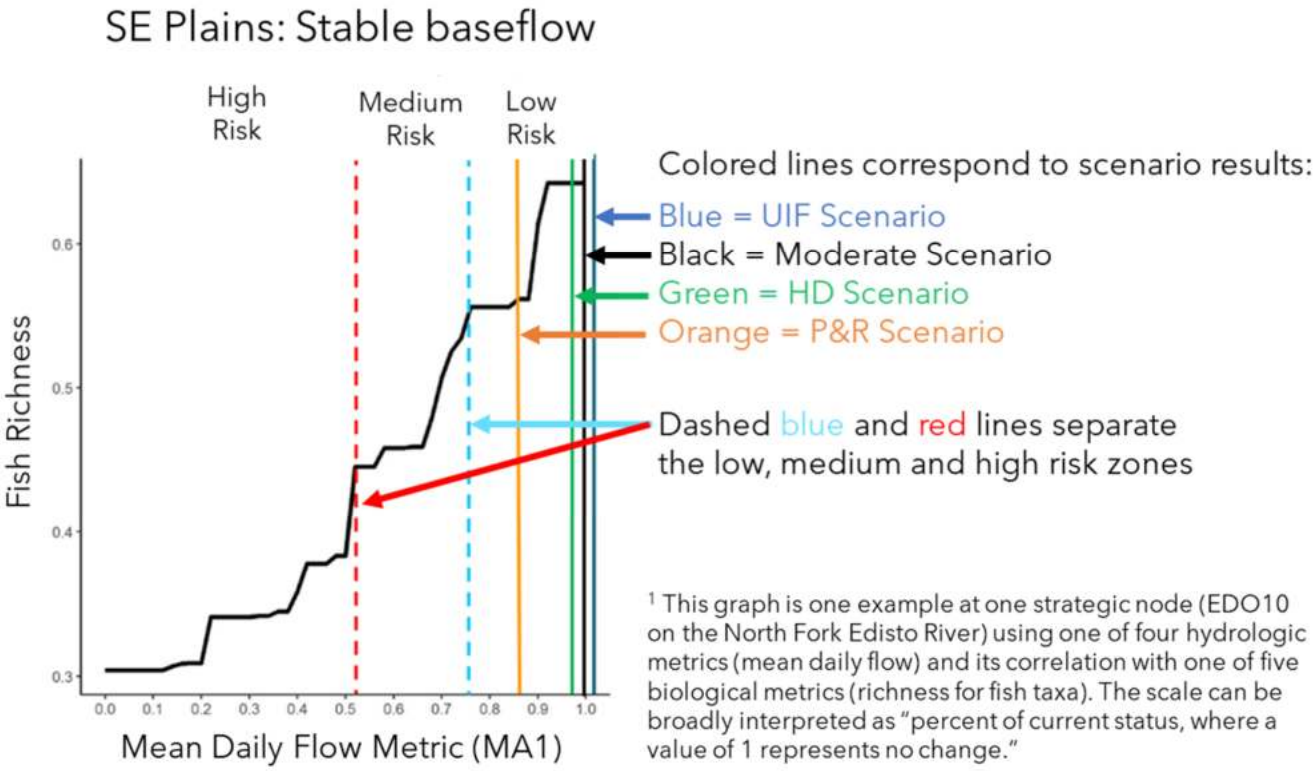
Once the changes in biological response metrics are calculated, they are converted into a risk chart, as shown in Figure 5-7. The three risk categories, high, medium, and low, are determined by sudden and significant changes in biological health, driven by the change in the hydrologic metric.

Biological response metrics were applied at Strategic Nodes in the North Fork, South Fork, Four Hole Swamp, and Edisto subbasins. Figure 5-8 presents representative results for many of the combinations of hydrologic metrics and biological response metrics in the four subbasins. These results do not constitute the full array of results for all subbasins and all metrics but are offered to help support understanding of the process, the results themselves as shared with the RBC, the consistency of results, and the interpretations that follow.

Table 5-23. Example of calculating changes in the biological metrics – Mean daily flow (MA1) at EDO10 on the North Fork Edisto River[1]

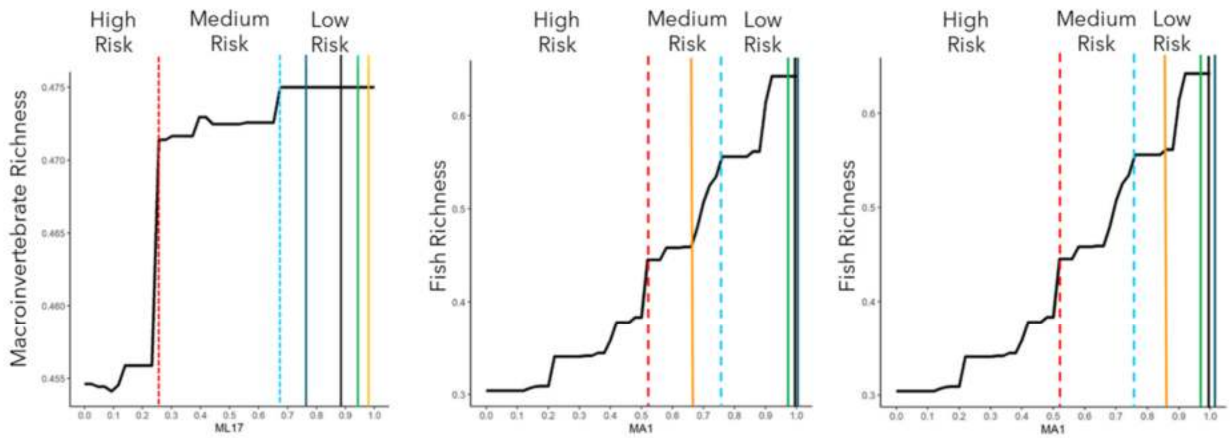
Demand Scenario	Current Scenario Flow (cfs)	Projected Demand Scenario Flow (cfs)	Percent Change	Bio Metric	Percent Change in Bio Metric	Standard Error
UIF	723	741	2.5%	Richness	1.9%	15
Moderate 2070		721	-0.2%	Richness	-0.2%	15
HD 2070		710	-1.8%	Richness	-1.4%	15
P&R		622	-14.0%	Richness	-10.4%	15

[1] This table is one example, extracted from the analysis at the EDO10 strategic node on the North Fork Edisto River, and looking at the single hydrologic metric of mean daily flow (MA1) and its correlation with the single biological metric of species richness for fish taxa. The results are then translated into risk scores as discussed below.



[1] This graph is one example at one strategic node (EDO10 on the North Fork Edisto River) using one of four hydrologic metrics (mean daily flow) and its correlation with one of five biological metrics (richness for fish taxa). The scale can be broadly interpreted as "percent of current status, where a value of 1 represents no change."

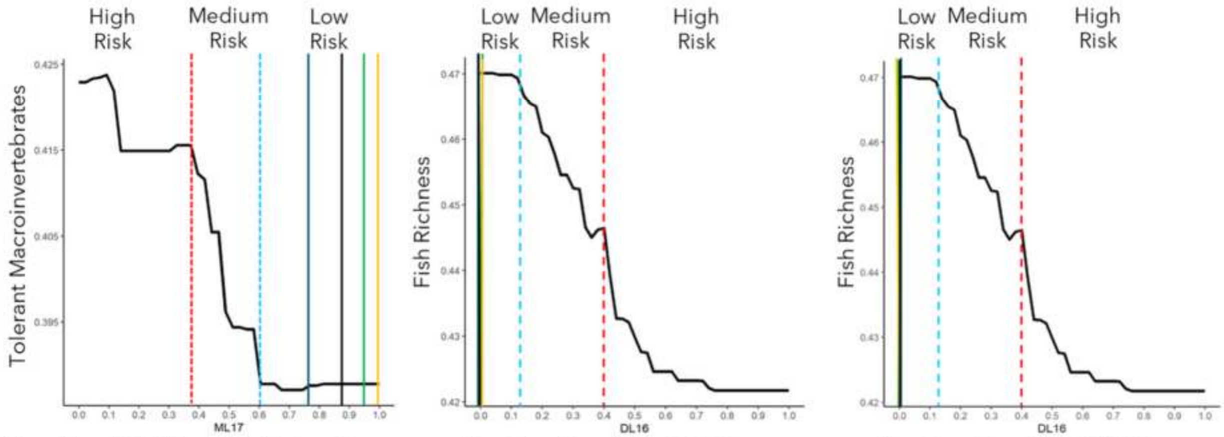
Figure 5-7. Example of the conversion of changes in biological metrics into risk[1].



Base Flow (ML17) as an indicator of Macroinvertebrate Richness
HUC 602 Outlet (Edisto River Subbasin)

Mean Daily Flow (MA1) as an indicator of Fish Richness
EDO06 (South Fork Subbasin)

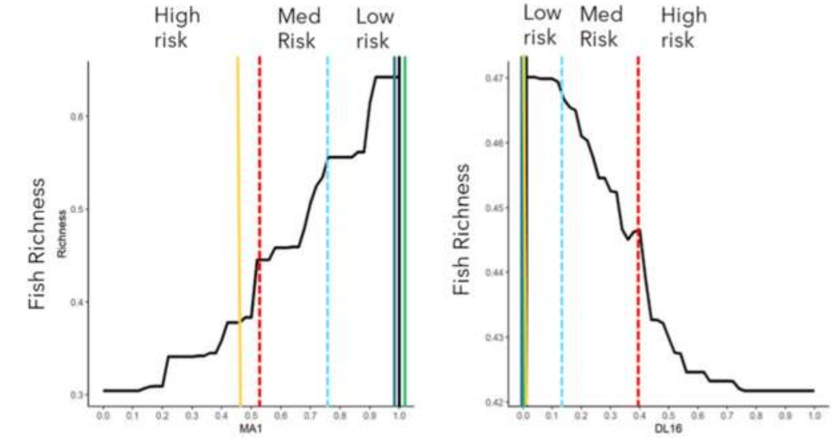
Mean Daily Flow (MA1) as an indicator of Fish Richness
EDO10 (North Fork Subbasin)



Base Flow (ML17) as an indicator of Tolerant Macroinvertebrate
HUC 602 Outlet (Edisto River Subbasin)

Duration of Low Flow (DL16) as an indicator of Fish Richness
EDO04 (South Fork Subbasin)

Duration of Low Flow (DL16) as an indicator of Fish Richness
EDO10 (North Fork Subbasin)



Dark Blue = UIF Scenario
Black = Moderate Scenario
Green = HD Scenario
Orange = P&R Scenario
Dashed blue and red lines separate low, medium, and high risk zones

Mean Daily Flow (MA1) as an indicator of Fish Richness
EDO04 (Dean Swamp)

Duration of Low Flow (DL16) as an indicator of Fish Richness
EDO04 (Dean Swamp)

Figure 5-8. Selected biological risk level results for various biological metrics and strategic node locations.

As illustrated in Figure 5-8, SWAM model-simulated flow metrics for the UIF, Moderate 2070, and HD 2070 Scenarios result in low risk for ecological integrity and tolerance. Modeling generally indicated that flow alterations associated with increasing demand projections would be relatively small as a percentage of current flow conditions in the primary reaches (North Fork, South Fork, and Four Hole Swamp) and secondary tributaries.

Several exceptions to this were identified. As illustrated Figure 5-8, the mean daily flow graph at EDO06, in the South Fork subbasin, shows medium risk for fish richness under the P&R Scenario. This is the only instance of risk higher than low risk on the primary tributaries (North Fork Edisto River, South Fork Edisto River, Edisto River, and Four Hole Swamp).

Like the primary tributaries, the secondary tributaries exhibited consistently low risk across the various biological response metrics and scenarios. One instance, however, of potentially high risk was identified in Dean Swamp Creek, a tributary to the South Fork Edisto River. Here, while changes in the duration of low flow posed low risk, the mean daily flow changes suggested a potentially high risk to fish richness due to a change of more than 50 percent in the P&R Scenario.

In general, the four future management scenarios examined in this study suggest low ecological risk for the primary and secondary tributaries in the Edisto River basin. Some important limitations of the work are listed below for proper context:

- Biological response metrics and associated risks were only calculated at select nodes, principally at the downstream end of primary tributaries and at the downstream end of certain secondary tributaries. There may be other locations in the river network that are more susceptible to flow changes, or where flow changes may be higher percentages when compared against current conditions. This could lead to more significant impacts to associated ecological integrity and tolerance in these unexamined locations.

- The relationships between hydrologic metrics and biological responses were derived by processing biological samples from wadeable sampling points and hydrologic records throughout the Edisto River basin via machine learning techniques. Wadeable access, while more limited downstream and in larger tributaries, occurs nearly throughout the basin.

- The assessment was limited to the hydrologic and biological response metrics selected by the principal investigators, and for which good correlation had been established. This limited the use of these metrics to four hydrologic metrics and five biological metrics. The findings do not rule out potential risks for ecological integrity or tolerance related to other metrics or flow changes.

- Because the SWAM model focuses principally on primary and secondary tributaries, the study did not examine impacts on smaller headwater streams, which may be more vulnerable to flow management changes, but which are also less likely to be affected by large-scale changes in their flow regimes. Since the SWAM model includes nearly all streams where significant flow management occurs (i.e., permitted and registered withdrawals and major discharges), the likelihood of significant flow alteration on non-modeled streams is low.

5.4 Scenario Descriptions and Groundwater Simulation Results

Four comparable scenarios were used to evaluate groundwater availability: the Current Groundwater Use Scenario (Current Scenario); the Permitted Groundwater Use Scenario (Permitted Scenario); the Moderate Water Demand Scenario (Moderate Scenario); and the High Water Demand Scenario (High Demand Scenario). The Moderate Scenario was originally referred to as the Business-as-Usual Scenario in the Framework. A fifth simulation was also evaluated by removing all groundwater withdrawals to simulate conditions prior to any groundwater development. The Permitted, Moderate, and High Demand Scenarios were simulated using annual stress periods over the 50-year period from 2021 to 2070. All model simulations incorporated average annual pumping (i.e. no distinction was made for variations in monthly or seasonal pumping). The total withdrawals simulated in each groundwater modeling scenario are shown in Table 5-24. The groundwater modeling focused on the Gordon, Crouch Branch, and McQueen Branch aquifers, from which most of the groundwater is withdrawn.

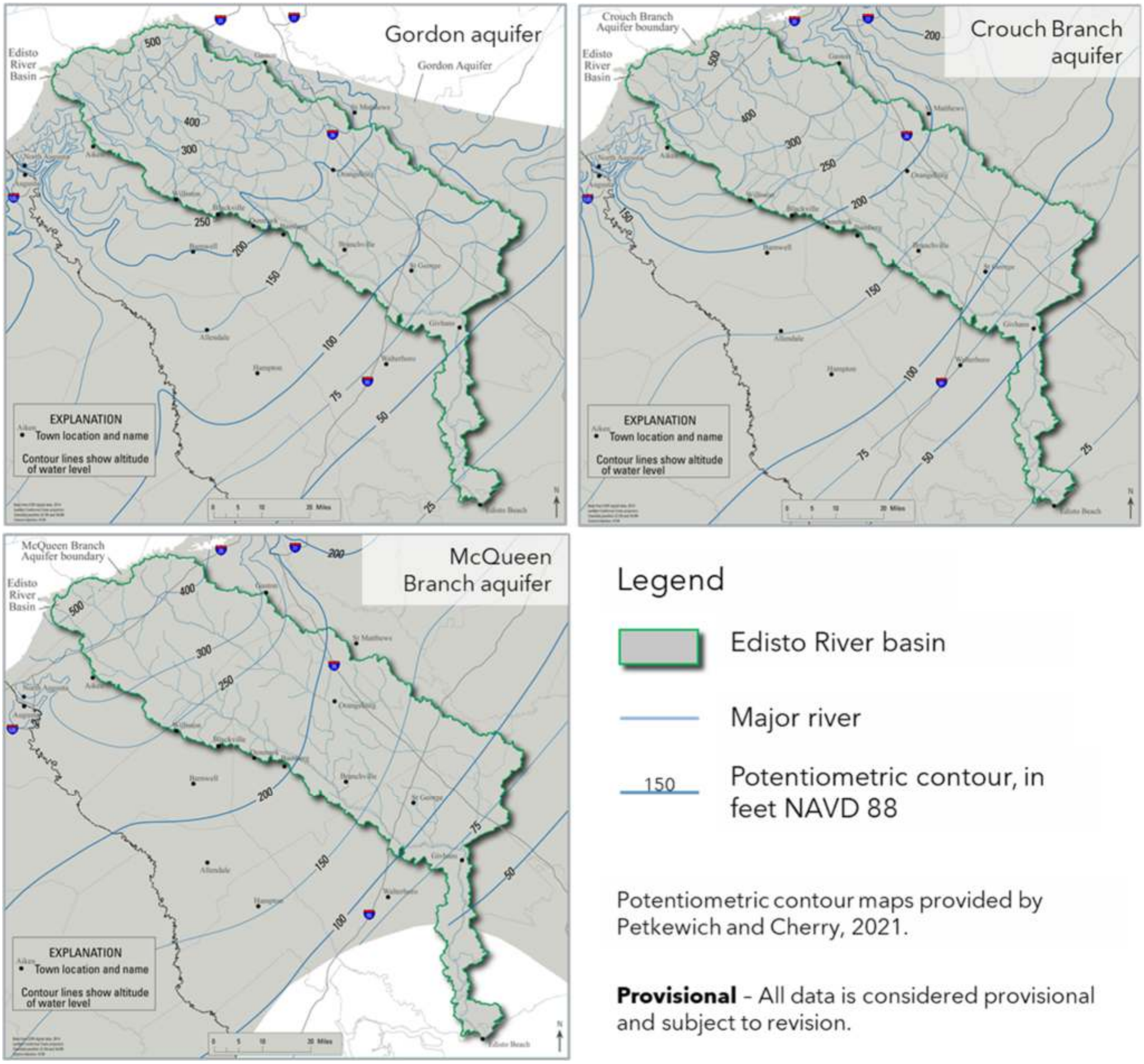
Table 5-24. Total withdrawals (MGD) in the groundwater scenarios.

Aquifer	Current	Permitted	Moderate	High Demand
	2020	2070	2070	2070
Surficial	0.13	0.44	0.23	0.3
Gordon	7.5	13	8.9	10
Crouch Branch	51	79	68	73
McQueen Branch	15	27	22	25
Total	**74**	**119**	**99**	**108**

5.4.1 Predevelopment Groundwater Use Simulation

The Predevelopment simulation simulates groundwater levels prior to any groundwater development – that is, prior to the withdrawal of groundwater from wells. The resulting model-simulated groundwater levels are useful for identifying areas where groundwater levels have declined due to pumping and for estimating discharge to surface water before groundwater development occurred.

Model simulated predevelopment groundwater levels in the Gordon, Crouch Branch, and McQueen Branch aquifers are shown in Figure 5-9. Additional information on predevelopment groundwater levels is presented in the discussion of the Current Scenario, where comparisons are made to simulated groundwater levels at specific locations throughout the basin.



Potentiometric contour maps provided by Petkewich and Cherry, 2021.

Provisional – All data is considered provisional and subject to revision.

Figure 5-9. Predevelopment simulation potentiometric contour maps for the Gordon, Crouch Branch, and McQueen Branch aquifers.

5.4.2 Current Groundwater Use Scenario

The Current Scenario represents current operations, infrastructure, and groundwater use in the Edisto River basin and across the Coastal Plain of South Carolina. This scenario simulates groundwater levels each year through 2070 using current groundwater withdrawal rates. It provides information on the cumulative effects that current rates of pumping may have on groundwater levels. Current Scenario simulated groundwater withdrawals in the Edisto River basin are shown in Figure 5-10. Total withdrawals are 73.4 MGD, with over 70 percent coming from the Crouch Branch aquifer. Figure 5-11 shows the location and number of wells screened in each aquifer, or a combination of aquifers. Not shown are wells screened in the Surficial aquifer. Surficial aquifer withdrawals, which may represent a significant source of water for homes not connected to a public water system, represent a very small portion (approximately 1 to 2 percent) of all known groundwater withdrawals.

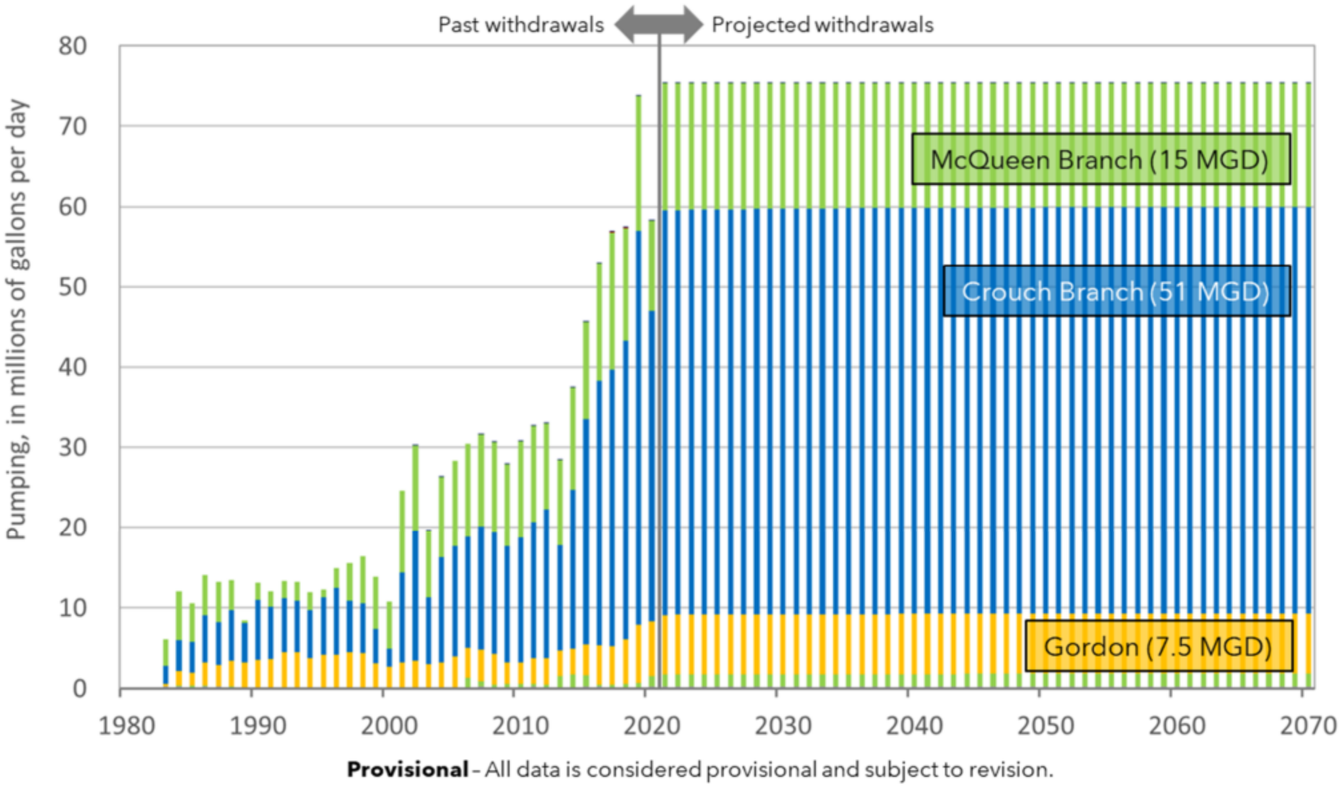
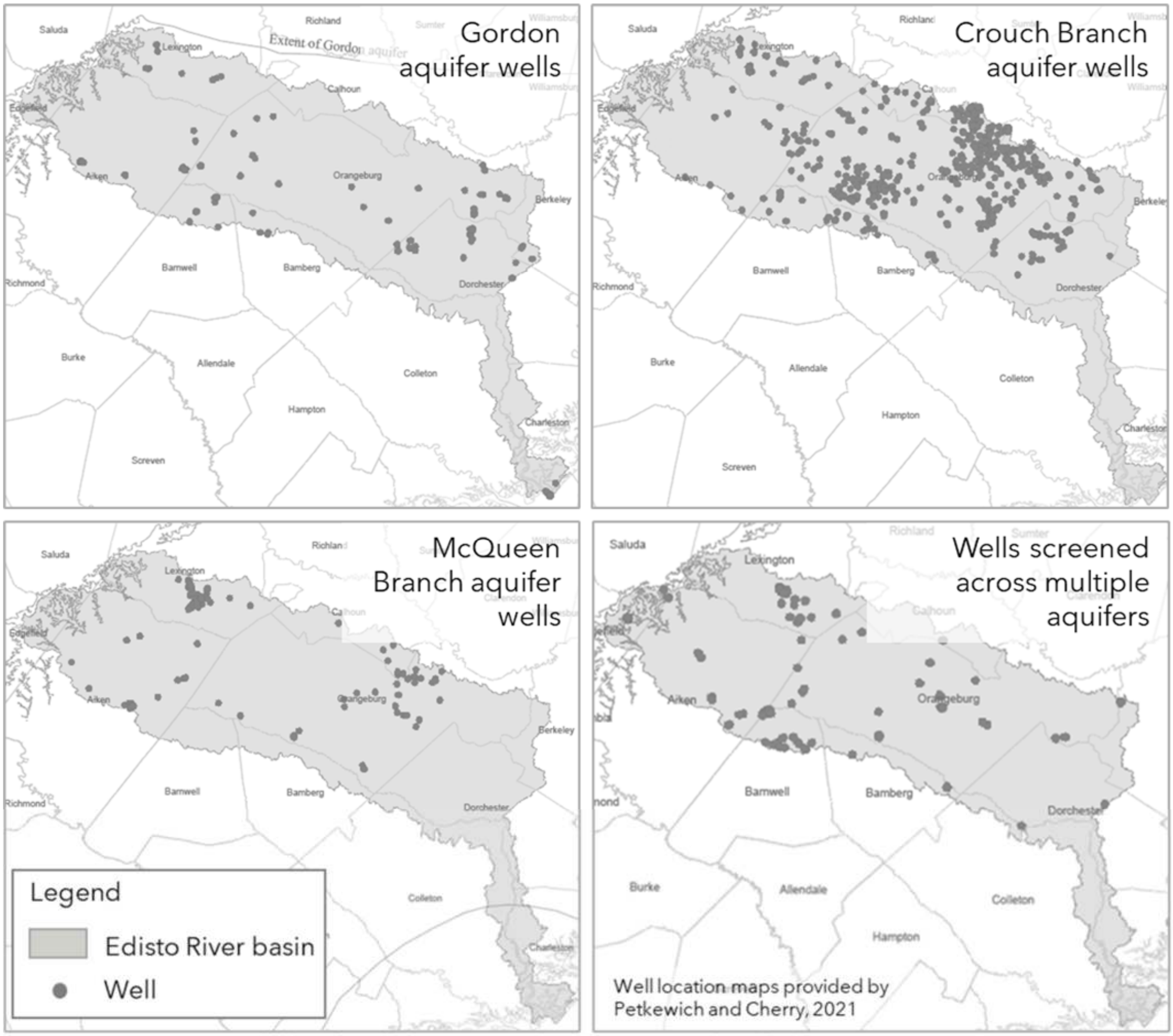


Figure 5-10. Current Scenario simulated groundwater withdrawal amounts in the Edisto River basin.

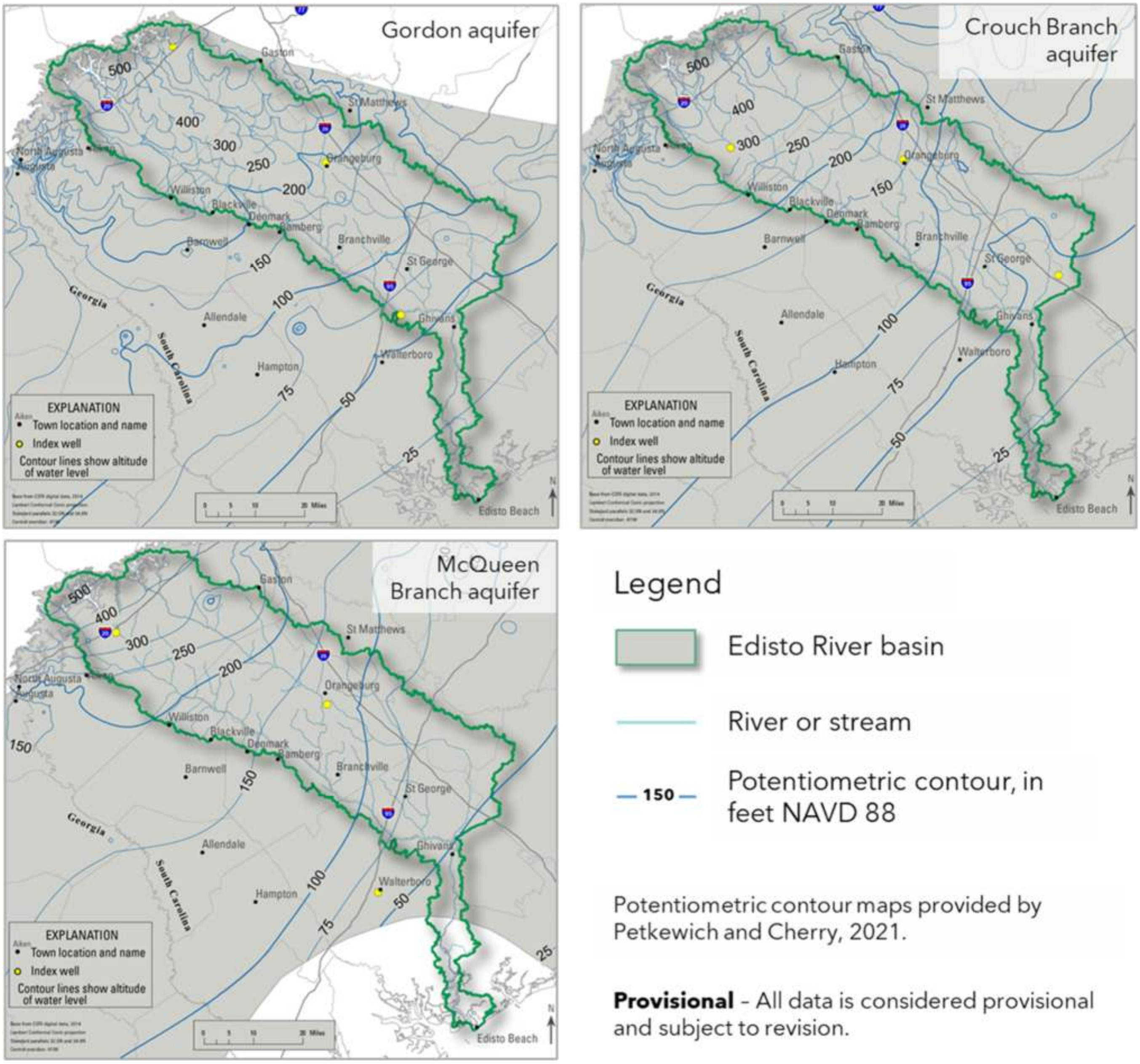


Well location maps provided by Petkewich and Cherry, 2021

Provisional – All data is considered provisional and subject to revision.

Figure 5-11. Locations of wells screened in the major aquifers.

Simulated Current Scenario groundwater levels in 2020 for the Gordon, Crouch Branch, and McQueen Branch aquifers are shown in Figure 5-12. Groundwater levels are represented by the contour lines at variable intervals, which range from 25- to 100-foot. The contour lines generally represent present day conditions, as simulated in the model. Although the model is calibrated to measured water levels, the simulated contours do not perfectly reflect present day conditions. In particular, the simulated 2020 contours significantly overestimate present day water levels in the Gordon aquifer in the southeastern third of the Edisto basin. Despite modeling imperfections, the model is useful for the regional scale, scenario comparisons the model is used for in this effort.

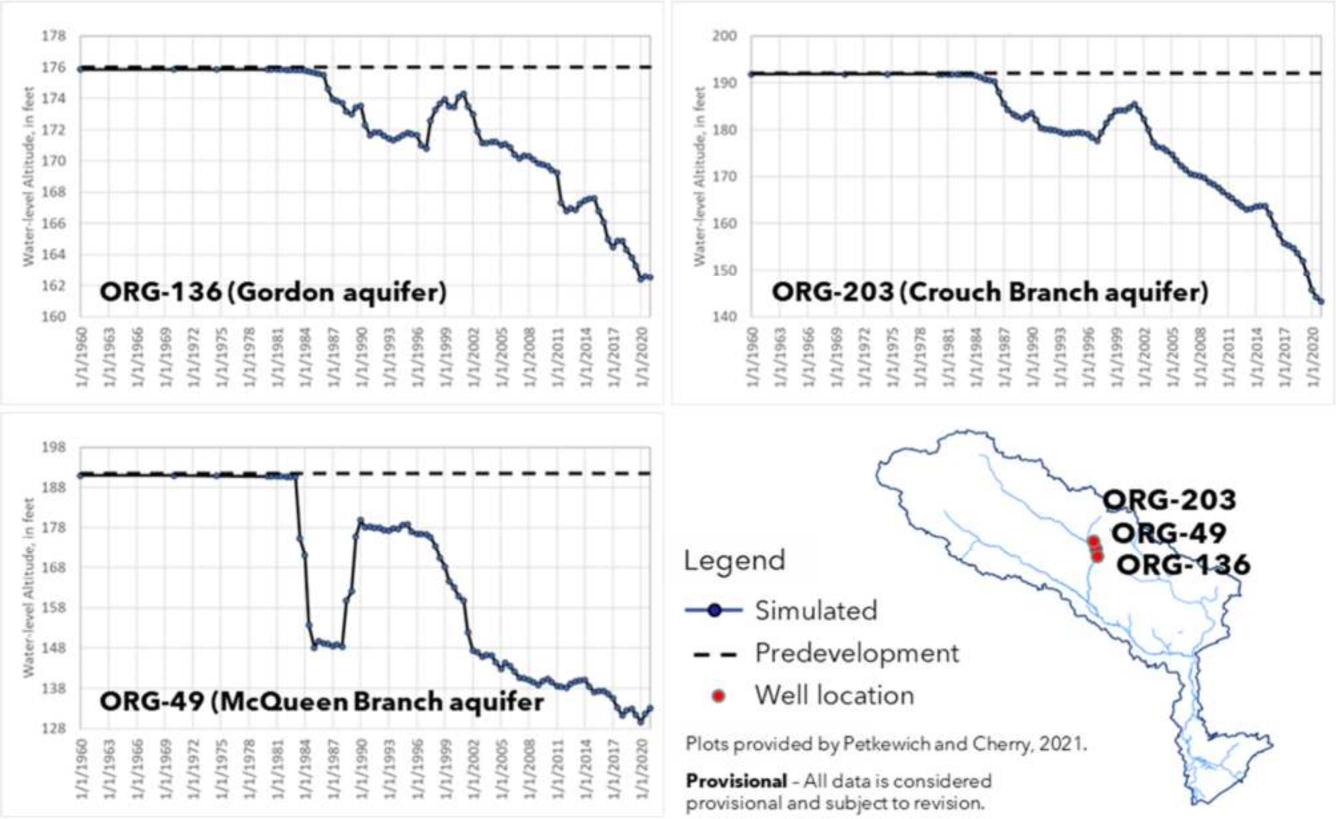


Potentiometric contour maps provided by Petkewich and Cherry, 2021.

Provisional – All data is considered provisional and subject to revision.

Figure 5-12. Simulated Current Scenario 2020 potentiometric contour maps for the Gordon, Crouch Branch, and McQueen Branch aquifers.

The change in simulated groundwater levels from predevelopment conditions to present day (2020) conditions at monitoring wells near Orangeburg are shown in Figure 5-13. Simulated declines in groundwater elevations range from 14 feet in the Gordon aquifer to approximately 65 feet in the McQueen Branch aquifer at this location. The three major aquifers are artesian; that is, groundwater stored in these aquifers is under pressure. As seen in Figure 5-13, predevelopment groundwater levels in the Crouch Branch and McQueen Branch aquifers are simulated to be higher than water levels in the shallower Gordon aquifer, at monitoring wells located in the same area near Orangeburg. The simulated declines in water levels show that groundwater development (pumping) has reduced the water level in the Crouch Branch and McQueen Branch aquifers to below that of the Gordon aquifer.



Plots provided by Petkewich and Cherry, 2021.

Provisional - All data is considered provisional and subject to revision.

Figure 5-13. Simulated change in groundwater levels from predevelopment to present day conditions for the Gordon, Crouch Branch, and McQueen Branch aquifers.

Simulated Current Scenario groundwater levels in 2070 for the three major aquifers are shown in Figure 5-14. These represent 50 years of pumping using current pumping rates and existing wells. The difference in groundwater levels for each aquifer between the simulated 2020 and 2070 conditions of the Current Scenario are shown in Figure 5-15. These "drawdown" maps depict the location and severity of groundwater level declines that are predicted to occur assuming 50 years of groundwater withdrawals at current pumping rates. As previously noted, for all scenarios that extended from 2021 to 2070, annual recharge rates developed using the SWB model reflecting conditions from 1979 through 2020 were applied to the groundwater model. The drawdown maps show that by year 2070, assuming current rates of groundwater withdrawals:

- Groundwater level declines in the Gordon aquifer will generally be in the 5-foot range, with declines of up to 10 feet at the basin boundary near Branchville.

- Groundwater level declines in the Crouch Branch aquifer will range from 5 to 50 feet, with the largest declines occurring east of Orangeburg and extending into the Santee River basin. In this area of Calhoun County, groundwater levels are simulated to drop up to 50 feet below the top of the Crouch Branch aquifer and more than 50 feet below the top of the aquifer east of the Edisto River basin boundary, in Calhoun County.

- Groundwater level declines in the McQueen Branch aquifer will range from 5 to 30 feet in most areas, and up to 75 feet in Lexington County. Near the Town of Pelion, groundwater levels are simulated to drop up to 50 feet below the top of the McQueen Branch aquifer.

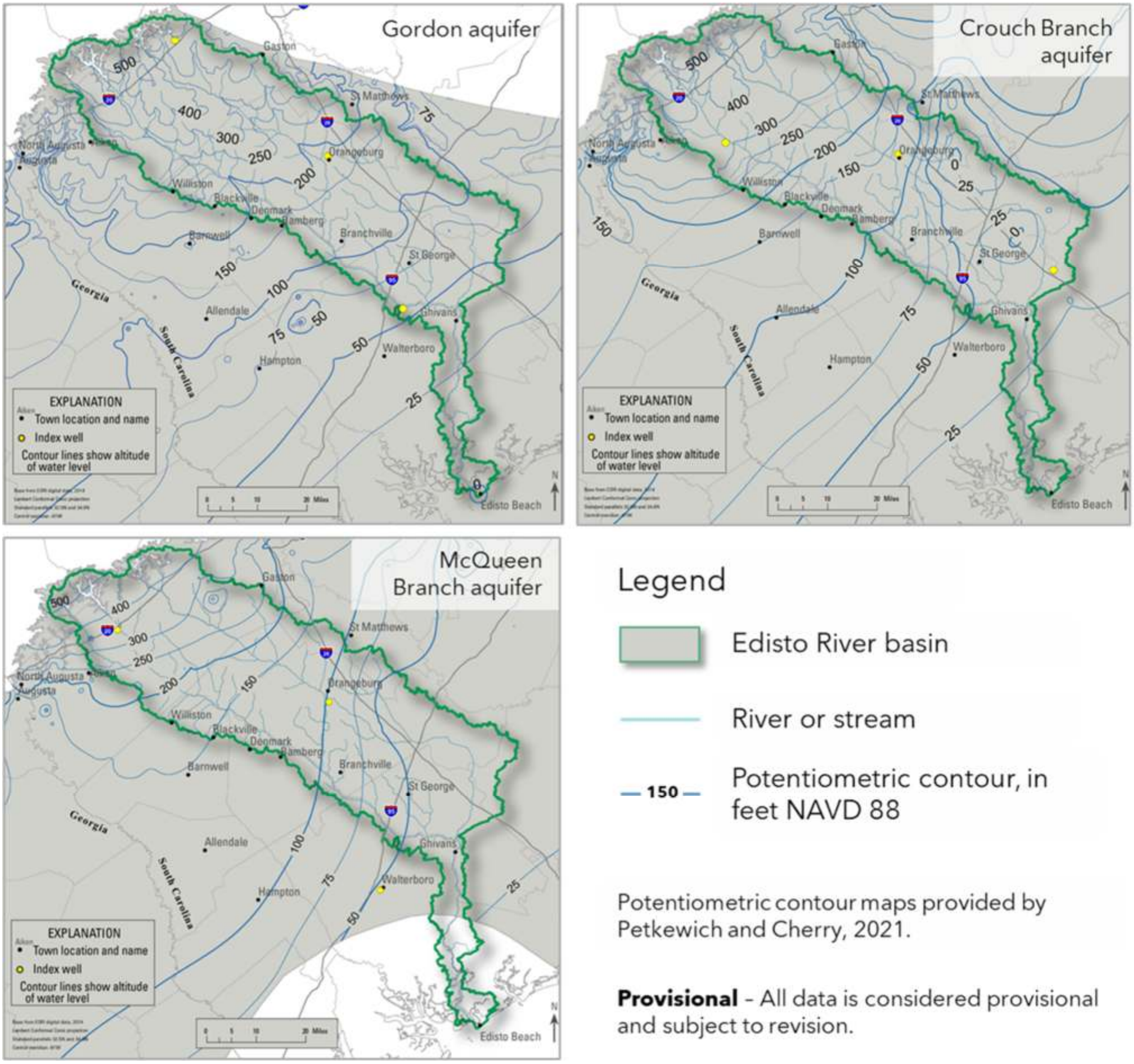
Groundwater declines below the top of a confined or semi-confined aquifer can be problematic for several reasons. Compaction of sediments may occur, which can permanently reduce the aquifer's storage capacity and also can cause land subsidence. The USGS reports that more than 17,000 square miles in 45 States, an area roughly the size of New Hampshire and Vermont combined, have been directly affected by subsidence due to excessive groundwater pumping (USGS 2018). Near the coast, the lowering of groundwater levels may result in a deterioration of water quality due to saltwater intrusion. The reduction in aquifer pressure and the drop in groundwater levels also can create problems for wells. Power costs for pumping increase as groundwater levels decline. Well yields may decline to below usable rates. In some cases, wells may need to be deepened, pumps may need to be lowered, or replacement wells may need to be drilled.

Because of the potential for negative impacts, the RBC decided to designate Groundwater Areas of Concern in areas where modeling or monitoring show declines below the top of an aquifer as Groundwater Areas of Concern. The Crouch Branch aquifer in Calhoun County, the McQueen Branch aquifer in Lexington County, and a small area in Aiken County near Shaw Creek are designated as Groundwater Areas of Concern, based on the modeling results. RBC recommendations to further investigate these Groundwater Areas of Concern are detailed in Chapter 9 – Recommendations.

When considering the potential for groundwater declines below the top of an aquifer, the RBC decided not to establish a formal Groundwater Condition which would set a limitation on the amount of groundwater that can be withdrawn from an aquifer, and which can be applied to evaluate Groundwater Supply for planning purposes. Instead, the RBC decided to establish a desired future condition, with the condition being maintaining groundwater levels at or above the top of an aquifer.

The potential for seasonal declines below the top of an aquifer, followed by recovery during the non-growing season was discussed by the RBC. Because the groundwater model uses annual stress periods, the pattern of seasonal drawdown followed by recovery was not modeled. The RBC identified the potential for negative impacts due to seasonal drawdown and recovery as a data gap and developed recommendations (presented in Chapter 9) to further research this topic.

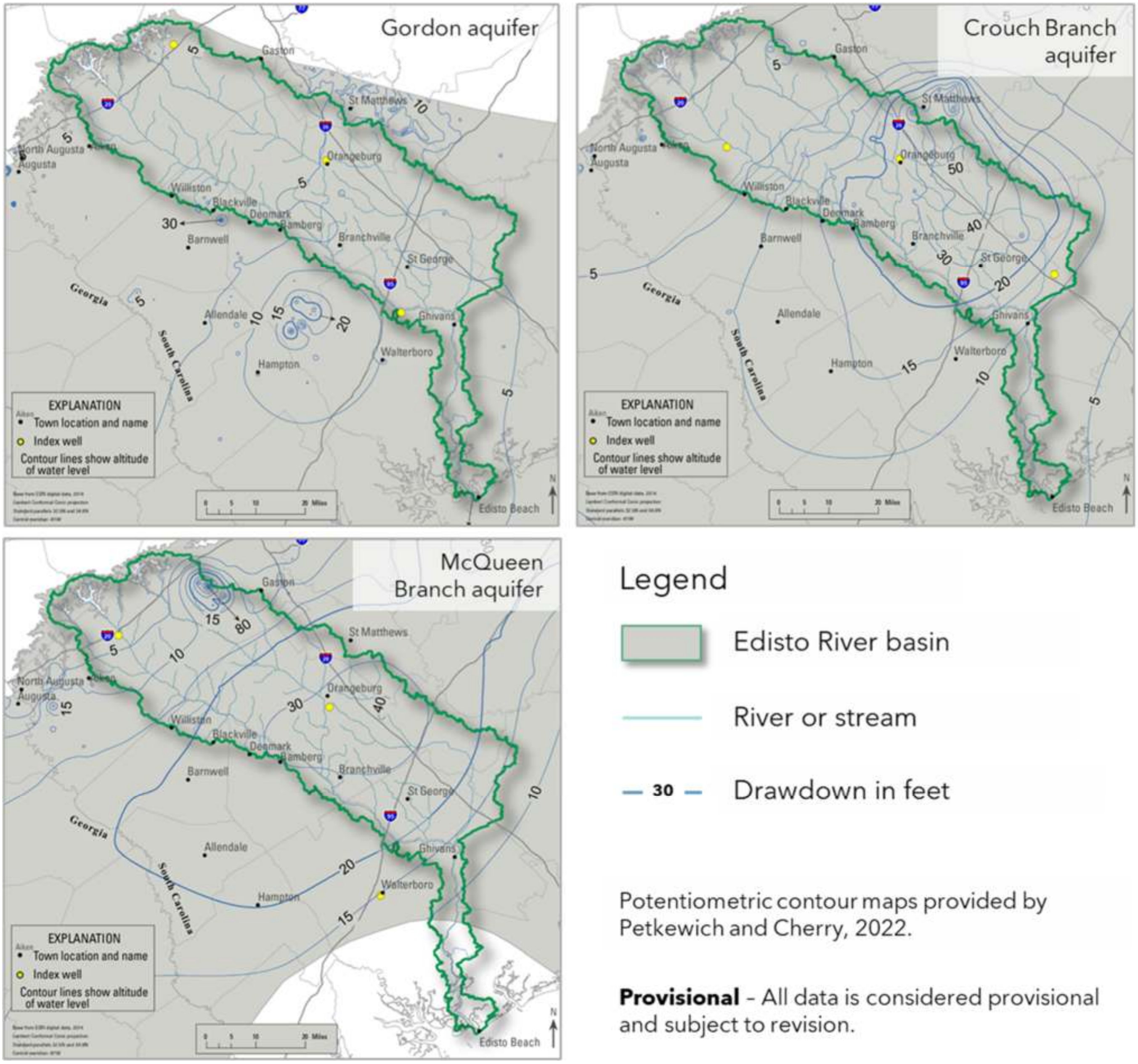
Additional discussion and maps of the areas where groundwater levels are simulated to drop below the top of the Crouch Branch and McQueen Branch aquifers for all planning scenarios are presented in Chapter 5.4.7.



Potentiometric contour maps provided by Petkewich and Cherry, 2021.

Provisional – All data is considered provisional and subject to revision.

Figure 5-14. Simulated Current Scenario 2070 potentiometric contour maps for the Gordon, Crouch Branch, and McQueen Branch aquifers.



Potentiometric contour maps provided by Petkewich and Cherry, 2022.

Provisional – All data is considered provisional and subject to revision.

Figure 5-15. Simulated drawdown for the Current Scenario from 2020 to 2070 for the Gordon, Crouch Branch, and McQueen Branch aquifers.

5.4.3 Permitted Groundwater Use Scenario

The Permitted Scenario incorporates the fully permitted water use allowable under existing groundwater permits for all groundwater users in Capacity Use Areas. This scenario simulates groundwater levels each year through 2070 at fully permitted groundwater withdrawal rates and provides information on the cumulative effects that those withdrawals may have on groundwater levels. Per the Framework, areas where future groundwater levels diverge significantly from predevelopment levels or from present day levels may indicate Groundwater Areas of Concern or Groundwater Shortages. Permitted Scenario simulated groundwater withdrawals in the Edisto River basin are shown in Figure 5-16. Total withdrawals are constant at 118 MGD from 2021 to 2070, with over 70 percent coming from the Crouch Branch aquifer. It is important to note that this scenario does not assume any withdrawals from new wells (i.e., wells that currently do not exist) between 2020 and 2070.

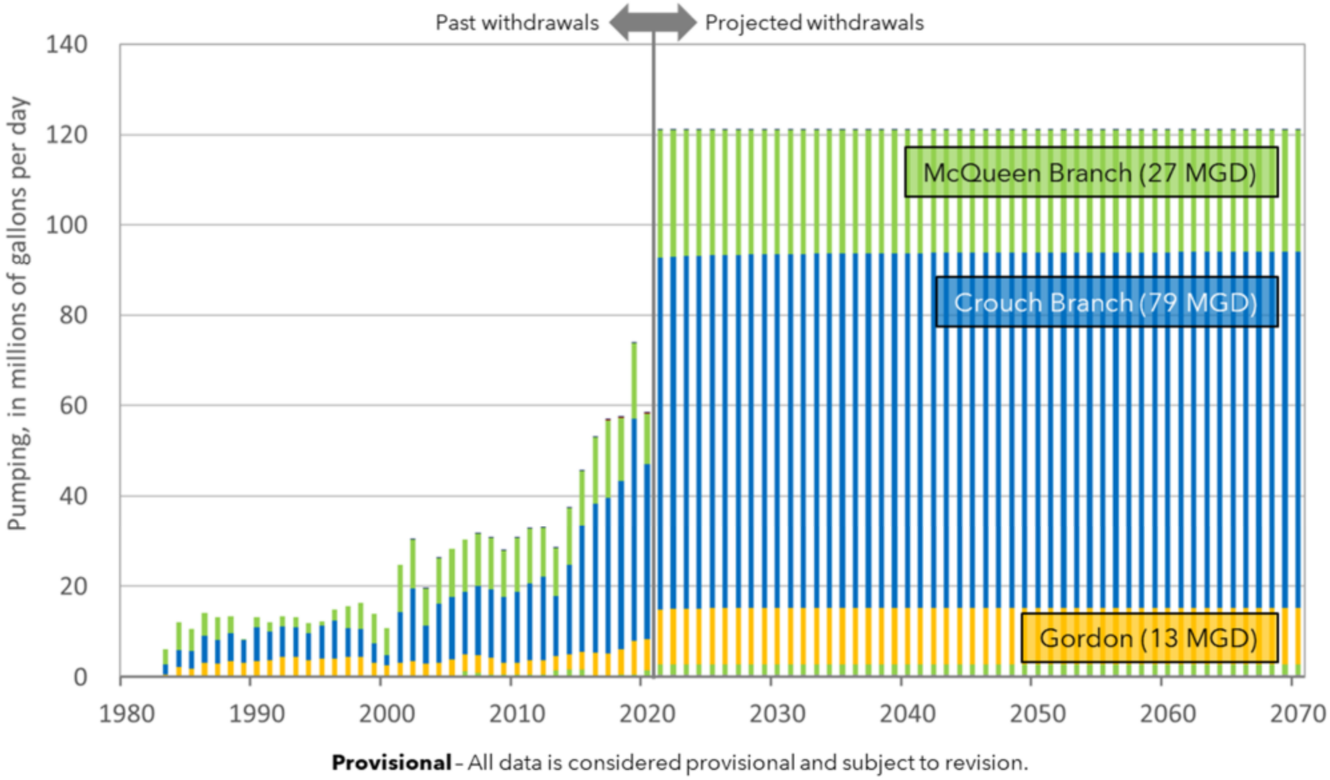


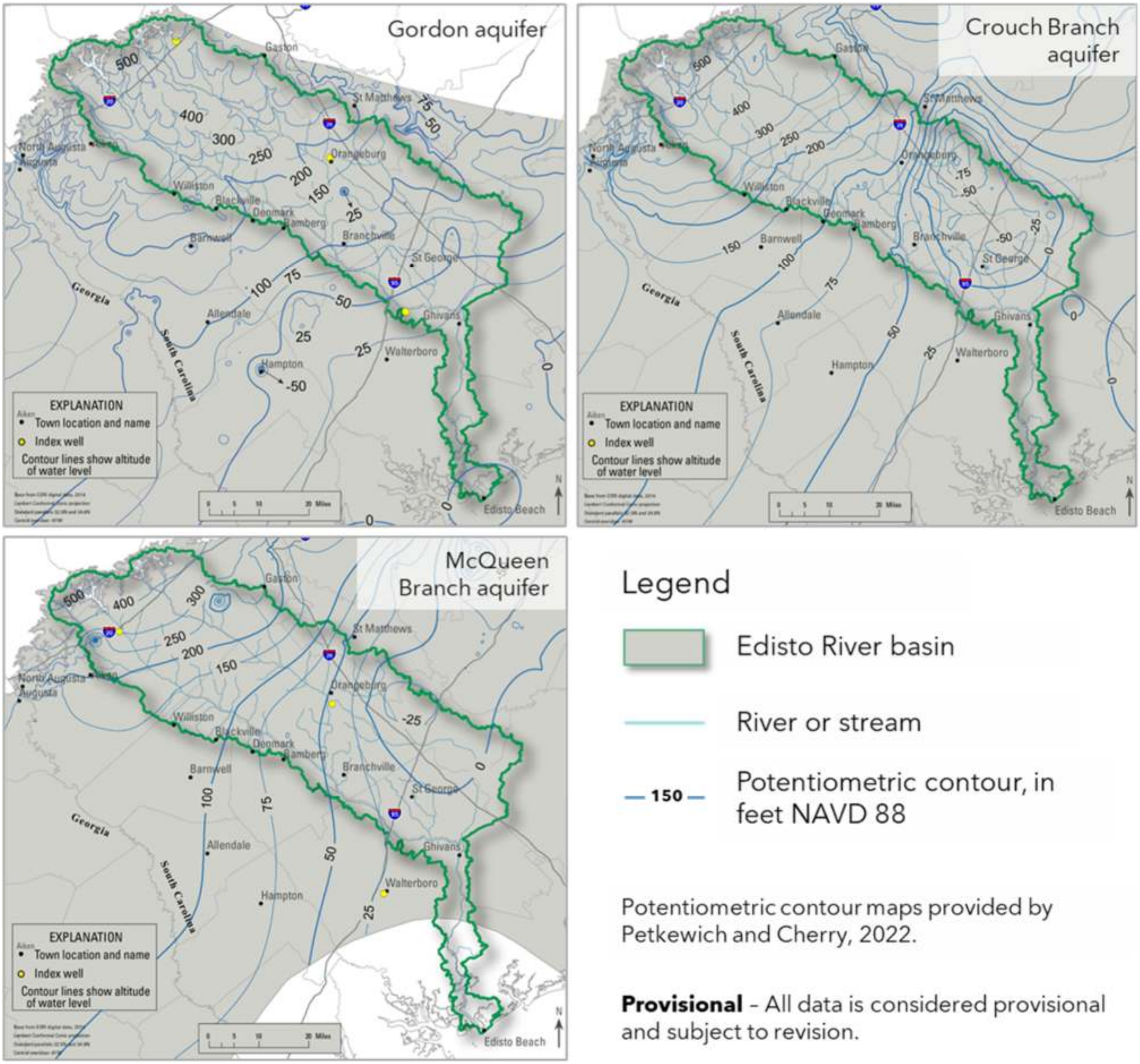
Figure 5-16. Permitted Scenario simulated groundwater withdrawal amounts in the Edisto basin.

Simulated Permitted Scenario groundwater levels in 2070 for the Gordon, Crouch Branch, and McQueen Branch aquifers are shown in Figure 5-17. These represent 50 years of pumping using permitted pumping rates. The difference in groundwater levels for each aquifer between the simulated 2020 and 2070 conditions for the Permitted Scenario are shown in Figure 5-18. These drawdown maps depict the location and severity of groundwater level declines that are predicted to occur assuming 50 years of groundwater withdrawals at permitted rates. The drawdown maps show that by year 2070, assuming permitted rates of groundwater withdrawals (and no new wells or withdrawals):

- Groundwater level declines in the Gordon aquifer will generally be in the 5 to 20-foot range, with isolated, higher declines at several wells or well clusters south and east of Orangeburg.

- Groundwater level declines in the Crouch Branch aquifer will range from 50 to 150 feet in the middle portion of the basin, with the largest declines occurring east of Orangeburg. In this area of Calhoun County, groundwater levels are simulated to decline more than 50 feet below the top of the Crouch Branch aquifer at the boundary of the Edisto River basin, and further east in Calhoun County.

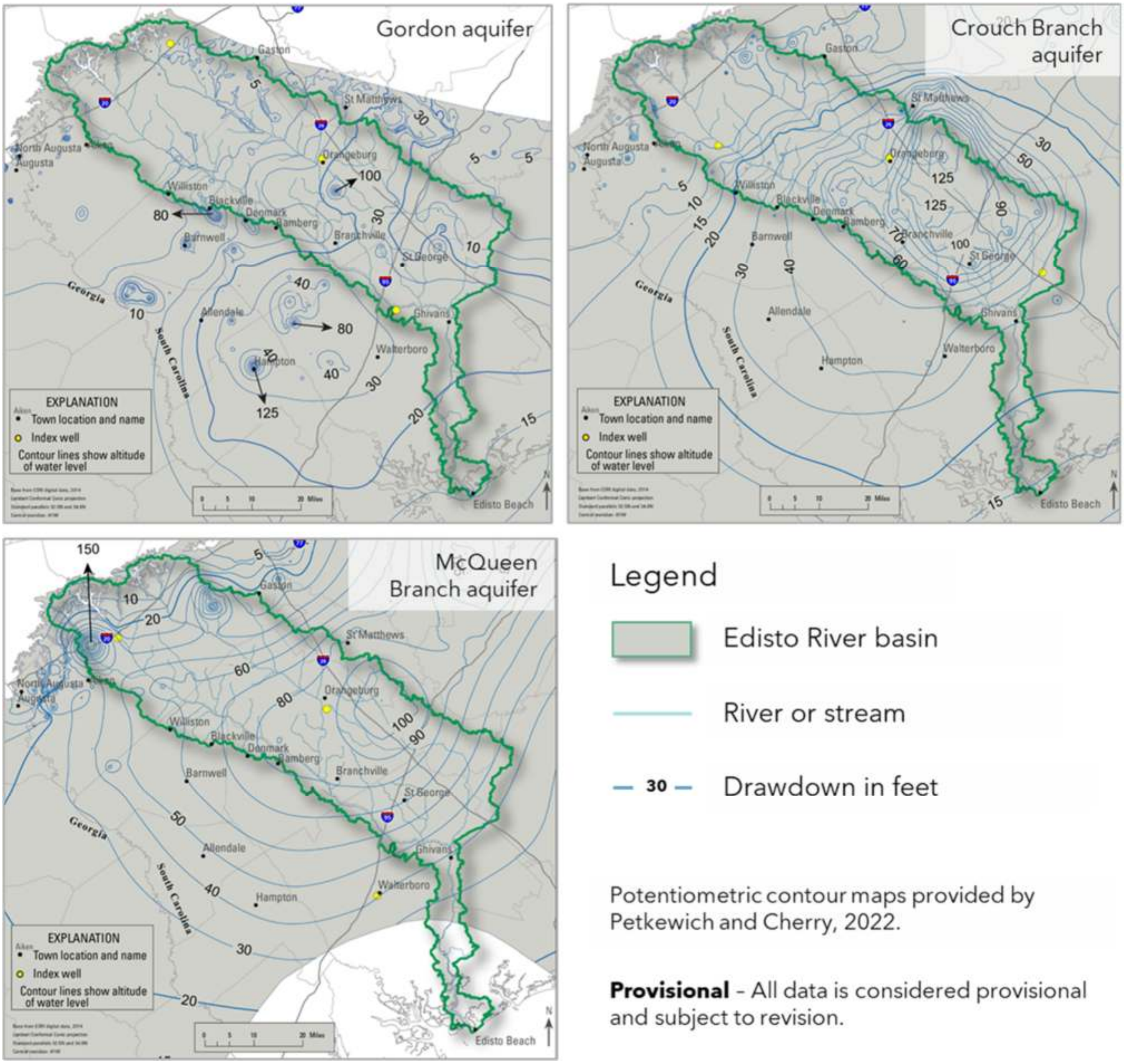
- Groundwater level declines in the McQueen Branch aquifer will range from 10 to 100 feet, with 10-foot declines near the northern extent of the basin, 100-foot declines just east of Orangeburg, and 40-foot declines near Givhans. In Lexington County near Pelion, groundwater levels are simulated to drop more than 50 feet below the top of the McQueen Branch aquifer.



Potentiometric contour maps provided by Petkewich and Cherry, 2022.

Provisional – All data is considered provisional and subject to revision.

Figure 5-17. Simulated Permitted Scenario 2070 potentiometric contour maps for the Gordon, Crouch Branch, and McQueen Branch aquifers.



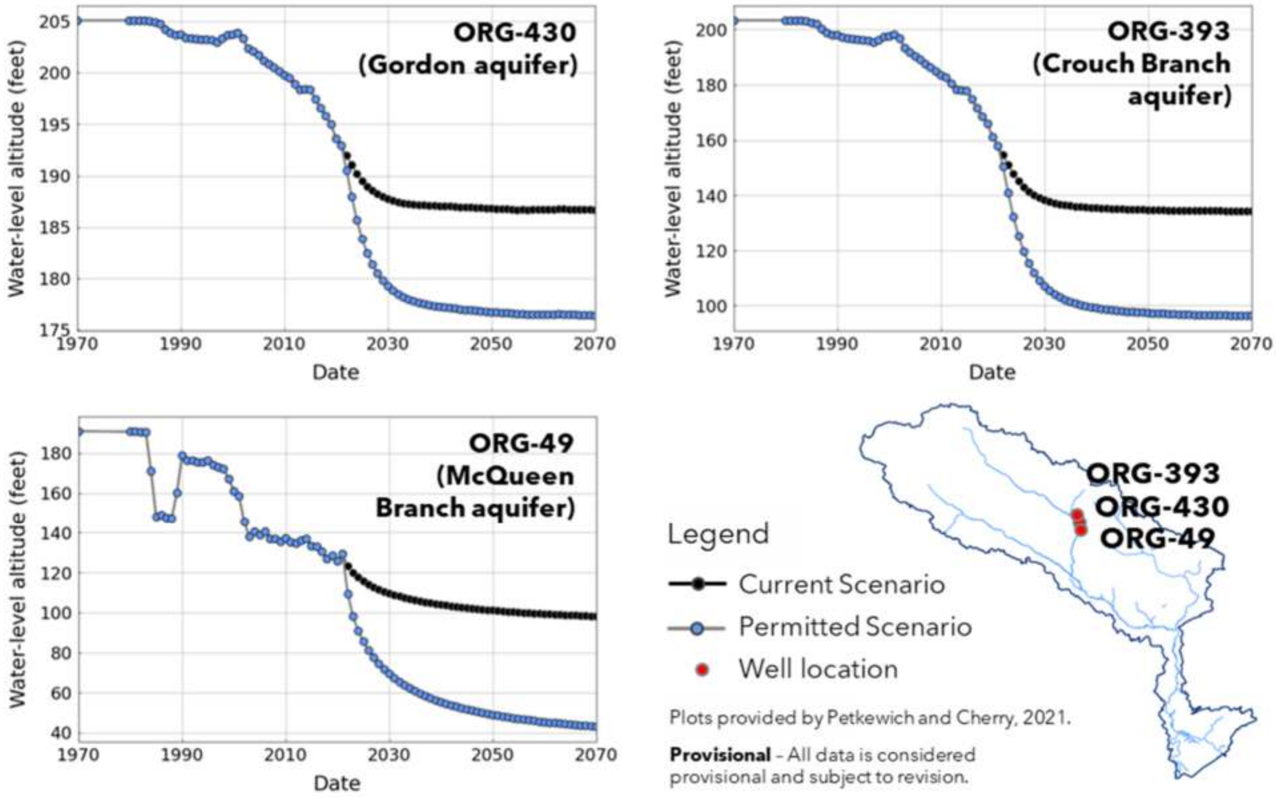
Potentiometric contour maps provided by Petkewich and Cherry, 2022.

Provisional – All data is considered provisional and subject to revision.

Figure 5-18. Simulated drawdown for the Permitted Scenario from 2020 to 2070 for the Gordon, Crouch Branch, and McQueen Branch aquifers.

The simulated time-history of groundwater levels under current and permitted rates of pumping at monitoring wells near Orangeburg are shown in Figure 5-19. These wells are in the central area of the basin where some of the largest declines in groundwater levels are predicted for each scenario. Pumping through 2070 at Permitted Scenario rates results in groundwater levels that are approximately 10 to 60 feet lower than those resulting from Current Scenario pumping rates. The simulated differences are approximately 10 feet in the Gordon aquifer, 40 feet in the Crouch Branch aquifer, and almost 60 feet in the McQueen Branch aquifer.

Given the projected groundwater level declines of up to 125 feet in the Crouch Branch aquifer and up to 100 feet in the McQueen Branch aquifer, and the fact that both aquifers will be subject to potential “dewatering” (lowering of water levels below the top of the aquifer), impacts to wells could be expected, including reduced well yields and potentially dry wells if they are screened only in the upper part of the aquifers. Even without reductions in yield, pumping costs would increase because of the additional energy required to lift water from deeper in the aquifer. Aquifer compaction, land subsidence, and a permanent loss of storage capacity might result. Because the drawdowns are expected in the central part of the basin away from the coast, saltwater intrusion would likely not be a concern.



Plots provided by Petkewich and Cherry, 2021.

Provisional – All data is considered provisional and subject to revision.

Figure 5-19. Simulated groundwater levels under Current Scenario and Permitted Scenario rates of pumping for the Gordon, Crouch Branch, and McQueen Branch aquifers.

5.4.4 Moderate Water Demand Projection Scenario

The Moderate Scenario incorporates future groundwater withdrawal rates based on the assumption of moderate population and economic growth. This scenario simulates groundwater levels each year through 2070 at moderate groundwater withdrawal rates and provides information on the cumulative effects that those withdrawals may have on groundwater levels. Moderate Scenario simulated groundwater withdrawals in the Edisto River basin are shown in Figure 5-20. Total withdrawals are 97.9 MGD by year 2070, with over 70 percent coming from the Crouch Branch aquifer.

