Regional Water Plan

September 2011

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Tables

Figures

AAD-MGD	annual average demand in million gallons per day
AAF-MGD	annual average flow in million gallons per day
ACCG	Association of County Commissioners of Georgia
AG	Agricultural Water Withdrawal (Permittee Category)
BMP	best management practice
BP	balance priorities
CMOM	capacity, management, operation, and maintenance
CR	conservation and reuse capacity
CST	Construction Stormwater (Permittee Category)
DA	data management
DCA	Department of Community Affairs
DCH	Department of Community Health
DNR	Department of Natural Resources
DO	dissolved oxygen
ES	educate stakeholders
FERC	Federal Energy Regulatory Commission
FOG	fats, oils, and grease
GADNR	Georgia Department of Natural Resources
GAEPD	Georgia Environmental Protection Division of GADNR
GAWP	Georgia Association of Water Professionals
GC	Golf Course Water Withdrawal (Permittee Category)
GEFA	Georgia Environmental Finance Authority
GEMA	Georgia Emergency Management Agency
GGCSA	Georgia Golf Course Superintendents Association
GGIA	Georgia Green Industry Association
GLUT	Georgia Land Use Trends
GMA	Georgia Municipal Association
gpd	gallons per day
gpf	gallons per flush
gpm	gallons per minute
GRWA	Georgia Rural Water Association
GSWCC	Georgia Soil and Water Conservation Commission
I/I	inflow and infiltration
IND	Industrial Water Withdrawal (Permittee Category)
INDST	Industrial Stormwater (Permittee Category)
INDWW	Industrial Wastewater (Permittee Category)
LAS	land application system
lb/yr	pounds per year

MG	million gallons
MGD	million gallons per day
mg/L	milligrams per liter
µg/L	micrograms per liter
MOA	Memorandum of Agreement
MPs	management practices
MS4	Municipal Separate Storm Sewer System (Permittee Category)
MU	Municipal Water Withdrawal (Permittee Category)
MUWW	Municipal Wastewater (Permittee Category)
MWh	megawatt-hour
NARSAL	Natural Resources Spatial Analysis Laboratory
NESPAL	National Environmentally Sound Production Agriculture Laboratory
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
O&M	operation and maintenance
O.C.G.A.	Official Code of Georgia Annotated
OSSM	On-Site Sewage Management System
RC	Regional Commission
RC&D	Resource Conservation and Development
RS	revenue strategies
SD	Safe Dams Program
TMDL	total maximum daily load
µg/L	micrograms per liter
UGA	University of Georgia
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UST	Underground Storage Tank (Permittee Category)
WC	water conservation (Management Practice Category)
WCIP	Water Conservation Implementation Plan
WQ	water quality (Management Practice Category)
WRD	Wildlife Resources Division of GADNR
WS	water supply (Management Practice Category)
WTP	water treatment plant
WW	wastewater (Management Practice Category)
WWTP	wastewater treatment plant

Acknowledgements

GAEPD and CH2M Hill gratefully acknowledge the cooperation, courtesy, and contributions of the following members of the Upper Oconee Council. The Council members volunteered their time and talents for more than a dozen Council Meetings, Joint Council Meetings, and countless conference calls during the development of this Regional Water Plan.

Name	City	County
James Andrews	Sandersville	Washington
Charles S. Armentrout	Athens - Clarke	Athens - Clarke
W. David Bennett	Milledgeville	Baldwin, Chairman
Richard Bentley	Milledgeville	Baldwin, Chairman
Hunter Bicknell	Jefferson	Jackson
Vincent Ciampa	Eatonton	Putnam
Stuart A. Cofer	Watkinsville	Oconee, Alternate
Melvin Davis	Watkinsville	Oconee
Jennifer Davis	Dublin	Laurens
Larry J. Eley	White Plains	Green
Roger L. Folsom	Dublin	Laurens
Alan Foster	Eatonton	Putnam
Linda S. Gantt	Watkinsville	Oconee
Pat Graham	Braselton	Barrow
Patrick H. Hardy, Sr.	Madison	Morgan
Dana M. Heil	Athens - Clarke	Athens - Clarke
Allen M. Hodges	Sandersville	Washington
Danny Hogan	Dexter	Laurens
Dennis W. Holder	Irwinton	Wilkinson, Vice Chair
Charles H. Jordan	Sandersville	Washington
Kevin Little	Monroe	Walton
Jim Luke	Bogart	Athens – Clarke, Alternate
Drew Marczak	Athens - Clarke	Athens - Clarke
Richard McSpadden	Bogart	Oconee, Vice Chair
W. Rabun Neal	Greensboro	Greene
Bill Ross	Statham	Barrow
Benjamin R. Tarbutton	Sandersville	Washington
Greg Thompson	Monroe	Walton
Representative Terry England		Ex-Officio
Senator Bill Cowsert		Ex-Officio

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Executive Summary

This Regional Water Plan lays out a roadmap for implementing specific measures designed to ensure wise use and management of the Region's water over the next 40 years. It focuses on four areas:

- Water Conservation—Responsible use of public resources.
- Water Supply—Optimal management of water supplies and systems.
- Wastewater—Reliable means for wastewater treatment and reuse.
- Water Quality—Environmental improvements through reduced pollution.

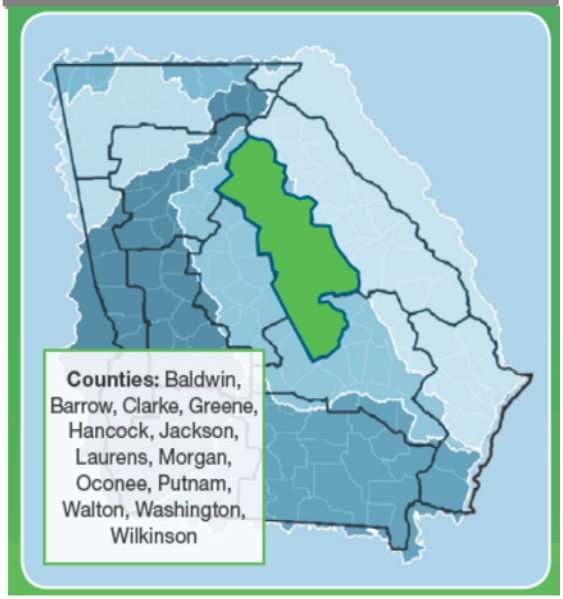
This Plan assesses the Region's current and future water and wastewater needs and describes 38 Management Practices (MPs) that can be implemented through collaboration between local, regional, and state entities. It also presents realistic and measurable benchmarks to track short-term and long-term progress toward implementing the MPs.

Introduction

The Georgia Environmental Protection Division (GAEPD), with oversight from the Georgia Water Council, developed the first Comprehensive State-wide Water Management Plan (State Water Plan), which was adopted by the Georgia General Assembly in January 2008. The State Water Plan included a provision to create 10 water planning regions across the state, each guided by a regional water planning council. (An eleventh region and council, covering the Atlanta metro area, already existed). Part of the mission of each council was to create a Regional Water Plan for submittal to GAEPD by the end of September 2011.

The Upper Oconee Regional Water Planning Council (the Council) prepared this Regional Water Plan for the Upper Oconee Water Planning Region which includes 13 counties and 62 incorporated municipalities (See Figure ES-1).

Figure ES-1: Location Map of Upper Oconee Water Planning Region



The Region contains portions of the Oconee, Ocmulgee, Ogeechee, Savannah, and Altamaha river basins and includes various groundwater aquifer systems, particularly the Crystalline rock aquifer systems, the Cretaceous aquifer system, and the Upper Floridan aquifer. Surface water supplies the bulk of the Region's water demands.

Process

The Upper Oconee Regional Water Planning Council is comprised of 29 individuals who represent a cross-section of public and private stakeholders within the Region's 13 counties: Baldwin, Barrow, Athens-Clarke, Greene, Hancock, Jackson, Laurens, Morgan, Oconee, Putnam, Walton, Washington, and Wilkinson. The Council adopted the following vision and goals (Table ES-1) to guide the development of this Regional Water Plan:

Vision: *Create a regional plan that focuses on managing water as a critical resource vital to our health, economic, social and environmental well being. Build trusting partnerships with neighboring regions and develop an educated and engaged citizenry that embraces sound water management.*

Table ES-1: Goals for the Regional Water Plan

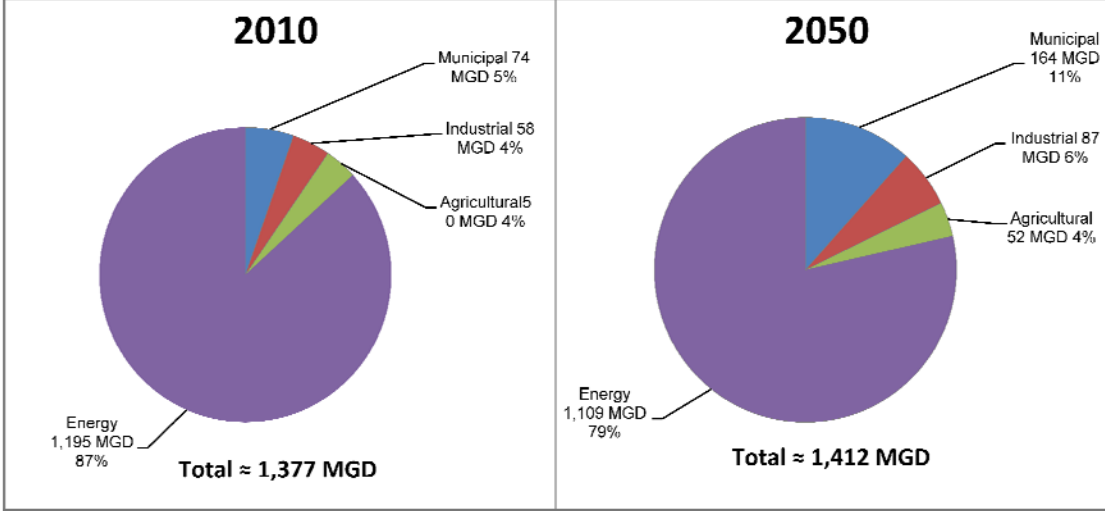
Number	Goal
1	Promote alternatives and technologies that conserve, reuse, return, and recycle water within the Upper Oconee region.
2	Ensure that management practices balance economic development, recreation, and environmental interests.
3	Educate stakeholders in the region on the importance of water quality and managing water as a resource including practices such as water conservation and increased water efficiency.
4	Encourage the development of and accessibility to data and information to guide management decisions.
5	Identify programs, projects, and educational messages to reduce non-point source pollution to protect water quality in lakes and streams.
6	Recommend innovative strategies (water, sewer, and/or stormwater) that provide sufficient revenues to maintain a high level of service while promoting water conservation and efficiency.
7	Identify and plan measures to ensure sustainable, adequate water supply to meet current and predicted long-term population, environmental, and economic needs.

Eleven full council meetings were held to develop the Regional Water Plan between February of 2009 and September of 2011. The meetings included representation from state agency staff, local government and utility staff, and interested stakeholders. Additional subcommittee meetings were held to address specific topics including the water and wastewater per capita demands, agricultural water demand forecasts, and the selection of MPs. Results and recommendations from subcommittee meetings were discussed and approved during full council meetings.

Water and Wastewater Demands

As shown in Figure ES-2, major water uses, based on 2010 water withdrawal totals, are for energy generation (87 percent), municipal water supply (5 percent), industrial use (4 percent), and agricultural use (4 percent). Virtually all of the water withdrawn for energy generation is used for cooling and then returned to its original source. Thus, consumptive water use for this purpose is negligible. Energy water demands are expected to decrease throughout the planning horizon (i.e., through 2050); however, energy use will remain the largest demand in the Region in 2050, comprising 79 percent of the total (CDM, 2010). Other uses forecast for 2050 include municipal water supply (11 percent), industrial use (6 percent), and agricultural use (4 percent). Municipal and industrial water demands are projected to increase steadily from approximately 132 million gallons per day (MGD) in 2010 to 251 MGD in 2050.

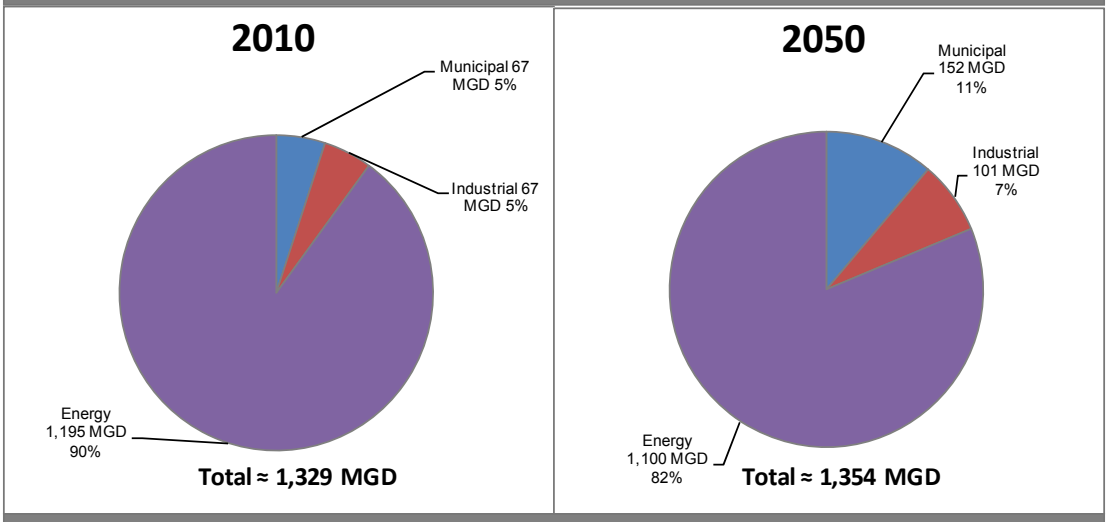
Figure ES-2: Water Demand for 2010 and 2050 (AAD-MGD)



Notes:
Based on Alternative Energy Forecast (CDM, 2010).
Data Sources: Upper Oconee Municipal and Industrial Forecasts (CH2M HILL, 2010), Energy Forecasts (CDM, 2010), and Agricultural Forecasts (UGA, 2010).

Figure ES-3 shows the results of the wastewater flow forecast for 2010 and 2050 by sector. Water returns from thermoelectric energy production make up 90 and 82 percent of the total in 2010 and 2050, respectively. However, these flows are generally for permitted cooling water returns and do not represent future needs for wastewater treatment. The total wastewater flow for municipal and industrial uses is projected to be 253 MGD in 2050.

Figure ES-3: Wastewater Flow Forecast in 2010 and 2050 (AAF-MGD)



Notes:
Energy water return is the Alternative Energy Forecast (CDM, 2010). Consumptive use was estimated to be 9 MGD in 2010 and 2050 for the Alternative Energy Forecast.

Municipal wastewater flow forecast includes point source discharges (NPDES), land application systems (LAS), and septic systems.

Data Sources: Upper Oconee Municipal and Industrial Forecasts (CH2M HILL, 2010) and Energy Forecasts (CDM, 2010).

Major Findings

The GAEPD developed Resource Assessments for the State's river basins and aquifers that examine three resource conditions:

Surface Water Quality (Assimilative Capacity)—The capacity of Georgia's surface waters to accommodate pollutants without unacceptable degradation of water quality, i.e., without exceeding State water quality standards or harming aquatic life.

Surface Water Quantity—The ability of surface water resources to meet municipal, industrial, agricultural, and thermoelectric power water needs, as well as the needs of in-stream and downstream users.

Groundwater Quantity—The sustainable yield for prioritized groundwater resources based on existing data.

The Resource Assessments identify potential shortcomings in these resources and classify them as "gaps." A gap means that the existing or future conditions exceed the Resource Assessment metric, e.g., the sustainable yield of a specific groundwater aquifer is exceeded, thus, a potential "gap" exists in groundwater availability in that area.

In addition, an analysis of existing permitted capacity (for water and wastewater facilities) versus future demands was conducted to identify potential water infrastructure "needs" and any potential wastewater infrastructure "shortages." A need or shortage means that the current permitted capacity of water or wastewater treatment facilities, respectively, is less than the future forecast demands, e.g., a "shortage" would occur if the permitted capacity of a wastewater treatment plant in 2050 is less than the forecast demand for that year.

Table ES-2 summarizes the potential gaps and/or needs and shortages identified for each county within the Region:

Table ES-2: Summary of Potential Gaps, Needs, or Shortages by County

County	Ground-water Gaps	Surface Water Gaps	Municipal Water Needs	Municipal Wastewater Shortages	Water Quality – Assimilative Capacity Gaps	Water Quality 303(d) Issues
For more details see:	*Table 5-1*	*Table 5-2*	*Table 5-4*	*Table 5-5*	*Figure 5-4*	*Sections 3.3.2 and 5.3*
Baldwin					Yes	Yes
Barrow		Yes	Yes	Yes		Yes
Athens-Clarke		Yes	Yes	Yes	Yes	Yes
Greene			Yes	Yes		Yes
Hancock						Yes
Jackson		Yes		Yes		Yes
Laurens	Yes				Yes	Yes
Morgan			Yes		Yes	Yes
Oconee		Yes		Yes		Yes
Putnam					Yes	Yes
Walton				Yes		Yes
Washington	Yes			Yes	Yes	Yes
Wilkinson	Yes				Yes	Yes
Total Counties	3	4	4	7	7	13

Notes:
"Yes" indicates that there is a potential existing or future gap or need/shortage in the indicated county.
"Gap" is defined as a condition where the existing or future conditions exceed the Resource Assessment metric.
"Need" and "Shortage" are defined as a condition where the current permitted capacity of water and wastewater treatment facilities, respectively, is less than the future forecast demands.

Based on the evaluation of the Resource Assessments and future consumption, there were only limited gaps in meeting future water demands in the Region primarily due to the storage (reservoirs) available in the basin. Future water consumption in the northern portion of the basin (Athens-Clarke, Barrow, Jackson, and Oconee Counties) will result in gaps in 2050 without implementation of additional Management Practices for water supply and conservation. Water quality gaps were predicted to occur in Lakes Oconee and Sinclair due to excess nutrients in the future due to a combination of point source and nonpoint source pollutant loads from anticipated wastewater discharges and land use changes. Additional nutrient controls will be required to protect drinking water supplies, recreational activities on the lakes, and the associated economic benefits for the Region. Nutrient controls will also be required to meet the pending numeric nutrient criteria.

Recommended Management Practices

The State Water Plan defines Management Practices (MPs) as reasonable methods, considering available technology and economic factors, for managing water demand, water supply, return of water to water sources, and prevention and control of pollution of the waters of the State. The Council ultimately selected 38 MPs within the following categories: Water Conservation (12 MPs), Water Supply (7 MPs), Wastewater (7 MPs), and Water Quality (12 MPs). In counties with no identified potential gaps at the Resource Assessment level, needs, or shortages within a particular category, the MPs were selected to align with the Region's visions and goals.

Due to the diversity of water users and land uses across the basin, the Council recognized that a "one size fits all" approach to MPs was not appropriate. Therefore, the Council developed a diverse set of MPs that may be applied to address more localized sub-regional water supply, wastewater, or water quality issues.

The Council used a prioritization process to assign a benefit ranking to each MP. The top two MPs in each category are as follows:

- Water Conservation: (1) Encourage conservation pricing and (2) Develop water conservation goals.
- Water Supply: (1) Expand existing reservoirs and (2) Construct new water supply reservoirs.
- Wastewater: (1) Encourage implementation of centralized sewer in developing areas where density warrants and (2) Encourage development of local wastewater master plans/Evaluate wastewater treatment and disposal options to meet future demands.
- Water Quality: (1) Encourage comprehensive land use planning and (2) Encourage local government participation in construction erosion and sediment control.

The Council also developed initial, short-term, and long-term actions for implementing all MPs; and identified the parties responsible for implementation. The bulk of implementation actions fall to local governments and utilities and their respective Regional Commissions; however, extensive support for initial activities, in particular, will be needed from State entities, such as the GAEPD. Cost estimates are presented that specify the capital or programmatic costs and funding sources and options for each MP. In addition, the Council compiled a list of recommendations to the State for actions that will support implementation of the Plan. It also established measurable, achievable, realistic, and time-phased benchmarks for implementing this Regional Water Plan, for example, progress in implementation of the initial and short-term actions is recommended to be measured using an annual survey and improvements in water quality monitoring results will be measured using the GAEPD water quality database.

Overview of Plan Sections

Table ES-3 presents an overview of the Sections of this Regional Water Plan.

Table ES-3: Overview of the Regional Water Plan

Section	Title	Overview
1	Introduction	Introduction of Regional Water Planning process and the Council.
2	Upper Oconee Water Planning Region	Characteristics of the Region, including geography and watersheds, aquifers, population, and land cover.
3	Water Resources of the Upper Oconee Region	Major water uses and baseline water resource capacities.
4	Forecasting Future Water Resource Needs	Municipal, industrial, agricultural, and energy water use forecasts through 2050.
5	Comparison of Available Water Resource Capacities and Future Needs	Groundwater and surface water (quantity and quality) comparisons and identification of future gaps, needs, or shortages.
6	Addressing Water Needs and Regional Goals	Identified Management Practices to address future goals, gaps, needs, and shortages.
7	Implementing Water Management Practices	Management Practice implementation schedules, roles of responsible parties, and cost estimates. Recommendations to the State.
8	Monitoring and Reporting Progress	Benchmarks and measurement tools to track progress toward meeting goals and addressing shortfalls.
9	Bibliography	Supporting and referenced materials list.

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Section 1. Introduction

Section Summary

Georgia is developing Regional Water Plans for 10 planning regions across the state to define sustainable practices to meet regional water resource needs through 2050.

The Council defined a vision and 7 goals to guide its evaluation and selection of Management Practices that best meet the Region's needs. These goals include sustainable strategies to support economic development, maintain or improve water quality, and provide water for both human and aquatic resource needs.