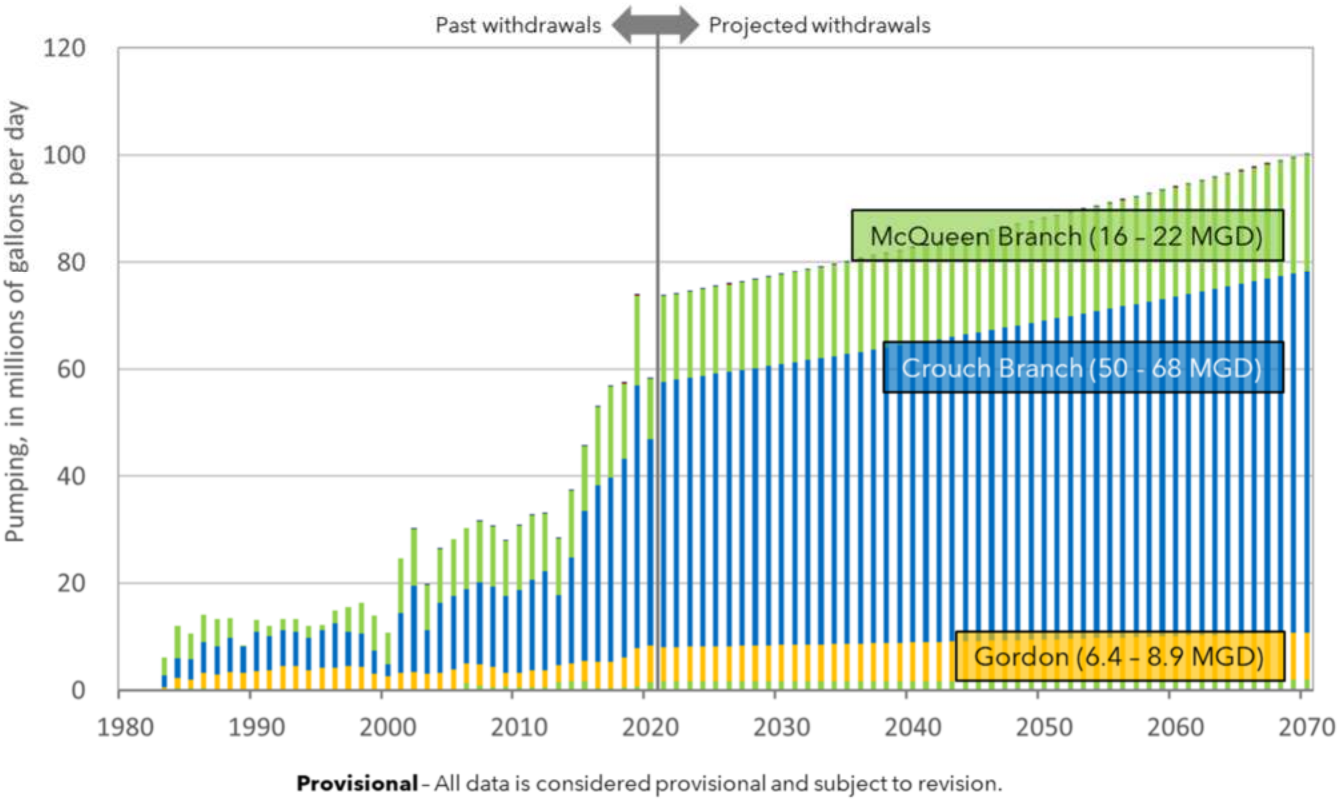


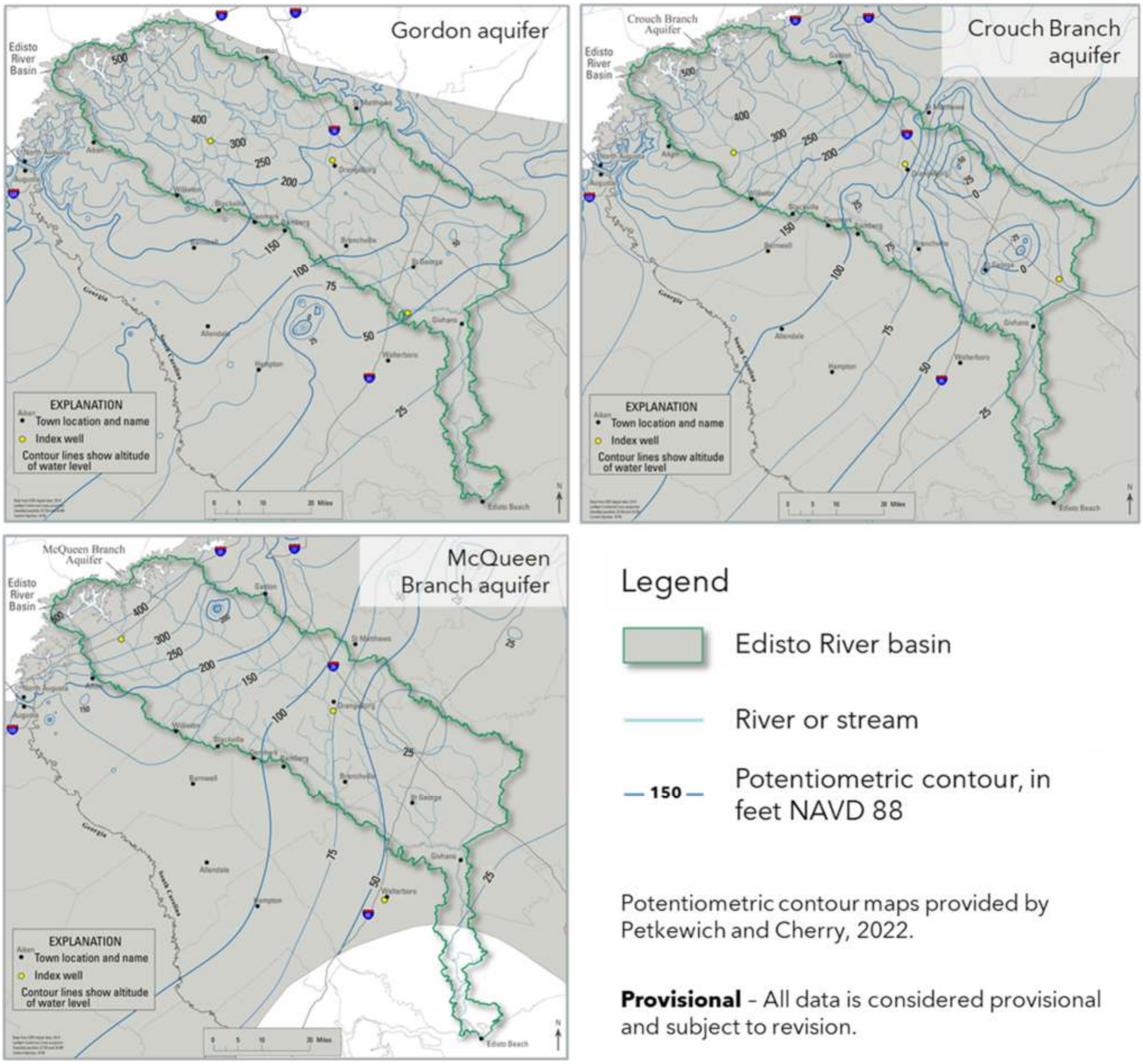
Figure 5-20. Moderate Scenario simulated groundwater withdrawal amounts in the Edisto basin.

Simulated Moderate Scenario groundwater levels in 2070 for the Gordon, Crouch Branch, and McQueen Branch aquifers are shown in Figure 5-21. These represent 50 years of annually increasing pumping assuming normal climate and moderate growth. The difference in groundwater levels for each aquifer between the simulated 2020 and 2070 conditions for the Moderate Scenario conditions are shown in Figure 5-22. These drawdown maps depict the location and severity of groundwater level declines that are predicted to occur assuming 50 years of groundwater withdrawals at moderate rates. The drawdown maps show that by year 2070:

- Groundwater level declines in the Gordon aquifer will generally be in the 5 to 10-foot range, with isolated, higher declines in a limited area south of Orangeburg. Outside the Edisto River basin in Colleton County, declines of greater than 50 feet are expected.

- Groundwater level declines in the Crouch Branch aquifer will range from 20 to just over 75 feet in the middle portion of the basin, with the largest declines occurring north of Bamberg and east of Orangeburg. East of Orangeburg in Calhoun County, groundwater levels are simulated to decline just below the top of the Crouch Branch aquifer at the boundary of the Edisto River basin, and by more than 50 feet below the top of the aquifer further east in Calhoun County.

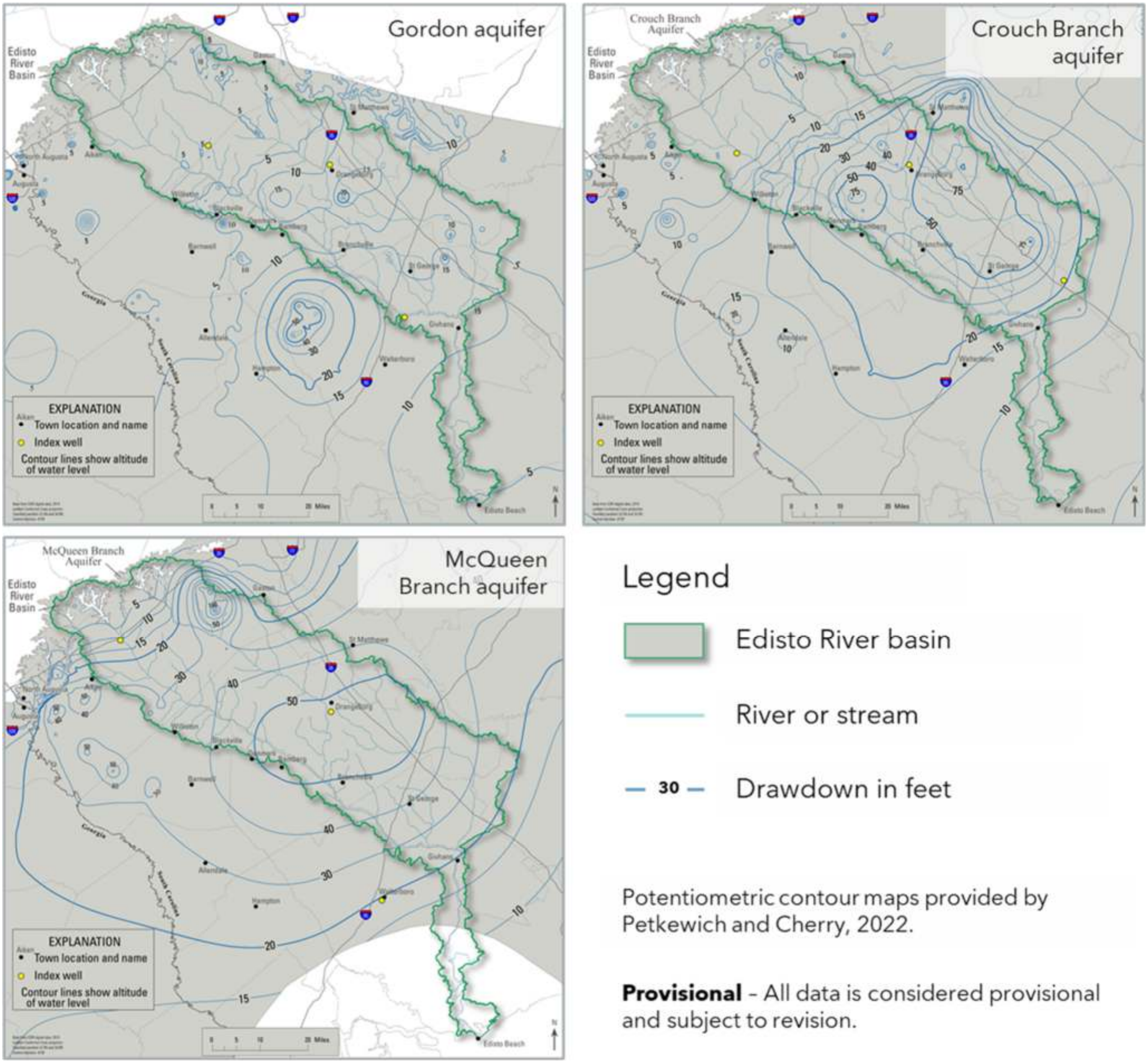
- Groundwater level declines in the McQueen Branch aquifer will range from 10 feet at the northern extent of the aquifer to over 100 feet in Lexington County. Drawdowns are approximately 50 feet in the middle of the aquifer near Orangeburg and drop to about 40 feet near Givhans. In Lexington County near Pelion, groundwater levels are simulated to drop more than 50 feet below the top of the McQueen Branch aquifer.



Potentiometric contour maps provided by Petkewich and Cherry, 2022.

Provisional – All data is considered provisional and subject to revision.

Figure 5-21. Simulated Moderate Scenario 2070 potentiometric contour maps for the Gordon, Crouch Branch, and McQueen Branch aquifers.



Potentiometric contour maps provided by Petkewich and Cherry, 2022.

Provisional – All data is considered provisional and subject to revision.

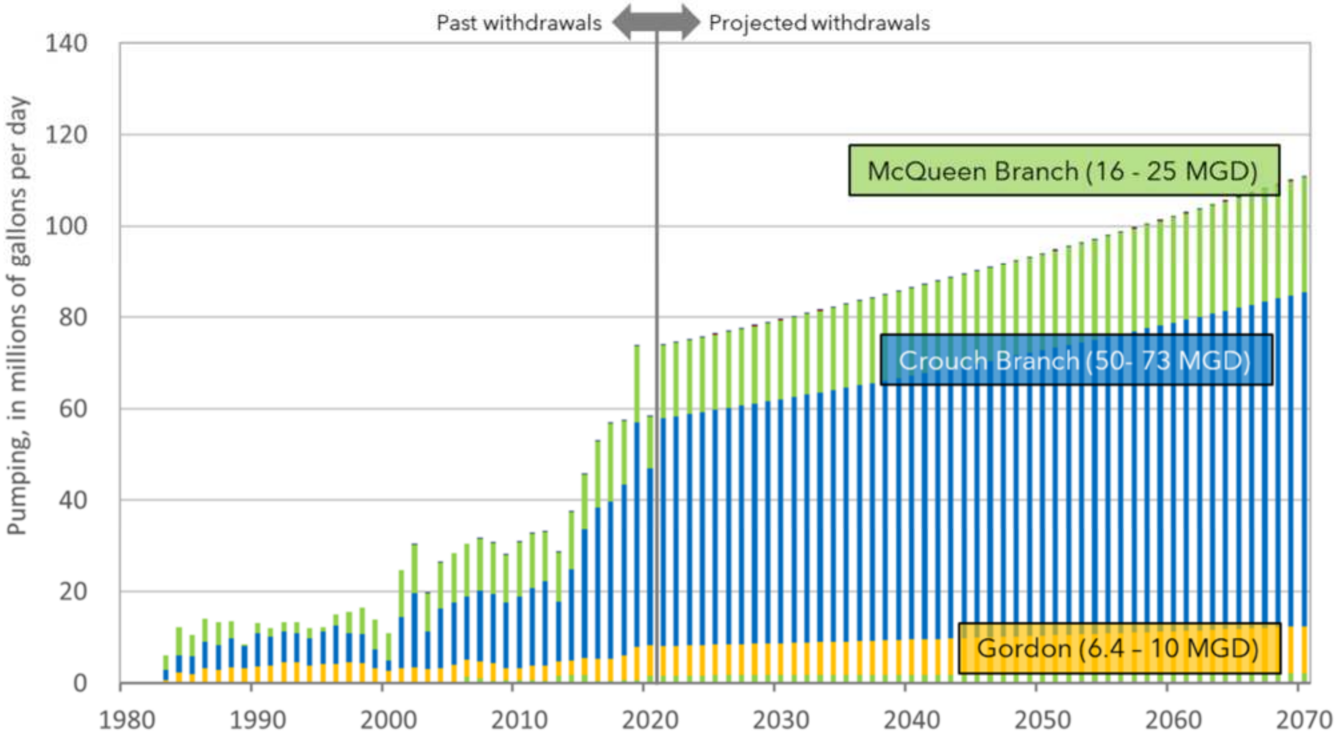
Figure 5-22. Simulated drawdown for the Moderate Scenario from 2020 to 2070 for the Gordon, Crouch Branch, and McQueen Branch aquifers.

Given the projected groundwater level declines of up to 75 feet in the Crouch Branch aquifer and up to 100 feet in the McQueen Branch aquifer, and the fact that both aquifers will be subject to potential dewatering, impacts to wells could be expected, including reduced well yields and potentially dry wells if they are screened only in the upper part of the aquifers. Because the drawdowns are expected in the central part of the basin away from the coast, saltwater intrusion would likely not be a concern.

5.4.5 High Water Demand Projection Scenario

The High Demand Scenario incorporates future groundwater withdrawal rates based on the assumption of high population and economic growth. This scenario simulates groundwater levels each year through

2070 at high groundwater withdrawal rates and provides information on the cumulative effects that those withdrawals may have on groundwater levels. High Demand Scenario simulated groundwater withdrawals in the Edisto River basin are shown in Figure 5-23. Total withdrawals are 108 MGD by year 2070, with just under 70 percent coming from the Crouch Branch aquifer.



Provisional – All data is considered provisional and subject to revision.

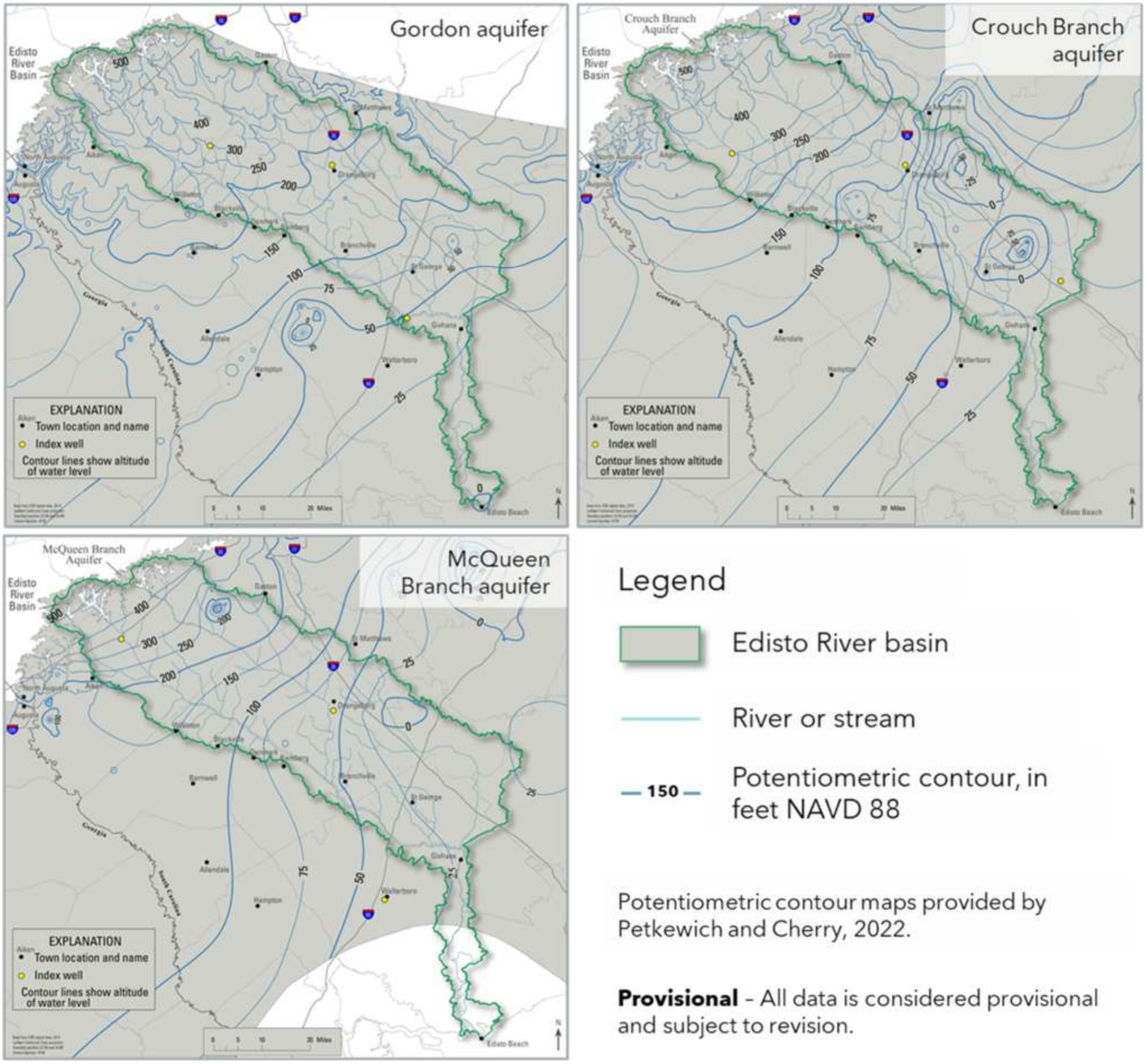
Figure 5-23. High Demand Scenario simulated groundwater withdrawal amounts in the Edisto basin.

Simulated High Demand Scenario groundwater levels in 2070 for the Gordon, Crouch Branch, and McQueen Branch aquifers are shown in Figure 5-24. These represent 50 years of annually increasing pumping assuming a hot and dry climate and high growth. The difference in groundwater levels for each aquifer between the simulated 2020 and 2070 conditions for the High Demand Scenario are shown in Figure 5-25. These drawdown maps depict the location and severity of groundwater level declines that are predicted to occur assuming 50 years of groundwater withdrawals at high rates (relative to the moderate rates). The drawdown maps show that by year 2070:

- Groundwater level declines in the Gordon aquifer will generally be in the 5 to 10-foot range, with isolated, higher declines in a limited area south of Orangeburg. Outside the Edisto River basin in Colleton County, declines of greater than 50 feet are expected.

- Groundwater level declines in the Crouch Branch aquifer will range from 20 to just over 100 feet in the middle portion of the basin, with the largest declines occurring north of Bamberg, east of Orangeburg, and east of St. George. East of Orangeburg in Calhoun County, groundwater levels are simulated to decline just below the top of the Crouch Branch aquifer at the boundary of the Edisto River basin, and by more than 50 feet below the top of the aquifer further east in Calhoun County.

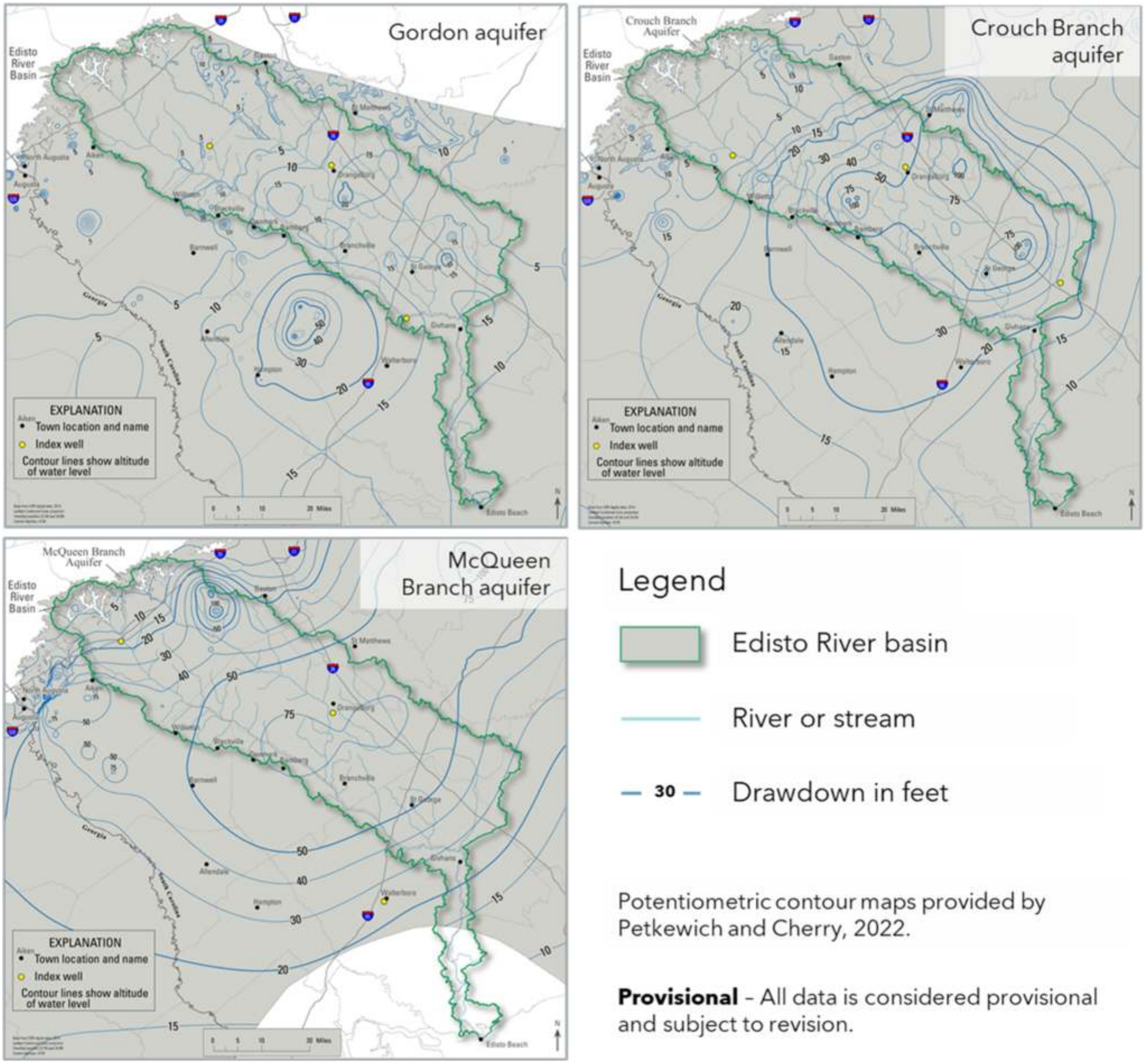
- Groundwater level declines in the McQueen Branch aquifer will range from 10 feet at the northern extent of the basin to over 150 feet in Lexington County. Drawdowns are approximately 50 to 80 feet in the middle of the basin, dropping to about 40 feet near Givhans. In Lexington County near Pelion, groundwater levels are simulated to drop more than 50 feet below the top of the McQueen Branch aquifer.



Potentiometric contour maps provided by Petkewich and Cherry, 2022.

Provisional – All data is considered provisional and subject to revision.

Figure 5-24. Simulated High Demand Scenario 2070 potentiometric contour maps for the Gordon, Crouch Branch, and McQueen Branch aquifers.



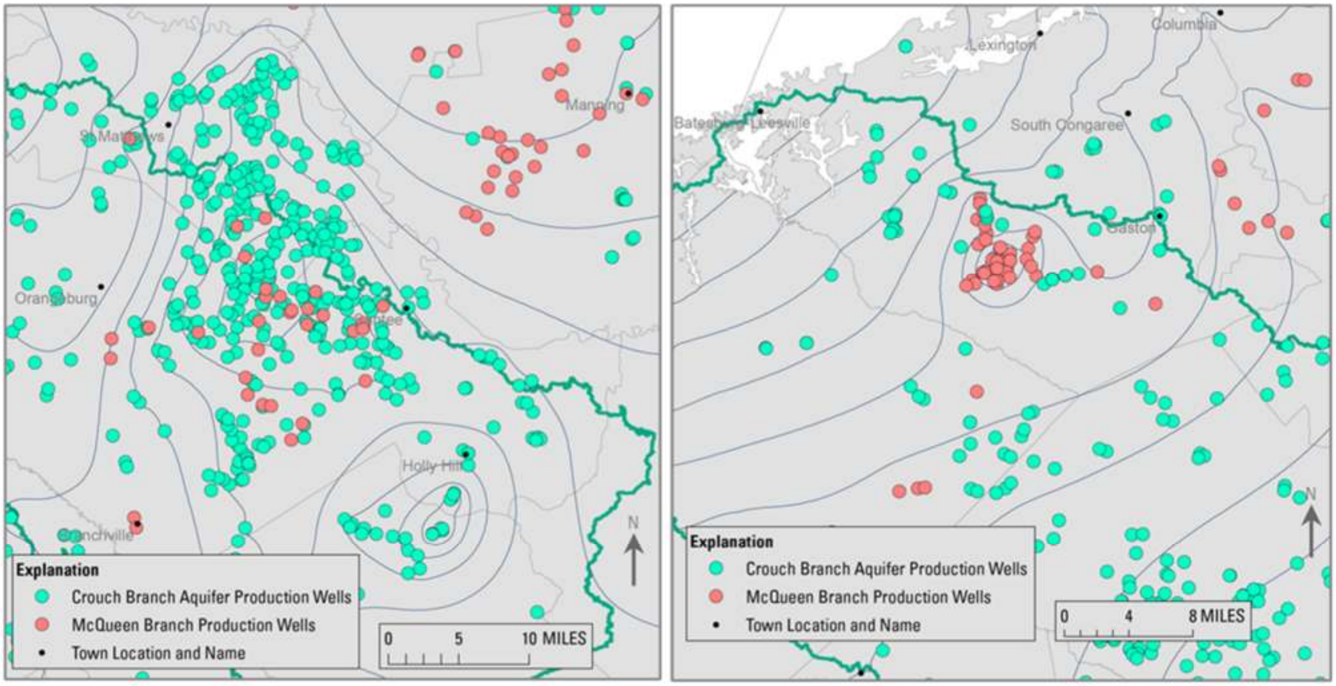
Potentiometric contour maps provided by Petkewich and Cherry, 2022.

Provisional – All data is considered provisional and subject to revision.

Figure 5-25. Simulated drawdown for the High Demand Scenario from 2020 to 2070 for the Gordon, Crouch Branch, and McQueen Branch aquifers.

Given the projected groundwater level declines of greater than 100 feet in the Crouch Branch and McQueen Branch aquifers, and the fact that both aquifers will be subject to potential dewatering, impacts to wells could be expected that are similar to those identified for the Moderate Scenario. Because the drawdowns are expected in the central part of the basin away from the coast, saltwater intrusion would likely not be a concern.

The simulated groundwater level declines below the top of the Crouch Branch aquifer in Calhoun County and the McQueen Branch aquifer in Lexington County for all planning scenarios occur primarily because of the high density of wells in these areas, and their associated pumping. Figure 5-26 shows the location and density of wells in the Lexington County and Calhoun County Groundwater Areas of Concern. Simulated groundwater level contours are also shown.



Crouch and McQueen Branch aquifer wells in the Calhoun County Groundwater Area of Concern. Potentiometric contours are shown for the HD Scenario, Crouch Branch aquifer.

Crouch and McQueen Branch aquifer wells in the Lexington County Groundwater Area of Concern. Potentiometric contours are shown for the HD Scenario, McQueen Branch aquifer.

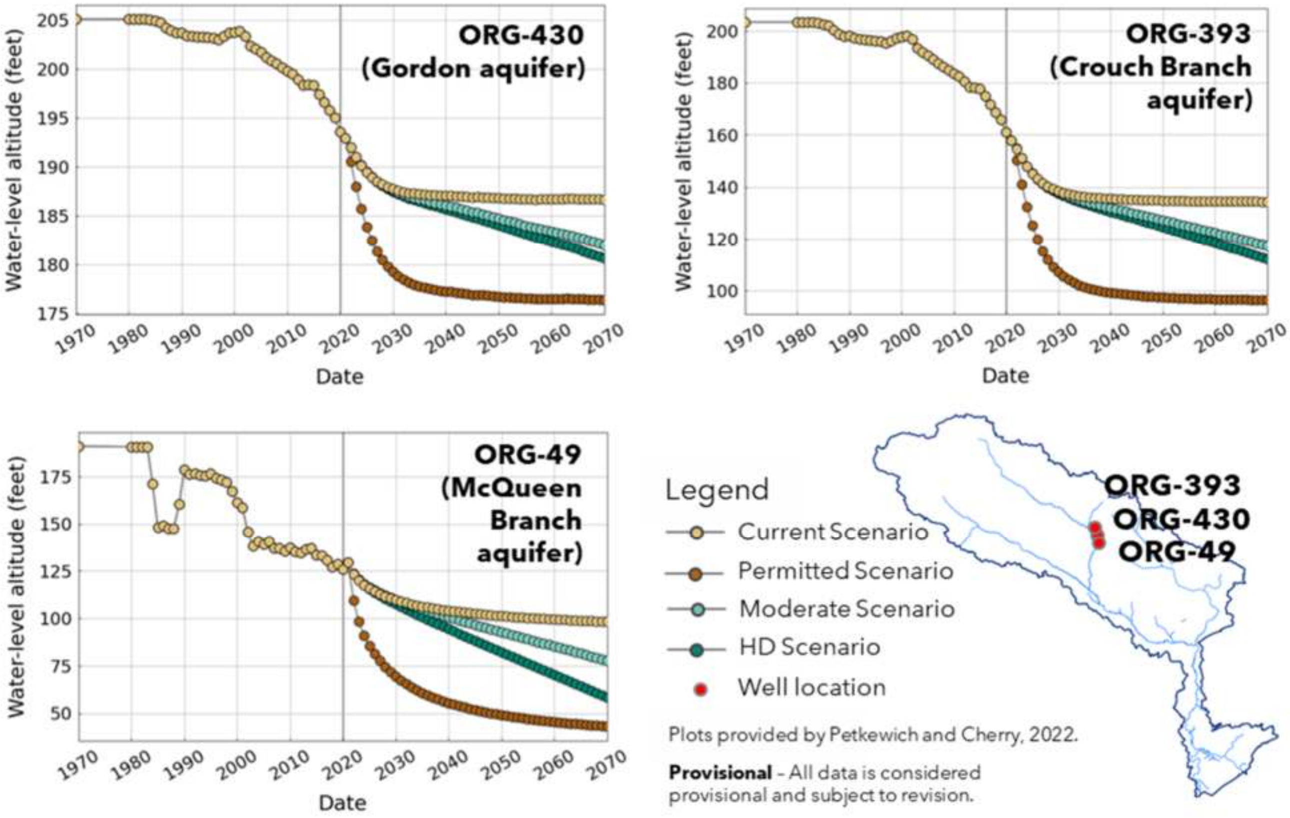
Potentiometric contour maps provided by Petkewich and Cherry, 2022.

Provisional – All data is considered provisional and subject to revision.

Figure 5-26. Well locations and simulated High Demand Scenario 2070 potentiometric contours in the Calhoun and Lexington County Groundwater Areas of Concern.

One limitation of the modeling was the assignment of increasing levels of pumping in the Moderate and High Demand Scenarios to existing wells. Assigning the growth in pumping to the existing wells is not meant to suggest that existing wells will see an increase in pumping, but that new wells would be installed in the same general area as existing wells. Using this approach, the model accounts for these new withdrawals in the general areas where they are expected to occur. While it is reasonable to assume that new wells are likely to be installed in areas where groundwater development has already occurred, the possibility remains that groundwater development (i.e., new wells) may occur outside of these areas. In that case, the drawdowns observed in the identified Groundwater Areas of Concern could be less severe.

The simulated time history of groundwater levels for the Current, Permitted, Moderate, and High Demand Scenarios at monitoring wells near Orangeburg are shown in Figure 5-27. These wells are in the central area of the basin where some of the largest declines in groundwater levels are predicted for each scenario.



Plots provided by Petkewich and Cherry, 2022.

Provisional – All data is considered provisional and subject to revision.

Figure 5-27. Simulated groundwater levels under Current, Permitted, Moderate and High Demand Scenarios for the Gordon, Crouch Branch, and McQueen Branch aquifers.

5.4.6 Groundwater Budgets

Groundwater budgets are commonly used in water resources studies to enhance the understanding of the groundwater system. In the Edisto River basin, groundwater budgets were developed for each planning scenario to provide a basis for evaluating potential changes and identifying stresses to the system. Budgets were developed from the output generated from the groundwater model simulations.

Table 5-25 summarizes the simulated groundwater discharge to streams for 2070 conditions for the Current Scenario, Moderate Scenario, High Demand Scenario, and Permitted Scenario. The average recharge rate applied to the model for year 2070 was approximately 0.2 feet per year (405 MGD), which reflects a significantly drier-than-normal year. A reduction in the amount of groundwater that discharges to streams would be expected with increased pumping; however, the water budgets show that the decrease in outflow to streams between the 2070 Current Scenario (-1,149 MGD) and the 2070 Permitted Scenario (-1,138 MGD) is only 11 MGD, or about 1 percent. The difference in pumping (discharge to wells from all aquifers) is 44.9 MGD between the two scenarios. The relatively minor reduction in discharge to streams suggests that groundwater withdrawals from the deeper Crouch Branch and McQueen Branch aquifers in the central part of the basin do not significantly impact stream baseflow. This is to be expected given the confined nature of the deeper aquifers. Pumping in the upper part of the basin, where the aquifers are thinner, closer to the surface, and less confined, would have more impact on stream baseflow.

Table 5-25. Simulated groundwater discharge to streams for all scenarios.

Flow Component	2070 Current	2070 Moderate	2070 High Demand	2070 Permitted
Discharge to streams	-1,149	-1,145	-1,144	-1,138

All values are in MGD
A positive number reflects a flow into an aquifer and a negative number reflects a flow out of an aquifer.
Adapted from Petkewich and Cherry, 2022.

Provisional – All data is considered provisional and subject to revision.

Table 5-26 shows the calculated difference for each water budget component between present day (2020) conditions and 2070 for each planning scenario. The large differences in the net lateral flow into the Surficial aquifer for 2020 and that of all the scenarios for 2070 (a range of 1,493 to 1,518 MGD) is the result of the significant difference in recharge applied to the model for the years 2020 and 2070. Also, the effects of increased pumping, most of which occurs in the Crouch Branch and McQueen Branch aquifers, are seen in the increasingly negative vertical flows associated with the Surficial aquifer. Under 2020 conditions, the net vertical flow out of the Surficial aquifer to the deeper Gordon aquifer is 74 MGD (a negative number in the table reflects a flow out of the aquifer). The net vertical flow out of the Surficial aquifer increases by 70 percent under Permitted Scenario pumping in 2070, and 53 percent under High Demand Scenario pumping in 2070. Effectively, the additional pumping results in more water being pulled into the deeper aquifers, where pumping is the greatest.

Table 5-26. Edisto River basin groundwater budget differences from 2020 Current Scenario.

Flow Component	MGD Difference from 2020 Current			
	2070 Current	2070 Moderate	2070 High Demand	2070 Permitted
Surficial aquifer				
Recharge	-1,618	-1,618	-1,618	-1,618
Outflow to streams	140	144	145	151
Discharge to wells	0	-0.1	-0.2	-0.3
Net lateral flow	1,493	1,506	1,511	1,518
Net vertical flow	-16	-32	-39	-52
Gordon aquifer				
Discharge to wells	-0.7	-2.2	-3.3	-6.3
Net lateral flow	0.1	-0.2	0	-0.1
Net vertical flow	1	3	4	6
Crouch Branch aquifer				
Discharge to wells	-12	-29	-35	-43
Net lateral flow	0	6	7	5
Net vertical flow	12	23	27	39

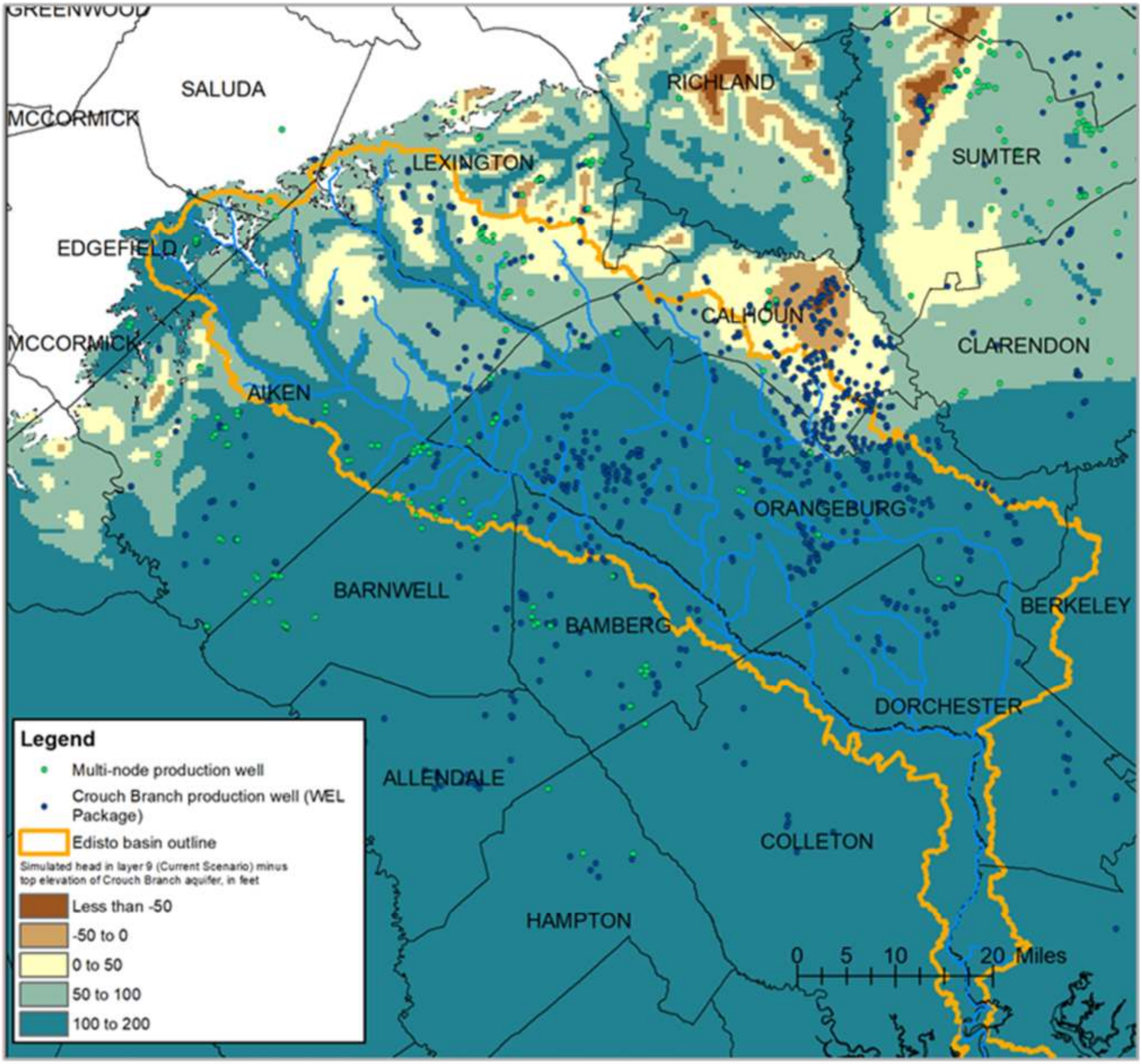
Table 5-26. Edisto River basin groundwater budget differences from 2020 Current Scenario. (Continued)

Flow Component	MGD Difference from 2020 Current			
	2070 Current	2070 Moderate	2070 High Demand	2070 Permitted
McQueen Branch aquifer				
Discharge to wells	-4	-10	-13	-12
Net lateral flow	2.2	5.1	5	6.3
Net vertical flow	1	4.7	7.2	6.5

All values are in MGD
A positive number reflects an increase over 2020 conditions and a negative number reflects a decrease.
Adapted from Petkewich and Cherry, 2022.
Provisional – All data is considered provisional and subject to revision.

5.4.7 Groundwater Areas of Concern

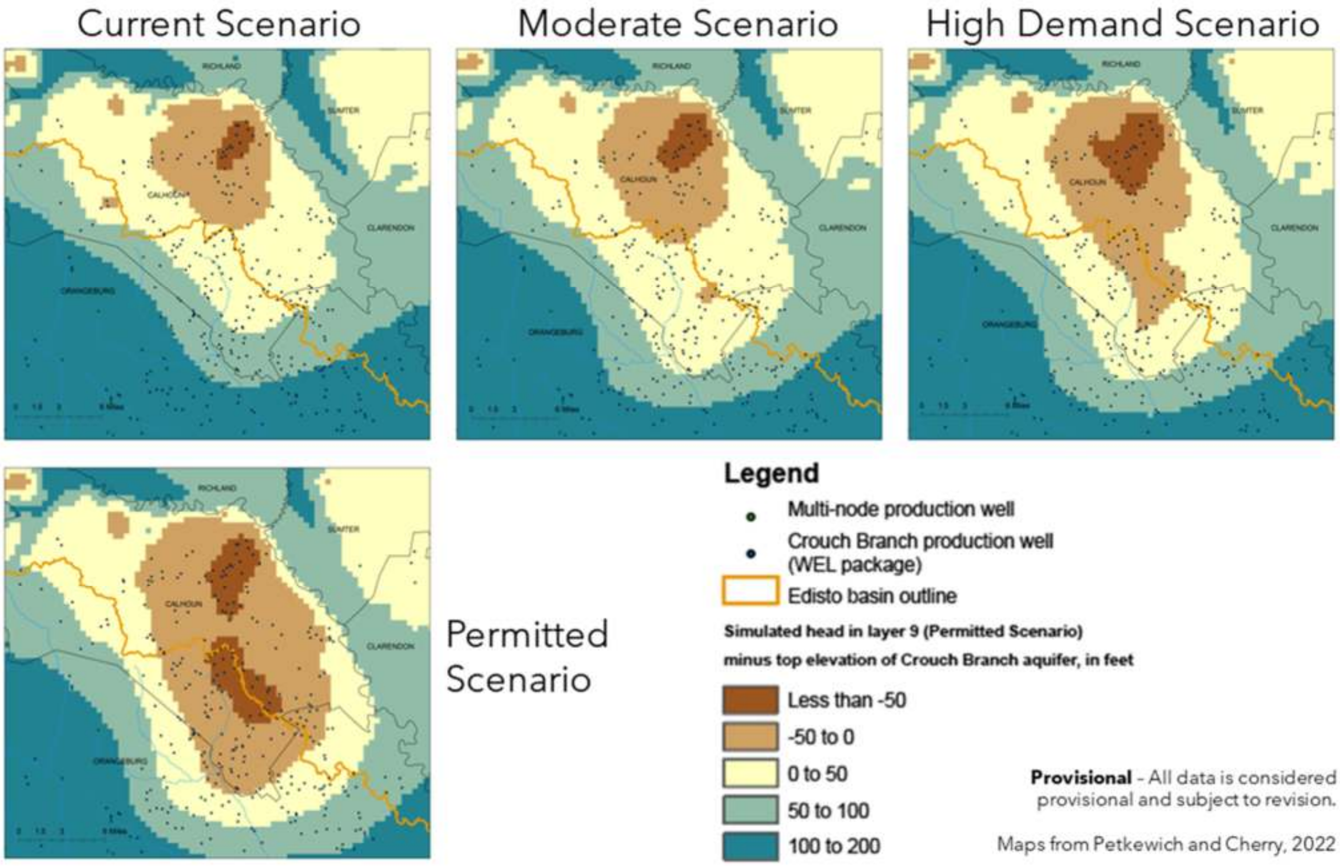
Every planning scenario groundwater model simulation predicted groundwater levels dropping below the top of the Crouch Branch aquifer in Calhoun County and the McQueen Branch aquifer in Lexington County by year 2070. Figure 5-28 shows the difference in feet between the simulated 2070 groundwater levels in the Crouch Branch aquifer under Current Scenario withdrawals, compared to the elevation of the top of the Crouch Branch aquifer. The light yellow contour interval reflects Crouch Branch aquifer levels that are 0 to 50 feet above the top of the aquifer. The light brown and dark brown contour intervals, which dominate the southern half of Calhoun County, indicate groundwater levels that are simulated to drop below the top of the aquifer by 0 to 50 feet, and more than 50 feet respectively. Groundwater levels in the Crouch Branch aquifer in Aiken County are also simulated to drop below the top of the aquifer over a relatively small area near Shaw Creek.



Provisional – All data is considered provisional and subject to revision.
Map from Petkewich and Cherry, 2022

Figure 5-28. Difference between simulated 2070 groundwater elevation and the top of Crouch branch aquifer for the Current Scenario.

Figure 5-29, which focuses just on the Calhoun County Groundwater Area of Concern, shows the extent and degree of 2070 groundwater level declines below the top of the Crouch Branch aquifer for all planning scenarios. Groundwater level declines below the top of an aquifer can result in aquifer compaction leading to land subsidence, a permanent loss of storage capacity, reduced well yields, and/or dry wells.



Current Scenario

Moderate Scenario

High Demand Scenario

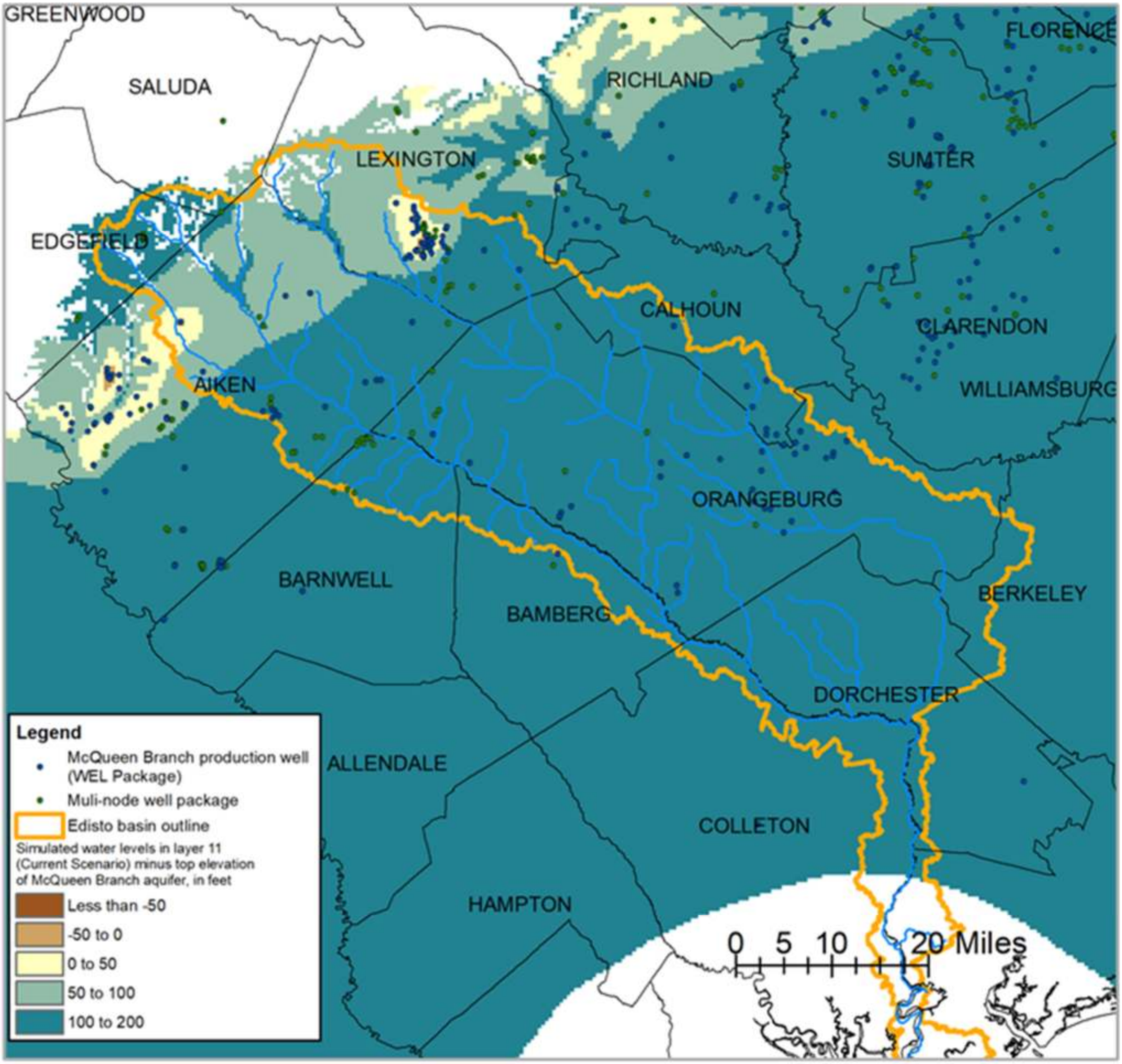
Permitted Scenario

Provisional - All data is considered provisional and subject to revision.

Maps from Petkewich and Cherry, 2022

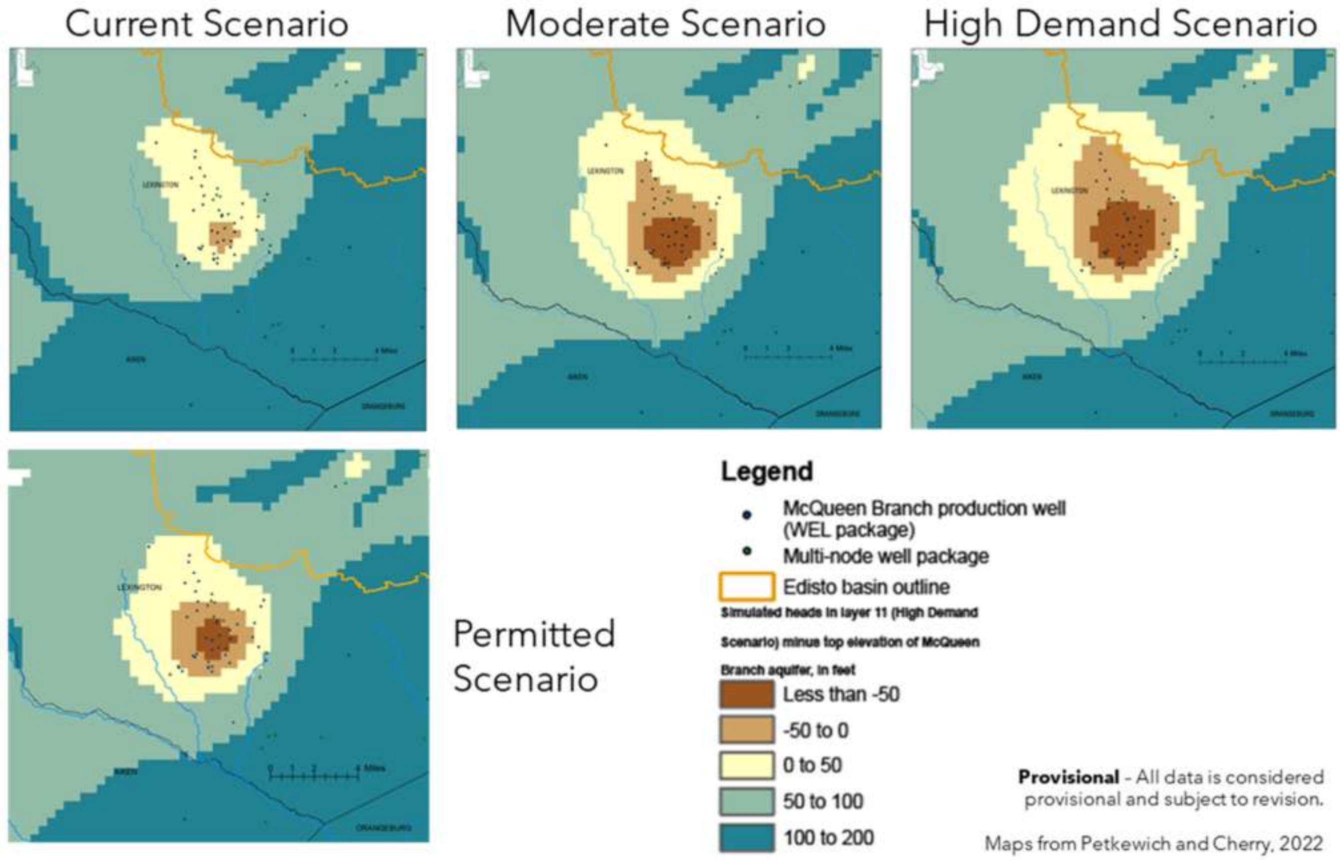
Figure 5-29. Difference between simulated 2070 groundwater elevation and the top of Crouch branch aquifer in Calhoun County for all planning scenarios.

Figure 5-30 shows the difference in feet between the simulated 2070 groundwater levels in the McQueen Branch aquifer under Current Scenario withdrawals, compared to the elevation of the top of the McQueen Branch aquifer. Figure 5-31, which focuses just on the Lexington County Groundwater Area of Concern, shows the extent and degree of 2070 groundwater level declines below the top of the McQueen Branch aquifer for all planning scenarios. Groundwater levels in the McQueen Branch aquifer in Aiken County are also simulated to drop below the top of the aquifer over a relatively small area near Shaw Creek.



Provisional – All data is considered provisional and subject to revision.
Map from Petkewich and Cherry, 2022

Figure 5-30. Difference between simulated 2070 groundwater elevation and the top of the McQueen Branch aquifer in Lexington County for the Current Scenario.



Provisional - All data is considered provisional and subject to revision.

Maps from Petkewich and Cherry, 2022

Figure 5-31. Simulated 2070 groundwater level declines below the top of the McQueen Branch aquifer in Lexington County for all planning scenarios.

5.5 Summary of Water Availability Assessments

The application of the surface and groundwater models using current and projected rates of water withdrawals resulted in the identification of several key observations and conclusions regarding the availability of water resources in the Edisto River basin. These key conclusions, presented below, led to the RBC identifying and evaluating a suite of water management strategies to address projected Surface Water Shortages and Groundwater Areas of Concern, and to identify strategies to protect Surface Water Supply and maintain adequate river flows, especially during low flow conditions. The evaluation and selection of water management strategies is presented in Chapter 6 – Water Management Strategies.

The results and conclusions are based on modeling that assumed historical climate patterns. In subsequent phases of river basin planning, the RBC may decide to evaluate potential impacts to water supply availability resulting from changing climate conditions such as increasing temperatures and more variable precipitation.

5.5.1 Key Surface Water Observations and Conclusions

The surface water availability modeling suggests a low risk of water supply shortages under reasonable future demand scenarios. It suggests there could be shortages for agricultural users in small headwater streams that do not have storage ponds. By year 2070, assuming high population and economic growth and hot/dry conditions, a repeat of the drought of record (2002) would produce shortages of 1 to 2 months for two water suppliers – Aiken, which withdraws from Shaw Creek in the upper part of the basin, and CWS, which withdraws from the Edisto River in the lower part of the basin. Both Aiken and CWS have alternative sources of water and drought management plans that include strategies that would potentially help avoid a shortage. A third water supplier with a predicted shortage, Batesburg-Leesville, has already signed a 40-year agreement to connect to the Joint Municipal Water & Sewer Commission of Lexington County, which withdraws water from Lake Murray in the Saluda River basin.

Specific observations and conclusions relative to each planning scenario are presented below.

- Surface Water Shortages were identified in the Current Scenario for 12 agricultural water users in the SWAM model, ranging in frequency from 0.1 to 46 percent of months of the 88-year simulation period. However, many if not all the simulated shortages in this Scenario are likely to be significantly tempered or avoided because of the on-site storage available from existing ponds which were not included in the model. The ponds provide much-needed storage during low flow conditions that occur during a drought.

- In the P&R Scenario (i.e., surface water withdrawals at fully permitted and registered amounts), river flows are predicted to decrease compared to the Current Scenario resulting in Surface Water Shortages for 54 percent of the surface water users. Mean and median flows on the Edisto River near Givhans are predicted to decrease by approximately 23 to 36 percent respectively. Edisto River flows would essentially be 0 cfs more than 5 percent of the time at this location. With surface water demands greater than four times the High Demand 2070 Scenario demands, the P&R Scenario represents an unrealistic scenario; however, it demonstrates that the surface water resources of the basin are over-allocated based on existing permit and registration amounts. The registered and permitted withdrawals have effectively used up the safe yield of the basin and SCDHEC cannot grant any new surface water registrations. Future surface water withdrawers seeking new registrations in the basin will need to apply for a permit instead, and be subject to permit fees and conditions, such as complying with minimum instream flow requirements. Because no new registrations can be granted and the existing registered and permitted amounts are unlikely to ever be withdrawn, the existing registrations effectively act as a conservation measure, ensuring additional withdrawals cannot be registered.

- In the Moderate Scenario, flows are predicted to decrease modestly, compared to the Current Use Scenario, throughout the basin. Modeled reductions are most pronounced during low flow periods. Mean and median Edisto River flows near Givhans are predicted to decrease by approximately 5 percent, and low flows by about 20 percent by 2070. Calculated water user shortages remain essentially unchanged, relative to the Current Scenario. Surface water supplies are predicted to be adequate to meet increased demands resulting from moderate economic and population growth.

- In the High Demand Scenario, river flows are also predicted to decrease modestly, compared to the Current Scenario, throughout the basin. Modeled reductions are most pronounced during low flow periods. Mean and median Edisto River flows near Givhans are predicted to decrease by approximately 10 percent, and low flows by more than 40 percent, by 2070 if population and economic growth is high and given a hotter and drier climate. Calculated water user shortages increase slightly, and terms of both duration and intensity, for the 2070 planning horizon, as compared to the Current Scenario results. CWS, Aiken, and Batesburg-Leesville each had shortages ranging from 1 to 2 months during the 2002 drought of record in the High Demand Scenario.

- UIF Scenario results show that near Givhans, mean and median unimpaired flows are approximately 3 and 4 percent higher than Current Scenario flows, respectively. At this same location, UIF Scenario low flows (25th – 5th percentile) are approximately 10 to 20 percent higher than Current Scenario flows. The UIF Scenario simulation results represent river hydrologic conditions without the impact of water users, dischargers, or water imports.

- The application of biological response metrics and the development of flow-ecology relationships at Strategic Nodes demonstrated that the simulated flow regimes of the Moderate, High Demand, and P&R Scenarios are likely to result in low ecological risk in primary and secondary tributaries of the Edisto River basin. At only a few Strategic Nodes were risks predicted to increase to the medium or high category in the High Demand and P&R Scenarios. The assessment was limited to a relatively small subset of hydrologic and biological response metrics for which good correlation had been established. This limited the use of these metrics to four hydrologic metrics and five biological metrics. The findings do not rule out potential risks for ecological integrity or tolerance related to other metrics or flow changes.

- Low flows occur naturally in the basin but can be exacerbated by surface water withdrawals. Figure 5-32 depicts the simulated (daily) UIF, Current, Moderate, High Demand, and P&R Scenario Edisto River flows at the Givhans gaging station, based on 2002 hydrology, which is the drought of record in the basin. Actual flows recorded at the gaging station are also shown. The hydrograph demonstrates that flows, which typically average from 1,500 to over 4,000 cfs depending on the month, can drop to as low as 250 cfs under naturalized conditions (UIF flows), and to zero assuming 2070 high demands or fully permitted and registered withdrawals.

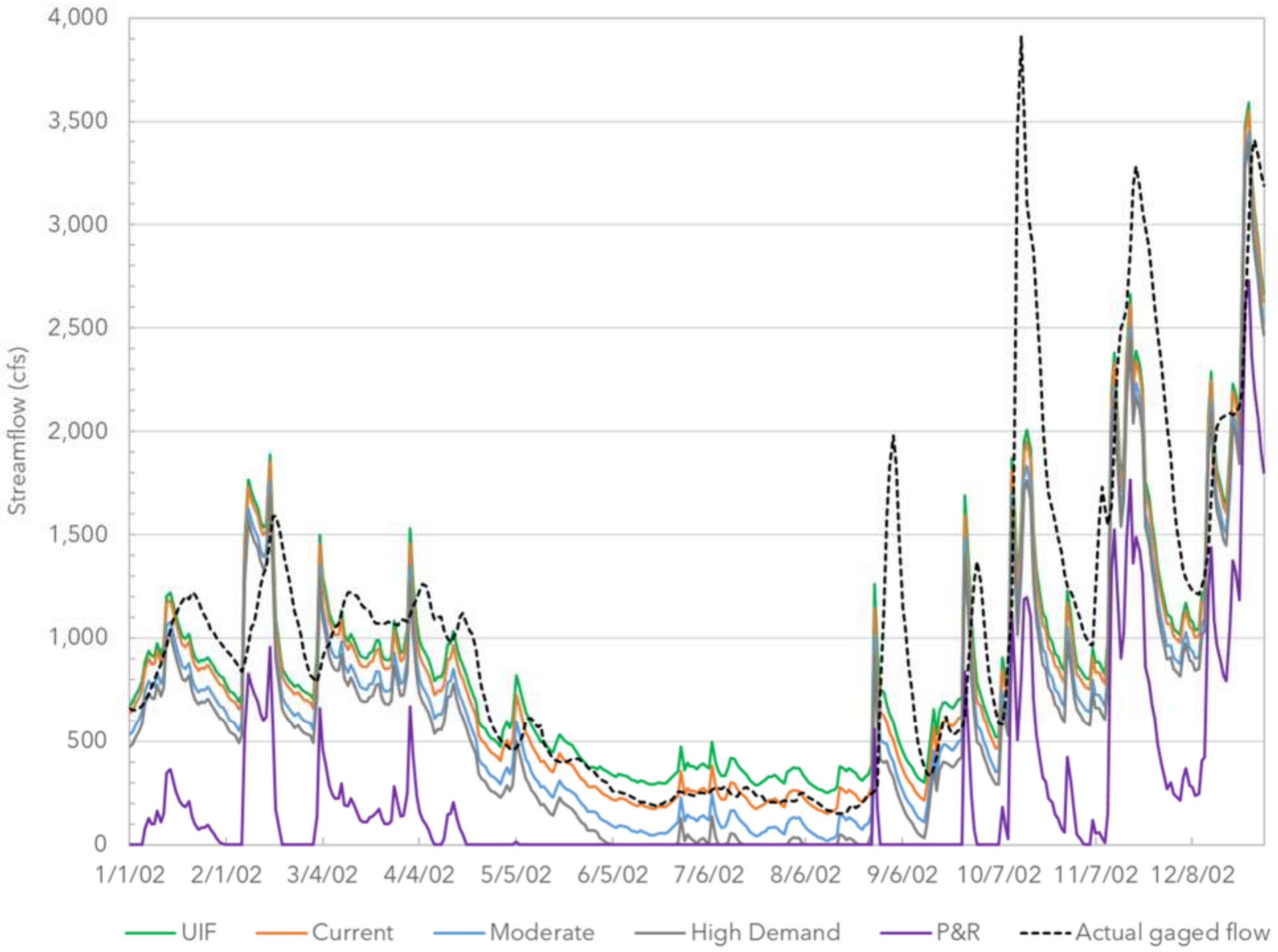


Figure 5-32. Hydrograph depicting simulated daily scenario flows for the 2002 drought of record.

5.5.2 Key Groundwater Observations and Conclusions

The groundwater level declines simulated in all scenarios result in aquifer levels dropping below the top of the Crouch Branch aquifer in the southern half of Calhoun County, and below the top of the McQueen Branch aquifer in a more limited area of Lexington County. In Aiken County, projected withdrawals also indicate the possibility for localized drawdowns in water levels below the top of the McQueen Branch aquifer near Shaw Creek. At each of these locations, there are risks to the groundwater aquifers under all scenarios that will need to be managed, including the risk of reduced storage, land subsidence, reduced well yields and/or dry wells. Because of the potential for negative impacts when groundwater levels drop below the top of an aquifer, the RBC decided to designate areas where modeling or monitoring show declines below the top of an aquifer as Groundwater Areas of Concern.

Additional observations and conclusions relative to each planning scenario are presented below.

- Model-predicted groundwater level declines from 2020 to 2070 with the Current Scenario pumping are generally in the 5 to 10-foot range for the Gordon aquifer, 5 to 50-foot range for the Crouch Branch aquifer, and 5 to 30-foot range for the McQueen Branch aquifer within the Edisto River basin.

- The most severe model predicted groundwater level declines were seen in the Permitted Scenario. Declines over present simulated conditions (2020) were up to approximately 20 feet in the Gordon aquifer, 125 feet in the Crouch Branch aquifer, and 100 feet in the McQueen Branch aquifer. Moderate and High Demand Scenario predicted groundwater level declines were generally in between the Current and Permitted Scenario declines, with the High Demand Scenario declines slightly more pronounced than the Moderate Scenario.

- The water budgets show a relatively minor reduction in discharge to streams with increased pumping from the deeper aquifers. The results suggest that groundwater withdrawals from the deeper Crouch Branch and McQueen Branch aquifers in the central part of the basin do not significantly impact stream baseflow. This is to be expected, given the confined nature of the deeper aquifers. Pumping in the upper part of the basin, where the aquifers are thinner, closer to the surface, and less confined, would be expected to have more impact on stream baseflow.

Chapter 6

Water Management Strategies

This chapter summarizes the evaluation of potential water management strategies identified by the Edisto RBC. The Framework identifies a two-step process to evaluate water management strategies. As a first step, proposed management strategies are simulated using the available models to assess their effectiveness in eliminating or reducing identified shortages or increasing surface water or groundwater supply. For strategies that are deemed to be effective, their feasibility for implementation is addressed during a second step. The Framework identifies multiple considerations for determining feasibility, including cost and benefits, consistency with state regulations, reliability, environmental and socioeconomic impacts, and potential interstate or interbasin impacts.

6.1 Surface Water Management Strategies

Under the Framework, a surface water management strategy is any water management strategy proposed to eliminate a surface water shortage, reduce a surface water shortage, or generally increase surface water supply to reduce the probability of future shortages. Strategies include demand-side management strategies that reduce supply gaps by reducing demands, as well as supply-side strategies that reduce supply gaps by directly increasing supply.

The Edisto RBC identified a portfolio of various demand-side strategies consisting of agricultural water efficiency practices and municipal water conservation practices as listed in Tables 6-1 and 6-2, respectively. While these demand-side strategies were first identified and evaluated for surface water withdrawers, they also apply to groundwater withdrawers. Surface water supply-side strategies identified by the RBC include conjunctive use of groundwater with surface water and the construction of offline storage reservoirs and small impoundments, as noted in Table 6-3. These strategies do not represent an exhaustive list of possible strategies that could be implemented by water users in the Edisto River basin. The most appropriate strategies for a water withdrawer will depend on their location, end use, water source, financial resources, and other constraints or opportunities. The RBC noted the importance of continuing to research and support new technologies and other means, as they become available and accepted, to improve water use efficiency.

Table 6-1. Agricultural water efficiency practices.

Agricultural Practice
Water Audits and Nozzle Retrofits
Irrigation Scheduling
Soil Management
Crop Variety, Crop Type, and Crop Conversions
Irrigation Equipment Changes

Table 6-2. Municipal water conservation and efficiency practices.

Municipal Practices	
Conservation Pricing Structures	Public Education of Water Conservation
Toilet Rebate Program	Residential Water Audits
Landscape Irrigation Program and Codes	Water Efficiency Standards for New Construction
Leak Detection and Water Loss Control Program	Reclaimed Water Programs
Car Wash Recycling Ordinances	Time-of-Day Watering Limits
Water Waste Ordinance	-

Table 6-3. Supply-side strategies.

Practice
Conjunctive Use
Offline Reservoir Storage and Small Impoundments

The following sections present the surface water management strategies identified by the RBC, a technical evaluation of their potential effectiveness, and an assessment of their feasibility.

6.1.1 Agriculture Water Efficiency Demand-Side Strategies

The agricultural water efficiency practices considered as part of the toolbox of strategies are further described below. These demand-side strategies also apply to groundwater users.

Water Audits and Nozzle Retrofits

Water audits monitor water use in an agricultural irrigation system to identify potential opportunities for water efficiency improvements. Water audits consider water entering the system, water uses, water costs, and existing water efficiency measures. They gather information on the size, shape, and topography of the agricultural field, depth to groundwater, vulnerability to flooding, pumping equipment, irrigation equipment, and past and present crop use and water use (Texas Water Development Board 2013).

In the Edisto basin and across the state, Clemson University Cooperative Extension Service specialists and researchers have held meetings to talk with farmers about center pivot irrigation and discuss the Clemson Center Pivot Irrigation Test Program, a type of water audit offered by the Clemson Extension Water Resources, Agronomic Crops, and Horticulture Teams. These audits measure irrigation uniformity–the consistency of irrigation depth across the irrigated area. Without irrigation uniformity, some crops may experience overirrigation and some may experience underirrigation, leading to wasted water and profit losses. The Center Pivot Irrigation Test Program can provide growers with a map of irrigation depths, observed issues such as leaks and clogs, estimated costs of over- or underwatering, estimated costs for nozzle retrofits, and design versus observed flow rates and system pressure (Clemson Cooperative Extension 2022a). After the audit, a report is provided that includes an estimated cost of under- and overirrigation based on crop types. This cost of suboptimal irrigation is compared to the estimated cost of a sprinkler retrofit.

The South Carolina Mobile Irrigation Laboratory pilot project is another example water audit program. This project is the result of a partnership with South Carolina Department of Agriculture (SCDA) and Aiken Soil and Water Conservation District. The audits identify areas of over- and underwatering, suggest energy savings opportunities, and recommend upgrades or operational changes (SCDNR 2019c). The project is providing no-cost water and energy audits on 24 agricultural center pivot irrigation systems throughout South Carolina over 3 years (SCDNR 2020b). Following the 3-year pilot program, the feasibility of expanding the pilot to a statewide project will be assessed (SCDNR 2020b).

Irrigation Scheduling

Irrigation scheduling refers to the process of scheduling when and how much to irrigate crops based on the needs of the crops and the climatic/meteorological conditions. It ensures that crops are receiving the correct amount of water at the right time. The three main types of irrigation scheduling methods include soil water measurement, plant stress sensing, and weather-based methods. To measure soil water, farmers can use soil moisture probes at varying depths. For weather-based methods, farmers can research regional crop evapotranspiration reports to develop an irrigation schedule. Additionally, farmers can use thermal sensors to detect plant stress (Freese and Nichols, Inc. 2020). The use of thermal and/or moisture sensors to automatically schedule irrigation is referred to as *smart irrigation*.

A 2021 Clemson study on Intelligent Water and Nutrient Placement (IWNP) combines smart watering strategies with smart fertilizer applications. IWNP will use smart sensing with model-based decision support systems to determine the irrigation water and nutrient application required by crops at a given time (Clemson College of Agriculture, Forestry and Life Sciences 2021). The IWNP systems would be installed on existing overhead irrigation systems as a retrofit. The program first seeks to develop the system, then develop a training program to teach farmers how to use the system.

Soil Management

Soil management includes land management strategies such as conservation tillage, furrow diking, and the use of cover crops in crop rotations. The USDA defines conservation tillage as “any tillage or planting system that covers 30 percent or more of the soil surface with crop residue, after planting, to reduce soil erosion by water” (USDA 2000). Conservation tillage can conserve soil moisture, increase water use efficiency, and can decrease costs for machinery, labor, and fuel. Types of conservation tillage include:

- No-Till – The soil is left undisturbed from harvest to planting except for nutrient injection. With this type of practice, planting is done in narrow seedbeds and a press wheel may be used to provide firm soil–seed contact (Janssen and Hill 1994).

- Strip Till – This practice involves tilling only the seed row prior to planting, disturbing less than one-third of the row width (CTIC 1999).

- Ridge Till – This practice involves planting into a seedbed prepared on ridges using sweeps, disk openers, coulters, or row cleaners. Residue is left on the surface between ridges to reduce soil loss (Janssen and Hill 1994).

- Mulch Till – This practice uses chisel flows, field cultivators, disks, sweeps, or blades to till soil in such a way that it does not invert the soil but leaves it rough and cloddy (Janssen and Hill 1994).

- Furrow Diking – The practice of creating small dams or catchments between crop rows to slow or prevent rainfall runoff and increase infiltration. Increased water capture reduces supplemental irrigation needed, resulting in a direct water savings.

- Cover Crops – This practice involves planting cover crops, such as cereal grains or legumes, following the harvest of summer crops. Such cover crops use unused nutrients and protect against nutrient runoff and soil erosion. They can increase infiltration and water-holding capacity of the soil, which may indirectly result in water savings.

Crop Variety, Crop Type, and Crop Conversion

Changing crop type from those that require a relatively large amount of water to crops that require less water use can save significant amounts of irrigation water. In South Carolina, transitioning away from corn and small grains, such as wheat, rye, oats, and barley, and increasing cotton crops can reduce water use. However, because the choice of crops is market-driven and certain machinery, infrastructure, and skills are specific to different crops, changing crop type may not make economic sense for growers. Conversion programs that offer growers incentives may be necessary. Switching the variety of a particular crop may also act as a water conservation strategy. For example, switching from full/mid-season corn to short-season corn could result in a 3.7 acre-inches per acre savings. However, such a change could also result in substantial yield loss, making it an unviable option for some growers (Freese and Nichols, Inc. 2020).

Converting from irrigated crops to dryland crops can have substantial water saving benefits. Exact savings vary by crop but could potentially be on the order of 15.8 acre-inches per acre (Freese and Nichols, Inc. 2020).

Irrigation Equipment Changes

Changing from low efficiency irrigation equipment to higher efficiency equipment can reduce water use but requires significant financial investment. Irrigation methodologies may include mid-elevation, low elevation, low elevation precision application, or drip irrigation. These methodologies have application efficiencies of 78, 88, 95, and 97 percent, respectively (Amosson et al. 2011).

6.1.2 Municipal Water Efficiency and Conservation Demand-Side Strategies

Municipal water efficiency practices considered as part of the toolbox of strategies are further described in this subchapter. These demand-side strategies also apply to groundwater users.

Conservation Pricing Structures

Conservation pricing structures increase the unit cost of water as consumption increases. Utilities may have pricing structures that have a flat rate for customers, a unit use rate that varies with consumption, or some combination of the two. Conservation pricing sets higher unit use rates for customers whose usage exceeds set thresholds. This strategy assumes that consumers will curtail their personal use to avoid paying higher prices. The extent of demand reduction depends on the magnitude of the price increase and the local price elasticity of demand for water usage.

Toilet Rebate Program

Toilet rebate programs offer rebates for applicants who replace old, inefficient toilets with water-efficient ones. For example, if the toilet being replaced uses 3.5 gallons per flush (gpf) and the replacement toilet uses 1.28 gpf, there will be a savings of 2.22 gpf per rebate. Assuming a use rate of five flushes per day per person (DeOreo et al. 2016) and an average of 2.5 persons per household results in savings of 27.8 gallons per household per day for each rebate.

Landscape Irrigation Program and Codes

Landscape irrigation programs or water-efficient landscaping regulations can encourage or require homeowners to adopt water-efficient landscaping practices. Such practices seek to retain the natural hydrological role of the landscape, promote infiltration into groundwater, preserve existing natural vegetation, and ultimately conserve water. Water-efficient landscaping may incorporate native plants or low water use plants into landscape design (City of Commerce, CA 2021).

Local governments can require the use of these water efficiency measures through municipal codes or encourage them through incentives or educational programs. Potential practices include:

- Smart Irrigation Controller Rebate – Utilities may offer rebates to homeowners who replace their existing irrigation controllers with smart irrigation controllers that adjust irrigation according to soil moisture levels (soil-moisture-based or SMS) and precipitation and/or evapotranspiration rates (weather-based or WBIC). Controllers can be WaterSense certified by meeting EPA criteria.

- Turf Replacement Rebate – Utilities may offer rebates to homeowners or businesses who replace irrigable turf grass with landscaping that requires minimal or no supplemental irrigation.

- Developer Turf Ordinance – Ordinances can be set that require new developments to have reduced irrigable turf grass area. Such development may be required to have low flow or microirrigation in plant beds, spray or rotor heads in separate zones for turf grass, or smart irrigation controllers to manage remaining turf area.

- Education Programs – Programs could be offered for homeowners to learn about water-efficient landscaping practices. Some examples of landscape irrigation improvements include:
  - Verifying the best irrigation schedule for the climate and soil conditions
  - Verifying the recommended nozzle pressure in sprinklers
  - Adjusting sprinkler locations to ensure water falls on lawns or gardens (not on sidewalks or other impervious surfaces)
  - Using a water meter to measure water used in landscape irrigation

Leak Detection and Water Loss Control Program

A water loss control program identifies and quantifies water uses and losses from a water system through a water audit. Once identified, sources of water loss can be reduced or eliminated through leak detection, pipe repair or replacements, and/or changes to standard program operations or standard maintenance protocols. Following these interventions, the water loss program can evaluate the success of the updates and adjust strategies as needed (EPA 2013).

Georgia is one of the few states that have implemented statewide water loss control requirements. In 2010, the Georgia Water Stewardship Act was signed into law. The Act set water loss control requirements that apply to public water systems serving populations over 3,300 that include:

- Completing an annual water loss audit using American Water Works Association (AWWA) M36 methodology
- Developing and implementing a water loss control program
- Developing individual goals to set measures of water supply efficiency
- Demonstrating progress toward improving water supply efficiency

Car Wash Recycling Ordinances

In-bay automatic car wash systems use approximately 35 gallons of water per vehicle. Touch-free car wash systems, which rely solely on chemicals and high-pressure spray rather than on the gentle friction of a soft-touch wash, use approximately 70 gallons of water per vehicle. Assuming one bay and 100 customers per day, these two common types of systems use between 3,500 and 7,000 gallons of water per day. To reduce water usage, car wash recycling ordinances require all new car washes to be constructed to include recycled water systems. Recycled water systems allow for water used in washing or rinsing to be captured and reused. Ordinances can set a percentage of recycled water to total water used. Typical ordinances require at least 50 percent use of recycled water.

Water Waste Ordinance

Local governments can establish a water waste ordinance to prohibit the watering of impervious surfaces, such as sidewalks or driveways, and/or prohibit runoff from private properties onto public streets.

Public Education of Water Conservation

Water conservation education could occur through public schools, civic associations, or other community groups. Local governments could create informational handouts and/or include additional water conservation information on water utility bills. For this strategy to remain effective, public outreach would need to continue on a regular basis to maintain public engagement and motivation.

Residential Water Audits

Residential water audits allow homeowners to gain a better understanding of their personal water use and identify methods to reduce water use. Homeowners can perform these audits themselves using residential water audit guides or water utilities may provide free residential water audits to their customers. Residential water audits involve checking both indoor uses (e.g., toilets, faucets, showerheads) and outdoor uses (e.g., lawn sprinklers). Based on the results of the audit, homeowners may invest in low flow systems, repair leaks, and/or adjust certain personal water use behaviors.

Water Efficiency Standards for New Construction

Local ordinances can require that renovations and new construction meet established water efficiency metrics. These ordinances may either be set by the local government or rely on existing water efficiency certification programs such as Leadership in Energy and Environmental Design (LEED) or EPA's WaterSense. These programs have set water efficiency requirements for all household fixtures, such as a maximum rating of 2.5 gpm flow rate for showers and maximum rating of 1.6 gallons per flush for toilets (Mullen n.d.).

Reclaimed Water Programs

Reclaimed water programs reuse highly treated wastewater for other beneficial purposes, reducing demands on surface water and groundwater. Water can be reclaimed from a variety of sources then treated and reused for beneficial purposes such as irrigation of crops, golf courses, and landscapes; industrial processes including cooling water; cooling associated with thermoelectric plants; and environmental restoration. The quality of reuse water would need to be matched with water quality requirements of the end use, and emerging contaminants of concern (e.g., per- and polyfluoroalkyl substances [PFAS] and microplastics) would need to be considered.

Time-of-Day Watering Limit

A time-of-day watering limit prohibits outdoor watering during the hottest part of the day, usually 10 a.m. to 6 p.m. This practice reduces water loss from evaporation.

6.1.3 Supply-Side Strategies

The Edisto RBC identified and considered two potential supply-side water management strategies: conjunctive use and small impoundments. These are discussed in this subchapter.

Conjunctive Use

Conjunctive use is the combination of multiple sources of water to improve the resilience of the overall water supply. At the basin scale, conjunctive use of both groundwater and surface water is already occurring. Groundwater and surface water are currently used in almost equal amounts in the Edisto River basin; however, demand projections suggest that surface water use will increase more than groundwater use. At a local scale, three types of conjunctive use are recognized:

- **Full conjunctive use** is the ability of a water user to meet 100 percent of water demands from either groundwater or surface water. Dominion Energy Cope Station is an example of a water user that is moving toward full conjunctive use. While they currently meet most of their water demand from groundwater, under agreement with SCDHEC, they are switching to surface water as their primary source, with the ability to switch to groundwater during low flow conditions.

- **Partial conjunctive use** is the ability of a water user to meet a portion of demands from either groundwater or surface water. Walther Farms is an example of an agricultural water user that can augment or replace a portion of their surface water use with groundwater. While they rely on their surface water source (the South Fork Edisto River) as their primary source, they have installed a well that can meet approximately 20 percent of their total water demand. Tampa Creek Farms is a similar example, with one surface water intake and one groundwater well. They can use the sources interchangeably to irrigate the same fields (with some limitations).

- **Noncentralized conjunctive use** occurs when a water user relies on surface and groundwater sources but does not have the ability to replace one with the other because of separate systems of delivery. Walter P. Rawl & Sons is an example of an agricultural water user that has one surface water intake and 17 groundwater wells but does not have the ability to use the sources interchangeably (without significant infrastructure modifications). Each source has a separate distribution system.

In the Edisto River basin, 19 of 50 agricultural surface water users also have one or more groundwater sources (wells). For this basin planning process, the evaluation of conjunctive use primarily focused on the use of groundwater to supplement surface water supplies during periods when streamflow is low.

Offline Reservoir Storage and Small Impoundments

Offline reservoirs and small impoundments add storage to improve resiliency to drought. Because of the desire to preserve the unique, free-flowing nature of the Edisto River and its major tributaries, an online reservoir was not considered by the RBC. An offline reservoir, which would divert and store water during high flow periods and release water to augment flows during low flow conditions in the Edisto River or major tributaries, was considered. Small impoundments are common in the Edisto River basin and provide storage needed to maintain (primarily agricultural) surface water intakes on small streams. There are currently 349 regulated dams in the basin that impound water, and countless smaller unregulated impoundments. Any dam constructed for a new reservoir or impoundment would be regulated by the State of South Carolina if it is 25 feet or greater in height, if it impounds 50 acre-feet or more of storage, or if its failure may cause loss of human life. Additional county-specific provisions may apply if a proposed dam could affect the designated floodplain of a river, or for other reasons, and USACE would have additional regulatory input on dams constructed in waters of the United States.

6.1.4 Technical Evaluation of Strategies

The effectiveness of surface water management strategies in the Edisto River basin were simulated using the SWAM surface water model. The 11 different scenarios simulated to evaluate demand-side strategies, supply-side strategies, low flow management strategies, and a combination of strategies, are summarized in Table 6-4. Most scenarios were simulated using both the Moderate and High Demand Scenario water demand projections. The scenarios build on each other by adding one type of strategy at a time to intentionally isolate the potential benefits and impacts of each strategy type.

Demand-Side Strategies

Three scenarios (Scenarios 1, 2, and 3) were developed to evaluate a range of potential actions that could be used to reduce water demands and mitigate shortfalls. These scenarios are listed in Table 6-4 and described below.

The demand-side strategies were evaluated by assuming the projected municipal and agricultural water demands would decrease because of implementing one or more strategies from portfolios of municipal and agricultural demand-side strategies. There is high uncertainty regarding the effective reduction in demand for individual demand-side management strategies, as their effectiveness depends on the extent of implementation and the magnitude of impact for each instance of implementation. For example, water savings associated with irrigation equipment changes will depend on the number of water users who change their equipment, the level of efficiency of their existing equipment, the level of efficiency of the new equipment, the water demand of the crops to be irrigated, the irrigated acreage, and the individual's adjustment of irrigation scheduling in response to the increased efficiencies.

Table 6-4. Summary of surface water model scenarios evaluating water management strategies.

Scenario Name	Demand Projections	Municipal Conservation?	Irrigation Efficiency Measures	Drought Management?	Supply-side Mitigation Measures
Scenario 1: Drought Management Plans	2070 Moderate and 2070 High Demand	No	No	Yes	None
Scenario 2: Drought Management + Irrigation Efficiency	2070 Moderate and 2070 High Demand	No	Yes	Yes	None
Scenario 3: Drought Management + Irrigation Efficiency + Municipal Conservation	2070 Moderate and 2070 High Demand	Yes	Yes	Yes	None
Scenario 4a: Low Flow Strategy (Current)	Current	Yes	Yes	No	None
Scenario 4b: Low Flow Strategy (High Demand)	2070 High Demand	Yes	Yes	No	None
Scenario 5a: 20% Conjunctive Use	2070 High Demand	No	No	No	20% Conjunctive Use
Scenario 5b: 50% Conjunctive Use	2070 High Demand	No	No	No	50% Conjunctive Use
Scenario 6a: 20% Conjunctive Use + Demand-side Strategies	2070 High Demand	Yes	Yes	Yes	20% Conjunctive Use
Scenario 6b: 50% Conjunctive Use + Demand-side Strategies	2070 High Demand	Yes	Yes	Yes	50% Conjunctive Use
Scenario 7: Offline Storage	2070 High Demand	No	No	No	New offline storage
Scenario 8: Local Storage	2070 High Demand	No	No	No	New/existing local storage

Scenario 1 evaluated the effectiveness of existing municipal water supply drought management plans. Municipal drought management plans are summarized in Chapter 8, Drought Response. To model these plans, each municipality was assumed to fully achieve water use reduction targets for a given drought condition as specified in their drought management plans. Drought triggers and reduction goals identified in the drought management plans were incorporated into the SWAM model using the software's water user conservation rules. Rules were prescribed for the following surface water withdrawers: CWS, Orangeburg, Aiken, and Batesburg-Leesville. For each of these, water use was curtailed in the model in stages according to when river flows at various locations throughout the basin dropped below trigger levels identified in the drought management plans. In their plans, other triggers calling for reductions in demand are not based on flow in a stream or river but are instead based on factors such as the amount precipitation in the previous 90 days or the average daily water use for the previous 30 days, in combination with other triggers. For modeling purposes, these triggers were not applied since they could not readily be incorporated into the model. This potentially results in conservative estimates of river flow since the scenarios did not simulate full curtailment.

Additionally, for this scenario, Walther Farms was assumed to switch to a groundwater backup supply to meet 20 percent of their water needs during drought conditions. Walther Farms installed a groundwater well as a contingency measure to reduce their surface water withdrawals during low flow conditions in the South Fork Edisto River. These drought management measures, simulated as Scenario 1, are summarized in Table 6-5.

Table 6-5. Scenario 1: Simulated drought management plans.

Water User	% Reduction in Water Use	Drought Flow Trigger
CWS	33–49% (80 MGD cap)	Edisto River at Givhans ≤ 312 cfs
CWS	50–62% (60 MGD cap)	Edisto River at Givhans ≤ 260 cfs
CWS	67–74% (40 MGD cap)	Edisto River at Givhans ≤ 174 cfs
CWS	79–84% (25 MGD cap)	Edisto River at Givhans ≤ 87 cfs
City of Orangeburg	15%	N. Fork Edisto River at Orangeburg ≤ 125 cfs
City of Orangeburg	20%	N. Fork Edisto River at Orangeburg ≤ 110 cfs
City of Orangeburg	25%	N. Fork Edisto River at Orangeburg ≤ 100 cfs
City of Aiken	15%	Shaw Creek at Aiken ≤ 14 cfs
City of Aiken	20%	Shaw Creek at Aiken ≤ 11 cfs
City of Aiken	25%	Shaw Creek at Aiken ≤ 8 cfs
Batesburg-Leesville	15%	Lightwood Knot Creek at Batesburg-Leesville ≤ 5 cfs
Batesburg-Leesville	20%	Lightwood Knot Creek at Batesburg-Leesville ≤ 3 cfs
Batesburg-Leesville	25%	Lightwood Knot Creek at Batesburg-Leesville ≤ 1.5 cfs
Walther Farms	20%	Edisto River at Givhans ≤ 312 cfs[1]

[1] 312 cfs is not a specific flow trigger used by Walther Farms, but was applied here for modeling purposes.

Scenario 2 evaluated agricultural water efficiency strategies in combination with the drought management plans of Scenario 1. For all projected new irrigation demands (new farms developed by 2070 that withdraw surface water), water use was decreased by 10.5 percent in the model. This is based on an assumed 15 percent gain in water efficiency achieved by 70 percent of new irrigators (0.15 × 0.7 = 0.105), compared to their currently projected water demand. The 15 percent efficiency gain was estimated to result from the use of high efficiency nozzles, smart irrigation technology, and other agricultural water efficiency measures. Additionally, 70 percent of existing irrigators were assumed to fully implement the efficiency strategies, thereby achieving 15 percent reductions in water use for these users. These water efficiency measures simulated under Scenario 2 (which also includes the drought management measures included in Scenario 1) are summarized in Table 6-6.

Scenario 3 evaluated the combination of Scenario 2 drought management plans and agriculture efficiency measures with a uniform 15 percent reduction in municipal water demand. For this scenario, the drought management rules summarized in Table 6-5 were retained in the model, and a demand multiplier of 0.85 was applied to all municipal surface water supply users. The 15 percent reduction in water demand is intended to represent some combination of known municipal water conservation strategies such as water audits, low flow appliances, public education, modified pricing structures, water loss control programs, landscape irrigation ordinances, and the use of reclaimed water.

Table 6-6. Scenario 2: Simulated agricultural irrigation water efficiency measures.

Water User	Percent Reduction in Surface Water Use	Basis of Estimate
HUC301 Future IR[1]	10.5%	70% of new irrigators implementing efficiency measures that achieve 15% reductions in water use
HUC302 Future IR	10.5%	
HUC303 Future IR	10.5%	
HUC401 Future IR	10.5%	
HUC402 Future IR	10.5%	
HUC403 Future IR	10.5%	
HUC501 Future IR	10.5%	
HUC503 Future IR	10.5%	
IR: Millwood	15%	70% of existing irrigators implementing efficiency measures that achieve 15% reductions in surface water use
IR: RRR Farms	15%	
IR: Shady Grove	15%	
IR: Backman	15%	
IR: Inabinet Farms	15%	
IR: Thomas C. Fink	15%	
IR: Shivers Trading	15%	
IR: Walter P. Rawl & Sons	15%	
IR: Phil Sandifer & Sons	15%	
IR: Rob Bates	15%	
IR: Norway	15%	
IR: Haigler	15%	
IR: Cotton Lane	15%	
IR: Williams & Sons	15%	
IR: Gray	15%	

[1] *"IR" = Irrigator*

Results of the three scenario simulations for the 2070 planning horizon and High Demand Scenario demand projections (adjusted to account for the demand reduction strategies as noted), are summarized in Tables 6-7 through 6-10. Water management scenario results based on the 2070 Moderate Scenario demand projections are provided in Appendix D.

In Table 6-7, the total annual mean shortage for Scenario 3 is slightly higher (0.1 percent) than the other three scenario listed. Intuitively, one might expect a decrease for Scenario 3 since it includes municipal water management strategies and shows a reduction in the mean annual shortage (to 1.4 MGD). However, the total mean annual shortage is calculated by dividing the average shortage for all surface water users by the average annual demand for all surface water users. In Scenario 3, the average annual demand is lower than the other scenarios because of the addition of municipal conservation measures. Therefore, the calculation results in a slightly higher value for the total annual mean shortage.

Table 6-7. Basin-wide surface water model simulation results, Scenarios 1, 2, and 3 (High Demand 2070 Scenario demands).

Parameter	High Demand 2070 Scenario	Scenario 1 Drought Management Plans	Scenario 2 Drought Management + Irrigation Efficiency	Scenario 3 Drought Management + Irrigation Efficiency + Municipal Conservation
Total annual mean shortage (MGD)	1.6	1.5	1.4	1.4
Maximum water user shortage (MGD)	5.1	4.1	3.7	3.7
Total annual mean shortage (%)	0.7%	0.7%	0.7%	0.8%
Percentage of water users experiencing shortage	20%	17%	17%	16%
Average frequency of shortage (%)	13%	15%	14%	16%

In Scenario 1, demand reductions are only triggered for CWS and Aiken (using the model's monthly time step). Monthly average flows do not drop below drought management plan trigger levels for Orangeburg and Batesburg-Leesville. Scenario 1 results (Tables 6-8 through 6-10) show a minor but positive impact, with respect to water availability, from drought management plans on low flow performance metrics. The most appropriate comparison, to isolate the impacts of the drought management plans, is with the High Demand 2070 Scenario results presented in Table 5-15. The 5th percentile low flow at the most downstream strategic node (EDO13 Edisto River near Givhans) increases from 299 cfs to 359 cfs with the introduction of the simulated drought management plans. This is attributable primarily to the triggered demand reductions in CWS's drought management plan. Low flows also increase at several other locations higher in the basin because of the other simulated drought management plans; however, the change is very minor (less than 1 percent). The 1 to 2 months of shortages for Aiken and CWS simulated in High Demand Scenario do not appear in the Scenario 1. Effectively, Aiken's and CWS's drought management plans call for incremental reductions in demands, and these demand reductions are sufficient to prevent a shortage. As noted in Chapter 5, both CWS and Aiken have multiple sources of water. CWS may also withdraw from the Bushy Creek and Goose Creek reservoirs in the Santee River basin. Aiken can release water from the Mason Branch reservoir to augment flows in Shaw Creek, if necessary. The release of flow from Mason Branch reservoir was not simulated in the model.

Table 6-8. Scenario 1 surface water model simulation results at Strategic Nodes (drought management plans, High Demand 2070 Scenario demands).

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
EDO03 S. Fork Edisto River near Montmorenci	185	168	35	122	95	78
EDO14 S. Fork Edisto River above Springfield	353	316	40	223	160	123
HUC402 Outlet	429	382	37	254	176	134
EDO05 S. Fork Edisto River near Denmark	692	613	84	404	288	220
EDO06 S. Fork Edisto River near Cope	752	635	86	412	293	224
EDO07 S. Fork Edisto River near Bamberg	917	769	97	435	301	226
EDO11 Edisto River near Branchville	1,843	1,411	254	924	666	543
HUC601 Outlet	1,973	1,407	202	845	573	453
EDO13 Edisto River near Givhans	2,403	1,570	166	780	451	359
EDO01 McTier Creek near Monetta	24	18	2	12	8	6
EDO02 McTier Creek near New Holland	49	37	5	26	17	13
Shaw Creek Outlet	123	107	17	74	49	38
EDO04 Dean Swamp Creek near Salley	25	25	10	21	18	16
EDO09 Bull Swamp Creek below Swansea	10	9	2	7	5	5
EDO08 Cedar Creek near Thor	19	18	8	15	13	12
HUC301 Outlet	252	228	58	166	122	104
HUC302 Outlet	445	403	111	299	222	194
EDO10 North Fork Edisto River at Orangeburg	710	640	155	464	340	292
HUC303 Outlet	747	675	161	485	356	303
HUC602 Outlet	151	80	7	40	23	18
EDO12 Cow Castle Creek near Bowman	21	10	1	5	2	2
HUC501 Outlet	97	64	2	29	15	11
Four Hole Outlet	443	290	21	141	79	61

Scenario 2 results presented in Table 6-9 show further, albeit minor gains in water availability throughout the basin with the implementation of measures to improve agricultural irrigation efficiency. Performance measures indicate slightly increased flows compared to the High Demand Scenario, with the implementation of drought management plans plus irrigation efficiency improvements. At Strategic Nodes along the South Fork Edisto River between the confluences of Shaw Creek and the North Edisto River, Surface Water Supply (i.e., the minimum flow over the simulation period) notably increases by 12 to 33 percent. Improvement in low flow statistics of 1 to 2 percent are seen at approximately half of the Strategic Node locations. Near the bottom of the basin (Givhans), Surface Water Supply is increased from 166 cfs to 173 cfs, compared to Scenario 1.

Table 6-9. Scenario 2 surface water model simulation results at Strategic Nodes (drought management plans + irrigation efficiency measures, High Demand 2070 Scenario demands).

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
EDO03 S. Fork Edisto River near Montmorenci	185	168	35	122	95	78
EDO14 S. Fork Edisto River above Springfield	353	317	42	223	161	125
HUC402 Outlet	430	384	40	257	178	136
EDO05 S. Fork Edisto River near Denmark	694	615	88	406	291	223
EDO06 S. Fork Edisto River near Cope	754	637	90	413	296	227
EDO07 S. Fork Edisto River near Bamberg	919	771	101	438	303	229
EDO11 Edisto River near Branchville	1,846	1,413	261	929	670	550
HUC601 Outlet	1,977	1,416	210	848	580	458
EDO13 Edisto River near Givhans	2,406	1,570	173	785	455	363
EDO01 McTier Creek near Monetta	24	18	2	12	8	6
EDO02 McTier Creek near New Holland	49	37	5	26	17	13
Shaw Creek Outlet	123	107	17	74	49	38
EDO04 Dean Swamp Creek near Salley	25	25	10	21	18	16
EDO09 Bull Swamp Creek below Swansea	10	9	2	7	5	5
EDO08 Cedar Creek near Thor	19	18	8	15	13	12
HUC301 Outlet	253	228	58	166	122	105
HUC302 Outlet	445	403	111	299	223	194
EDO10 N. Fork Edisto River at Orangeburg	711	641	156	466	341	293
HUC303 Outlet	748	676	164	487	358	305
HUC602 Outlet	151	80	7	40	23	18
EDO12 Cow Castle Creek near Bowman	21	10	1	5	2	2
HUC501 Outlet	97	64	2	29	16	11
Four Hole Outlet	443	290	21	141	80	62

As with Scenario 2, Scenario 3 demonstrates additional gains in water availability throughout the basin with the implementation of municipal water conservation, as shown in Table 6-10. Performance measures indicate a further increase in flows compared to the High Demand Scenario, with the implementation of drought management plans, irrigation efficiency improvements and municipal efficiency improvements. At Strategic Nodes along the South Fork Edisto River between the confluences of Shaw Creek and the North Fork Edisto River, Surface Water Supply notably increases by 16 to 43 percent. Improvement in low flow statistics of 1 to 4 percent are seen at approximately half of the Strategic Node locations. Near the bottom of the basin (Givhans), Surface Water Supply is increased from 173 cfs to 205 cfs, compared to Scenario 2.

Table 6-10. Scenario 3 surface water model simulation results at Strategic Nodes (drought management plans + irrigation efficiency measures + municipal conservation measures, High Demand 2070 Scenario demands).

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
EDO03 S. Fork Edisto River near Montmorenci	185	168	35	122	95	78
EDO14 S. Fork Edisto River above Springfield	356	320	45	227	165	128
HUC402 Outlet	433	387	43	260	181	140
EDO05 S. Fork Edisto River near Denmark	697	618	91	409	295	227
EDO06 S. Fork Edisto River near Cope	756	640	93	417	300	231
EDO07 S. Fork Edisto River near Bamberg	922	775	104	442	306	232
EDO11 Edisto River near Branchville	1,851	1,417	265	935	675	555
HUC601 Outlet	1,981	1,422	214	853	586	464
EDO13 Edisto River near Givhans	2,438	1,601	205	818	492	363
EDO01 McTier Creek near Monetta	24	18	2	12	8	6
EDO02 McTier Creek near New Holland	49	37	5	26	17	13
Shaw Creek Outlet	126	110	20	77	53	42
EDO04 Dean Swamp Creek near Salley	25	25	10	21	18	16
EDO09 Bull Swamp Creek below Swansea	10	9	2	7	5	5
EDO08 Cedar Creek near Thor	19	18	8	15	13	12
HUC301 Outlet	253	228	58	166	123	105
HUC302 Outlet	446	404	111	299	223	195
EDO10 N. Fork Edisto River at Orangeburg	714	644	159	470	344	297
HUC303 Outlet	750	677	165	489	360	307
HUC602 Outlet	151	80	7	39	23	18
EDO12 Cow Castle Creek near Bowman	21	10	1	5	2	2
HUC501 Outlet	97	64	2	29	16	11
Four Hole Outlet	443	290	21	141	80	62

The basin-wide performance measures shown in Table 6-10 indicate modest reductions in water shortages throughout the basin because of the simulated drought management plans and increasing reductions when irrigation and municipal water efficiency strategies are implemented. As discussed in Chapter 5, most of the shortages identified in the Current, Moderate, and High Demand Scenarios are associated with agriculture surface water users. These are not likely to be "real" shortages because of several factors, including the presence of small ponds and impoundments that were not included in the SWAM model and the uncertainty associated with flows on the ungaged smaller tributaries.

Table 6-11 presents and compares the percentage of months when flows are simulated to drop below the calculated minimum instream flow (MIF) at the strategic nodes where there was a change in the percentage of months, compared to the High Demand 2070 Scenario. The MIF is the "flow that provides an adequate supply of water at the surface water withdrawal point to maintain the biological, chemical, and physical integrity of the stream taking into account the needs of downstream users, recreation, and navigation" (SCDHEC 2012). The MIF is set at 40 percent of the mean annual daily flow for the months of January, February, March, and April; 30 percent of the mean annual daily flow for the months of May, June, and December; and 20 percent of the mean annual daily flow for the months of July through November for surface water withdrawers. This regulation applies to new surface water permits only. In this instance, the MIF was calculated at a Strategic Node not at an existing or proposed surface water withdraw location, and then simulated monthly flows for each scenario were compared to the MIF. The percentage of months that unimpaired flows are below MIFs is also shown for comparison. The results show slight but incremental reductions in the percentage of months below MIFs, compared to the 2070 Scenario, moving from Scenario 1 to Scenario 2 to Scenario 3 for the months of May through November. Notably, there are a small percentage of months when even unimpaired flows are below the MIFs. This is especially apparent at the EDO13 strategic node on the Edisto River near Givhans.

Table 6-11. Comparison of months with flows below MIFs, Scenarios 1, 2, and 3 (High Demand 2070 Scenario demands).

Strategic Node	Scenario	Percentage of Months below MIFs											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ED005 South Fork Edisto River near Denmark	**UIF**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**
	High Demand 2070	**0**	**0**	**0**	**1**	**3**	**10**	**3**	**2**	**0**	**0**	**0**	**0**
	Scenario 1	0	0	0	1	3	10	2	2	0	0	0	0
	Scenario 2	0	0	0	1	3	8	2	2	0	0	0	0
	Scenario 3	0	0	0	1	2	8	2	1	0	0	0	0
Outlet of Shaw Creek	**UIF**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**
	High Demand 2070	**0**	**0**	**0**	**1**	**6**	**11**	**6**	**2**	**1**	**1**	**0**	**0**
	Scenario 1	0	0	0	1	6	11	6	2	1	1	0	0
	Scenario 2	0	0	0	1	6	11	6	2	1	1	0	0
	Scenario 3	0	0	0	1	3	7	1	1	0	0	0	0
EDO13 Edisto River near Givhans	**UIF**	**5**	**2**	**0**	**3**	**9**	**13**	**6**	**5**	**2**	**3**	**2**	**2**
	High Demand 2070	**6**	**2**	**1**	**9**	**29**	**33**	**28**	**26**	**27**	**15**	**7**	**6**
	Scenario 1	6	2	1	9	29	33	28	26	27	15	7	6
	Scenario 2	6	2	1	9	29	32	26	26	27	15	7	6
	Scenario 3	6	2	1	9	24	30	25	26	23	14	5	6
HUC 303 Outlet	**UIF**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**
	High Demand 2070	**0**	**0**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**0**	**0**
	Scenario 1	0	0	0	0	0	5	0	0	0	0	0	0
	Scenario 2	0	0	0	0	0	3	0	0	0	0	0	0
	Scenario 3	0	0	0	0	0	3	0	0	0	0	0	0
EDO11 Edisto River near Branchville	**UIF**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**
	High Demand 2070	**0**	**0**	**0**	**1**	**0**	**6**	**1**	**1**	**0**	**0**	**0**	**0**
	Scenario 1	0	0	0	1	0	6	1	1	0	0	0	0
	Scenario 2	0	0	0	1	0	6	1	1	0	0	0	0
	Scenario 3	0	0	0	1	0	5	1	1	0	0	0	0

Green shaded cells indicate a change in the percentage of months compared to the High Demand 2070 Scenario.

Low Flow Management Strategy

As a supplement to the demand-side water management scenarios described above, and in response to an RBC-developed suggestion, a scenario was simulated whereby all surface water users in the basin reduce (curtail) their water use based on the same hydrologic triggers. The intent of this simulation was to investigate the effectiveness of a potential low flow management strategy whereby surface water users incrementally curtail their withdraws based river conditions with the intent of maintaining MIFs at key locations. The strategy was performed as a "what if" simulation to gage potential effectiveness and did not consider the ability of water users to curtail their surface water withdraws.

For this scenario, a MIF target of 332 cfs at the EDO13 Edisto River near the Givhans Strategic Node was assumed. This value represents 20 percent of the median daily flow, calculated over the period of record. As the flow at this location drops below this target, curtailments for all surface water users are triggered according to the rules summarized in Table 6-12. The scenario was simulated with the SWAM model through a series of post-processing steps, whereby conserved consumptive water was calculated at each timestep as a function of the model flow at Givhans without curtailments. The conserved flow volume was then added to the modeled flow for each timestep to generate an augmented timeseries of river flows at Givhans. Simulations were performed for both the Current Scenario and High Demand 2070 Scenario demand projections, and are referred to as Scenarios 4a and 4b, respectively.

Results of the curtailment scenarios are summarized in Table 6-13. Modeling results show that the low flow strategy would be effective in mitigating against extreme low flows at the EDO13 Strategic Node that would otherwise be realized with projected high demands. For both the Current Scenario and High Demand 2070 Scenario, the number of months when flow drops below the MIF is approximately halved with the introduction of the simulated curtailment program compared to without curtailments. For the High Demand 2070 Scenario, flow below the 332 cfs MIF occurs approximately 3 percent of the time with the low flow strategy in place. Without the low flow strategy, modeling indicates monthly average low flow drops below the MIF approximately 6 percent of the time.

Table 6-12. Scenarios 4a and 4b low flow strategy simulation rules.

Flow (%) below MIF, Edisto River near Givhans	Bottom of Flow Range (cfs), Edisto River near Givhans	Top of Flow Range (cfs), Edisto River near Givhans	Basin Surface Water Use Curtailment
0–20%	266	332[1]	20%
20–40%	199	266	40%
40–60%	133	199	60%
60–80%	66	133	80%
80–100%	0	66	100%

[1] 332 cfs represents the MIF target, estimated at 20 percent of the median daily flow

Important context to Table 6-13 is that the associated withdrawal curtailments result in less water demand being satisfied. Moving forward, it will be important to determine whether the curtailments result in acceptable reductions in available consumptive use. This low flow management strategy represents an important tradeoff in the basin between instream river flows for ecological purposes and consumptive withdrawals, directly addressing the RBC's vision and goal statement for an improved balance between these needs.

Table 6-13. Scenarios 4a and 4b surface water model simulation results, low flow strategy.

Scenario	EDO13 Edisto River near Givhans Flow Statistics		
	5th percentile flow	1st percentile flow	Frequency of flow months below MIF
Baseline Demands without Low Flow Strategy	520	346	0.7%
Baseline Demands with Low Flow Strategy	520	350	0.4%
High Demand 2070 Demands without Low Flow Strategy	299	128	6.1%
High Demand 2070 Demands with Low Flow Strategy	352	315	2.9%

Conjunctive Use

The effects on surface water of conjunctive use of groundwater to supplement surface water was evaluated using the surface water model from the standpoint of reducing surface water demands during low flow periods. As previously noted, 19 of 50 agricultural surface water users in the Edisto River basin also have one or more groundwater sources (wells). While some of these users can use the sources interchangeably (full or partial conjunctive use), others rely exclusively on surface water to irrigate certain fields and groundwater to irrigate other fields (noncentralized conjunctive use).

For these scenarios, a flow of 312 cfs at the EDO13 Edisto River near Givhans Strategic Node was used as a trigger for agricultural users to switch from surface water use to groundwater use. This value represents the 7-day annual low flow, with a 10-year return period (7Q10) for this location. This change was applied to a designated portion of agricultural users' surface supply portfolio. In the model, this was simulated simply as either a 20 percent reduction (Scenario 5a) or a 50 percent reduction (Scenario 5b) in agricultural water use when Givhans flows dip below the threshold of 312 cfs.

The strategy of conjunctive use for Orangeburg (a municipal water user) was also included for these scenarios, derived in the same manner as the agricultural water users' scenarios. Orangeburg surface water demands were reduced by either 20 percent or 50 percent when Givhans flows drop below 312 cfs, reflecting a switch to groundwater and/or imported source of water supply. Orangeburg maintains two aquifer storage and recovery (ASR) wells, which can be used to augment supplies as needed. Orangeburg also has an interconnection with the Lake Marion Regional Water System and can purchase water to augment their surface and groundwater supplies.

The two conjunctive use scenarios were also simulated in combination with the demand-side strategies (drought management plans + irrigation efficiency strategies + municipal efficiency strategies) featured in Scenario 3. These two additional scenarios are referred to as Scenario 6a (20 percent conjunctive use) and Scenario 6b (50 percent conjunctive use).

Results of the conjunctive use simulations (Scenarios 5a, 5b, 6a, and 6b) using the High Demand 2070 Scenario demands are presented in Tables 6-14 through 6-22. Compared to High Demand 2070 Scenario 1 results without conjunctive use, minor gains in low flow water availability and larger (percentage) gains in Surface Water Supply along the South Fork Edisto River and Edisto River are predicted from the implementation of conjunctive use strategies. Impacts of the simulated conjunctive use strategies are most apparent for 10th and 5th percentile low flows compared to the 25th percentile flows. At the EDO13 Edisto

River near Givhans Strategic Node, the 5th percentile flow is projected to increase by approximately 26 cfs with the implementation of 50 percent low flow conjunctive use strategies (Scenario 5b). When 50 percent conjunctive use is combined with municipal water supply drought management plans and conservation (Scenario 6b), the 5th percentile flow gain is projected to be 70 cfs. The Surface Water Supply at this location increases from 0 cfs for High Demand 2070 Scenario 1 to 10, 39, 221, and 248 cfs for Scenarios 5a, 5b, 6a, and 6b, respectively. Conjunctive use simulation results for the 2070 Moderate Scenario demands are provided in Appendix D.

Table 6-14. Scenario 5a surface water model simulation results at Strategic Nodes (20 percent conjunctive use, High Demand 2070 Scenario demands).

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
EDO03 S. Fork Edisto River near Montmorenci	185	168	36	122	95	79
EDO14 S. Fork Edisto River above Springfield	353	316	41	223	161	126
HUC402 Outlet	429	382	40	254	177	137
EDO05 S. Fork Edisto River near Denmark	693	613	90	404	288	228
EDO06 S. Fork Edisto River near Cope	752	635	92	412	294	232
EDO07 S. Fork Edisto River near Bamberg	917	769	102	435	302	233
EDO11 Edisto River near Branchville	1,844	1,411	265	924	666	549
HUC601 Outlet	1,974	1,407	214	845	573	462
EDO13 Edisto River near Givhans	2,397	1,570	10	780	451	314
EDO01 McTier Creek near Monetta	24	18	2	12	8	6
EDO02 McTier Creek near New Holland	49	37	5	26	17	13
Shaw Creek Outlet	123	107	14	74	49	38
EDO04 Dean Swamp Creek near Salley	25	25	10	21	18	16
EDO09 Bull Swamp Creek below Swansea	10	9	2	7	5	5
EDO08 Cedar Creek near Thor	19	18	8	15	13	12
HUC301 Outlet	252	228	59	166	122	104
HUC302 Outlet	445	403	112	299	222	195
EDO10 N. Fork Edisto River at Orangeburg	711	640	161	464	340	294
HUC303 Outlet	747	675	165	485	356	305
HUC602 Outlet	151	80	7	40	23	18
EDO12 Cow Castle Creek near Bowman	21	10	1	5	2	2
HUC501 Outlet	97	64	2	29	15	11
Four Hole Outlet	443	290	21	141	79	62

Table 6-15. Percent change in Scenario 5a flows at Strategic Nodes relative to High Demand 2070 Scenario flows.

Strategic Node	Mean Flow	Median Flow	Surface Water Supply[1]	Percentile Flows		
				25th	10th	5th
EDO03 S. Fork Edisto River near Montmorenci	0%	0%	3%	0%	0%	1%
EDO14 S. Fork Edisto River above Springfield	0%	0%	21%	0%	1%	2%
HUC402 Outlet	0%	0%	33%	0%	1%	2%
EDO05 S. Fork Edisto River near Denmark	0%	0%	15%	0%	0%	4%
EDO06 S. Fork Edisto River near Cope	0%	0%	15%	0%	0%	4%
EDO07 S. Fork Edisto River near Bamberg	0%	0%	13%	0%	0%	3%
EDO11 Edisto River near Branchville	0%	0%	7%	0%	0%	1%
HUC601 Outlet	0%	0%	9%	0%	0%	2%
EDO13 Edisto River near Givhans	0%	0%	>100%[2]	0%	0%	5%
EDO01 McTier Creek near Monetta	0%	0%	0%	0%	0%	0%
EDO02 McTier Creek near New Holland	0%	0%	0%	0%	0%	0%
Shaw Creek Outlet	0%	0%	0%	0%	0%	0%
EDO04 Dean Swamp Creek near Salley	0%	0%	0%	0%	0%	0%
EDO09 Bull Swamp Creek below Swansea	0%	0%	0%	0%	0%	0%
EDO08 Cedar Creek near Thor	0%	0%	0%	0%	0%	0%
HUC301 Outlet	0%	0%	2%	0%	0%	0%
HUC302 Outlet	0%	0%	1%	0%	0%	1%
EDO10 N. Fork Edisto River at Orangeburg	0%	0%	4%	0%	0%	1%
HUC303 Outlet	0%	0%	2%	0%	0%	1%
HUC602 Outlet	0%	0%	0%	0%	0%	0%
EDO12 Cow Castle Creek near Bowman	0%	0%	0%	0%	0%	0%
HUC501 Outlet	0%	0%	0%	0%	0%	0%
Four Hole Outlet	0%	0%	0%	0%	0%	2%

[1] Surface water supply (water availability) increases noticeably because the demand is satisfied with groundwater.
[2] Simulated High Demand 2070 Scenario Surface Water Supply at this location is zero.

Table 6-16. Scenario 5b surface water model simulation results at Strategic Nodes (50 percent conjunctive use, High Demand 2070 Scenario demands).

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
EDO03 S. Fork Edisto River near Montmorenci	185	168	38	122	96	82
EDO14 S. Fork Edisto River above Springfield	353	316	53	223	162	130
HUC402 Outlet	430	382	57	254	180	142
EDO05 S. Fork Edisto River near Denmark	693	613	108	404	289	234
EDO06 S. Fork Edisto River near Cope	753	635	110	412	294	239
EDO07 S. Fork Edisto River near Bamberg	918	769	120	435	302	241
EDO11 Edisto River near Branchville	1,845	1,411	293	924	666	567
HUC601 Outlet	1,975	1,407	242	845	573	474
EDO13 Edisto River near Givhans	2,398	1,570	39	780	451	325
EDO01 McTier Creek near Monetta	24	18	2	12	8	6
EDO02 McTier Creek near New Holland	49	37	5	26	17	13
Shaw Creek Outlet	123	107	15	74	49	38
EDO04 Dean Swamp Creek near Salley	25	25	10	21	18	16
EDO09 Bull Swamp Creek below Swansea	10	9	2	7	5	5
EDO08 Cedar Creek near Thor	19	18	8	15	13	12
HUC301 Outlet	253	228	60	166	122	105
HUC302 Outlet	445	403	114	299	222	195
EDO10 N. Fork Edisto River at Orangeburg	711	640	170	464	340	297
HUC303 Outlet	747	675	172	485	356	307
HUC602 Outlet	151	80	7	40	23	18
EDO12 Cow Castle Creek near Bowman	21	10	1	5	2	2
HUC501 Outlet	97	64	3	29	15	12
Four Hole Outlet	443	290	22	141	79	62

Table 6-17. Percent change in Scenario 5b flows at Strategic Nodes relative to High Demand 2070 Scenario flows.

Strategic Node	Mean Flow	Median Flow	Surface Water Supply	Percentile Flows		
				25th	10th	5th
EDO03 S. Fork Edisto River near Montmorenci	0%	0%	9%	0%	1%	5%
EDO14 S. Fork Edisto River above Springfield	0%	0%	56%	0%	1%	6%
HUC402 Outlet	0%	0%	90%	0%	2%	6%
EDO05 S. Fork Edisto River near Denmark	0%	0%	38%	0%	0%	7%
EDO06 S. Fork Edisto River near Cope	0%	0%	38%	0%	0%	7%
EDO07 S. Fork Edisto River near Bamberg	0%	0%	33%	0%	0%	7%
EDO11 Edisto River near Branchville	0%	0%	19%	0%	0%	5%
HUC601 Outlet	0%	0%	23%	0%	0%	5%
EDO13 Edisto River near Givhans	0%	0%	>100%[1]	0%	0%	9%
EDO01 McTier Creek near Monetta	0%	0%	0%	0%	0%	0%
EDO02 McTier Creek near New Holland	0%	0%	0%	0%	0%	0%
Shaw Creek Outlet	0%	0%	7%	0%	0%	0%
EDO04 Dean Swamp Creek near Salley	0%	0%	0%	0%	0%	0%
EDO09 Bull Swamp Creek below Swansea	0%	0%	0%	0%	0%	0%
EDO08 Cedar Creek near Thor	0%	0%	0%	0%	0%	0%
HUC301 Outlet	0%	0%	3%	0%	0%	1%
HUC302 Outlet	0%	0%	3%	0%	0%	1%
EDO10 N. Fork Edisto River at Orangeburg	0%	0%	10%	0%	0%	2%
HUC303 Outlet	0%	0%	7%	0%	0%	1%
HUC602 Outlet	0%	0%	0%	0%	0%	0%
EDO12 Cow Castle Creek near Bowman	0%	0%	0%	0%	0%	0%
HUC501 Outlet	0%	0%	50%	0%	0%	9%
Four Hole Outlet	0%	0%	5%	0%	0%	2%

[1] Simulated High Demand 2070 Scenario Surface Water Supply at this location is zero.

Table 6-18. Scenario 6a surface water model simulation results at Strategic Nodes (20 percent conjunctive use + demand-side strategies, High Demand 2070 Scenario demands).

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
EDO03 S. Fork Edisto River near Montmorenci	185	168	36	122	95	78
EDO14 S. Fork Edisto River above Springfield	356	320	49	227	165	128
HUC402 Outlet	434	387	50	260	181	140
EDO05 S. Fork Edisto River near Denmark	697	618	99	409	295	227
EDO06 S. Fork Edisto River near Cope	757	640	101	417	300	231
EDO07 S. Fork Edisto River near Bamberg	922	775	112	442	306	233
EDO11 Edisto River near Branchville	1,851	1,417	281	935	675	555
HUC601 Outlet	1,982	1,422	230	853	586	464
EDO13 Edisto River near Givhans	2,439	1,601	221	818	492	371
EDO01 McTier Creek near Monetta	24	18	2	12	8	6
EDO02 McTier Creek near New Holland	49	37	5	26	17	13
Shaw Creek Outlet	126	110	21	77	53	42
EDO04 Dean Swamp Creek near Salley	25	25	10	21	18	16
EDO09 Bull Swamp Creek below Swansea	10	9	2	7	5	5
EDO08 Cedar Creek near Thor	19	18	8	15	13	12
HUC301 Outlet	253	228	59	166	123	105
HUC302 Outlet	446	404	112	299	223	195
EDO10 N. Fork Edisto River at Orangeburg	715	644	164	470	344	297
HUC303 Outlet	750	677	170	489	360	307
HUC602 Outlet	151	80	7	39	23	18
EDO12 Cow Castle Creek near Bowman	21	10	1	5	2	2
HUC501 Outlet	97	64	2	29	16	11
Four Hole Outlet	443	290	21	141	80	62

Table 6-19. Percent change in Scenario 6a flows at Strategic Nodes relative to High Demand 2070 Scenario flows.

Strategic Node	Mean Flow	Median Flow	Surface Water Supply	Percentile Flows		
				25th	10th	5th
EDO03 S. Fork Edisto River near Montmorenci	0%	0%	3%	0%	0%	0%
EDO14 S. Fork Edisto River above Springfield	1%	1%	44%	2%	3%	4%
HUC402 Outlet	1%	1%	67%	2%	3%	4%
EDO05 S. Fork Edisto River near Denmark	1%	1%	27%	1%	2%	4%
EDO06 S. Fork Edisto River near Cope	1%	1%	26%	1%	2%	4%
EDO07 S. Fork Edisto River near Bamberg	1%	1%	24%	2%	2%	3%
EDO11 Edisto River near Branchville	0%	0%	14%	1%	1%	3%
HUC601 Outlet	0%	1%	17%	1%	2%	3%
EDO13 Edisto River near Givhans	2%	2%	>100%[1]	5%	9%	24%
EDO01 McTier Creek near Monetta	0%	0%	0%	0%	0%	0%
EDO02 McTier Creek near New Holland	0%	0%	0%	0%	0%	0%
Shaw Creek Outlet	2%	3%	50%	4%	8%	11%
EDO04 Dean Swamp Creek near Salley	0%	0%	0%	0%	0%	0%
EDO09 Bull Swamp Creek below Swansea	0%	0%	0%	0%	0%	0%
EDO08 Cedar Creek near Thor	0%	0%	0%	0%	0%	0%
HUC301 Outlet	0%	0%	2%	0%	1%	1%
HUC302 Outlet	0%	0%	1%	0%	0%	1%
EDO10 N. Fork Edisto River at Orangeburg	1%	1%	6%	1%	1%	2%
HUC303 Outlet	0%	0%	6%	1%	1%	1%
HUC602 Outlet	0%	0%	0%	-3%	0%	0%
EDO12 Cow Castle Creek near Bowman	0%	0%	0%	0%	0%	0%
HUC501 Outlet	0%	0%	0%	0%	7%	0%
Four Hole Outlet	0%	0%	0%	0%	1%	2%

[1] Simulated High Demand 2070 Scenario Surface Water Supply at this location is zero.

Table 6-20. Scenario 6b surface water model simulation results at Strategic Nodes (50 percent conjunctive use + demand-side strategies, High Demand 2070 Scenario demands).

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
EDO03 S. Fork Edisto River near Montmorenci	185	168	38	122	95	79
EDO14 S. Fork Edisto River above Springfield	356	320	60	227	165	129
HUC402 Outlet	434	387	65	260	181	141
EDO05 S. Fork Edisto River near Denmark	697	618	117	409	295	229
EDO06 S. Fork Edisto River near Cope	757	640	119	417	300	233
EDO07 S. Fork Edisto River near Bamberg	922	775	129	442	306	235
EDO11 Edisto River near Branchville	1,855	1,420	310	939	679	558
HUC601 Outlet	1,986	1,426	259	857	589	468
EDO13 Edisto River near Givhans	2,443	1,605	248	821	495	370
EDO01 McTier Creek near Monetta	24	18	2	12	8	6
EDO02 McTier Creek near New Holland	49	37	5	26	17	13
Shaw Creek Outlet	126	110	21	77	53	42
EDO04 Dean Swamp Creek near Salley	25	25	10	21	18	16
EDO09 Bull Swamp Creek below Swansea	10	9	2	7	5	5
EDO08 Cedar Creek near Thor	19	18	8	15	13	12
HUC301 Outlet	253	228	60	166	123	105
HUC302 Outlet	446	404	114	299	223	195
EDO10 N. Fork Edisto River at Orangeburg	724	653	172	479	354	306
HUC303 Outlet	754	681	179	492	364	311
HUC602 Outlet	151	80	7	39	23	18
EDO12 Cow Castle Creek near Bowman	21	10	1	5	2	2
HUC501 Outlet	97	64	3	29	16	11
Four Hole Outlet	443	290	22	141	80	62

Table 6-21. Percent change in Scenario 6b flows at Strategic Nodes relative to High Demand 2070 Scenario flows.

Strategic Node	Mean Flow	Median Flow	Surface Water Supply	Percentile Flows		
				25th	10th	5th
EDO03 S. Fork Edisto River near Montmorenci	0%	0%	9%	0%	0%	1%
EDO14 S. Fork Edisto River above Springfield	1%	1%	76%	2%	3%	5%
HUC402 Outlet	1%	1%	117%	2%	3%	5%
EDO05 S. Fork Edisto River near Denmark	1%	1%	50%	1%	2%	5%
EDO06 S. Fork Edisto River near Cope	1%	1%	49%	1%	2%	4%
EDO07 S. Fork Edisto River near Bamberg	1%	1%	43%	2%	2%	4%
EDO11 Edisto River near Branchville	1%	1%	26%	2%	2%	3%
HUC601 Outlet	1%	1%	32%	1%	3%	4%
EDO13 Edisto River near Givhans	2%	2%	>100%[1]	5%	10%	24%
EDO01 McTier Creek near Monetta	0%	0%	0%	0%	0%	0%
EDO02 McTier Creek near New Holland	0%	0%	0%	0%	0%	0%
Shaw Creek Outlet	2%	3%	50%	4%	8%	11%
EDO04 Dean Swamp Creek near Salley	0%	0%	0%	0%	0%	0%
EDO09 Bull Swamp Creek below Swansea	0%	0%	0%	0%	0%	0%
EDO08 Cedar Creek near Thor	0%	0%	0%	0%	0%	0%
HUC301 Outlet	0%	0%	3%	0%	1%	1%
HUC302 Outlet	0%	0%	3%	0%	0%	1%
EDO10 N. Fork Edisto River at Orangeburg	2%	2%	11%	3%	4%	5%
HUC303 Outlet	1%	1%	11%	1%	2%	3%
HUC602 Outlet	0%	0%	0%	-3%	0%	0%
EDO12 Cow Castle Creek near Bowman	0%	0%	0%	0%	0%	0%
HUC501 Outlet	0%	0%	50%	0%	7%	0%
Four Hole Outlet	0%	0%	5%	0%	1%	2%

[1] Simulated High Demand 2070 Scenario Surface Water Supply at this location is zero.

Table 6-22. Basin-wide surface water model simulation results, Scenarios 5a, 5b, 6a, and 6b, High Demand 2070 Scenario demands.

Parameter	High Demand 2070 Scenario	Scenario 5a	Scenario 5b	Scenario 6a	Scenario 6b
Total annual mean shortage (MGD)	1.6	1.5	1.4	1.4	1.4
Maximum water user shortage (MGD)	5.1	4.1	3.7	3.7	3.7
Total annual mean shortage (%)	0.7%	0.7%	0.6%	0.7%	0.7%
Percentage of water users experiencing shortage	20%	17%	16%	15%	15%
Average frequency of shortage (%)	13%	15%	15%	17%	16%

Offline Storage Reservoirs and Small Impoundments

The use of an offline storage reservoir to mitigate against critical low flows was also investigated with a series of model simulations (Scenario 7). For this scenario, hypothetical offline storage was added to the model to capture and store high flows and, subsequently, augment critical low flows. A similar (but not identical) example of this approach is Aiken's Mason Branch Reservoir. The reservoir, with an estimated storage capacity of 340 million gallons (MG), is used to augment flows in Shaw Creek, where Aiken maintains a surface water intake. During low flow conditions, water can be released to Mason Branch, which flows into Shaw Creek.

The conceptual storage reservoir was modeled as receiving diverted water from the South Fork Edisto River just below the confluence with Shaw Creek. Diversions, up to specified withdrawal capacities, occurred in the model any time river flows were above the mean annual flow (i.e., above average flows). Releases from the reservoir back to the mainstem were dictated by a programmed operational rule targeting the maintenance of a MIF of 312 cfs for the Edisto River at Givhans. As part of this investigation, a range of storage capacities were assumed for the conceptual reservoir. Reservoir evaporation rates were assumed for the new reservoir based on rates quantified for regional reservoirs included in other South Carolina basin models. The 2070 High Demand projections were used. Results, with respect to augmented low flows on the Edisto River at Givhans, are summarized in Figures 6-1 and 6-2. As shown in Figure 6-1, with 4,000 MG of new offline storage, model results indicate that the 5th percentile low flow at Givhans would increase from 299 cfs to 317 cfs. Results further indicate that less than 1,000 MG would be required to increase the 5th percentile flow to the stated MIF (312 cfs). Figure 6-2 shows that the percentage of time that flows drop below the MIF could be decreased from greater than 5 percent to less than 3 percent with new offline storage, and that storage yields plateau beyond approximately 20,000 MG of total storage.

Impoundments, both existing and new, can provide dual benefits to river basins such as the Edisto. Not only can they increase reliable yield for consumptive uses, but as will be shown, they can be managed to improve low flow conditions.

Additionally, the ability of small impoundments to provide local storage and help maintain supply during low flow periods was evaluated using the surface water model (Scenario 8). Small irrigation ponds and impoundments exist currently throughout the basin; however, such ponds were not explicitly included in the SWAM model. For this exercise, two impoundments were added to the model to provide local storage for two case study agricultural water users: Shivers Traders and Titan Farms–Bog. Both irrigators are known to have existing impoundments, but the specifications of those impoundments are not known. Therefore, a range of storage capacities was assumed for each. As above, regional evaporation rates and 2070 High Demand Scenario demands were assumed.

Results of this exercise are summarized in Table 6-23, which demonstrates the ability of local storage to mitigate water shortages for the two case study irrigators. Simulated shortages are reduced considerably for Shivers Trading with the inclusion of local storage in the model. A coarse estimate of the actual existing local storage available to this user (30 MG) reduces the simulated frequency of shortage from 19 percent to 2 percent. Shortages are fully eliminated with an assumed storage capacity of 70 MG. For Titan Farms–Bog, shortages can also be significantly reduced with the use of local storage. Model simulation results indicate water supply yields (i.e., reductions in shortages) with increased local storage, up to a maximum capacity of 1,600 MG.

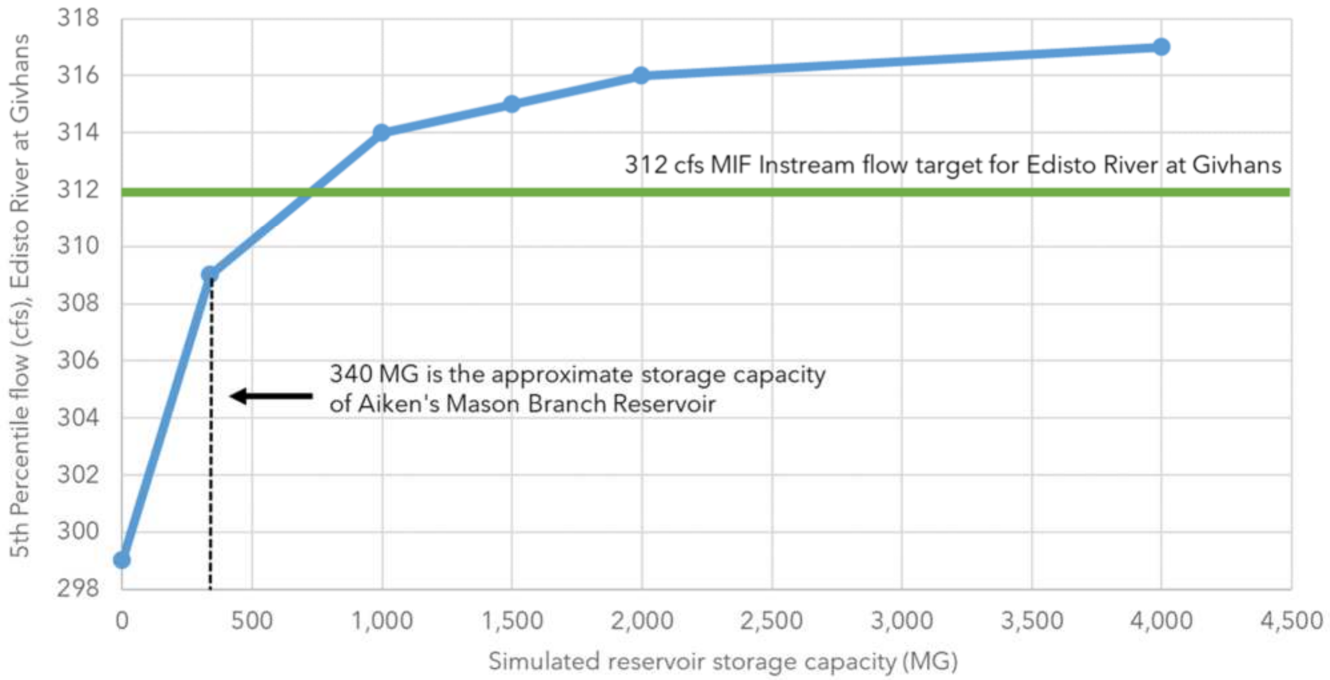


Figure 6-1. Simulated change in 5th percentile flows on the Edisto River at Givhans for various offline reservoir storage capacities (Scenario 7, High Demand 2070 Scenario demands).

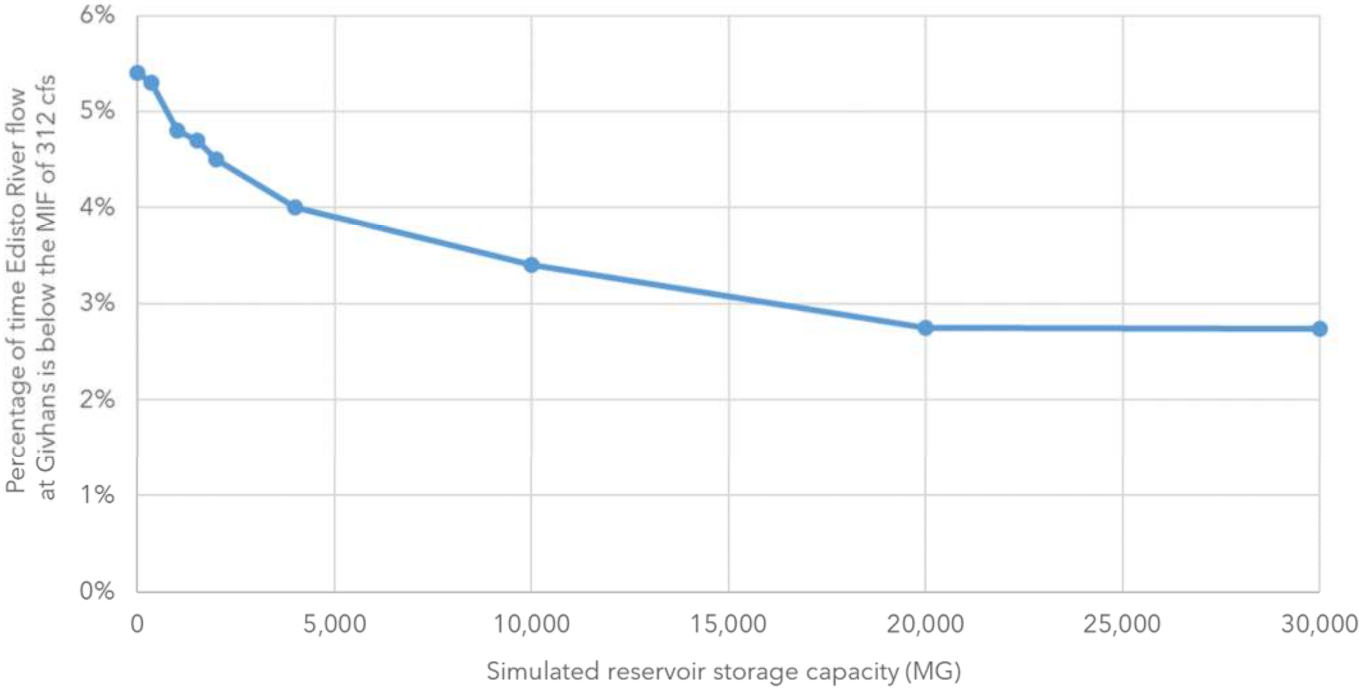


Figure 6-2. Percentage of time flows are below MIF of 312 cfs on the Edisto River at Givhans for various offline reservoir storage capacities (Scenario 7, High Demand 2070 Scenario demands).

Table 6-23. Local storage simulation results (Scenario 8, High Demand 2070 Scenario demands).