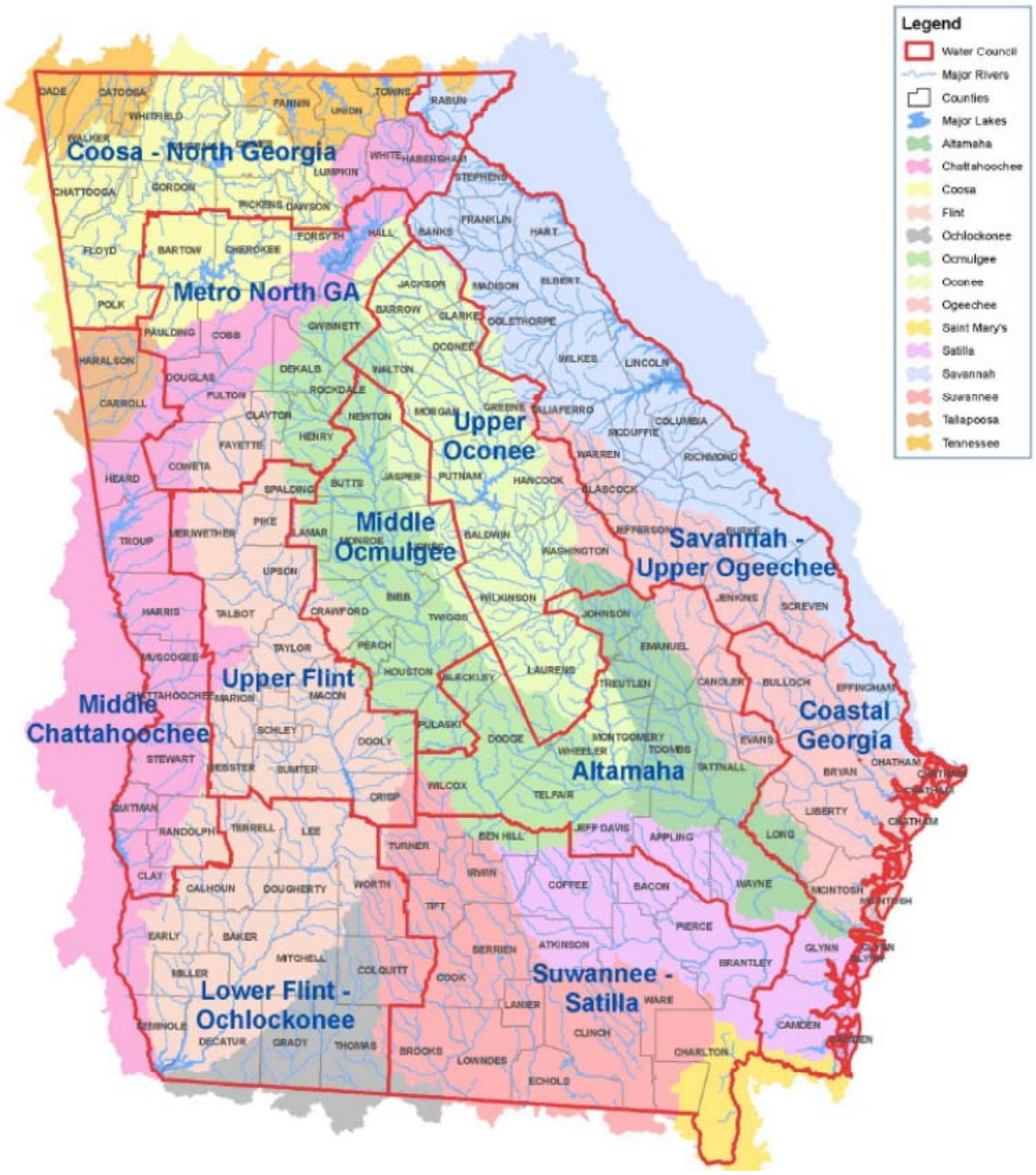
The 2004 Comprehensive State-wide Water Management Planning Act mandated the development of a state-wide water plan that supports a far-reaching vision for water resource management: "Georgia manages water resources in a sustainable manner to support the State's economy, to protect public health and natural systems, and to enhance the quality of life for all citizens" (Official Code of Georgia Annotated [O.C.G.A.] 12-5-522(a)). The Georgia Environmental Protection Division (GAEPD), with oversight from the Georgia Water Council, was charged with developing the first Comprehensive State-wide Water Management Plan (State Water Plan), which was adopted by the Georgia General Assembly in January 2008.

The State Water Plan included a provision to create 10 water planning regions across the state, each guided by a regional water planning council. Figure 1-1 illustrates the location of these regions relative to Georgia's river basins and counties. The preexisting eleventh planning region, the Metropolitan North Georgia Water Planning District (Metro Water District), represents 15 counties in the metropolitan Atlanta area. The Metro Water District was established in May 2001 by separate legislation and is discussed further in Section 7.3. In February 2009 the Governor, Lieutenant Governor, and Speaker of the House appointed the members of the regional water planning councils. Part of the mission of each council, including the Upper Oconee Regional Water Planning Council (the Council) was to submit a Regional Water Plan by September 30, 2011.

Each Regional Water Plan recommends sustainable water management practices (MPs) designed to meet each region's needs through the year 2050 while coordinating with the Regional Water Plans of adjoining regional water planning councils for consistency across the state. As such, this Regional Water Plan:

- Provides an overview of the population, land cover, and municipalities of the Upper Oconee Water Planning Region (the Region) in Section 2.
- Describes the Region's existing water resources and unique characteristics in Section 3.
- Forecasts the Region's future water resources needs in Section 4.

Figure 1-1: Georgia Regional Water Planning Councils



Source: GA EPD, 2009.

- Compares the Region's future needs with existing capacities to identify potential water resource issues, particularly any water gaps, needs, or shortages, in Section 5.
- Reviews existing local and regional plans as part of an effort to select MPs to address these potential issues while still meeting the Region's goals in Section 6.
- Establishes a roadmap for implementing the selected MPs in Section 7.
- Establishes benchmarks for measuring and reporting progress toward implementation in Section 8.

This Regional Water Plan is an important first step toward achieving the vision and goals of the Region while recognizing the need for an adaptive management approach of revisiting the Regional Water Plan on a regular, 5-year cycle.

1.1 The Significance of Water Resources in Georgia

Of all Georgia's natural resources, none is more important to the future of the state than water. The wise use and management of water is critical to support the state's economy, to protect public health and natural systems, and to enhance the quality of life for all citizens. Georgia has abundant water resources, with 14 major river systems and multiple groundwater aquifer systems. These waters are shared natural resources. Streams and rivers run through many political jurisdictions. The rain that falls in one region of Georgia may replenish the aquifers used by communities many miles away. But, while water in Georgia is abundant, it is not an unlimited resource and must be carefully and sustainably managed to meet long-term water needs.

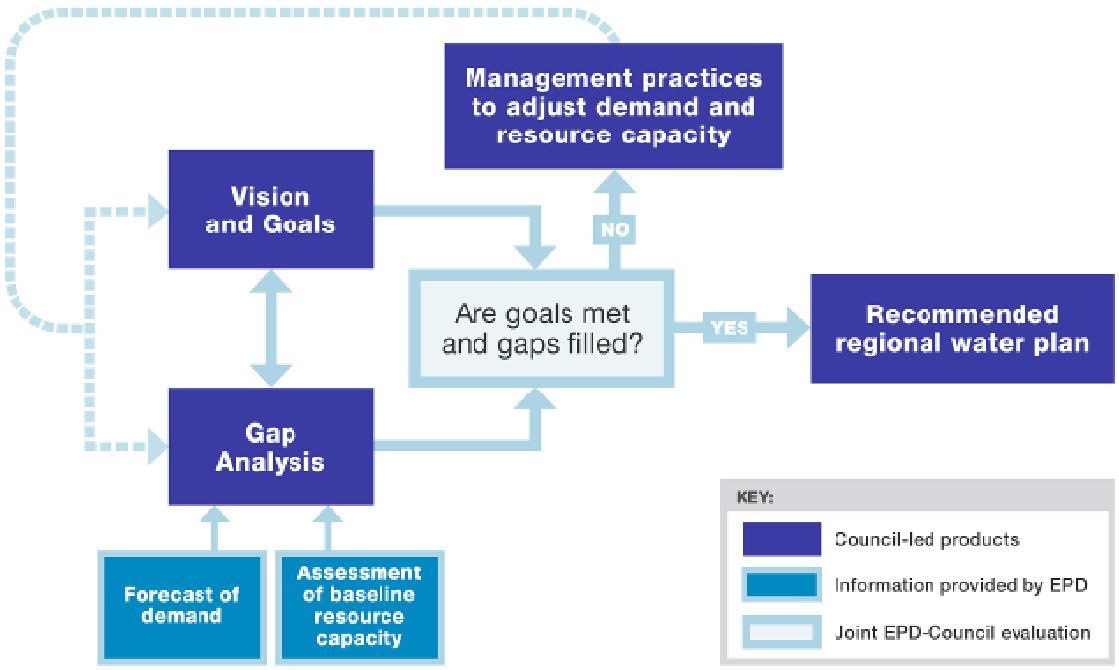
Because water resources, their conditions, and their uses vary greatly across the state, selection and implementation of MPs on a regional and local level is the most effective way to ensure that current and future needs for water supply and assimilative capacity are met. Therefore, the State Water Plan calls for the preparation of ten regional water development and conservation plans (Regional Water Plans). This Regional Water Plan prepared for the Upper Oconee Water Planning Region by the Upper Oconee Regional Water Planning Council describes the regionally appropriate water management practices to be employed in Georgia's Upper Oconee Water Planning Region over the next 40 years.

1.2 State and Regional Water Planning Process

The State Water Plan called for the preparation of Regional Water Plans designed to manage water resources in a sustainable manner through 2050. It established the 10 regional water planning councils illustrated in Figure 1-1, including the Upper Oconee Council, and provided a framework for regional planning.

The Regional Water Plans were prepared following the consensus-based planning process outlined in Figure 1-2, which integrated the input of regional water planning councils, local governments, and the public. GAEPD oversaw the planning process and, along with partner agencies, provided support to the councils. The primary role of each council was to develop a Regional Water Plan and submit it to GAEPD for approval. The Council coordinated its efforts with councils adjacent to the Region. Specific roles and responsibilities for regional water planning councils are outlined in a Memorandum of Agreement (MOA) between each council, GAEPD and the Georgia Department of Community Affairs (DCA). As detailed in the Council's MOA with GAEPD and the DCA and the Council's Public Involvement Plan[1], the process required and benefited from the input of other regional water planning councils, local governments, and the public.

Figure 1-2: State Water Planning Process



Source: Georgia Environmental Protection Division, 2009.

[1] See supplemental document on Public Involvement Plan at http://www.upperoconee.org.

The Council established a series of subcommittees which met and held conference calls throughout the planning process to assist in development of specific elements of the Regional Water Plan. These included an executive, agriculture, media, and MP subcommittee. Results of subcommittee discussions and recommendations were presented at full Council meetings and aided in the development of specific elements of this Regional Water Plan.

1.3 Upper Oconee Water Planning Region Vision and Goals

This Regional Water Plan reflects extensive efforts on the part of the 29 participants of the Council; these efforts are described in detail in the supplemental document titled *Upper Oconee Water Council: Summary of Public Outreach and Coordination Activities*, which is available on the Council website. One of the Council's first responsibilities was to establish the vision and goals for water management in the Region; these components play a critical role in the evaluation and selection of MPs that will best meet the Region's needs. The Council adopted the following vision and goals to guide the development of this Regional Water Plan:

Vision: *Create a regional plan that focuses on managing water as a critical resource vital to our health, economic, social and environmental well being. Build trusting partnerships with neighboring regions and develop an educated and engaged citizenry that embraces sound water management.*

Goals:

- Promote alternatives and technologies that conserve, reuse, return, and recycle water within the Upper Oconee region.
- Ensure that management practices balance economic development, recreation, and environmental interests.
- Educate stakeholders in the region on the importance of water quality and managing water as a resource including practices such as water conservation and increased water efficiency.
- Encourage the development of and accessibility to data and information to guide management decisions.
- Identify programs, projects, and educational messages to reduce non-point source pollution to protect water quality in lakes and streams.
- Recommend innovative strategies (water, sewer, and/or stormwater) that provide sufficient revenues to maintain a high level of service while promoting water conservation and efficiency.
- Identify and plan measures to ensure sustainable, adequate water supply to meet current and predicted long-term population, environmental, and economic needs.

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Section 2. Upper Oconee Water Planning Region

The Region, as shown in Figure 2-1, extends from Jackson County in northeast Georgia southeast approximately 150 miles to Laurens County in the Coastal Plain of south-central Georgia. The Region is approximately 5,000 square miles in size and had an estimated population of 579,873 in 2010 (Georgia Office of Planning and Budget, 2010). The Region borders the Metro Water District to the northwest, the Altamaha Water Planning Region to the south, the Savannah-Upper Ogeechee Water Planning Region to the east, and the Middle Ocmulgee Water Planning Region to the west.

Section Summary

The Region covers approximately 5,000 square miles and includes 13 counties and 62 municipalities. Athens-Clarke County is the most populous county in the Region, while Hancock County is the least populated.

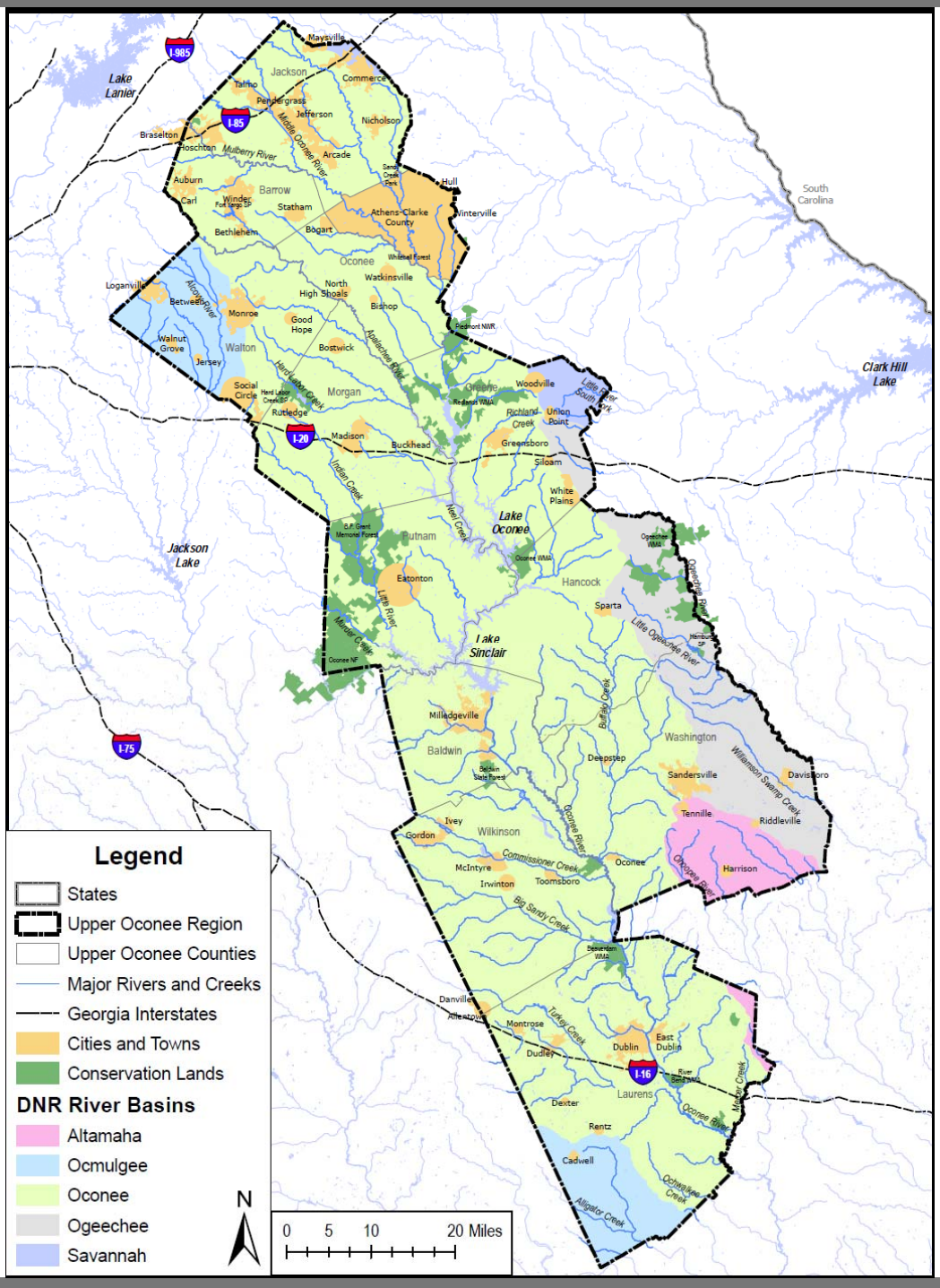
2.1 History and Geography

The Region has historical significance to the State, because it includes features, such as the City of Athens—home to the University of Georgia (UGA)—and the City of Milledgeville, which was the capital of Georgia during the Civil War and one-time home of acclaimed novelist Flannery O'Connor (Jackson, 1988; Gordon 2009). In 1785, Georgia became the first state to charter a state-supported university when UGA was incorporated by an act of the General Assembly; the university's location was selected in 1801 to be along the banks of the Oconee River in Athens-Clarke County (UGA, 2010). Due to the topography along the Ocmulgee and Oconee Rivers, the presence of their headwaters in southeast and northeast Atlanta, respectively, and Milledgeville's importance during the Civil War, General Sherman's "March to the Sea" after the Battle of Atlanta generally followed these waterways as his troops made their way southward to Savannah (Clark, 1999; UGA, 2008).

2.1.1 Local Governments

Local governments in the Region include 13 counties and 62 incorporated municipalities with jurisdictional authority, as illustrated in Figure 2-1 and listed in Table 2-1. These local governments are responsible for land use and zoning decisions that affect local water resources management. Many local governments are also responsible for the planning, operation, and management of water and wastewater infrastructure.

Figure 2-1: Counties and Cities in the Upper Oconee Region



Source: CH2M HILL, 2009.

Table 2-1: Upper Oconee Counties, Cities, and Towns	
County	**Cities and Towns**
Baldwin	Milledgeville[a]
Barrow	Auburn, Bethlehem, Braselton, Carl, Statham, Winder[a]
Athens-Clarke	Athens[a], Bogart, Winterville
Greene	Greensboro[a], Siloam, Union Point, White Plains, Woodville
Hancock	Sparta[a]
Jackson	Arcade, Braselton, Commerce, Hoschton, Jefferson[a], Maysville, Nicholson, Pendergrass, Talmo
Laurens	Allentown, Cadwell, Dexter, Dudley, Dublin[a], East Dublin, Montrose
Morgan	Bostwick, Buckhead, Madison[a], Rutledge
Oconee	Bogart, Bishop, North High Shoals, Watkinsville[a]
Putnam	Eatonton[a]
Walton	Between, Good Hope, Loganville, Jersey, Monroe[a], Social Circle, Walnut Grove
Washington	Davisboro, Deepstep, Harrison, Oconee, Riddleville, Sandersville[a], Tennille
Wilkinson	Allentown, Danville, Gordon, Irwinton[a], Ivey, McIntyre, Toomsboro
[a] County Seat	

2.1.2 Watersheds and Water Bodies

While primarily centered on the Upper Oconee River basin, the region also includes portions of four other river basins as shown in Figure 2-1. Section 3 describes the Region's water use classifications and impaired waters. The headwaters of the Oconee River originate in Hall County, just upstream of the Region, where the Middle Oconee and North Oconee Rivers originate. These two rivers flow independently for 55-65 miles before merging below Athens to form the Oconee River. The latter flows south for another 220 miles to its confluence with the Ocmulgee River to form the Altamaha River, just downstream of the Region.

From the junction of the North and Middle Oconee Rivers, the Oconee River flows for about 20 miles to the northern end of Lake Oconee, a 19,050-acre reservoir formed by Wallace Dam. Immediately downstream of Lake Oconee is 15,330-acre Lake Sinclair behind Sinclair Dam (located approximately 5 miles upstream of Milledgeville). Both impoundments are used for hydropower generation. Georgia Power Company (Georgia Power) pumps water from Lake Sinclair upstream to Lake Oconee as needed to generate additional hydropower at Wallace Dam, a pumped-storage project.

2.1.3 Physiography and Groundwater Aquifers

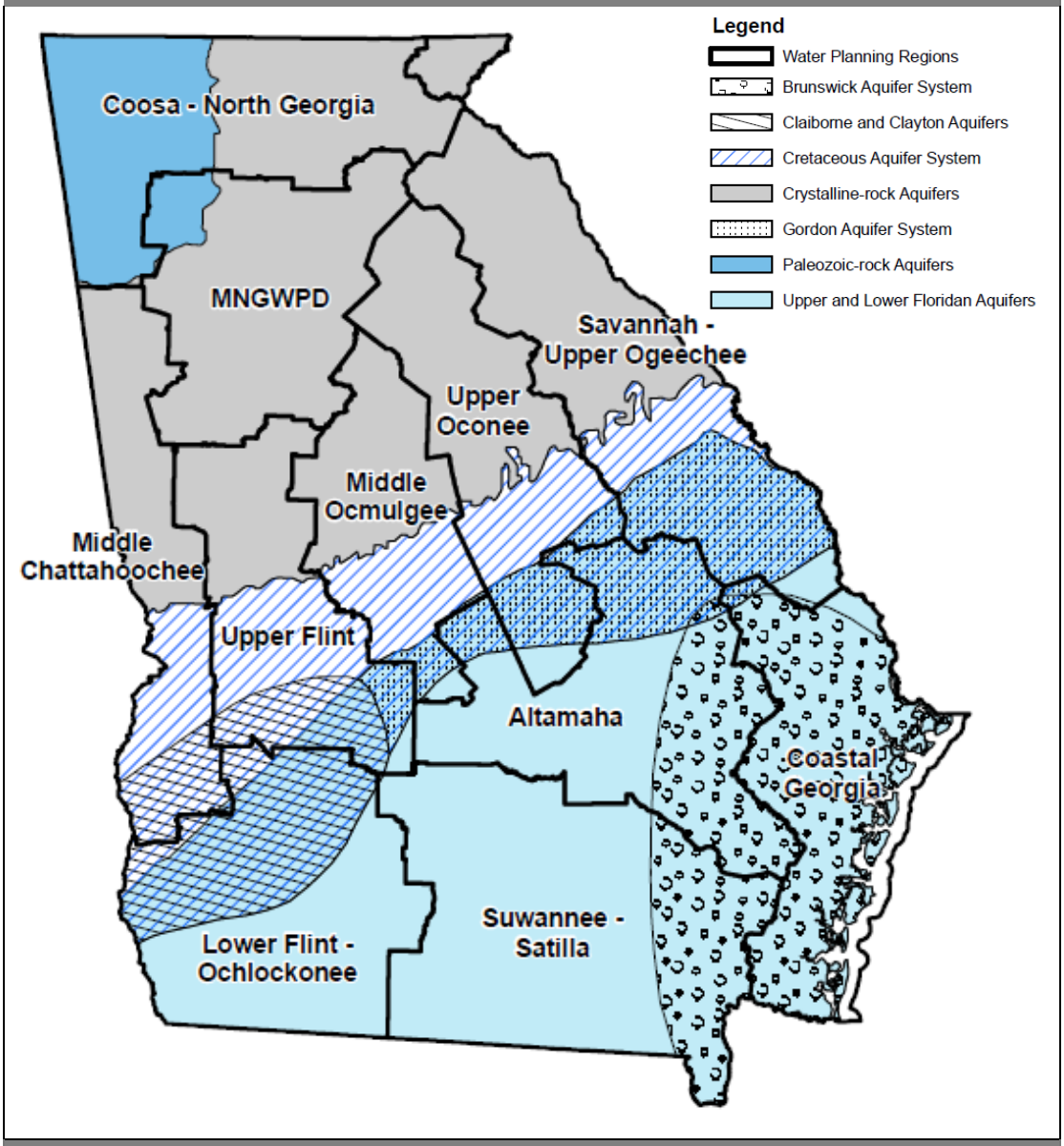
The Region is characterized by a moist and temperate climate with mean annual precipitation ranging from 47 inches in the lower basin to 56 inches in the basin headwaters. The driest months are September and October, and the wettest month is March (GAEPD, 1998).