Water User	Annual Demand (MGD)	Modeled Storage (MG)	Simulated Average Shortage (MGD)	Simulated Frequency of Shortage	Notes
IR: Shivers Trading[1]	0.23	0	0.03	19%	High Demand Scenario, no storage modeled
IR: Shivers Trading	0.23	30	0.003	2%	Estimate of existing storage
IR: Shivers Trading	0.23	70	0	0%	Maximum yield capacity
IR: Titan - Bog	1.8	0	0.7	39%	High Demand demands, no storage modeled
IR: Titan - Bog	1.8	1,600	0.3	14%	Maximum yield capacity

[1] IR = Irrigator

6.1.5 Feasibility of Surface Water Management Strategies

The Edisto RBC assessed the feasibility of the strategies described above with regards to consistency with regulations, reliability of water source, environmental impacts, socioeconomic impacts, potential interstate or interbasin impacts, and water quality impacts. This assessment is presented in Table 6-24.

Table 6-24. Water management strategy feasibility assessment.

Color Code

Potential Moderate/High Adverse Effect	Potential Low Adverse Effect	Likely Neutral Effect (either no effect, or offsetting effects)	Potential Low Positive Effect	Potential Moderate/High Positive Effect

Water Management Strategy	Strategy Type	Consistency with Regulations	Reliability of Water Source	Environmental Impacts and Benefits[1]	Socioeconomic Effects	Potential Interstate or Interbasin Effects	Other Water Quality Considerations
Water Audits and Nozzle Retrofits	Demand-side - Agriculture	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands	**Impacts:** None anticipated **Benefits:** Prevention of overwatering may limit runoff, erosion, and sedimentation	No to low anticipated effects – Financial gains from reduced delivery and pumping costs likely outweigh costs of audit and nozzle retrofits	No anticipated effects	See Environmental Benefits
Irrigation Scheduling	Demand-side - Agriculture	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands	**Impacts:** None anticipated **Benefits**: May reduce over fertilization and prevention of overwatering may limit runoff, erosion, and sedimentation	Low to moderate effects – Initial costs of advanced technology may be partially offset by savings from reduced water and nutrient use	No anticipated effects	See Environmental Benefits
Soil Management	Demand-side - Agriculture	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands	**Impacts:** Low anticipated impacts – Increase in herbicides may be required **Benefits:** May improve soil quality and reduce runoff	Low to moderate effects – Initial costs of new equipment plus training and O&M costs. Costs may be partially offset by reduction in soil, water, and nutrient loss	No anticipated effects	No to low anticipated impacts – Conservation tillage may increase potential leaching of nitrogen or pesticide to groundwater. See also Environmental Benefits
Crop Variety, Crop Type, Crop Conversion	Demand-side - Agriculture	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands	**Impacts:** Low anticipated impacts – Variation in chemical application for different crops must be considered	Medium to high anticipated effects – Potential profit loss from switching to lower demand crop or from a full season to short season crop	No anticipated effects	No anticipated impacts

Table 6-24. Water management strategy feasibility assessment. (Continued)

Water Management Strategy	Strategy Type	Consistency with Regulations	Reliability of Water Source	Environmental Impacts and Benefits[1]	Socioeconomic Effects	Potential Interstate or Interbasin Effects	Other Water Quality Considerations
Irrigation Equipment Changes	Demand-side - Agriculture	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands	**Impacts:** Low anticipated impacts – Changing equipment may disturb environmentally sensitive areas	Low anticipated effects – Initial costs of equipment changes may be partially offset by water use savings	No anticipated effects	No anticipated impacts
Conservation Pricing Structures	Demand-side - Municipal	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands	**Impacts:** None anticipated	Moderate anticipated effects – Customers that cannot reduce water use may face economic hardship. Reduced billing revenue for utilities may cause financing issues or lead to further rate increases	No anticipated effects	No anticipated impacts
Toilet Rebate Program	Demand-side - Municipal	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands	**Impacts:** Low anticipated impacts – Minor additional waste from discarded inefficient toilets	Low anticipated Effects – Positive benefit for homeowners from upgrading appliances for lower cost and reduced water billings (if billed at unit rate). Adverse effect due to need to hire implementation and compliance staff which would contribute to rate increase.	No anticipated effects	No anticipated impacts
Landscape Irrigation Program and Codes	Demand-side - Municipal	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands	**Impacts:** None anticipated **Benefits:** Water quality of receiving waters may be improved by reducing runoff from landscaping	Low anticipated effects – Mandates to meet standards may cause financial hardship for homeowners. No anticipated effects to homeowners from educational programs. The need to hire implementation and compliance staff would contribute to rate increase.	No anticipated effects	See Environmental Benefits
Leak Detection and Water Loss Control	Demand-side - Municipal	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands	**Impacts**: None anticipated	Cost of program implementation could result in rate increase, no impact, or potential rate decrease, depending on circumstances	No anticipated effects	No anticipated impacts

Table 6-24. Water management strategy feasibility assessment. (Continued)

Water Management Strategy	Strategy Type	Consistency with Regulations	Reliability of Water Source	Environmental Impacts and Benefits[1]	Socioeconomic Effects	Potential Interstate or Interbasin Effects	Other Water Quality Considerations
Car Wash Recycling Ordinances	Demand-side - Municipal	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands	**Impacts:** Low anticipated impacts – renovation or construction may impact sensitive areas **Benefits:** Positive environmental benefit of reduced pollutant runoff	Low anticipated effects – Financial burden to developer or owner of car wash for construction/renovation. The need to hire implementation and compliance staff would contribute to rate increase	No anticipated effects	See Environmental Benefits
Water Waste Ordinance	Demand-side - Municipal	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands	**Impacts:** Low anticipated impacts **Benefits:** Water quality of receiving waters may be improved by reducing runoff from landscaping	Low anticipated effects – Homeowners and business owners may face economic hardship from required modifications to irrigation system. The need to hire implementation and compliance staff would contribute to rate increase	No anticipated effects	See Environmental Benefits
Public Education of Water Conservation	Demand-side - Municipal	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands	**Impacts:** None anticipated	Low anticipated effects – Effects to utility revenue if demand reductions are substantial. Positive effect to residential users from reduced water bills (if billed at unit rate)	No anticipated effects	No anticipated impacts
Residential Water Audits	Demand-side - Municipal	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands	**Impacts:** None anticipated	No to low anticipated effects – Revenue effects to utility from reduced demand may be offset by lower delivery costs. Effects to homeowners from repairs may be offset by reduced water bills (if billed at unit rate). The need to hire implementation and compliance staff would contribute to rate increase	No anticipated effects	No anticipated impacts

Table 6-24. Water management strategy feasibility assessment. (Continued)

Water Management Strategy	Strategy Type	Consistency with Regulations	Reliability of Water Source	Environmental Impacts and Benefits[1]	Socioeconomic Effects	Potential Interstate or Interbasin Effects	Other Water Quality Considerations
Water Efficiency Standards for New Construction	Demand-side - Municipal	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands	**Impacts:** None anticipated	Low anticipated effects – Efficiency standards may make renovations or construction more expensive and limit access to renovate or build. The need to hire implementation and compliance staff would contribute to rate increase	No anticipated effects	No anticipated impacts
Reclaimed Water Programs	Demand-side - Municipal	SCDHEC regulates reclaimed wastewater systems for irrigation use with public contact; there are no laws or regulations pertaining to indirect potable reuse or direct potable reuse	Strategy reduces demand and extends supply, increasing water source reliability for other demands	**Impacts:** Low to moderate anticipated impacts: Depending on the extent of reclaim demand, reduced discharge from wastewater treatment facilities may reduce low flow levels **Benefits:** Depending on the extent of reclaim demand, reduced discharge from wastewater treatment facilities may results in improved receiving water quality	Moderate anticipated effects – Higher initial water bills to finance a reclaimed water program may be offset by long-term savings from postponing the need for new supplies and raw water treatment facilities. The need to hire operations staff could contribute to rate increase	No anticipated effects	See Environmental Benefits Need to match end use with quality of reclaimed water. Consider emerging contaminants of concern (e.g., PFAS and microplastics)
Time-of-Day Watering Limit	Demand-side - Municipal	Consistent	Strategy reduces demand and extends supply, increasing water source reliability for other demands	**Impacts**: None anticipated	The need to hire implementation and compliance staff would contribute to rate increase	No anticipated effects	No anticipated impacts

Table 6-24. Water management strategy feasibility assessment. (Continued)

Water Management Strategy	Strategy Type	Consistency with Regulations	Reliability of Water Source	Environmental Impacts and Benefits[1]	Socioeconomic Effects	Potential Interstate or Interbasin Effects	Other Water Quality Considerations
Conjunctive Use	Supply-side	Consistent – Wells that withdraw more than 3 MGD on average are required to apply for a permit under CUA requirements	Expected High reliability but depends on the reliability of the groundwater supply which varies by location and depth of well. There are currently no major cones of depression in the Edisto River basin	**Impacts:** Low anticipated impacts – Expected to be temporary, but extensive and prolonged pumping may draw down groundwater levels potentially leading to aquifer compaction, reduction in well yield, and land subsidence **Benefits:** May increase flow in streams during low flow periods	Moderate anticipated effects – The cost of drilling a new groundwater supply well will vary with local conditions and depth. The effect on a specific operation will depend on its size and financial capacity. Cost is also associated with conveyance and treatment infrastructure to allow switching and or blending of the primary and conjunctive sources.	No anticipated effects	Low to moderate anticipated impacts – Extent of impact depends on quality of local groundwater. Acidic groundwater may not be ideal for crop growth. Hard groundwater may reduce life or irrigation equipment from mineral precipitation
Small Impoundment	Supply-side	Consistent	Medium to high reliability – Reliability depends on climatological factors like precipitation, evaporation, contributing streamflow, and seepage to groundwater	**Impacts:** Medium to high anticipated impacts – Construction of impoundments may disturb existing stream habitat. Reductions in streamflow may adversely impact aquatic species. **Benefits**: Small impoundments may create new habitat	Medium anticipated effects – Costs of design, construction, and any permitting will be borne by the developer. Depending on dam size and classification, permitting requirements may be significant. Costs of inspections and maintenance in keeping with regulations and best management practices	No anticipated effects	Moderate anticipated impacts – Small impoundments may impact water quality of streams due to reduced streamflow. Algae growth may also be a concern

[1] For the purposes of this comparison, "impacts" can be understood as potentially adverse consequences, while "benefits" are potential advantageous consequences.

6.1.6 Cost-Benefit Analysis

Available information related to costs and benefits in terms of potential savings of water or dollars for each strategy is summarized below. These are generalized values from literature or other locations and should be considered for planning-level assessment only, to help screen and understand the alternatives. Implementation planning would require more specific analysis.

The information provided in this chapter is not intended to rule any of the alternatives into or out of a recommended River Basin plan for the Edisto River basin. Rather, the information is presented for relative comparison purposes, so that the potential benefits, risks, and impacts of the alternatives can be understood more completely and decision-makers can make more informed decisions about priorities.

Demand-Side Agricultural Strategies

Water Audits and Nozzle Retrofits

The cost of a Clemson Center Pivot Irrigation Test Program audit is $125.00 per pivot. Costs of other water audits vary significantly depending on whether they are conducted internally, by a consultant, or by a government entity. While the process of conducting a water audit does not alone provide benefits, if improvements such as nozzle retrofits are made, benefits can include increased water efficiency and energy savings. An approximately 15 percent reduction in water use could be expected from nozzle retrofits made following a center pivot sprinkler audit (Walther, pers. comm. 2021).

A sample audit report provided by Clemson Cooperative Extension estimates the cost of a retrofit sprinkler package at $5 per foot of pivot length (Clemson Cooperative Extension 2022b). In this example, the total cost to retrofit is estimated at $2,982. Using an assumed crop value, irrigation need, and cost of under- or overirrigation, the estimated suboptimal irrigation cost is $4.39/acre. With an irrigated area of 37.4 acres, this comes out to an estimated loss of $164. Over the estimated 23.6-year lifespan of the retrofit, this equates to $3,875 in savings compared to the total cost of $3,107 ($2,982 cost of the retrofit plus the $125 cost of the initial audit).

Irrigation Scheduling

According to the 2021 Texas Panhandle Water Plan, the cost of a typical smart irrigation system ranges from $6.50 to $12.00 per acre and benefits amount to approximately 10 percent of the water used on each crop seasonally (Freese and Nichols, Inc. 2020).

Soil Management

The 2021 Texas Panhandle Water Plan assumed a 1.75 acre-inches per acre of water savings from soil management strategies (Freese and Nichols, Inc. 2020). While conservation tillage may result in savings from reduced machine, fuel, and labor costs, depending on the conservation type implemented, it also has initial costs to transition from conventional to conservation tillage, including the purchase of new equipment and any chemical control costs (herbicides or pesticides). For example, ridge tilling requires specially designed equipment such as a ridge cultivator or ridge planter.

Implementing furrow diking can range from less than $2,000 to several thousand dollars. Per crop per season per acre estimates range from $5 to $30. The Texas Water Development Board estimates water savings of 3 inches per season (0.2 acre-feet per acre), but savings will vary by field and season.

Crop Variety, Crop Type, and Crop Conversion

The cost of implementation and the actual reduction in irrigation water used will depend on numerous local factors including market pricing, cost of seed, cost of harvesting, and the value of crops.

If farmers are encouraged to switch from long season varieties to short season varieties, they may experience loss in yield and therefore revenue. However, they will also see a cost savings from reduced seed, pumping, fertilizer, harvest, and water use costs.

Irrigation Equipment Changes

Total replacement of a system (assumed 125-acre, 30-inch spacing) with a new 60-inch spacing system is estimated at $151.20 an acre, including labor and new hoses, heads, and weights. Conversion instead of full replacement of the same system is estimated at $44 per acre. Costs assume that the system is converting from low elevation spray application (LESA) or mid-elevation spray application (MESA) systems to low elevation precision application (LEPA) systems (Freese and Nichols, Inc. 2020). This transfer in irrigation practice may result in a 7 to 17 percent increase in irrigation efficiency and, consequently, water usage. In most cases, irrigation equipment changes will be a combination of replacement and conversion.

Demand-Side Municipal Strategies

Conservation Pricing Structures

The implementation of conservation pricing structures is a cost-effective option for utilities as there are no direct costs to them to achieve a reduction in demand. However, reduction in billing revenue associated with decreased customer usage must be considered. On average, in the United States, a 10 percent increase in the marginal price of water in the urban residential sector can be expected to diminish demand by about 3 to 4 percent in the short run (Olmstead and Stavins 2009). An example application in the Texas Panhandle assumed 10 percent of households would respond and change their water consumption behavior resulting in 6,000 gallons saved per household per year (Freese and Nichols, Inc. 2020).

Toilet Rebate Program

Toilet rebate program costs to the utility or local government are based on the rebate amount per toilet, plus any program management costs. Reduced total water use in the community results in lower operating costs for the utility but may also result in lower billing revenue depending on the fee structure used. An example of an existing rebate requires customers to purchase a toilet using 1.1 gallons per flush or less to receive a $75 rebate (Metropolitan North Georgia Water Planning District 2022). Metro Atlanta utilities have proven these programs can be successful by replacing more than 150,000 toilets with low flow models between 2008 and 2019.

Landscape Irrigation Program and Codes

If water efficiency measures are required, costs would be associated with enforcement. If not required, costs will be associated with incentives or education programs. If programs include rebate offerings, the cost of the rebate itself and the administration of the program must be considered. Smart irrigation controllers with an EPA WaterSense certification are commercially available for between $120 and $280. These costs assume there is already a compatible irrigation system in place. Costs to the homeowner would be greater if irrigation system installation or renovation is required. Irrigation with a smart irrigation meter rather than a standard irrigation meter may result in a water use efficiency reduction of 30 percent.

An example of a turf replacement rebate is from California's Metropolitan Water District, which offers a $2 per square foot rebate for up to 5,000 square feet. Ultimately, the cost to the utility or municipality would be dependent on the rebate rate and percent uptake by customers.

Leak Detection and Water Loss Control Program

EPA estimates that the average water loss in water systems is 16 percent, with up 75 percent of the water loss potentially recoverable through a water loss control program (EPA 2013). Since 2010, Georgia's public water systems have reported, on average, between 13.5 and 17.4 percent water loss; however, 43 of 263 systems reported over 30 percent average annual water loss since 2010. Costs of a water loss control program would be associated with the time spent conducting the water audit and the costs of needed repairs, which would depend on the system. However, water audits have generally been proven to be cost-effective practices. The AWWA M36 Manual of Water Audits and Loss Control Programs includes an example of a utility with a $79,000 water audit cost, which, in 2022 dollars, translates to a unit cost $310/mile water main (AWWA 2016).

Car Wash Recycling Ordinances

Costs of this practice are associated with purchase and installation of a recycled water system by the car wash owner or developer. The initial cost for a water recycling system can range between $20,000 and $40,000 (in 2022 dollars) depending on the car wash size and requirements (Taylor 2013). Operating costs would be higher than a nonrecycled wash water system because of increased energy usage, replacement of filters and membranes, and other factors. Depending on whether the water was obtained from a public water system or (private) well, there would be a reduction in raw water costs since water demand would be reduced. Ordinances can set a percentage of recycled water to total water used. Typical ordinances require at least 50 percent use of recycled water.

Water Waste Ordinance

Costs of this practice would be related to enforcement of the ordinance. Estimates range from $2,500 (communities less than 20,000 people) to $10,000 (communities with more than 20,000 people). Savings are estimated at 3,000 gallons per year per household (Freese and Nichols, Inc. 2020).

Public Education of Water Conservation

Building water conservation awareness will not only save water but will save money on operational and production costs. Savings are estimated at 5,000 gallons per household per year for 30 percent of households targeted. Public education and outreach costs more per person in smaller communities than in larger ones ($2.75 per person per year for communities less than 20,000 and $1.80 per person per year for communities with more than 20,000) (Freese and Nichols, Inc. 2020).

Residential Water Audits

Residential water audits may result in the implementation of various strategies, retrofits, and other measures that save up to 20 to 30 gallons of water per day. Costs are associated with the cost of the water audit (if applicable) and the costs of replacements or repairs to the household system.

Water Efficiency Standards for New Construction

High efficiency toilets can save more than $100 per family per year (Mullen n.d.). EPA estimates that fixtures meeting the WaterSense requirements can save approximately 700 gallons of water per year per household (EPA 2021). The costs associated with implementing local ordinances outlining water efficiency standards is low. There are numerous examples that can be used to guide ordinance development and implementation.

Reclaimed Water Programs

Benefits include increased water supply, increased reliability, and reduced effluent disposal. Initial costs may be substantial and include construction/retrofit costs to wastewater facilities for full reuse capabilities and construction of distribution lines to end users. Benefits may result by lowering demand on highly treated potable water, thereby extending the source of supply and delaying the need for future upgrades to treatment processes or procuring additional water sources. The overall cost-benefit is dependent on the system, the end user, the cost of treatment, and many other factors. Utilities and others that have implemented reclaimed water programs have typically done so after careful analysis and planning to demonstrate the long-term financial viability of a reclaimed water program.

Time-of-Day Watering Limit

Setting a time-of-day watering limit may save up to 1,000 gallons of water per household per year, depending on the amount of irrigated landscape. Costs are associated with enforcement and can vary depending on the size of the utility but are expected to be low. Utilities may benefit from reduced water use and a reduction in peak demands if a time-of-day water limit restricts usage before typical morning peak demands.

Supply-Side Strategies

Conjunctive Use

The 2021 Panhandle Regional Water Plan – Volume II estimated the cost of a 300-foot-deep, 350 gpm irrigation well and pump at just over $250,000 (Freese and Nichols, Inc 2020). Similar costs have been observed for production wells and their associated pumps and appurtenances in South Carolina (Walther, pers. comm, 2021).

Small Impoundments

Costs are associated with the construction of the impoundments, which includes excavation, grading, labor, vegetation plantings, and potentially liner materials (Curtis et al. 2001). Costs estimates for an unlined 100 acre-foot storage pond ranges from $70,000 to $478,000 (escalated from 2001 to 2022 dollars) Curtis et al. 2001).

6.2 Groundwater Management Strategies

Under the Framework, a groundwater water management strategy is any water management strategy proposed to address a Groundwater Area of Concern or groundwater shortage. Strategies may include demand-side management strategies that reduce supply gaps by reducing demands, and supply-side strategies that increase or augment supply. Examples of demand-side strategies include municipal and agriculture conservation and water use efficiency measures. Examples of supply-side strategies include ASR and relocating pumping from one aquifer to another.

6.2.1 Demand-Side Strategies

In the Edisto River basin, over 75 percent of agricultural demands are met by groundwater (Pellett 2021). As presented in Tables 6-1 and 6-2, the Edisto RBC identified a portfolio of various demand-side strategies consisting of agricultural water efficiency practices and municipal water conservation practices, respectively. These demand-side strategies also apply to groundwater withdrawers.

6.2.2 Supply-Side Strategies

Although groundwater supplies are reliable and there are currently no major cones of depression within the Edisto River basin, groundwater modeling described in Chapter 5.4 illustrates that excessive drawdown may become an issue within the planning horizon. If groundwater levels are drawn below the top of the aquifer, the affected area may experience aquifer compaction and subsequent reduced groundwater yields and land subsidence. To avoid these impacts, the Edisto RBC evaluated a supply-side groundwater management strategy of encouraging new pumping in less used aquifers rather than continuing development of highly used aquifers. Specifically, the RBC recommends that responsible agencies and stakeholders consider encouraging that new pumping come from aquifers that can support the additional withdrawals. One example indicted by modeling was the Groundwater Area of Concern in the Crouch Branch of Calhoun County. Here the RBC recommends that if groundwater monitoring suggests continued increasing drawdowns in the Crouch Branch aquifer, future pumping should be transitioned to the McQueen Branch aquifer.

Although the Edisto RBC chose not to evaluate ASR as a supply-side strategy, this practice is in use within the basin. In 2008, the Orangeburg Department of Public Utilities (DPU) installed two ASR wells in the Crouch Branch and McQueen Branch aquifers. Orangeburg DPU reports that the ASR wells work, albeit not to the full capacity that was envisioned. Mounding while recharging limits the ability to effectively store water in shorter time periods. Additionally, groundwater that is withdrawn has elevated iron levels, requiring treatment.

The surface water supply-side strategies described in Chapter 6.1.3 may impact groundwater demands and groundwater supply within the basin. Conjunctive use would result in direct increases in groundwater demands as users switch from surface water to groundwater during time of drought and low surface water flows. The use of small surface water impoundments will provide a new source of surface water to users, which may result in reduced groundwater demands if demands are transferred from groundwater to surface water or may result in delays in future groundwater demand increases as surface water supply will be extended.

6.2.3 Technical Evaluation of Strategies

Water management strategies were evaluated using the USGS Atlantic Coastal Plain Groundwater Model. Four groundwater model scenarios were evaluated, as summarized in Table 6-25. In Scenario 9, demand-side strategies were evaluated as a portfolio of agricultural water efficiency practices that were assumed to result in a 15 percent reduction in agricultural water demand. The portfolios were evaluated in the groundwater model by reducing future groundwater demands by 15 percent for all agricultural groundwater users. In Scenario 10, the supply-side strategy of relocating future pumping from the Crouch Branch aquifer to the McQueen Branch aquifer in Calhoun County was evaluated for the High Demand projections. Scenarios 11a and 11b assessed the combination of these two strategies for the Moderate and High Demand projections, respectively.

Table 6-25. Summary of groundwater model scenarios evaluating water management strategies.

Scenario Name	Demand Projections	Description
Scenario 9: Implement Irrigation Efficiency Practices	Moderate Demand	Based on an assumption of a continued increase in irrigation efficiency practices, water use from all irrigation wells was reduced by 15 percent.
Scenario 10: Relocate Future Pumping Demand	High Demand	Projected increases in water use for the Crouch Branch aquifer wells in Calhoun County were moved to the McQueen Branch aquifer.
Scenario 11a: Relocate Future Pumping Demand and Implement Irrigation Efficiency Practices	Moderate Demand	Projected increases in water use for the Crouch Branch aquifer wells in Calhoun County were moved to the McQueen Branch aquifer. In addition, a 15 percent reduction in irrigation pumping was applied, reflecting the use of irrigation efficiency practices.
Scenario 11b: Relocate Future Pumping Demand and Implement Irrigation Efficiency Practices	High Demand	

The effectiveness of the water management strategies was evaluated by comparing the 2070 simulated groundwater levels of the Moderate and High Demand Scenarios to the 2070 simulated groundwater levels following implementation of the water management strategy scenarios listed in Table 6-25. The effectiveness was also assessed by comparing the simulated differences in 2070 groundwater levels and the elevation of the top of the Crouch Branch aquifer in Calhoun County, and the McQueen Branch aquifer in Lexington County. Figures 6-3 through 6-10 show this latter comparison for the four Scenarios in the Calhoun and Lexington County Groundwater Areas of Concern.

Figure 6-3 compares the 2070 Moderate Demand Scenario and 2070 Scenario 9 results for the Crouch Branch aquifer in Calhoun County. The light brown shaded areas represent the simulated extent of heads (i.e., groundwater levels) in the Crouch Branch aquifer dropping below the top of the Crouch Branch aquifer by up to 50 feet. The dark brown shaded area (seen only in the 2070 Moderate Demand Scenario results) represents the simulated extent of heads in the Crouch Branch aquifer dropping below the top of the Crouch Branch aquifer by more than 50 feet. Groundwater level declines below the top of a confined or semi-confined aquifer can be problematic for several reasons. Compaction of sediments may occur, which can permanently reduce the aquifer's storage capacity and can cause land subsidence. Wells screened in the upper portion of the aquifer may experience reduced yield or stop producing water. Wells screen throughout the full extent of the aquifer could also experience reduction in well yield as reduced head and compaction occurs. The comparison shown in Figure 6-3 suggests that the implementation of irrigation efficiency practices will have a positive effect in reducing the extent and severity of 2070 Crouch Branch aquifer groundwater level declines below the top of the aquifer but will not eliminate the problem.

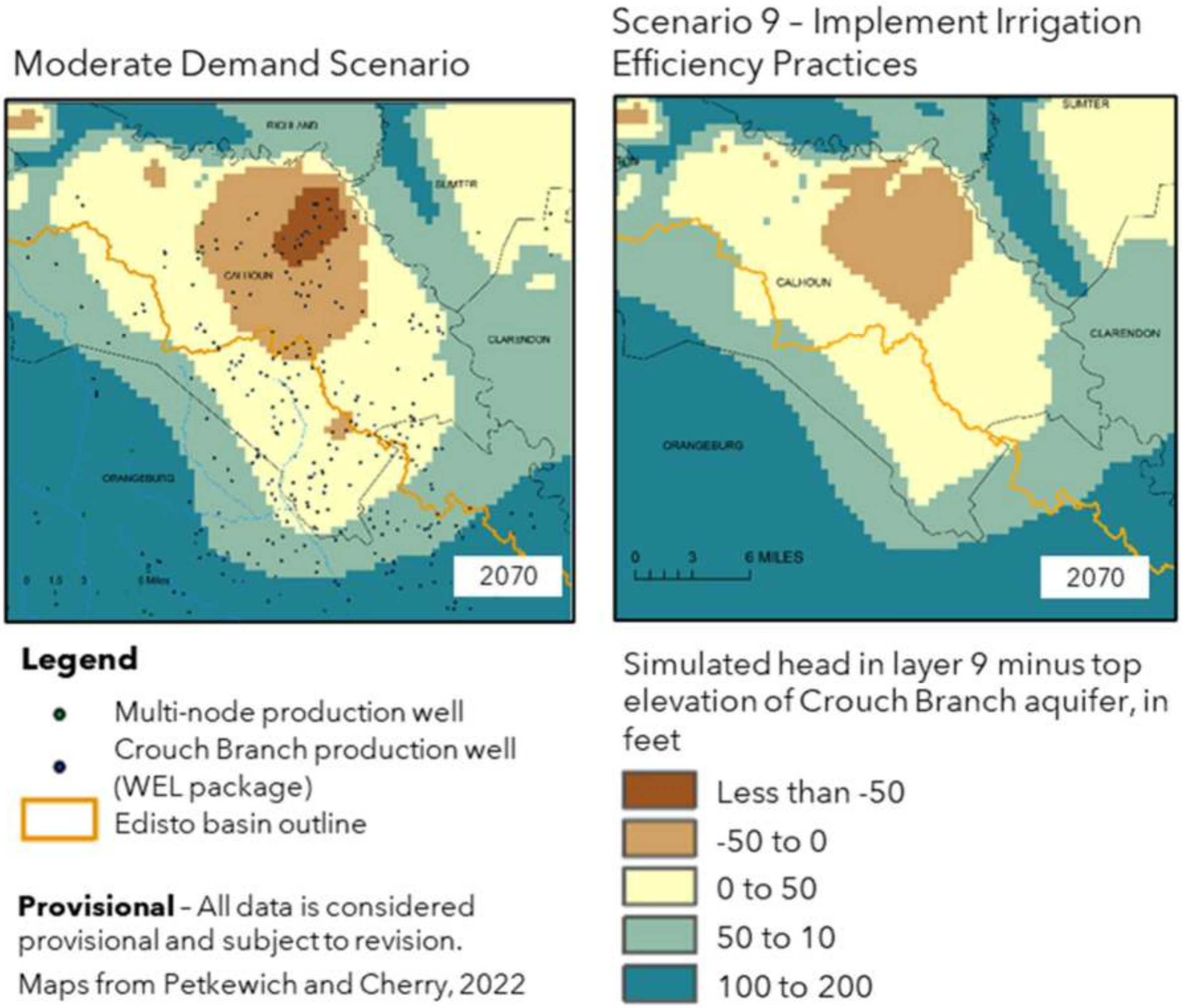
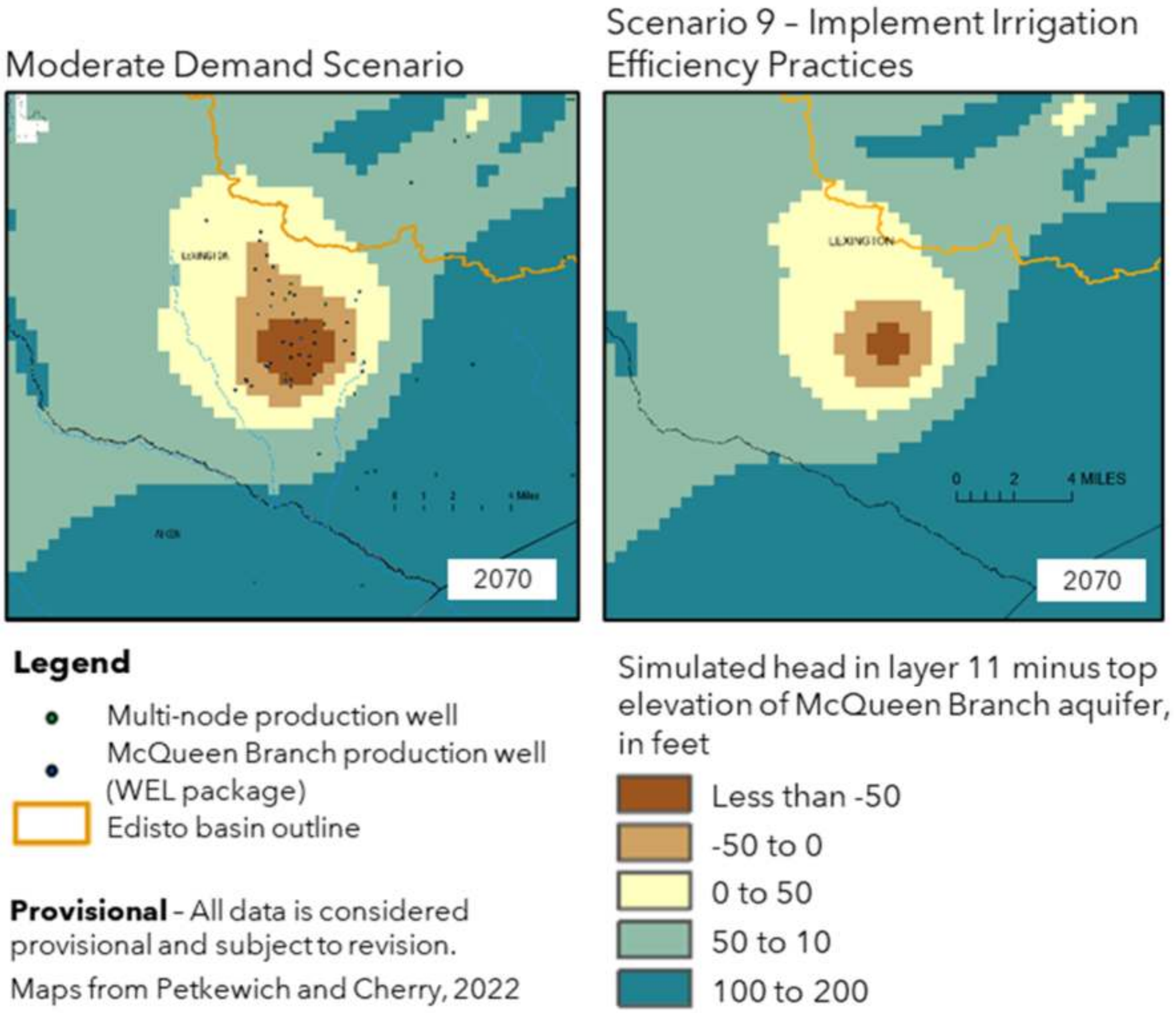


Figure 6-3. Simulated difference in 2070 groundwater elevation and the top of the Crouch Branch aquifer for the Moderate Demand Scenario and Scenario 9.

Figure 6-4 compares the 2070 Moderate Demand Scenario and 2070 Scenario 9 results for the McQueen Branch aquifer in Lexington County. The comparison suggests that the implementation of irrigation efficiency practices will have a relatively minor effect in reducing the extent and severity of McQueen Branch aquifer groundwater level declines below the top of the aquifer.



Provisional - All data is considered provisional and subject to revision.

Maps from Petkewich and Cherry, 2022

Figure 6-4. Simulated difference in 2070 groundwater elevation and the top of the McQueen Branch aquifer for the Moderate Demand Scenario and Scenario 9.

Figure 6-5 compares the 2070 High Demand Scenario and 2070 Scenario 10 results for the Crouch Branch aquifer in Calhoun County. The comparison suggests that relocating future pumping from the Crouch Branch aquifer to the McQueen Branch aquifer will have a very similar effect as the implementation of irrigation efficiency practices in reducing the extent and severity of Crouch Branch aquifer groundwater level declines below the top of the aquifer.

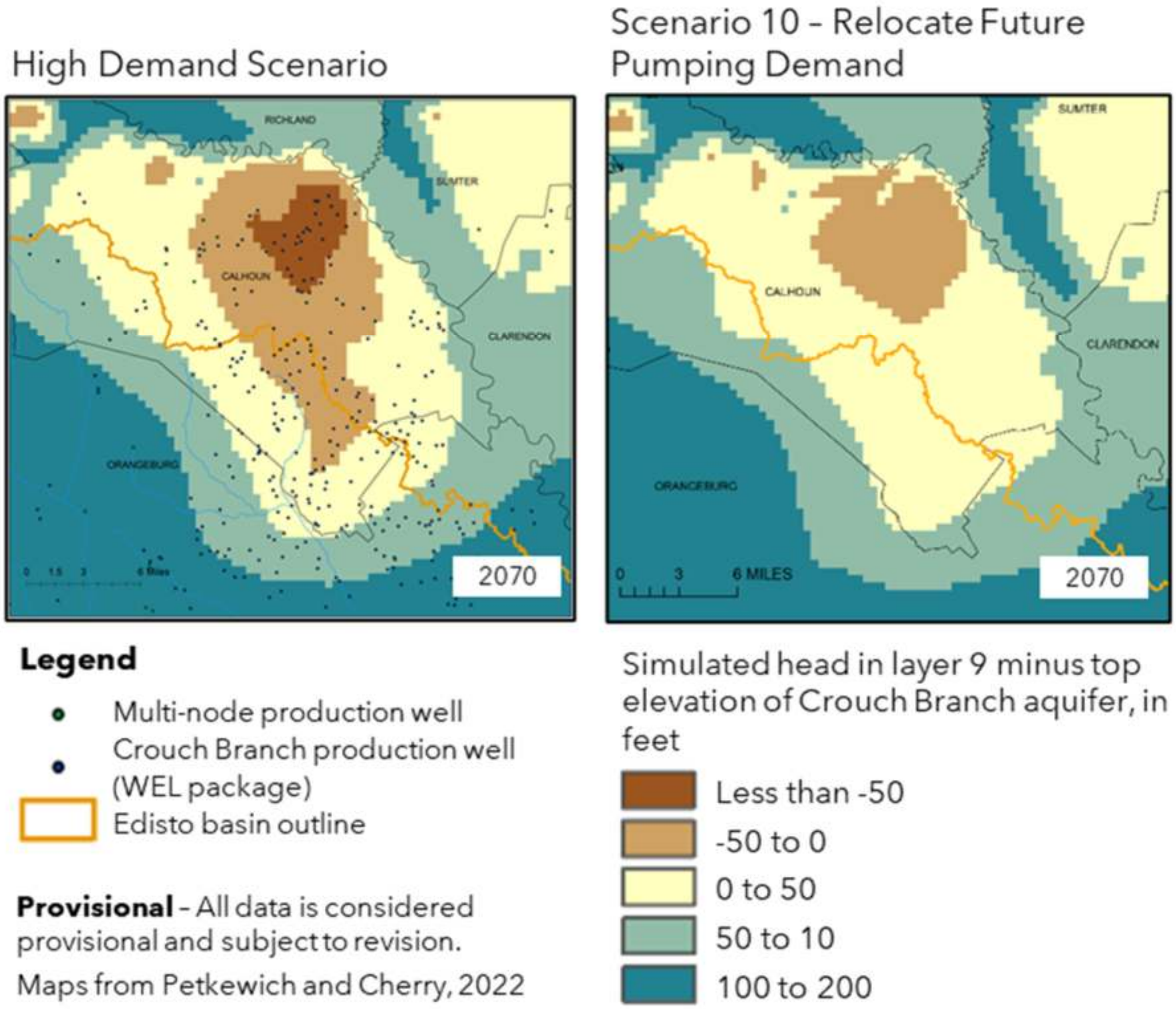


Figure 6-5. Simulated difference in 2070 groundwater elevation and the top of the Crouch Branch aquifer for the High Demand Scenario and Scenario 10.

Figure 6-6 compares the 2070 High Demand Scenario and 2070 Scenario 10 results for the McQueen Branch aquifer in Lexington County. The comparison suggests that relocating future pumping from the Crouch Branch aquifer to the McQueen Branch aquifer in Calhoun County will have virtually no impact in increasing or reducing the extent and severity of McQueen Branch aquifer groundwater level declines below the top of the aquifer in Lexington County.

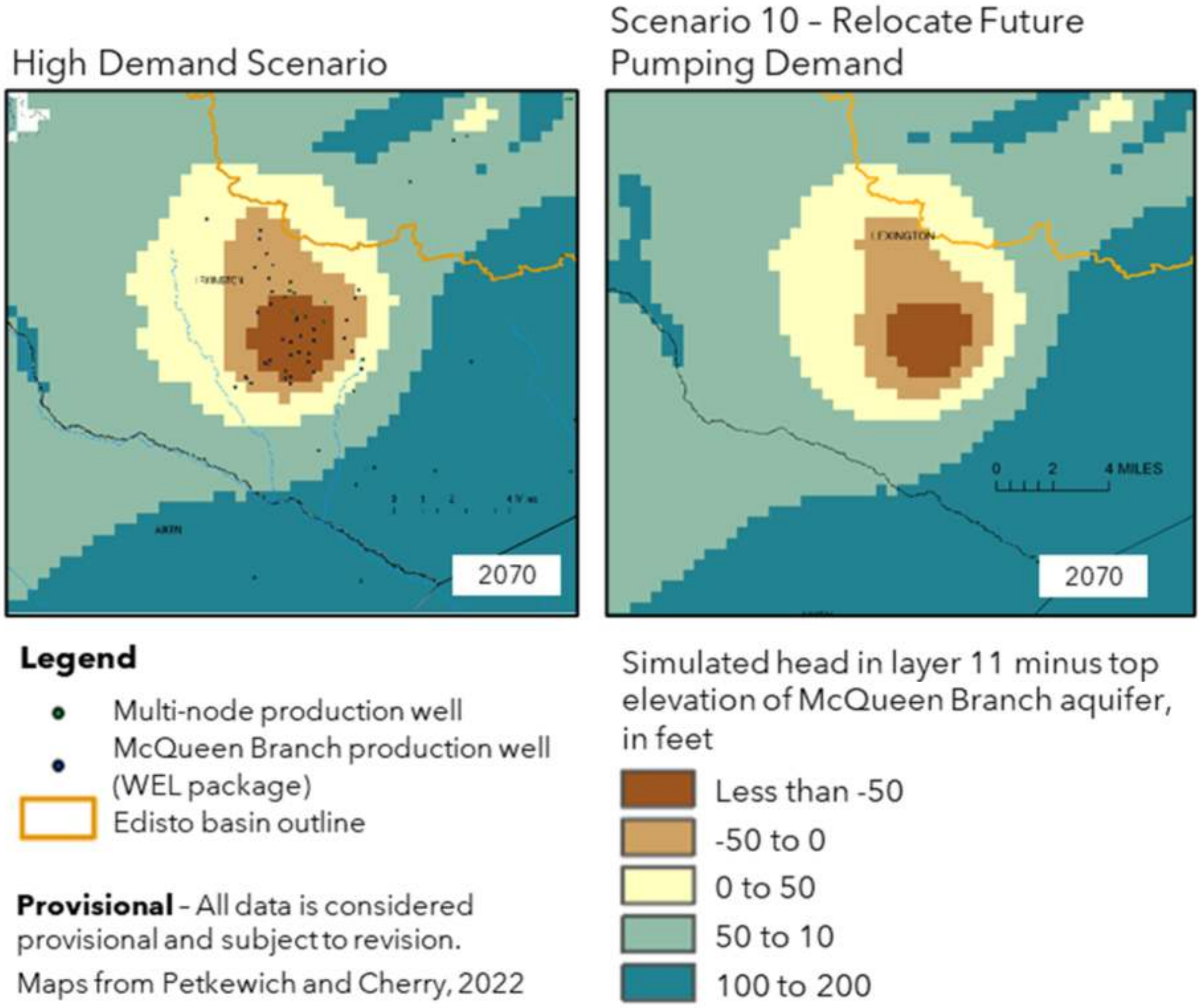


Figure 6-6. Simulated difference in 2070 groundwater elevation and the top of the McQueen Branch aquifer for the High Demand Scenario and Scenario 10.

Figure 6-7 compares Scenario 9 results for the Crouch Branch Aquifer in Calhoun County to Scenario 11a results, which evaluated the combination of irrigation efficiency practices and the relocation of future pumping in Calhoun County from the Crouch Branch aquifer to the McQueen Branch aquifer. Both scenarios were run using projected moderate demands. The comparison suggests that the combination of strategies (compared to just using one strategy) will further reduce the extent and severity of Crouch Branch aquifer groundwater level declines below the top of the aquifer, but it will not eliminate them.

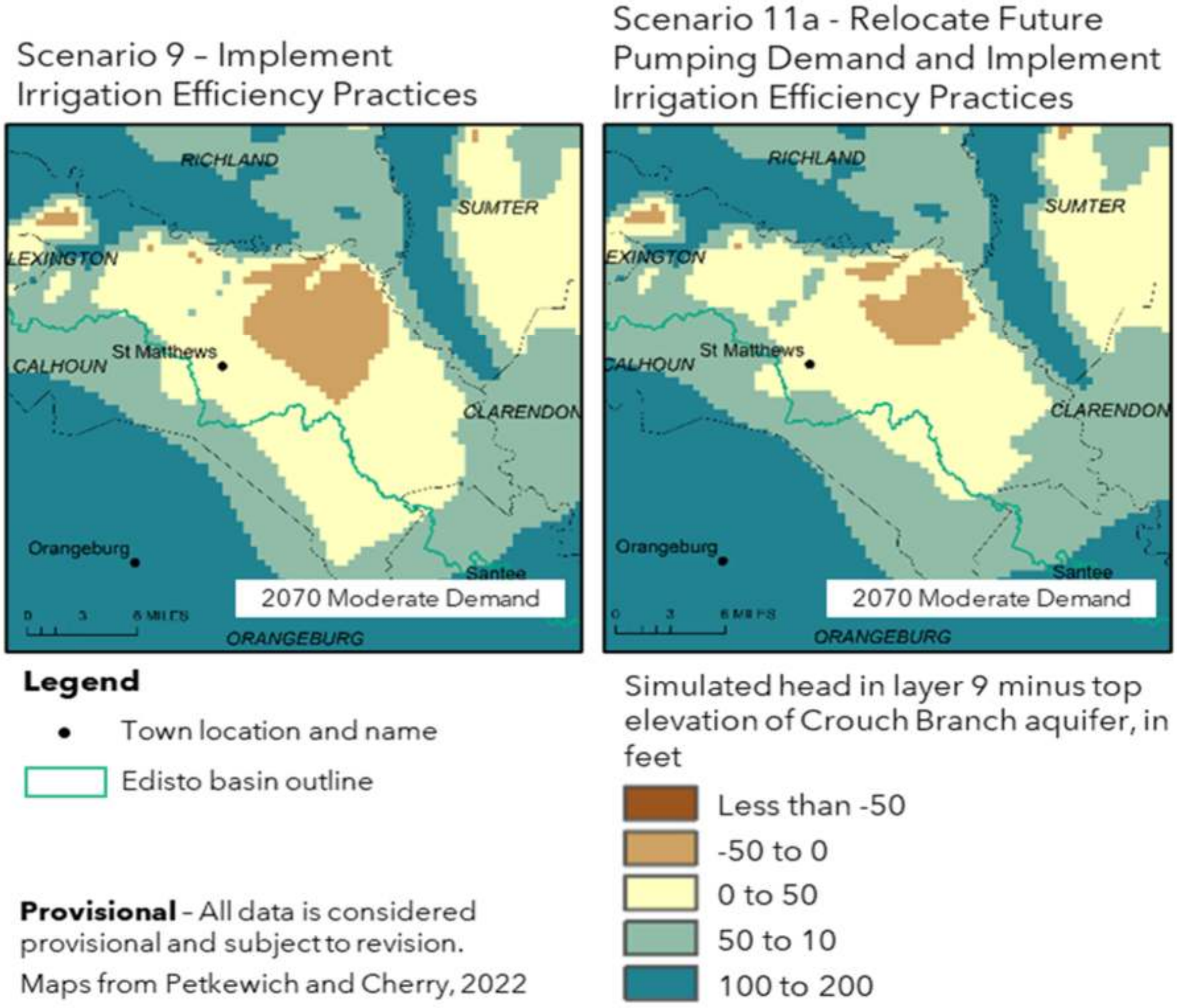
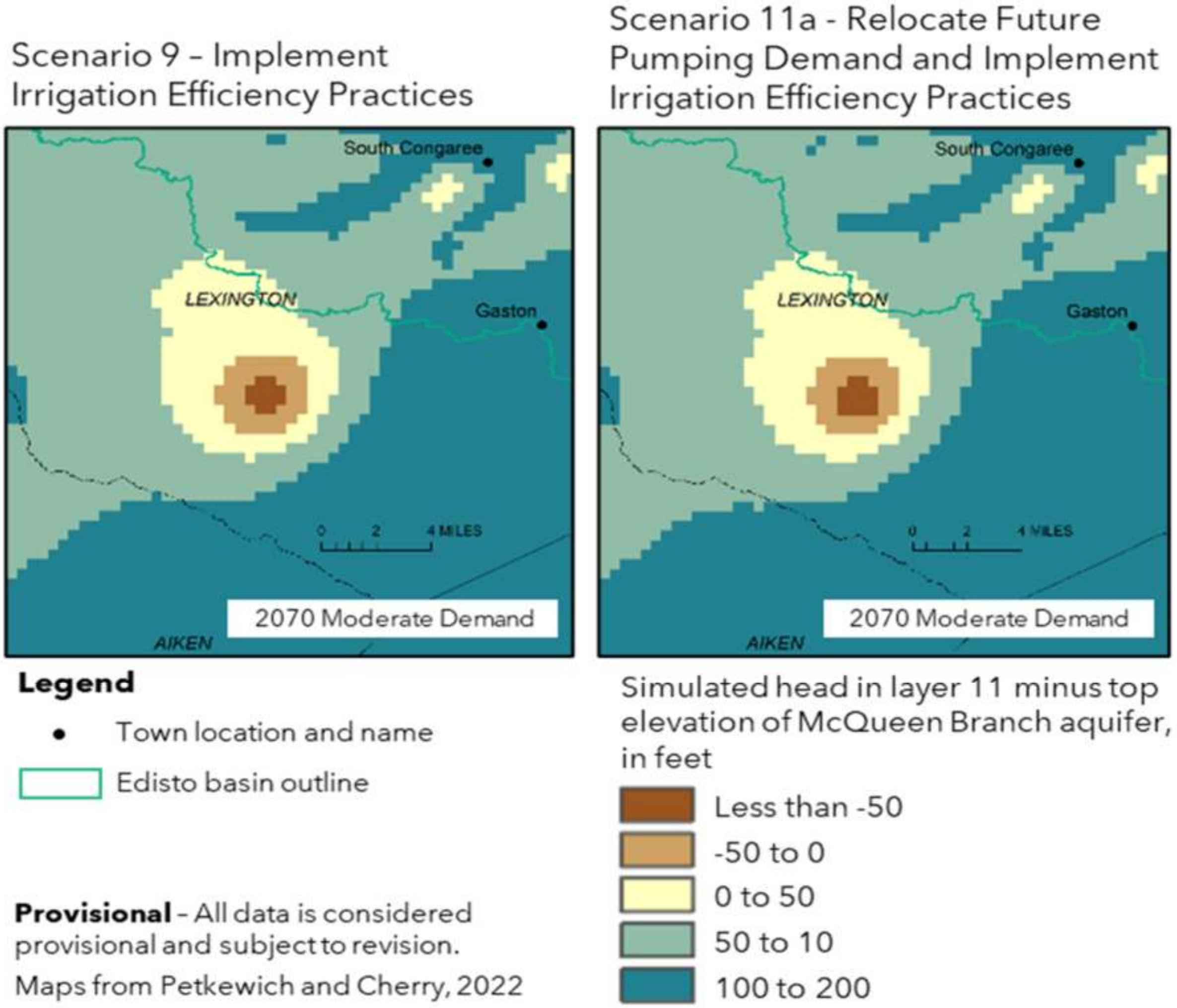


Figure 6-7. Simulated difference in 2070 groundwater elevation and the top of the Crouch Branch aquifer for Scenario 9 and Scenario 11a.

Figure 6-8 compares Scenario 9 results for the McQueen Branch Aquifer in Lexington County to Scenario 11a results, which evaluated the combination of irrigation efficiency practices and the relocation of future pumping in Calhoun County from the Crouch Branch aquifer to the McQueen Branch aquifer. Both scenarios were run using projected moderate demands. The comparison suggests that the combination of strategies (compared to just using one strategy) will not have any noticeable effect on McQueen Branch aquifer groundwater level declines below the top of the aquifer in Lexington County.



Provisional - All data is considered provisional and subject to revision.
Maps from Petkewich and Cherry, 2022

Figure 6-8. Simulated difference in 2070 groundwater elevation and the top of the McQueen Branch aquifer for Scenario 9 and Scenario 11a.

Figure 6-9 compares Scenario 10 results for the Crouch Branch Aquifer in Calhoun County to Scenario 11b results, which evaluated the combination of irrigation efficiency practices and the relocation of future pumping in Calhoun County from the Crouch Branch aquifer to the McQueen Branch aquifer. Both scenarios were run using projected high demands. The comparison suggests that the combination of strategies (compared to just using one strategy) will further reduce the extent and severity of Crouch Branch aquifer groundwater level declines below the top of the aquifer, but it will not eliminate them.

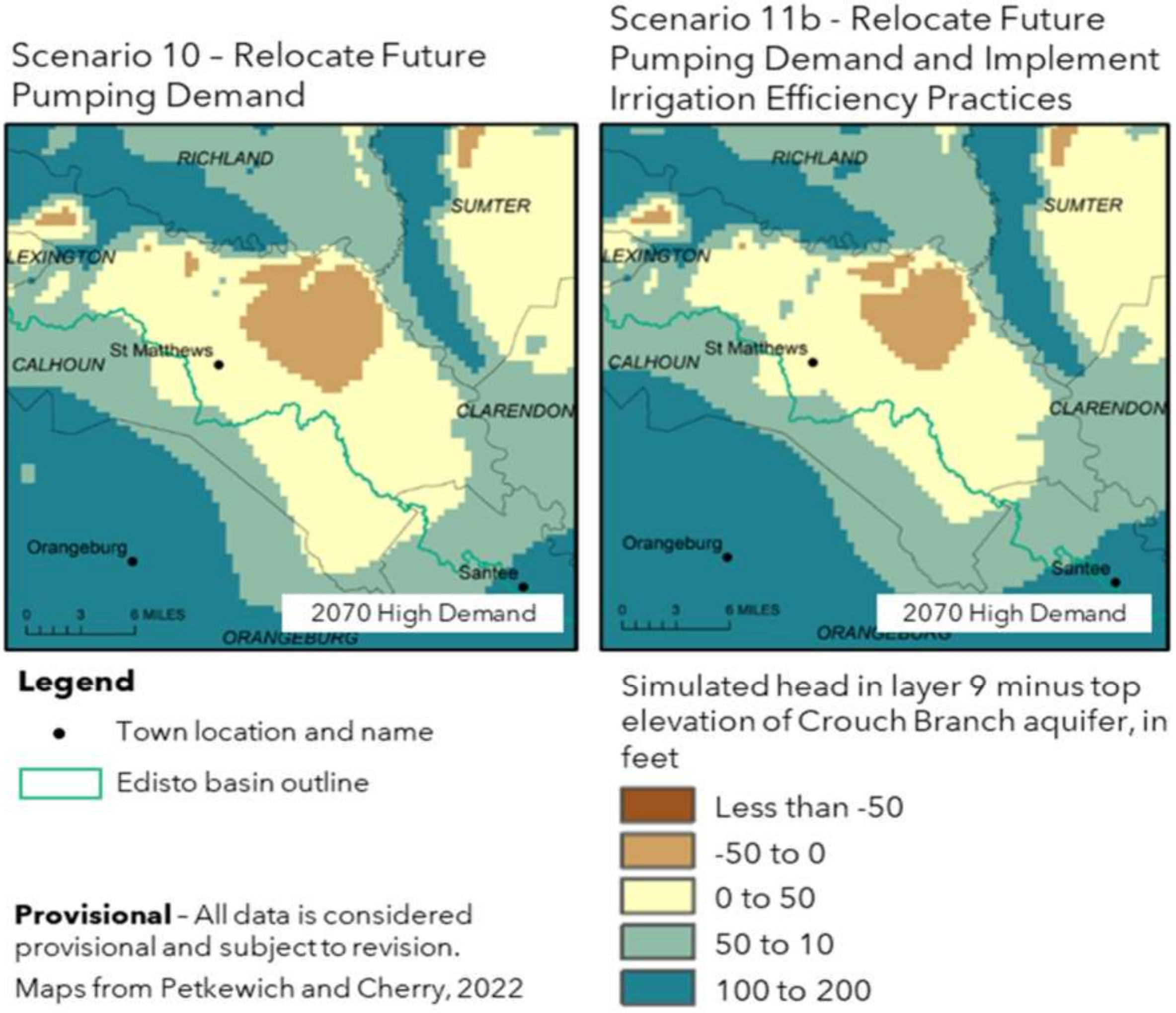


Figure 6-9. Simulated difference in 2070 groundwater elevation and the top of the Crouch Branch aquifer for Scenario 10 and Scenario 11b.

Figure 6-10 compares Scenario 10 results for the McQueen Branch Aquifer in Lexington County to Scenario 11b results, which evaluated the combination of irrigation efficiency practices and the relocation of future pumping in Calhoun County from the Crouch Branch aquifer to the McQueen Branch aquifer. Both scenarios were run using projected high demands. The comparison suggests that the combination of strategies (compared to just using one strategy) will have a very minor but positive effect in reducing the extent and severity on McQueen Branch aquifer groundwater level declines below the top of the aquifer in Lexington County.

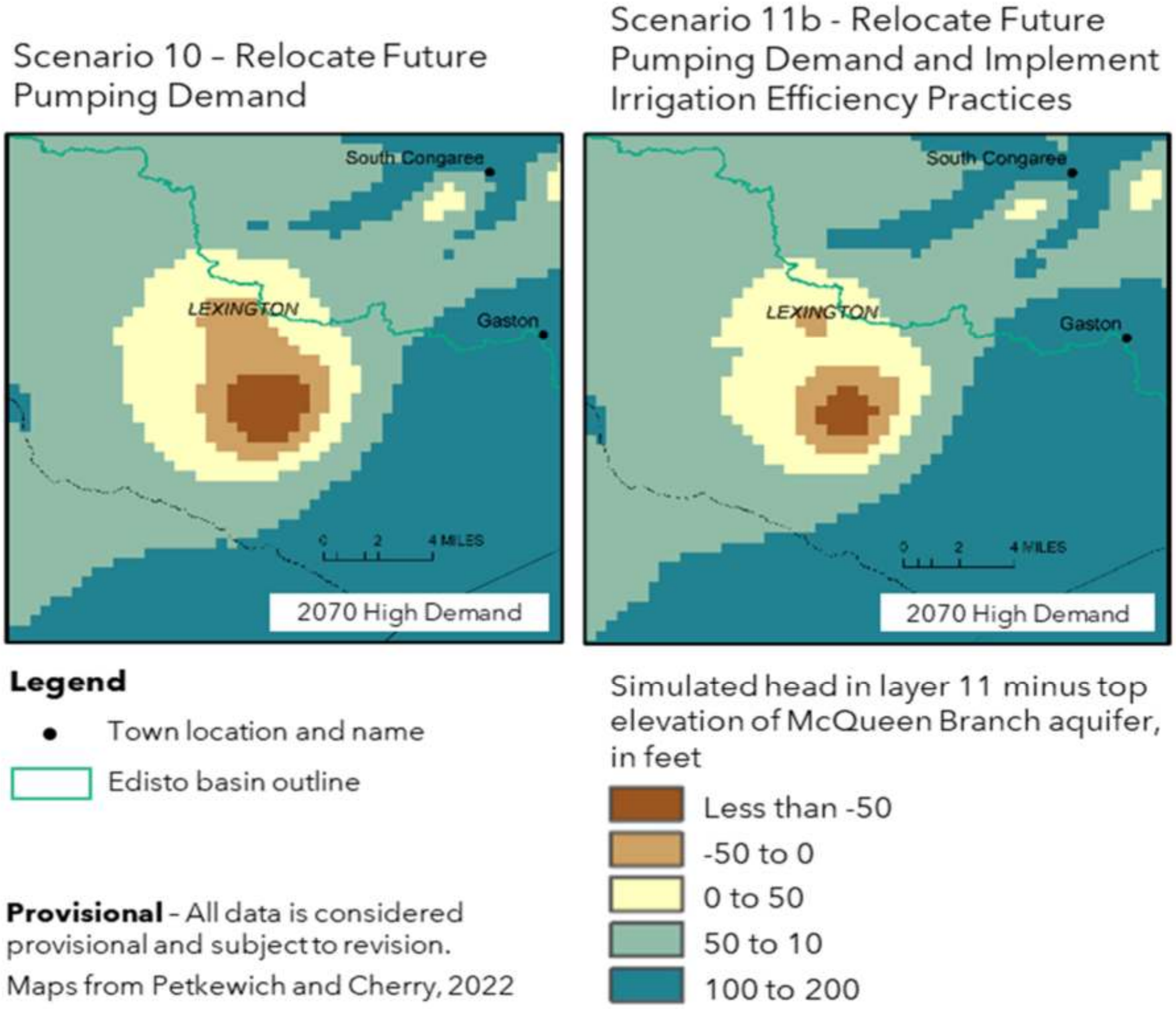
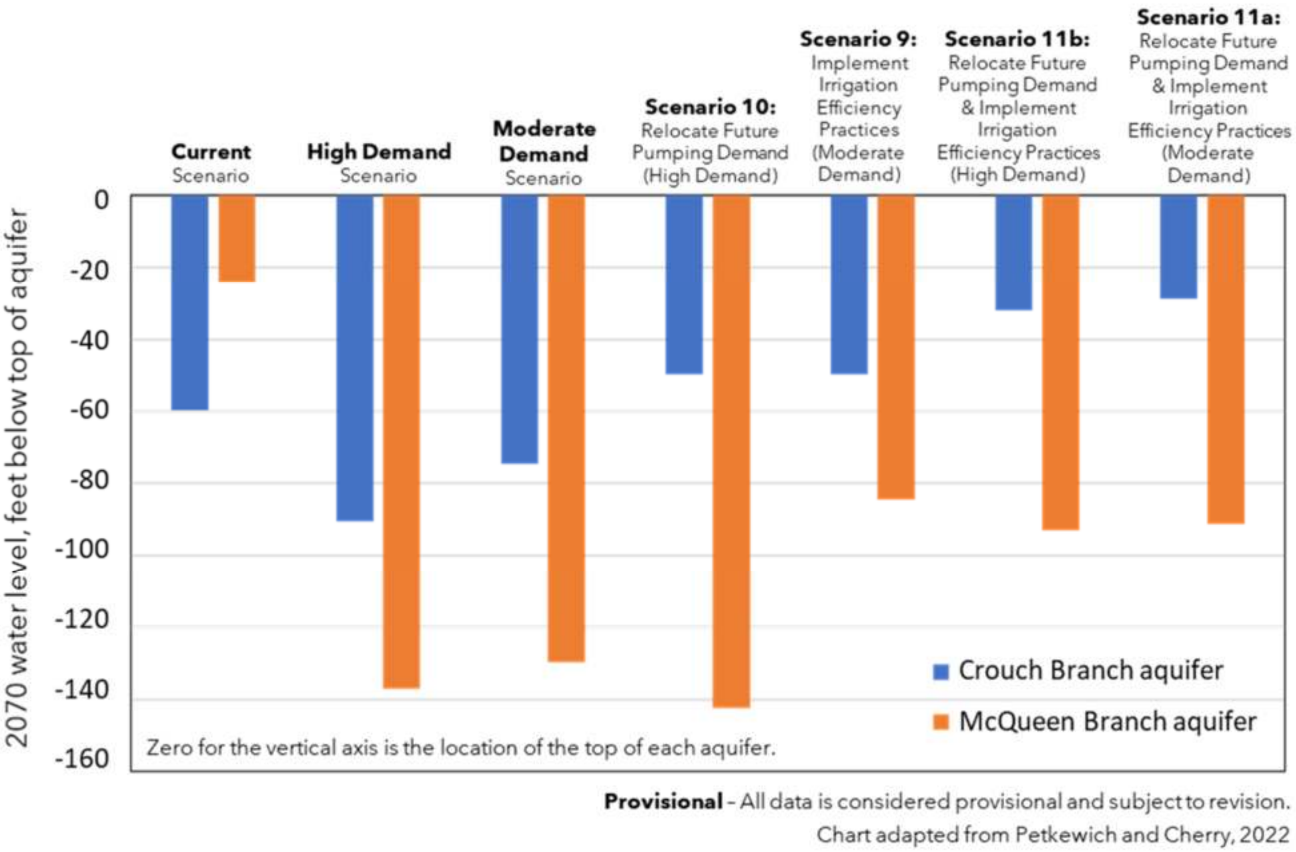


Figure 6-10. Simulated difference in 2070 groundwater elevation and the top of the McQueen Branch aquifer for Scenario 10 and Scenario 11b.

Figure 6-11 provides a graphical summary of the results depicted in Figures 6-3 through 6-10. The chart shows the simulated maximum breach of aquifer depths (distance that the groundwater levels drop below the top of the aquifer) in the Crouch Branch aquifer in Calhoun County (blue bars) and the McQueen Branch aquifer in Lexington County (orange bars). Included for comparison along with the 2070 High and Moderate Scenario results are the 2070 results assuming Current Scenario levels of pumping.



Provisional - All data is considered provisional and subject to revision.
Chart adapted from Petkewich and Cherry, 2022

Figure 6-11. Maximum breach of aquifer depths at Groundwater Areas of Concern.

6.2.4 Feasibility of Groundwater Management Strategies

An analysis of the feasibility of agricultural irrigation efficiency practices was presented in Table 6-24 and the cost-benefit analysis was presented in subchapter 6.1.6. Practices evaluated included water audits and nozzle retrofits, irrigation scheduling, soil management, crop variety, crop type, crop conversion, and irrigation equipment changes.

The feasibility of transferring new pumping from the Crouch Branch to the deeper, less-developed McQueen Branch aquifer is summarized in Table 6-26. The Crouch Branch aquifer in the Calhoun County Groundwater Area of Concern ranges from about 200 to 500 feet below land surface. A typical irrigation well in this area might be 300 feet deep. The cost of a 300-foot-deep, 350 gpm irrigation well and pump is approximately $250,000. Installing wells in the deeper McQueen Branch aquifer in the Calhoun County Groundwater Area of Concern would require drilling to depths of approximately 600 to 800 feet below land surface, resulting in approximately twice the cost of a 300-foot well.

Table 6-26. Groundwater water management strategy feasibility assessment.

Color Code

Potential Moderate/High Adverse Effect	Potential Low Adverse Effect	Likely Neutral Effect (either no effect, or offsetting effects)	Potential Low Positive Effect	Potential Moderate/High Positive Effect

Water Management Strategy	Strategy Type	Consistency with Regulations	Reliability of Water Source	Environmental Impacts & Benefits[1]	Socioeconomic Effects	Potential Interstate or Interbasin Effects	Other Water Quality Considerations
Relocate Future Pumping Demand from Crouch Branch Aquifer to the McQueen Branch Aquifer.	Supply-side – Groundwater	Consistent	High reliability – Groundwater modeling simulations suggests the McQueen Branch aquifer has capacity to provide additional water without drawing water levels below the top of aquifer.	**Impacts:** None anticipated **Benefits**: Moderate environmental impacts – Transferring pumping to an aquifer with greater availability will reduce negative impacts in over-allocated aquifers, such as land subsidence, loss of storage capacity, and reduced well yields.	Moderate to high impacts – The cost of drilling to deeper aquifers will present a financial burden to withdrawers and may be infeasible for others.	No anticipated impacts.	Water quality in the McQueen Branch aquifer would need to be evaluated. There is the potential for elevated hardness that could reduce the lifespan of irrigation equipment.

[1] For the purposes of this comparison, "impacts" can be understood as potentially adverse consequences, while "benefits" are potential advantageous consequences.

Chapter 7

Water Management Strategy Recommendations

7.1 Selection, Prioritization, and Justification for each Recommended Water Management Strategy

The Edisto RBC recommends that each of the surface water and groundwater management strategies evaluated in Chapter 6 be included in the implementation plan. The recommended water management strategies are categorized as a portfolio of agricultural water efficiency practices, a portfolio of municipal conservation and efficiency practices, and supply strategies. The feasibility analysis in Chapter 6 illustrated the viability of each strategy. Although the assumed combined reduction in projected demands resulting from the portfolios of water efficiency and conservation strategies is uncertain and dependent on many factors, they are considered reasonable for the Edisto River basin and were shown to be effective in increasing water supply availability and reducing impacts in the Groundwater Areas of Concern. Similarly, although the additional water supply provided by the recommended supply-side strategies is uncertain and dependent on the individual designs, the assumptions of effectiveness described in Chapter 6 illustrate that these strategies can reduce the risks or impacts of water shortages. Additional detail about the recommended water management strategies is described below.

The results of the modeling and analysis summarized in Chapters 5 and 6 indicate that the risks and potential impacts of current and future water shortages are relatively low, with annual shortages through 2070 projected at less than 1 percent of annual demand across all sectors combined. Many of the projected shortages can also likely be managed with existing on-site small impoundments for agricultural irrigation. Since water shortage potential is not necessarily the prevailing concern in the Edisto River basin, a more useful framework for understanding and conveying the value of the RBC recommendations includes the following:

- The RBC recommendations are direct responses to their vision and goal statements for the basin. Table 7-1 identifies the water management strategies that will help achieve the RBC's vision and goals.
- The recommendations are also designed to protect against unknown future conditions. The RBC recommends that future climate trends be included in subsequent modeling because the measures help guard against unforeseen economic or demographic changes.

Table 7-1. RBC vision, goals, and responsive recommended water management strategies.

Vision Statement	
A resilient and sustainably managed Edisto River basin where stakeholder and ecosystem needs are recognized, balanced, and protected.	
Goals	**Responsive Water Management Strategies**
1 Develop water use strategies, policies, and legislative recommendations for the Edisto River basin to:	
1a Ensure water resources are maintained to support current and future human and ecosystem needs	▪ Low flow management strategy, conjunctive use, encouraging that new pumping in areas of concern come from aquifers that can support additional withdrawal
1b Improve the resiliency of the water resources and help minimize disruptions within the basin	▪ Agricultural and municipal water efficiency and conservation measures, conjunctive use, encouraging that new pumping in areas of concern come from aquifers that can support additional withdrawal
1c Promote future development in areas with adequate water resources	▪ Additional storage (small impoundments, encouraging that new pumping in areas of concern come from aquifers that can support additional withdrawal)
1d Encourage responsible land use practices	▪ Soil management and cover crops, crop variety, crop type, and crop conversion, future agricultural technologies
2 Develop and implement a communication plan to promote the strategies, policies, and recommendations for the Edisto River basin	▪ Public education of water conservation, residential water audits

Agricultural Strategies: The agricultural water management strategies are summarized in Table 7-2 along with the prioritization of each strategy. The prioritization was developed by members of the Edisto RBC representing agricultural interests. Although the strategies were given a prioritization, the Edisto RBC recognizes that the most appropriate strategy for a given agricultural operation will depend on the size of the operation, crops grown, current irrigation practices, and financial resources of the owner/farmer. The prioritization represents what may be preferred under typical conditions. The Edisto RBC noted the importance of continuing to research and support new technologies as they become available and accepted by the water conservation community.

Table 7-2. Agricultural water management strategy prioritization.

Water Management Strategy	Prioritization
Water Audits and Nozzle Retrofits	1
Irrigation Equipment Changes	2
Soil Management and Cover Crops	3
Irrigation Scheduling	4
Crop Variety, Crop Type, and Crop Conversion	5
Future Technologies	-

Municipal Strategies: The municipal water management strategies are summarized in Table 7-3. The Edisto RBC did not prioritize these strategies because of the significance of individual utility circumstances (e.g., current operations and programs, utility size, financial means) in determining which is the most desirable strategy to pursue. The strategies instead represent a "toolbox" of potential approaches to reduce water demands. Utility managers may find the descriptions and feasibility assessment presented in Chapter 6 helpful for determining which strategy to pursue.

Table 7-3. Municipal water management strategy prioritization.

Water Management Strategy	Prioritization
Conservation Pricing Structures	Toolbox of strategies. Priority varies by utility.
Toilet Rebate Program	
Landscape Irrigation Program and Codes	
Leak Detection and Water Loss Control Program	
Car Wash Recycling Ordinances	
Water Waste Ordinance	
Public Education of Water Conservation	
Residential Water Audits	
Water Efficiency Standards for New Construction	
Reclaimed Water Programs	
Time-of-Day Watering Limit	

Supply Strategies: The Edisto RBC assessed the supply strategies listed in Table 7-4:

Table 7-4. Supply-side strategies.

Water Management Strategy	Prioritization
Conjunctive Use	1
Small Impoundments	1
Encouraging that new pumping in areas of concern come from aquifers that can support the additional withdrawal	2

The feasibility of each strategy is highly dependent on the location of implementation and on the existing operations of water users. The Edisto RBC prioritized the first two of these supply strategies with equal priority. Conjunctive use, or the use of groundwater to supplement surface water supplies during periods of low streamflow, depends on the availability of access to a reliable groundwater supply. As described in Chapter 3.3.1, the depth to each aquifer unit varies spatially throughout the basin. As the depth to aquifer increases, so do the costs of drilling wells and pumping water from the wells. Depending on the location in the basin, a productive and available water-bearing unit may be prohibitively deep. The construction of small impoundments on a second-order or lower tributary requires the water withdrawer to be sufficiently close to the tributary to make the investment in an intake and transmission line cost-effective. Site constraints must also be amendable to the construction of a small impoundment. Each water user would assess which of the first two supply strategies makes the most sense for their operation.

The third strategy of encouraging new pumping from aquifers that can better support the pumping would be a second-tier priority action. The main reason for classifying this strategy with a lower priority than the first two strategies is that the need for the action is not yet verified by monitoring data. Groundwater modeling simulations suggested that future demands may result in water levels being drawn down below the top of aquifer in portions of Calhoun and Lexington Counties, and in a small area near Aiken, but there are currently there are no monitoring wells installed in this area to corroborate this result. Before recommending this strategy for implementation, the need to mitigate drawdowns in the Crouch Branch and McQueen Branch aquifers must be verified by monitoring data, and the broader impacts of relocating new pumping should be further explored.

Other Basin Management Strategies: The Edisto RBC developed and recommended a low flow management plan for the basin (see Chapter 8). The plan would serve to augment statewide and municipal drought management programs by triggering tiered withdrawal curtailment by the largest water users in the basin when river flow reaches successively lower levels. The specific aim of the plan would not be to reduce water shortages associated with consumptive uses, but rather improve the balance between consumptive and environmental uses throughout the basin during periods of hydrologic stress, a direct response to the RBC's vision statement and Goal 1a.

7.2 Remaining Shortages

The remaining surface water shortages with various water management strategies employed are summarized in Table 7-5. Each of the scenarios includes 2070 high demands and assumptions about a reduction in demand or increase in supply resulting from implementation of the specified surface water management strategies. The remaining shortages for each scenario can be compared to those in the 2070 High Demand Scenario.

As described in Chapter 5, the agricultural surface water users with simulated shortages have several things in common. Nearly all are located on a relatively small ungaged tributary near the headwater of their source water stream or river. Additionally, many of these agricultural water users have multiple intake locations, which are aggregated in the model to just one or two locations. The ability of the model to estimate low flows on the smaller ungaged tributaries is limited, and there is increased model uncertainty on these streams. Furthermore, inspection of aerial imagery shows that most of these water users have created or made use of existing small ponds for their surface water intake. These small ponds are not included in the SWAM model. The ponds provide much-needed storage during low flow conditions that occur during a drought. For these reasons, the identified shortages are not likely to occur at the same frequencies and amounts as simulated in the model. Many if not all the simulated agricultural water user shortages are likely to be significantly tempered or avoided because of the on-site storage available from the ponds.

A more useful comparison of the effectiveness of the surface water management strategies is shown in Table 7-6, which compares performance measures between the 2070 High Demand Scenario and the water management strategy scenarios at the EDO13 Strategic Node on the Edisto River near Givhans. This is the most downstream Strategic Node (downstream of all surface water users). The implementation of the various surface water management strategies on their own or in combination results in negligible increases in mean and median flows, but more pronounced, albeit still minor, increases in Surface Water Supply and 5th, 10th, and 25th percentile flows (i.e., low flows).

Given that the benefits realized by the water management strategies are also relatively small, it may be more useful to consider these alternatives primarily as “future risk avoidance” or “best management practices” in direct response to the vision and goals expressed by the RBC. The Edisto River basin exhibits fairly low risk currently, and implementing conservation and water efficiency practices will help to keep future risks low. It is noted that the shortage values are simulated with historical climate conditions only (per guidance in the Planning Framework), but the Framework suggests and the RBC recommends that future climate trends be incorporated into subsequent modeling and analysis.

Table 7-5. Summary of remaining surface water shortages for scenarios with recommended water management strategies.

Parameter	2070 High Demand Scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 5a	Scenario 5b	Scenario 6a	Scenario 6b
		Drought Management Plans	Drought Management + Irrigation Efficiency	Drought Management + Municipal Conservation	Conjunctive Use (20%)	Conjunctive Use (50%)	Conjunctive Use (20%) + Demand-Side Strategies	Conjunctive Use (50%) + Demand-Side Strategies
Water Use Sectors with Shortages	Public Supply and Agriculture	Agriculture	Agriculture	Agriculture	Agriculture	Agriculture	Agriculture	Agriculture
Total Annual Mean Shortage (MGD)	1.6	1.5	1.4	1.4	1.5	1.4	1.4	1.4
Maximum Water User Shortage (MGD)	5.1	4.1	3.7	3.7	4.1	3.7	3.7	3.7
Total Annual Mean Shortage	0.7%	0.7%	0.7%	0.8%	0.7%	0.6%	0.7%	0.7%
Water Users Experiencing Shortage	20%	17%	17%	16%	17%	16%	15%	15%
Average Frequency of Shortage	13%	15%	14%	16%	15%	15%	17%	16%

Table 7-6. Comparison of performance measures at the EDO13 Strategic Node (Edisto River near Givhans) for scenarios with recommended surface water management strategies.

Scenario	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
2070 High Demand Scenario	2,396	1,570	0	780	451	299
Scenario 1 Drought Management Plans	2,403	1,570	166	780	451	359
Scenario 2 Drought Management + Irrigation Efficiency	2,406	1,570	173	785	455	363
Scenario 3 Drought Management + Municipal Conservation	2,438	1,601	205	818	492	363
Scenario 5a Conjunctive Use (20%)	2,397	1,570	10	780	451	314
Scenario 5b Conjunctive Use (50%)	2,398	1,570	39	780	451	325
Scenario 6a Conjunctive Use (20%) + Demand-side Strategies	2,439	1,601	221	818	492	371
Scenario 6b Conjunctive Use (50%) + Demand-side Strategies	2,443	1,605	248	821	495	370

7.3 Remaining Issues Regarding Designated Reaches of Interest or Groundwater Areas of Concern

The evaluation presented in Chapter 6 and 7 allowed for the Edisto RBC to identify any Reaches of Interest or Groundwater Areas of Concern. Reaches of Interest are defined in the Framework as "specific stream reaches that may have no identified Surface Water Shortage but experience undesired impacts, environmental or otherwise, determined from current or future water-demand scenarios or proposed water management strategies" (SCDNR 2009). The Edisto RBC did not identify any Reaches of Interest.

A Groundwater Area of Concern is defined in the Framework as "an area in the Coastal Plain, designated by a River Basin Council, where groundwater withdrawals from a specified aquifer are causing or are expected to cause unacceptable impacts to the resource or to the public health and well-being" (SCDNR 2019). The Edisto RBC identified Groundwater Areas of Concern where groundwater modeling demonstrated the potential for water levels to be drawn down below the top of aquifer. Three Groundwater Areas of Concern were identified in Aiken, Calhoun, and Lexington Counties. Groundwater modeling conducted with water management strategies included showed a reduction in the size of the area where groundwater levels were simulated to drop below the top of an aquifer, and a decrease in severity (maximum groundwater level depth below the top of the aquifer). However, in no scenario was the issue completely resolved. The RBC recommended monitoring water levels in the Groundwater Areas of Concern and potential future groundwater modeling following the collection of additional data and possible model enhancements.

Chapter 8
Drought Response

8.1 Existing Drought Management Plans and Drought Management Advisory Groups

8.1.1 Statewide Drought Response

The South Carolina Drought Response Act of 2000 (Code of Laws of South Carolina, 1976, Section 49-23-10, et seq., as amended) was enacted to provide the state with a mechanism to respond to drought conditions (SCDNR 2009). The Act stated that SCDNR will formulate, coordinate, and execute a statewide drought mitigation plan. The Act also created the South Carolina DRC to be the major drought decision-making entity in the state. The DRC is a statewide committee chaired and supported by SCDNR's State Climatology Office (SCO) with representatives from local interests.

To help prevent overly broad response to drought, the Act assigned SCDNR the responsibility of developing smaller DMAs within the state. SCDNR split the state into four DMAs that generally follow the boundaries of the four major river basins but are delineated along geopolitical county boundaries rather than basin boundaries. The Edisto River basin is largely within the Southern (ACE Basin) DMA but has portions of its upper reaches in the West (Savannah) and Central (Santee) DMAs as shown in Figure 8-1. The Governor appoints members from various sectors to represent each DMA within the DRC. The organizational relationship of the DRC, DMAs, SCDNR, and SCO are illustrated in Figure 8-2.

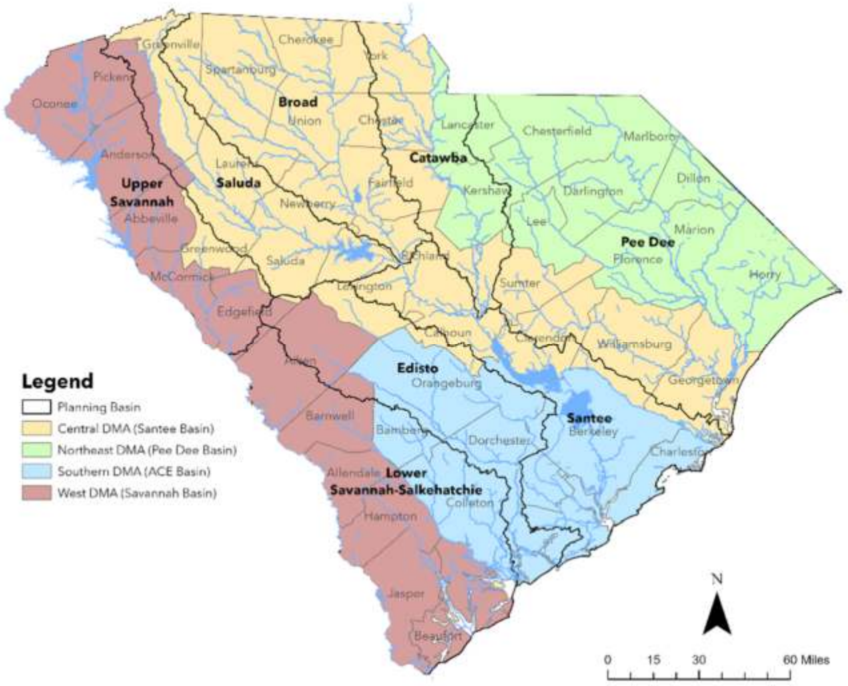


Figure 8-1. The four Drought Management Areas.

In accordance with the Drought Response Act of 2000, SCDNR developed the South Carolina Drought Response Plan, which is included as Appendix 10 of the South Carolina Emergency Operations Plan. South Carolina has four drought alert phases: incipient, moderate, severe, and extreme. SCDNR and the DRC monitor a variety of drought indicators to determine when drought phases are beginning or ending. Examples of

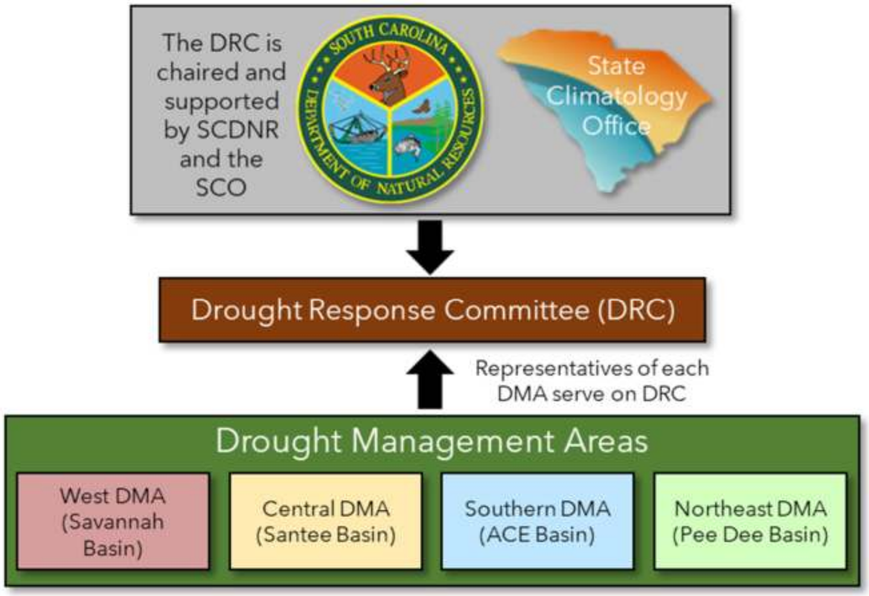


Figure 8-2. Drought Act organizational chart.

drought indicators include streamflows, groundwater levels, the Palmer Drought Severity Index, the Crop Moisture Index, the Standardized Precipitation Index, and the United States Drought Monitor. The South Carolina Drought Regulations establish thresholds for these drought indicators corresponding to the four drought alert phases. Declaration of a drought alert phase is typically not made based only on one indicator, rather a convergence of evidence approach is used. The need for the declaration of a drought alert phase is also informed by additional information including water supply and demand, rainfall records, agricultural and forestry conditions, and climatological data.

Based on their assessment of drought conditions, SCDNR and the DRC coordinate the appropriate response with the affected DMAs or counties. Local drought response is discussed in more detail in the following section. Under Section 49-23-80 of the Drought Response Act, if SCDNR and the DRC determine that drought has reached a level of severity such that the safety and health of citizens are threatened, the DRC shall report such conditions to the Governor. The Governor is then authorized to declare a drought emergency and may require curtailment of water withdrawals.

8.1.2 Local Drought Response

At a local level, Section 49-23-90 of the Drought Response Act states that municipalities, counties, public services districts, and commissions of public works shall develop and implement drought response plans or ordinances. These local plans must be consistent with the State Drought Response Plan. SCDNR developed a sample drought plan and ordinance for local governments and water systems to use as templates. In a drought mitigation plan, each phase of drought has a set of responses that are set in motion to reduce demand, bolster supply, or both. The drought plans and ordinances include system-specific drought indicators, trigger levels, and responses. Responses include a variety of actions that would be taken to reduce water demand at the levels indicated in Table 8-1. When drought conditions have reached a level of severity beyond the scope of the DRC and local communities, the State Drought Response Plan, Emergency Management Division, and State Emergency Response Team are activated.

The drought response plans and ordinances prepared by public water suppliers located in the Edisto River basin or who draw water from the basin largely follow the templates prepared by SCDNR. The drought response plans for all water systems in the Edisto River basin are summarized in Table 8-2. Many of the plans were submitted to SCDNR in 2003, shortly after the Drought Response Act went into effect in

2000. As such, they may present information that is outdated. The Drought Response Act of 2000 did not explicitly require drought plans to be updated at a specific interval.

Table 8-1. Demand reduction goals of drought response plans in South Carolina.

Drought Phase	Response
Incipient	None specified
Moderate	Seek voluntary reductions with the goal of: ▪ 20% reduction in residential use ▪ 15% reduction in other uses ▪ 15% overall reduction
Severe	Mandatory restrictions for nonessential use and voluntary reductions of all use with the goal of: ▪ 25% reduction in residential use ▪ 20% reduction in other uses ▪ 20% overall reduction
Extreme	Mandatory restrictions of water use for all purposes with the goal of: ▪ 30% reduction in residential use ▪ 25% reduction in other uses ▪ 25% overall reduction

Table 8-2. Drought response plans for water suppliers withdrawing water from the Edisto River basin.

Water Supplier	Year	DMA	Water Source	Drought Indicator/Trigger Types[1]	Alternative Water Supply Agreements
Batesburg-Leesville	2008	Central	**Surface water** – reservoir in town with supplemental 2 MGD from Brodie Creek	- Town Pond Reservoir 80%, 60%, or 50% full - Brodie Creek flow below 5.0, 3.0, or 1.5 cfs - 60, 45, or 21 days of raw water supply available - Average daily use greater than 1.3 MGD for 45 consecutive days, 1.5 MGD for 50 consecutive days, or 1.5 MGD for 30 consecutive days - Local average rainfall less than 6 inches for 60 days, 2 inches for 90 days, or 1 inch for 100 days	In early 2022, the town reached an agreement to connect to the Joint Municipal Water & Sewer Commission. Once this occurs, the town will no longer withdraw from the Edisto River basin.
Blackville	2003	Southern	**Groundwater**	- Storage below 60% capacity - Aquifer levels less than 5%, 10%, or 15% of normal level - Average daily use greater than 1 MGD for 28, 21, and 14 consecutive days	None
Bowman	2014	Southern	**Surface Water** – Purchased from the Lake Marion Regional Water System	- The Lake Marion Region Water System Drought Plan has various triggers tied to Lake Marion elevations and average daily use in Lake Marion and Lake Moultrie. These lakes area in the Santee River Basin.	None
Aiken (City)	2003	Savannah	**Surface Water** – Shaw Creek, a tributary to South Fork Edisto River	- Aquifer levels 5, 10, or 12 feet below historic static level - Average daily use greater than 15.5, 16.5 or 17.5 MGD for 5 consecutive days - Reservoir valve 1 or valve 2 discharge required to maintain flow in Shaw Creek (severe and extreme phases)	Considering an alternative water supply source agreement with North Augusta when the Drought Plan was submitted.

[1] When multiple trigger points are listed, those reflect trigger points for the moderate, severe, and extreme drought phases, in that order.

[2] 7Q10: The lowest 7-day average flow that can be statistically expected to occur once every 10 years.

Table 8-2. Drought response plans for water suppliers withdrawing water from the Edisto River basin (Continued).

Water Supplier	Year	DMA	Water Source	Drought Indicator/Trigger Types[1]	Alternative Water Supply Agreements
Charleston Water System	2021	Southern	**Surface Water** - Edisto River and Bushy Park and Goose Creek Reservoirs (in the Santee River basin)	- Edisto River: Edisto River flow 90%, 75%, 50%, or 25 of 7Q10[2] - Bushy Park Reservoir: Specific conductance of water in Durham Canal is between 260 and 500, 500 and 1,500, or greater than 1,500 microSiemens for a period greater than 48 hours	None
Denmark	2003	Southern	**Groundwater**	- Storage falls below 60% of capacity - Aquifer levels less than 5%, 10%, or 15% normal level - Average daily use greater than 1 MGD for 28, 21, or 14 consecutive days	Negotiating a Mutual Aid Agreement with the Bamberg Board of Public Works when the Drought Plan was submitted.
Dorchester County Public Works	2003	Southern	**Purchase** – Charleston Commissioners of Public Works Groundwater	- Dorchester will use Charleston CPW triggers except Edisto River extreme drought phase is triggered when Edisto River flow is between 50% and 75% of 7Q10[2] rather than below 50% of 7Q10	Connections to Dorchester Water Authority and the Town of Ridgeville
Dorchester County Water Authority (DCWA)-Reevesville	2003	Southern	**Groundwater**	- Proclamation by Drought Response Committee - Static water levels drop 20, 40, or 60 feet below average - Pumping water levels drop 20, 40, or 60 feet below average - Determination by DCWA Administrator	None
Edisto Beach	2003	Southern	**Groundwater**	- Average daily use greater than 0.392, 0.5, or 1.4 MGD for 7 consecutive days	None
Eutawville[3]	2003	Southern	**Groundwater**	- Aquifer levels are more than 100, 150, or 200 feet from ground level - Average daily use greater than 0.1, 0.125, or 0.15 MGD for 7, 14, or 21 consecutive days, respectively - Information based on DNR Drought Committee declaration	None
Gaston[3]	2003	Central	**Groundwater**	- Storage falls below 25%, 50%, or 75% of capacity and is unable to recover - Pumping level at wells drops to 25%, 50%, or 75% under normal conditions	None
Holly Hill	2003	Central	**Groundwater**	- Based on aquifer levels below normal, 10 feet below normal, or less than 10 feet above pump intake	Considering agreements with Santee and Lake Marion Regional Water Systems when the Drought Plan was submitted.
Monetta	2003	West and Central	**Groundwater** **Purchase** – Ridge Spring Water System	- Storage falls below 25%, 50%, or 75% of capacity	None
Norway	2003	Southern	**Surface Water** – Edisto River **Purchase** – Orangeburg DPU	- Norway will use the Orangeburg DPU triggers	Orangeburg DPU

[1] When multiple trigger points are listed, those reflect trigger points for the moderate, severe, and extreme drought phases, in that order. Charleston Water System has two extreme drought triggers.

[3] Eutawville and Gaston each have one groundwater well in the Edisto River basin.

Table 8-2. Drought response plans for water suppliers withdrawing water from the Edisto River basin (Continued).

Water Supplier	Year	DMA	Water Source	Drought Indicator/Trigger Types[1]	Alternative Water Supply Agreements
Orangeburg Department of Public Utilities	2003	Southern	**Surface Water** - North Fork Edisto River	- Elevation of North Fork Edisto River less than 151.6, 151.4, or 151.3 feet mean sea level at water plant Streamflow of North Fork Edisto River less than 125, 110, or 100 cfs - Determination by DPU Manager	None
Pelion	2003	Central	**Purchase** - Lexington Joint Municipal Water Authority	- Any restriction of water use during a drought will be triggered by Lexington Municipal Joint and the West Columbia water system	None
Perry	2003	West	**Groundwater**	- Static water level falls less than 180, 188, or 197 feet	Agreement with the Town of Wagener
Salley	2003	West	**Groundwater**	- Average daily use greater than 0.2, 0.3, or 0.4 MGD for 5 consecutive days	A project was underway to connect to the Silver Springs Water District when the Drought Plan was submitted.
Silver Springs Water District	2003	Southern	**Groundwater**	- Storage falls below 90%, 50%, or 60% of capacity	Buy 12,000 gallons per day from the City of Orangeburg DPU
Springfield	2003	Southern	**Groundwater**	- Trigger levels on wells cannot be determined, triggers based on DRC declaration for Orangeburg County	None
St. George	2003	Southern	**Groundwater**	- Storage falls below 75%, 65%, or 50% of capacity - Average daily use greater than 0.45 or 0.5 MGD for 5 consecutive days (severe and extreme phases, respectively)	A 4th emergency well connected to Reevesville's system. Considering a tie-on to Dorchester County Water Authority when the Drought Plan was submitted.
Wagener	2003	West	**Groundwater**	- Average daily use greater than 0.14, 0.18, or 0.22 MGD for 5 consecutive days	The Perry Water System may provide water during a supply emergency.

[1] When multiple trigger points are listed, those reflect trigger points for the moderate, severe, and extreme drought phases, in that order.

8.2 RBC Drought Response

8.2.1 Roles and Responsibilities

Under the Planning Framework, the RBC will support drought response, collect drought information, and coordinate drought response activities. With support of SCDNR, the RBC will:

- Collect and evaluate local hydrologic information for drought assessment
- Provide local drought information and recommendations to the DRC regarding drought declarations
- Communicate drought conditions and declarations to the rest of the RBC, stakeholders, and the public

- Advocate for a coordinated, basinwide response by entities with drought management responsibilities (e.g., water utilities, reservoir operators, large water users)
- Coordinate with other drought management groups in the basin as needed

8.2.2 Communication Plan

The Edisto RBC will communicate drought conditions and responses within the basin through the RBC elected chair and vice chair. If any part of the basin is in a declared drought as determined by the DRC, the RBC chair and vice chair will solicit input from all RBC members regarding drought conditions and responses in their respective locations or interests. If there is significant response from RBC members, the chair and vice chair may additionally form an ad hoc drought response subcommittee to further discuss and coordinate response to current conditions. The chair and vice chair are then responsible for communicating updates on drought conditions and responses within the Edisto River Basin to the DRC, SCO, and/or appropriate DMA representatives. The DRC has existing mechanisms to communicate and coordinate drought response with stakeholders and the public. Under Section 49-23-70 of the Drought Response Act, SCDNR is responsible for disseminating public information concerning all aspects of the drought.

Further communication channels may exist if a member of the Edisto RBC also serves on the DRC as a DMA representative. This member may work with the RBC chair and vice chair to directly communicate between the Edisto RBC and the DRC. The Edisto RBC suggests to SCDNR that an opening for RBC representatives be added to the DRC to formalize the communication between entities during drought.

8.2.3 Low Flow Management Strategy

The Edisto RBC developed and approved a low flow management strategy for the basin. The intent of the low flow management strategy is to incrementally reduce surface water withdrawals so that water users, including the most downstream users on the Edisto River, still have access to water under conditions that might arise during severe and extreme drought. The strategy, which calls for increasing reductions in withdrawal as river flows drop below certain thresholds, also works to maintain water in the river to support ecological needs.

The strategy takes effect when flow in the Edisto River measured at the Givhan’s Ferry USGS gaging station (02175000) is less than 332 cfs, which is 20 percent of the long-term median flow of 1,660 cfs. When flow drops below this threshold, the strategy calls for voluntary reductions in withdrawals of certain surface water users by a specified amount. Should the observed flow in the river continue to drop further below the median, the suggested curtailment of withdrawals will increase in accordance with the percentages shown in Table 8-3. For practical purposes, the trigger for curtailment will be based on a running 7-day average flow at Givhans Ferry. By using the running 7-day average flow as an indicator rather than the daily flow, the strategy will be less likely to be applicable one day and not applicable the next, as flow varies.

The running 7-day average flows at Givhans Ferry from January 1, 2000 through September 19, 2021 are shown in Figure 8-3. For clarity, only flows below 500 cfs are shown. The average flow at Givhans Ferry over this period was 1,905 cfs and the median flow was 1,316 cfs. The figure shows that there have been 10 different times, ranging from periods of 2 days (in September 2010) to 88 days (in June, July, and

August 2002), when the running 7-day average flow dropped below 332 cfs. There have been no running 7-day average flows below 332 cfs in the last 7 years (2015 through 2021).

Table 8-3. Low flow management strategy triggers and reduction goals.

Incremental Percent Below 20% of Median Flow	Edisto River Flow Range (cfs) at Givhans Ferry		Reduction Goal for Surface Water Withdrawals
	Lower	Upper	
0-20%	266	332	20%
20-40%	199	266	40%
40-60%	133	199	60%
60-80%	66	133	80%
80-100%	0	66	100%

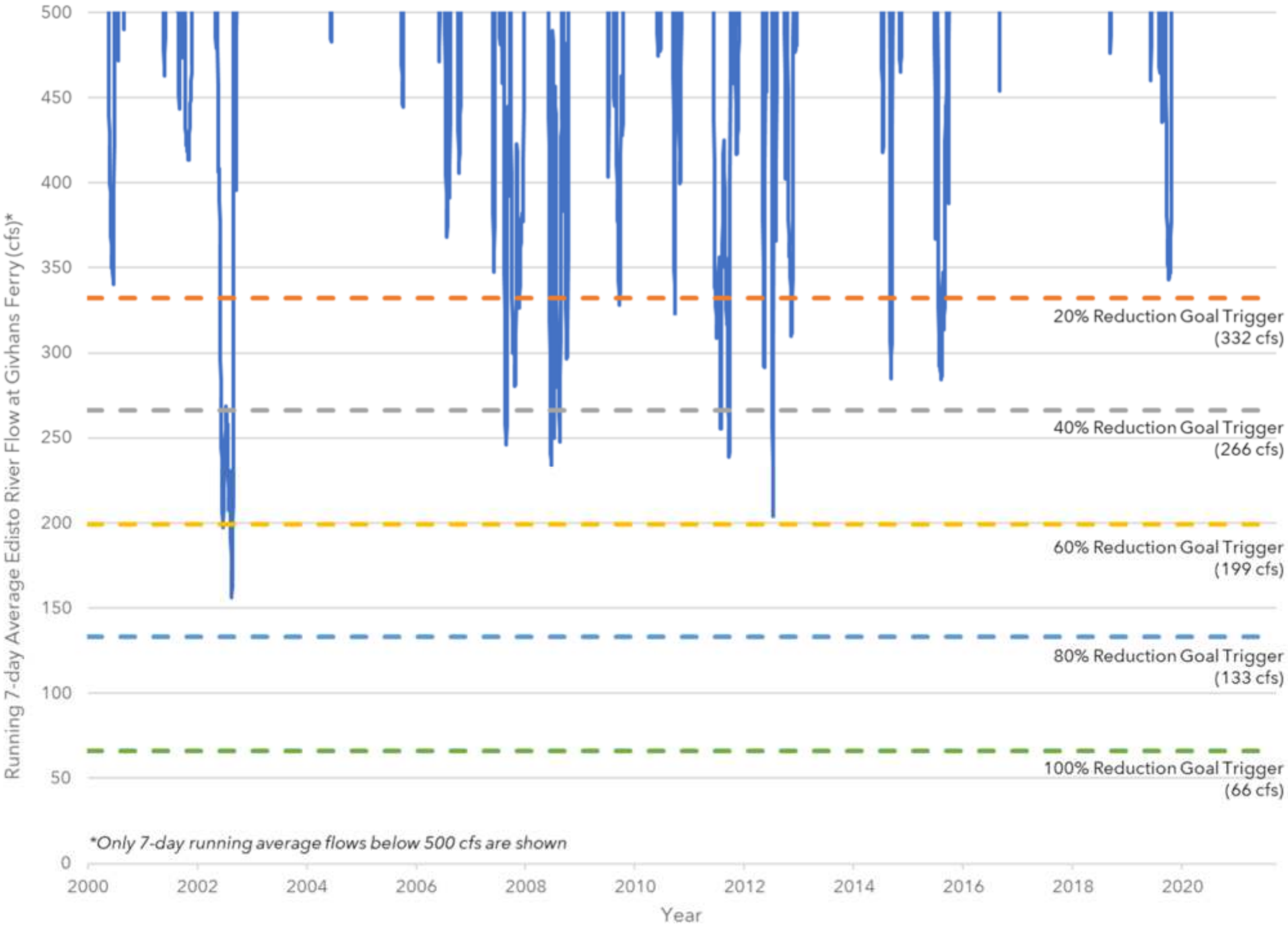


Figure 8-3. Comparison of 7-day running average Edisto River flows from January 2000 through September 2021 to low flow strategy trigger levels.

The Edisto RBC recognizes that surface water users in the basin do not have equal means to comply with the voluntary withdrawal reductions. To ease the burden on users with fewer resources, the low flow management strategy applies to surface water users whose cumulative (from all intakes) peak monthly withdrawal has exceeded 60 million gallons per month (MGM) in any of the previous 12 months. These surface water users are referred to as the "largest users" in the context of this discussion. With this threshold, and based on current withdrawals, the strategy will capture 92 percent of the volumetric withdrawal from the Edisto River but exclude the lower 86 percent of small withdrawers that may have more difficulty in reducing withdrawals and/or using alternative sources of water, such as groundwater.

The reduction in withdrawal will apply to each of the largest user's peak monthly withdrawal from the last 12 months. This approach provides a balance between asking the largest users to curtail off their total permitted or registered withdrawal (which may be substantially higher than actual withdrawals) and asking the largest users to curtail their demand in months when withdrawal is already low. The intent of curtailing off the monthly maximum is to ensure that withdrawals are curtailed during the months the lowest streamflows are experienced and during the months in which withdrawals are potentially the greatest. These conditions typically occur from May to October.

If the drought continues through the winter months and flows in the Edisto River at Givhans Ferry remain below 332 cfs, the largest users will not be asked to curtail already lower withdrawals provided each month's withdrawals are below the threshold. For example, if a user's peak withdrawal in the last 12 months was 100 MGM in May, then the percent reduction would be applied to the 100 MGM value. If flow on the Edisto River indicates a 20 percent reduction is desired, the user could withdraw a maximum of 80 MGM in any month and be in compliance with the strategy. If the low flow management strategy is triggered in Feburary, when the user is only withdrawing 10 MGM, the user will not be asked to reduce the 10 MGM by 20 percent. Table 8-4 shows the monthly withdrawal limits for a hypothetical user with a peak monthly withdrawal of 100 MGM. Assuming the prior 12 months of flow represented typical usage, Table 8-5 shows an example of monthly withdrawals that would be compliant with the low flow management strategy at various levels. Several additional examples are provided below Table 8-5, to further explain the strategy.

Table 8-4. Withdrawal limits for a sample user with a peak usage of 100 MGM.

Reduction	Peak Monthly Withdrawal (MGM)
20%	80
40%	60
60%	40
80%	20
100%	0

The low flow management strategy is intended to be implemented over time and is contingent upon available funding. The reduction in withdrawals specified in the strategy is voluntary. Methods to meet the desired reduction are at the discretion of each user. Some users may have existing alternative supplies or curtailment practices that they may use to comply with the low flow management strategy. Other users will need to develop these redundancies and may seek funding to do so. Chapter 10 provides a list of funding sources that could potentially be used by surface water withdrawers that seek to develop alternative water sources and implement the strategy.

Table 8-5. Example application of low flow management strategy withdrawal limits.

Month	Prior 12-Month Withdrawals (MGM)	Potential Monthly and Daily Maximum Withdrawal when Low Flow Management Strategy is Activated									
		20% Reduction		40% Reduction		60% Reduction		80% Reduction		100% Reduction	
		MGM	MGD	MGM	MGD	MGM	MGD	MGM	MGD	MGM	MGD
January	10	10	0.33	10	0.33	10	0.33	10	0.33	10	0.33
February	10	10	0.33	10	0.33	10	0.33	10	0.33	10	0.33
March	20	20	0.67	20	0.67	20	0.67	20	0.67	0	0
April	60	60	2.00	60	2.00	40	1.33	20	0.67	0	0
May	100	80	2.67	60	2.00	40	1.33	20	0.67	0	0
June	85	80	2.67	60	2.00	40	1.33	20	0.67	0	0
July	80	80	2.67	60	2.00	40	1.33	20	0.67	0	0
August	70	70	2.33	60	2.00	40	1.33	20	0.67	0	0
September	45	45	1.50	45	1.50	40	1.33	20	0.67	0	0
October	30	30	1.00	30	1.00	30	1.00	20	0.67	0	0
November	15	15	0.50	15	0.50	15	0.50	15	0.50	0	0
December	10	10	0.33	10	0.33	10	0.33	10	0.33	0	0

Orange shading represents months when a withdrawal limit would be triggered. MGM is million gallons per month and MGD is million gallons per day.

Example 1: The 7-day running average Edisto River flow at Givhans Ferry is 260 cfs. The withdrawer, who's peak monthly demand was 100 MGM over the last 12 months (as shown above), has a current water demand of 85 MGM. Since Edisto River flow is less than 266 cfs, a 40% reduction in withdrawal from their 12-month peak withdrawal of 100 MGM is necessary. A 40% reduction of 100 MGM means they could withdraw 60 MGM. They will need to reduce their surface water withdrawal from 85 MGM (2.83 MGD) to 60 MGM (2 MGD).

Example 2: The 7-day running average Edisto River flow at Givhans Ferry is 260 cfs. The withdrawer, who's peak monthly demand was 100 MGM over the last 12 months (as shown above), has a current water demand of 60 MGM. Since Edisto River flow is less than 266 cfs, a 40% reduction in withdrawal from their 12-month peak withdrawal of 100 MGM is necessary. A 40% reduction of 100 MGM means they could withdraw 60 MGM. In this case, their 60 MGM (2 MGD) demand is the same as the maximum allowed, therefore they would not need to curtail their withdrawal amount.

Example 3: The 7-day running average Edisto River flow at Givhans Ferry is 120 cfs. The withdrawer, who's peak monthly demand was 100 MGM over the last 12 months (as shown above), has a current water demand of 30 MGM. Since Edisto River flow is less than 133 cfs, an 80% reduction in withdrawal from their 12-month peak withdrawal of 100 MGM is necessary. A 80% reduction of 100 MGM means they could withdraw 20 MGM. They will need to reduce their surface water withdrawal from 30 MGM (1 MGD) to 20 MGM (0.67 MGD).

The low flow strategy does not apply to surface water users who have existing agreements with SCDHEC to shift withdrawals from surface water to groundwater or vice versa, based on agreed-to triggers. In such cases, the timing of their shift from surface water to groundwater will be dictated by their agreement with SCDHEC, not the low flow management strategy. The low flow strategy does not set any new (lower) minimum flow requirements for new surface water withdrawals permitted in the basin. New permits will still be governed by the prescribed minimum instream flow in the Surface Water Withdrawal, Permitting, Use and Reporting Act.

A summary of the low flow management strategy is provided in Table 8-6.

Table 8-6. Summary of the Edisto River basin low flow management strategy.

Incremental Percent Below 20% of Median Flow	Edisto River Flow Range (cfs) at Givhans Ferry		Reduction Goal for Surface Water Withdrawals
	Lower	Upper	
0-20%	266	332	20%
20-40%	199	266	40%
40-60%	133	199	60%
60-80%	66	133	80%
80-100%	0	66	100%

1. The trigger for curtailment will be based on running 7-day average flows at Givhans Ferry.
2. The strategy only applies to surface water users whose cumulative (from all intakes) peak monthly withdrawal has exceeded 60 million gallons per month (MGM) in any of the previous 12 months. Those meeting this definition are referred to as the "largest users" in the context of this strategy.
3. When triggered, the reduction in surface water withdrawals will apply to each of the largest user's peak monthly withdrawal from the last 12 months.
4. The reductions in withdrawals specified in the strategy are voluntary.
5. The strategy is intended to be implemented over time and is contingent upon available funding.
6. Methods to meet the desired withdrawal reductions are at the discretion of each user.
7. The low flow strategy does not apply to surface water users who have existing agreements with SCDHEC to shift withdrawals from surface water to groundwater or vice versa, based on agreed-to triggers.
8. The low flow strategy does not set any new (lower) limits for new surface water withdrawals permitted in the basin.

Chapter 9

Policy, Legislative, Regulatory, Technical, and Planning Process Recommendations

During the fourth and final phase of the planning process, the Edisto RBC identified and discussed recommendations related to the river basin planning process; technical and program considerations; and policy, legislative, or regulatory considerations. Various recommendations were proposed by RBC members and discussed over the span of several meetings. Although no formal vote was conducted for most of the planning process, technical, and program recommendations, these recommendations generally received broad RBC support and are to be taken as having consensus as defined by the River Basin Council Bylaws (SCDNR 2019). Under these bylaws, consensus is achieved when all members can “live with” a decision, although some members may strongly endorse a solution while others may only accept it as a workable agreement. The planning process recommendations are summarized in Chapter 9.1 and the technical and program recommendations are summarized in Chapter 9.2.

In contrast to the planning process, technical, and program recommendations, the RBC members completed a written survey to identify their support or lack thereof for potential policy, legislative, and regulatory changes. Through RBC discussion, it was determined that consensus was not likely to be achieved on potential policy, regulatory and legislative changes. Lacking consensus, the level of support for the potential changes is summarized. The reasons that RBC members and/or the interest categories they represent were in favor of a change, or do not support a change, are presented. The RBC’s level of support for these changes is discussed in Section 9.3.

9.1 River Basin Planning Process Recommendations

The river basin planning recommendations developed by the Edisto RBC are based on the RBC members’ experiences with the process. To provide context, it is useful to understand the planning process. The Edisto RBC met monthly, from June 2020 through November 2022. The initial 12 meetings were conducted virtually via the videoconference platform Zoom because of the coronavirus pandemic. These meetings typically ranged from 2 to 3 hours in duration. The remaining meetings were conducted in a hybrid format, with most RBC members attending in person and the remaining members attending virtually via Zoom. These meetings typically ranged from 3 to 6 hours. The Edisto RBC also conducted two field trips in April and July 2021, which included a tour of Walther Farms, a canoe trip on the Edisto River, and a visit to the Charleston Water System intake location adjacent to Givhans Ferry State Park. The Edisto RBC concluded that the monthly frequency and hybrid format of meetings was appropriate to provide momentum for the planning process while not placing an undue burden on RBC members. The following recommendations should be taken as considerations for development of future river basin plans.

Members of the Edisto RBC proposed the following recommendations related to RBC membership, bylaws, meeting schedules, or procedures:

- **Conduct an initial get-to-know-you meeting to introduce and promote trust among RBC members.** This was infeasible for the Edisto RBC because of the coronavirus pandemic.

- **Establish attendance requirements.** This may include providing a warning to members who miss a threshold number of meetings, and which are not attended by their selected alternate.

- **Incorporate into the RBC bylaws a preference for in-person attendance with a hybrid option as needed, recognizing that it is not always feasible to travel to monthly meetings.**

- **Rotate the location of meetings to accommodate members from different regions of the basin, if possible.**

- **Send the previous meeting's summary just before the next meeting or briefly review past outcomes at the start of each meeting, time permitting.** During the Edisto planning process, facilitators sent meeting minutes and summaries to Edisto RBC members. Later in the planning process, the facilitator, at the beginning of each RBC meeting, provided a high-level review of the previous meeting. RBC members indicated that this approach was useful, and helped establish continuity.

- **Accomplish the goals of the river basin planning process in fewer meetings than the Edisto RBC convened, if possible.** The Edisto RBC was the first river basin council to go through the planning process, and there were some delays due to the ongoing development of tools, such as the groundwater model, that will now be available for future RBCs. The Edisto RBC also had delays due to the coronavirus pandemic. The first 12 meetings of the Edisto RBC were held virtually and consisted of shorter sessions than was envisioned in the Planning Framework. The Edisto RBC noted that some meetings could likely be combined or reduced for future RBCs.

Members of the Edisto RBC proposed the following recommendations to improve communication among RBCs and other groups:

- **The Edisto and Santee RBCs should coordinate and participate in future monitoring, planning, modeling, and other activities focused on the Calhoun County Groundwater Area of Concern, which extends into both basins.**

- **RBC members should communicate with legislative delegations throughout the river basin planning process to promote their familiarity with the process and its goals and to generate buy-in on its recommendations.** To facilitate this consistent communication, the RBC may develop talking points that members may use when meeting with legislative representatives. RBC members should seek to meet with representatives at various levels of government, including the county level and the legislature.

- **The RBC should communicate through SCDHEC to the stakeholders that participated in the development of Groundwater Management Plans and the establishment of Capacity Use Areas.**

- **The RBC should communicate with the Drought Response Committee as described in Chapter 8.2.2.**

Members of the Edisto RBC proposed the following recommendations for funding needs and sources of funding:

- **Most members of the Edisto RBC recommend that the river basin planning process remain fully funded so that regular updates to the plans can be made.** Currently, nearly all the funding for the river basin planning process has come from the legislature. The USACE, through their Planning Assistance to States program, provided a relatively small amount of funding that was used for developing methodology for water demand projections prior to formation of the Edisto RBC.

Potential outside funding sources for implementation of the River Basin Plan's objectives are described in Chapter 10.

Members of the Edisto RBC proposed the following recommendations to improve the public outreach process:

- **During the implementation phase, the RBC should consider establishing a social media presence to engage with the public and share RBC activities.** RBC members, SCDHEC, and SCDNR may have existing social media accounts that could be leveraged to share RBC activities and include links for additional information. The Edisto RBC should identify potential resources (e.g. SCDNR and SCDHEC) and member-volunteers to develop its own social media account.

- **RBC members representing municipalities should consider including inserts in mailings to inform their customers of RBC activities.**

- **RBC members should describe the river basin planning process to customers and/or the public during ongoing outreach, education, or training programs.** For example, Charleston Water System has a Citizens Academy and has discussed the river basin planning process with members of the program.

- **RBC members should be encouraged to present observations and outcomes of the river basin planning process at conferences that focus on water resources, sustainability, environmental stewardship, smart growth, and other related topics.**

Members of the Edisto RBC proposed the following recommendations to improve the River Basin Plan implementation process:

- **The RBC should conduct quarterly meetings immediately following the release of the River Basin Plan to facilitate implementation and seek funding sources.** Meetings may be conducted less frequently once funding for recommended activities is secured and programs are functioning. Per the bylaws, meetings must occur a minimum of once per year.

- **SCDNR and/or RBC facilitators should offer new RBC member orientation to introduce basin concerns, strategies, and implementation plans.** SCDNR is responsible for maintaining continuity of the RBC between updates and throughout member turnover.

9.2 Technical and Program Recommendations

The following technical and program recommendations were identified and discussed by the RBC. For most of these, there was no official vote taken to determine the level of support for each recommendation, however, discussion during the RBC meetings suggested that there was generally broad consensus from the RBC in support of these recommendations. For a proposed recommendation that water quality be addressed in future RBC planning efforts, a survey was taken to identify the level of consensus among the RBC. The results of that survey, and the reasons for and against this recommendation are presented below.

The following recommendations should be taken as considerations for future river basin planning.

Members of the Edisto RBC noted the following needs for more data:

- **The Edisto RBC recommends that SCDNR work with SCDHEC, USGS, and other partners (e.g., property owners, well owners, and stakeholders representing Capacity Use Areas) to enhance monitoring capabilities in areas where model simulations indicate potential for water levels to drop below the top of the aquifer.** These entities may first identify, seek access to, and monitor water levels in existing production wells in Groundwater Areas of Concern. If additional groundwater monitoring locations are deemed necessary, these entities may seek funding and drill new monitoring wells in Groundwater Areas of Concern.

The possibility of installing a streamflow gage at Four Hole Swamp was discussed, but no formal recommendation was made by the RBC. SCDNR has investigated the possibility of monitoring this location, but determined that it is likely not feasible because of various site constraints. Streamflow monitoring at Four Hole Swamp could be reconsidered in the future as technology advances.

Members of the Edisto RBC proposed the following recommendations related to models:

- During groundwater modeling, a potential groundwater area of concern was noted in Calhoun County where, under certain scenarios, simulations indicate water levels may drop below the top of aquifer. **To better understand the conditions in this area, the Edisto RBC recommends that SCDNR work with SCDHEC and USGS to carve out a regional groundwater model covering the potential Groundwater Areas of Concern and (1) further calibrate the model to local land conditions, including seasonal drawdowns, and (2) evaluate seasonal drawdowns through the planning horizon under each planning scenario.**

Members of the Edisto RBC proposed the following recommendations related to data and projections:

- **Incorporate lessons learned from other basins in future Edisto River Basin Plan updates.** This includes promoting consistency in methodology from basin to basin.

- **Incorporate future climate projections into modeling analyses (e.g., projected temperature, evapotranspiration, and precipitation trends).**

Members of the Edisto RBC proposed the following recommendations related to technical studies to improve knowledge of specific issues:

- **Study the impacts of land use changes on recharge and where feasibile, incorporate changes in recharge from changing land use into future modeling scenarios.**

- **Study the relationship between the duration of drawdown below the top of aquifer and negative impacts such as compaction and reduced aquifer yield.** The Edisto RBC seeks to understand whether short-term, seasonal drawdowns below the top of aquifer are likely to cause harm.

Members of the Edisto RBC proposed the following recommendations related to the need for technical training of RBC members:

- **Develop and provide a handout of groundwater and surface water concepts to establish a common knowledge base among RBC members.** The Edisto RBC discussed having more meeting time spent on groundwater and surface water basics; however, because members have various levels of technical understanding, the provision of handouts was selected as a better use of members' time.

- **The USGS and/or SCDNR should offer additional demonstration and discussion of the groundwater model focusing on input parameters and sensitivity of results to various parameters.**

- **Offer and organize additional field trips to better understand various water users' withdrawal needs and water management strategies.** The RBC indicated that the two field trips helped members better understand the perspectives of the various water interest groups. It was noted that additional field trips might be useful to further educate the members and broaden their perspectives.

Members of the Edisto RBC considered and voted (via a Google Survey) on the following proposed recommendation related to water quality being addressed in future RBC planning efforts:

Proposed Recommendation: Future Edisto RBC planning efforts should address water quality.

Discussion: RBC members in support of this recommendation noted that the Planning Framework acknowledges and allows consideration of water quality as/when appropriate and suggests that water quality issues can be considered in future phases of river basin planning. The Planning Framework states that "*The River Basin Plans described in this document are intended to focus on water quantity issues; water quality concerns, however, may be highlighted when appropriate in a River Basin Plan. Water quality considerations will be more fully developed in later iterations of the River Basin Plans*". Several members emphasized that water quantity and quality are inherently linked, especially during drought when water quality issues may be exacerbated by low flows. The proponents of this recommendation acknowledged that while water quality is not the RBC's primary consideration, it should be recognized that "good" water quality is important for every user that relies on the river for water, recreation, fishing, and other uses. One member noted that urbanization of the basin's headwaters in Aiken, Edgefield, and Lexington Counties is projected to increase over the next two decades. The increased withdrawals from this growth will reduce flows in the Edisto River, impacting the river's ability to absorb and dilute the increasing volume of non-point source pollution. The proposed recommendation provides some guidance to future Edisto RBC members.

RBC members opposed to this recommendation noted that although the Planning Framework leaves the door open for water quality considerations in the future, the primary focus of the river basin plans should remain on water quantity issues. One member noted that water quality regulations such as those contained in the Clean Water Act already far exceed the regulations around quantity. The Clean Water Act addresses both point and nonpoint pollution through National Pollutant Discharge Elimination System (NPDES) regulation, the 319 program, and even emerging contaminants. These existing regulations already address (or will eventually address) many of the issues likely to be raised within the RBC if the focus was shifted from water quantity to water quality. Several members noted that a shift to focusing the RBC process on water quality is likely to impede consensus building around the primary objective of addressing water quantity challenges.

Survey Results: Seventeen of the 21 RBC members responded to the survey seeking feedback on this proposed recommendation. Eleven voted in favor of the recommendation, five voted against, and one abstained (Figure 9-1). Three of the four representatives of the agricultural, forestry, and irrigation interest category and two of the three representatives of the water and wastewater utilities interest category were not in favor of this recommendation. Not including the members who did not vote or abstained, 69 percent of the voting RBC members were in support of this recommendation, indicating it has strong, but not unanimous support.

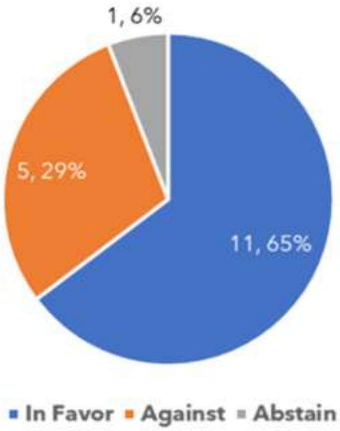


Figure 9-1. RBC voting results for proposed recommendation on addressing water quality in future RBC planning efforts.

9.3 Policy, Legislative, or Regulatory Recommendations

The Edisto RBC engaged in discussion about issues and concerns with the existing policies, laws, and regulations governing water withdrawals and water use. For each issue, a proposed recommendation was developed by one or more RBC members and the members were asked to indicate (via a written survey) whether they supported or did not support the proposed recommendation. The issues, concerns, proposed recommendations, and survey results are summarized below. The regulations regarding surface water and groundwater withdrawals are summarized in Table 9-1 for reference.

Issue No. 1: **Using mean flow rather than median flow may result in overallocation of surface water.**

In the Surface Water Withdrawal, Permitting, Use and Reporting regulations, safe yield at the point of withdrawal is evaluated and calculated as "…the difference between the mean annual daily flow and twenty (20) percent of mean annual daily flow at the withdrawal point…" for withdrawals in a stream segment not influenced by a licensed or otherwise flow-controlled impoundment (SCDHEC 2012, p. 14). In part due to infrequent high flows during severe flood events, flows in a river or stream are statistically non-normally distributed. This distribution yields a different value for mean versus median, as shown in Figure 9-2. The median of a non-normally distributed flow series is more reflective of both typical conditions in a stream and typical availability. The use of the mean to describe available water may result in an overallocation of water under normal conditions, which may lead both to future shortages and

Table 9-1. Summary of regulations related to surface water and groundwater withdrawal.

Water Source	Use Type	User Type	Process	Applicability	Withdrawal Volume	Use Criteria	Low Flow Period Requirements	Review Period	Reporting
Surface Water	Agricultural	Existing (pre Jan 1, 2011)	Registration	Users withdrawing more than 3 MG in a month	Highest previous water usage	No criteria	No MIF obligations	No review, in perpetuity	Annual
		New (post Jan 1, 2011) or Expanding	Registration	Users withdrawing more than 3 MG in a month	Amount of water requested by the proposed withdrawer and availability of water at the point of withdrawal based on Safe Yield calculations.	Subject to safe yield assessment	No MIF obligations	No review, in perpetuity	Annual
	Hydropower	All	Exempt (non-consumptive use)					30-40 years for existing users, 20-40 years for new users	Annual
	All Other Use Types	Existing (pre Jan 1, 2011)	Permit	Users withdrawing more than 3 MG in a month	Largest volume as determined by previously documented use, current treatment capacity, or designed capacity of the intake structure	No criteria	Must address "appropriate industry standards for water conservation." No required Contingency Plan development.	30 to 50 years[1]	Annual
		New (post Jan 1, 2011) or Expanding	Permit	Users withdrawing more than 3 MG in a month	Based on reasonableness, availability of water at point of withdrawal based on Safe Yield calculations.	Reasonable use criteria	Development of Contingency Plan for low flow periods, enforceable. Public water suppliers not subject to MIF[2]	20 to 50 years[1]	Annual

Table 9-1. Summary of regulations related to surface water and groundwater withdrawal. (Continued)

Water Source	Use Type	User Type	Process	Applicability	Withdrawal Volume	Use Criteria	Low Flow Period Requirements	Review Period	Reporting
Ground water	All Use Types	Withdrawals in Capacity Use Areas	Permit	Users withdrawing more than 3 MG in a month	Permit withdrawals based on reasonable use guidelines, which vary by water use sector.	Reasonable use criteria	Requires development of Best Management Plan that identifies water conservation measures, alternate sources of water, justification of water use, and description of beneficial use	Every 5 years	Annual
	Non-Agricultural	Withdrawals Outside of Capacity Use Areas	Registration	Users withdrawing more than 3 MG in a month	Registrations do not have limits but require reporting.	No criteria	No MIF obligations	No review, in perpetuity	Annual

[1] New surface water permitees may receive permits of 20 years or up to 40 as determined by department review
Existing surface water permittees may receive permits of 30 years or up to 40 years as determined by department review
Municipal or governmental bodies may receive permits of up to 50 years to retire a bond it issues to finance the construction of waterworks (SECTION 49-4-100)

[2] Public water suppliers not subject to MIF but are required to implement their contingency plan in accordance with drought declarations 49-4-150 6

increased frequency of flows below MIF. Because the median is lower than the mean, a change of safe yield from 80 percent mean to 80 percent median will result in a lower safe yield and higher flow to be maintained in the river. This change would similarly lead to greater availability of the allocation (safe yield) to withdrawers.

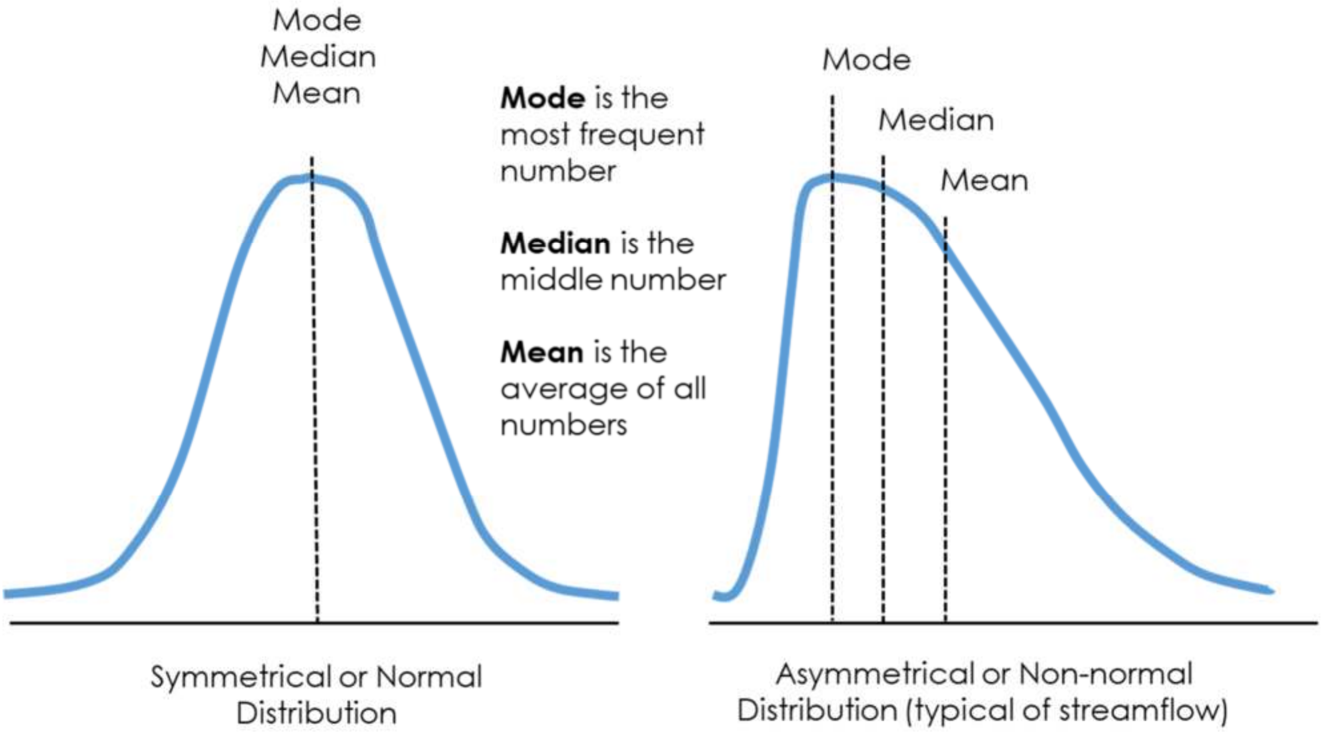


Figure 9-2. Normal and non-normal distributions.

Proposed Recommendation No. 1: Based on this discussion point, the following recommendation was proposed: ***The Surface Water Withdrawal, Permitting, Use, and Reporting Regulations should use 80 percent of median annual daily flows instead of 80 percent of mean annual daily flows to determine safe yield at a withdrawal point.***

Discussion: RBC members in support of this recommendation agreed that median is a better statistical representation of flow on the river and may reduce overallocation. Concerns with this proposed recommendation were also expressed. One RBC member was concerned whether the benefit from switching from mean to median would be worth the confusion created because the mean is currently used in regulations related to safe yield and minimum flow. Another member expressed the desire to better understand how the 80 percent benchmark was chosen and whether there should be different thresholds at various points in the river based on scientific study. Another RBC member indicated that although the regulations are flawed, they are effectively protecting the resource as written, and no change is warranted.

Survey Results: Twenty of the 21 RBC members responded to this survey question. Fifteen voted in favor of this proposed recommendation, four voted against, and one abstained (Figure 9-3). The sole member representing the electric-power category; two of the four representatives of the agricultural, forestry, and irrigation interest category; and one of the four representatives of the at-large interest category were not in favor of this proposed recommendation. Not including the members who abstained, 79 percent of the RBC were in support of this proposed recommendation, indicating the recommendation has strong, but not unanimous support.

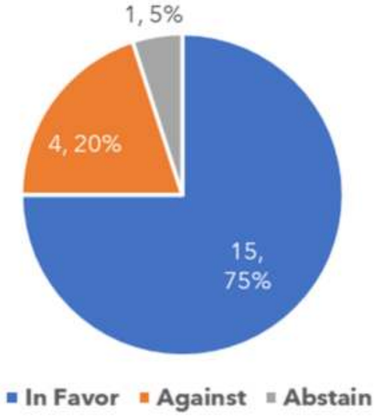


Figure 9-3. RBC voting results for proposed recommendation no. 1.

Issue No. 2: Minimum instream flow is based on mean flow rather than median.

Minimum instream flow is defined in Section 49-4-20.14 of the South Carolina Surface Water Withdrawal, Permitting, Use, and Reporting Act and in the regulations as the "…flow that provides an adequate supply of water at the surface water withdrawal point to maintain the biological, chemical, and physical integrity of the stream taking into account the needs of downstream users, recreation, and navigation…" Specifically, it is defined as a percentage of mean annual daily flow that varies by month (i.e., 40 percent mean in January through April; 30 percent mean in May, June, and December; and 20 percent mean in July through November). The concern with the definition of minimum instream flow is the same as the concern expressed for the definition of safe yield. That is, the use of mean in a non-normally distributed flow dataset will result in an overestimate of typical river flows. The use of median would be more representative of typical flow conditions.

Proposed Recommendation: Based on this discussion point, the following recommendation was proposed: ***The Surface Water Withdrawal, Permitting, Use, and Reporting regulations should use median annual daily flows instead of mean annual daily flows to determine seasonal minimum instream flows at a withdrawal point.***

Discussion: Feedback from RBC members in support of the proposed recommendation were similar to those expressed for the proposed safe yield recommendation above. Members indicated the median is a better statistical descriptor of typical river flows. As applied to minimum instream flows, the change from a percentage of mean flow to a percentage of median flow will result in a lower minimum instream flow threshold, i.e., a lower flow to be maintained in the river. Proponents of the change suggested that the minimum instream flow based on a mean has led to a biased high minimum instream flow. Opponents of the change argue that the change will reduce conservation of the Edisto River (i.e. lower the instream flow threshold and thereby offer less protection to ecological needs). One member expressed concern that such a change wouldn't go far enough to protect flows because the existing regulation does not guarantee that 20 percent of mean (or if changed, 20 percent of median) flow is left in the river due to natural variations in streamflow. An additional concern is that South Carolina's minimum instream flow regulation was based on site-specific assessments of instream use at varying flow rates at nine critical stream reaches in South Carolina (South Carolina Water Resources Commission 1988, SCDNR 2009). At each site, flow rates necessary to achieve various instream flow benefits were determined and related back to a percentage of mean annual flow. Changing the regulation from percentages of mean flow to the same percentages of median flow may negate the relationship of actual flow rates to the benefits achieved. Additional analysis may be necessary to define alternative percentages of median annual flow that correlate to the same instream use characteristics.

Survey Results: Twenty of the 21 RBC members responded to this survey question. Thirteen voted in favor of this proposed recommendation, four voted against, and three abstained (Figure 9-4). The sole member representing the electric-power interest category; two of the four representatives of the agricultural, forestry, and irrigation interest category; and one of the three representatives of the local governments interest category were not in favor of this proposed recommendation. Not including the members who abstained, 76 percent of the RBC were in support of this proposed recommendation, indicating the recommendation has strong, but not unanimous support.

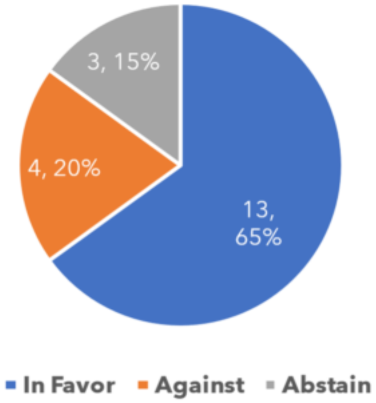


Figure 9-4. RBC voting results for proposed recommendation no. 2.

Issue No. 3: The law and regulations do not allow SCDHEC to apply reasonable use criteria to agricultural surface water withdrawals or existing (pre-2011), non-agricultural surface water withdrawals.

Edisto RBC members noted that different types of water withdrawers are not regulated by the same criteria. Specifically, as noted in Table 9-1, groundwater withdrawers and new, non-agricultural surface water users are subject to reasonable use criteria while agricultural surface water and existing, non-agricultural surface water users are not.

Under SCDHEC's regulation 61-113 Groundwater Use and Reporting, permittees of any use category seeking to withdraw greater than 3 million gallons in any month from groundwater must demonstrate to SCDHEC's satisfaction that groundwater withdrawal is reasonable and necessary and there are no unreasonable adverse effects on other water users.

For surface water withdrawals, reasonable use criteria varies depending on the water use category and the time of permit application (pre- or post-2011, when SCDHEC's regulation, 61-119 Surface Water Withdrawal, Permitting, Use, and Reporting, came into effect).

- Existing (pre-2011) non-agricultural surface water withdrawers do not need to meet reasonable use criteria. The permitted withdrawal is based on the largest volume as determined by previously documented use, current treatment capacity, or designed capacity of the intake structure
- New (post-2011) or expanding non-agricultural surface water withdrawers must demonstrate that the requested water withdrawal amount meets the criteria for reasonable use.
- Agricultural surface water withdrawals, all of which do not require a permit where there is remaining safe yield in a basin, do not need to satisfy reasonableness criteria for the requested withdrawal amount.

In the Edisto River basin, the lack of reasonable use criteria for agricultural surface water withdrawers has had the unintended consequence of several registrations being granted for very large quantities of surface water. These new registrations have effectively used up the remaining safe yield in the basin and SCDHEC cannot grant any new surface water registrations. Future surface water withdrawers seeking new registrations in the basin will need to apply for a permit instead, and be subject to permit fees and all conditions associated with the permit.

Proposed Recommendation: Based on this discussion, the following recommendation was proposed: ***Reasonable use criteria should be applied to all water use requests.***

Discussion: RBC members in support of this recommendation noted that this change would allow for fairness for water use among all stakeholders. Another member in support of the recommendation noted that the change would allow for additional permits in the basin. On the contrary, it was noted during the discussions that a side effect of water being tied up in permits or registrations that will never use it, is that the water is protected from future use. In effect, tying water up in registrations with unreasonably high limits acts as an unintended conservation measure. One member stated they were in support of this measure if it was combined with an effort to address overallocations by not simply replacing existing permitted/registered allocations with new allocations. Other members that voted in favor of the measure also noted concerns such as what/who determines reasonable use criteria and suggests that there should be guidelines to clearly indicate what is reasonable. Another member noted that reasonable use criteria must allow for future growth. Some RBC members noted that the permitted or registered use should be reviewed after permits are granted to consider historical and future use along with any capital investments that have been undertaken.

A member that voted against the recommendation noted that the law as written protects the resource. The member that abstained noted that this recommendation should only apply to new and expanding users.

Survey Results: Twenty of the 21 RBC members responded to this survey question. Eighteen voted in favor of this proposed recommendation, one voted against, and one abstained (Figure 9-5). One of the four representatives of the agricultural, forestry, and irrigation interest category was not in favor of this proposed recommendation. Not including the members who abstained, 95 percent of the RBC were in support of this proposed recommendation, indicating the recommendation has strong, but not unanimous support.