The Region encompasses parts of two physiographic provinces: the Piedmont and Coastal Plain. The Piedmont province is characterized by low hills and narrow valleys, while the Coastal Plain is characterized by flatter terrain and sandy soils. The Fall Line forms the boundary between the two provinces. Streams flowing across the Fall Line, as the name implies, can undergo abrupt changes in gradient that are marked by the presence of rapids and shoals. Geomorphic characteristics of streams also differ between the Piedmont and Coastal Plain provinces. In the Coastal Plain, streams typically lack the riffles and shoals common to streams in the Piedmont and exhibit greater floodplain development and increased sinuosity.

The Region includes portions of three aquifer systems that were prioritized for determination of sustainable yield by GAEPD. These aquifers are the Crystalline rock aquifer systems, the Cretaceous aquifer system, and the Upper Floridan aquifer (Figure 2-2). The Piedmont portion of the Region includes the Crystalline rock aquifer. These aquifer systems occur in metamorphic and igneous rocks where secondary porosity and permeability has developed as a function of differential weathering along discontinuities. Enlargement of discontinuities provides discreet pathways for groundwater storage and flow. The intersection and interconnection of these features creates localized aquifer systems within the bedrock that are dependent on many variables of each rock unit. Although these aquifer systems do not typically provide significant quantities of groundwater over the Region, local topographic and geologic conditions are conducive to development of discreet aquifer systems with sufficient sustainable yield to supplement water supply. These aquifer systems are typically local in extent, and the yield and groundwater chemistry can be affected by localized water use and climate. However, if properly managed these aquifer systems can provide drought-resistant sources of groundwater to supplement surface water supplies.

The Coastal Plain portion of the Region includes the Cretaceous aquifer system and Upper Floridan aquifers. As shown in Figure 2-2, the Cretaceous aquifer systems crop out in a narrow band just south of the Fall Line. These aquifer systems, primarily comprised of the Providence and Eutaw-Dublin aquifers, are geologically older than the Floridan aquifer and serve as a major source of water in the northern third of the Coastal Plain. These aquifer systems primarily consist of a wedge-shaped package of sand and gravel that thickens and dips to the southeast with local layers of clay and silt that function as confining to semi-confining.

Figure 2-2: Groundwater Aquifers



Source: GAEPD, 2009.

The Region lies in the portion of the Upper Floridan aquifer system comprised of primarily unconsolidated coarse-grained clastic sands and gravels. Only a small portion of the Upper Floridan aquifer is located within the Region and is primarily used for domestic purposes and is less productive than other parts of the aquifer.

The Lower Floridan aquifer system does not occur within the Region. The Floridan aquifer system is one of the most productive groundwater storage areas in the United States. The Floridan supplies about 50 percent of the groundwater used in Georgia and serves as a major water source throughout the Coastal Plain of Georgia. Wells in this aquifer are generally high-yielding and are extensively used for irrigation, municipal supplies, industry, and private domestic supply.

2.2 Characteristics of the Region

The Region's population, employment, and land use are briefly discussed in the following sub-sections. Also included is an examination of regional and local planning organizations.

2.2.1 Population

The total population for the 13-county Region was estimated at 579,873 in 2010 (Georgia Office of Planning and Budget, 2010). Athens-Clarke County is the most populated county in the Region, with approximately 117,500 residents. Walton, Barrow, and Jackson Counties also have populations greater than 50,000; however, the remaining 9 counties in the Region have populations below 50,000. The 4 most populous counties represent approximately 60 percent of the total population in the Region.

2.2.2 Employment

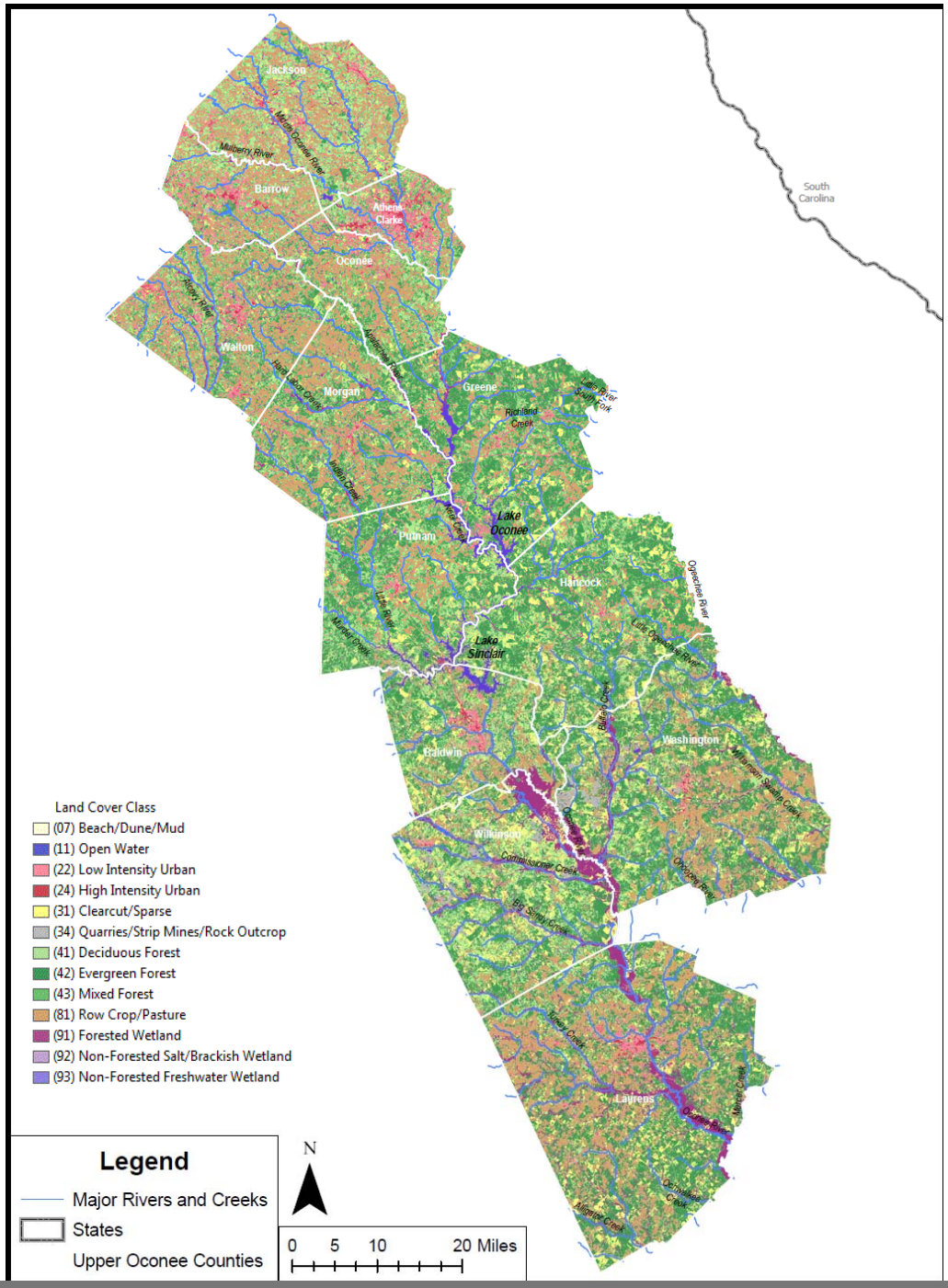
Based on Department of Labor and U.S. Census Bureau estimates, the Region's employment is dominated by the government, health care, services, manufacturing, retail, and construction sectors. The estimated total employment in the Region was 243,768 in November 2009. The unemployment rate (not seasonally adjusted) for the Region was 11.5 percent at that time compared to 9.9 percent unemployment rate statewide.

The Region includes five of Georgia's higher learning institutions which contribute significantly to the economy of the communities in which they are located. They are UGA, Georgia College and State University, Athens Technical College, Heart of Georgia Technical College, and Sandersville Technical College.

2.2.3 Land Use

Figure 2-3 illustrates the diverse land cover distribution within the Region in 2005. Athens-Clarke County is the most urbanized county in the Region; land cover in the balance of the northern counties have a suburban or rural residential mix composed of low-intensity urban, forested lands, and row crop/pasture lands. With the exception of limited pockets of urban land around Eatonton and Milledgeville, most of the lands in the central portion of the Region contain forest, row crop/pasture, or clearcut/sparse vegetation.

Figure 2-3: 2005 Land Cover in the Upper Oconee Region



Source: University of Georgia Natural Resources Spatial Analysis Laboratory, 2007.

The land cover distribution in the lower third of the Region is even less developed; Washington and Laurens Counties have a large percentage of land used for row crops or as pasture lands. Unique to Wilkinson and Washington Counties are large pockets of quarries, mining, or rock outcrops found in the headwaters of Big Sandy Creek, along Commissioner's Creek, Buffalo Creek, and the Oconee River. Wide riverine corridors of forested wetlands are relatively common in the lower third of the Region and parallel the Oconee River, Black Creek, Little Ohoopee Creek, and the Ogeechee River.

2.3 Local Policy Context

The Region includes portions of four Regional Commissions (RCs): Northeast Georgia, Central Savannah River Area, Middle Georgia, and Heart of Georgia-Altamaha (See Table 2-2). Georgia's 12 RCs are quasi-governmental regional planning organizations created and managed under Georgia law by their member local governments to serve regions that share similar economic, physical, and social characteristics. The RCs, working with the DCA, assist communities with a variety of planning issues, including local government planning, economic development, sustainable growth planning, and grant preparation and administration. Each RC reviews local comprehensive land use plans and can help coordinate connections between growth and water planning.

Table 2-2: Regional Commissions by County

Commissions	Counties
Northeast Georgia	Athens-Clarke, Barrow, Greene, Jackson, Morgan, Oconee, Walton
Central Savannah River Area	Hancock, Washington
Middle Georgia	Baldwin, Putnam, Wilkinson
Heart of Georgia - Altamaha	Laurens

Local governments develop ordinances, policies, and plans to meet the requirements of State and Federal water resource regulations. For example, communities with existing stormwater permits within the Region have developed local requirements for erosion and sediment control, post-construction runoff control, and other regulatory programs. Local governments can be contacted directly for access to their individual ordinances, policies, and plans.

Section 3. Water Resources of the Upper Oconee Region

This Section summarizes existing conditions in the Region, including existing water usage by sector (i.e., municipal industrial, agriculture, and energy production), surface water and groundwater availability, and water quality conditions.

Section Summary

The Resource Assessments indicate that most streams in the Region have sufficient assimilative capacity; however, select segments of the Oconee River and its smaller tributaries have exceeded their available assimilative capacity. There are potential groundwater sustainable yield limitations in the Crystalline rock system, which serves portions of Athens-Clarke, Jackson, Barrow, and Oconee Counties. No gaps in water availability were identified under current water use conditions.

GAEPD has evaluated 1,240 stream miles in the Region; of these, 62 percent are not currently supporting their designated use, primarily due to impaired biological communities (fish or macroinvertebrates) or due to high fecal coliform levels.

3.1 Major Water Use in Region

For planning purposes, water "withdrawal" is defined as removal of water from a water source for a specific use. Depending on the type of use, a portion of the withdrawn water is not returned to a water source as a measurable discharge. Water consumption (or consumptive use) is the difference between the amount of water withdrawn from a water source and the amount returned. Current water use information, based on 2005 U.S. Geological Survey (USGS) data for this Region (Fanning and Trent, 2009), was compiled for the development of the water use forecasts for four major water use sectors:

- **Municipal**—water withdrawn by public and private water suppliers and delivered for a variety of uses (such as residential, commercial, and light industrial).
- **Industrial**—water used for fabrication, processing, washing, and cooling at facilities that manufacture products, including steel, chemical and allied products, paper, and mining. These industrial categories use the largest amount of water of all the industrial classifications in Georgia.
- **Energy**—water used to generate electricity, mainly for cooling purposes at thermoelectric plants. Water returns vary depending on the cooling technology used by each plant.
- **Agriculture**—water for crop irrigation, which covers more than 95 percent of Georgia's irrigated land. Nursery water use, animal operations and golf courses with agricultural water use permits are not included in the forecasts, but estimates of current use are available and provided in the supplemental document titled *Agricultural Water Demand Forecast for the Upper Oconee Region*, which is available on the Council website.[2]

[2] http://www.upperoconee.org/pages/our_plan/index.php

As shown in Figure 3-1, surface water is the predominant source of water in the Region. In 2005, water withdrawals from surface water and groundwater sources to supply the four major water use sectors totaled approximately 1,249 million gallons per day (MGD) on an annual average demand (AAD) basis (Fanning and Trent, 2009). The annual average demand (AAD) value is the total amount of water withdrawn in a year from surface and ground water sources divided by 365 days.

Figure 3-2 shows the surface water withdrawal by major water withdrawal sector. Thermoelectric energy production is the largest water withdrawal category (94 percent), followed by municipal withdrawal (4 percent). The majority of the water withdrawn in this Region is for energy production at four in-stream hydropower plants and one thermoelectric facility; however, water consumption at the hydropower plants is negligible, because most of it is returned to its source (Fanning and Trent, 2009). Likewise, the thermoelectric facility—Georgia Power's Plant Harllee Branch (Plant Branch) on Lake Sinclair in Putnam County—uses mainly a once-through cooling system with negligible water consumption. Therefore, the consumptive use at Plant Branch was assumed to be zero for planning purposes (CDM, 2010).

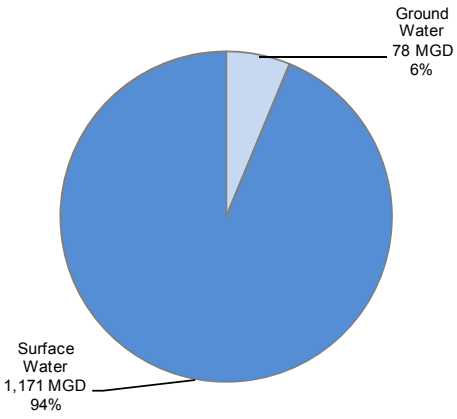
Figure 3-3 shows groundwater withdrawal by major sector. The leading groundwater use in the Region is industrial (59 percent), then municipal (24 percent), followed by agricultural (17 percent). The main groundwater supply sources for the Region are the Cretaceous and Crystalline rock aquifers. However, the Crystalline rock aquifer system provides very limited amounts of water because of its geologic limitations.

Wastewater treatment for the Region is summarized in Figure 3-4. GAEPD data provided in 2009 indicated 111 municipal and industrial discharge permits in the Region with 82 point discharge facilities, including the thermoelectric plant, and 29 land application systems (LASs).

Figure 3-4 shows that the leading method for treating wastewater is by facilities with point source discharges including energy production. In contrast to Figure 3-4, if energy production returns are excluded, a significant portion of the municipal wastewater generated in the Region is treated by private onsite treatment systems (45 percent), such as septic tanks, in areas where public collection systems are unavailable.

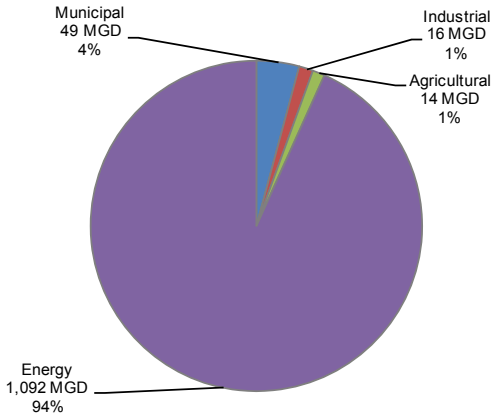
Throughout the planning process and in the Resource Assessments, existing agricultural water use, onsite sewage treatment, and LASs were considered to be consumptive. Although water may ultimately return to its source from these applications, it is not considered to be returned within a time frame that allows for it to offset the impact of related withdrawals.

Figure 3-1: 2005 Water Supply by Source Type (AAD) [a]



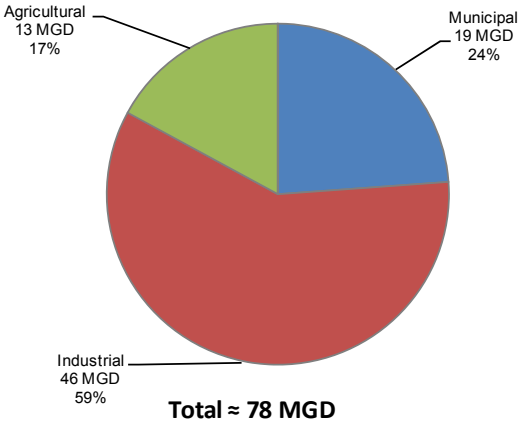
Total ≈ 1,249 MGD

Figure 3-2: 2005 Surface Water Withdrawal by Category (AAD) [a,d]



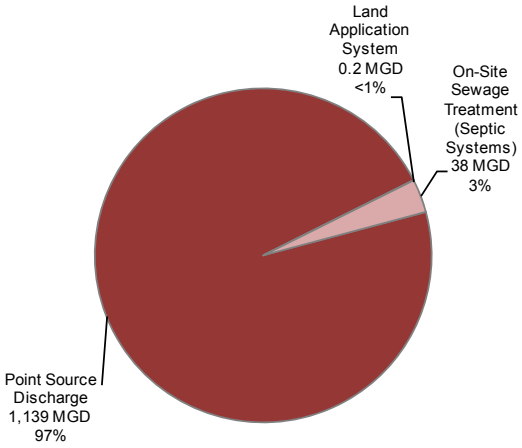
Total ≈ 1,171 MGD

Figure 3-3: 2005 Groundwater Withdrawal by Category (AAD) [a,d]



Total ≈ 78 MGD

Figure 3-4: 2005 Wastewater Treatment by Category (AAF) [b,c,e]



Total ≈ 1,177 MGD

Notes:

[a] Energy is represented by the 2005 water withdrawals for thermoelectric power production (Plant Branch).

[b] Point Source Discharge includes 1092 MDG total returns from Plant Branch (thermoelectric energy production facility).

[c] Some industrial categories are supplied by municipal suppliers are included in the municipal category.

[d] Data Sources: "Water Use in Georgia by County for 2005; and Water-Use Trends, 1980-2005" (USGS)

[e] Data Source: Georgia EPD existing permit database.

3.2 Resource Assessments

GAEPD developed three Resource Assessments: (1) surface water quality (assimilative capacity), (2) surface water quantity, and (3) groundwater quantity. The Resource Assessments determined the capacity of water resources to meet demands for water supply and to accommodate corresponding wastewater discharge needs without unreasonable impacts. The Resource Assessments were completed on a resource basis (river basins and aquifers), but are summarized here as they relate to the Region. The following Section describes the Resource Assessments results used to define "baseline conditions" and the state of the basin under current uses and demands. Full details of each Resource Assessment can be found on the GAEPD State Water Planning website.[3]

In the context of the Resource Assessments a "gap" is defined as a condition where the existing or future conditions exceed the Resource Assessment metric. For example, if the sustainable yield of a specific groundwater aquifer is exceeded then there would be a "gap" in groundwater availablity in that area. Similarly, if an existing water quality standard for nutrient loadings to a lake is exceeded, then there would be a potential water quality "gap" for that location. By contrast a potential "need" or "shortage" (discussed in Section 5) is defined as a condition where the current permitted capacity of water or wastewater treatment facilities, respectively, is less than the future forecast demands. For example, a potential "shortage" would occur if the permitted capacity of a wastewater treatment plant is 10 MGD and the forecast demand is 20 MGD.

3.2.1 Surface Water Quality (Assimilative Capacity)

The Surface Water Quality (Assimilative Capacity) Assessment estimates the capacity of Georgia's surface waters to accommodate pollutants without unacceptable degradation of water quality, i.e., without exceeding State water quality standards or harming aquatic life. The assimilative capacity results for the existing conditions focus on dissolved oxygen (DO), nutrients (specifically nitrogen and phosphorus), and chlorophyll a (the green pigment found in algae, which serves as an indicator of lake water quality). Fish and other aquatic organisms need oxygen to survive; therefore, DO standards have been established to protect aquatic life. Nutrients are required for plant production, which provides food for aquatic organisms; however, if nutrient concentrations are too high, algal blooms can occur, negatively affecting recreational use of the water and potentially impacting taste and odor in water supplies. The assimilative capacity Resource Assessment evaluated the impact of current wastewater and stormwater discharges, combined with current withdrawals, land use, and meteorological conditions, on DO, nutrients, and chlorophyll a and the assimilative capacity of stream segments that receive wastewater discharges. The waters in the Region have a daily average DO standard of ≥5 milligrams per liter (mg/L). GAEPD recognizes that waters in the Coastal Plain may have naturally occurring low DO (less than 5mg/L); limited flexibility is allowed in these cases within a range of 10 percent; if DO is naturally below 3 mg/L, the regulations allow for an additional 0.1-mg/L DO deficit.

[3] http://www.georgiawaterplanning.org.

The majority of the modeled stream segments in the Upper Oconee basin appear to have "good" to "very good" available assimilative capacity for DO under critical conditions. Assimilative capacity can range from "very good" to "exceeded" as illustrated in Figure 5-11. Initial baseline modeling results indicate that the North Oconee River near Athens, the Oconee River downstream of the confluence of the Middle Oconee and North Oconee Rivers had exceeded their available assimilative capacity. That segment of the Oconee River downstream of the confluence of Turkey Creek in Laurens County. A small segment of Buffalo Creek and smaller tributaries such as Barrow, White Oak, and Keg Creeks are also exceeding their assimilative capacity. Facility upgrades and permit modifications have since addressed these assimilative capacity issues in the Oconee River as shown in Figure 5-4. These modeled exceedances may be due to discharges from secondary treatment plants into low-flow streams. Additional data will need to be collected for these streams to confirm these potential impairments. The results also indicate that expansions of facilities near streams with limited or no assimilative capacity may require future upgrades to wastewater treatment plants (WWTPs) discharging to these tributaries.

There are currently no established chlorophyll a or nutrient (total phosphorus and/or total nitrogen) standards for Lake Oconee or Lake Sinclair. Therefore, results for chlorophyll a, total nitrogen, and the total phosphorus loading for these lakes were compared to the standards for Lake Jackson. Lake Jackson, located in the adjacent Middle Ocmulgee Water Planning Region, has a growing season average chlorophyll a standard of 20 micrograms per liter (µg/L). Modeling was completed for Lake Oconee for 2001 through 2007, a period which included both wet and dry years. The model results indicated that if the chlorophyll a standard had been 20 ug/L, it would have been exceeded in 2007, a drought year, on the Oconee River arm of Lake Oconee. This could be due to point source nutrient loadings from the Athens and eastern metro Atlanta areas as well as loadings from agricultural sources (GAEPD, 2010b).