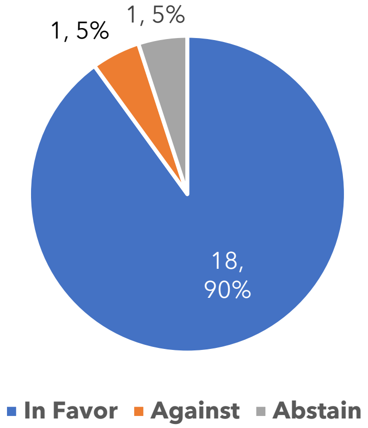


Figure 9-5. RBC voting results for proposed recommendation no. 3.

Issue No. 4: **Some existing surface water permits and agricultural registrations are for a quantity of water that withdrawers have no intention of ever using or needing. Existing regulations have varying or no authority to review and revise withdrawal quantities.**

Existing regulations that only allow for application of reasonable use criteria for groundwater withdrawals and new, non-agricultural surface water withdrawals have resulted in an overallocation of water on paper to permittees or registrants that will never use the quantity of water allocated to them. This may prevent new growth in the basin. At the same time, permits and registration limits should allow for growth and accommodate new planned infrastructure. In addition to the current regulations allowing for unrealistically large withdrawals, the current regulations also do not have consistent methodology for periodically reviewing the permitted or registered withdrawals. Depending on the water use category and age of the permit or registration, the review and renewal period for permits or registrations varies from every 5 years to never (granted in perpetuity). Renewal periods are summarized in Table 9-1.

Groundwater permits, which are required for all water use categories, may be renewed and must be shown to be in compliance with Part E every 5 years (Regulation 61-113, Part H). Part E of the regulations require documentation that the permitted withdrawal rates are reasonable for the intended use. Groundwater registrations for withdrawals outside of CUAs are not periodically reviewed.

Surface water permits issued after January 1, 2011, are issued for 20 to 50 years, depending on individual circumstances (Regulation 61-119, Part H). During renewal, permittees are reviewed to ensure they meet the reasonable use and safe yield requirements of Part E. Surface water permits issued before January 1, 2011, may be issued for between 30 and 50 years, depending on individual circumstances (Regulation 61-119, Part H). When permits are renewed, they are not subject to the same reasonableness criteria under Part E as new permits are, unless the permittee seeks to increase withdrawal. Surface water registrations for agricultural use are not subject to reasonable use criteria and are granted in perpetuity i.e., are never reviewed.

Proposed Recommendation: Based on this discussion point, the following recommendation was proposed: ***A user's actual water use and water needs, accounting for growth, should be periodically reviewed to prevent locking up water that is not needed.***

Discussion: Members voting in support of this recommendation noted that the recommendation would be more reflective of actual water use in the basin and would support future growth. Another member noted that this policy reflects the fact that water use patterns by stakeholders will constantly change. Some members voted in support of the recommendation but had several concerns. First, determining growth can be subjective and the same standards may not apply to all water user types. Second, members noted that the definition of "periodically reviewed" is not clear. One member noted that water utilities are financed through 30-year bond cycles, and consequently would not support permit reviews more frequently than that interval. Registrants that use less than 10 percent of their allocation could have earlier reviews. Third, one member suggested that both permits and registrations should have the same review period. Although this perspective was expressed by one member, it does not represent the measure that was voted upon. That is, the RBC was not recommending that the groundwater permit review period be applied to surface water permits. Fourth, a member stated that the review must consider any capital spent on investment in withdrawal capabilities as part of the review. Finally, a member noted that SCDHEC should revise the application process to ensure applicants are using realistic projections.

Members voting against the recommendation noted that the law as written protects the resource as water is tied up in existing permits and registration and not available for allocation. Another member noted that existing permitted capacity should not be relinquished as many have invested in infrastructure to support those withdrawals for current and future use. One member expressed concern about a lack of clarity on how often and by whom the use and needs will be reviewed. Finally, one member noted that although it may be advantageous to reduce the effects of unrealistic agricultural registrations that have negative impacts on future river users, there may be too much opposition from existing users to move forward with the recommendation.

Survey Results: Twenty of the 21 RBC members responded to this survey question. Thirteen voted in favor of this proposed recommendation, five voted against, and two abstained (Figure 9-6).

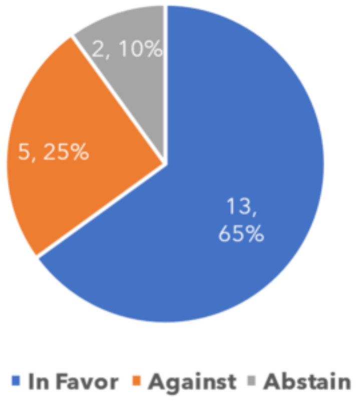


Figure 9-6. RBC voting results for proposed recommendation no. 4.

Two of the four representatives of the agricultural, forestry, and irrigation interest category and one member from each of the environmental interests, industry and economic development, and water and sewer utilities interest categories were not in favor of this proposed recommendation. Not including the members who abstained, 72 percent of the RBC were in support of this proposed recommendation, indicating the recommendation has moderate to strong support.

Issue No. 5: Water withdrawers are not subject to the same rules.

Examples of water withdrawers not being subject to the same rules include: (1) nonagricultural withdrawers must apply for permits whereas agricultural water withdrawers register their use, and (2) reasonable use criteria only applies to new or expanding surface water withdrawals. Surface water and groundwater withdrawal regulations for various water user categories are summarized in Table 9-1.

Proposed Recommendation: Based on this discussion point, the following recommendation was proposed: ***All water withdrawers should be subject to the same rules.***

Discussion: Members voting in support of this recommendation suggested that allowing one class of withdrawals to be exempt from enhanced protection measures that new permits provide is problematic. Minimum Instream Flow (MIF) regulations for water conversation during periods of low flow do not apply to agricultural surface water users, surface water users with permits issued prior to the enactment of Surface Water Regulation 61-119 in 2011, or public water suppliers seeking new surface water permits. Because of these exceptions, currently no users in the Edisto River basin are subject to MIF requirements. Also noted was the fact that existing registrations are "eternal." Another member noted that registrations should be periodically reviewed as well as permits. Multiple members who voted in favor of subjecting all water users to the same rules also noted the importance of prioritizing critical services for health and safety such as potable water supply for drinking and cooking, food production, and healthcare facilities. One member additionally noted that there still may need to be different rules for conjunctive use for major users that would not be required for smaller farmers. Members voting against this measure noted there is not a "one size fits all" for different users' water needs and that stakeholders do not have the same consumptive use. Another member noted that farmers cannot afford some of the regulations that utilities and power providers are able to afford. One member expressed concern that should the resource be overallocated, prioritization should be given to existing users (permitted or registered). Also, a member noted that streamflow at existing permit and registration withdrawal points should be protected from future upstream withdrawals.

Survey Results: Nineteen of the 21 RBC members responded to this survey question. Nine voted in favor of this proposed recommendation, eight voted against, and two abstained (Figure 9-7). The members that generally voted in support for the proposed recommendation included those in the at-large, environmental, local governments, and water-based recreation interest categories; however, the voting was not necessarily unanimous within each category. Members that generally did not support the proposed recommendation were from the agricultural, forestry, and irrigation; industry and economic development; and water and sewer utilities interest categories.

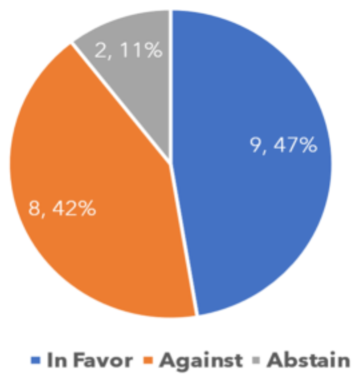


Figure 9-7. RBC voting results for proposed recommendation no. 5.

Not including the members who abstained, 53 percent of the RBC were in support of this proposed recommendation and 47 were not in support. Even the several members supporting the recommendation noted instances where different rules may be necessary. As such, the RBC does not place any level of emphasis on promoting this as a recommendation to SCDHEC and the legislature.

Chapter 10

River Basin Plan Implementation

10.1 Recommended Five-Year Implementation Plan

10.1.1 Implementation Objectives

The Edisto RBC identified six implementation objectives for the Edisto River Basin Plan. The objectives are listed in Table 10-1. These six objectives were developed based on themes that emerged from the specific water management strategies presented in Chapter 7; the drought response strategies discussed in Chapter 8; and certain planning process, programmatic, and technical recommendations identified in Chapter 9. The Planning Framework states that the RBC should prioritize the objectives. The Edisto RBC determined that all identified objectives are important and, as such, developed an implementation schedule that includes activities in year one for all objectives. However, recognizing that multiple objectives may be dependent on the same, limited funding sources, the RBC prioritized actions to help guide where available funding should be allocated first. To do this, objectives were grouped by those with funding needed for water management strategy implementation (Group 1) and those with funding for programmatic recommendations likely to come from the SCDNR budget (Group 2). Table 10-1 includes the RBC's justification for prioritizing each objective.

The first three objectives under Group 1 were developed based on themes that emerged from the water management strategies presented in Chapter 7 and the low-flow management strategy presented in Chapter 8. Objective 1, **reduce demand to conserve water resources**, corresponds to the demand side management strategies discussed in Chapters 6.1.1, 6.1.2, and 6.2.1. Objective 2, **conserve surface water during low-flow conditions**, refers to the implementation of the low-flow management strategy discussed in Chapter 8.2.3. Although the focus of both objectives is water conservation, the objectives were listed separately because Objective 1 aims to reduce demand during all conditions whereas Objective 2 focuses on low-flow conditions. Objective 3, **augment sources of supply**, corresponds to the strategies discussed in Chapters 6.1.3 and 6.2.2. The Edisto RBC chose to prioritize these objectives equally. Each water withdrawer will ultimately determine which strategies to prioritize based on their individual circumstances.

Objectives 4 through 6 under Group 2 are programmatic recommendations dependent on SCDNR for implementation and most likely, funding. Objective 4, **effectively communicate RBC findings and recommendations**, was given the highest priority as communication is essential to ensuring all objectives are pursued. Objective 5, **improve technical understanding of water resource management issues**, was ranked second. Objective 6, **protect groundwater supplies and existing users**, was ranked third.

Table 10-1. Implementation objectives and prioritization.

Objective	Prioritization	Prioritization Justification
Group 1 – Objectives related to water withdrawers		
Objective 1. Reduce demand to conserve water resources	1	The Edisto RBC did not find the strategies associated with one of these objectives to be of higher priority than another. Each water withdrawer will ultimately determine which strategies to prioritize based on their individual circumstances.
Objective 2. Conserve surface water during low-flow conditions	1	
Objective 3. Augment sources of supply	1	
Group 2 – Objectives related to SCDNR activities		
Objective 4. Effectively communicate RBC findings and recommendations	1	Communication is essential to ensuring all objectives are pursued by stakeholders.
Objective 5. Improve technical understanding of water resource management issues	2	Necessary to inform and continually update the RBC's understanding of basin issues and best practices to manage concerns.
Objective 6. Protect groundwater supplies and existing users	3	Necessary to monitor conditions and track potential concerns.

The strategies and corresponding actions to achieve each objective are presented in Table 10-2. Where applicable, each strategy under an objective was listed by its priority for implementation. Table 10-2 also includes an outline of 5-year actions, responsible parties, budget, and potential funding sources to achieve each objective. The funding sources are further described in Chapter 10.1.2.

Table 10-2. Implementation plan.

Strategy		Strategy Priority	5-Year Actions	Responsible Parties	Budget	Funding Sources[1]
Objective 1. Reduce demand to conserve water resources						
A. Agricultural Conservation	Water Audits and Nozzle Retrofits	1	1. Identify funding opportunities (years 1–5) 2. Implement outreach and education program about water management practices and funding opportunities (years 1–5) 3. Water withdrawers to implement conservation practices (years 3–5) 4. Develop survey of practices implemented, funding issues, and funding sources used (beginning in year 5 as part of 5-year plan update) 5. Review and analyze water usage to improve understanding of water savings of strategies (beginning in year 5 as part of 5-year plan update)	RBC with support of SCDHEC, SCDNR, and contractors - Identify funding opportunities and develop and implement outreach program. Conduct surveys and analyze results. Agricultural and Municipal Water Withdrawers - Implement appropriate strategies and seek funding from recommended sources as necessary.	Implementation costs will vary by operation according to size of operation, crops grown, current irrigation practices, and financial means. See Chapter 6.1.1 for discussion of cost-benefit of individual strategies. Cost of RBC activities are included in ongoing RBC meeting budgets.	Possible funding sources include USDA-7
	Irrigation Equipment Changes	2				
	Soil Management and Cover Crops	3				
	Irrigation Scheduling	4				
	Crop Variety, Crop Type, and Crop Conversion	5				
	Future Technologies	-				
B. Municipal Conservation	Conservation Pricing Structures	Toolbox of strategies. Priority varies by utility.			Implementation costs will vary by municipality according to current program capabilities and financial means. See Chapter 6.1.2 for discussion of cost-benefit of individual strategies. Cost of RBC support activities are included in ongoing RBC meeting budgets.	Individual strategies to be funded using outside funding opportunities or by evaluating existing rate structure. Possible outside funding sources include Fed-1, 2, 5, 6, 7, and 8 and USDA-8 and 9
	Toilet Rebate Program					
	Landscape Irrigation Program and Codes					
	Leak Detection and Water Loss Control Program					
	Car Wash Recycling Ordinances					
	Water Waste Ordinance					
	Public Education of Water Conservation					
	Residential Water Audits					
	Water Efficiency Standards for New Construction					
	Reclaimed Water Programs					
	Time-of-Day Watering Limit					

[1] See Tables 10-3 and 10-4 for funding source references.

Table 10-2. Implementation plan. (Continued)

Strategy	Strategy Priority	5-Year Actions	Responsible Parties	Budget	Funding Sources[1]
Objective 2. Conserve surface water during low-flow conditions					
A. Implement low-flow management strategy	1	1. Identify funding opportunities (years 1–5) 2. Develop and implement communication strategy for low-flow declarations (years 1–2) 3. Perform outreach and education to affected users (surface water withdrawers with peak monthly usage exceeding 60 MGM) to communicate goals of low-flow strategy and approaches to meet voluntary reductions (years 1–5) 4. Each affected user to develop a curtailment schedule and implement as necessary (years 1–5) 5. Evaluate effectiveness of low-flow management strategy (year 5)	RBC with support of SCDHEC, SCDNR, and contractors - Identify funding opportunities and develop information to distribute. Users with peak monthly usage exceeding 60 MGM - develop and implement approaches to comply with low-flow strategy.	Implementation costs will vary by entity according to existing system redundancies and financial means. Reduction in surface water withdrawals to be accomplished by alternative supply (See Objective 3) or by demand reduction (see Objective 1). Cost of RBC support activities are included in ongoing RBC meeting budgets.	Possible outside funding sources for municipal water withdrawers include Fed-1, 2, 3, 5, and 9. Possible outside funding sources for agricultural water withdrawers include USDA-7.
Objective 3. Augment sources of supply					
A. Conjunctive Use (use of groundwater to supplement surface water supplies)	Priority varies by entity.	1. Identify funding opportunities (years 1–5) 2. Implement education and outreach program about conjunctive use and funding opportunities (years 1–5) 3. Individual withdrawers to explore and implement alternative water supply strategy (years 1-5) 4. Develop survey of implementation, funding issues, and funding sources used (beginning in year 5 as part of 5-year plan update)	RBC with support of SCDHEC, SCDNR, and contractors - Identify funding opportunities and develop information to distribute. Conduct surveys and analyze results. Surface Water Withdrawers - Implement strategies as appropriate and seek funding from recommended sources as necessary.	Implementation costs vary based on location, size (diameter) and depth of well and can range from $50,000 to $250,000. See Chapter 6.1.3 for discussion of cost-benefit. Cost of RBC support activities are included in ongoing RBC meeting budgets.	Possible outside funding sources for agricultural water withdrawers include USDA-7
B. Small Impoundments (on 2nd order or lower tributaries)				Implementation costs vary based on size of impoundment and site-specific conditions. See Chapter 6.1.3 for discussion of cost-benefit. Cost of RBC support activities are included in ongoing RBC meeting budgets.	Possible outside funding sources for agricultural water withdrawers include USDA-7

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[1] See Tables 10-3 and 10-4 for funding source references.

Table 10-2. Implementation plan. (Continued)

Strategy	Strategy Priority	5-Year Actions	Responsible Parties	Budget	Funding Sources[1]
Objective 4. Effectively communicate RBC findings and recommendations					
A. Conduct Edisto RBC meetings to review, initiate, and support implementation actions	1	1. Edisto RBC to meet quarterly as needed following publishing of Edisto River Basin Plan. Meetings will focus on implementation plan actions and identifying funding (year 1) 2. Future RBC meetings on less frequent basis, as deemed necessary (minimum of one per year) (years 2–5) 3. SCDNR and/or contractors to provide new member orientation (years 1–5, ongoing) 4. Convene existing or form new ad hoc subcommittees to address time-sensitive matters (years 1–5 as needed)	Edisto RBC members to attend. SCDNR, DHEC, and contractors to organize.	If contractor led, RBC meetings may range between $5,000 and $15,000 per meeting, depending on effort needed to prepare for, conduct, and document each meeting.	Funded by SC Legislature and Fed-8
B. Encourage use of social media through professional accounts of Edisto RBC, SCDNR, SCDHEC, and/or RBC members	2	1. Develop a social media policy (year 1) 2. Develop social media accounts for the Edisto RBC (year 1) 3. Develop key messages from Edisto RBC to highlight using professional accounts of RBC, SCDNR, SCDHEC, and/or RBC members (years 1–5)	RBC to discuss key messages to highlight via social media. Individual RBC members to develop content for their individual professional accounts as able. RBC member(s) to manage RBC account and can share postings by individual member accounts as related to RBC business.	No direct cost. Cost of RBC activities are included in ongoing RBC meeting budgets.	No direct cost

[1] See Tables 10-3 and 10-4 for funding source references.

Table 10-2. Implementation plan. (Continued)

Strategy	Strategy Priority	5-Year Actions	Responsible Parties	Budget	Funding Sources[1]
C. Communicate with legislative delegation throughout planning process to promote their familiarity with RBC activities and goals in advance of funding requests	3	1. Develop talking points/script to provide consistent message from RBC (years 1–5) 2. Track which representatives have been spoken to and by whom from the RBC. Note any outcomes of conversation (years 1–5)	RBC with the support of contractors to develop talking points and track interactions.	No direct cost, other than ongoing contractor support, if needed. Cost of RBC activities are included in ongoing RBC meeting budgets.	No direct cost
D. Coordinate with the Santee RBC on future monitoring, planning, modeling, and other activities focused on Calhoun County Groundwater Area of Concern	4	1. Communicate the modeling results and decision process to establish a Calhoun County Groundwater Area of Concern to the Santee RBC (timing dependent on other RBC meeting schedules) 2. Consider forming an Interbasin River Council to collaboratively address the issue	SCDNR and SCDHEC to advise other RBCs on Edisto RBC findings and notify Edisto RBC when other RBCs enter groundwater assessment stage of planning. RBC to organize representative or ad hoc subcommittee to meet with other RBC representatives/attend other RBC meeting.	No direct cost. Cost of RBC activities are included in ongoing RBC meeting budgets.	No direct cost

[1] See Tables 10-3 and 10-4 for funding source references.

Table 10-2. Implementation plan. (Continued)

Strategy	Strategy Priority	5-Year Actions	Responsible Parties	Budget	Funding Sources[1]
Objective 5. Improve technical understanding of water resource management issues					
A. Research how changes in land-use impact recharge	1	1. SCDNR to continue ongoing research into this subject and report findings to RBC (years 1–3) 2. Depending on findings of research, RBC to consider incorporating projections into future modeling as appropriate (beginning in year 5 as part of 5-year plan update)	SCDNR to continue ongoing research and report findings to RBC.	SCDNR existing budget.	Funded by SCDNR budget as available
B. Develop a regional groundwater model to further evaluate potential drawdowns in groundwater areas of concern (e.g., Calhoun County)	2	1. Develop regional groundwater model covering the potential groundwater areas of concern. Further calibrate the model to local land conditions, including seasonal drawdowns (years 3–4, or after monitoring data demonstrates drawdowns to (or below) the top of an aquifer) 2. Evaluate the moderate and high growth demand scenarios using monthly or seasonal stress periods (beginning in year 5 as part of 5-year plan update)	SCDNR will work with SCDHEC and USGS to develop regional groundwater model.	Costs of developing and applying a regional groundwater model may range from $150,000 to $200,000.	Possible external funding: Fed-8
C. Research impacts of seasonal drawdown below the top of aquifer	3	1. Conduct a literature review of impacts of seasonal aquifer drawdown (years 2–3) 2. If monitoring indicates seasonal drawdowns below the top of an aquifer, consider development of a test program to monitor for possible impacts (e.g., reduction in well yield, land subsidence, and aquifer compaction) (years 4–5 [contingent on monitoring data])	SCDNR and USGS - monitor groundwater levels and alert RBC if water levels drop below top of aquifer. SCDHEC, SCDNR, and contractors - perform literature review	Costs of conducting research will vary with the level of detail (i.e., literature review or new study) and could range between $10,000 to $20,000. Cost of a test program could range between $25,000 and $100,000 or more, depending on the program components.	Funded by SCDNR budget as available

[1] See Tables 10-3 and 10-4 for funding source references.

Table 10-2. Implementation plan. (Continued)

Strategy	Strategy Priority	5-Year Actions	Responsible Parties	Budget	Funding Sources[1]
Objective 6. Protect groundwater supplies and existing users					
A. Enhance groundwater monitoring program in groundwater areas of concern	1	1. Continue to monitor water levels in existing wells throughout Edisto River basin (years 1–5) 2. Identify, seek access to, and monitor water levels in existing production wells in groundwater areas of concern to confirm actual groundwater conditions (years 1–5) 3. Seek funding and drill new monitoring wells in groundwater areas of concern, as needed (years 1–5) 4. Conduct data analysis (analyze collected water level data) (years 1–5)	SCDNR with potential support from USGS	Costs of monitoring existing wells are minimal (SCDNR labor and expenses). New monitoring wells and monitoring equipment may range from $10,000 to $50,000 depending on depth.	SCDNR and potential USGS budgets as available
B. Work with SCDHEC and the Groundwater Management Areas to encourage locating new pumping in aquifers that can better support additional withdrawals, where applicable	2	1. Implement Strategy A (years 1–5) 2. Identify funding opportunities for drilling deeper production wells (where applicable) (years 3–5)	SCDHEC and SCDNR - Analyze groundwater level trends in area of concern and report findings to RBC. USGS - Use regional model to assess alternative future pumping scenarios. RBC with support of SCDHEC, SCDNR, and contractors - Assess need to recommend transition of future pumping to aquifers that can support additional withdrawal.	Costs of drilling a deeper well will vary based on location and depth to aquifer. A new irrigation well drilled to 250–400 feet, versus 100–250 feet may cost an extra $25,000 to $100,000.	Possible outside funding sources for municipal water withdrawers include Fed-1, 3, 4, 5, and 9 Possible outside funding sources for agricultural water withdrawers include USDA-7

[1] See Tables 10-3 and 10-4 for funding source references.

10.1.2 Funding Opportunities

Existing external funding sources may be leveraged to promote implementation of the objectives outlined in Chapter 10.1.1. For example, EPA's Water Infrastructure Finance and Information Act program offers funding to support eligible water and wastewater infrastructure projects including those related to drought prevention, reduction, and mitigation. Other funding to support drought mitigation efforts may be available through the Federal Emergency Management Agency's Hazard Mitigation Grant Program (HMGP) or Building Resilient Infrastructure and Communities (BRIC) programs. The USDA offers numerous programs for farmers and ranchers to reduce risk from drought or to restore land impacted by drought. Table 10-3 and Table 10-4 summarize existing federal and USDA funding sources, respectively.

During the writing of this River Basin Plan, Congress passed the Inflation Reduction Act (IRA), which may provide additional funding to programs related to agricultural conservation. For example, of the $20 billion allotted to the USDA, Section 21001 of the IRA assigned $8.5 billion in addition to amounts otherwise available to an existing USDA program, the Environmental Quality Incentives Program (EQIP). EQIP pays for ecosystem restoration and emissions reduction projects on farmland and may be used for activities such as the purchase of cover crops (one of the agricultural conservation strategies discussed in this plan). Annual obligations from the EQIP program have been approximately $1.8 to $1.9 billion from 2018 through 2021, with between $36 to $45 million allotted for projects in South Carolina in these years. Additionally, $3.25 billion was allotted to the federal Conservation Stewardship Program, $1.4 million to the Agricultural Conservation Easement Program, and $4.95 billion to the Regional Conservation Partnership Program. The IRA indicates that activities funded by these programs must "directly improve soil carbon, reduce nitrogen losses, or reduce, capture, avoid, or sequester carbon dioxide, methane, or nitrous oxide emissions, associated with agricultural production" (Inflation Reduction Act 2022). Projects that provide water efficiency benefits in addition to these climate benefits may be eligible for funding under these programs. Section 30002 of the IRA also designated $837.5 million in funding to the Secretary of Housing and Urban Affairs for projects that improve energy or water efficiency for affordable housing (Inflation Reduction Act 2022).

In September 2022, $70 million in USDA "Partnerships for Climate-Smart Commodities" funding was invested in South Carolina's two land-grant universities, Clemson University and South Carolina State University, to promote "climate-smart" agricultural practices in South Carolina. The project will utilize a coalition of 27 entities to promote the program to farmers , with a focus on peanuts, leafy greens, beef cattle, and forestry. Most of the funding will go directly to growers to offset the costs of implementing conservation practices. There may be opportunities to leverage this new funding source to implement the agricultural conservation strategies recommended in this plan.

Table 10-3. Federal funding sources.

Funding Source Index[1]	Program	Agency	Grant/Loan Funds Available	Description
Fed-1	U.S. Economic Development Administration (EDA) Grants	EDA	No limit (subject to federal appropriation)	EDA's Public Works Program and Economic Adjustment Assistance Program aids distressed communities by providing funding for existing physical infrastructure improvements and expansions.
Fed-2	Water Infrastructure Finance and Information Act	U.S. Environmental Protection Agency (EPA)	Up to 49 percent of eligible project costs (minimum project size is $20 million for large communities and $5 million for small communities)	A federal credit program administered by EPA for eligible water and wastewater infrastructure projects, including drought prevention, reduction, and mitigation.
Fed-3	Section 502 Direct Loan Program	USDA Rural Development	Loans based on individual county mortgage limits	Loans are available for wells and water connections in rural communities. Availability is based on community income.
Fed-4	National Rural Water Association Revolving Loan Fund	USDA Rural Utilities Service	$100,000 or 75% of the total project	Provides loans for predevelopment costs associated with water and wastewater projects and for existing systems in need of small-scale capital improvements.
Fed-5	Emergency Community Water Assistance Grants	USDA Rural Development	Up to $100,000 or $1,000,000 depending on the type of project	Offers grants to rural areas and towns with populations of 10,000 or less to construct waterline extensions; repair breaks or leaks; address maintenance necessary to replenish the water supply; or construct a water source, intake, or treatment facility.
Fed-6	HMGP	Federal Emergency Management Agency (FEMA)	Variable	Provides funds to states, territories, tribal governments, and communities for hazard mitigation planning and the implementation of mitigation projects following a presidentially declared disaster event
Fed-7	Building Resilient Infrastructure and Communities	FEMA	Variable	Building Resilient Infrastructure and Communities will support states, local communities, tribes, and territories as they undertake hazard mitigation projects, reducing the risks they face from disasters and natural hazards
Fed-8	Planning Assistance to States	USACE	Variable – funding is 50% federal and 50% nonfederal	USACE can provide states, local governments, and other nonfederal entities assistance in the development of comprehensive plans for the development, use, and conservation of water resources.

[1] As referenced in the "Funding Sources" column of Table 10-2.

Table 10-3. Federal funding sources. (Continued)

Funding Source Index[1]	Program	Agency	Grant/Loan Funds Available	Description
Fed-9	Drinking Water State Revolving Fund	SCDHEC and SC Rural Infrastructure Authority	Congress appropriates funding for the Drinking Water State Revolving Fund that is then awarded to states by EPA based on results of the most recent Drinking Water Infrastructure Needs Survey and Assessment.	This program is a federal-state partnership aimed at ensuring that communities have safe drinking water by providing low-interest loans and grants to eligible recipients for drinking water infrastructure projects.

[1] As referenced in the "Funding Sources" column of Table 10-2.

Table 10-4. USDA disaster assistance programs.

Funding Source Index[1]	Program	Agency	Description
USDA-1	Crop Insurance	Risk Management Agency	Provides indemnity payments to growers who purchased crop insurance for production and quality losses related to drought, including losses from an inability to plant caused by an insured cause of loss.
USDA-2	Conservation Reserve Program Haying and Grazing	Farm Service Agency (FSA)	Provides for emergency haying and grazing on certain Conservation Reserve Program practices in a county designated as D2 or higher on the United States Drought Monitor, or in a county where there is at least a 40% loss in forage production.
USDA-3	Emergency Assistance for Livestock, Honeybees, and Farm-Raised Fish Program	FSA	Provides assistance to eligible owners of livestock and producers of honeybees and farm-raised fish for losses.
USDA-4	Emergency Conservation Program	FSA	Provides funding and technical assistance for farmers and ranchers to restore farmland damaged by natural disasters and for emergency water conservation measures in severe droughts.
USDA-5	Emergency Forest Restoration Program	FSA	Provides funding to restore privately owned forests damaged by natural disasters. Assistance helps landowners carry out emergency measures to restore forest health on land damaged by drought disasters.
USDA-6	Farm Loans	FSA	Provides emergency and operating loans to help producers recover from production and physical losses due to natural disasters and can pay for farm operating and family living expenses.
USDA-7	Environmental Quality Incentives Program	FSA	Provides agricultural producers with financial resources and assistance to plan and implement improvements on the land in support of disaster recovery and repair and can help mitigate loss from future natural disasters. Assistance may also be available for emergency animal mortality disposal from natural disasters.

[1] As referenced in the "Funding Sources" column of Table 10-2.

Table 10-4. USDA disaster assistance programs. (Continued)

Funding Source Index[1]	Program	Agency	Description
USDA-8	Emergency Watershed Program (Recovery)	Natural Resources Conservation Service	Offers vital recovery options for local communities to help people reduce hazards to life and property caused by droughts.
USDA-9	Emergency Community Water Assistance Grants	Rural Development	Offers grants to rural areas and towns with populations of 10,000 or less to construct waterline extensions; repair breaks or leaks; address maintenance necessary to replenish the water supply; or construct a water source, intake, or treatment facility.

[1] As referenced in the "Funding Sources" column of Table 10-2.

10.1.3 Implementation Considerations

The Edisto RBC may encounter challenges in the implementation of the identified strategies. One such challenge is the identification of sufficient funding. For the implementation of Objectives 1–3, water withdrawers may have limited financial capacity to pursue the recommended water management strategies. A municipal water utility's budget is limited by its customer base and rate structure. Increases to water rates may not be feasible for some communities. Agricultural water withdrawers operate on relatively low profit margins and may be hesitant to invest in new and potentially expensive water conservation or augmentation strategies, particularly if their current irrigation practices are working well (State of Utah 2022). Although some outside funding sources exist, Edisto RBC members indicated that applications for such programs may present a technical or resource barrier to many water withdrawers. Any new funding sources pursued by the RBC with SCDNR support may take time to develop, leading to delays in implementation. The identification of immediately available funding opportunities, the provision of support in funding applications, and the investigation of new funding sources are vital to implementation of the recommended strategies under Objectives 1–3.

Another challenge in the implementation of the River Basin Plan is stakeholder acceptance. The RBC itself has no authority to enforce recommendations in the basin. Therefore, implementation of these strategies is dependent upon effective communication of RBC findings and recommendations to stakeholders. For example, stakeholder acceptance is vital for achieving Objectives 1–3, as these strategies rely on individual water withdrawers reducing their demands or developing new supplies. To gain acceptance, water withdrawers must understand the need for and goals of the recommended strategies as well as have assurance that they are viable and effective in improving equitable access to the basin's water resources. The RBC must compile sufficient data and develop and execute an outreach plan to meet these stakeholder needs. The RBC included the development and implementation of an education and outreach communication plan as one of the 5-year actions for the water management objectives (Objectives 1–3). During RBC meetings following publication of the River Basin Plan, the RBC will craft outreach plans to both agricultural and municipal water withdrawers within the basin. Outreach may include the development of print or online materials and/or a workshop to describe potential water management strategies, benefits, and funding sources and to describe how these strategies relate to findings from the planning process.

Another recommended communication strategy under Objective 4 is to establish an RBC social media presence to promote public outreach and communication. Although Edisto RBC members identified social media as an effective tool to communicate with the public, there is uncertainty surrounding who would be responsible for maintaining the accounts. Running a social media account involves developing content, vetting content, following a content posting schedule, engaging with other accounts, and providing oversight on account engagement. If an RBC member were to run the accounts, there would have to be a procedure for vetting content to ensure it represents a broad perspective and not solely that of the account manager. These issues will continue to be discussed during implementation meetings of the RBC.

To effectively implement the recommended strategies of the River Basin Plan, the RBC must continue to meet as a planning body. The Planning Framework states that the River Basin Plan should not be perceived as a static document and the RBC should not be a stagnant planning body between successive updates. Rather, the RBC is to be "actively engaged in promoting the implementation of the recommendations proposed" and "will continue to meet on a periodic basis to pursue River Basin Plan implementation activities as needed" (SCDNR 2019, p. 90). The Edisto RBC has identified quarterly meetings as desirable in the first year after publication of the River Basin Plan to pursue funding and implementation. After the first year, meetings may be held less frequently as needed, but at least once per year.

10.2 Long-Term Planning Objectives

The Edisto RBC's objectives described in Chapter 10.1 represent both short-term and long-term objectives. For each objective, short-term strategies are discussed in Chapter 10.1 and long-term strategies are presented below in Table 10-5.

Table 10-5. Long-term planning objectives.

Objective and Strategy	Long-Term Strategy
Objective 1. Reduce demand to conserve water resources	
A. Agricultural Conservation	Continue short-term goals. Adjust recommended actions based on water savings realized. Seek additional funding sources. Explore new technologies and incorporate into recommendations as appropriate.
B. Municipal Conservation	Continue short-term goals. Adjust recommended actions based on water savings realized. Seek additional funding sources.
Objective 2. Conserve surface water during low-flow conditions	
A. Implement low-flow management strategy	Continue short-term goals. Review and adjust strategy based on effectiveness and changing conditions.
Objective 3. Augment sources of supply	
A. Conjunctive Use (use of groundwater to supplement surface water supplies)	Continue short-term goals. Monitor groundwater levels to assess impacts of increased groundwater usage.
B. Small Impoundments (on tributaries)	Continue short-term goals. Monitor Edisto River basin streamflows to assess impact of small impoundments on downstream flows.

Table 10-5. Long-term planning objectives. (Continued)

Objective and Strategy	Long-Term Strategy
Objective 4. Effectively communicate RBC findings and recommendations	
A. Conduct Edisto RBC meetings to review, initiate, and support implementation actions	Maintain regular meeting schedule to encourage continuity between various iterations of RBC membership.
B. Encourage use of social media through professional accounts of Edisto RBC, SCDNR, SCDHEC, and/or RBC members	Continue short-term goals and assess impact.
C. Communicate with legislative delegation throughout planning process to familiarize them with RBC activities and goals in advance of funding requests	Continue regular communication to emphasize the ongoing work and impacts of the RBC.
D. Coordinate with the Santee RBC on future monitoring, planning, modeling, and other activities focused on Calhoun County Groundwater Area of Concern	Continued collaboration as deemed necessary by cross-basin concerns and interests.
Objective 5. Improve technical understanding of water resource management issues	
A. Research how changes in land-use impact recharge	Incorporate land use projections and recharge impacts into future modeling efforts.
B. Develop a regional groundwater model to further evaluate potential drawdowns in groundwater areas of concern (e.g., Calhoun County)	Continually improve groundwater model with new monitoring data. Use model to assess drawdown in potential areas of concern.
C. Research impacts of seasonal drawdown below the top of aquifer	Consider findings of analysis in next 5-year plan update. If water levels drop below the top of aquifer, determine approach to monitor impacts of such declines.
Objective 6. Protect groundwater supplies and existing users	
A. Enhance groundwater monitoring program in groundwater areas of concern	Continually assess groundwater level trends across the basin and seek to improve monitoring data as needed.
B. Work with SCDHEC and the Groundwater Management Areas to encourage locating new pumping in aquifers that can better support additional withdrawals, where applicable	If monitoring suggests increasing drawdowns in areas of concern: 1. Use regional groundwater model to assess impacts of redistributed future withdrawals. 2. Encourage new pumping come from aquifers that can support the additional withdrawals.

10.3 Progress of River Basin Plan Implementation

To assess the performance of and quality of actions taken by the RBC, the Framework proposes the development of progress metrics. A progress metric is a "*benchmark used to monitor the success or failure of an action taken by an RBC*" (SCDNR 2009). Noting that the ultimate value and impact of the river basin planning process is the dissemination of its findings and implementation of its recommendations, the Edisto RBC developed progress metrics around each of the six implementation objectives defined at the beginning of this chapter. The progress metrics are:

1. Reduce demand to conserve water resources

   a. Metric 1a: Municipal and agricultural water conservation and efficiency strategies are considered, evaluated, and implemented. On the municipal side, a 5-year reduction in per capita demand is realized and water utility financial strength is maintained.
   b. Metric 1b: Funding opportunities are identified and used to implement strategies.
2. Conserve surface water during low-flow conditions
   a. Metric 2a: The low-flow strategy is effectively implemented when triggered
3. Augment sources of supply
   a. Metric 3a: Supply augmentation strategies are implemented
   b. Metric 3b: Funding opportunities are identified and successfully used to implement supply augmentation strategies
4. Effectively communicate RBC findings and recommendations
   a. Metric 4a: The public develops a better understanding of the Edisto River Basin resources, challenges, and opportunities. Myths and falsehoods are eliminated and sound science is accepted.
   b. Metric 4b: Outreach is effective, prompting Legislative actions, decisions and funding that support implementation strategies and actions
5. Improve technical understanding of water resource management issues
   a. Metric 5a: Research into land use impacts on recharge is completed
   b. Metric 5b: Regional groundwater model of area of concern is developed (if needed)
   c. Metric 5c: Research into impacts of seasonal drawdown below the top of an aquifer is completed
6. Protect groundwater supplies and existing users
   a. Metric 6a: Monitoring wells in the Calhoun County groundwater area of concern are identified or constructed

This 2022 publication is the first Edisto River Basin Plan publication. Future 5-year updates will evaluate the Edisto RBC's performance relative to the progress metrics.

As noted throughout this plan, communication and the development of stakeholder buy-in is key to successful plan implementation. To develop stakeholder acceptance, RBC members, who are the ambassadors of the River Basin Plan, must have confidence in the planning process and outcomes. A key responsibility of RBC members, as defined in the Framework, is to regularly communicate with stakeholders to maintain a current understanding of RBC activities, the River Basin Plan, and emerging issues. To assess each RBC member's confidence in the plan, the plan approval process dictates that there will first be a test for consensus on the Draft Edisto River Basin Plan. For the test of consensus, each member rates their concurrence with the plan using a five-point scale, as shown below:

1. Full Endorsement (i.e., member likes it).
2. Endorsement but with minor points of contention (i.e., basically member likes it).
3. Endorsement but with major points of contention (i.e., member can live with it).
4. Stand aside with major reservations (i.e., member cannot live with it in its current state and can only support it if changes are made).
5. Withdraw - Member will not support the draft river basin plan and will not continue working within the RBC's process. Member has decided to leave the RBC.

For the Final River Basin Plan, each RBC member votes simply to support or not support the plan. By indicating support, the member would be acknowledging his/her concurrence with the Final River Basin Plan and their commitment to support implementation of the plan. The results of the test for consensus on the Draft River Basin Plan and the RBC's votes on the Final River Basin Plan are shown in Table 10-6 below. The full results are included in Appendix E.

Table 10-6. Test of consensus results.

Test of Consensus Result	Number of RBC Members
Draft River Basin Plan	
1. Full Endorsement (i.e., Member likes it).	3
2. Endorsement but with Minor Points of Contention (i.e., basically Member likes it).	12
3. Endorsement but with Major Points of Contention (i.e., Member can live with it).	5
4. Stand aside with Major Reservations (i.e., Member cannot live with it in its current state and can only support it if changes are made).	1
5. Withdraw – Member will not support the Draft River Basin Plan and will not continue working within the RBC's process. Member has decided to leave the RBC.	0
Final River Basin Plan*	
Support	17
Does Not Support	3

* One member in the Water and Sewer Utilities interest category left his position with a utility in the Edisto River Basin as the Plan was being finalized and did not cast a vote on the Final Plan.

Chapter 11

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Appendix A
2018 GDP for Counties in the Edisto Basin

Table A-1. 2018 GDP for Counties in the Edisto Basin in Millions of Dollars.

Industry Type	Aiken	Bamberg	Barnwell	Berkeley
Percentage of County in Edisto River Basin	92.9%	24.3%	15.4%	5.2%
All industry total	7,200	340	530	8,200
Private industries	6,500	280	430	7,300
Agriculture, forestry, fishing, and hunting	29	9	7	9
Mining, quarrying, and oil and gas extraction	38	-	9	40
Utilities	130	10	2	550
Construction	430	5	40	570
Manufacturing	1,360	70	160	1,200
Durable goods manufacturing	490	60	90	720
Nondurable goods manufacturing	870	10	70	500
Wholesale trade	160	20	7	530
Retail trade	430	20	40	450
Transportation and warehousing	160	5	(D)	290
Information	130	8	6	280
Finance, insurance, real estate, rental, and leasing	1,030	70	80	1,600
Finance and insurance	260	(D)	7	150
Real estate and rental and leasing	770	(D)	70	1,400
Professional and business services	1,840	10	30	1,200
Professional, scientific, and technical services	440	8	(D)	1,000
Management of companies and enterprises	14	-	(D)	20
Administrative and support and waste management and remediation services	1,380	4	10	160
Educational services, health care, and social assistance	400	30	20	240
Educational services	13	10	(D)	80
Health care and social assistance	390	20	(D)	160
Arts, entertainment, recreation, accommodation, and food services	220	7	(D)	220
Arts, entertainment, and recreation	43	-	(D)	50
Accommodation and food services	170	7	(D)	170
Other services (except government and government enterprises)	150	10	20	200
Government and government enterprises	650	60	100	860

Table A-1. 2018 GDP for Counties in the Edisto Basin in Millions of Dollars. (Continued)

Industry Type	Calhoun	Charleston	Colleton	Dorchester
Percentage of County in Edisto River Basin	32.5%	27.7%	18.4%	59.9%
All industry total	560	31,300	970	3,900
Private industries	500	25,600	820	3,400
Agriculture, forestry, fishing, and hunting	20	20	40	(D)
Mining, quarrying, and oil and gas extraction	-	4	7	8
Utilities	90	90	8	13
Construction	50	2,000	50	280
Manufacturing	170	2,800	80	750
Durable goods manufacturing	20	2,000	350	30
Nondurable goods manufacturing	150	790	300	40
Wholesale trade	10	1,100	60	140
Retail trade	10	2,000	80	290
Transportation and warehousing	20	1,000	(D)	(D)
Information	(D)	1,100	30	63
Finance, insurance, real estate, rental, and leasing	60	5,600	170	930
Finance and insurance	4	1,000	58	30
Real estate and rental and leasing	50	4,500	310	150
Professional and business services	30	4,100	(D)	350
Professional, scientific, and technical services	7	2,600	60	(D)
Management of companies and enterprises	-	320	7	(D)
Administrative and support and waste management and remediation services	20	1,200	190	50
Educational services, health care, and social assistance	(D)	2,900	110	190
Educational services	(D)	270	17	4
Health care and social assistance	(D)	2,600	180	100
Arts, entertainment, recreation, accommodation, and food services	6	2,300	50	160
Arts, entertainment, and recreation	1	260	27	7
Accommodation and food services	5	2,100	130	40
Other services (except government and government enterprises)	10	650	30	140
Government and government enterprises	50	5,600	150	520

Table A-1. 2018 GDP for Counties in the Edisto Basin in Millions of Dollars. (Continued)

Industry Type	Edgefield	Lexington	Orangeburg	Saluda
Percentage of County in Edisto River Basin	15.3%	37.7%	49.7%	2.9%
All industry total	610	13,000	2,900	420
Private industries	470	11,000	2,300	350
Agriculture, forestry, fishing, and hunting	70	70	(D)	10
Mining, quarrying, and oil and gas extraction	10	30	8	-
Utilities	5	320	(D)	1
Construction	30	750	80	10
Manufacturing	100	1,800	650	120
Durable goods manufacturing	40	790	350	1
Nondurable goods manufacturing	60	970	300	120
Wholesale trade	10	1,200	(D)	8
Retail trade	30	1,100	220	20
Transportation and warehousing	(D)	540	92	(D)
Information	7	470	140	(D)
Finance, insurance, real estate, rental, and leasing	110	2,300	370	110
Finance and insurance	6	430	58	6
Real estate and rental and leasing	110	1,900	310	110
Professional and business services	30	970	100	9
Professional, scientific, and technical services	(D)	430	60	3
Management of companies and enterprises	(D)	120	7	-
Administrative and support and waste management and remediation services	20	420	41	5
Educational services, health care, and social assistance	20	650	210	(D)
Educational services	(D)	50	58	(D)
Health care and social assistance	(D)	600	150	(D)
Arts, entertainment, recreation, accommodation, and food services	(D)	440	120	6
Arts, entertainment, and recreation	(D)	50	12	2
Accommodation and food services	(D)	390	110	4
Other services (except government and government enterprises)	20	370	62	(D)
Government and government enterprises	150	2,100	150	70

Appendix B
Demand Projections for Individual Water Users

Table B-1. Current Water Demands, Consumptive Use, and Returns.

User	Use Category	Source	Withdrawal (MGD)	Consumptive Use (%)	Consumptive Use (MGD)	Return (MGD)	Return to Edisto (MGD)
Agriculture Total	Agriculture	Surface Water	17.73	100%	17.73	0.00	0.00
Agriculture Total	Agriculture	Groundwater	61.25	100%	61.25	0.00	0.00
Indian Trail	Golf Course	Surface Water	0.02	100%	0.02	0.00	0.00
Orangeburg Country Club	Golf Course	Groundwater	0.17	100%	0.17	0.00	0.00
Plantation Course at Edisto, LLC	Golf Course	Groundwater	0.02	100%	0.02	0.00	0.00
ARGOS Cement LLC/Harleyville Plant	Manufacturing	Groundwater	0.29	100%	0.29	0.00	0.00
ASCO Groundwater Extraction and Treatment System	Manufacturing	Groundwater	0.23	100%	0.23	0.00	0.00
Carolina Chips, Inc.	Manufacturing	Groundwater	0.18	100%	0.18	0.00	0.00
Giant Cement Company/ Harleyville Plant	Manufacturing	Groundwater	0.48	100%	0.48	0.00	0.00
Holcim (US) Inc. - Holly Hill, SC	Manufacturing	Groundwater	0.99	100%	0.99	0.00	0.00
Showa Denko Inc.	Manufacturing	Groundwater	0.24	100%	0.24	0.00	0.00
SI Group	Manufacturing	Surface Water	0.92	1%	0.01	0.91	0.91
Dominion-Cope	Thermoelectric	Groundwater	3.55	54%	1.93	1.62	1.62
Dorchester Biomass, LLC	Thermoelectric	Groundwater	0.35	100%	0.35	0.00	0.00
Batesburg-Leesville	Water Supply	Surface Water	1.46	26%	0.38	1.09	1.09
Berkeley County Water and Sanitation	Water Supply	Groundwater	0.03	100%	0.03	0.00	0.00
Bull Swamp Rural Water Company	Water Supply	Groundwater	0.12	100%	0.12	0.00	0.00
Bull Swamp Rural Water Company	Water Supply	Groundwater	0.10	100%	0.10	0.00	0.00
Charleston	Water Supply	Surface Water	42.84	57%	24.38	18.46	0.00

Table B-1. Current Water Demands, Consumptive Use, and Returns.

User	Use Category	Source	Withdrawal (MGD)	Consumptive Use (%)	Consumptive Use (MGD)	Return (MGD)	Return to Edisto (MGD)
City of Aiken	Water Supply	Surface Water	6.26	45%	2.85	3.42	0.00
City of Aiken	Water Supply	Groundwater	1.31	100%	1.31	0.00	0.00
City of Denmark Water System	Water Supply	Groundwater	0.16	100%	0.16	0.00	0.00
City of Orangeburg	Water Supply	Surface Water	6.55	40%	2.61	3.93	3.93
DCWA/Conoflow	Water Supply	Groundwater	0.01	100%	0.01	0.00	0.00
DCWA/Reevesville	Water Supply	Groundwater	0.02	100%	0.02	0.00	0.00
Dorchester County Water & Sewer	Water Supply	Groundwater	0.03	100%	0.03	0.00	0.00
Gaston Rural Community Water District	Water Supply	Groundwater	0.16	100%	0.16	0.00	0.00
Giant Cement Company/ Harleyville Plant	Water Supply	Groundwater	0.00	100%	0.00	0.00	0.00
Gilbert-Summit Rural Water District	Water Supply	Groundwater	0.80	100%	0.80	0.00	0.00
Montmorenci-Couchton Water and Sewer District	Water Supply	Groundwater	0.32	100%	0.32	0.00	0.00
New Holland W/D	Water Supply	Groundwater	0.05	100%	0.05	0.00	0.00
Orangeburg Department of Public Utilities John F. Pearson Water Treatment Plant	Water Supply	Groundwater	0.06	100%	0.06	0.00	0.00
SC Dept of Corrections Division of Facilities Management	Water Supply	Groundwater	0.10	100%	0.10	0.00	0.00
Silver Springs Water District Water System	Water Supply	Groundwater	0.20	100%	0.20	0.00	0.00

Table B-1. Current Water Demands, Consumptive Use, and Returns.

User	Use Category	Source	Withdrawal (MGD)	Consumptive Use (%)	Consumptive Use (MGD)	Return (MGD)	Return to Edisto (MGD)
St. George	Water Supply	Groundwater	0.35	0%	0.00	0.35	0.35
Town of Blackville	Water Supply	Groundwater	0.35	41%	0.14	0.21	0.21
Town of Bowman	Water Supply	Groundwater	0.00	100%	0.00	0.00	0.00
Town of Branchville	Water Supply	Groundwater	0.16	40%	0.06	0.09	0.09
Town of Edisto Beach	Water Supply	Groundwater	0.95	100%	0.95	0.00	0.00
Town of Elko Public Water Supply	Water Supply	Groundwater	0.09	100%	0.09	0.00	0.00
Town of Eutawville	Water Supply	Groundwater	0.00	100%	0.00	0.00	0.00
Town of Harleyville	Water Supply	Groundwater	0.081	13%	0.01	0.07	0.07
Town of Holly Hill	Water Supply	Groundwater	0.17	100%	0.17	0.00	0.00
Town of Monetta	Water Supply	Groundwater	0.07	100%	0.07	0.00	0.00
Town of North	Water Supply	Groundwater	0.13	71%	0.09	0.04	0.04
Town of Perry	Water Supply	Groundwater	0.07	100%	0.07	0.00	0.00
Town of Ridge Spring	Water Supply	Groundwater	0.08	100%	0.08	0.00	0.00
Town of Salley	Water Supply	Groundwater	0.03	100%	0.03	0.00	0.00
Town of Springfield	Water Supply	Groundwater	0.05	100%	0.05	0.00	0.00
Town of Wagener	Water Supply	Groundwater	0.08	32%	0.03	0.06	0.06

Table B-2. Permit and Registration Amounts for Current Water Users.

User	Use Category	Water Source	Permit or Registration	Permit or Registration Amount (MGD)	Permit or Registration Amount (MGM)	Permit or Registration Amount (MGY)
Agriculture Total	Agriculture	Groundwater	Permit	97.3	2,958.9	35,506.1
Backman	Agriculture	Surface Water	Registration	2.0	60.5	726.0
Bear Spring Farm, Inc.	Agriculture	Surface Water	Registration	0.1	4.3	51.6
Boland	Agriculture	Surface Water	Registration	0.5	14.5	174.0
Brown	Agriculture	Surface Water	Registration	0.1	4.2	50.4
Brown2	Agriculture	Surface Water	Registration	0.4	13.0	156.0
Brown3	Agriculture	Surface Water	Registration	-		-
Brown4	Agriculture	Surface Water	Registration	-		-
Brown5	Agriculture	Surface Water	Registration	-		-
Bull Swamp	Agriculture	Surface Water	Registration	1.4	42.9	514.8
Cotton Lane	Agriculture	Surface Water	Registration	1.8	56.1	673.0
Double B Farms	Agriculture	Surface Water	Registration	1.1	33.7	404.4
Gray	Agriculture	Surface Water	Registration	0.2	7.0	84.0
Gregg Bates	Agriculture	Surface Water	Registration	0.4	12.2	146.0
Guinyard's Landing	Agriculture	Surface Water	Registration	18.4	559.5	6,714.0
Haigler	Agriculture	Surface Water	Registration	4.8	147.4	1,768.2
Holmes & Son	Agriculture	Surface Water	Registration	1.6	48.7	584.4
Inabinet Farms	Agriculture	Surface Water	Registration	0.2	6.6	79.2
Inabinet Farms2	Agriculture	Surface Water	Registration	0.3	8.0	96.0
Inabinet Farms3	Agriculture	Surface Water	Registration	1.1	34.0	408.0
Inabinet Farms4	Agriculture	Surface Water	Registration	-		-

Table B-2. Permit and Registration Amounts for Current Water Users.

User	Use Category	Water Source	Permit or Registration	Permit or Registration Amount (MGD)	Permit or Registration Amount (MGM)	Permit or Registration Amount (MGY)
Inabinet Farms5	Agriculture	Surface Water	Registration	-		-
Kyzer	Agriculture	Surface Water	Registration	0.1	3.0	36.0
Lois Ann	Agriculture	Surface Water	Registration	105.2	3,200.0	38,400.0
Maury Furtick	Agriculture	Surface Water	Registration	0.2	6.0	72.0
Miller Farm	Agriculture	Surface Water	Registration	0.4	13.0	156.0
Millwood	Agriculture	Surface Water	Registration	3.1	94.5	1,134.0
Millwood2	Agriculture	Surface Water	Registration	3.2	98.4	1,180.8
Millwood3	Agriculture	Surface Water	Registration	2.6	78.6	943.2
Millwood4	Agriculture	Surface Water	Registration	-		-
Millwood5	Agriculture	Surface Water	Registration	-		-
Norway	Agriculture	Surface Water	Registration	1.0	30.0	360.0
Oak Lane	Agriculture	Surface Water	Registration	1.3	39.1	469.2
Page Farm	Agriculture	Surface Water	Registration	0.1	4.3	51.8
Pebble Creek	Agriculture	Surface Water	Registration	0.1	4.0	48.0
Phil Sandifer & Sons	Agriculture	Surface Water	Registration	1.6	50.0	600.0
Rast Farm Livingston	Agriculture	Surface Water	Registration	1.3	40.7	488.4
River Bluff Sod	Agriculture	Surface Water	Registration	0.4	13.0	156.0
Rob Bates	Agriculture	Surface Water	Registration	0.7	20.0	240.0
RRR Farms	Agriculture	Surface Water	Registration	4.4	134.0	1,608.0
Sedso Farms	Agriculture	Surface Water	Registration	14.8	450.0	5,400.0
Shady Grove	Agriculture	Surface Water	Registration	3.3	100.6	1,207.2
Shivers Trading	Agriculture	Surface Water	Registration	0.8	23.7	284.4
Smith WG III	Agriculture	Surface Water	Registration	1.0	31.2	374.4

Table B-2. Permit and Registration Amounts for Current Water Users.

User	Use Category	Water Source	Permit or Registration	Permit or Registration Amount (MGD)	Permit or Registration Amount (MGM)	Permit or Registration Amount (MGY)
Spring Flower Farm	Agriculture	Surface Water	Registration	2.9	87.0	1,044.0
Springfield	Agriculture	Surface Water	Registration	0.4	11.0	132.0
Springfield Grain Co	Agriculture	Surface Water	Registration	3.2	96.0	1,152.0
Tampa Creek Farms	Agriculture	Surface Water	Registration	2.0	60.5	725.8
Thomas C. Fink	Agriculture	Surface Water	Registration	1.3	40.0	480.0
Thrasher Branch	Agriculture	Surface Water	Registration	5.9	178.0	2,136.0
Titan - Beaverdam	Agriculture	Surface Water	Registration	0.9	26.0	312.0
Titan - Beech	Agriculture	Surface Water	Registration	3.1	95.0	1,140.0
Titan - Bog	Agriculture	Surface Water	Registration	3.6	110.0	1,320.0
Titan - Bog2	Agriculture	Surface Water	Registration	1.4	42.0	504.0
Titan - Bog3	Agriculture	Surface Water	Registration	1.9	57.0	684.0
Titan - Bog4	Agriculture	Surface Water	Registration	-		-
Titan - Bog5	Agriculture	Surface Water	Registration	-		-
Titan - Chinquapin	Agriculture	Surface Water	Registration	2.3	71.0	852.0
Titan - Mill	Agriculture	Surface Water	Registration	1.3	40.0	480.0
Titan - Shaw	Agriculture	Surface Water	Registration	1.2	36.0	432.0
Titan - South Fork	Agriculture	Surface Water	Registration	4.4	134.0	1,608.0
Titan - Temples	Agriculture	Surface Water	Registration	3.1	94.0	1,128.0
Titan - Temples2	Agriculture	Surface Water	Registration	0.5	15.0	180.0
Titan - Temples3	Agriculture	Surface Water	Registration	1.4	44.0	528.0
Titan - Temples4	Agriculture	Surface Water	Registration	-		-
Titan - Temples5	Agriculture	Surface Water	Registration	-		-
Turf Connections	Agriculture	Surface Water	Registration	0.5	15.0	180.0
Walter P. Rawl & Sons	Agriculture	Surface Water	Registration	0.6	19.3	231.6
Walthers	Agriculture	Surface Water	Registration	13.2	400.0	4,800.0
Williams & Sons	Agriculture	Surface Water	Registration	1.6	48.8	585.6
Willshire	Agriculture	Surface Water	Registration	0.6	18.1	217.2
Indian Trail	Golf Course	Surface Water	Permit	0.1	3.0	36.0

Table B-2. Permit and Registration Amounts for Current Water Users.

User	Use Category	Water Source	Permit or Registration	Permit or Registration Amount (MGD)	Permit or Registration Amount (MGM)	Permit or Registration Amount (MGY)
Orangeburg CC	Golf Course	Surface Water	Permit	0.4	11.0	132.0
Orangeburg Country Club	Golf Course	Groundwater	Permit	0.2	6.8	81.0
Plantation Course at Edisto, LLC	Golf Course	Groundwater	Permit	0.2	6.7	80.0
ARGOS Cement LLC/Harleyville Plant	Manufacturing	Groundwater	Permit	0.7	20.8	250.0
ASCO Groundwater Extraction and Treatment System	Manufacturing	Groundwater	Permit	0.4	11.0	132.1
Carolina Chips, Inc.	Manufacturing	Groundwater	Permit	0.3	10.2	122.4
Giant Cement Company/ Harleyville Plant	Manufacturing	Groundwater	Permit	0.8	25.7	308.0
Holcim (US) Inc. - Holly Hill, SC	Manufacturing	Groundwater	Permit	1.5	46.7	560.1
SHOWA DENKO INC	Manufacturing	Groundwater	Permit	0.5	15.8	190.0
SI Group	Manufacturing	Surface Water	Permit	0.6	19.5	234.0
SI Group2	Manufacturing	Surface Water	Permit	90.2	2,743.3	32,919.6
Aiken	Public Supply	Surface Water	Permit	8.2	248.0	2,976.0
Aiken2	Public Supply	Surface Water	Permit			
Batesburg-Leesville	Public Supply	Surface Water	Permit	1.2	35.0	420.0
Batesburg-Leesville2	Public Supply	Surface Water	Permit	0.8	25.0	300.0
Batesburg-Leesville3	Public Supply	Surface Water	Permit	0.5	15.0	180.0
Blackville Town of	Public Supply	Groundwater	Permit	0.5	16.7	200.0
Branchville Town of	Public Supply	Groundwater	Permit	0.2	6.0	72.0
Bull Swamp Rural Water Company	Public Supply	Groundwater	Permit	0.2	5.2	63.0
Bull Swamp Rural Water Company	Public Supply	Groundwater	Permit	0.2	6.5	78.0
Charleston	Public Supply	Surface Water	Permit	287.0	8,729.4	104,752.3
City of Aiken	Public Supply	Groundwater	Permit	4.6	140.4	1,685.4

Table B-2. Permit and Registration Amounts for Current Water Users.

User	Use Category	Water Source	Permit or Registration	Permit or Registration Amount (MGD)	Permit or Registration Amount (MGM)	Permit or Registration Amount (MGY)
City of Denmark Water System	Public Supply	Groundwater	Permit	0.2	5.9	70.6
DCWA/CONOFLOW	Public Supply	Groundwater	Permit	0.5	14.6	175.0
DCWA/REEVESVILLE	Public Supply	Groundwater	Permit	0.0	1.2	15.0
Eutawville Town of	Public Supply	Groundwater	Permit	0.0	0.5	5.6
Gaston Rural Community Water District	Public Supply	Groundwater	Permit	0.2	5.4	64.9
Giant Cement Company/ Harleyville Plant	Public Supply	Groundwater	Permit	0.0	1.2	15.0
Gilbert-Summit Rural Water District	Public Supply	Groundwater	Permit	0.6	17.8	213.7
Holly Hill Town of	Public Supply	Groundwater	Permit	0.3	8.3	100.0
Monetta Town of	Public Supply	Groundwater	Permit	0.1	3.8	45.1
Montmorenci-Couchton Water and Sewer District	Public Supply	Groundwater	Permit	0.5	16.7	200.0
New Holland W/D	Public Supply	Groundwater	Permit	0.1	1.9	23.0
North Town of	Public Supply	Groundwater	Permit	0.2	6.0	72.0
Orangeburg	Public Supply	Surface Water	Permit	56.9	1,732.0	20,784.0
Orangeburg Department of Public Utilities John F. Pearson Water Treatment Plant	Public Supply	Groundwater	Registration	0.1	1.7	20.5
PERRY TOWN OF	Public Supply	Groundwater	Permit	0.1	2.6	31.3
RIDGE SPRING TOWN OF	Public Supply	Groundwater	Registration	0.3	9.9	119.1
SC Dept of Corrections Division of Facilities Management	Public Supply	Groundwater	Permit	0.1	4.2	50.0
Silver Springs Water District Water System	Public Supply	Groundwater	Permit	0.3	9.7	116.0
Springfield Town of	Public Supply	Groundwater	Permit	0.1	2.2	27.0

Table B-2. Permit and Registration Amounts for Current Water Users.

User	Use Category	Water Source	Permit or Registration	Permit or Registration Amount (MGD)	Permit or Registration Amount (MGM)	Permit or Registration Amount (MGY)
St. George Water Department	Public Supply	Groundwater	Permit	0.5	14.0	168.0
Town of Edisto Beach	Public Supply	Groundwater	Permit	0.9	27.2	327.0
Town of Elko Public Water Supply	Public Supply	Groundwater	Permit	0.1	3.1	37.0
Town of Harleyville	Public Supply	Groundwater	Permit	0.1	3.0	36.0
Town of Salley	Public Supply	Groundwater	Permit	0.0	1.4	17.0
Wagener (Town)	Public Supply	Groundwater	Permit	0.1	3.4	41.0
Williston Town of	Public Supply	Groundwater	Permit	0.0	0.0	-
Dominion - Cope	Thermoelectric	Surface Water	Permit	22.0	670.0	8,040.0
Dominion Canady's Station	Thermoelectric	Surface Water	Permit	41.9	1,273.0	15,276.0
Dominion Energy Cope Electric Generating Station	Thermoelectric	Groundwater	Permit	5.5	165.9	1,991.0
Dorchester Biomass, LLC	Thermoelectric	Groundwater	Permit	0.5	16.5	198.0

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Agriculture Total	Groundwater	AG	Moderate	2025	57.1
Agriculture Total	Groundwater	AG	Moderate	2030	59.0
Agriculture Total	Groundwater	AG	Moderate	2035	61.0
Agriculture Total	Groundwater	AG	Moderate	2040	63.0
Agriculture Total	Groundwater	AG	Moderate	2050	67.2
Agriculture Total	Groundwater	AG	Moderate	2060	71.7
Agriculture Total	Groundwater	AG	Moderate	2070	76.5
Agriculture Total	Surface Water	AG	Moderate	2025	18.4
Agriculture Total	Surface Water	AG	Moderate	2030	19.0
Agriculture Total	Surface Water	AG	Moderate	2035	19.6
Agriculture Total	Surface Water	AG	Moderate	2040	20.3
Agriculture Total	Surface Water	AG	Moderate	2050	21.6
Agriculture Total	Surface Water	AG	Moderate	2060	23.1
Agriculture Total	Surface Water	AG	Moderate	2070	24.6
Indian Trail	Surface Water	GC	Moderate	2025	0.02
Indian Trail	Surface Water	GC	Moderate	2030	0.02
Indian Trail	Surface Water	GC	Moderate	2035	0.02
Indian Trail	Surface Water	GC	Moderate	2040	0.02
Indian Trail	Surface Water	GC	Moderate	2050	0.02
Indian Trail	Surface Water	GC	Moderate	2060	0.02
Indian Trail	Surface Water	GC	Moderate	2070	0.02
Orangeburg Country Club	Groundwater	GC	Moderate	2025	0.18
Orangeburg Country Club	Groundwater	GC	Moderate	2030	0.18
Orangeburg Country Club	Groundwater	GC	Moderate	2035	0.18
Orangeburg Country Club	Groundwater	GC	Moderate	2040	0.18
Orangeburg Country Club	Groundwater	GC	Moderate	2050	0.18
Orangeburg Country Club	Groundwater	GC	Moderate	2060	0.18
Orangeburg Country Club	Groundwater	GC	Moderate	2070	0.18
Plantation Course at Edisto, LLC	Groundwater	GC	Moderate	2025	0.02
Plantation Course at Edisto, LLC	Groundwater	GC	Moderate	2030	0.02

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Plantation Course at Edisto, LLC	Groundwater	GC	Moderate	2035	0.02
Plantation Course at Edisto, LLC	Groundwater	GC	Moderate	2040	0.02
Plantation Course at Edisto, LLC	Groundwater	GC	Moderate	2050	0.02
Plantation Course at Edisto, LLC	Groundwater	GC	Moderate	2060	0.02
Plantation Course at Edisto, LLC	Groundwater	GC	Moderate	2070	0.02
ARGOS Cement LLC/Harleyville Plant	Groundwater	IN	Moderate	2025	0.32
ARGOS Cement LLC/Harleyville Plant	Groundwater	IN	Moderate	2030	0.35
ARGOS Cement LLC/Harleyville Plant	Groundwater	IN	Moderate	2035	0.37
ARGOS Cement LLC/Harleyville Plant	Groundwater	IN	Moderate	2040	0.40
ARGOS Cement LLC/Harleyville Plant	Groundwater	IN	Moderate	2050	0.46
ARGOS Cement LLC/Harleyville Plant	Groundwater	IN	Moderate	2060	0.53
ARGOS Cement LLC/Harleyville Plant	Groundwater	IN	Moderate	2070	0.60
ASCO Groundwater Extraction and Treatment System	Groundwater	IN	Moderate	2025	0.13
ASCO Groundwater Extraction and Treatment System	Groundwater	IN	Moderate	2030	0.14
ASCO Groundwater Extraction and Treatment System	Groundwater	IN	Moderate	2035	0.15
ASCO Groundwater Extraction and Treatment System	Groundwater	IN	Moderate	2040	0.16
ASCO Groundwater Extraction and Treatment System	Groundwater	IN	Moderate	2050	0.19
ASCO Groundwater Extraction and Treatment System	Groundwater	IN	Moderate	2060	0.22
ASCO Groundwater Extraction and Treatment System	Groundwater	IN	Moderate	2070	0.25
Carolina Chips, Inc.	Groundwater	IN	Moderate	2025	0.12
Carolina Chips, Inc.	Groundwater	IN	Moderate	2030	0.14

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Carolina Chips, Inc.	Groundwater	IN	Moderate	2035	0.16
Carolina Chips, Inc.	Groundwater	IN	Moderate	2040	0.18
Carolina Chips, Inc.	Groundwater	IN	Moderate	2050	0.22
Carolina Chips, Inc.	Groundwater	IN	Moderate	2060	0.28
Carolina Chips, Inc.	Groundwater	IN	Moderate	2070	0.35
Giant Cement Company/ Harleyville Plant	Groundwater	IN	Moderate	2025	0.59
Giant Cement Company/ Harleyville Plant	Groundwater	IN	Moderate	2030	0.63
Giant Cement Company/ Harleyville Plant	Groundwater	IN	Moderate	2035	0.68
Giant Cement Company/ Harleyville Plant	Groundwater	IN	Moderate	2040	0.72
Giant Cement Company/ Harleyville Plant	Groundwater	IN	Moderate	2050	0.83
Giant Cement Company/ Harleyville Plant	Groundwater	IN	Moderate	2060	0.96
Giant Cement Company/ Harleyville Plant	Groundwater	IN	Moderate	2070	1.10
Holcim (US) Inc.	Groundwater	IN	Moderate	2025	0.92
Holcim (US) Inc.	Groundwater	IN	Moderate	2030	0.99
Holcim (US) Inc.	Groundwater	IN	Moderate	2035	1.07
Holcim (US) Inc.	Groundwater	IN	Moderate	2040	1.13
Holcim (US) Inc.	Groundwater	IN	Moderate	2050	1.31
Holcim (US) Inc.	Groundwater	IN	Moderate	2060	1.50
Holcim (US) Inc.	Groundwater	IN	Moderate	2070	1.72
Showa Denko Inc.	Groundwater	IN	Moderate	2025	0.22
Showa Denko Inc.	Groundwater	IN	Moderate	2030	0.24
Showa Denko Inc.	Groundwater	IN	Moderate	2035	0.26
Showa Denko Inc.	Groundwater	IN	Moderate	2040	0.28
Showa Denko Inc.	Groundwater	IN	Moderate	2050	0.32
Showa Denko Inc.	Groundwater	IN	Moderate	2060	0.39
Showa Denko Inc.	Groundwater	IN	Moderate	2070	0.46

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
SI Group	Surface Water	IN	Moderate	2025	0.11
SI Group	Surface Water	IN	Moderate	2030	0.12
SI Group	Surface Water	IN	Moderate	2035	0.13
SI Group	Surface Water	IN	Moderate	2040	0.14
SI Group	Surface Water	IN	Moderate	2050	0.16
SI Group	Surface Water	IN	Moderate	2060	0.19
SI Group	Surface Water	IN	Moderate	2070	0.23
Dominion Energy Cope Electric Generating Station	Surface Water	PT	Moderate	2025	4.36
Dominion Energy Cope Electric Generating Station	Surface Water	PT	Moderate	2030	4.45
Dominion Energy Cope Electric Generating Station	Surface Water	PT	Moderate	2035	4.65
Dominion Energy Cope Electric Generating Station	Surface Water	PT	Moderate	2040	4.83
Dominion Energy Cope Electric Generating Station	Surface Water	PT	Moderate	2050	5.20
Dominion Energy Cope Electric Generating Station	Surface Water	PT	Moderate	2060	5.57
Dominion Energy Cope Electric Generating Station	Surface Water	PT	Moderate	2070	5.95
Dorchester Biomass, LLC	Groundwater	PT	Moderate	2025	0.36
Dorchester Biomass, LLC	Groundwater	PT	Moderate	2030	0.37
Dorchester Biomass, LLC	Groundwater	PT	Moderate	2035	0.39
Dorchester Biomass, LLC	Groundwater	PT	Moderate	2040	0.40
Dorchester Biomass, LLC	Groundwater	PT	Moderate	2050	0.43
Dorchester Biomass, LLC	Groundwater	PT	Moderate	2060	0.46
Dorchester Biomass, LLC	Groundwater	PT	Moderate	2070	0.49
Batesburg-Leesville	Surface Water	WS	Moderate	2025	1.64
Batesburg-Leesville	Surface Water	WS	Moderate	2030	1.72

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Batesburg-Leesville	Surface Water	WS	Moderate	2035	1.79
Batesburg-Leesville	Surface Water	WS	Moderate	2040	1.87
Batesburg-Leesville	Surface Water	WS	Moderate	2050	2.03
Batesburg-Leesville	Surface Water	WS	Moderate	2060	2.19
Batesburg-Leesville	Surface Water	WS	Moderate	2070	2.35
Berkeley County Water and Sanitation	Groundwater	WS	Moderate	2025	0.01
Berkeley County Water and Sanitation	Groundwater	WS	Moderate	2030	0.01
Berkeley County Water and Sanitation	Groundwater	WS	Moderate	2035	0.01
Berkeley County Water and Sanitation	Groundwater	WS	Moderate	2040	0.01
Berkeley County Water and Sanitation	Groundwater	WS	Moderate	2050	0.01
Berkeley County Water and Sanitation	Groundwater	WS	Moderate	2060	0.01
Berkeley County Water and Sanitation	Groundwater	WS	Moderate	2070	0.01
Bull Swamp Rural Water Company	Groundwater	WS	Moderate	2025	0.11
Bull Swamp Rural Water Company	Groundwater	WS	Moderate	2030	0.10
Bull Swamp Rural Water Company	Groundwater	WS	Moderate	2035	0.10
Bull Swamp Rural Water Company	Groundwater	WS	Moderate	2040	0.10
Bull Swamp Rural Water Company	Groundwater	WS	Moderate	2050	0.10
Bull Swamp Rural Water Company	Groundwater	WS	Moderate	2060	0.10
Bull Swamp Rural Water Company	Groundwater	WS	Moderate	2070	0.10
Bull Swamp Rural Water Company	Groundwater	WS	Moderate	2025	0.10
Bull Swamp Rural Water Company	Groundwater	WS	Moderate	2030	0.09
Bull Swamp Rural Water Company	Groundwater	WS	Moderate	2035	0.09
Bull Swamp Rural Water Company	Groundwater	WS	Moderate	2040	0.09
Bull Swamp Rural Water Company	Groundwater	WS	Moderate	2050	0.09
Bull Swamp Rural Water Company	Groundwater	WS	Moderate	2060	0.09

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Bull Swamp Rural Water Company	Groundwater	WS	Moderate	2070	0.09
Charleston	Surface Water	WS	Moderate	2025	53.3
Charleston	Surface Water	WS	Moderate	2030	58.2
Charleston	Surface Water	WS	Moderate	2035	63.1
Charleston	Surface Water	WS	Moderate	2040	68.0
Charleston	Surface Water	WS	Moderate	2050	77.7
Charleston	Surface Water	WS	Moderate	2060	87.3
Charleston	Surface Water	WS	Moderate	2070	97.0
City of Aiken	Groundwater	WS	Moderate	2025	1.43
City of Aiken	Groundwater	WS	Moderate	2030	1.47
City of Aiken	Groundwater	WS	Moderate	2035	1.50
City of Aiken	Groundwater	WS	Moderate	2040	1.54
City of Aiken	Groundwater	WS	Moderate	2050	1.61
City of Aiken	Groundwater	WS	Moderate	2060	1.69
City of Aiken	Groundwater	WS	Moderate	2070	1.76
City of Aiken	Surface Water	WS	Moderate	2025	6.74
City of Aiken	Surface Water	WS	Moderate	2030	6.92
City of Aiken	Surface Water	WS	Moderate	2035	7.05
City of Aiken	Surface Water	WS	Moderate	2040	7.23
City of Aiken	Surface Water	WS	Moderate	2050	7.58
City of Aiken	Surface Water	WS	Moderate	2060	7.93
City of Aiken	Surface Water	WS	Moderate	2070	8.28
City of Denmark Water System	Groundwater	WS	Moderate	2025	0.17
City of Denmark Water System	Groundwater	WS	Moderate	2030	0.16
City of Denmark Water System	Groundwater	WS	Moderate	2035	0.15
City of Denmark Water System	Groundwater	WS	Moderate	2040	0.15
City of Denmark Water System	Groundwater	WS	Moderate	2050	0.15
City of Denmark Water System	Groundwater	WS	Moderate	2060	0.15
City of Denmark Water System	Groundwater	WS	Moderate	2070	0.15
City of Orangeburg	Surface Water	WS	Moderate	2025	7.80

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
City of Orangeburg	Surface Water	WS	Moderate	2030	7.48
City of Orangeburg	Surface Water	WS	Moderate	2035	7.11
City of Orangeburg	Surface Water	WS	Moderate	2040	7.12
City of Orangeburg	Surface Water	WS	Moderate	2050	7.12
City of Orangeburg	Surface Water	WS	Moderate	2060	7.12
City of Orangeburg	Surface Water	WS	Moderate	2070	7.13
DCWA/Conoflow	Groundwater	WS	Moderate	2025	0.01
DCWA/Conoflow	Groundwater	WS	Moderate	2030	0.01
DCWA/Conoflow	Groundwater	WS	Moderate	2035	0.01
DCWA/Conoflow	Groundwater	WS	Moderate	2040	0.01
DCWA/Conoflow	Groundwater	WS	Moderate	2050	0.02
DCWA/Conoflow	Groundwater	WS	Moderate	2060	0.02
DCWA/Conoflow	Groundwater	WS	Moderate	2070	0.02
DCWA/Reevesville	Groundwater	WS	Moderate	2025	0.02
DCWA/Reevesville	Groundwater	WS	Moderate	2030	0.02
DCWA/Reevesville	Groundwater	WS	Moderate	2035	0.03
DCWA/Reevesville	Groundwater	WS	Moderate	2040	0.03
DCWA/Reevesville	Groundwater	WS	Moderate	2050	0.03
DCWA/Reevesville	Groundwater	WS	Moderate	2060	0.04
DCWA/Reevesville	Groundwater	WS	Moderate	2070	0.04
Gaston Rural Community Water District	Groundwater	WS	Moderate	2025	0.17
Gaston Rural Community Water District	Groundwater	WS	Moderate	2030	0.18
Gaston Rural Community Water District	Groundwater	WS	Moderate	2035	0.19
Gaston Rural Community Water District	Groundwater	WS	Moderate	2040	0.20
Gaston Rural Community Water District	Groundwater	WS	Moderate	2050	0.22
Gaston Rural Community Water District	Groundwater	WS	Moderate	2060	0.24

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Gaston Rural Community Water District	Groundwater	WS	Moderate	2070	0.26
Giant Cement Company/ Harleyville Plant	Groundwater	WS	Moderate	2025	0.00
Giant Cement Company/ Harleyville Plant	Groundwater	WS	Moderate	2030	0.00
Giant Cement Company/ Harleyville Plant	Groundwater	WS	Moderate	2035	0.00
Giant Cement Company/ Harleyville Plant	Groundwater	WS	Moderate	2040	0.00
Giant Cement Company/ Harleyville Plant	Groundwater	WS	Moderate	2050	0.00
Giant Cement Company/ Harleyville Plant	Groundwater	WS	Moderate	2060	0.00
Giant Cement Company/ Harleyville Plant	Groundwater	WS	Moderate	2070	0.01
Gilbert-Summit Rural Water District	Groundwater	WS	Moderate	2025	0.68
Gilbert-Summit Rural Water District	Groundwater	WS	Moderate	2030	0.72
Gilbert-Summit Rural Water District	Groundwater	WS	Moderate	2035	0.76
Gilbert-Summit Rural Water District	Groundwater	WS	Moderate	2040	0.80
Gilbert-Summit Rural Water District	Groundwater	WS	Moderate	2050	0.89
Gilbert-Summit Rural Water District	Groundwater	WS	Moderate	2060	0.97
Gilbert-Summit Rural Water District	Groundwater	WS	Moderate	2070	1.05
Montmorenci-Couchton Water and Sewer District	Groundwater	WS	Moderate	2025	0.36
Montmorenci-Couchton Water and Sewer District	Groundwater	WS	Moderate	2030	0.37
Montmorenci-Couchton Water and Sewer District	Groundwater	WS	Moderate	2035	0.38

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Montmorenci-Couchton Water and Sewer District	Groundwater	WS	Moderate	2040	0.39
Montmorenci-Couchton Water and Sewer District	Groundwater	WS	Moderate	2050	0.41
Montmorenci-Couchton Water and Sewer District	Groundwater	WS	Moderate	2060	0.43
Montmorenci-Couchton Water and Sewer District	Groundwater	WS	Moderate	2070	0.44
New Holland W/D	Groundwater	WS	Moderate	2025	0.05
New Holland W/D	Groundwater	WS	Moderate	2030	0.06
New Holland W/D	Groundwater	WS	Moderate	2035	0.06
New Holland W/D	Groundwater	WS	Moderate	2040	0.06
New Holland W/D	Groundwater	WS	Moderate	2050	0.07
New Holland W/D	Groundwater	WS	Moderate	2060	0.08
New Holland W/D	Groundwater	WS	Moderate	2070	0.08
Orangeburg Department of Public Utilities John F. Pearson Water Treatment Plant	Groundwater	WS	Moderate	2025	0.00
Orangeburg Department of Public Utilities John F. Pearson Water Treatment Plant	Groundwater	WS	Moderate	2030	0.00
Orangeburg Department of Public Utilities John F. Pearson Water Treatment Plant	Groundwater	WS	Moderate	2035	0.00
Orangeburg Department of Public Utilities John F. Pearson Water Treatment Plant	Groundwater	WS	Moderate	2040	0.00
Orangeburg Department of Public Utilities John F. Pearson Water Treatment Plant	Groundwater	WS	Moderate	2050	0.00
Orangeburg Department of Public Utilities John F. Pearson Water Treatment Plant	Groundwater	WS	Moderate	2060	0.00
Orangeburg Department of Public	Groundwater	WS	Moderate	2070	0.00

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Utilities John F. Pearson Water Treatment Plant					
SC Dept of Corrections Division of Facilities Management	Groundwater	WS	Moderate	2025	0.11
SC Dept of Corrections Division of Facilities Management	Groundwater	WS	Moderate	2030	0.11
SC Dept of Corrections Division of Facilities Management	Groundwater	WS	Moderate	2035	0.11
SC Dept of Corrections Division of Facilities Management	Groundwater	WS	Moderate	2040	0.11
SC Dept of Corrections Division of Facilities Management	Groundwater	WS	Moderate	2050	0.11
SC Dept of Corrections Division of Facilities Management	Groundwater	WS	Moderate	2060	0.11
SC Dept of Corrections Division of Facilities Management	Groundwater	WS	Moderate	2070	0.11
Silver Springs Water District Water System	Groundwater	WS	Moderate	2025	0.19
Silver Springs Water District Water System	Groundwater	WS	Moderate	2030	0.18
Silver Springs Water District Water System	Groundwater	WS	Moderate	2035	0.17
Silver Springs Water District Water System	Groundwater	WS	Moderate	2040	0.17
Silver Springs Water District Water System	Groundwater	WS	Moderate	2050	0.17
Silver Springs Water District Water System	Groundwater	WS	Moderate	2060	0.17
Silver Springs Water District Water System	Groundwater	WS	Moderate	2070	0.17
St. George Water Department	Groundwater	WS	Moderate	2025	0.39
St. George Water Department	Groundwater	WS	Moderate	2030	0.42
St. George Water Department	Groundwater	WS	Moderate	2035	0.46
St. George Water Department	Groundwater	WS	Moderate	2040	0.50
St. George Water Department	Groundwater	WS	Moderate	2050	0.57
St. George Water Department	Groundwater	WS	Moderate	2060	0.64

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
St. George Water Department	Groundwater	WS	Moderate	2070	0.72
Town of Blackville	Groundwater	WS	Moderate	2025	0.30
Town of Blackville	Groundwater	WS	Moderate	2030	0.29
Town of Blackville	Groundwater	WS	Moderate	2035	0.28
Town of Blackville	Groundwater	WS	Moderate	2040	0.28
Town of Blackville	Groundwater	WS	Moderate	2050	0.28
Town of Blackville	Groundwater	WS	Moderate	2060	0.28
Town of Blackville	Groundwater	WS	Moderate	2070	0.28
Town of Bowman	Groundwater	WS	Moderate	2025	0.000012
Town of Bowman	Groundwater	WS	Moderate	2030	0.000011
Town of Bowman	Groundwater	WS	Moderate	2035	0.000011
Town of Bowman	Groundwater	WS	Moderate	2040	0.000011
Town of Bowman	Groundwater	WS	Moderate	2050	0.000011
Town of Bowman	Groundwater	WS	Moderate	2060	0.000011
Town of Bowman	Groundwater	WS	Moderate	2070	0.000011
Town of Branchville	Groundwater	WS	Moderate	2025	0.16
Town of Branchville	Groundwater	WS	Moderate	2030	0.15
Town of Branchville	Groundwater	WS	Moderate	2035	0.14
Town of Branchville	Groundwater	WS	Moderate	2040	0.14
Town of Branchville	Groundwater	WS	Moderate	2050	0.14
Town of Branchville	Groundwater	WS	Moderate	2060	0.14
Town of Branchville	Groundwater	WS	Moderate	2070	0.14
Town of Edisto Beach	Groundwater	WS	Moderate	2025	0.42
Town of Edisto Beach	Groundwater	WS	Moderate	2030	0.40
Town of Edisto Beach	Groundwater	WS	Moderate	2035	0.37
Town of Edisto Beach	Groundwater	WS	Moderate	2040	0.37
Town of Edisto Beach	Groundwater	WS	Moderate	2050	0.37
Town of Edisto Beach	Groundwater	WS	Moderate	2060	0.37
Town of Edisto Beach	Groundwater	WS	Moderate	2070	0.37
Town of Eutawville	Groundwater	WS	Moderate	2025	0.002
Town of Eutawville	Groundwater	WS	Moderate	2030	0.002
Town of Eutawville	Groundwater	WS	Moderate	2035	0.002
Town of Eutawville	Groundwater	WS	Moderate	2040	0.002

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Town of Eutawville	Groundwater	WS	Moderate	2050	0.002
Town of Eutawville	Groundwater	WS	Moderate	2060	0.002
Town of Eutawville	Groundwater	WS	Moderate	2070	0.002
Town of Harleyville	Groundwater	WS	Moderate	2025	0.09
Town of Harleyville	Groundwater	WS	Moderate	2030	0.10
Town of Harleyville	Groundwater	WS	Moderate	2035	0.11
Town of Harleyville	Groundwater	WS	Moderate	2040	0.12
Town of Harleyville	Groundwater	WS	Moderate	2050	0.13
Town of Harleyville	Groundwater	WS	Moderate	2060	0.15
Town of Harleyville	Groundwater	WS	Moderate	2070	0.17
Town of Holly Hill	Groundwater	WS	Moderate	2025	0.16
Town of Holly Hill	Groundwater	WS	Moderate	2030	0.16
Town of Holly Hill	Groundwater	WS	Moderate	2035	0.15
Town of Holly Hill	Groundwater	WS	Moderate	2040	0.15
Town of Holly Hill	Groundwater	WS	Moderate	2050	0.15
Town of Holly Hill	Groundwater	WS	Moderate	2060	0.15
Town of Holly Hill	Groundwater	WS	Moderate	2070	0.15
Town of Monetta	Groundwater	WS	Moderate	2025	0.07
Town of Monetta	Groundwater	WS	Moderate	2030	0.07
Town of Monetta	Groundwater	WS	Moderate	2035	0.07
Town of Monetta	Groundwater	WS	Moderate	2040	0.08
Town of Monetta	Groundwater	WS	Moderate	2050	0.08
Town of Monetta	Groundwater	WS	Moderate	2060	0.09
Town of Monetta	Groundwater	WS	Moderate	2070	0.10
Town of North	Groundwater	WS	Moderate	2025	0.13
Town of North	Groundwater	WS	Moderate	2030	0.12
Town of North	Groundwater	WS	Moderate	2035	0.12
Town of North	Groundwater	WS	Moderate	2040	0.12
Town of North	Groundwater	WS	Moderate	2050	0.12
Town of North	Groundwater	WS	Moderate	2060	0.12
Town of North	Groundwater	WS	Moderate	2070	0.12
Town of Perry	Groundwater	WS	Moderate	2025	0.07
Town of Perry	Groundwater	WS	Moderate	2030	0.07

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Town of Perry	Groundwater	WS	Moderate	2035	0.07
Town of Perry	Groundwater	WS	Moderate	2040	0.07
Town of Perry	Groundwater	WS	Moderate	2050	0.08
Town of Perry	Groundwater	WS	Moderate	2060	0.08
Town of Perry	Groundwater	WS	Moderate	2070	0.08
Town of Ridge Spring	Groundwater	WS	Moderate	2025	0.02
Town of Ridge Spring	Groundwater	WS	Moderate	2030	0.02
Town of Ridge Spring	Groundwater	WS	Moderate	2035	0.02
Town of Ridge Spring	Groundwater	WS	Moderate	2040	0.02
Town of Ridge Spring	Groundwater	WS	Moderate	2050	0.03
Town of Ridge Spring	Groundwater	WS	Moderate	2060	0.03
Town of Ridge Spring	Groundwater	WS	Moderate	2070	0.03
Town of Salley	Groundwater	WS	Moderate	2025	0.03
Town of Salley	Groundwater	WS	Moderate	2030	0.03
Town of Salley	Groundwater	WS	Moderate	2035	0.03
Town of Salley	Groundwater	WS	Moderate	2040	0.03
Town of Salley	Groundwater	WS	Moderate	2050	0.03
Town of Salley	Groundwater	WS	Moderate	2060	0.03
Town of Salley	Groundwater	WS	Moderate	2070	0.03
Town of Springfield	Groundwater	WS	Moderate	2025	0.05
Town of Springfield	Groundwater	WS	Moderate	2030	0.05
Town of Springfield	Groundwater	WS	Moderate	2035	0.05
Town of Springfield	Groundwater	WS	Moderate	2040	0.05
Town of Springfield	Groundwater	WS	Moderate	2050	0.05
Town of Springfield	Groundwater	WS	Moderate	2060	0.05
Town of Springfield	Groundwater	WS	Moderate	2070	0.05
Town of Wagener	Groundwater	WS	Moderate	2025	0.09
Town of Wagener	Groundwater	WS	Moderate	2030	0.09
Town of Wagener	Groundwater	WS	Moderate	2035	0.09
Town of Wagener	Groundwater	WS	Moderate	2040	0.10
Town of Wagener	Groundwater	WS	Moderate	2050	0.10
Town of Wagener	Groundwater	WS	Moderate	2060	0.10
Town of Wagener	Groundwater	WS	Moderate	2070	0.11

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Town of Williston	Groundwater	WS	Moderate	2025	0.00
Town of Williston	Groundwater	WS	Moderate	2030	0.00
Town of Williston	Groundwater	WS	Moderate	2035	0.00
Town of Williston	Groundwater	WS	Moderate	2040	0.00
Town of Williston	Groundwater	WS	Moderate	2050	0.00
Town of Williston	Groundwater	WS	Moderate	2060	0.00
Town of Williston	Groundwater	WS	Moderate	2070	0.00
Agriculture Total	Groundwater	AG	High Demand	2025	57.4
Agriculture Total	Groundwater	AG	High Demand	2030	59.5
Agriculture Total	Groundwater	AG	High Demand	2035	61.8
Agriculture Total	Groundwater	AG	High Demand	2040	64.0
Agriculture Total	Groundwater	AG	High Demand	2050	68.9
Agriculture Total	Groundwater	AG	High Demand	2060	74.1
Agriculture Total	Groundwater	AG	High Demand	2070	79.7
Agriculture Total	Surface Water	AG	High Demand	2025	24.6
Agriculture Total	Surface Water	AG	High Demand	2030	25.5
Agriculture Total	Surface Water	AG	High Demand	2035	26.4
Agriculture Total	Surface Water	AG	High Demand	2040	27.4
Agriculture Total	Surface Water	AG	High Demand	2050	29.5
Agriculture Total	Surface Water	AG	High Demand	2060	31.7
Agriculture Total	Surface Water	AG	High Demand	2070	34.1
Indian Trail	Surface Water	GC	High Demand	2025	0.06
Indian Trail	Surface Water	GC	High Demand	2030	0.06
Indian Trail	Surface Water	GC	High Demand	2035	0.06
Indian Trail	Surface Water	GC	High Demand	2040	0.06
Indian Trail	Surface Water	GC	High Demand	2050	0.06

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Indian Trail	Surface Water	GC	High Demand	2060	0.06
Indian Trail	Surface Water	GC	High Demand	2070	0.06
Orangeburg Country Club	Groundwater	GC	High Demand	2025	0.18
Orangeburg Country Club	Groundwater	GC	High Demand	2030	0.18
Orangeburg Country Club	Groundwater	GC	High Demand	2035	0.18
Orangeburg Country Club	Groundwater	GC	High Demand	2040	0.18
Orangeburg Country Club	Groundwater	GC	High Demand	2050	0.18
Orangeburg Country Club	Groundwater	GC	High Demand	2060	0.18
Orangeburg Country Club	Groundwater	GC	High Demand	2070	0.18
Plantation Course at Edisto, LLC	Groundwater	GC	High Demand	2025	0.02
Plantation Course at Edisto, LLC	Groundwater	GC	High Demand	2030	0.02
Plantation Course at Edisto, LLC	Groundwater	GC	High Demand	2035	0.02
Plantation Course at Edisto, LLC	Groundwater	GC	High Demand	2040	0.02
Plantation Course at Edisto, LLC	Groundwater	GC	High Demand	2050	0.02
Plantation Course at Edisto, LLC	Groundwater	GC	High Demand	2060	0.02
Plantation Course at Edisto, LLC	Groundwater	GC	High Demand	2070	0.02
ARGOS Cement LLC/Harleyville Plant	Groundwater	IN	High Demand	2025	0.44
ARGOS Cement LLC/Harleyville Plant	Groundwater	IN	High Demand	2030	0.48
ARGOS Cement LLC/Harleyville Plant	Groundwater	IN	High Demand	2035	0.51
ARGOS Cement LLC/Harleyville Plant	Groundwater	IN	High Demand	2040	0.56
ARGOS Cement LLC/Harleyville Plant	Groundwater	IN	High Demand	2050	0.65
ARGOS Cement LLC/Harleyville Plant	Groundwater	IN	High Demand	2060	0.77
ARGOS Cement LLC/Harleyville Plant	Groundwater	IN	High Demand	2070	0.92

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
ASCO Groundwater Extraction and Treatment System	Groundwater	IN	High Demand	2025	0.13
ASCO Groundwater Extraction and Treatment System	Groundwater	IN	High Demand	2030	0.14
ASCO Groundwater Extraction and Treatment System	Groundwater	IN	High Demand	2035	0.16
ASCO Groundwater Extraction and Treatment System	Groundwater	IN	High Demand	2040	0.18
ASCO Groundwater Extraction and Treatment System	Groundwater	IN	High Demand	2050	0.22
ASCO Groundwater Extraction and Treatment System	Groundwater	IN	High Demand	2060	0.26
ASCO Groundwater Extraction and Treatment System	Groundwater	IN	High Demand	2070	0.32
Carolina Chips, Inc.	Groundwater	IN	High Demand	2025	0.12
Carolina Chips, Inc.	Groundwater	IN	High Demand	2030	0.14
Carolina Chips, Inc.	Groundwater	IN	High Demand	2035	0.16
Carolina Chips, Inc.	Groundwater	IN	High Demand	2040	0.18
Carolina Chips, Inc.	Groundwater	IN	High Demand	2050	0.22
Carolina Chips, Inc.	Groundwater	IN	High Demand	2060	0.28
Carolina Chips, Inc.	Groundwater	IN	High Demand	2070	0.35
Giant Cement Company/ Harleyville Plant	Groundwater	IN	High Demand	2025	0.80
Giant Cement Company/ Harleyville Plant	Groundwater	IN	High Demand	2030	0.86
Giant Cement Company/ Harleyville Plant	Groundwater	IN	High Demand	2035	0.93
Giant Cement Company/ Harleyville Plant	Groundwater	IN	High Demand	2040	1.01

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Giant Cement Company/ Harleyville Plant	Groundwater	IN	High Demand	2050	1.18
Giant Cement Company/ Harleyville Plant	Groundwater	IN	High Demand	2060	1.40
Giant Cement Company/ Harleyville Plant	Groundwater	IN	High Demand	2070	1.67
Holcim (US) Inc.	Groundwater	IN	High Demand	2025	1.41
Holcim (US) Inc.	Groundwater	IN	High Demand	2030	1.50
Holcim (US) Inc.	Groundwater	IN	High Demand	2035	1.61
Holcim (US) Inc.	Groundwater	IN	High Demand	2040	1.73
Holcim (US) Inc.	Groundwater	IN	High Demand	2050	2.02
Holcim (US) Inc.	Groundwater	IN	High Demand	2060	2.36
Holcim (US) Inc.	Groundwater	IN	High Demand	2070	2.78
Showa Denko Inc.	Groundwater	IN	High Demand	2025	0.35
Showa Denko Inc.	Groundwater	IN	High Demand	2030	0.37
Showa Denko Inc.	Groundwater	IN	High Demand	2035	0.39
Showa Denko Inc.	Groundwater	IN	High Demand	2040	0.41
Showa Denko Inc.	Groundwater	IN	High Demand	2050	0.47
Showa Denko Inc.	Groundwater	IN	High Demand	2060	0.55
Showa Denko Inc.	Groundwater	IN	High Demand	2070	0.64
SI Group	Surface Water	IN	High Demand	2025	0.41
SI Group	Surface Water	IN	High Demand	2030	0.42
SI Group	Surface Water	IN	High Demand	2035	0.43
SI Group	Surface Water	IN	High Demand	2040	0.44
SI Group	Surface Water	IN	High Demand	2050	0.47

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
SI Group	Surface Water	IN	High Demand	2060	0.51
SI Group	Surface Water	IN	High Demand	2070	0.55
Dominion Energy Cope Electric Generating Station	Surface Water	PT	High Demand	2025	5.63
Dominion Energy Cope Electric Generating Station	Surface Water	PT	High Demand	2030	6.03
Dominion Energy Cope Electric Generating Station	Surface Water	PT	High Demand	2035	6.57
Dominion Energy Cope Electric Generating Station	Surface Water	PT	High Demand	2040	7.10
Dominion Energy Cope Electric Generating Station	Surface Water	PT	High Demand	2050	8.16
Dominion Energy Cope Electric Generating Station	Surface Water	PT	High Demand	2060	9.22
Dominion Energy Cope Electric Generating Station	Surface Water	PT	High Demand	2070	10.3
Dorchester Biomass, LLC	Groundwater	PT	High Demand	2025	0.39
Dorchester Biomass, LLC	Groundwater	PT	High Demand	2030	0.42
Dorchester Biomass, LLC	Groundwater	PT	High Demand	2035	0.46
Dorchester Biomass, LLC	Groundwater	PT	High Demand	2040	0.51
Dorchester Biomass, LLC	Groundwater	PT	High Demand	2050	0.60
Dorchester Biomass, LLC	Groundwater	PT	High Demand	2060	0.68
Dorchester Biomass, LLC	Groundwater	PT	High Demand	2070	0.77
Batesburg-Leesville	Surface Water	WS	High Demand	2025	2.59
Batesburg-Leesville	Surface Water	WS	High Demand	2030	2.69
Batesburg-Leesville	Surface Water	WS	High Demand	2035	2.80
Batesburg-Leesville	Surface Water	WS	High Demand	2040	2.91
Batesburg-Leesville	Surface Water	WS	High Demand	2050	3.17

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Batesburg-Leesville	Surface Water	WS	High Demand	2060	3.45
Batesburg-Leesville	Surface Water	WS	High Demand	2070	3.77
Berkeley County Water and Sanitation	Groundwater	WS	High Demand	2025	0.01
Berkeley County Water and Sanitation	Groundwater	WS	High Demand	2030	0.01
Berkeley County Water and Sanitation	Groundwater	WS	High Demand	2035	0.01
Berkeley County Water and Sanitation	Groundwater	WS	High Demand	2040	0.01
Berkeley County Water and Sanitation	Groundwater	WS	High Demand	2050	0.01
Berkeley County Water and Sanitation	Groundwater	WS	High Demand	2060	0.01
Berkeley County Water and Sanitation	Groundwater	WS	High Demand	2070	0.01
Bull Swamp Rural Water Company	Groundwater	WS	High Demand	2025	0.12
Bull Swamp Rural Water Company	Groundwater	WS	High Demand	2030	0.12
Bull Swamp Rural Water Company	Groundwater	WS	High Demand	2035	0.13
Bull Swamp Rural Water Company	Groundwater	WS	High Demand	2040	0.13
Bull Swamp Rural Water Company	Groundwater	WS	High Demand	2050	0.15
Bull Swamp Rural Water Company	Groundwater	WS	High Demand	2060	0.16
Bull Swamp Rural Water Company	Groundwater	WS	High Demand	2070	0.17
Bull Swamp Rural Water Company	Groundwater	WS	High Demand	2025	0.11
Bull Swamp Rural Water Company	Groundwater	WS	High Demand	2030	0.11
Bull Swamp Rural Water Company	Groundwater	WS	High Demand	2035	0.12
Bull Swamp Rural Water Company	Groundwater	WS	High Demand	2040	0.12
Bull Swamp Rural Water Company	Groundwater	WS	High Demand	2050	0.13
Bull Swamp Rural Water Company	Groundwater	WS	High Demand	2060	0.14
Bull Swamp Rural Water Company	Groundwater	WS	High Demand	2070	0.16
Charleston	Surface Water	WS	High Demand	2025	58.2

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Charleston	Surface Water	WS	High Demand	2030	63.6
Charleston	Surface Water	WS	High Demand	2035	69.5
Charleston	Surface Water	WS	High Demand	2040	76.1
Charleston	Surface Water	WS	High Demand	2050	91.5
Charleston	Surface Water	WS	High Demand	2060	110.3
Charleston	Surface Water	WS	High Demand	2070	133.5
City of Aiken	Groundwater	WS	High Demand	2025	1.45
City of Aiken	Groundwater	WS	High Demand	2030	1.51
City of Aiken	Groundwater	WS	High Demand	2035	1.58
City of Aiken	Groundwater	WS	High Demand	2040	1.66
City of Aiken	Groundwater	WS	High Demand	2050	1.81
City of Aiken	Groundwater	WS	High Demand	2060	1.98
City of Aiken	Groundwater	WS	High Demand	2070	2.16
City of Aiken	Surface Water	WS	High Demand	2025	7.65
City of Aiken	Surface Water	WS	High Demand	2030	7.96
City of Aiken	Surface Water	WS	High Demand	2035	8.28
City of Aiken	Surface Water	WS	High Demand	2040	8.62
City of Aiken	Surface Water	WS	High Demand	2050	9.34
City of Aiken	Surface Water	WS	High Demand	2060	10.1
City of Aiken	Surface Water	WS	High Demand	2070	11.0
City of Denmark Water System	Groundwater	WS	High Demand	2025	0.19
City of Denmark Water System	Groundwater	WS	High Demand	2030	0.20
City of Denmark Water System	Groundwater	WS	High Demand	2035	0.20
City of Denmark Water System	Groundwater	WS	High Demand	2040	0.21

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
City of Denmark Water System	Groundwater	WS	High Demand	2050	0.23
City of Denmark Water System	Groundwater	WS	High Demand	2060	0.25
City of Denmark Water System	Groundwater	WS	High Demand	2070	0.28
City of Orangeburg	Surface Water	WS	High Demand	2025	9.4
City of Orangeburg	Surface Water	WS	High Demand	2030	9.8
City of Orangeburg	Surface Water	WS	High Demand	2035	10.2
City of Orangeburg	Surface Water	WS	High Demand	2040	10.6
City of Orangeburg	Surface Water	WS	High Demand	2050	11.5
City of Orangeburg	Surface Water	WS	High Demand	2060	12.5
City of Orangeburg	Surface Water	WS	High Demand	2070	13.6
DCWA/Conoflow	Groundwater	WS	High Demand	2025	0.01
DCWA/Conoflow	Groundwater	WS	High Demand	2030	0.01
DCWA/Conoflow	Groundwater	WS	High Demand	2035	0.01
DCWA/Conoflow	Groundwater	WS	High Demand	2040	0.02
DCWA/Conoflow	Groundwater	WS	High Demand	2050	0.02
DCWA/Conoflow	Groundwater	WS	High Demand	2060	0.02
DCWA/Conoflow	Groundwater	WS	High Demand	2070	0.03
DCWA/Reevesville	Groundwater	WS	High Demand	2025	0.02
DCWA/Reevesville	Groundwater	WS	High Demand	2030	0.02
DCWA/Reevesville	Groundwater	WS	High Demand	2035	0.03
DCWA/Reevesville	Groundwater	WS	High Demand	2040	0.03
DCWA/Reevesville	Groundwater	WS	High Demand	2050	0.04
DCWA/Reevesville	Groundwater	WS	High Demand	2060	0.04
DCWA/Reevesville	Groundwater	WS	High Demand	2070	0.06

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Gaston Rural Community Water District	Groundwater	WS	High Demand	2025	0.17
Gaston Rural Community Water District	Groundwater	WS	High Demand	2030	0.18
Gaston Rural Community Water District	Groundwater	WS	High Demand	2035	0.19
Gaston Rural Community Water District	Groundwater	WS	High Demand	2040	0.20
Gaston Rural Community Water District	Groundwater	WS	High Demand	2050	0.23
Gaston Rural Community Water District	Groundwater	WS	High Demand	2060	0.26
Gaston Rural Community Water District	Groundwater	WS	High Demand	2070	0.30
Giant Cement Company/ Harleyville Plant	Groundwater	WS	High Demand	2025	0.003
Giant Cement Company/ Harleyville Plant	Groundwater	WS	High Demand	2030	0.003
Giant Cement Company/ Harleyville Plant	Groundwater	WS	High Demand	2035	0.004
Giant Cement Company/ Harleyville Plant	Groundwater	WS	High Demand	2040	0.004
Giant Cement Company/ Harleyville Plant	Groundwater	WS	High Demand	2050	0.01
Giant Cement Company/ Harleyville Plant	Groundwater	WS	High Demand	2060	0.01
Giant Cement Company/ Harleyville Plant	Groundwater	WS	High Demand	2070	0.01
Gilbert-Summit Rural Water District	Groundwater	WS	High Demand	2025	0.68
Gilbert-Summit Rural Water District	Groundwater	WS	High Demand	2030	0.73
Gilbert-Summit Rural Water District	Groundwater	WS	High Demand	2035	0.78

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Gilbert-Summit Rural Water District	Groundwater	WS	High Demand	2040	0.83
Gilbert-Summit Rural Water District	Groundwater	WS	High Demand	2050	0.94
Gilbert-Summit Rural Water District	Groundwater	WS	High Demand	2060	1.08
Gilbert-Summit Rural Water District	Groundwater	WS	High Demand	2070	1.23
Montmorenci-Couchton Water and Sewer District	Groundwater	WS	High Demand	2025	0.37
Montmorenci-Couchton Water and Sewer District	Groundwater	WS	High Demand	2030	0.38
Montmorenci-Couchton Water and Sewer District	Groundwater	WS	High Demand	2035	0.40
Montmorenci-Couchton Water and Sewer District	Groundwater	WS	High Demand	2040	0.42
Montmorenci-Couchton Water and Sewer District	Groundwater	WS	High Demand	2050	0.46
Montmorenci-Couchton Water and Sewer District	Groundwater	WS	High Demand	2060	0.50
Montmorenci-Couchton Water and Sewer District	Groundwater	WS	High Demand	2070	0.54
New Holland W/D	Groundwater	WS	High Demand	2025	0.05
New Holland W/D	Groundwater	WS	High Demand	2030	0.06
New Holland W/D	Groundwater	WS	High Demand	2035	0.06
New Holland W/D	Groundwater	WS	High Demand	2040	0.07
New Holland W/D	Groundwater	WS	High Demand	2050	0.07
New Holland W/D	Groundwater	WS	High Demand	2060	0.09
New Holland W/D	Groundwater	WS	High Demand	2070	0.10
Orangeburg Department of Public Utilities John F. Pearson Water Treatment Plant	Groundwater	WS	High Demand	2025	0
Orangeburg Department of Public	Groundwater	WS	High Demand	2030	0

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Utilities John F. Pearson Water Treatment Plant					
Orangeburg Department of Public Utilities John F. Pearson Water Treatment Plant	Groundwater	WS	High Demand	2035	0
Orangeburg Department of Public Utilities John F. Pearson Water Treatment Plant	Groundwater	WS	High Demand	2040	0
Orangeburg Department of Public Utilities John F. Pearson Water Treatment Plant	Groundwater	WS	High Demand	2050	0
Orangeburg Department of Public Utilities John F. Pearson Water Treatment Plant	Groundwater	WS	High Demand	2060	0
Orangeburg Department of Public Utilities John F. Pearson Water Treatment Plant	Groundwater	WS	High Demand	2070	0
SC Dept of Corrections Division of Facilities Management	Groundwater	WS	High Demand	2025	0.11
SC Dept of Corrections Division of Facilities Management	Groundwater	WS	High Demand	2030	0.11
SC Dept of Corrections Division of Facilities Management	Groundwater	WS	High Demand	2035	0.11
SC Dept of Corrections Division of Facilities Management	Groundwater	WS	High Demand	2040	0.11
SC Dept of Corrections Division of Facilities Management	Groundwater	WS	High Demand	2050	0.11
SC Dept of Corrections Division of Facilities Management	Groundwater	WS	High Demand	2060	0.11
SC Dept of Corrections Division of Facilities Management	Groundwater	WS	High Demand	2070	0.11
Silver Springs Water District Water System	Groundwater	WS	High Demand	2025	0.21
Silver Springs Water District Water System	Groundwater	WS	High Demand	2030	0.22
Silver Springs Water District Water System	Groundwater	WS	High Demand	2035	0.23

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Silver Springs Water District Water System	Groundwater	WS	High Demand	2040	0.24
Silver Springs Water District Water System	Groundwater	WS	High Demand	2050	0.26
Silver Springs Water District Water System	Groundwater	WS	High Demand	2060	0.28
Silver Springs Water District Water System	Groundwater	WS	High Demand	2070	0.31
St. George Water Department	Groundwater	WS	High Demand	2025	0.39
St. George Water Department	Groundwater	WS	High Demand	2030	0.43
St. George Water Department	Groundwater	WS	High Demand	2035	0.47
St. George Water Department	Groundwater	WS	High Demand	2040	0.52
St. George Water Department	Groundwater	WS	High Demand	2050	0.64
St. George Water Department	Groundwater	WS	High Demand	2060	0.78
St. George Water Department	Groundwater	WS	High Demand	2070	0.95
Town of Blackville	Groundwater	WS	High Demand	2025	0.33
Town of Blackville	Groundwater	WS	High Demand	2030	0.34
Town of Blackville	Groundwater	WS	High Demand	2035	0.36
Town of Blackville	Groundwater	WS	High Demand	2040	0.37
Town of Blackville	Groundwater	WS	High Demand	2050	0.41
Town of Blackville	Groundwater	WS	High Demand	2060	0.45
Town of Blackville	Groundwater	WS	High Demand	2070	0.49
Town of Bowman	Groundwater	WS	High Demand	2025	0.00001
Town of Bowman	Groundwater	WS	High Demand	2030	0.00001
Town of Bowman	Groundwater	WS	High Demand	2035	0.00001
Town of Bowman	Groundwater	WS	High Demand	2040	0.00001
Town of Bowman	Groundwater	WS	High Demand	2050	0.00002
Town of Bowman	Groundwater	WS	High Demand	2060	0.00002

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Town of Bowman	Groundwater	WS	High Demand	2070	0.00002
Town of Branchville	Groundwater	WS	High Demand	2025	0.17
Town of Branchville	Groundwater	WS	High Demand	2030	0.18
Town of Branchville	Groundwater	WS	High Demand	2035	0.18
Town of Branchville	Groundwater	WS	High Demand	2040	0.19
Town of Branchville	Groundwater	WS	High Demand	2050	0.21
Town of Branchville	Groundwater	WS	High Demand	2060	0.23
Town of Branchville	Groundwater	WS	High Demand	2070	0.25
Town of Edisto Beach	Groundwater	WS	High Demand	2025	0.46
Town of Edisto Beach	Groundwater	WS	High Demand	2030	0.48
Town of Edisto Beach	Groundwater	WS	High Demand	2035	0.50
Town of Edisto Beach	Groundwater	WS	High Demand	2040	0.52
Town of Edisto Beach	Groundwater	WS	High Demand	2050	0.57
Town of Edisto Beach	Groundwater	WS	High Demand	2060	0.63
Town of Edisto Beach	Groundwater	WS	High Demand	2070	0.68
Town of Eutawville	Groundwater	WS	High Demand	2025	0.002
Town of Eutawville	Groundwater	WS	High Demand	2030	0.002
Town of Eutawville	Groundwater	WS	High Demand	2035	0.002
Town of Eutawville	Groundwater	WS	High Demand	2040	0.002
Town of Eutawville	Groundwater	WS	High Demand	2050	0.002
Town of Eutawville	Groundwater	WS	High Demand	2060	0.003
Town of Eutawville	Groundwater	WS	High Demand	2070	0.003
Town of Harleyville	Groundwater	WS	High Demand	2025	0.09
Town of Harleyville	Groundwater	WS	High Demand	2030	0.10

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Town of Harleyville	Groundwater	WS	High Demand	2035	0.11
Town of Harleyville	Groundwater	WS	High Demand	2040	0.12
Town of Harleyville	Groundwater	WS	High Demand	2050	0.15
Town of Harleyville	Groundwater	WS	High Demand	2060	0.18
Town of Harleyville	Groundwater	WS	High Demand	2070	0.22
Town of Holly Hill	Groundwater	WS	High Demand	2025	0.18
Town of Holly Hill	Groundwater	WS	High Demand	2030	0.19
Town of Holly Hill	Groundwater	WS	High Demand	2035	0.20
Town of Holly Hill	Groundwater	WS	High Demand	2040	0.20
Town of Holly Hill	Groundwater	WS	High Demand	2050	0.22
Town of Holly Hill	Groundwater	WS	High Demand	2060	0.24
Town of Holly Hill	Groundwater	WS	High Demand	2070	0.27
Town of Monetta	Groundwater	WS	High Demand	2025	0.07
Town of Monetta	Groundwater	WS	High Demand	2030	0.07
Town of Monetta	Groundwater	WS	High Demand	2035	0.08
Town of Monetta	Groundwater	WS	High Demand	2040	0.08
Town of Monetta	Groundwater	WS	High Demand	2050	0.09
Town of Monetta	Groundwater	WS	High Demand	2060	0.10
Town of Monetta	Groundwater	WS	High Demand	2070	0.12
Town of North	Groundwater	WS	High Demand	2025	0.14
Town of North	Groundwater	WS	High Demand	2030	0.15
Town of North	Groundwater	WS	High Demand	2035	0.15
Town of North	Groundwater	WS	High Demand	2040	0.16
Town of North	Groundwater	WS	High Demand	2050	0.17

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Town of North	Groundwater	WS	High Demand	2060	0.19
Town of North	Groundwater	WS	High Demand	2070	0.21
Town of Perry	Groundwater	WS	High Demand	2025	0.07
Town of Perry	Groundwater	WS	High Demand	2030	0.07
Town of Perry	Groundwater	WS	High Demand	2035	0.07
Town of Perry	Groundwater	WS	High Demand	2040	0.08
Town of Perry	Groundwater	WS	High Demand	2050	0.08
Town of Perry	Groundwater	WS	High Demand	2060	0.09
Town of Perry	Groundwater	WS	High Demand	2070	0.10
Town of Ridge Spring	Groundwater	WS	High Demand	2025	0.02
Town of Ridge Spring	Groundwater	WS	High Demand	2030	0.02
Town of Ridge Spring	Groundwater	WS	High Demand	2035	0.02
Town of Ridge Spring	Groundwater	WS	High Demand	2040	0.03
Town of Ridge Spring	Groundwater	WS	High Demand	2050	0.03
Town of Ridge Spring	Groundwater	WS	High Demand	2060	0.03
Town of Ridge Spring	Groundwater	WS	High Demand	2070	0.04
Town of Salley	Groundwater	WS	High Demand	2025	0.03
Town of Salley	Groundwater	WS	High Demand	2030	0.03
Town of Salley	Groundwater	WS	High Demand	2035	0.04
Town of Salley	Groundwater	WS	High Demand	2040	0.04
Town of Salley	Groundwater	WS	High Demand	2050	0.04
Town of Salley	Groundwater	WS	High Demand	2060	0.05
Town of Salley	Groundwater	WS	High Demand	2070	0.05
Town of Springfield	Groundwater	WS	High Demand	2025	0.06

Table B-3. Projected Water Demands by Water User.

User	Water Source	Use Category	Projection	Year	Demand (MGD)
Town of Springfield	Groundwater	WS	High Demand	2030	0.06
Town of Springfield	Groundwater	WS	High Demand	2035	0.06
Town of Springfield	Groundwater	WS	High Demand	2040	0.06
Town of Springfield	Groundwater	WS	High Demand	2050	0.07
Town of Springfield	Groundwater	WS	High Demand	2060	0.08
Town of Springfield	Groundwater	WS	High Demand	2070	0.08
Town of Wagener	Groundwater	WS	High Demand	2025	0.09
Town of Wagener	Groundwater	WS	High Demand	2030	0.09
Town of Wagener	Groundwater	WS	High Demand	2035	0.10
Town of Wagener	Groundwater	WS	High Demand	2040	0.10
Town of Wagener	Groundwater	WS	High Demand	2050	0.11
Town of Wagener	Groundwater	WS	High Demand	2060	0.12
Town of Wagener	Groundwater	WS	High Demand	2070	0.13
Town of Williston	Groundwater	WS	High Demand	2025	0
Town of Williston	Groundwater	WS	High Demand	2030	0
Town of Williston	Groundwater	WS	High Demand	2035	0
Town of Williston	Groundwater	WS	High Demand	2040	0
Town of Williston	Groundwater	WS	High Demand	2050	0
Town of Williston	Groundwater	WS	High Demand	2060	0
Town of Williston	Groundwater	WS	High Demand	2070	0

Appendix C

Moderate and High Demand Scenarios Surface Water Availability Results for 2030 and 2050 Planning Horizons

Table C-1. Identified Surface Water Shortages, Moderate 2030 Scenario.

Water User Name	Source Water	Average Annual Demand (MGD)	Minimum Physically Available Flow (MGD)	Maximum Shortage (MGD)	Frequency of Shortage (%)
IR: Titan - South Fork	Mainstem	1.53	3.43	0.07	0.1%
IR: Titan - Temples	Temples Creek	1.97	0.41	3.49	35.1%
IR: Titan - Bog	Bog Branch	1.78	0.22	3.66	38.8%
IR: Titan - Beech	Beech Creek	0.79	1.11	0.91	2.2%
IR: Titan - Mill	Mill Creek	0.66	0.71	0.61	3.3%
IR: Titan - Beaverdam	Beaverdam Branch	0.22	0.18	0.68	17.9%
IR: Shivers Trading	Sykes Swamp	0.23	0.15	0.35	19.1%
IR: Millwood	Limestone Creek	2.74	2.04	4.11	6.7%
IR: Gray	Cooper Swamp	0.12	0.50	0.21	25.0%
IR: Titan - Chinquapin	North Fork Edisto River	0.50	0.86	0.88	4.0%
IR: Cotton Lane	Goodbys Swamp	0.14	0.13	0.20	1.7%
IR: Shady Grove	Cow Castle Creek	0.44	0.02	0.59	46.2%

IR = agricultural (irrigation) water user

Table C-2. Surface water model simulation results at Strategic Nodes, Moderate 2030 Scenario.

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
EDO03 S. Fork Edisto Riv. nr Montmorenci	185	168	35	122	95	78
EDO14 S. Fork Edisto River ab. Springfield	362	325	57	231	174	136
HUC402 Outlet	445	396	66	271	200	157
EDO05 S. Fork Edisto River near Denmark	708	626	114	419	310	242
EDO06 S. Fork Edisto River near Cope	768	648	116	426	315	246
EDO07 S. Fork Edisto River near Bamberg	936	790	122	457	325	252
EDO11 Edisto River near Branchville	1875	1438	313	962	708	596
HUC601 Outlet	2006	1449	262	878	624	503
EDO13 Edisto River near Givhans	2510	1661	212	904	574	431
EDO01 McTier Creek near Monetta	24	18	2	12	8	6
EDO02 McTier Creek near New Holland	49	37	5	26	17	13
Shaw Creek Outlet	129	113	23	80	56	45
EDO04 Dean Swamp Creek near Salley	25	25	10	21	18	16
EDO09 Bull Swamp Creek below Swansea	10	9	2	7	5	5
EDO08 Cedar Creek near Thor	19	18	8	15	13	12
HUC301 Outlet	254	229	62	168	124	106
HUC302 Outlet	447	405	115	300	225	196
EDO10 N. Fork Edisto Riv. at Orangeburg	722	652	171	478	353	305
HUC303 Outlet	757	683	184	499	368	319
HUC602 Outlet	149	78	8	38	22	17
EDO12 Cow Castle Creek near Bowman	21	10	1	5	2	2
HUC501 Outlet	98	64	3	30	16	12
Four Hole Outlet	440	286	28	138	76	58

Table C-3. Percent change in Moderate 2030 Scenario flows at Strategic Nodes relative to Current Scenario flows.

Strategic Node	Mean Flow	Median Flow	Surface Water Supply	Percentile Flows		
				25th	10th	5th
EDO03 S. Fork Edisto Riv. nr Montmorenci	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
EDO14 S. Fork Edisto River ab. Springfield	-1.3%	-1.3%	-2.9%	-2.4%	-3.5%	-5.6%
HUC402 Outlet	-1.3%	-1.3%	-4.1%	-1.8%	-3.1%	-5.3%
EDO05 S. Fork Edisto River near Denmark	-0.8%	-0.7%	-2.4%	-2.1%	-2.2%	-4.0%
EDO06 S. Fork Edisto River near Cope	-0.8%	-0.9%	-2.4%	-2.1%	-2.3%	-3.9%
EDO07 S. Fork Edisto River near Bamberg	-1.3%	-1.3%	-2.3%	-3.2%	-4.1%	-6.6%
EDO11 Edisto River near Branchville	-0.8%	-1.0%	-1.5%	-1.8%	-2.3%	-2.9%
HUC601 Outlet	-0.8%	-1.3%	-1.8%	-2.3%	-2.7%	-3.6%
EDO13 Edisto River near Givhans	-3.2%	-5.1%	-2.2%	-9.0%	-12.8%	-17.0%
EDO01 McTier Creek near Monetta	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
EDO02 McTier Creek near New Holland	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Shaw Creek Outlet	-1.9%	-2.2%	0.0%	-3.3%	-4.5%	-5.6%
EDO04 Dean Swamp Creek near Salley	0.0%	0.1%	0.0%	0.1%	0.1%	0.1%
EDO09 Bull Swamp Creek below Swansea	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
EDO08 Cedar Creek near Thor	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
HUC301 Outlet	-0.3%	-0.1%	-0.5%	-0.7%	-0.9%	-0.8%
HUC302 Outlet	-0.2%	-0.1%	-0.3%	-0.3%	-0.6%	-0.2%
EDO10 N. Fork Edisto Riv. at Orangeburg	-0.2%	-0.1%	-0.2%	-0.2%	-0.3%	-0.3%
HUC303 Outlet	-0.3%	-0.2%	-0.7%	-0.6%	-1.2%	-1.0%
HUC602 Outlet	-1.7%	-3.1%	0.0%	-6.1%	-9.6%	-13.7%
EDO12 Cow Castle Creek near Bowman	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
HUC501 Outlet	-0.2%	-0.4%	-2.7%	-0.8%	-1.5%	-2.6%
Four Hole Outlet	-2.4%	-3.4%	-0.3%	-7.1%	-12.3%	-15.0%

Table C-4. Basin-wide surface water model simulation results, Moderate 2030 Scenario.

Performance Measure	Result
Total basin annual mean shortage (MGD)	1.54
Maximum water user shortage (MGD)	4.1
Total basin annual mean shortage (% of demand)	1.7%
Percentage of water users experiencing shortage	17.6%
Average frequency of shortage (%)	16.7%

Table C-5. Identified Surface Water Shortages, Moderate 2050 Scenario.

Water User Name	Source Water	Average Annual Demand (MGD)	Minimum Physically Available Flow (MGD)	Maximum Shortage (MGD)	Frequency of Shortage (%)
IR: Titan - South Fork	Mainstem	1.53	3.43	0.07	0.1%
IR: Titan - Temples	Temples Creek	1.97	0.41	3.49	35.1%
IR: Titan - Bog	Bog Branch	1.78	0.22	3.66	38.8%
IR: Titan - Beech	Beech Creek	0.79	1.11	0.91	2.2%
IR: Titan - Mill	Mill Creek	0.66	0.71	0.61	3.3%
IR: Titan - Beaverdam	Beaverdam Branch	0.22	0.18	0.68	17.9%
IR: Shivers Trading	Sykes Swamp	0.23	0.15	0.35	19.1%
IR: Millwood	Limestone Creek	2.74	2.04	4.11	6.7%
IR: Gray	Cooper Swamp	0.12	0.50	0.21	25.0%
IR: Titan - Chinquapin	North Fork Edisto River	0.50	0.86	0.88	4.0%
IR: Cotton Lane	Goodbys Swamp	0.14	0.13	0.20	1.7%
IR: Shady Grove	Cow Castle Creek	0.44	0.02	0.59	46.2%

IR = agricultural (irrigation) water user

Table C-6. Surface water model simulation results at Strategic Nodes, Moderate 2050 Scenario.

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
EDO03 S. Fork Edisto Riv. nr Montmorenci	185	168	35	122	95	78
EDO14 S. Fork Edisto River ab. Springfield	362	325	51	231	174	136
HUC402 Outlet	445	396	58	271	200	157
EDO05 S. Fork Edisto River near Denmark	708	626	105	419	310	242
EDO06 S. Fork Edisto River near Cope	768	648	107	426	315	246
EDO07 S. Fork Edisto River near Bamberg	936	790	114	457	325	252
EDO11 Edisto River near Branchville	1875	1438	299	962	708	596
HUC601 Outlet	2006	1449	248	878	624	503
EDO13 Edisto River near Givhans	2510	1661	133	904	574	431
EDO01 McTier Creek near Monetta	24	18	2	12	8	6
EDO02 McTier Creek near New Holland	49	37	5	26	17	13
Shaw Creek Outlet	129	113	21	80	56	45
EDO04 Dean Swamp Creek near Salley	25	25	10	21	18	16
EDO09 Bull Swamp Creek below Swansea	10	9	2	7	5	5
EDO08 Cedar Creek near Thor	19	18	8	15	13	12
HUC301 Outlet	254	229	60	168	124	106
HUC302 Outlet	447	405	114	300	225	196
EDO10 N. Fork Edisto Riv. at Orangeburg	722	652	169	478	353	305
HUC303 Outlet	757	683	179	499	368	319
HUC602 Outlet	149	78	6	38	22	17
EDO12 Cow Castle Creek near Bowman	21	10	1	5	2	2
HUC501 Outlet	98	64	3	30	16	12
Four Hole Outlet	440	286	18	138	76	58

Table C-7. Percent change in Moderate 2050 Scenario flows at Strategic Nodes relative to Current Scenario flows.

Strategic Node	Mean Flow	Median Flow	Surface Water Supply	Percentile Flows		
				25th	10th	5th
EDO03 S. Fork Edisto Riv. nr Montmorenci	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
EDO14 S. Fork Edisto River ab. Springfield	-1.3%	-1.3%	-13.9%	-2.4%	-3.5%	-5.6%
HUC402 Outlet	-1.3%	-1.3%	-17.0%	-1.8%	-3.1%	-5.3%
EDO05 S. Fork Edisto River near Denmark	-0.8%	-0.7%	-10.1%	-2.1%	-2.2%	-4.0%
EDO06 S. Fork Edisto River near Cope	-0.8%	-0.9%	-10.0%	-2.1%	-2.3%	-3.9%
EDO07 S. Fork Edisto River near Bamberg	-1.3%	-1.3%	-9.1%	-3.2%	-4.1%	-6.6%
EDO11 Edisto River near Branchville	-0.8%	-1.0%	-6.0%	-1.8%	-2.3%	-2.9%
HUC601 Outlet	-0.8%	-1.3%	-7.2%	-2.3%	-2.7%	-3.6%
EDO13 Edisto River near Givhans	-3.2%	-5.1%	-38.6%	-9.0%	-12.8%	-17.0%
EDO01 McTier Creek near Monetta	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
EDO02 McTier Creek near New Holland	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Shaw Creek Outlet	-1.9%	-2.2%	-11.5%	-3.3%	-4.5%	-5.6%
EDO04 Dean Swamp Creek near Salley	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%
EDO09 Bull Swamp Creek below Swansea	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
EDO08 Cedar Creek near Thor	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
HUC301 Outlet	-0.3%	-0.1%	-2.6%	-0.7%	-0.9%	-0.8%
HUC302 Outlet	-0.2%	-0.1%	-1.5%	-0.3%	-0.6%	-0.2%
EDO10 N. Fork Edisto Riv. at Orangeburg	-0.2%	-0.1%	-1.4%	-0.2%	-0.3%	-0.3%
HUC303 Outlet	-0.3%	-0.2%	-3.3%	-0.6%	-1.2%	-1.0%
HUC602 Outlet	-1.7%	-3.1%	-28.8%	-6.1%	-9.6%	-13.7%
EDO12 Cow Castle Creek near Bowman	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
HUC501 Outlet	-0.2%	-0.4%	-8.7%	-0.8%	-1.5%	-2.6%
Four Hole Outlet	-2.4%	-3.4%	-36.0%	-7.1%	-12.3%	-15.0%

Table C-8. Basin-wide surface water model simulation results, Moderate 2050 Scenario.

Performance Measure	Result
Total basin annual mean shortage (MGD)	1.54
Maximum water user shortage (MGD)	4.1
Total basin annual mean shortage (% of demand)	1.2%
Percentage of water users experiencing shortage	15.8%
Average frequency of shortage (%)	16.%

Table C-9. Identified Surface Water Shortages, High Demand 2030 Scenario.

Water User Name	Source Water	Average Annual Demand (MGD)	Minimum Physically Available Flow (MGD)	Maximum Shortage (MGD)	Frequency of Shortage (%)
IR: Titan - South Fork	Mainstem	1.53	3.43	0.07	0.1%
IR: Titan - Temples	Temples Creek	1.97	0.41	3.49	35.1%
IR: Titan - Bog	Bog Branch	1.78	0.22	3.66	38.8%
IR: Titan - Beech	Beech Creek	0.79	1.11	0.91	2.2%
IR: Titan - Mill	Mill Creek	0.66	0.71	0.61	3.3%
IR: Titan - Beaverdam	Beaverdam Branch	0.22	0.18	0.68	17.9%
IR: Shivers Trading	Sykes Swamp	0.23	0.15	0.35	19.1%
IR: Millwood	Limestone Creek	2.74	2.04	4.11	6.7%
IR: Gray	Cooper Swamp	0.12	0.50	0.21	25.0%
IR: Titan - Chinquapin	North Fork Edisto River	0.50	0.86	0.88	4.0%
IR: Cotton Lane	Goodbys Swamp	0.14	0.13	0.20	1.7%
IR: Shady Grove	Cow Castle Creek	0.44	0.02	0.59	46.2%

IR = agricultural (irrigation) water user

Table C-10. Surface water model simulation results at Strategic Nodes, High Demand 2030 Scenario.

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
EDO03 S. Fork Edisto Riv. nr Montmorenci	185	168	35	122	95	78
EDO14 S. Fork Edisto River ab. Springfield	362	325	51	231	175	137
HUC402 Outlet	442	394	55	269	194	151
EDO05 S. Fork Edisto River near Denmark	705	623	102	417	305	237
EDO06 S. Fork Edisto River near Cope	765	645	104	425	310	241
EDO07 S. Fork Edisto River near Bamberg	933	783	112	454	321	247
EDO11 Edisto River near Branchville	1867	1432	286	953	696	581
HUC601 Outlet	1997	1445	235	869	608	490
EDO13 Edisto River near Givhans	2523	1677	145	913	590	442
EDO01 McTier Creek near Monetta	24	18	2	12	8	6
EDO02 McTier Creek near New Holland	49	37	5	26	17	13
Shaw Creek Outlet	129	113	20	80	56	45
EDO04 Dean Swamp Creek near Salley	25	25	10	21	18	16
EDO09 Bull Swamp Creek below Swansea	10	9	2	7	5	5
EDO08 Cedar Creek near Thor	19	18	8	15	13	12
HUC301 Outlet	254	229	60	168	123	106
HUC302 Outlet	446	405	113	300	224	195
EDO10 N. Fork Edisto Riv. at Orangeburg	718	647	164	473	348	300
HUC303 Outlet	753	679	174	494	364	313
HUC602 Outlet	149	78	6	38	22	17
EDO12 Cow Castle Creek near Bowman	21	10	1	5	2	2
HUC501 Outlet	97	64	2	30	16	12
Four Hole Outlet	440	286	18	138	76	58

Table C-11. Percent change in High Demand 2030 Scenario flows at Strategic Nodes relative to Current Scenario flows.

Strategic Node	Mean Flow	Median Flow	Surface Water Supply	Percentile Flows		
				25th	10th	5th
EDO03 S. Fork Edisto Riv. nr Montmorenci	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
EDO14 S. Fork Edisto River ab. Springfield	-1.3%	-1.2%	-13.9%	-2.3%	-3.1%	-5.2%
HUC402 Outlet	-2.1%	-1.9%	-20.7%	-2.4%	-5.9%	-8.8%
EDO05 S. Fork Edisto River near Denmark	-1.3%	-1.3%	-12.2%	-2.5%	-3.8%	-5.9%
EDO06 S. Fork Edisto River near Cope	-1.2%	-1.4%	-12.0%	-2.4%	-4.0%	-5.9%
EDO07 S. Fork Edisto River near Bamberg	-1.7%	-2.2%	-10.6%	-3.7%	-5.2%	-8.6%
EDO11 Edisto River near Branchville	-1.3%	-1.4%	-10.0%	-2.7%	-4.0%	-5.3%
HUC601 Outlet	-1.2%	-1.6%	-11.9%	-3.3%	-5.2%	-6.1%
EDO13 Edisto River near Givhans	-2.7%	-4.2%	-33.0%	-8.1%	-10.4%	-15.0%
EDO01 McTier Creek near Monetta	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
EDO02 McTier Creek near New Holland	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Shaw Creek Outlet	-2.2%	-2.5%	-12.6%	-3.8%	-5.0%	-6.3%
EDO04 Dean Swamp Creek near Salley	0.1%	0.1%	0.2%	0.1%	0.1%	0.1%
EDO09 Bull Swamp Creek below Swansea	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
EDO08 Cedar Creek near Thor	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
HUC301 Outlet	-0.3%	-0.3%	-3.2%	-0.8%	-1.1%	-1.1%
HUC302 Outlet	-0.2%	-0.1%	-1.8%	-0.4%	-0.8%	-0.3%
EDO10 N. Fork Edisto Riv. at Orangeburg	-0.8%	-0.9%	-4.5%	-1.2%	-1.7%	-1.9%
HUC303 Outlet	-0.8%	-0.7%	-6.2%	-1.7%	-2.4%	-2.8%
HUC602 Outlet	-1.8%	-3.2%	-30.0%	-6.3%	-10.1%	-14.2%
EDO12 Cow Castle Creek near Bowman	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
HUC501 Outlet	-0.3%	-0.8%	-18.1%	-1.3%	-2.5%	-4.1%
Four Hole Outlet	-2.4%	-3.4%	-35.8%	-7.0%	-12.2%	-15.0%

Table C-12. Basin-wide surface water model simulation results, High Demand 2030 Scenario.

Performance Measure	Result
Total basin annual mean shortage (MGD)	1.54
Maximum water user shortage (MGD)	4.1
Total basin annual mean shortage (% of demand)	1.3%
Percentage of water users experiencing shortage	15.8%
Average frequency of shortage (%)	16.7%

Table C-13. Identified Surface Water Shortages, High Demand 2050 Scenario.

Water User Name	Source Water	Average Annual Demand (MGD)	Minimum Physically Available Flow (MGD)	Maximum Shortage (MGD)	Frequency of Shortage (%)
IR: Titan - South Fork	Mainstem	1.53	3.43	0.07	0.1%
IR: Titan - Temples	Temples Creek	1.97	0.41	3.49	35.1%
IR: Titan - Bog	Bog Branch	1.78	0.22	3.66	38.8%
IR: Titan - Beech	Beech Creek	0.79	1.11	0.91	2.2%
IR: Titan - Mill	Mill Creek	0.66	0.71	0.61	3.3%
IR: Titan - Beaverdam	Beaverdam Branch	0.22	0.18	0.68	17.9%
IR: Shivers Trading	Sykes Swamp	0.23	0.15	0.35	19.1%
IR: Millwood	Limestone Creek	2.74	2.04	4.11	6.7%
IR: Gray	Cooper Swamp	0.12	0.50	0.21	25.0%
IR: Titan - Chinquapin	North Fork Edisto River	0.50	0.86	0.88	4.0%
IR: Cotton Lane	Goodbys Swamp	0.14	0.13	0.20	1.7%
IR: Shady Grove	Cow Castle Creek	0.44	0.02	0.59	46.2%

IR = agricultural (irrigation) water user

Table C-14. Surface water model simulation results at Strategic Nodes, High Demand 2050 Scenario.