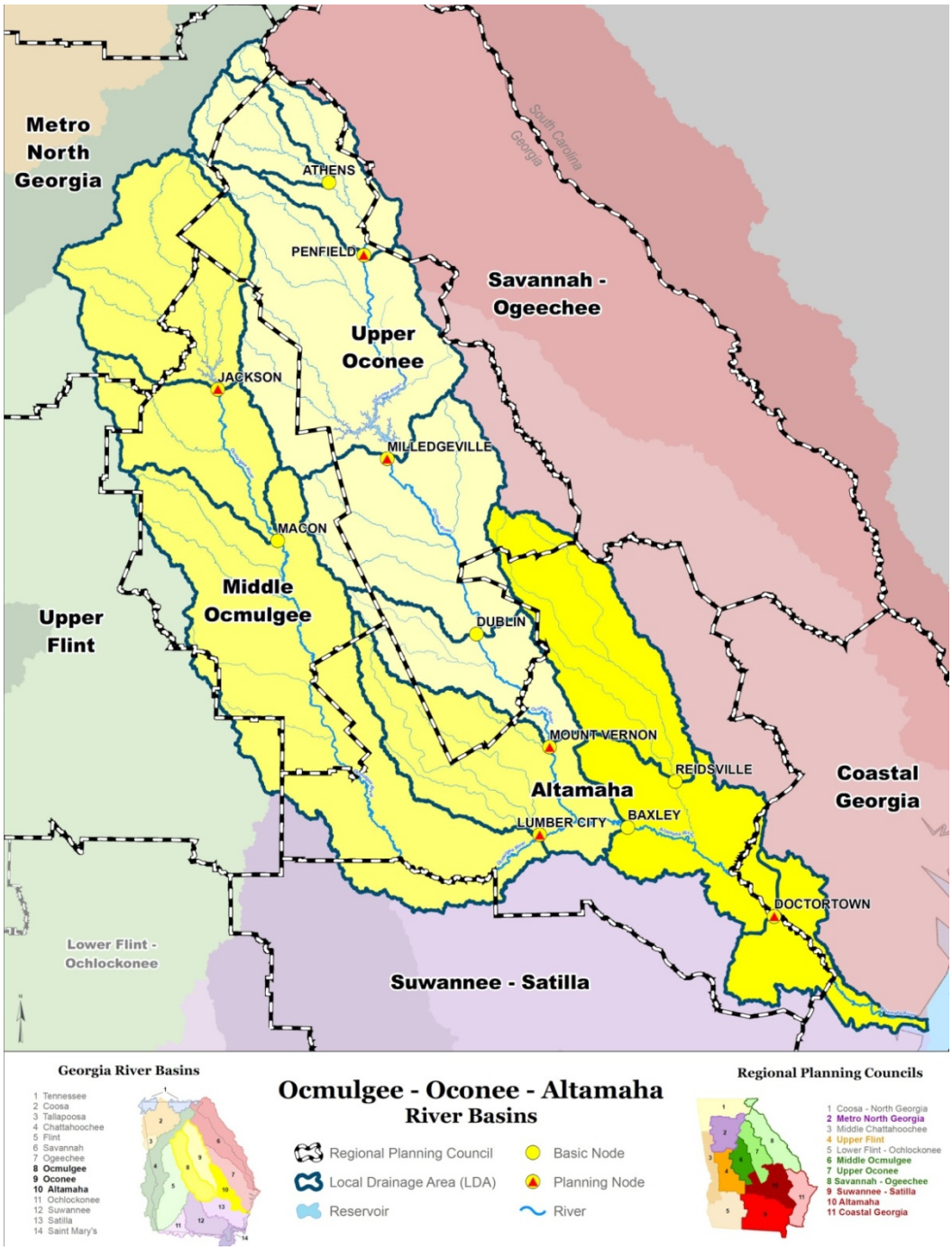
3.2.2 Surface Water Quantity

The Surface Water Quantity Resource Assessment estimates the ability of surface water resources to meet current municipal, industrial, agricultural, and thermoelectric power water needs, as well as the needs of in-stream and downstream users. Minimum in-stream flows are based on DNR policy, existing federal policy, or existing Federal Energy Regulatory Commission (FERC) license requirements. The Resource Assessment determines the reliability of the surface water to meet demands in terms of both magnitude (how much would flow drop below minimum in-stream requirements) and duration (number of days below minimum in-stream requirements).

Figure 3-5 illustrates the local drainage areas and planning nodes used in developing the Surface Water Resource Assessment. Planning nodes were locations within the watershed where existing flow data were available to assess current and future water availability.[4]

[4] See Resource Assessments at http://www.GeorgiaWaterPlanning.org.

Figure 3-5: Local Drainage Areas and Planning Nodes in the Region



Source: GAEPD, 2009

The Region is part of the Oconee-Ocmulgee-Altamaha River basin which includes six planning nodes, or points where in-stream flow was estimated (see Figure 3-5); three of these nodes are located along the Oconee River. No gaps were predicted under current withdrawal and discharge conditions.

3.2.3 Groundwater Quantity/Quality

The Groundwater Availability Resource Assessment estimates the sustainable yield for prioritized groundwater resources based on existing data. GAEPD prioritized the aquifers based on their characteristics, evidence of existing impacts, as well as potential future impacts. The Region includes three prioritized aquifer systems: the Crystalline rock aquifer, the Cretaceous aquifer system, and the Upper Floridan aquifer. The Crystalline rock aquifer system lies within the upper portion of the Oconee River watershed; the Cretaceous and Upper Floridan aquifer systems lie within the Ocmulgee, Oconee, and Altamaha River watersheds in the Region. GAEPD developed a regional numerical groundwater model to estimate sustainable yield in the Upper Floridan of south-central Georgia and the eastern Coastal Plain of Georgia and the Cretaceous aquifer system; a water budget approach developed for a basin within the Crystalline rock aquifer system was used to estimate sustainable yield in this part of the Region.

Based on the analyses, the combined Coastal Plain aquifer systems, including areas outside the Region, currently support approximately 667 MGD of pumping with a sustainable yield ranging from 1,066 MGD to 1,229 MGD in total. Conservative estimates (low yield and high agricultural use) project approximately 45 MGD in additional yield available in 2050 within the Coastal Plain, the Cretaceous aquifers between Macon and Augusta, which serve Washington, Wilkinson, and Laurens Counties, as well as areas outside the Region, which have a sustainable yield ranging from 347 MGD to 445 MGD. Within the Cretaceous aquifer system, approximately 100 MGD is pumped from the Providence aquifer and 24 MGD is pumped from the Eutaw-Midville aquifer (GAEPD, 2011). It should be noted that the groundwater yield estimates are based on the capacity of the entire aquifer system and local or regional groundwater yields may vary.

Although most wells produce less than 200 gallons per minute (gpm) in the Crystalline rock aquifers, in local geologically unique settings, several wells exist with production rates between 200 and 500 gpm (Georgia Geologic Survey, 2006). Although there are potential sustainable yield limitations in the Crystalline rock aquifer systems that locally serve portions of Athens-Clarke, Jackson, Barrow, and Oconee Counties, data analysis indicates that there is a limited amount of additional groundwater available above its current use, assuming that conditions are similar to those in the Piedmont Study basin (GAEPD, 2010a).

Typical water quality issues known to be associated with the Crystalline rock aquifer systems include elevated iron/manganese levels and local concentration of radionuclides. Groundwater within the Upper Floridan aquifer is generally hard (calcium bicarbonate-rich) with few surface or groundwater quality problems in the area. Dominant cations include Ca, Mg, Na, and K; dominant anions include HCO_3, CL and SO_4. Water from the Cretaceous aquifer system is reported to be generally of good chemical quality, although lower values of pH have been reported locally (Clarke et al., 1985; Johnson and Bush, 1988).

3.3 Ecosystem Conditions and In-Stream Use

This section includes information on stream classifications, impaired waters, priority watersheds, conservation areas, and fisheries resources.

3.3.1 Water Use Classifications (Designated Uses)

In accordance with the Clean Water Act, GAEPD classifies each of its surface waters according to six designated uses: (1) drinking water supply; (2) recreation; (3) fishing—propagation of fish, shellfish, game and other aquatic life; (4) wild river; (5) scenic river; and (6) coastal fishing. Each designated use has numeric and narrative water quality criteria developed to protect the use. At a minimum, all waters are classified as fishable. Table 3-1 lists the water bodies in the Region that are classified by the State for uses other than fishing. There are six separate stream segments classified as drinking water sources. These waters will also support the fishing use and any other use requiring water of a lesser quality. Additionally, the Oconee River from Georgia Highway 16 to the Sinclair dam (i.e., including Lake Sinclair) is designated for recreational activities, such as water skiing, boating, and swimming, or for any other use requiring water of a lesser quality, such as recreational fishing.

Table 3-1: Special Stream or Reservoir Classifications

Stream/Reservoir	Reach	Counties	Classification[a]
Alcovy River	Maple Creek to Cornish Creek (including John T. Briscoe Reservoir)	Walton	Drinking Water[b]
Apalachee River	Shoal Creek to Freeman Creek	Walton, Oconee, Morgan	Drinking Water
Beaverdam Creek	Headwaters to confluence with Alcovy River	Walton	Drinking Water
Barber Creek	Headwaters to Parker Branch	Barrow, Oconee	Drinking Water
Bear Creek	Headwaters to confluence with Middle Oconee River (including Bear Creek Reservoir)	Barrow, Jackson, Athens-Clarke	Drinking Water
Big Haynes Creek	Georgia Highway 78 to	Walton	Drinking Water

Table 3-1: Special Stream or Reservoir Classifications

Stream/Reservoir	Reach	Counties	Classification[a]
	confluence with Yellow River		
Curry Creek	Headwaters to confluence with Little Curry Creek	Jackson	Drinking Water
Fort Creek	Headwaters to confluence with Sikes Creek upstream of Lake Sinclair	Hancock	Drinking Water
Hard Labor Creek	Headwaters to Lake Brantley Dam	Morgan, Walton	Drinking Water
Hard Labor Creek	Lake Rutledge Dam to Mile Branch	Morgan	Drinking Water
Jacks Creek	Headwaters to Grubby Creek	Walton	Drinking Water
Lake Oconee	Lake Oconee to Lake Oconee Dam (Wallace Dam)	Greene, Hancock, Morgan, Putnam	Recreation and Drinking Water
Lake Sinclair	Lake Oconee Dam downstream to Sinclair Dam	Baldwin, Hancock, Putnam	Recreation and Drinking Water
Middle Oconee River	Beech Creek to McNutt Creek	Athens-Clarke, Jackson	Drinking Water
North Oconee River	Cedar Creek to Gravelly Creek	Hall, Jackson	Drinking Water
North Oconee River	Shankles Creek to Trail Creek	Athens-Clarke	Drinking Water
Oconee River	Sinclair Dam to Fishing Creek	Baldwin	Drinking Water
Oconee River	Oochee Creek to Long Branch	Laurens, Washington, Wilkinson	Drinking Water
Parks Creek	Headwaters to confluence with North Oconee River	Jackson	Drinking Water
Popes Branch	Headwaters to confluence with Pearson Creek	Putnam	Drinking Water

Source:
GAEPD Rule 391-3-6-.03 Water Use Classifications and Water Quality Standards.
Notes:
[a] Streams and stream reaches not specifically listed are classified as Fishing
[b] Classified as drinking water supplies.

3.3.2 Monitored and Impaired Waters

GAEPD publishes a list of streams that do not meet the water quality standards associated with each designated use category. GAEPD monitors streams throughout the State and publishes the list, known as the 303(d) list, every 2 years. In 2008 GAEPD evaluated 1,240 stream miles in the Region; of these, 62 percent were not supporting their designated use. Most of these waters were rated impaired based on biological data (i.e., fish or macroinvertebrates data indicated reduced organism number or diversity) or fecal coliform data. Fecal coliform bacteria are an indicator of the presence of human waste, and high levels indicate potential health risks in waters used for swimming and other recreational purposes. Figure 3-6 shows the locations of the impaired stream segments within the Region based on the 2008 listings, the most recent year for which mapping data were available at the time of plan development. Note that Figure 3-6 does not specify the stream miles that were assessed in 2008 and found to be supporting their uses

Lakes are also monitored as part of the 303(d) process and are listed as "not supporting" if sample results indicate they do not meet State water quality standards. A small portion (650 acres of 12,509 acres, or 5 percent) of Lake Sinclair near the intersection of Putnam, Baldwin, and Hancock Counties was included on the impaired streams list, because water temperatures exceeded the State's water quality standard for that parameter.

3.3.3 Conservation Areas

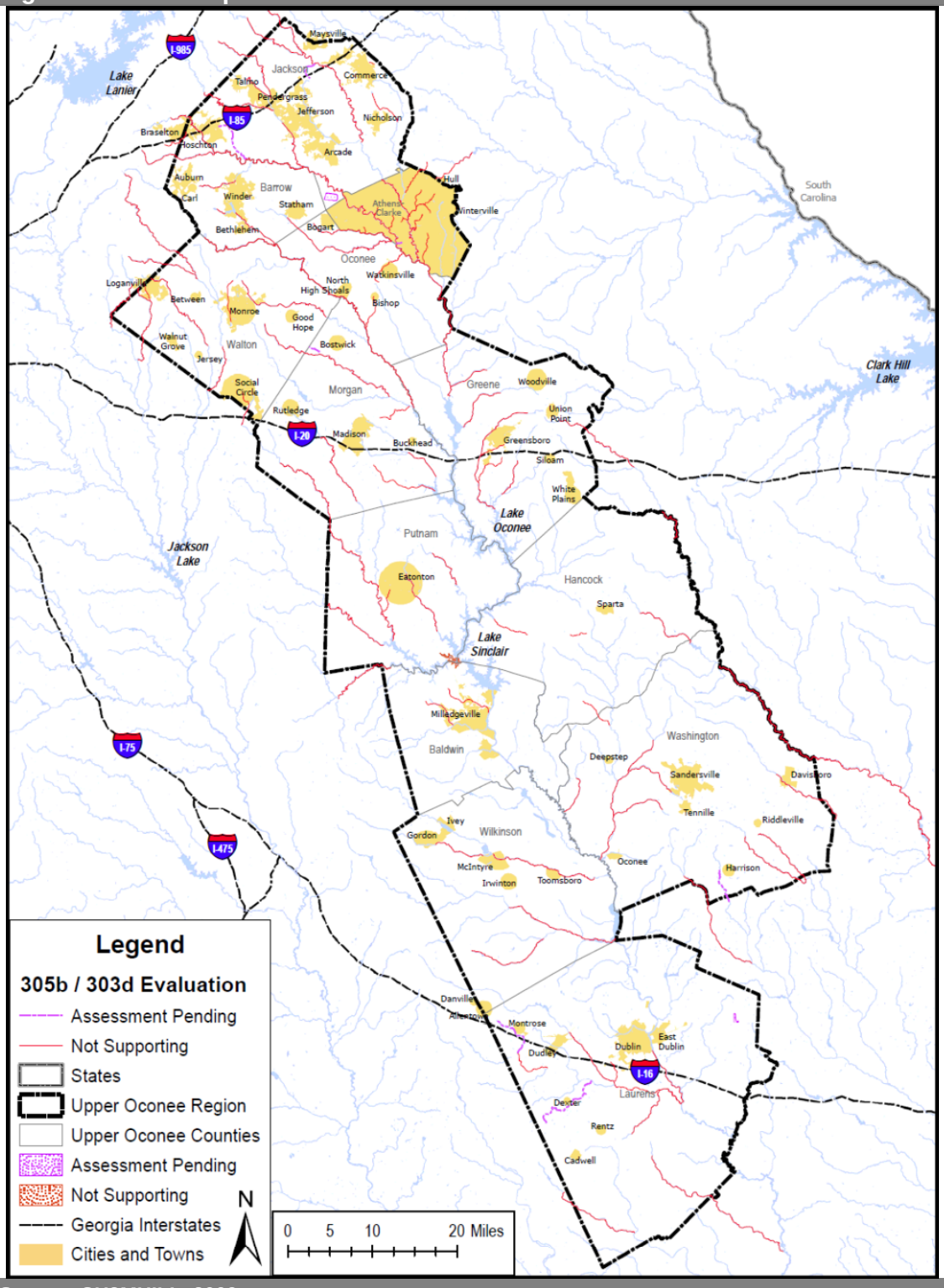
The Georgia Department of Natural Resources (GADNR) Wildlife Resources Division (WRD) identifies waters and watersheds it believes should be given high conservation priority to protect important populations of high priority species and to protect or restore representative aquatic systems throughout Georgia (GADNR, 2011). The high priority waters in the Region are listed in Table 3-2 and shown in Figure 3-7. The streams included on the final priority list are those that are a high priority for restoration, preservation, or other conservation activity; streams that were too degraded were not included in the final list. The streams on the list contain anadromous fish (fish that return to the river where they were born to breed), include rare habitats, or represent the least disturbed aquatic systems within the Region. Although the individual stream reaches were the basis for the selection process, Figure 3-7 identifies approximately half of the Oconee watershed as a high priority watershed.

Table 3-2: High Priority Waters in the Upper Oconee Region

Classification	Waters
High Priority Aquatic Community Stream	Alligator Creek, Copeland Creek
High Priority Species Stream	Alcovy River, Little River
High Priority Species and Aquatic Community Streams	Apalachee River, Jacks Creek, Little River, Murder Creek, North Fork Wolf Creek, North Oconee River, Oconee River, Ogeechee River, Shoal Creek, Williamson Swamp Creek

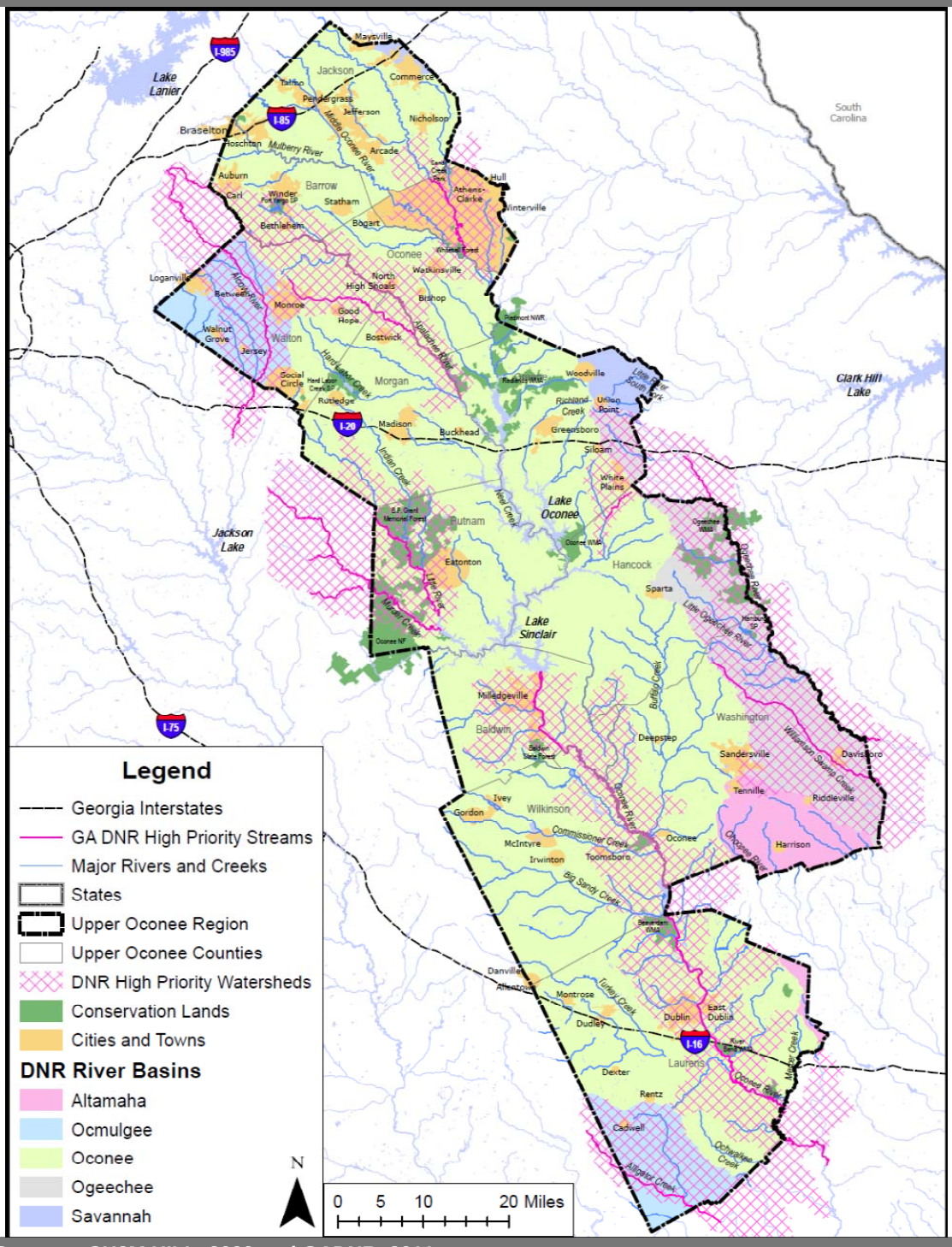
Source: GADNR, 2011.

Figure 3-6: 2008 Impaired Waters



Source: CH2MHILL, 2009.

Figure 3-7: High Priority Waters and Watersheds



Sources: CH2M HILL, 2009 and GADNR, 2011.

The Georgia Conservation Lands Database, a product of the Georgia Gap Analysis Program was compiled to aid a state-wide evaluation of how the distribution of lands managed for protection of biodiversity compares with potential vertebrates habitat. Within the Region, there are over 131,000 acres of protected land managed for conservation purposes, representing 4 percent of the Region's total area. The largest portion of these conservation lands is located in the Oconee National Forest; the B.F. Grant Memorial Forest and the Ogeechee Wildlife Management Area also contain significant conservation acreage.

Within the Region's waters are several species listed by Georgia (but not the Federal government) as threatened or endangered. One fish species—Altamaha Shiner (*Cyprinella xaenura*)—and two invertebrates—Altamaha Arcmussel (*Alasmidonta arcula*) and Oconee Burrowing Crayfish (*Cambarus truncates*) are State-listed as threatened. The fish species Robust Redhorse (*Moxostoma robustum*) is State-listed as endangered. The latter is an important conservation species re-discovered in 1991 in the Oconee River below Sinclair Dam after being presumed extinct for more than 100 years. The Robust Redhorse Conservation Committee was organized soon after the re-discovery with the intention or reestablishing the species in other rivers within the species' former range and to avoid a listing in the future under the Federal Endangered Species Act. The Oconee River contains a remnant gene pool that is considered indispensible to the recovery of this rare species.

3.3.4 Fisheries Resources

The WRD manages the fisheries resources of the Region's two major sport fishing reservoirs, Oconee and Sinclair. Both lakes are routinely stocked with striped bass, and Lake Oconee is also stocked with hybrid striped bass. Largemouth bass, striped bass, hybrid bass, white bass, crappie, sunfish, and catfish are very popular with anglers at Lake Oconee, as are largemouth bass, crappie, catfish, sunfish, and striped bass at Lake Sinclair (GADNR, 2010). The WRD also manages the fisheries of Lake Rutledge in Morgan County, Bear Creek Reservoir in Jackson County, and the Hugh M. Gillis Public Fishing Area in Laurens County.

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Section 4. Forecasting Future Water Resource Needs

Water demand and wastewater flow forecasts and the Resource Assessments described in Section 3 form the foundation for water planning in the Region and serve as the basis for the selection of the MPs discussed in Sections 6 and 7. Any differences between the 2005 USGS data presented in Section 3 and the data in this Section are due to variations in data sources and methodologies.

This Section presents the regional water demand and wastewater flow forecasts at 10-year intervals from 2010 through 2050 for the 4 water use sectors: municipal, industrial, agriculture, and energy. Three supplemental documents—*Municipal and Industrial Water and Wastewater Forecasting for the Upper Oconee Region*, *Agriculture Water Demand Forecast for the Upper Oconee Region*, and *Statewide Energy Sector Water Demand Forecast*—are available on the Council website.[5]

Section Summary

Total water demands are expected to increase from 1,377 MGD in 2010 to 1,412 MGD in 2050. Wastewater flows are likewise anticipated to increase from 1,329 MGD in 2010 to 1,354 MGD in 2050.