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
EDO03 S. Fork Edisto Riv. nr Montmorenci	185	168	35	122	95	78
EDO14 S. Fork Edisto River ab. Springfield	358	321	43	228	168	130
HUC402 Outlet	436	388	43	263	186	144
EDO05 S. Fork Edisto River near Denmark	699	619	91	412	297	230
EDO06 S. Fork Edisto River near Cope	759	641	93	418	302	234
EDO07 S. Fork Edisto River near Bamberg	925	778	102	444	310	237
EDO11 Edisto River near Branchville	1855	1422	268	942	681	565
HUC601 Outlet	1986	1432	217	857	592	472
EDO13 Edisto River near Givhans	2471	1634	81	859	527	384
EDO01 McTier Creek near Monetta	24	18	2	12	8	6
EDO02 McTier Creek near New Holland	49	37	5	26	17	13
Shaw Creek Outlet	126	110	17	77	53	42
EDO04 Dean Swamp Creek near Salley	25	25	10	21	18	16
EDO09 Bull Swamp Creek below Swansea	10	9	2	7	5	5
EDO08 Cedar Creek near Thor	19	18	8	15	13	12
HUC301 Outlet	253	228	59	167	123	105
HUC302 Outlet	446	404	112	299	223	195
EDO10 N. Fork Edisto Riv. at Orangeburg	714	644	160	469	344	297
HUC303 Outlet	750	677	168	490	361	307
HUC602 Outlet	150	79	6	39	22	17
EDO12 Cow Castle Creek near Bowman	21	10	1	5	2	2
HUC501 Outlet	97	64	2	30	16	11
Four Hole Outlet	441	288	19	139	78	59

Table C-15. Percent change in High Demand 2050 Scenario flows at Strategic Nodes relative to Current Scenario flows.

Strategic Node	Mean Flow	Median Flow	Surface Water Supply	Percentile Flows		
				25th	10th	5th
EDO03 S. Fork Edisto Riv. nr Montmorenci	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
EDO14 S. Fork Edisto River ab. Springfield	-2.6%	-2.6%	-27.6%	-3.8%	-6.8%	-9.7%
HUC402 Outlet	-3.4%	-3.3%	-37.4%	-4.5%	-10.1%	-13.4%
EDO05 S. Fork Edisto River near Denmark	-2.1%	-1.9%	-22.1%	-3.8%	-6.4%	-9.0%
EDO06 S. Fork Edisto River near Cope	-1.9%	-2.0%	-21.7%	-3.9%	-6.4%	-8.9%
EDO07 S. Fork Edisto River near Bamberg	-2.5%	-2.8%	-18.7%	-5.9%	-8.5%	-12.1%
EDO11 Edisto River near Branchville	-1.9%	-2.1%	-15.7%	-3.8%	-6.1%	-7.9%
HUC601 Outlet	-1.7%	-2.5%	-18.7%	-4.6%	-7.8%	-9.4%
EDO13 Edisto River near Givhans	-4.7%	-6.6%	-62.6%	-13.6%	-19.9%	-26.2%
EDO01 McTier Creek near Monetta	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
EDO02 McTier Creek near New Holland	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Shaw Creek Outlet	-4.2%	-4.8%	-26.2%	-7.2%	-10.2%	-12.4%
EDO04 Dean Swamp Creek near Salley	0.2%	0.2%	0.4%	0.2%	0.2%	0.2%
EDO09 Bull Swamp Creek below Swansea	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
EDO08 Cedar Creek near Thor	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
HUC301 Outlet	-0.6%	-0.6%	-5.1%	-1.4%	-1.6%	-1.7%
HUC302 Outlet	-0.3%	-0.2%	-2.9%	-0.6%	-1.2%	-0.6%
EDO10 N. Fork Edisto Riv. at Orangeburg	-1.3%	-1.3%	-6.9%	-2.1%	-2.8%	-3.1%
HUC303 Outlet	-1.2%	-1.0%	-9.4%	-2.6%	-3.2%	-4.5%
HUC602 Outlet	-1.3%	-2.4%	-21.6%	-4.7%	-7.1%	-10.7%
EDO12 Cow Castle Creek near Bowman	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
HUC501 Outlet	-0.5%	-1.2%	-27.3%	-2.2%	-4.5%	-5.0%
Four Hole Outlet	-2.1%	-2.9%	-31.1%	-6.2%	-10.7%	-13.2%

Table C-16. Basin-wide surface water model simulation results, High Demand 2050 Scenario.

Performance Measure	Result
Total basin annual mean shortage (MGD)	1.54
Maximum water user shortage (MGD)	4.1
Total basin annual mean shortage (% of demand)	1.0%
Percentage of water users experiencing shortage	15.8%
Average frequency of shortage (%)	16.7%

Appendix D
2070 Scenario 1, 2, and 3 Results (Moderate Scenario Demands)

Table D-1. Basin-wide surface water model simulation results, Scenarios 1, 2, and 3 (Moderate Demand 2070 Scenario demands).

Parameter	Moderate Demand 2070 Scenario	Scenario 1 Drought Management Plans	Scenario 2 Drought Management + Irrigation Efficiency	Scenario 3 Drought Management + Irrigation Efficiency + Municipal Conservation
Total annual mean shortage (MGD)	1.6	1.5	1.4	1.4
Maximum water user shortage (MGD)	5.1	4.1	3.7	3.7
Total annual mean shortage (%)	0.7%	1.0%	0.9%	1.1%
Percentage of water users experiencing shortage	20%	16%	16%	16%
Average frequency of shortage (%)	13%	17%	16%	16%

Table D-2. Scenario 1 surface water model simulation results at Strategic Nodes (drought management plans, Moderate 2070 Scenario demands).

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
EDO03 S. Fork Edisto Riv. nr Montmorenci	185	168	35	122	95	78
EDO14 S. Fork Edisto River ab. Springfield	359	322	51	229	169	132
HUC402 Outlet	442	394	55	268	195	151
EDO05 S. Fork Edisto River near Denmark	704	623	102	415	304	236
EDO06 S. Fork Edisto River near Cope	764	644	104	422	309	240
EDO07 S. Fork Edisto River near Bamberg	931	782	112	452	319	245
EDO11 Edisto River near Branchville	1868	1431	292	954	698	585
HUC601 Outlet	1999	1446	241	871	611	492
EDO13 Edisto River near Givhans	2476	1633	222	863	539	392
EDO01 McTier Creek near Monetta	24	18	2	12	8	6
EDO02 McTier Creek near New Holland	49	37	5	26	17	13
Shaw Creek Outlet	128	112	22	79	55	44
EDO04 Dean Swamp Creek near Salley	25	25	10	21	18	16
EDO09 Bull Swamp Creek below Swansea	10	9	2	7	5	5
EDO08 Cedar Creek near Thor	19	18	8	15	13	12
HUC301 Outlet	253	229	59	167	123	105
HUC302 Outlet	446	405	112	299	224	195
EDO10 N. Fork Edisto Riv. at Orangeburg	722	652	168	476	352	305
HUC303 Outlet	755	681	176	497	366	316
HUC602 Outlet	150	79	6	39	22	17
EDO12 Cow Castle Creek near Bowman	21	10	1	5	2	2
HUC501 Outlet	97	64	3	30	16	12
Four Hole Outlet	441	287	19	139	77	59

Table D-3. Scenario 2 surface water model simulation results at Strategic Nodes (drought management plans + irrigation efficiency measures, Moderate 2070 Scenario demands).

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
EDO03 S. Fork Edisto River near Montmorenci	185	168	35	122	95	78
EDO14 S. Fork Edisto River above Springfield	360	323	52	229	170	132
HUC402 Outlet	442	394	57	268	196	152
EDO05 S. Fork Edisto River near Denmark	705	624	105	417	306	237
EDO06 S. Fork Edisto River near Cope	765	645	107	424	311	241
EDO07 S. Fork Edisto River near Bamberg	932	783	114	453	320	246
EDO11 Edisto River near Branchville	1870	1433	296	955	702	587
HUC601 Outlet	2001	1446	245	875	615	496
EDO13 Edisto River near Givhans	2478	1633	226	867	540	395
EDO01 McTier Creek near Monetta	24	18	2	12	8	6
EDO02 McTier Creek near New Holland	49	37	5	26	17	13
Shaw Creek Outlet	128	112	22	79	55	44
EDO04 Dean Swamp Creek near Salley	25	25	10	21	18	16
EDO09 Bull Swamp Creek below Swansea	10	9	2	7	5	5
EDO08 Cedar Creek near Thor	19	18	8	15	13	12
HUC301 Outlet	254	229	60	167	123	106
HUC302 Outlet	446	405	113	300	224	195
EDO10 N. Fork Edisto River at Orangeburg	723	652	169	478	353	305
HUC303 Outlet	756	682	177	499	366	317
HUC602 Outlet	150	79	6	39	22	17
EDO12 Cow Castle Creek near Bowman	21	10	1	5	2	2
HUC501 Outlet	98	64	3	30	16	12
Four Hole Outlet	441	287	19	139	77	59

Table D-4. Scenario 3 surface water model simulation results at Strategic Nodes (drought management plans + irrigation efficiency measures + municipal conservation measures, Moderate 2070 Scenario demands).

Strategic Node	Mean Flow (cfs)	Median Flow (cfs)	Surface Water Supply (cfs)	Percentile Flows (cfs)		
				25th	10th	5th
EDO03 S. Fork Edisto River near Montmorenci	185	168	35	122	95	78
EDO14 S. Fork Edisto River above Springfield	362	325	54	231	173	135
HUC402 Outlet	444	396	59	270	198	154
EDO05 S. Fork Edisto River near Denmark	708	626	107	419	309	240
EDO06 S. Fork Edisto River near Cope	767	648	109	426	314	244
EDO07 S. Fork Edisto River near Bamberg	935	786	116	455	322	249
EDO11 Edisto River near Branchville	1873	1436	299	958	706	591
HUC601 Outlet	2004	1448	248	879	619	499
EDO13 Edisto River near Givhans	2503	1655	215	897	568	422
EDO01 McTier Creek near Monetta	24	18	2	12	8	6
EDO02 McTier Creek near New Holland	49	37	5	26	17	13
Shaw Creek Outlet	130	114	24	81	58	46
EDO04 Dean Swamp Creek near Salley	25	25	10	21	18	16
EDO09 Bull Swamp Creek below Swansea	10	9	2	7	5	5
EDO08 Cedar Creek near Thor	19	18	8	15	13	12
HUC301 Outlet	254	229	60	168	123	106
HUC302 Outlet	447	405	113	300	224	196
EDO10 N. Fork Edisto River at Orangeburg	724	654	171	480	355	307
HUC303 Outlet	757	683	178	500	367	318
HUC602 Outlet	150	79	6	39	22	17
EDO12 Cow Castle Creek near Bowman	21	10	1	5	2	2
HUC501 Outlet	98	64	3	30	16	12
Four Hole Outlet	441	287	19	139	77	59

Table D-5. Comparison of months with flows below MIFs, Scenarios 1, 2, and 3 (Moderate 2070 Scenario demands).

Strategic Node	Scenario	Percentage of Months below MIFs											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ED005 South Fork Edisto River near Denmark	UIF	0	0	0	0	0	2	0	0	0	0	0	0
	Moderate 2070	0	0	0	1	2	6	1	1	0	0	0	0
	Scenario 1	0	0	0	1	2	6	1	1	0	0	0	0
	Scenario 2	0	0	0	1	2	6	1	1	0	0	0	0
	Scenario 3	0	0	0	1	2	5	1	1	0	0	0	0
Outlet of Shaw Creek	UIF	0	0	0	0	0	2	0	0	0	0	0	0
	Moderate 2070	0	0	0	1	2	6	1	1	0	0	0	0
	Scenario 1	0	0	0	1	2	6	1	1	0	0	0	0
	Scenario 2	0	0	0	1	2	6	1	1	0	0	0	0
	Scenario 3	0	0	0	1	1	4	0	1	0	0	0	0
EDO13 Edisto River near Givhans	UIF	5	2	0	3	9	13	6	5	2	3	2	2
	Moderate 2070	5	2	1	6	19	25	18	18	17	10	3	4
	Scenario 1	5	2	1	6	19	25	18	18	17	10	3	4
	Scenario 2	5	2	1	6	19	25	18	18	16	10	3	4
	Scenario 3	5	2	1	6	18	22	16	16	16	8	3	4
HUC 303 Outlet	UIF	0	0	0	0	0	1	0	0	0	0	0	0
	Moderate 2070	0	0	0	0	0	3	0	0	0	0	0	0
	Scenario 1	0	0	0	0	0	3	0	0	0	0	0	0
	Scenario 2	0	0	0	0	0	3	0	0	0	0	0	0
	Scenario 3	0	0	0	0	0	3	0	0	0	0	0	0
EDO11 Edisto River near Branchville	UIF	0	0	0	0	0	2	0	0	0	0	0	0
	Moderate 2070	0	0	0	0	0	4	0	0	0	0	0	0
	Scenario 1	0	0	0	0	0	4	0	0	0	0	0	0
	Scenario 2	0	0	0	0	0	4	0	0	0	0	0	0
	Scenario 3	0	0	0	0	0	4	0	0	0	0	0	0

Green shaded cells indicate a change in the percentage of months compared to the Moderate 2070 Scenario.

Appendix E

Draft and Final Plan Consensus Survey Results

To assess each RBC member's confidence in the plan, the plan approval process dictates that there will be a test for consensus on the Draft River Basin Plan and a vote of support or disagreement on the Final River Basin Plan. For the test of consensus on the Draft Plan, each member rates their concurrence with the plan using a five-point scale, as shown below:

1. Full Endorsement (i.e., member likes it).
2. Endorsement but with minor points of contention (i.e., basically member likes it).
3. Endorsement but with major points of contention (i.e., member can live with it).
4. Stand aside with major reservations (i.e., member cannot live with it in its current state and can only support it if changes are made).
5. Withdraw - Member will not support the draft river basin plan and will not continue working within the RBC's process. Member has decided to leave the RBC.

For the Final River Basin Plan, each RBC member votes simply to support or disagree with the plan. By indicating support, the member would be acknowledging his/her concurrence with the Final River Basin Plan and their commitment to support implementation of the plan. The RBC members vote's on the Draft and Final River Basin Plans are listed below.

Table E-1. Level of consensus for the Draft and Final River Basin Plan.

RBC Member	Draft Plan Level of Endorsement	Final Plan Level of Support
Aakhus, Mark	**2**	**Support**
Bagwell, Laura	**2**	**Support**
Bell, Glenn	**2**	**Support**
Dr. Bishop, David	**2**	**Support**
Dr. Bass, John	**1**	**Support**
Duke, Joel	**2**	**Support**
Haralson, Johney	**2**	**Support**
Jowers, J.J.	**3**	**Disagree**
Krispyn, Hugo	**3**	**Support**
Marvin, Alta Mae	**1**	**Support**
Mehrzad, Alan	**3**	**No vote**[1]
Odom, Eric	**2**	**Support**
Sievers, Amanda	**1**	**Support**
Stallworth, Hank	**2**	**Support**
Stutts, Brandon	**3**	**Support**
Thompson, Jason	**2**	**Support**
Tolbert, Alex	**2**	**Support**
Walther, Jeremy	**4**	**Disagree**
Waters, Jerry	**2**	**Support**
Weathers, Landrum	**3**	**Disagree**
Williams, Will	**2**	**Support**

[1] Member left the RBC (left his position with a local water utility) before voting on the Final Plan.

Per the RBC Bylaws appended to the Planning Framework, "any member that rates the Draft River Basin Plan as a 4 or 5 must specify their major reservations or dissension, respectively, in a written statement of 500 words or fewer for inclusion in the Draft River Basin Plan". The written statement provided by Jeremy Walther (Agriculutre, Forestry and Irrigation interest category) is provided below. On the following pages is a response statement from the Edisto RBC Chair, Hank Stallworth. The response statement should not be interpreted as a statement from the full RBC.

Statement from Jeremy Walther:

In my opinion, the basin council was disproportionately skewed towards members whose goal was to protect the river by excluding reasonable, commercial use rather than a reflection of actual users. A lot of the council members representing these protectionists' views are retired or paid advocates, who are not juggling a full-time job or operating their own businesses, and therefore had the ability to devote all their time and efforts to the council. Other industries should be afforded the same opportunity to use paid advocates for their interests. For instance, I would suggest having AG represented by Farm Bureau as they are our spokespeople in the state. This is especially important when you have members on the basin council who have publicly stated "the [Edisto] river is threatened by excessive agricultural surface water withdrawals" and other non-factually based statements that misrepresent agricultural use of the Edisto River and other surface water.

Additionally, the plan is improperly skewed towards these protectionist views by using data that was created by activists for the express political purpose of attacking and spreading lies about agricultural use on the Edisto River. As was reported in The State Newspaper and other media sources, anti-agricultural advocates filed registrations with SCDHEC to perpetuate the false narrative that farmers can and will "suck a river dry." The /fraudulent agricultural that maxed out the safe yield in the basin. Including this data in the river basin plan spreads disinformation to the public about what is really happening and pits society against agriculture. I cannot support a plan that has such skewed data and anti-agricultural views represented within it – especially when the public will see it as legitimate when coming from a state agency process and paid for by taxpayer money.

Response from Hank Stallworth, RBC Chair, to the statement submitted by Jeremy Walther on the Draft Edisto River Basin Plan.

As the Chair of the RBC, I offer the following response to the statement submitted by RBC member Jeremy Walther on the Draft Edisto River Basin Plan. It reflects my personal opinion of Mr. Walther's comments and does not necessarily represent other members' thoughts.

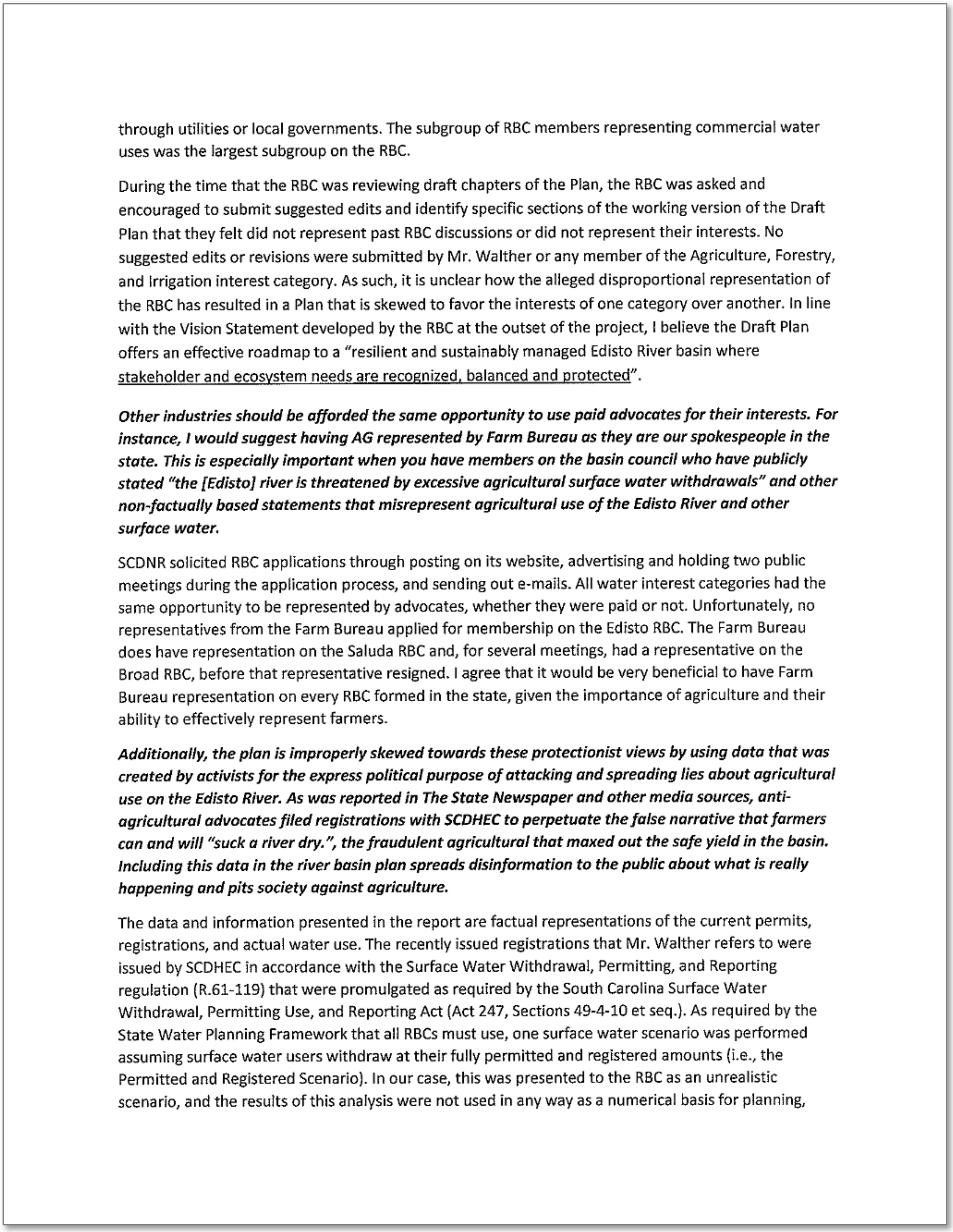
Prior to release of the Draft Plan, a "test for consensus" was conducted whereby each member voted on the Draft Plan using a 5 point scale. Mr. Walther voted a "4", which indicated his desire to "Stand Aside with Major Reservations" (the wording offered in the RBC Bylaws). In accordance with the RBC Bylaws, Mr. Walther submitted the following statement supporting his decision:

> **Statement from Jeremy Walther:**
> ***In my opinion, the basin council was disproportionately skewed towards members whose goal was to protect the river by excluding reasonable, commercial use rather than a reflection of actual users. A lot of the council members representing these protectionists' views are retired or paid advocates, who are not juggling a full-time job or operating their own businesses, and therefore had the ability to devote all their time and efforts to the council. Other industries should be afforded the same opportunity to use paid advocates for their interests. For instance, I would suggest having AG represented by Farm Bureau as they are our spokespeople in the state. This is especially important when you have members on the basin council who have publicly stated "the [Edisto] river is threatened by excessive agricultural surface water withdrawals" and other non-factually based statements that misrepresent agricultural use of the Edisto River and other surface water.***
>
> ***Additionally, the plan is improperly skewed towards these protectionist views by using data that was created by activists for the express political purpose of attacking and spreading lies about agricultural use on the Edisto River. As was reported in The State Newspaper and other media sources, anti-agricultural advocates filed registrations with SCDHEC to perpetuate the false narrative that farmers can and will "suck a river dry.", the /fraudulent agricultural that maxed out the safe yield in the basin. Including this data in the river basin plan spreads disinformation to the public about what is really happening and pits society against agriculture. I cannot support a plan that has such skewed data and anti-agricultural views represented within it – especially when the public will see it as legitimate when coming from a state agency process and paid for by taxpayer money.***

For clarity, I have repeated portions of Mr. Walther's statement below, and provided a response to each portion of his statement.

In my opinion, the basin council was disproportionately skewed towards members whose goal was to protect the river by excluding reasonable, commercial use rather than a reflection of actual users.

More than a third (38 percent) of the RBC members represent commercial uses of water in the basin, including 4 members representing the Agriculture, Forestry, and Irrigation interest category, 2 representing the Industry and Economic Development interest category, 1 representing a private Electric Power Utility, and 1 (at large) affiliated with real estate and land development. This compares with 33 percent of the RBC affiliated with either Environmental interests, Water-based recreation interests, or the other three at-large representatives, and 29 percent representing public interests



through utilities or local governments. The subgroup of RBC members representing commercial water uses was the largest subgroup on the RBC.

During the time that the RBC was reviewing draft chapters of the Plan, the RBC was asked and encouraged to submit suggested edits and identify specific sections of the working version of the Draft Plan that they felt did not represent past RBC discussions or did not represent their interests. No suggested edits or revisions were submitted by Mr. Walther or any member of the Agriculture, Forestry, and Irrigation interest category. As such, it is unclear how the alleged disproportional representation of the RBC has resulted in a Plan that is skewed to favor the interests of one category over another. In line with the Vision Statement developed by the RBC at the outset of the project, I believe the Draft Plan offers an effective roadmap to a “resilient and sustainably managed Edisto River basin where stakeholder and ecosystem needs are recognized, balanced and protected”.

Other industries should be afforded the same opportunity to use paid advocates for their interests. For instance, I would suggest having AG represented by Farm Bureau as they are our spokespeople in the state. This is especially important when you have members on the basin council who have publicly stated “the [Edisto] river is threatened by excessive agricultural surface water withdrawals” and other non-factually based statements that misrepresent agricultural use of the Edisto River and other surface water.

SCDNR solicited RBC applications through posting on its website, advertising and holding two public meetings during the application process, and sending out e-mails. All water interest categories had the same opportunity to be represented by advocates, whether they were paid or not. Unfortunately, no representatives from the Farm Bureau applied for membership on the Edisto RBC. The Farm Bureau does have representation on the Saluda RBC and, for several meetings, had a representative on the Broad RBC, before that representative resigned. I agree that it would be very beneficial to have Farm Bureau representation on every RBC formed in the state, given the importance of agriculture and their ability to effectively represent farmers.

Additionally, the plan is improperly skewed towards these protectionist views by using data that was created by activists for the express political purpose of attacking and spreading lies about agricultural use on the Edisto River. As was reported in The State Newspaper and other media sources, anti-agricultural advocates filed registrations with SCDHEC to perpetuate the false narrative that farmers can and will “suck a river dry.”, the fraudulent agricultural that maxed out the safe yield in the basin. Including this data in the river basin plan spreads disinformation to the public about what is really happening and pits society against agriculture.

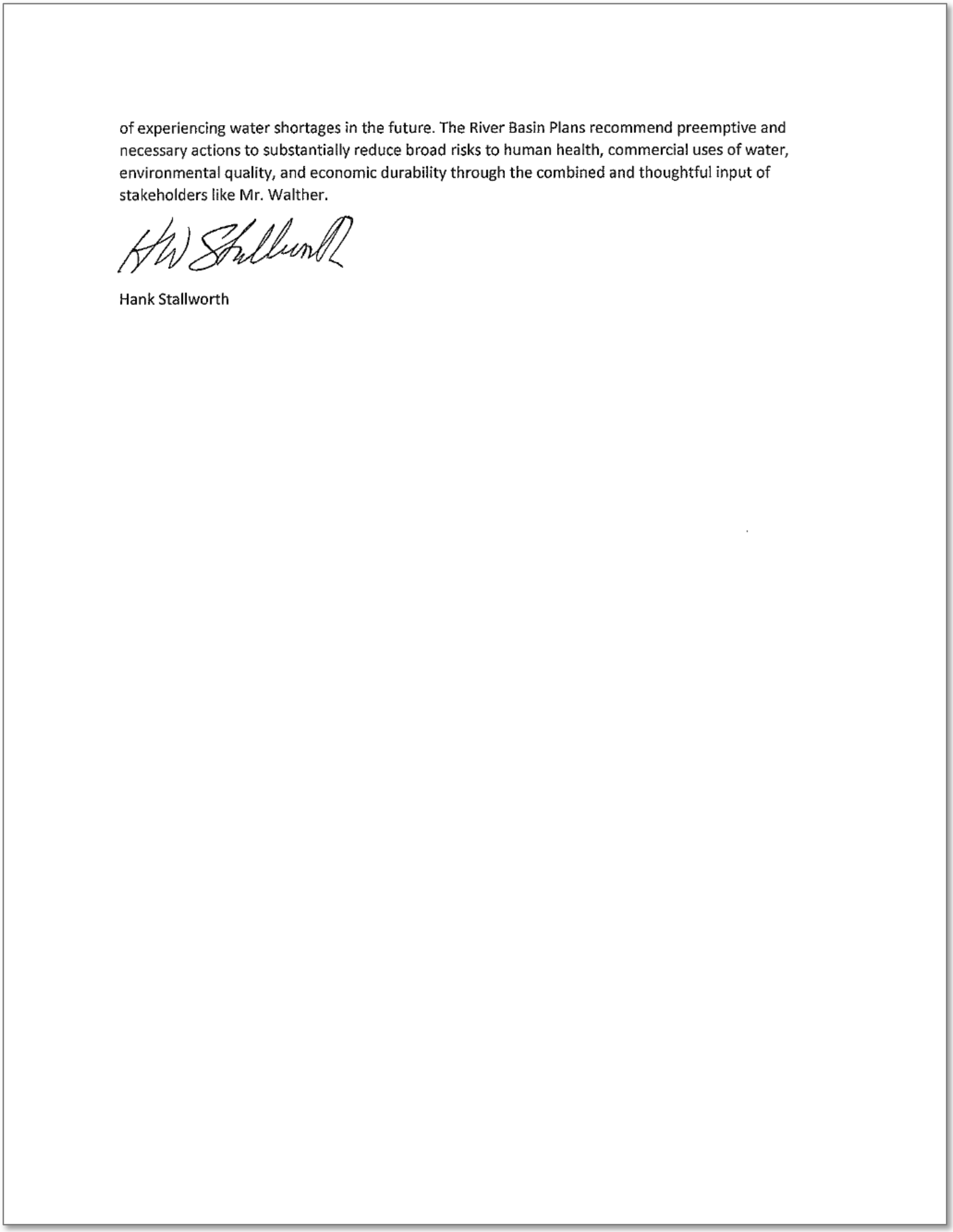
The data and information presented in the report are factual representations of the current permits, registrations, and actual water use. The recently issued registrations that Mr. Walther refers to were issued by SCDHEC in accordance with the Surface Water Withdrawal, Permitting, and Reporting regulation (R.61-119) that were promulgated as required by the South Carolina Surface Water Withdrawal, Permitting Use, and Reporting Act (Act 247, Sections 49-4-10 et seq.). As required by the State Water Planning Framework that all RBCs must use, one surface water scenario was performed assuming surface water users withdraw at their fully permitted and registered amounts (i.e., the Permitted and Registered Scenario). In our case, this was presented to the RBC as an unrealistic scenario, and the results of this analysis were not used in any way as a numerical basis for planning, recommendations, or decisions. The Permitted and Registered Scenario was not used in any of the planning scenarios that served as the foundation for water management recommendations considered and adopted by the RBC.

To its credit, the RBC also discussed policy means to address overallocation in the future. In direct response to both agricultural and non-agricultural water registrations and permits far exceeding actual need, the majority of the RBC voted to recommend periodic review of each user's actual water use and needs, accounting for growth, and that this should be done to prevent "locking up" water that is not needed, which is what Mr. Walther appears to be seeking.

I believe the analyses conducted during development of the Plan help dispel the myth that agriculture has or will harm other users in the basin (including environmental interests) and/or "suck the river dry". The results documented in the Plan, and its accompanying Executive Summary, represent "good news" for continued agricultural water use in the Edisto River Basin. Furthermore, the implementation plan (see Chapter 10) offers numerous actions and strategies that are intended to protect and support continued use of surface and groundwater for agriculture (and other users). Some examples from the Plan are noted below:

- The Plan asserts that water resources of the Edisto River basin are generally sufficient to meet current and projected needs through 2070, assuming future hydrologic conditions will be similar to historical hydrology over the past 90 years. This is an important finding and is repeatedly stated in both in the Draft Plan and Executive Summary to help dispel the myth that agriculture operations are causing the Edisto River to run dry.
- The Plan states that changes in water use are not likely to impose significant risk to aquatic ecology of the basin. This is another important finding which demonstrates that agricultural (and other) surface water withdrawals are not currently, nor are they projected to, cause significant risk or harm to the ecological health of the river basin.
- The Plan identifies numerous funding opportunities to help implement management strategies for agriculture, including those that improve irrigation efficiency, something which Mr. Walther promoted and effectively demonstrated to the RBC.
- The Plan includes a recommendation about surveying water users, including ag operations, to evaluate effectiveness of implemented strategies and their ability to leverage funding sources.
- The Plan recommends enhancing groundwater monitoring and conducting additional groundwater modeling to investigate potential Groundwater Areas of Concern. This action will ultimately help protect and sustain groundwater use, which is predominantly used by agricultural operations, in these Groundwater Areas of Concern.
- The Plan recommends evaluating the existence and impact of seasonal drawdowns in the Groundwater Areas of Concern (a recommendation offered by Mr. Walther).
- The Plan's voluntary Low Flow Water Management Strategy recognizes that most agricultural operations lack the resources and ability to reduce water use and/or switch to groundwater sources during drought and exempts them from any water use curtailments.

Finally, I want to emphasize that without the legislatively allocated funding for this and other River Basin Plans throughout the state, South Carolina runs the risk of not just over-allocating water on paper, but



of experiencing water shortages in the future. The River Basin Plans recommend preemptive and necessary actions to substantially reduce broad risks to human health, commercial uses of water, environmental quality, and economic durability through the combined and thoughtful input of stakeholders like Mr. Walther.

HW Stallworth

Hank Stallworth

Appendix F
Public Comments and Responses

Public comments on the Draft Edisto River Basin Plan were accepted from February 15th through March 17th, 2023. Comments were received from the following:

Peter DeLorme, PMP
W.A.T.E.R. Water for Aiken Through Environmental Reform

Eric Krueger
Director of Science and Stewardship
The Nature Conservancy, South Carolina

Leonilda Burke

Landrum Weathers
Edisto RBC Vice Chairman and Planning Process and Advisory Committee Member

The Edisto RBC appreciates the comments and suggestions for improving the Draft Plan. Where noted, the Final River Basin Plan was revised to address comments. All submitted comments are included on the following pages. Responses follow each set of comments.

Comments Submitted by:
Peter DeLorme, PMP
W.A.T.E.R. Water for Aiken Through Environmental Reform

RBC responses follow each comment in red text.

1. My general impression upon reading the Executive Summary and scanning the full draft is that the report is based on extensive research and discussion, some which confirms data and modeling seen in the past during advocacy for the Western Capacity Use Area. The science is appropriate and sufficient for the Council to make informed decisions on near-term and anticipated future needs for our critical, though not infinite, water resources.

Response: The RBC appreciates the comment.

2. The consensus basis for making decisions about recommendations has several drawbacks and should be replaced by presentation of the majority recommendation with provision for including one, or multiple, minority opinions in the Plan.

   a. Having followed the entire process from beginning to end, with periodic updates on progress, the one recurring theme in those updates was the difficulty in reaching consensus. Consensus building is known to be a difficult outcome to achieve. In this case though it seems to have been extremely difficult. Just one person was generally the cause of much of the drawn-out discussion and watering down of recommendations.
   b. Requiring consensus makes it possible for one member of the team to disrupt, or make less useful the recommendations proposed by the majority. Perhaps, as is used in Congress, a 2/3 rule should apply, with published recommendations requiring more than just a simple majority vote.
   c. The reporting of the votes for and against a recommendation/proposal such as in the pie charts found in in Table ES-4 is a step in the right direction. An improvement would be provision for counter proposal(s) by the dissenter(s). See Executive Summary page 24.
   d. More extensive majority/minority reporting would give future users of the information, especially those building the State Water Plan, a clearer understanding of the issues which will need to be addressed.

Response: The State Water Planning Framework notes that, *"the diverse membership of each RBC is intended to allow for a variety of perspectives during the formulation of the River Basin Plan. The planning process is intended to follow a consensus-driven approach, in which local stakeholders work together to develop a water plan that fairly and adequately addresses the needs and concerns of all water users."* Most recommendations developed by the RBC which are documented in Chapter 9, were consensus-based.

When considering recommendations focusing on policy, legislative and regulatory issues, it became apparent that the RBC was not likely to reach consensus. So that decision makers can assimilate and understand the diverse points of view represented, the RBC decided to document not only the number of votes for and against these specific recommendations, but to include the reasons why RBC members were in favor or against it. Other RBCs may decide to document decisions where consensus was not achieved, by presenting majority and minority opinions, or through other means.

3. The strident objections of the stakeholder who gave the Plan its lowest acceptance rating (a four) raises the question of the appropriate strength of representation on the current Council. Not including at least some reference to this objection in the Executive Summary may appear to devalue the importance of that minority opinion (as correct or incorrect as it may be). Given the strength of the reservations or dissensions represented by a 4 or 5 rating of the Plan, readers of the Executive Summary be advised of the number of statements and should be referred to that section of the Plan for more details.

Response: The RBC appreciates the comment and will make a final decision on whether to include reference in the Executive Summary to the statement and objections issued by the RBC member who offered a 4 rating on the Draft Plan. At this time, that decision has not been made. The Final Plan will reflect the RBC's decision.

4. Enhance Figure ES-3 - the representation of interest categories - so as to graphically show the relative weight of stakeholder representation on the Council. There should be some discussion as to how that weighting was determined, but also how that representation is reflective of what will be the relative importance of each category at the end of the planning period.

Response: Figure ES-3 has been updated to list, in parentheses, the number of RBC members representing each water interest category at the time the Final Plan was developed. The composition of the RBC followed the guidelines developed by the PPAC.

5. Balance of allocations between the categories of uses represented on the ERB should be tracked and possibly maintained over time. Current relationships between sector allocations may shift due to uneven future growth. This report should define how future allocations be distributed and who will make the decisions. For instance, if irrigation uses 40% of river flow at present and Municipal Water Supply uses 20%, will that two to one ratio be maintained in the future. Will municipalities be allowed to grow their consumption to the detriment of Irrigation?

Response: Permits and registrations for surface water withdrawals are issued by SCDHEC. SCDHEC does not consider sector allocations when issuing permits and registrations.

6. Enhance Table ES-4 to include the minority position. For instance the first item (the mean flow issue) should have the minority position represented, which would presumably be that the current calculation method be retained.

Response: The minority positions are summarized in the "Key Concerns" column of Table ES-4.

7. Defined, generally accepted, metrics should be used to clearly define recommendations, establish triggers, and track implementation of recommendations. For instance, again in Table ES-4, the concern about surface water permits should define the amount of current water use for all registrations and permits vs the amounts of the approved registrations and permits so as the clarify the extent of the disparity.

Response: Progress metrics were developed by the RBC to track the success of Plan implementation. These are presented in Chapter 10 (Section 10.3).

The difference between current surface water use, projected surface water use, and approved registrations and permits is presented in both the executive summary and in Chapter 4.

8. Trigger points in defined metrics should be used to start voluntary action, with mandatory restrictions following if there is further lowering or increasing of the defined metrics-based triggers. These triggers should be strongly supported by scientific data, rather than merely by the votes of the RBC participants.

> a. A good example of this is seen in the Drought Management Low Flow Management Strategy section and Table ES-3. This chart shows defined Triggers for a voluntary program. This table should be improved by clearly defining the triggers for voluntary action and the triggers for mandatory, enforceable, action.

Table ES-3. Low flow management strategy triggers and reduction goals.

Incremental Percentage Below 20 Percent of Median Flow	TRIGGER: Edisto River Flow Range (cfs) at Givhans		Reduction Goal for Surface Water Withdrawals
	Lower	Upper	
0-20%	266	332	20%
20-40%	199	266	40%
40-60%	133	199	60%
60-80%	66	133	80%
80-100%	0	66	100%

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Response: The trigger points were selected and agreed upon by the RBC, with the clear understanding that they are triggers for voluntary action. The RBC is not a regulatory body, and therefore the recommendations, including the Low Flow Management Strategy, are not considered to be mandatory, enforceable actions.

9. Provide some context and data analysis around the votes to approve or disapprove the report such as seen in the following chart. For instance:

> a. The four At Large members - those presumably without a special interest to protect – had as a group the highest support for the Draft (1.5 average support).
>
> b. The two groups, Water-Based Resources and Electric-Power Utilities, each with just a single representative, that had the lowest approval ratings. Both rated approval of the plan as a 3, the median rating.

c. Agriculture's four reps had the second lowest approval rating – 2.75. The sole lowest vote (4) was in this group. Ensure that a minority report informs future readers about the concerns of the Agriculture group

a. Identify Area Of Interest for each participant in the chart on page E-2 of the Draft Plan which shows individual votes

b. Group by area of interest, in a new chart such as that shown below, the individual votes of each group's member, and average those votes so as to be able to gauge the level of support by each group.

Per Interest Average sort		
Member	Interest	
Table 1-1. Edisto RBC members and affiliations.		
Name Organization Position Interest Category		
Marvin, Alta Mae Edisto River Canoe andKayak Trail Commission Commissioner/Property Owner	At-Large	1
Dr.Bass, John Retired Citizen	At-Large	1
Bagwell, Laura Aiken Soil and WaterConservation DistrictCommissioner	At-Large	2
Waters, Jerry Palmetto Realty and LandCo.Owner/Broker	At-Large	2
	Avg	1.5
Sievers,Amanda1Orangeburg County PlanningDirector	Industry and EconomicDevelopment	1
Williams, Will Western South CarolinaEconomic DevelopmentPartnershipPresident/CEO	Industry and EconomicDevelopment	2
	Avg	1.5
Aakhus, Mark Town of Edisto Beach Assistant TownAdministrator	Local Governments	2
Duke, Joel Aiken County AssistantCountyAdministrator	Local Governments	2
Haralson,JohneZBamberg Soil and WaterDistrictVice Chair	Local Governments	2
	Avg	2.0
Dr. Bishop,DavidThe Nature Conservancy CoastalConservationDirector	Environmental	2
Stallworth, Hank(RBC Chair)Retired (SCDNR Chief ofStaff)Citizen	Environmental	2
Krispyn, Hugo Friends of the Edisto andEdisto RiverkeeperExecutiveDirector	Environmental	3
	Avg	2.3
Odom, Eric Orangeburg Department ofPublic UtilitiesWater DivisionDirector	Water and Sewer Utilities	2
Thompson,JasonCharleston Water System Source WaterManager	Water and Sewer Utilities	2
Mehrzad, Alan Bamberg Board of PublicWorksAssistantManager	Water and Sewer Utilities	3
	Avg	2.3
Bell, Glenn RBM Forestry, LLC Owner	Agriculture, Forestry, and Irrigation	2
Tolbert, Alex Orangeburg Country Club Golf CourseSuperintendent	Agriculture, Forestry, andIrrigation	2
Weathers,Landrum (RBCVice Chair)Weathers Farms/Circle WFarmsManager	Agriculture, Forestry, andIrrigation	3
Walther, Jeremy Walther Farms Owner/Operator	Agriculture, Forestry, andIrrigation	4
	Avg	2.75
Jowers, J.J. Public Citizen	Water-Based Recreational	3
	Avg	3.0
Stutts, Brandon2 Dominion Energy SouthCarolinaEnvironmentalSpecialist	Electric-Power Utilities	3
	Avg	3.0

Response: The votes of the RBC members on the Draft Plan were meant as a test of consensus. With only 1 to 4 members in each interest category, the RBC is hesitant to read too much into averages by category. More important is understanding why a member endorses the Draft Plan fully, with minor or major points of contention, or has major reservations and does not endorse the it. The test of consensus helps identify potential RBC member concerns, which might be addressed prior to finalizing the Plan. As such, there may be changes to the Draft Plan, as agreed to by the RBC, before the Plan becomes final.

In the future, RBCs will be reminded to make clear their points of contention during preparation of the Draft Plan chapters, so that attempts can be made to address any concerns before the test of consensus is performed.

10. Given the gross overallocation of water to some withdrawers, all allocations should be reviewed in each of the quinquennial Plan updates. Yes, this would add economic uncertainty to all users, but demonstrated prior use should be one determining factor in assessing future allocations. Being mindful of this strategy should inform urban and other sector growth plans (see next to last proposal on page 24 of the Summary)

Response: SCDHEC has recently circulated for PPAC and stakeholder comment, draft revisions to the South Carolina Surface Water Withdrawal, Permitting, Use and Reporting Act (§ 49-4-10, et.seq.) that include the concept of having reasonable permitting timeframes of 30 years, with a coordinated review of use and permits every 10 years, which would correlate to the 10 year basin planning findings and updates.

11.Define who would need to act where suggested future courses of action are identified, and show how the cost of that action would be shared amongst stakeholders. For instance, reducing irrigation use by installing flow controllers on equipment is a good strategy, but who would fund the cost to corporations and individual farmers of implementing this strategy should be addressed by the Plan.

Response: Funding of strategies is likely to vary on a case-by-case basis. Chapter 10 includes tables that highlight USDA and other potential programs that provide funding for strategies that improve irrigation efficiency, for example. Future work by the RBC will focus on implementation, and a key component of the effort will be identifying sources of funding.

12. UIF is used extensively as an acronym. In the Acronym section include a more expansive description such as " The UIF Scenario removes all surface water withdrawals and discharges and simulates conditions prior to any surface water development."

Response: Unimpaired flows are defined on page 3-9. The acronym section was not intended to serve as a definitions section.

13. More extensively indicate how basin plans – with easy to define boundaries – integrate with ground water management plans which deal with aquifers which cross river basin boundaries.

   a. The upper coastal plain is the catchment basin for multiple defined aquifer layers along the coast.

b. Include discussion about how the needs of the upper coastal plain to supply ground water to coastal areas should be factored into allocations of ground water withdrawals in the catchment areas of the aquifers

c. This analysis may be insufficiently hinted at in Table ES-6, Objective 5, Item 1: Research how changes in land use impact recharge.

Response: While this doesn't directly address the comment, it is worth noting that during the planning process, the RBC discussed how the River Basin Plans would integrate with the Groundwater Management Plans. There was some concern that evaluating groundwater availability as part of the river basin planning process was duplicative with the work that went into development of the Groundwater Management Plans. Ultimately, it is expected that SCDHEC will use the analysis and recommended water management strategies from the river basin planning process, to supplement the Groundwater Management Plans. For example, the groundwater modeling conducted during the river basin planning process identified several Groundwater Areas of Concern and resulted in the recommendation for groundwater level monitoring in those areas. This information and recommendations should help guide the development of more detailed, actionable Groundwater Management Plans. No groundwater modeling was conducted when developing the Groundwater Management Plans.

The RBC did not discuss making a recommendation regarding the needs of the upper Coastal Plain to supply ground water to coastal areas, and whether that should be factored into allocations of ground water withdrawals in the catchment areas of the aquifers. This may be a topic for future RBC discussions and recommendations.

At the request of the RBC, the USGS examined the sensitivity of the recharge rates used for the groundwater model scenarios. Although this was not documented in the Plan, the results of the sensitivity analysis showed that groundwater availability was not very sensitive to changes in recharge rates over the 50-year planning horizon. This is because groundwater generally takes between 100 and 1,000 years to reach portions of the Coastal Plain aquifers where groundwater most typically extracted. The results of this analysis suggest that changes in land use in the upper Coastal Plain, where much of the recharge occurs, is not sensitive to near-term (less than 50 to 100 years) changes in recharge, but may be sensitive in the long-term (greater than 100 years).

Comments Submitted by:
Eric Krueger
Director of Science and Stewardship
The Nature Conservancy, South Carolina

RBC responses follow each comment in red text.

Congratulations to the South Carolina Department of Natural Resources (SCDNR) on the completion of the draft Edisto River Basin Plan 2023 (Plan). Basin-specific and built on actionable technical information and stakeholder processes, the Plan is the first of its kind for the State. The Plan is the culmination of a great deal of work which began with the initial basin modeling to set the technical basis over 6 years ago, stepping through framework development with the State's Planning Process Advisory Committee, and then specific Plan development through the Edisto River Basin Council (RBC). The work also relied upon case-building and appeal to the State Legislature for support and funding. The Nature Conservancy (TNC) has participated in each step and appreciates the opportunity to comment at this important juncture. Please know that any critical comments we offer are in the spirit of continual learning, and TNC stands ready as a partner to continue working with and improving this process.

We have divided our comments along lines of process, general content, and use of biological response metrics. Where comments address a specific place in the document, we have provided a page number reference. For time efficiency, we have also chosen to focus on chapters regarding water management strategies, policy, and implementation while recognizing the excellent information accumulated here regarding basin characteristics, modeling tools, and other technical matters.

Process Comments

We commend SCDNR's approach to the planning process and use of multi-sector stakeholder participation to reach consensus-based decisions on Edisto River water use. We share the following observations as potential improvements to the process and decision making.

1. The Plan's many good outcomes are currently based in model outputs which assume reduced water use by the basin's withdrawers. The Plan recognizes the outcomes will require a great deal of stakeholder outreach and cultivation beyond the RBC members and the reach of the draft Plan. Also, some of the Plan outcomes will rely on funding or technical assistance that current withdrawers are not aware of or may not have time to seek. TNC suggests there may be an opportunity for the State of South Carolina to create paid full-time basin advisory position(s) to do this work. This could be similar to the SCDNR's liaison positions to the US Department of Agriculture's Natural Resources Conservation Service and would link directly to Group 2 Implementation Objectives detailed in Chapter 10 (Table 10-1).

Response: The RBC appreciates this suggestion which recognizes that funding and technical assistance are critical to implementation, and more resources may be needed to implement the findings of the River Basin Plans and State Water Plan.

2. For future RBC's, we encourage more effort to get stakeholders to voice their specific concerns. This may include surveying RBC members in real time as the information and proposals roll out to maintain active engagement and group understanding. A number of RBC members didn't clarify their concerns or positions until indirectly prodded by a pending decision or a result which impacted their concerns; a few didn't seem to speak at all.

Response: Paramount to a successful stakeholder-led planning process is those stakeholders providing timely input and feedback and voicing any concerns throughout the process. Various methods were employed to promote engagement and provide opportunities for all members to be heard. For example, small group breakout discussions were held, subcommittees were formed, and at least four different surveys we sent to RBC members to solicit feedback and provide the the RBC the opportunity to raise issues and concerns outside of the normal, RBC meeting discussions. Recognizing that there is always room for improvement, steps have been taken to better engage members (and illuminate specific concerns they may have) in the Broad, Saluda and Pee Dee RBCs, early and throughout all phases of the planning process.

3. We suggest seeking ways to make the Chair and Vice Chair more visible in the process. As an example, perhaps they lead the Q and A sessions after major agenda items, then cue the transition to the next item. They could cite the specific objectives and decision points of that day when they call the meeting to order. There may be other possibilities. In the Edisto RBC, the actions or importance of these seats seemed lost or diminished over time. We recognize the challenge of recruiting strong lay leadership into a technical space like water planning, but these roles are important to demonstrating stakeholder ownership in the process and need visibility.

Response: We appreciate the suggestion. For the Edisto RBC meetings, the Chair and Vice Chair participated in the Planning Team calls to help set the meeting agendas and discuss pertinent topics. The Edisto RBC Chair called the meeting to order, reviewed the objectives and key decision points for the day, and offered RBC members the opportunity to briefly introduce a topic of information, prior to moving through the agenda. Each elected Chair of an RBC can assume more or less responsibility, based on their desires and the determined need.

4. The rules regarding attendance and use of official alternates may need more consistent enforcement, or perhaps reaching out to absent RBC members to encourage regular attendance. There was uneven representation across meetings.

Response: The RBC Facilitator frequently reached out to members who were not consistently attending meetings to encourage their attendance, encourage that they identify an alternate, and identify possible solutions to help them attend in-person or virtually. Attendance was frequently discussed during Planning Team calls. In the Edisto Basin, one member was voted off the RBC due to lagging attendance and another was voted off after taking a water utility-related position in a different river basin. Ultimately, it needs to be recognized that RBC members have many competing priorities, including a full-time job that may or may not be compatible to attending all RBC meetings over a 24 month period. With consideration for these circumstances, the Planning Team felt that it was prudent to relax attendance requirements slightly. Ultimately, while the PPAC provides guidelines, the RBC retains discretion over enforcing attendance.

Content Comments

Generally, the document details a wide range of proven water management strategies and does an excellent job in Chapter 6 of showing how combinations of strategies and demand scenarios affect water availability in the Edisto River basin. We appreciate how the conservation strategies are constructed to require contributions from multiple sectors, adhering to a principle of shared responsibility. The connection between the water management strategies (Chapter 6) and the Implementation Plan (Chapter 10) is unclear, though. For example, how many objectives across which sectors need to be accomplished to affect all or part of the outcomes detailed in Chapter 6? As it stands now, a variety of strategies could be implemented without knowing whether the collective result is meaningful to the basin.

We appreciate the technical and sociopolitical difficulty of doing the above. We do suggest future workings of the Edisto RBC pursue a goal of multi-sector consensus on a narrower set of targeted strategies which produce a measurable outcome. TNC remains willing to assist in this.

Response: We appreciate the comment and suggestion. During RBC discussion, it was recognized that there is not a "one-size fits all" solution to many of the recommended strategies, and especially the demand-side strategies. Pursuing a narrower set of targeted strategies which are expected to produce a measurable outcome is an excellent suggestion for future work in the basin.

We also offer the following specific content-related comments. Again, we focused on a limited set of Chapters, and the following is not intended to be comprehensive.

1. Page numbers for content items should be hot-linked for navigation

2. Map legends and legend items are blurry and colors and shapes are indistinct from one another. The resolution for most figures needs to be increased. Remove black-line borders from legend items to improve distinctions when viewed at basin level.

3. The same is true for figures and figure labels. Many labels, graph axes, and other objects become blurry when the magnification is at a readable level.

Response to Comments 2 and 3): A lower-resolution version was posted to facilitate access and review. The Final Plan will have better resolution. In some instances, (i.e., groundawater modeling maps and figures) the Plan authors used the best available images provided by others.

4. Page 3-11 SWAM Figure: "Model Objects" is an opaque term to the public. Strike "Model Objects" and just list "Tributary, Discharge, Stream Gage" as legend items, then header the remainder as "Withdrawal Types" and list (municipal, agricultural, etc).

   a. We provide this as an example, and suggest reviewing the document for other figures, tables, and legends which use opaque technical terms. The visual items are the parts of the plan most likely to be reviewed by lay stakeholders and should be as accessible as possible.

Response: We appreciate the comment and suggestion and have taken some steps to improve the accessibility of the Plan to lay stakeholders.

5. On Page 6-17, the Plan states "This low flow management strategy represents an important tradeoff in the basin between instream river flows for ecological purposes and consumptive withdrawals" without proof. This would be an excellent place to deploy the biological response metrics to demonstrate the degree of tradeoff. The ecological value of fixed MIF's is not demonstrated for one. And, these just may be conditions we face as a society sometime. To cast this as "ecological" sets up the situation where users only agree to it if they care about fish.

   a. "Balanced needs" also mentioned – the 4a and 4b scenarios better represent this broader concept and the value of "shared pain"

Response: The suggestion to deploy the biological response metrics to better evaluate the potential ecological benefit is a good one, and will be considered by the RBC for future work.

6. Summarize the policy recommendations at the top of Chapter 9, then allow the reader to review discussion, voting, etc if they wish. As it stands now, the recommendations are lost within the voluminous text and figures. So, it would read from the top:

a. Recommendation 1: The Regulations use 80% median flow instead of 80% mean to determine safe yield
b. Recommendation 2: The Regulations use median annual daily flow instead of..
c. Recommendation 3: … and so on

Response: The recommendations detailed in Chapter 9 are presented in the order specified in the Planning Framework (Planning Process followed by Technical, followed by Policy, Legislative and Regulatory). The five Policy, Legislative and Regulatory recommendations were considered as "proposed" recommendations, and the results of voting were reported. Listing them as recommendations at the beginning of Chapter 9, or even at the beginning of Chapter 9.3, without the supporting explanation, discussion, and voting results my confuse the lay reader, as several of these address somewhat technical issues. We think it's better to list them in context. Note that the Executive Summary does have a simplified one-page summary of these five proposed recommendations, how the RBC voted on them, and what their concerns were if they did not support the proposed recommendation.

Use of Biological Response Metrics

We strongly commend the SCDNR for its deployment of biological response metrics in assessing the impact of different water use scenarios. We view this as a groundbreaking step to understand the explicit impact of human-driven changes to stream and river flow to aquatic life communities. In our view, there is a long history of science connecting water flow cues to the life cycles of aquatic organisms.

These cues come in forms of flow magnitude, frequency, duration, timing, and rates of change and may operate singularly or in combination depending on the group of organisms under consideration.

Fair to say, these metrics demonstrated very low biological impacts due to flow changes likely to occur in the Edisto River through 2070. This is positive, as it demonstrates the absence of any near-term tipping points for instream health as it relates to water use. The relative insensitivity may also demonstrate the need for additional work on biological responses to assure no important flow relationships were missed. The latter work is currently being undertaken by SCDNR, Clemson University, TNC and others. As the health of our rivers and streams is a broadly shared concern, we are firm in our commitment to this work.

Despite any challenges encountered, using these metrics is a key conversation opener with water use sector representatives, as previous approaches to conserving stream and river organisms like a single minimum flow are unclear in their relationship to those organisms.

In some instances, the flow-ecology metrics used in the Plan are mis-characterized as arising from or applicable at specific geographic points in the river basin. Instead, the metrics are based in stream types and their use is valid anywhere in the basin where a certain stream type is found. All of the stream reaches in the Edisto River basin fall within one of the three stream types for which we developed biological response metrics.

The purpose of using a specific geographic point for application is to reflect the flow changes imposed by a unique set of users and projected demands. The point location determines the hydrologic change. The biology responds to that change. As now portrayed, water users could interpret the information as only applicable at points. If a user is not at or affecting that point, then it becomes irrelevant to them.

The following comments offer specific amendments to make the description and use of these metrics more clear and accurate:

1. Page 5-6, second paragraph: Amend the phrase ".. a general assessment of habitat suitability.." to ".. a general assessment of how aquatic life will be impacted by changes in flow..". The use of "habitat suitability" conjures a wide range of non-flow factors like land use, sedimentation, pollution and the like.

2. Page 5-27; Chapter 5.3.6: Amend the end of the first paragraph to "Generally, the study demonstrated that the simulated flow regimes of the Moderate, HD, and P&R Scenarios are likely to result in low ecological risk in most primary and secondary tributaries of the Edisto River basin."

3. Page 5-27; Chapter 5.3.6: … amend to ".. The three risk categories, high, medium, and low, are determined by sudden and significant changes in biological health, driven by the change in the hydrologic metric."

4. Page 5-27; Chapter 5.3.6: The second paragraph references 5.2.2 as a section detailing the biological response metrics, but 5.2.2 (Page 5-7) is currently titled "Groundwater Performance Measures". It appears there is a missing section header.

5. Page 5-27; Chapter 5.3.6: amend to "… Biological response metrics were applied at Strategic Nodes…" or you could say "Biological responses in response to flow changes were examined at Strategic Nodes…"

6. Page 5-30, bullet point #2 states "The relationships between hydrologic metrics and biological response metrics were derived from a detailed study that focused on small "wadeable" streams in headwater subbasins. A key assumption in this work is that these relationships scale up reasonably to larger primary and secondary tributaries."

   a. This statement minimizes the range of the biological data underpinning the metrics. Biological data was collected in the Edisto River throughout the basin, even including several mainstem sites down to Givhans Ferry. "Wadeable" is a loose term which only describes whether one can sample on foot in the stream. The Edisto contains such places throughout its length.
   b. A summary document titled "Executive Summary for the Edisto RBC 051921" was submitted to SCDNR in May 2021 and contains a map showing the range of Edisto sampling sites. Refer back to this map to see the geographic range of sampling.
   c. An accurate amendment might state "The relationships between hydrologic metrics and biological responses were derived by processing biological samples from wadeable sampling points and hydrologic records throughout the Edisto River basin via machine learning techniques. Wadeable access, while more limited downstream and in larger tributaries, occurs nearly throughout the basin.

Response: All of the recommended wording changes listed above have been made in Chapter 5. We appreciate the thorough review and clarifying language.

This concludes our comments to the Draft Edisto River Basin Plan. For questions regarding the content of these comments, please contact Eric Krueger, Director of Science and Stewardship, using the contact information below. Again, we appreciate the ability to engage with this process across multiple levels and remain a willing partner in working toward a true statewide water plan.

Comments Submitted by:
Leonilda Burke

Many thanks to all members of the Edisto RBC and staff for their hundreds of hours devoted to making a Plan for the Edisto River Basin.

I attended some of the virtual RBC meetings as well as the February 15th presentation of the Draft Plan in Orangeburg. I have studied the Executive Summary of the Edisto River Basin Plan Draft.

I believe this draft can be improved. If the report and those of the other RBC's are to be a basis for a new State Water Plan, recommendations need to be stronger and more clear-cut. Using a consensus approach dilutes the recommendations legislators will ultimately depend on to support new legislation related to our rivers. "Consensus" has various definitions depending on what dictionary you consult and seems quite vague.

Response: The RBC appreciates the comment and recognizes that consensus approach may have some minor limitations in certain instances. The State Water Planning Framework that the RBC followed defines "consensus" as being *when all members can "live with" the outcome of a proposal being made*. The Framework also notes that, "*the diverse membership of each RBC is intended to allow for a variety of perspectives during the formulation of the River Basin Plan. The planning process is intended to follow a consensus-driven approach, in which local stakeholders work together to develop a water plan that fairly and adequately addresses the needs and concerns of all water users.*"

Water planning typically involves many stakeholders with varied interests, and as such, there are significant drawbacks to making decisions based on majority votes. For one, a majority vote may reflect the make-up of the RBC, but not adequately represent those who most rely on the water, or those who have invested the most (financially or otherwise) in the resource. The consensus-based approach seeks to identify areas of common interests, and find balanced solutions that stakeholders from all water interest categories can live with.

However, many of the policy recommendations in the report were presented in the form of advantages and disadvantages, and by vote of the RBC members. These are included both in the Executive Summary and in Chapter 9, with comments from the RBC that express both support and concern about each.

Page 24 Draft Summary - Pie Charts

The way results are displayed is confusing. It took me awhile to figure out that the chart lists the number of votes, then a comma and the percentage represented. It would be much easier if the % was on top and then number of votes beneath it in parentheses. Including a key or legend for the pie charts as in some of the other charts throughout the Plan would be valuable.

I do not understand why abstentions would even be allowed in the all-important recommendation section of this report. Council members have been educated throughout this process and tasked with making recommendations. Each and every person should make his/her voice heard.

Response: Because of the highly technical nature of some of the issues and proposed recommendations, the opportunity to abstain from voting was provided, recognizing that the RBC members may not have a strong enough understanding of the complexities of the issue to cast a vote one way or another.

The process of permitting and registering large users to take surface water from the River in perpetuity is flawed. The root of the process - Safe Yield - definitely needs to be revised. Surface water resources are over allocated based on existing permits and registrations. Even though they are currently taking 17% of what has been allocated , the risk is there and safe yield needs to be fixed.

Replacing grandfathered registrations and newer permits with a different system that would have have all users subject to periodic reviews would allow the Bureau of Water to better manage water in our rivers. It makes more sense as now it appears some users have an advantage over others.

Response: The RBC appreciates the suggestions and ideas. SCDHEC has recently circulated some proposed changes to the South Carolina Surface Water Withdrawal, Permitting, Use, and Reporting Act that attempt to address some of these issues.

Comments Submitted by:
Landrum Weathers
Edisto RBC Member and Vice Chair

My name is Landrum Weathers and I am from Bowman, South Carolina –a small rural town in Orangeburg County. Other than the four years I attended Clemson, I have spent my whole life in Bowman on my family's farm. I am the fourth generation of my family to farm and I am proud and honored to continue our family's farming heritage in our part of the state.

In March of 2018, I was appointed to the Planning Process Advisory Committee (PPAC) coordinated by DNR. I appreciated, and still do, the members of our committee and our dedication to the water resources in our state. I think we would all agree we came together and cooperated for the good of the resource.

Since I was appointed after PPAC had already been formed and had met a few times, I wanted to make sure I was caught up on everything. I did my homework on water planning and the history of water planning in our State. As part of my research, I obtained and read a copy of the last water plan that our

State had done: the 2004 State Water Plan. I also learned the 2004 State Water Plan has basically been sitting on a shelf since then and has never been adopted by the General Assembly. The PPAC developed a framework for eight River Basin Councils (RBCs) – double that of the never-adopted 2004 plan– to develop their own unique river basin plan that would one day be compiled into the overarching State's Water Plan. I have never been able to be at peace with using the same approach/strategy, and doubling the work, of a plan that was never adopted.

During most of the PPAC, and this still continues today, there was always an overarching feeling I got in all of the meetings: it is the simple fact that we have too many people, agencies, and bureaucrats handling our water resources. We have an agency that is in control of planning, we have an agency that is in control of regulating, we have another new agency that is looking into flooding. Not to mention a drought response committee and the Governor who has control of the Drought Act. We have too many agencies and too much confusion. Most of water planning and/or regulation is based off maps and associated boundaries. None of the maps and boundaries are the same as there are at least four different maps that are used for different reasons.

I am also a member of the Edisto River Basin Council and serve as Vice Chairman. The Edisto RBC was charged to be the first RBC. Not because we had problems or lacked water, but because we had a family move in from out of state in 2013 and start a potato farm. We have had over 30 meetings and it has been a long and tedious and somewhat wasteful process. We have developed a plan and have yet to have our final vote on that plan. If this plan is approved by the RBC, this will only be one eighth or 13% of our State Water Plan completed. Two other RBC's have been started but those are still in the "infant" stages of a 2.5-3 year process.

While the plan that the group came up with is mostly data based, the data was pulled using parameters set up by individuals The plan is based on models that were run using different parameters. Those parameters can be set based on a number of different things and I will always contend that the parameters were set to show what some wanted the models to show.

For example, in my very first PPAC meeting, DNR debuted the highly touted-and highly priced-SWAM model. The very first public showing of the SWAM model was a hypothetical 25,000 corn farm on the Edisto River. Why did this have to be a farm? Of course irrigating 25,000 acres of one of the most water intensive crops off a small river out of one intake could suck the river dry.

Why couldn't it be an Elon Musk rocket plant on the Broad River? If it was a hypothetical example, why would DNR staff choose to use agriculture as its example on the most politically driven topic at the time?

The plan that is pending approval has a few good things in it. A lot of the water saving recommendations that are in the plan are already being done because it's good business and businesses around the state already know that. But, like I said, it has a lot of fluff in it as well.

In my personal opinion, I can summarize with this simple timeline:

- DNR is charged by the General Assembly to plan water
- DNR's 2004 water plan never adopted
- DHEC is charged by the General Assembly to regulate water

- Edisto River and its surrounding communities have disagreements about water
- DNR asks for more money to plan water, even though DNR is supposed to be doing it and their latest product failed
- DNR results in doubling the scope of the failed plan
- DNR asks for more money for RBC's
- DHEC doesn't want to be left out and doesn't like taking planning orders from DNR
- Office of Resiliency is formed to study flooding/water management
- Edisto RBC takes 3 years and $1,300,000 to develop a feel good 300 page document
- State of South Carolina $10,500,000 poorer and only a mediocre product to show for it, with no certainty that it won't "sit on the shelf" for another 20 years.

The amount of time and tax payer dollars allocated to the process is disheartening. For me personally, I agreed to get involved in the stakeholder process because I am passionate about agriculture and I am honored to represent the largest industry of our state. As I reflect on the amount of personal time and money I have spent in these processes, I am constantly discouraged because of the process and the inefficiencies. If I conducted my business the way these processes are conducted, I would be out of business. If we want to get serious about our water resources in South Carolina, we should care enough to have all of water business handled in one single water agency.

Response: The RBC appreciates Mr. Weathers' perspective, his comments and the multi-year commitment he has put into serving on the PPAC and the Edisto RBC.

As a point of clarification, the very first public demonstrations of the SWAM models were made between 2015 and 2017 at 16 different meetings open to the public and stakeholders in each of the 8 major basins. Two meetings were held in the Edisto River basin. At the second Edisto public meeting, demonstrations of the Edisto SWAM model were given. These demonstrations offered examples of how the model can be used to evaluate water availability and evaluate water management strategies. Examples of both agricultural and municipal water withdrawals were used to demonstrate model functionality. Similar examples of all types of water uses, including municipal, industrial, energy, agricultural and in-stream uses, were provided at meetings introducing the other seven models.

In addition to the 16 public meetings, at least eight presentations and demonstrations of the models were given at water-related conferences and symposiums throughout the state. In total, there were over two dozen opportunities for the public and stakeholders with water-related interests to become familiar with the models prior to the PPAC forming in 2018, and prior to the demonstration noted by Mr. Weathers. These presentations focused on how the models can be used to evaluate conditions resulting from current and projected water demands for all permitted and registered water use sectors, and how to develop sustainable solutions to reduce or eliminate potential shortages.

It is also important to note that the SWAM modeling in the Edisto River basin clearly demonstrated the sufficiency of water to satisfy both current agricultural needs, and the projected increase in agricultural water needs by 2070 of up to 40 percent (as referenced in Section 4.4.1). The modeling did not emphasize any water use sector over any others but demonstrated the overall sufficiency of water in the basin and recommended continued stewardship practices by all users to help realize this outcome.

CDM Smith®

Photo courtesy Charleston Water System