Energy generation is forecast to continue to make up the largest portion of future water withdrawals; however, the majority of this water is not consumptive, i.e., it is returned to its source.

Agricultural water demands are also expected to remain relatively constant, while municipal and industrial water demands are projected to increase by 90 percent from 132 MGD in 2010 to 251 MGD in 2050.

4.1 Municipal Forecasts

Municipal water demand and wastewater flow forecasts include water supplied to residences, commercial businesses, small industries, institutions, and military bases. The municipal forecasts are based on county population projections developed by the Governor's Office of Planning and Budget in accordance with State law (O.C.G.A. 45-12-171) and summarized in Table 4-1.

The Region's population is projected to increase from 579,873 in 2010 to 1,309,893 in 2050, a 126 percent growth increase over this 40-year period.

[5] http://www.upperoconee.org/pages/our_plan/index.php

Table 4-1: Population Projections by County[a]

County	2010 US Census	2010 [a]	2020 [a]	2030 [a]	2040 [b]	2050 [b]	Difference [b] (2010 - 2050)	% Increase [b] (2010 – 2050)
Baldwin	45,720	47,858	54,384	60,988	67,672	74,726	26,868	56%
Barrow	69,367	75,713	107,798	151,417	195,388	236,396	160,683	212%
Athens-Clarke	116,714	117,485	131,257	147,373	164,811	184,015	66,530	57%
Greene	15,994	16,360	20,971	26,134	31,477	36,206	19,846	121%
Hancock	9,429	9,538	10,132	10,562	11,125	11,952	2,414	25%
Jackson	60,485	66,250	90,713	123,728	168,409	228,902	162,652	246%
Laurens	48,434	49,125	56,383	63,812	71,358	79,237	30,112	61%
Morgan	17,868	19,432	24,787	31,090	38,018	44,846	25,414	131%
Oconee	32,808	34,503	48,233	65,828	89,714	122,875	88,372	256%
Putnam	21,218	21,092	24,855	28,705	32,783	37,089	15,997	76%
Walton	83,768	91,068	118,742	153,053	185,530	215,494	124,426	137%
Washington	21,187	21,372	23,326	24,588	25,697	27,294	5,922	28%
Wilkinson	9,563	10,077	10,352	10,482	10,737	10,861	784	8%
TOTAL	**552,555**	**579,873**	**721,933**	**897,760**	**1,092,719**	**1,309,893**	**730,020**	**-**

Notes:
[a] Population projections provided by the Governor's Office of Planning and Budget, 2010.
[b] Population projections for 2040 and 2050 were based on the Governor's Office of Planning and Budget 2010 – 2030 projections and provided for State water planning purposes.

4.1.1 Municipal Water Demand Forecasts

Regional municipal water demand forecasts were calculated by multiplying the estimated per person (capita) water use for each county by its population. Typically, per capita water use rates differ for public water systems and self-supplied private wells; therefore, the demands are calculated separately and then added together for each county.

Per capita water use rates were initially developed using withdrawal data for 2005 reported by GAEPD and USGS (Fanning and Trent, 2009). With feedback from water providers, adjustments were made to subtract wholesale and industrial water uses where necessary. Self-supplied water users were assumed to use a standard 75 gallons per capita per day, unless stakeholder feedback indicated otherwise. Adjustments also were made to both public and self-supplied water use rates to account for changes in plumbing codes and to reflect water savings over time from the transition to ultra low flow and high efficiency toilets (maximum 1.6 and 1.28 gallons per flush [gpf], respectively), required by Federal and State laws. These adjustments were based on U.S. Census Bureau housing information and an assumed 2 percent annual replacement rate for plumbing fixtures (older fixtures replaced with new, more efficient ones).

Although the assumed plumbing improvements lowered future per capita water use rates, the total municipal water demand increases significantly from 2010 to 2050 (73.5 MGD to 163.9 MGD) as a result of population growth. Table 4-2 summarizes the municipal water demand forecasts by county for the Region over the planning period.

Table 4-2: Municipal Water Demand Forecasts by County (AAD-MGD)[a]

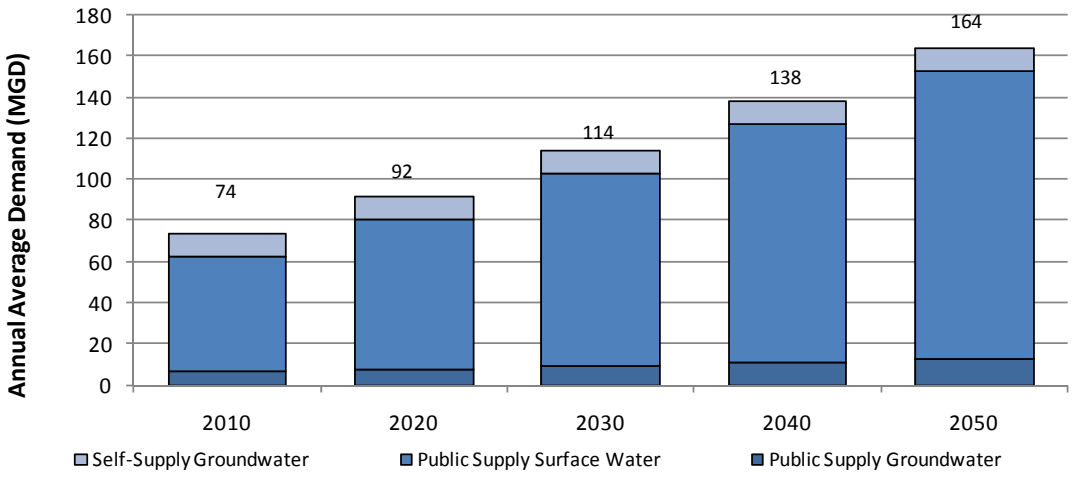
County	2010	2020	2030	2040	2050
Baldwin	6.66	7.44	8.19	8.92	9.67
Barrow	8.78	13.50	19.84	26.09	31.75
Athens-Clarke	18.39	20.24	22.37	24.63	27.06
Greene	2.29	2.96	3.68	4.41	5.03
Hancock	1.02	1.06	1.07	1.10	1.15
Jackson	7.24	9.75	13.07	17.48	23.34
Laurens	5.85	6.57	7.27	7.95	8.62
Morgan	2.35	3.18	4.13	5.15	6.13
Oconee	4.29	6.16	8.51	11.66	15.98
Putnam	2.35	2.84	3.37	3.94	4.56
Walton	10.18	13.82	18.25	22.32	25.96
Washington	2.98	3.19	3.30	3.38	3.52
Wilkinson	1.15	1.16	1.15	1.15	1.13
TOTAL	**73.53**	**91.85**	**114.20**	**138.18**	**163.90**

Notes:
[a] Municipal water demand forecasts include publicly supplied and self supplied demands from surface water and groundwater sources.

Additional details regarding development of the municipal water demand forecasts, including the per capita rate and plumbing code adjustment for each county, are provided in the supplemental document titled Municipal and Industrial Water and Wastewater Forecasting for the Upper Oconee Region, which is available on the Council website.

The demand in the Region for municipal water is forecast to increase from 74 MGD in 2010 to 164 MGD in 2050. Based on existing uses, it is forecast that approximately 85 percent of the water demand in the future will be obtained from surface water sources and 15 percent from groundwater sources; the latter includes private wells (self-supply). Figure 4-1 shows the municipal water demand forecasts for the Region; the demands in this forecast do not include major publicly supplied industries which were included in a separate forecast.

Figure 4-1: Municipal Water Demand Forecast (AAD-MGD)



Notes:
Values represent forecasted annual average demand (AAD).
Municipal water demands include residential, commercial, small industry, institutions, and military bases.

4.1.2 Municipal Wastewater Flow Forecasts

Municipal wastewater flow forecasts were developed to determine the amount of treated wastewater generated and returned to the watershed. These forecasts were calculated based on the expected municipal water demand as described in Section 4.1.1 and adjusted for outdoor water use (which does not require wastewater treatment) and inflow and infiltration (I/I). Inflow is the water discharged into the sewer system from roof and foundation drains, springs and swampy areas, manhole covers, cross connections from storm sewers, catch basins, storm water, surface runoff, or drainage. Inflow varies rapidly with rainfall conditions, with flows rising and falling within minutes or hours of a severe storm event. Infiltration is the water entering a sewer system from groundwater, through defective pipes, joints, connections, or manhole walls. Infiltration is relatively constant over a period of days, weeks, or even months as high groundwater conditions persist. All privately supplied customers on wells are assumed to use septic systems for wastewater management. The percentage of publicly supplied water customers using sewer and centralized treatment systems was estimated based on available data; the remaining users were assumed to be on septic systems. These percentages were calculated using reported GAEPD and other State of Georgia data, and based on feedback from cities, counties, and water systems. Table 4-3 summarizes municipal wastewater flow forecasts for the Region over the planning period.

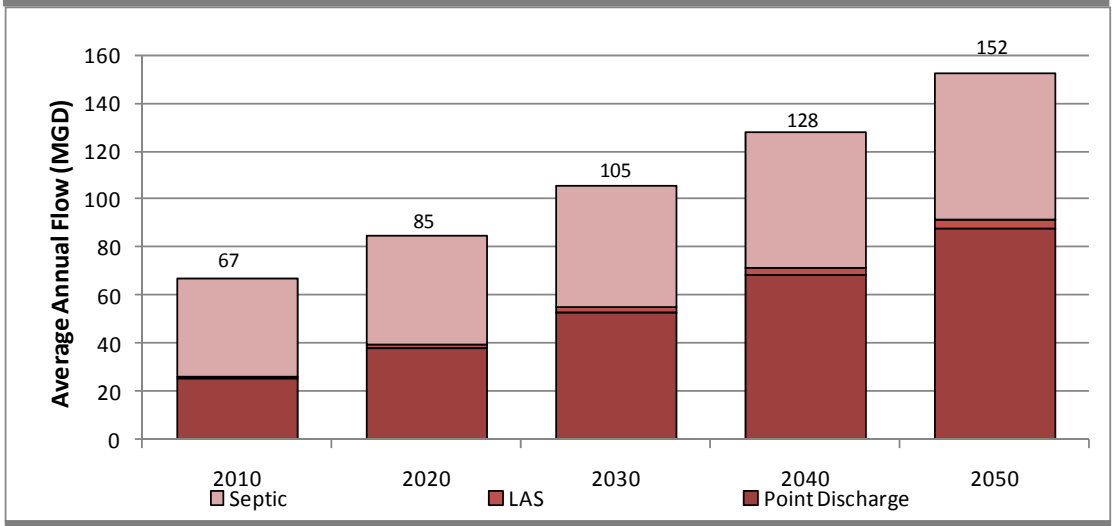
Table 4-3: Municipal Wastewater Flow Forecasts by County (AAF-MGD)[a]					
County	**2010**	**2020**	**2030**	**2040**	**2050**
Baldwin	5.48	6.12	6.74	7.35	7.96
Barrow	7.15	11.42	17.37	23.58	29.57
Athens-Clarke	19.96	22.58	24.76	26.96	29.20
Greene	2.07	2.68	3.34	4.01	4.58
Hancock	0.81	0.84	0.86	0.88	0.92
Jackson	6.34	8.65	11.76	15.98	21.71
Laurens	5.38	6.05	6.70	7.33	7.95
Morgan	2.07	2.82	3.67	4.59	5.47
Oconee	3.39	5.04	7.34	10.08	13.84
Putnam	2.03	2.46	2.92	3.43	3.99
Walton	8.50	11.84	15.82	19.45	22.64
Washington	2.77	2.97	3.07	3.15	3.28
Wilkinson	1.03	1.04	1.03	1.03	1.01
TOTAL	**67.00**	**84.50**	**105.39**	**127.80**	**152.11**

Notes:
[a] Municipal wastewater flow forecasts do not include major industrial sources that treat their water in municipal facilities, these industrial flows are included in the industrial wastewater forecast (see page 4-6).

Estimated flows to centralized treatment were modified to include an estimated 20 percent I/I which is an engineering industry standard; this I/I estimate was kept constant throughout the planning period, unless specified differently through feedback from individual water systems. Wastewater treatment is managed using one of three disposal methods: point discharge, LAS, or septic systems. For forecasting purposes, the current mix of point discharge facilities versus LASs was held proportionate to current conditions, and adjustments were made based on feedback provided by local water systems or utilities. Further details regarding development of the municipal wastewater forecasts and county-specific results are presented in the supplemental document titled Municipal and Industrial Water and Wastewater Forecasting for the Upper Oconee Region, which is available on the Council website. Figure 4-2 shows the municipal wastewater flow forecasts by disposal type.

In summary, municipal wastewater demand in the Region is forecast to increase from 67 MGD in 2010 to 152 MGD in 2050. Of this amount, 2 percent will be treated by LASs and 58 percent by systems with point source discharges. While septic systems currently treat approximately 61 percent of the municipal wastewater generated in the Region, this is expected to decline overall to 40 percent by 2050 as a result of additional areas being served by centralized sewer (point discharge), but remain relatively steady in counties with lower population density.

Figure 4-2: Municipal Wastewater Flow Forecast (AAF-MGD)



Notes: Values represent forecasted annual average daily (AAF).

4.2 Industrial Forecasts

Industrial water demand and wastewater flow forecasts anticipate the future needs of industries that are expected to be the major water users through 2050. Industries use water in their production processes and for sanitation, cooling, and employee use and consumption. The industrial forecasts in this Section are based upon either the rate of growth in employment for specific industrial sectors, the rate of growth in units of production for specific industrial sectors, or other relevant information and data provided by specific industrial water users. The forecast industrial demands include major industrial water users and wastewater generators, many of which supply their own water and/or treat their own wastewater. Many categories of industrial users with very small demands are serviced by municipal water and wastewater systems. The water demands for industries in these categories are included in the municipal forecasts.

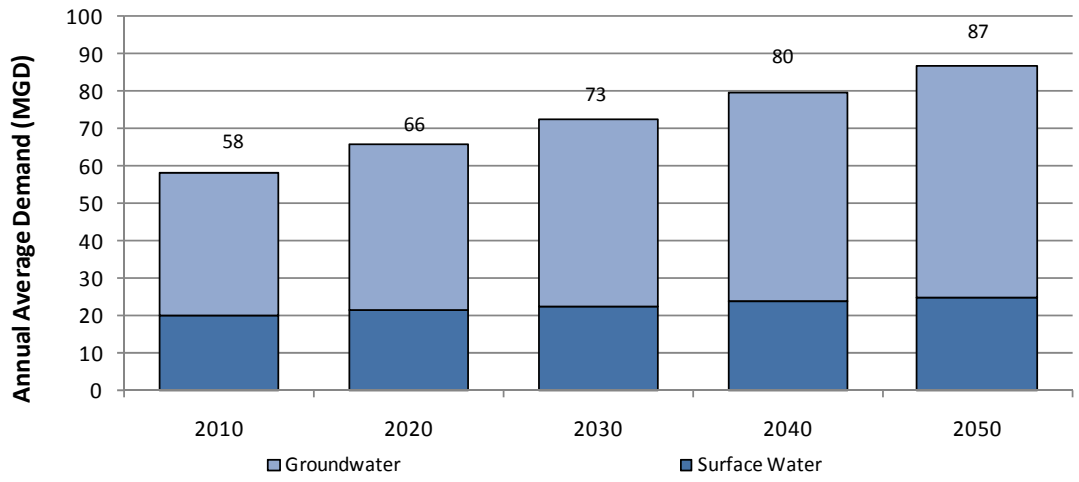
4.2.1 Industrial Water Demand Forecasts

Industrial water demand forecasts were developed using information and data specific to each major water-using industry. For industries for which information was available on water use per unit of production, water forecasts were based on production. For industries for which product-based forecasts were not available, industry-specific workforce projections were assumed to reflect the anticipated growth in water use within the industry. UGA produced industry-specific workforce projections that were used to calculate future water needs for the major water-using industries in the Region. A summary of the employment projections is included in the supplemental document titled Municipal and Industrial Water and Wastewater Forecasting for the Upper Oconee Region, which is available at the Council website.

The employment projections for the Region indicate that overall employment among major industrial water-using industries will increase over the 2010-2050 planning horizon. Decreasing employment is forecast for the apparel industry in the Region, in keeping with trends over the past several decades. However, water demands for this industry were not reduced in the forecast calculations, because water use can change independently of employment change. The mining (kaolin) and paper industries are expected to continue to be the most significant water-using industries in the Region. While the mining industry obtains its water supply primarily from groundwater, the paper industry relies heavily on surface water. Both industries tend to have their own permits for withdrawals. Industrial demand for water in the Region is forecast to increase from 58 MGD in 2010 to 87 MGD in 2050. Based on current proportions, approximately 29 percent of demand in the future will be met by surface water and 71 percent by groundwater sources. The results of the industrial water demand forecast for the Region are provided in Municipal and Industrial Water and Wastewater Forecasting for the Upper Oconee Region (available at the Council website).

Figure 4-3 shows the steady increase of industrial water demand in the Region throughout the planning period.

Figure 4-3: Industrial Water Demand Forecast (AAD-MGD)



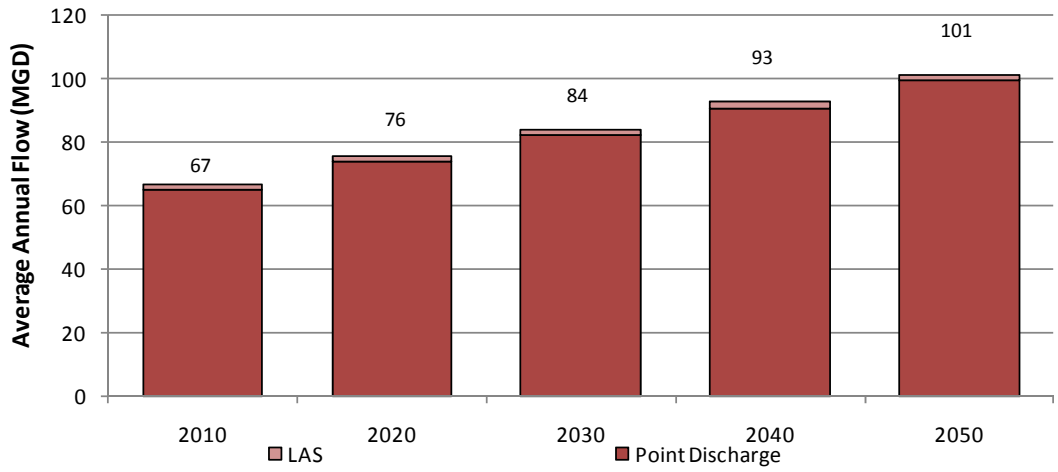
Notes: Values represent forecasted annual average demand (AAD).

4.2.2 Industrial Wastewater Flow Forecasts

Industrial wastewater flow forecasts were estimated for each sector by multiplying the industrial water demand forecast described in Section 4.2.1 by the ratio of wastewater generated to water used for each industrial sector. Wastewater to water ratios per industry were derived through a state-wide analysis of multiple years of actual annual average water return and withdrawal data for permitted users and information provided by industrial stakeholder groups within a region or industry, as appropriate.

Figure 4-4 shows the industrial wastewater flow forecast, which is projected to increase from 67 MGD in 2010 to 101 MGD in 2050. Based on current proportions, approximately 2 percent of the flows in the future will be treated by LASs and 98 percent will be treated by systems with point source discharges. The industrial wastewater flows are greater than the industrial water demands due to the additional water generated by mine dewatering processes.

Figure 4-4: Industrial Wastewater Flow Forecast (AAF-MGD)



Notes: Values represent forecasted annual flow (AAF).

The results of the forecasting exercise for industrial wastewater flows are provided in the supplemental document titled Municipal and Industrial Water and Wastewater Forecasting for the Upper Oconee Region, which is available at the Council website.

4.3 Agricultural Forecasts

Agricultural water use includes irrigation for both crop production and non-crop agricultural water users. The future irrigation needs for crop production were developed by the University of Georgia's National Environmentally Sound Production Agriculture Laboratory (NESPAL). Based on the acres irrigated for each crop, these forecasts provide values for irrigation water use as expected for dry, average, and wet years. Each year's projection includes a wet year, a normal year, and a dry year because planning must allow for the range of weather conditions that might reasonably be encountered in future years. Current non-crop (including non-permitted) agricultural water uses, such as water use for nurseries/greenhouses, golf courses, and livestock production, have been compiled by respective industry associations; however, water forecasts for future non-crop agricultural use were not developed for this first round of regional water planning because of the lack of available data. For this planning effort, the non-crop water uses are assumed to remain at current levels throughout the planning period. The majority of agricultural water needs are located in Laurens and Washington Counties.

Table 4-4 summarizes agricultural water demands for the Region over the planning period assuming a forecasted 75 percent probability level for irrigation (a 75 percent probability level for irrigation is larger than a 50 percent probability level for irrigation). A more detailed description of the agricultural forecasts is provided in the supplemental document titled Agriculture Water Demand Forecast for the Upper Oconee Region, which is available on the Council website.

Table 4-4: Agricultural Water Demand Forecasts by County (AAD-MGD)[a]

County	Crop Demand					Non-Crop Demand
	2010	2020	2030	2040	2050	2010-2050
Baldwin	0.00	0.00	0.00	0.00	0.00	0.33
Barrow	0.00	0.00	0.00	0.00	0.00	1.26
Athens-Clarke	0.44	0.45	0.47	0.49	0.51	3.90
Greene	0.30	0.31	0.32	0.33	0.35	3.00
Hancock	0.73	0.73	0.74	0.74	0.75	0.21
Jackson	0.14	0.14	0.15	0.15	0.16	1.45
Laurens	8.43	8.45	8.52	8.59	8.68	0.65
Morgan	1.56	1.60	1.65	1.70	1.75	3.45
Oconee	4.24	4.33	4.46	4.59	4.73	2.95
Putnam	0.36	0.35	0.35	0.35	0.35	1.12
Walton	2.94	3.03	3.14	3.25	3.38	2.83
Washington	8.83	8.91	9.02	9.15	9.29	0.36
Wilkinson	0.06	0.06	0.07	0.07	0.07	0.04
Total	**28.04**	**28.37**	**28.87**	**29.41**	**30.01**	**21.55**

Notes:
[a] Forecasted agricultural crop water demand is based on the 75th percentile scenario (in MGD).The non-crop demand is not forecasted, and is comprised of golf courses, livestock, and nurseries.

4.4 Water for Thermoelectric Power Forecasts

Forecasts for future water needs for thermoelectric power production were developed by GAEPD and an ad-hoc group representing Georgia's power industry. Future energy needs are based on projected population. The ad-hoc group helped identify the mix of future fuel sources and potential water needs from various energy generation processes. Certain types of power plants utilize water and others do not. "Waterless" power plants include wind turbine and most solar photovoltaic systems. These plants made up about 1 percent of the total energy generated in 2001 in the United States (EPA, 2001). Thermoelectric facilities (powered by fossil fuels, nuclear, or geothermal energy) are the primary types of power plants that utilize water for cooling.

Thermoelectric facilities use a significant amount of water, but their water consumption varies depending on the type of cooling used for power generation. The two major types are once-through cooling and closed-loop cooling. Once-through cooling systems use water to condense steam. River or lake water is passed through a heat exchanger to condense steam, the condensed steam is pumped back through the steam cycle, and the cooling water is returned to its source. Although the consumptive water use is minimal at the power plant, the amount of water withdrawn from the river or lake is significant. However, the once-through cooling water is immediately returned to the source. Closed-loop cooling systems were designed to minimize the amount of water withdrawn and / or to minimize the heat rejected to the receiving river or lake. Closed-loop systems also use water for cooling to condense the steam but the heat is rejected through evaporation in a cooling tower. The cooling water is pumped in a closed loop between the cooling tower and the condenser heat exchanger; makeup water is required to replace the water that evaporates. This system consumes much more water than once-through systems because the entire energy exchange is through evaporation of the water, but they withdraw less water because less water is needed to make up the evaporated portion.

There are four hydropower facilities in this Region, in Athens-Clarke, Oconee, Washington, and Wilkinson Counties. Consumptive use is negligible for in-stream hydroelectric power generation (Fanning and Trent, 2009). There is only one thermoelectric facility in the Region, Plant Harllee Branch, located in Putnam County. This facility withdrawals approximately 1,195 MGD and has primarily once-through cooling systems; therefore, it is assumed that 100 percent of the water withdrawn is returned to its source. Thus, consumptive use for Plant Branch is negligible.

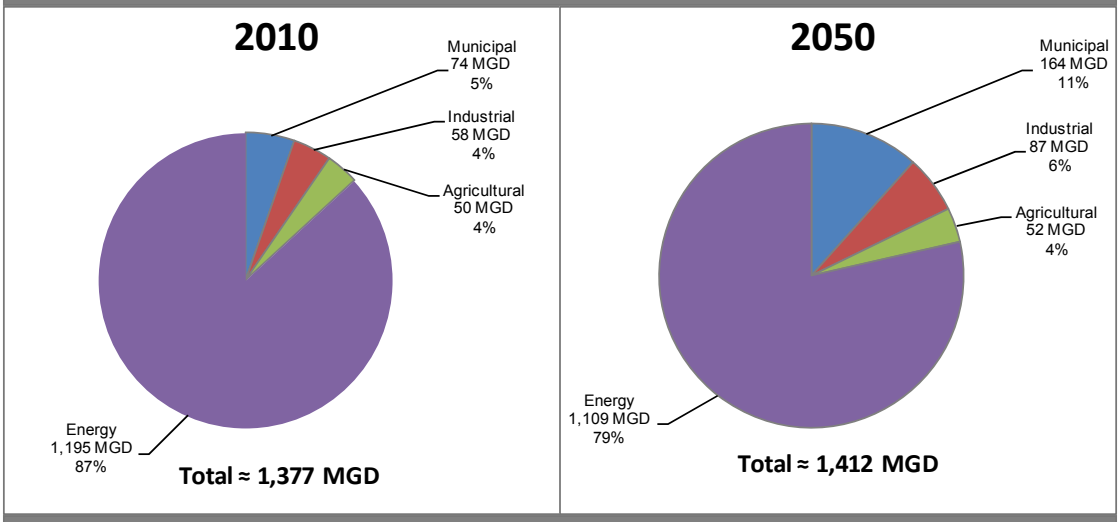
There is one planned thermoelectric facility in the Region, Plant Washington in Washington County. It is permitted to withdraw a maximum of 16.0 MGD daily with a monthly average not to exceed 13.5 MGD of surface water and utilize a closed-loop cooling system. It will be discharging, on average, 1.55 MGD (2.4 cfs) of non-contact cooling water to the Oconee River. Therefore, the consumption is expected to be approximately 11.95 MGD on an annual average basis.

The process of generating the forecasted water demands and wastewater returns for thermoelectric power generation is documented in the supplemental document titled Statewide Energy Sector Water Demand Forecast, which is available on the Council website. It should be noted that the future water demands and returns decrease in 2030, which is attributed to the increase in available capacity of less water-withdrawal-intensive power generation and relatively stable capacity factors.

4.5 Total Water Demand and Wastewater Flow Forecasts

In the Region, energy generation comprises (by a significant margin) the largest portion (87 percent) of water withdrawals, as shown in Figure 4-5. Even though energy water demands are expected to decrease throughout the planning horizon, they are forecast to remain the largest demands in the Region in 2050. Agricultural water demands are also expected to remain relatively constant, while municipal and industrial water demands are projected to increase steadily from approximately 132 MGD in 2010 to 251 MGD in 2050 (Figure 4-5).

Figure 4-5: Water Demand for 2010 and 2050 (AAD-MGD)

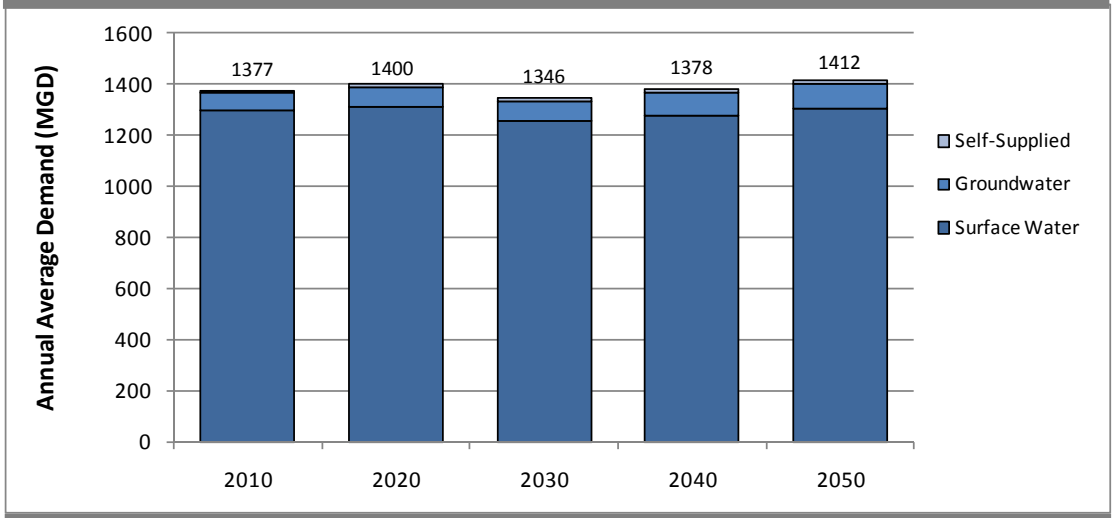


Notes:
Based on Alternative Energy Forecast (CDM, 2010).
Data Sources: Upper Oconee Municipal and Industrial Forecasts (CH2M HILL, 2010), Energy Forecasts (CDM, 2010), and Agricultural Forecasts (UGA, 2010).

Figure 4-6 shows the total water demand forecast by source. The main water source for this Region is surface water, a large portion of which is used as cooling water for thermoelectric power generation. It should be noted that the decrease in water demands in 2030 is the result of a reduction in energy water demands due to the availability of less water-withdrawal-intensive power generation.

Figure 4-7 shows the total wastewater flow forecast by sector (energy, municipal, and industrial) for the Region in 2010 and 2050. In 2010, water returns from thermoelectric energy production make up 90 percent of the total; however, these flows are generally for permitted cooling water returns and do not represent future needs for wastewater treatment. Unlike municipal or industrial discharges, thermoelectric power discharges are for cooling purposes and do not require treatment. The total wastewater flow for municipal and industrial uses is projected to be 253 MGD in 2050.

Figure 4-6:Total Water Demand Forecast (AAD-MGD)

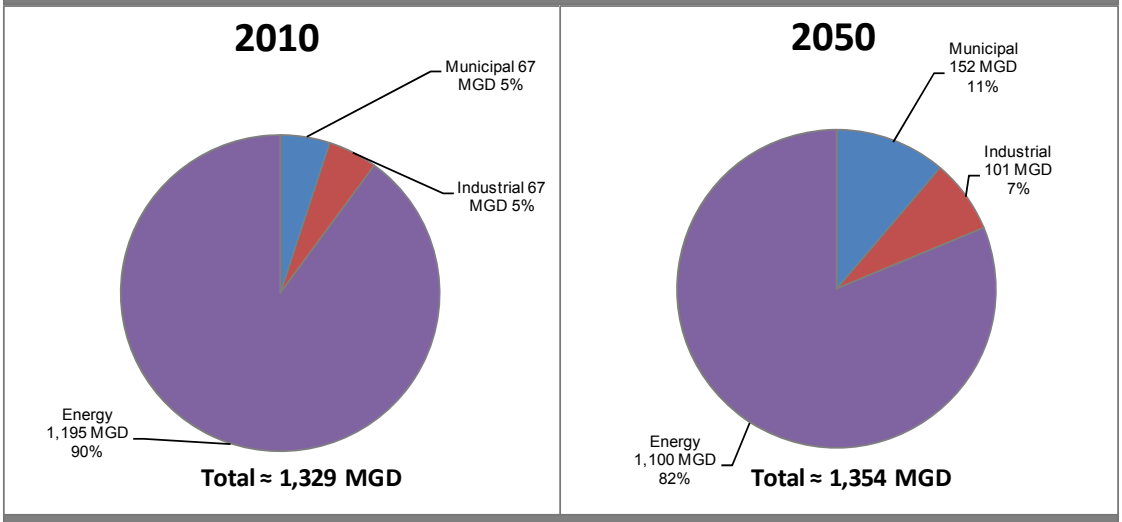


Notes:
Values represent forecasted annual average demand (AAD).
Energy demands decrease in 2030 due to availablilty of less water-withdrawal-intensive power generation.

Wastewater flows by treatment and disposal type (point discharge, LAS, or onsite septic) are illustrated for 2010 through 2050 in Figure 4-8. Removing the thermoelectric (energy) discharges from the total, point discharges of municipal and industrial wastewater are projected to make up 74 percent of the total, LASs 2 percent, and septic systems 24 percent of the future wastewater flow forecasts in 2050.

Municipal and industrial wastewater flows comprise 18 percent of the estimated wastewater return in 2050. The increase in wastewater quantity is particularly significant in fast-growing counties such as Barrow, Jackson, Oconee, and Walton. Strategic wastewater management will be essential to protecting the Region's surface water quality.

Figure 4-7: Wastewater Flow Forecast in 2010 and 2050 (AAF-MGD)

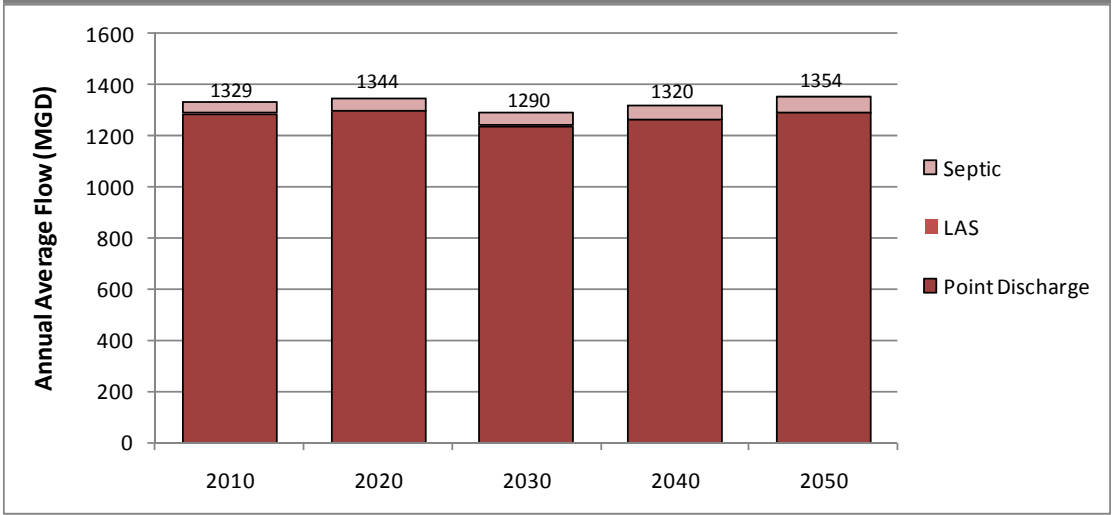


Notes:
Energy water return is the Alternative Energy Forecast (CDM, 2010). Consumptive use was estimated to be 9 MGD in 2010 and 2050 for the Alternative Energy Forecast.

Municipal wastewater flow forecast includes point source discharges (NPDES), land application systems (LAS), and septic systems.

Data Sources: Upper Oconee Municipal and Industrial Forecasts (CH2M HILL, 2010) and Energy Forecasts (CDM, 2010).

Figure 4-8:Total Wastewater Flow Forecast (AAF-MGD)



Notes:
Values represent forecasted annual average flow (AAF).
Energy returns decrease in 2030.

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Section 5. Comparison of Available Water Resource Capacities and Future Needs

Section Summary

For groundwater availability, the combined Coastal Plain aquifers will start experiencing a gap in 2040 under dry conditions. Similarly, gaps in surface water availability in the upper portion of the Region will potentially occur in 2050.

Potential needs in available facilities or infrastructure capacity include water infrastructure needs in Barrow, Athens-Clarke, Greene, and Morgan Counties. Potential shortages in wastewater infrastructure ranging from 0.16 to 13.28 MGD were identified in Barrow, Athens-Clarke, Greene, Jackson, Oconee, Walton, and Washington Counties.

Results indicate potential nutrient issues in Lake Oconee and Lake Sinclair without implementation of Management Practices to reduce nutrient loadings.

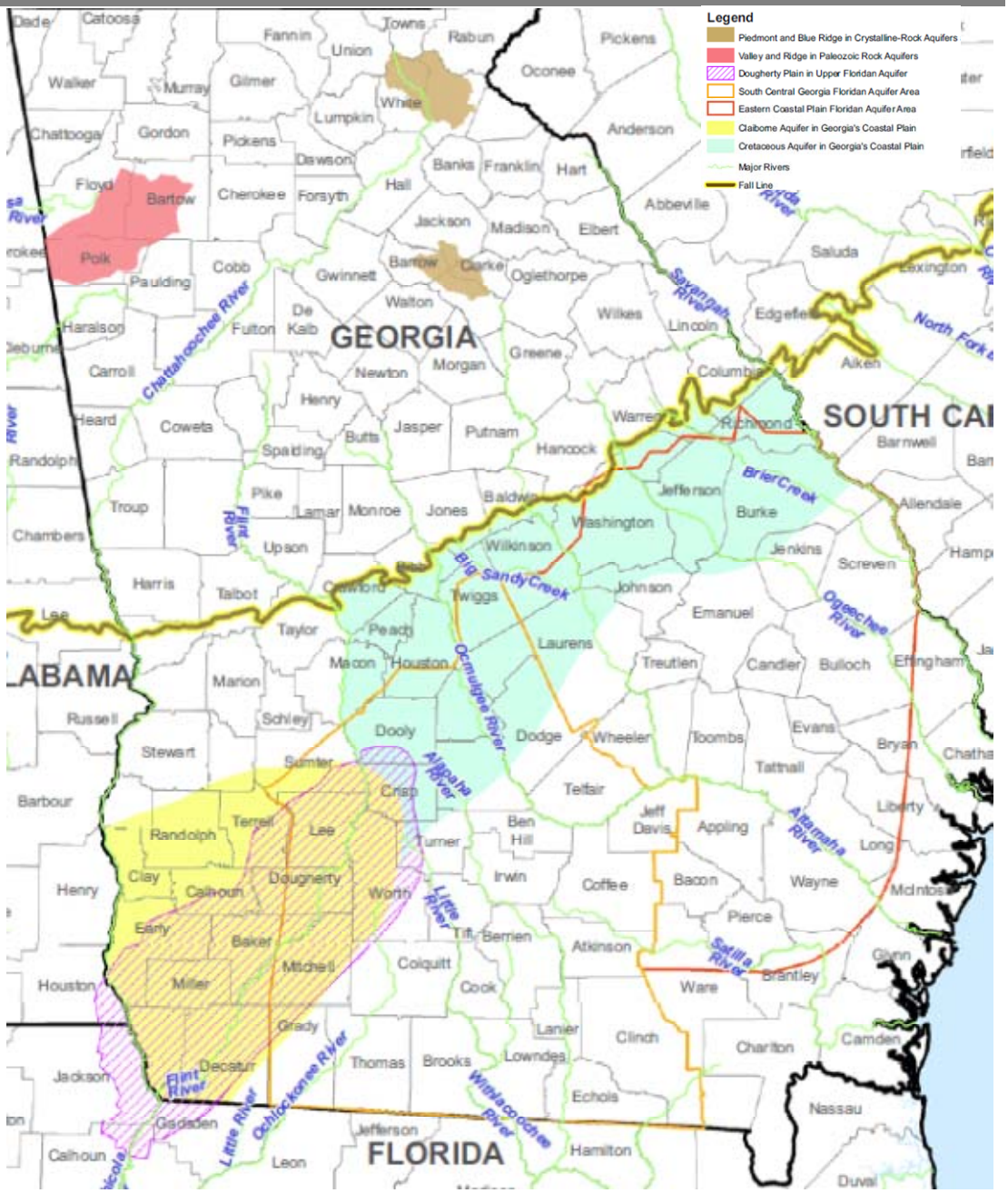
This Section compares the water demand and wastewater flow forecasts (Section 4) with the Resource Assessments (Section 3), providing the basis for selecting the water MPs discussed in Sections 6 and 7. Areas where future demands exceed the capacity of the resource for groundwater, surface water availability, and surface water quality (the assimilative capacity of the waterway) have a gap or shortage that will be addressed through the MPs described in Section 6.2. This section summarizes the potential gaps and shortages, also referred to as water resource management issues, for the Region.

5.1 Groundwater Availability Comparisons

There are three priority aquifers within the Region, as shown in Figure 2-2. North of the Fall Line, in the Piedmont Physiographic Province, the Crystalline rock aquifer system is located beneath Barrow, Jackson, Walton, Oconee, Morgan, Greene, Putnam, Baldwin, and Hancock Counties (see Figure 5-1). South of the Fall Line, the Cretaceous aquifer system is located beneath Wilkinson, Washington, and Laurens Counties in Georgia's Coastal Plain. The Floridan aquifer is located south of the portions of the Region within the Eastern Coastal Plain. Only a small portion of the Region includes the Upper Floridan aquifer. Section 3.2 summarizes the existing Resource Assessment for groundwater availability, which estimates the potential sustainable yield for the key aquifers.

The future groundwater assessment compared the forecast groundwater demands with currently modeled ranges of aquifer sustainable yields for the years 2010, 2020, 2030, 2040, and 2050 based on the prioritized aquifers modeled (see Figure 5-1). Although the Crystalline rock aquifer systems were not assessed for future conditions, the existing groundwater Resource Assessment for the Crystalline rock aquifers indicates that there is additional groundwater available within this system. It is more difficult, however, to find sufficient water-bearing zones in the Crystalline rock aquifers to develop the entire estimated sustainable yield. To take advantage of this resource, careful geologic mapping and well siting by experienced geologists is necessary.

Figure 5-1: Groundwater Resource Areas Evaluated for the Resource Assessment



Source: GAEPD, 2010a.

The future groundwater assessment modeled for the Cretaceous and Floridan aquifers used the following information:

- Range of sustainable yield in MGD
- Forecast agricultural groundwater demands for normal and dry years (defined as the 50 and 75 percentile irrigation requirements in MGD, respectively)
- Forecast municipal, industrial, and self-supplied groundwater demands; and current energy groundwater demands in MGD.

Table 5-1 summarizes the results of the future groundwater assessment assuming a dry year (i.e., 75% agricultural use). No gaps are forecast for the Cretaceous aquifer systems or the South-Central Georgia and Eastern Coastal Plain of the Upper Floridan Aquifer. Although the Eastern Coastal Plain of the Upper Floridan aquifer is not projected to have gaps, when the Coastal Plain aquifers are assessed together, a gap is projected to begin in 2040 under dry conditions. These potential gaps are relatively small, approximately 69 MGD, compared to the overall yield of the aquifers (between 868 to 982 MGD). Localized well fields would have to be evaluated to accurately determine the potential for site-specific yields.

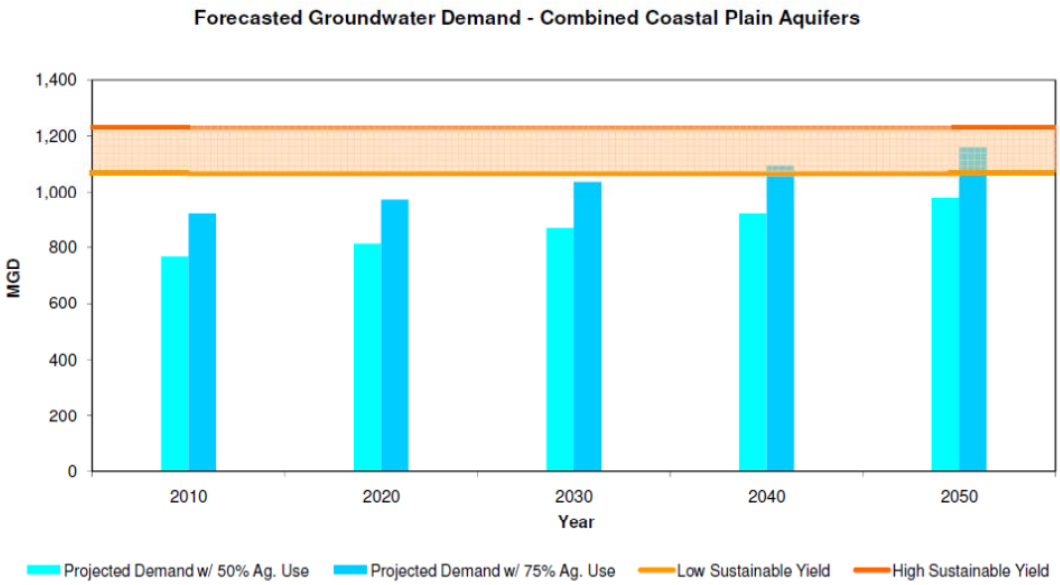
Table 5-1: Groundwater Assessment Results

Aquifer	Sustainable Yield (MGD)		Forecasted Groundwater Demand (MGD)[a]	
	Low	High	2010	2050
South-Central Georgia and Eastern Coastal Plain of the Floridan Aquifer[b]	868	982	580	739
Cretaceous Aquifer Between Macon and Augusta	347	445	246	303
Combined Coastal Plain Aquifers[c]	1,066	1,229	922	1,160

Source: Initial Future Groundwater Availability Assessment, July 2010.
Notes:
[a] Based on dry year (75% agricultural use).
[b] Only a small portion of the Region includes the Floridan aquifer.
[c] Also includes yield from Claiborne aquifer which is located outside of the Region.

Figure 5-2 illustrates the results of the future groundwater Resource Assessment for the combined Coastal Plain Aquifers, which also includes yield from Claiborne aquifer is located outside of the Region. The dark blue bar represents the total forecast groundwater demand for irrigation requirements in a dry year (75 percent agricultural use), and the light blue bar indicates corresponding demands in a normal year (50 percent agricultural use). The dark orange line indicates the high end of the sustainable yield range, and the light orange line indicates the low end of the range.

Figure 5-2: Combined Coastal Plain Aquifers

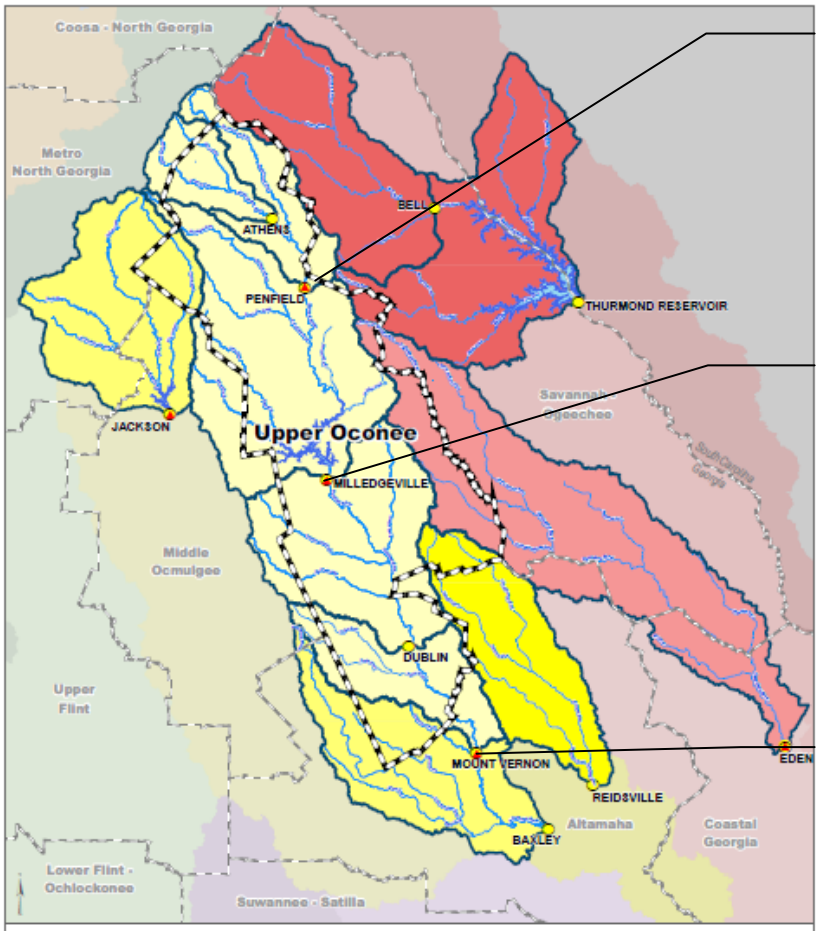


5.2 Surface Water Availability Comparisons

The evaluation of surface water availability is based on the existing surface water quantity assessment described in Section 3.2 and the projected surface water demands for 2050. For modeling purposes, the basin was divided into subbasins with results summarized at individual (not cumulative) planning nodes (Figure 5-3), including the "Penfield" planning node in the upper portion of the basin, the "Milledgeville" node in the middle portion of the basin encompassing Lakes Oconee and Sinclair, and the "Mount Vernon" node at the extreme lower end of the basin.

The water quantity Resource Assessment modeling and future availability projections are based on the ability to meet and sustain a flow regime at the planning nodes that will support water quality and downstream aquatic resource communities. In unregulated portions of the basin, upstream of the Penfield node, the flow regime is defined by the State's Interim Instream Flow Protection Policy, which calls for the protection of monthly 7Q10 or natural inflow, whichever is lower. (The 7Q10 flow is the seven-day, consecutive low flow with a 10-year return frequency; the lowest stream flow for 7 consecutive days that would be expected to occur once in 10 years).

Figure 5-3: Surface Water Modeling Nodes



Penfield Node:

- Includes portions of Barrow, Athens-Clarke, Jackson, and Oconee Counties
- Drainage Area: 942 square miles
- Average future gap of 42 MGD occurring 0.1 percent of the time.

Milledgeville Node:

- Includes portions of Baldwin, Greene, Hancock, Morgan, Putnam, and Walton Counties
- Drainage Area: 1999 square miles
- No gap due to existing reservoir storage.

Mount Vernon Node:

- Includes portions of Laurens, Washington, and Wilkinson Counties
- Drainage Area: 2132 square miles
- No gap due to existing reservoir storage.

Source: Initial Future Surface Water Availability Assessment, July 2010.

Milledgeville and Mount Vernon are both regulated nodes at which FERC specifies an explicit flow requirement. The Resource Assessment estimates whether or not a gap or shortage in stream flow or storage exists, if so, it can be compared to future demands to understand potential future gaps by node. According to the future surface water demand projections by county discussed in Section 4, most future demands are projected to occur in the upper portion of the basin (i.e., Jackson, Barrow, Athens-Clarke, Oconee, and Walton Counties) followed by Baldwin County in the central portion of the basin, and Laurens County in the lower portion of the basin. Figure 5-3 also indicates whether there will be a potential shortage in flow or storage in the future. Tables 5-2 and 5-3 summarize the results of the water quantity Resource Assessment for the riverine and reservoir (regulated) nodes.

Table 5-2: Summary of Flow Regime Shortage at Unregulated Penfield Node

Scenario	Length of Gap (% Time Target Flow not Met)	Average Gap (MGD)	Long-Term Flow Average (MGD)	Maximum Gap (MGD)	Corresponding Flow Regime (MGD)
Current	0%	0	775	0	N/A
2050	0.1%	42	753	45	299

Source: Initial Future Surface Water Availability Assessment, September 2010.

Within the area encompassed in the Penfield node (portions of Jackson, Barrow, Oconee, and Athens-Clarke Counties), a gap is projected in 2050. Modeling results suggest this gap would average 42 MGD and occur approximately 0.1 percent of the time. This is consistent with ongoing planning studies at the county and local utility level in the upper basin that have focused on the need for additional surface water storage. Considering the anticipated population growth and associated water demand in this area, additional surface water sources or other MPs will be needed.

At the Milledgeville node, the modeling indicates that there would not be a shortage in meeting future demands, but the model assumes that the potential storage available in Lakes Oconee and Sinclair could be used for water supply (Table 5-3). The slight increase in available storage is due to the forecasted increase in return flows in this subbasin in 2050. Both of these reservoirs are owned and operated by Georgia Power, and the storage in these lakes is reserved for hydropower generation. Any future use of this storage capacity for water supply purposes would have to be negotiated and approved by Georgia Power, GAEPD and FERC. Similarly, at the Mount Vernon node, there would be no shortages in meeting future surface water needs based on the existing storage in the basin. Evaluations of potential needs for surface water storage take into consideration the willingness of Georgia Power to re-allocate storage in its reservoirs.

Table 5-3: Summary of Milledgeville and Mount Vernon Regulated Nodes				
Node	Current Minimum Reservoir Storage (acre-feet)	Current Minimum Reservoir Storage (%)	2050 Minimum Reservoir Storage (acre-feet)	2050 Minimum Reservoir Storage (%)
Milledgeville	92,140	61%	91,384	61%
Mount Vernon	92,140	61%	91,384	61%
Source: Initial Future Surface Water Availability Assessment, September 2010.				

In addition to the potential gaps in water availability within the Region, the existing permitted water withdrawals (surface- and groundwater) and future demands were compared to identify potential needs in available facilities or infrastructure. Across the Region, future needs were identified only in Barrow, Athens-Clarke, Greene, and Morgan Counties. It should be noted that need estimates were calculated by comparing the permitted monthly average withdrawal limit with the forecast annual average demands. Therefore, these estimates are only an indicator of potential future needs in permitted capacity and indicate areas where continued localized facility planning will be needed, but are useful for regional planning.

Table 5-4: Permitted Municipal Water Withdrawal Limits versus Forecasted Municipal Water Demands (MGD)				
County	Permitted Municipal Water Withdrawal Limits [a,b,e]	2010 Forecasted Municipal Water Demand (AAD) [a,c]	2050 Forecasted Municipal Water Demand (AAD) [a,c]	2050 Permitted Capacity Need [a,d]
Baldwin [f]	18.44	7.14	10.49	None
Barrow [g]	17.55	7.01	30.76	13.21
Athens-Clarke [h]	28.00	20.77	30.10	2.10
Greene	4.41	2.08	4.85	0.45
Hancock [i]	1.30	0.77	0.89	None
Jackson [j]	28.88	7.16	22.77	None
Laurens	9.00	4.13	6.23	None
Morgan [k]	3.50	1.78	5.66	2.16
Oconee [l]	23.60	3.60	15.35	None
Putnam [m]	4.90	1.81	4.55	None
Walton [n]	46.51	7.45	23.59	None
Washington [o]	5.44	2.57	3.29	None

Table 5-4: Permitted Municipal Water Withdrawal Limits versus Forecasted Municipal Water Demands (MGD) (Continued)

County	Permitted Municipal Water Withdrawal Limits [a,b,e]	2010 Forecasted Municipal Water Demand (AAD) [a,c]	2050 Forecasted Municipal Water Demand (AAD) [a,c]	2050 Permitted Capacity Need [a,d]
Wilkinson	0.94	0.92	0.92	None

[a] Water withdrawal values includes surface water and groundwater withdrawals and purchases from outside the County. The purchases from outside each County are detailed below, when applicable.
[b] Surface water and groundwater permitted withdrawal limits are based on the current Monthly Average Limit (in MGD) of each permit. Purchases from outside the County reflect the Average Annual Demand for 2005 (in MGD).
[c] Forecasted Municipal Water Demands include water supplied to residences, commercial businesses, small industries, institutions, and military bases as well as water demands from major industrial sectors when supplied by municipal sources but they do not include self-supplied water demands. Forecasted Municipal Water Demands were calculated applying the new plumbing code (1.28 gpf toilets) mandated by the Water Stewardship Act passed in 2010. Values based on Annual Average Demand (in MGD).
[d] Based on differences between Permitted Withdrawal Limit and 2050 forecast demand (in MGD). Values are estimates for future needs or additional capacity available.
[e] Includes the municipal withdrawal permit holders listed in the GAEPD database for each county.
[f] Municipal sources supplied approximately 0.49 MGD (2005) to major industries. Includes a permit for Sinclair Water Authority (Lake Sinclair) which is split between Baldwin and Putnam Counties, 3.00 MGD of which goes to this county.
[g] Municipal sources supplied approximately 0.89 MGD (2005) to major industries. Includes purchase of 0.51 MGD from Gwinnett County. Includes permit for Upper Oconee Water Authority (Bear Creek WTP) which is split between Barrow, Athens-Clarke, Jackson and Oconee Counties, 11.00 MGD of which is allocated to this county.
[h] Municipal sources supplied approximately 2.40 MGD (2005) to major industries. Includes a set of three permits (North Oconee, Middle Oconee, and Bear Creek) that have a combined limit of 28.00 MGD.
[i] Municipal sources supplied approximately 0.01 MGD (2005) to major industries.
[j] Municipal sources supplied approximately 0.18 MGD (2005) to major industries. Includes purchases of 1.32 MGD from Banks County, 0.70 MGD from Barrow County, and 0.54 MGD from Gwinnett County. Includes a 4.60 MGD permit for Parks Creek Reservoir, which is permitted, but not in operation. Includes permit for Upper Oconee Water Authority (Bear Creek WTP) which is split between Barrow, Athens-Clarke, Jackson and Oconee Counties, 14.50 MGD of which is allocated to this county.
[k] Municipal sources supplied approximately 0.13 MGD (2005) to major industries.
[l] Includes permit for Upper Oconee Water Authority (Bear Creek WTP) which is split between Barrow, Athens-Clarke, Jackson and Oconee Counties, 7.00 MGD of which is allocated to this county. Includes permit for Walton County W&S Authority (Hard Labor Creek) which is split between Oconee and Walton Counties, 12.00 MGD of which is allocated to this county.
[m] Includes a permit for Sinclair Water Authority(Lake Sinclair) which is split between Baldwin and Putnam Counties, 3.00 MGD of which goes to this county.
[n] Municipal sources supplied approximately 0.13 MGD (2005) to major industries. Includes purchases of 0.01 MGD from Gwinnett County and 6.00 MGD from Newton County. Includes permit for Walton County W&S Authority (Hard Labor Creek) which is split between Oconee and Walton Counties, 29.50 MGD of which is allocated to this county.
Sources: Forecasted water demands and GAEPD approved permit database.
[o] Municipal sources supplied approximately 0.30 MGD (2005) to major industries.
Reference: Supplemental document titled *Comparison of Water and Wastewater Forecasts to Existing Permits and Planned Projects*.

5.3 Surface Water Quality Comparisons (Assimilative Capacity)

The assimilative capacity of a watershed is the amount of a given pollutant that can be discharged to the watershed while still maintaining water quality standards. The water quality evaluation was based on the modeling for DO conditions and nutrient loadings, as described in Section 3.2. In-stream DO conditions were modeled for the majority of the major streams and tributaries currently receiving treated wastwater discharges. For purposes of this modeling effort and to identify potential gaps, future wastewater flows

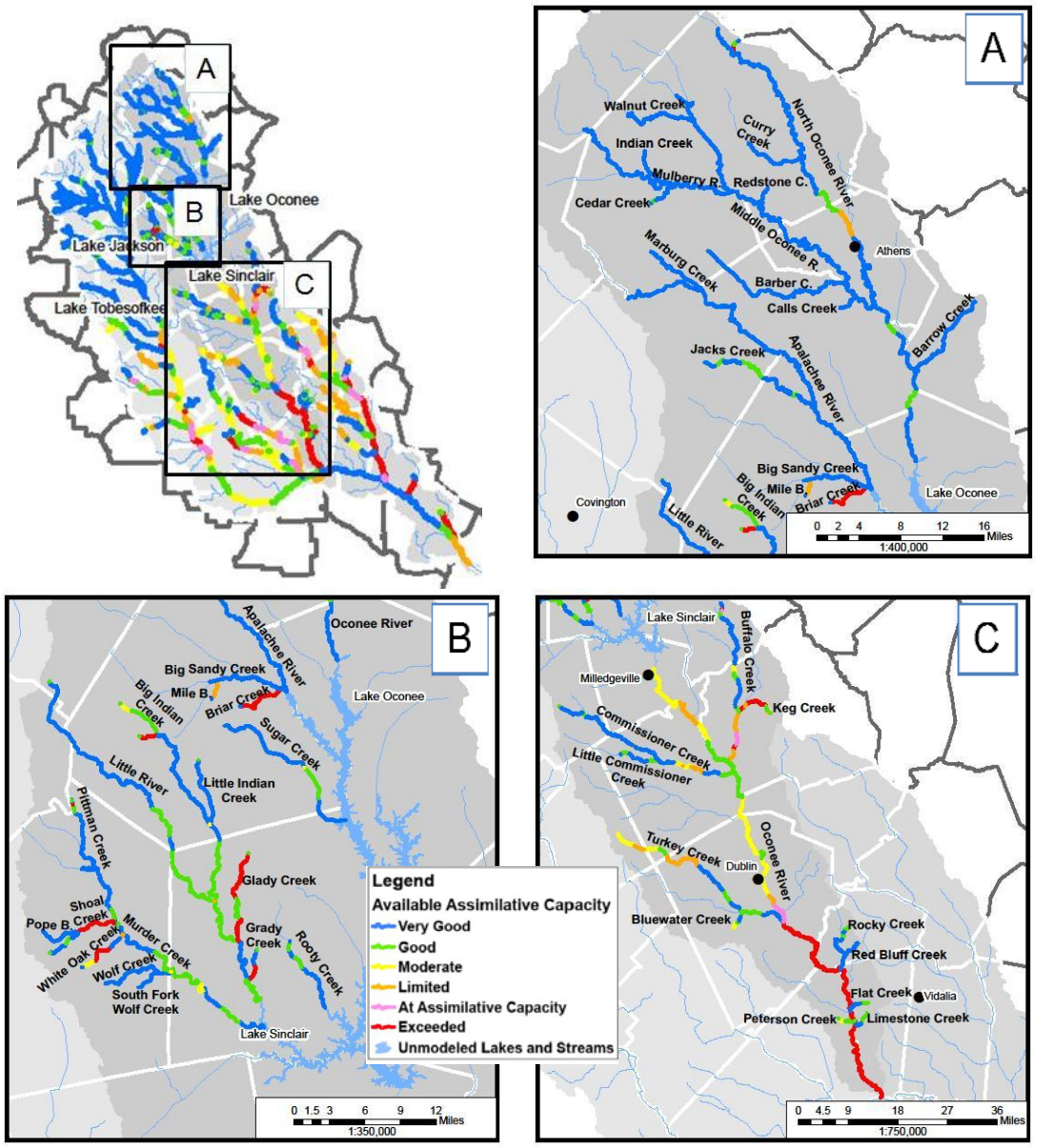
for municipal and industrial facilities were assumed to be the current permitted treatment capacity and limits, unless planned facility expansions were identified in existing permits.

In the upper portion of the basin, DO conditions are projected to be generally adequate for surface waters to accept additional wastewater discharges (Figure 5-4A). Figure 5-4B illustrates that several tributaries in the Lake Oconee and Lake Sinclair watersheds may have exceeded assimilative capacity for DO in 2050 assuming current permitted conditions. These tributaries include: Briar Creek in the Lake Oconee watershed and (an unnamed tributary of) Big Indian Creek, Glady Creek, Grady Creek, Shoal Creek, and White Oak Creek in the Lake Sinclair watershed. Figure 5-4C illustrates that the lower Oconee River and Keg Creek may have exceeded their assimilative capacity for oxygen-consuming wastes under permitted conditions. Existing natural conditions, including low flow and high organic loading from adjacent wetlands, contribute to this DO and assimilative capacity limitation. It should be noted that the future conditions scenarios assume that treatment facilities will operate at their permitted capacity, which seldom occurs, particularly during the low flow, summer conditions assumed in the model. However, the MPs described in Sections 6 and 7 for wastewater demands reflect these areas of lower available assimilative capacity.

Watershed-based modeling to evaluate nutrient loadings under 2050 conditions was completed only for those watersheds contributing to the areas upstream of Lakes Oconee and Sinclair. As noted in Section 3.2.1, there are currently no chlorophyll a or nutrient standards in effect in the Region. However, GAEPD has assumed a target of 20 micrograms per liter (µg/L) chlorophyll a to lakes in adjacent planning areas; this serves as an example standard for evaluation of conditions in Lakes Oconee and Sinclair. Modeling results (Figure 5-5) indicate that a potential 20-µg/L chlorophyll a threshold is exceeded near Wallace Dam on Lake Oconee and on the Oconee River arm in both wet and dry years under 2050 conditions. Based on anticipated future conditions and wastewater capacity needs, the nutrient load during dry years is mainly from point sources, while during a wet year less than half the nutrient load is from point sources (Figure 5-6 and 5-7).

Modeling completed for Lake Sinclair indicates that the potential 20-µg/L chlorophyll a threshold is maintained under 2050 conditions throughout the lake. Although nutrient standards are not currently in place for waters within the Region, GAEPD is developing nutrient standards based on mandates from the U.S. Environmental Protection Agency. Therefore, nutrient standards for waters within the Region are likely in the future. MPs for nutrient reductions from both point and nonpoint sources will be needed in order for waters to meet these new standards and to maintain conditions in Lakes Oconee and Sinclair.

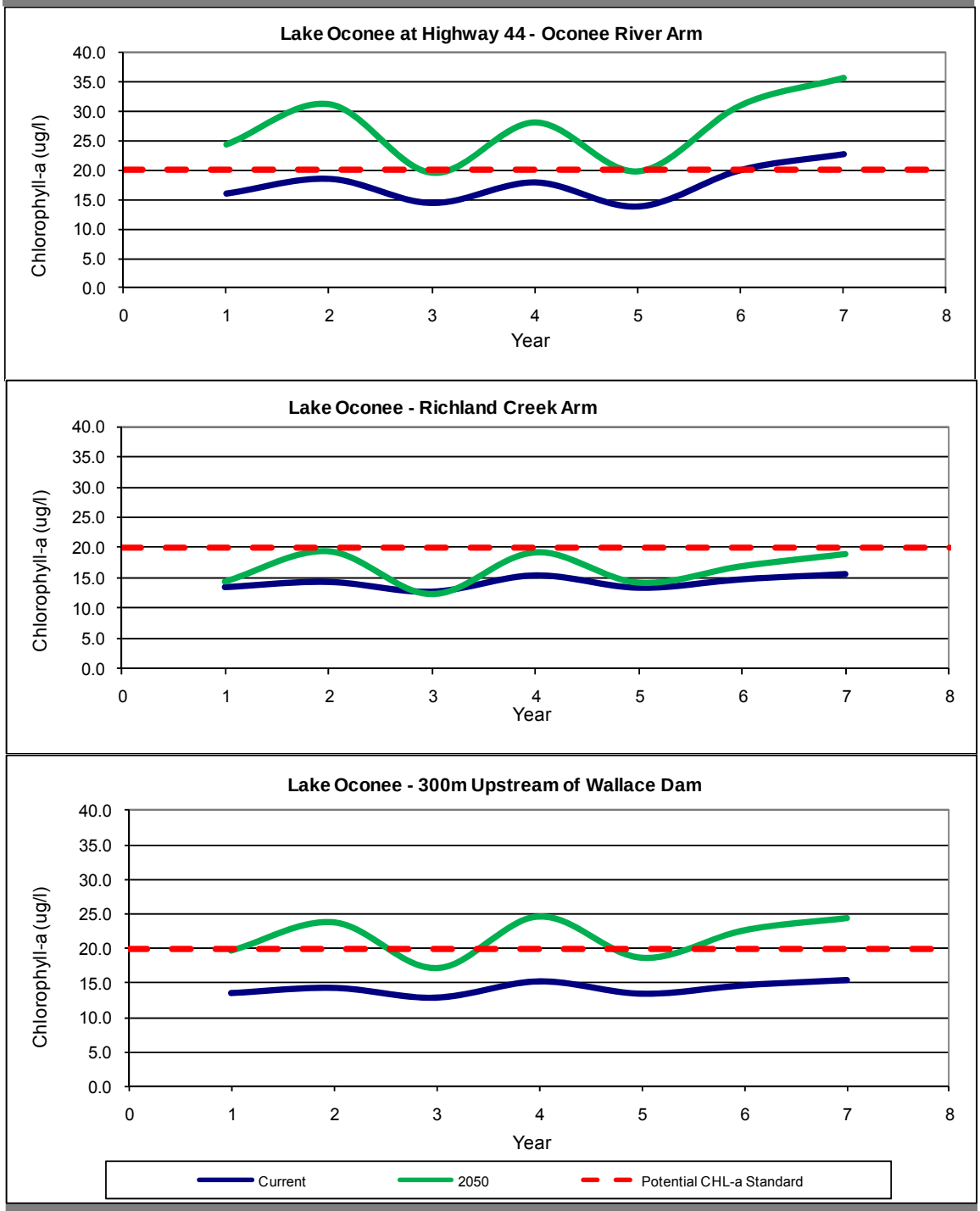
Figure 5-4: Surface Water Quality (Assimilative Capacity) Comparison



Source: Georgia Environmental Protection Division, 2010.
Notes: The results shown are based on municipal and industrial facilities at their full permitted levels.

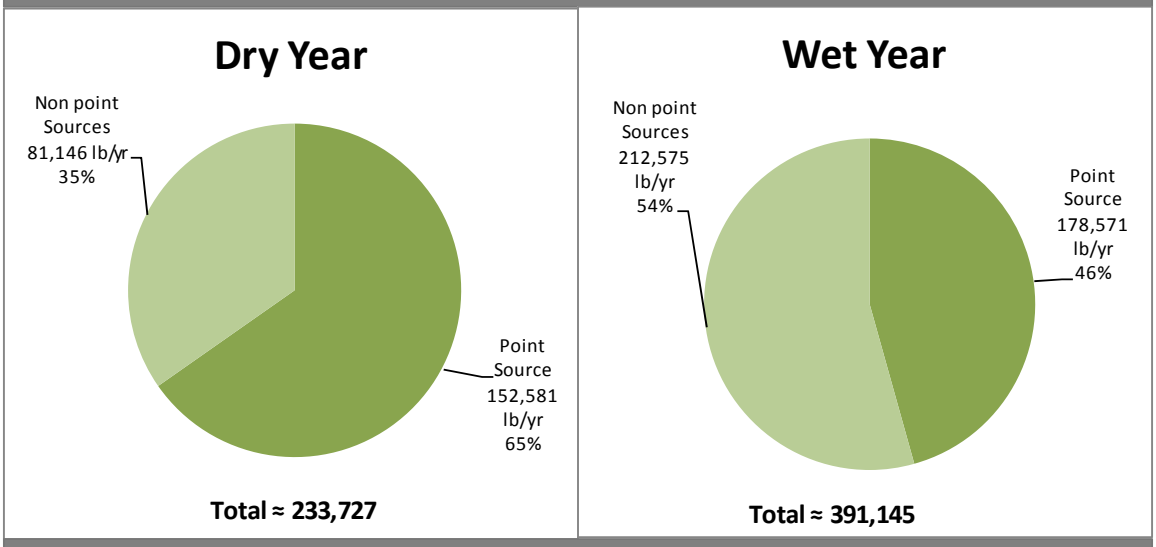
Very good:	≥ 1 mg/L available DO (that is, above DO standards)
Good:	> 0.5 mg/L to 1.0 mg/L DO available
Moderate:	> 0.2 mg/L to ≤ 0.5 mg/L DO available
Limited:	> 0.0 mg/L to ≤ 0.2 mg/L DO available
At assimilative capacity:	≤ 0 mg/L DO available
Exceeded:	Predicted DO less than standard.

Figure 5-5: Growing Season Median Chlorophyll-a Concentration- Lake Oconee



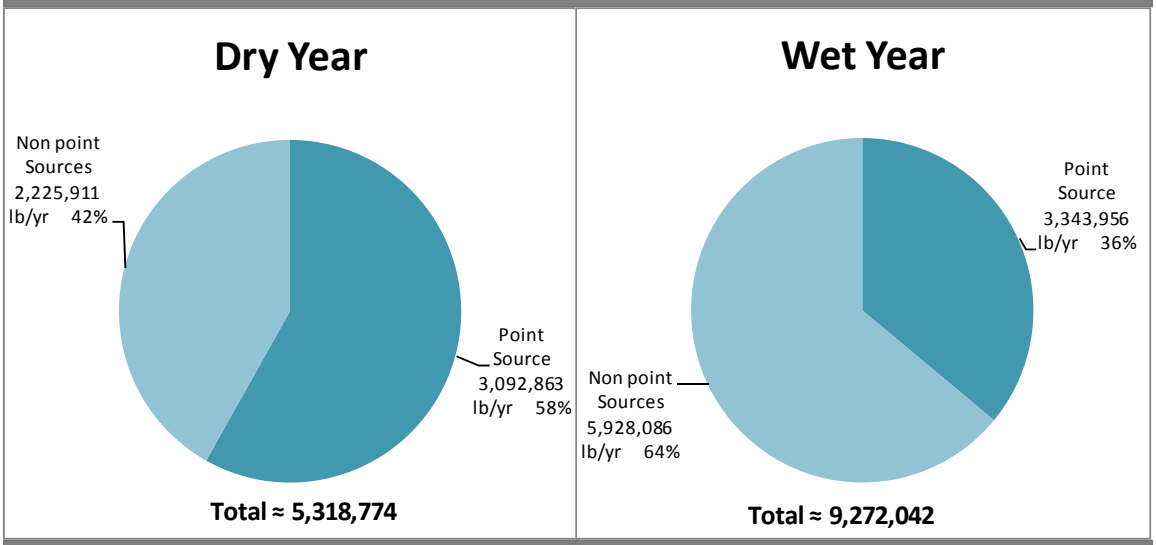
Notes: Years 1-7 are based on the meteorological record for 2001-07. Current conditions are based on existing point source discharge, land use and associated non point source loadings. Future conditions are based on 2050 discharges and land use.

Figure 5-6: Upper Oconee Watershed- FutureTributary Phosphorus Loading (lb/yr)



Notes:
Based on 2050 demands
Point sources = wastewater discharges; Non point sources = loading from stormwater runoff

Figure 5-7: Upper Oconee Watershed- Future Tributary Nitrogen Loading (lb/yr)



Notes:
Based on 2050 demands
Point sources = wastewater discharges; Non point sources = loading from stormwater runoff

5.4 Future Treatment Capacity Comparison

Based on a comparison of the future wastewater capacity needs with existing permitted capacity, future demands for municipal wastewater management can largely be met with existing permitted facilities (Table 5-5). Availability of existing permitted wastewater capacity in the Region suggests that future MPs described in Sections 6 and 7 will need to focus on the few specific counties where capacity shortages are likely to occur. These include Barrow, Athens-Clarke, Greene, Jackson, Oconee, Walton, and Washington Counties. Potential 2050 shortages in wastewater capacity range from 0.16 MGD in Athens-Clarke County to 13.28 MGD in Barrow County in 2050.

Note that shortage/surplus estimates were calculated by comparing the current permitted maximum monthly average discharge with the forecast annual average wastewater flow. Thus, these estimates are only an indicator of potential future shortages/surpluses in permitted treatment capacity and indicate areas where continued localized facility planning will be needed.

Table 5-5: Permitted Municipal Wastewater Discharge Limits versus Forecasted Municipal Wastewater Flows (MGD)

County	Permitted Municipal Wastewater Discharge Limit [a,b]	2010 Forecasted Municipal Wastewater Flows [a,c]	2050 Forecast Municipal Wastewater Flows [a,c]	2050 Surplus or (Shortage) [a,d]
Baldwin [e]	10.50	2.58	3.85	6.65
Barrow [f]	7.61	2.25	20.89	(13.28)
Athens- Clarke [g]	28.17	14.75	28.33	(0.16)
Greene	2.07	1.06	2.47	(0.40)
Hancock	0.20	0.00	0.00	0.20
Jackson [h]	6.32	2.44	15.14	(8.81)
Laurens	6.72	2.49	3.75	2.97
Morgan [i]	1.97	0.59	1.69	0.28
Oconee	2.30	0.50	9.22	(6.92)
Putnam	1.84	0.66	1.64	0.20
Walton	6.84	0.51	7.08	(0.24)
Washington [j]	2.52	2.46	3.16	(0.64)
Wilkinson	0.79	0.19	0.19	0.60

[a] Includes centralized systems such as land application systems and point source discharges but not septic system.
[b] Permitted Discharge Limits based on the current Maximum Monthly Average Permit Limit (in MGD) of each permit.
[C] Municipal wastewater flow forecasts include water supplied to residences, commercial businesses, small industries, institutions, and military bases. In addition, Forecasted Municipal Wastewater Flows include flow from industries that are served by municipal facilities. Values based on Annual Average Flow (in MGD).
[d] Based on difference between Permitted Treatment Limit and 2050 Forecasted Flows (in MGD). Red values in parentheses are shortages and values in black are surpluses.
[e] Estimated to provide 0.40 MGD of treatment capacity to textile industries (based on 2010 data).
[f] Estimated to provide 0.64 MGD of treatment capacity to chemical and food industries (based on 2010 data).
[g] Estimated to provide 2.16 MGD of treatment capacity to food industries (based on 2010 data).
[h] Estimated to provide 0.16 MGD of treatment capacity to food industries (based on 2010 data).
[i] Estimated to provide 0.13 MGD of treatment capacity to paper industries (based on 2010 data).
[j] Estimated to provide 0.35 MGD of treatment capacity to mining and chemical industries (based on 2010 data).
Sources: Forecasted wastewater flows and GAEPD approved permit database (provided in 2009).
Reference: supplemental document *Comparison of Water and Wastewater Forecasts to Existing Permits and Planned Projects*.

5.5 Summary of Potential Water Resource Gaps, Needs, and Shortages

Table 5-6 summarizes the counties occurring upstream of planning nodes with potential water resource gaps or infrastructure needs or shortages from the previous subsections to help guide the appropriate selection and application of MPs in Sections 6 and 7. The basis, or source, for each potential gap or need/shortage is noted so the reader can return to the source of the gap or need/shortage for further explanation. In addition to indicating the results of the watershed-based nutrient modeling for those watersheds contributing to Lake Oconee and the Oconee River, the water quality 303(d) issues column also integrates the widespread listings of impaired streams in the Region that were noted in Section 3.3.2.

Table 5-6: Summary of Potential Gaps, Needs, or Shortages by County

County	Ground-water Gaps	Surface Water Gaps	Municipal Water Needs	Municipal Wastewater Shortages	Water Quality – Assimilative Capacity Gaps	Water Quality 303(d) Issues
For more details see:	*Table 5-1*	*Section 5.1 Table 5-2*	*Section 5.2 Table 5-4*	*Table 5-5*	*Section 5.4 Figure 5-4*	*Sections 3.3.2 and 5.3*
Baldwin					Yes	Yes
Barrow		Yes	Yes	Yes		Yes
Athens-Clarke		Yes	Yes	Yes	Yes	Yes
Greene			Yes	Yes		Yes
Hancock						Yes
Jackson		Yes		Yes		Yes
Laurens	Yes				Yes	Yes
Morgan			Yes		Yes	Yes
Oconee		Yes		Yes		Yes
Putnam					Yes	Yes
Walton				Yes		Yes
Washington	Yes			Yes	Yes	Yes
Wilkinson	Yes				Yes	Yes
Total Counties	**3**	**4**	**4**	**7**	**7**	**13**

Notes: "Yes" indicates that there is a potential gap or need/shortage in the indicated county or a water quality issue.
"Gap" is defined as a condition where the existing or future conditions exceed the Resource Assessment metric.
"Need" and "Shortage" are defined as a condition where the current permitted capacity of water and wastewater treatment facilities, respectively, is less than the future forecast demands.

Section 6. Addressing Water Needs and Regional Goals

This Section presents the Council's MPs, selected to address the water resource management issues (such as potential gaps or shortages) identified and described in Section 5, and/or to meet the Council's vision and goals described in Section 1.3.

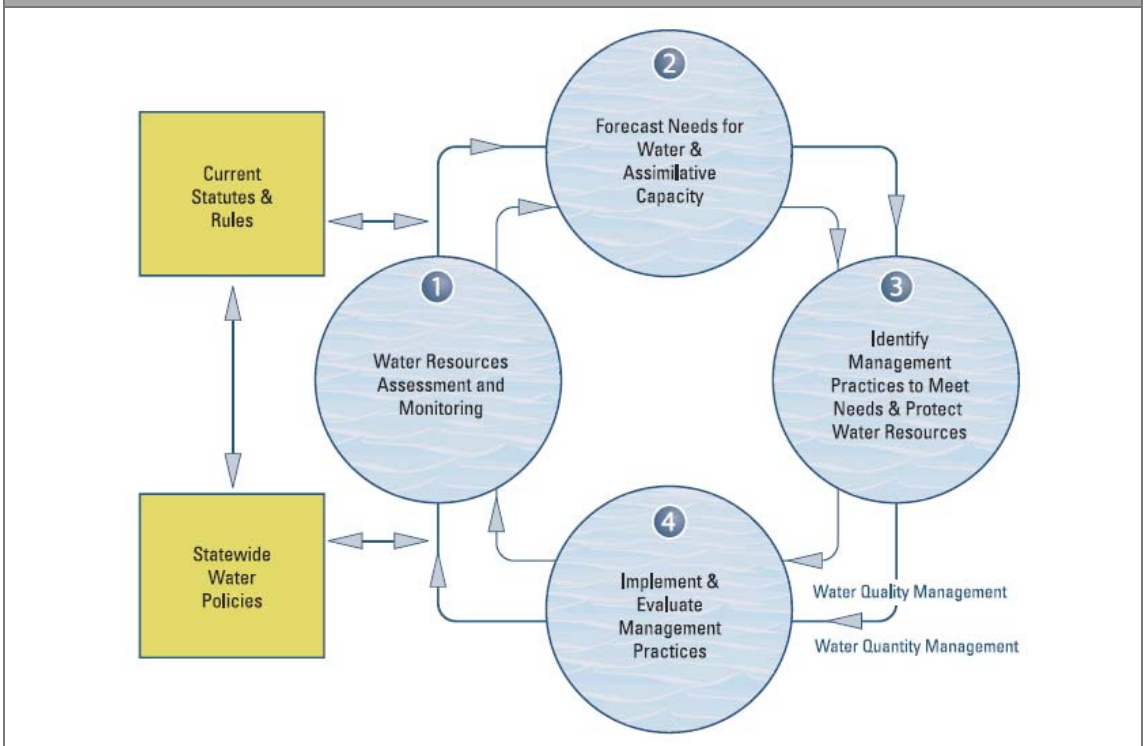
Section Summary

A prioritization and ranking process resulted in the Council selecting 12 Water Conservation, 7 Water Supply, 7 Wastewater, and 12 Water Quality Management Practices.

6.1 Identifying Water Management Practices

The State Water Plan defines MPs as reasonable methods, considering available technology and economic factors, for managing water demand, water supply, return of water to water sources, and prevention and control of pollution of the waters of the state. The plan builds upon Georgia's current statutory framework to create a more integrated water management policy, with MP selection as part of an adaptive four-step water planning process. This process is consistent with current state laws and policies. Figure 6-1 illustrates how it interacts with State-wide water policy.

Figure 6-1: Relationship of MPs to Georgia Rules and Statutes



Source: Georgia Comprehensive State-wide Water Management Plan

Identification of potential MPs appropriate for the Region started with a review of existing local and regional plans, which helped update the Council about practices already in place. Section 5 compares the Resource Assessments described in Section 3 with the forecasted future needs described in Section 4. Section 5 also summarizes the Region's existing or likely future water resource or infrastructure issues and demonstrates the need for County- and resource-specific MPs. In areas with no issues or gaps, the MPs have been selected to meet needs specified by the Council (i.e., facility/infrastructure needs and practices, programmatic practices, etc.) that are aligned with the Region's vision and goals.

6.1.1 Review of Existing Plans and Practices

The Council conducted a comprehensive review of over 40 existing local and regional Water Management Plans and related documents to frame the selection of MPs. Key documents reviewed included: Oconee River Basin Management Plan, total maximum daily load (TMDL) Implementation Plans, the Metro Water District 2009 Plans, and county-specific plans such as the Walton County Water and Sewerage Authority Water Conservation Plan. A complete listing and review of the local and regional plans is provided in the supplemental document titled *Review and Summary of Existing Plans*, which is available on the Council website.[6]

6.2 Selected Water Management Practices for the Upper Oconee Region

This Section presents the MPs selected by the Council to address the water resource issues and gaps identified in Section 5 and to meet the Council's vision and goals. Each subsection groups MPs by the primary water resource area addressed, such as Water Quality or Water Conservation, and then generally lists the practices in order of the total benefit ranking assigned by the Council. The prioritization and ranking process is described in the supplemental document titled *Management Practice Decision Making Process*, which is available on the Council website. MPs may not be applicable to all sub-geographies or local governments based on existing conditions or future gaps or needs/shortages in resources or infrastructure. The Council assumes that the list of MPs would be considered for implementation based on local needs. Section 7 provides a summary of the recommendations for implementation responsibilities.

During the MP selection process, the Council was divided into three Planning Area subcommittees generally representing the unique water resource conditions found in the upper, central, and lower portions of the Region. The Upper Planning Area includes Athens-Clarke, Barrow, Jackson, Oconee, and Walton Counties and contains the most densely developed lands in the basin, as described in Section 2.2.3. Putnam, Morgan, Greene, and Hancock Counties comprise the Central Planning Area of the Region, which largely drains to Lakes Oconee and Sinclair. The Lower Planning Area includes the south shoreline and embayments of Lake Sinclair near Milledgeville and extends southward past Interstate 16 in Laurens County. Other counties in the Lower Planning

[6] http://www.upperoconee.org/pages/our_plan/index.php

Area include Baldwin, Washington, and Wilkinson Counties, which drain to the Oconee River, Ogeechee River, and Ohoopee River.

After reviewing the Resource Assessments, each subcommittee provided initial feedback on the types of MPs already being implemented, local needs, and the feasibility of local implementation of MPs to address potential resource or infrastructure gaps or shortages. Tables 6-1(a) to 6-1(d) identify the MPs adopted by the Council for implementation.

6.2.1 Water Conservation Management Practices

Georgia will need to practice water conservation in order to meet its long-term water needs. Conservation also helps ensure responsible use of a public resource and may reduce the need for, or delay, implementation of potentially costly water supply MPs. As laid out in this Section, this Regional Water Plan's approach to water conservation will be accomplished by setting water conservation goals and requiring water withdrawal permittees to demonstrate progress toward those goals, while providing for due consideration of technical feasibility, cost-effectiveness, conservation measures in place prior to the adoption of this plan, and water use required by other regulatory programs for human health and sanitation.

Water conservation is a priority MP in Section 7, Policy 3 of the State Water Plan and the State Water Conservation Implementation Plan (WCIP). The latter, released in March 2010, identifies water conservation goals, benchmarks, and best management practices (BMPs) for the State's diverse water users. The WCIP framed the following conservation tiers for each Council to use during MP selection:

- Tier 1: Basic water conservation activities and practices that are currently required by statute or will soon be required in GAEPD's upcoming amended rules.
- Tier 2: Basic water conservation activities and practices that will be addressed in upcoming amended rules, but are not required of all permit applicants.
- Tier 3: Basic water conservation practices (for all water use sectors) that will not be addressed in current or upcoming amended rules.
- Tier 4: "Beyond basic" water conservation practices to be considered if a gap exists between current or future water supplies and demands for the Region.

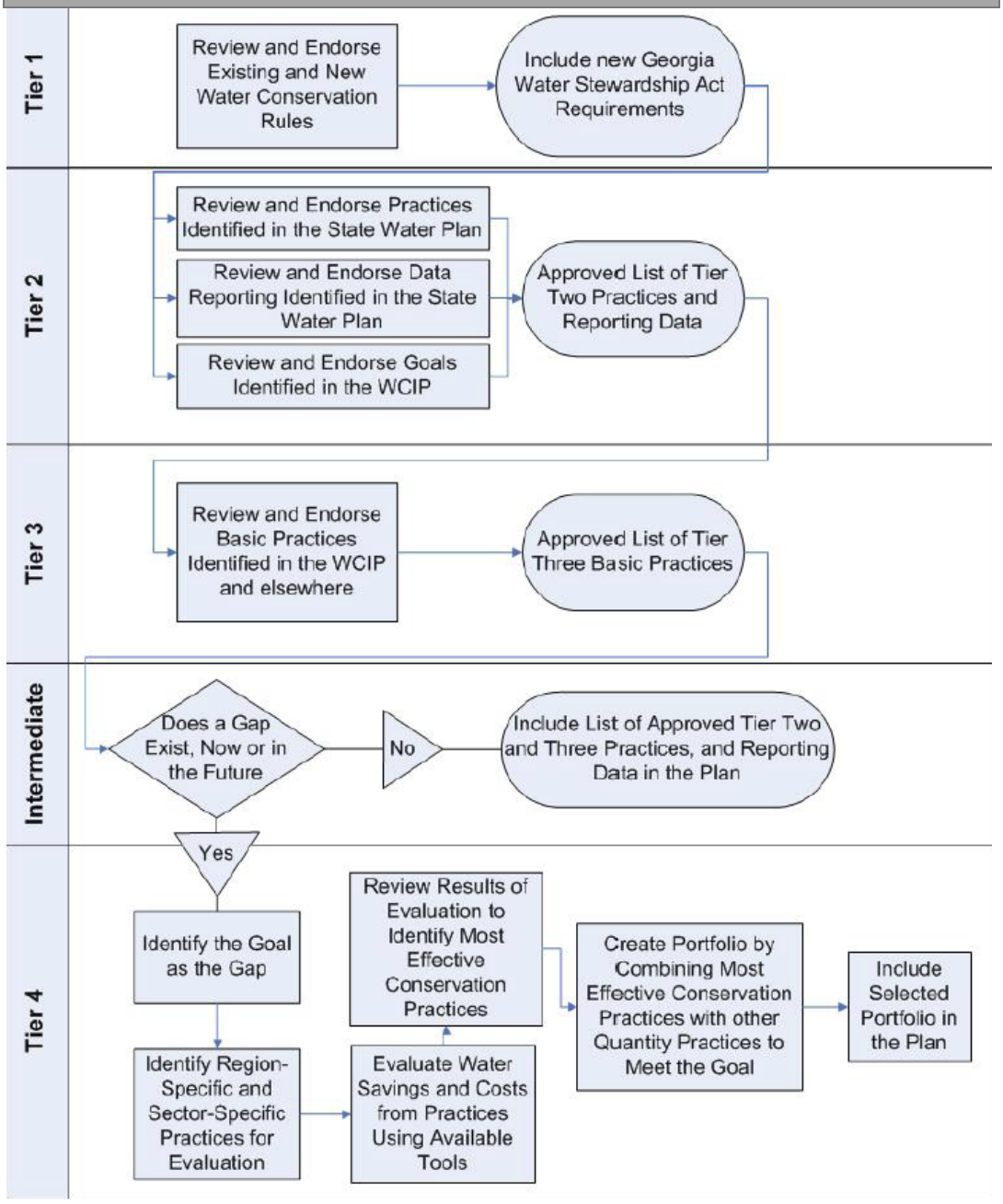
Figure 6-2 illustrates the process used to consider these tiered practices during selection of the Water Conservation MPs listed in Table 6-1(a) (GAEPD, 2009). Three of the Council's goals specifically address conservation or water infrastructure optimization:

Goal # 1: Promote alternatives and technologies that conserve, reuse, return, and recycle water within the Upper Oconee region.

Goal # 3: Educate stake-holders in the region on the importance of water quality and managing water as a resource including practices such as water conservation and increased water efficiency.

Goal # 6: Recommend innovative strategies (water, sewer, and/or stormwater) that provide sufficient revenues to maintain a high level of service while promoting water conservation and efficiency.

Figure 6-2: Water Conservation Guidance Process Flow Chart



Source: GAEPD, 2010d.

The 12 final Water Conservation MPs listed in Table 6-1(a) meet the goals noted above, address potential gaps at the Penfield node in order to extend the life of the existing water supplies, and address potential gaps in Athens-Clarke, Barrow, Jackson, and Oconee Counties; these potential gaps are discussed in Section 5 and summarized in Table 5-7. Additionally, the MPs promote increased efficiency by agricultural users to decrease water demand from the groundwater aquifers. Many of the MPs involving public education address multiple sectors, such as both water conservation and nonpoint source/water quality issues. Some of the MPs, e.g., WC-3, provide a secondary benefit by generating improved information for use in future Regional Water Plan updates.

Table 6-1(a): Water Conservation MPs Selected for the Region

Action Needed (MP)	Description/Definition of Action	Relationship of Action or Issue to Vision and Goals (Section 1.3)
WC-1. Encourage conservation pricing	Encourage conservation pricing to provide economic incentive for people to use water more efficiently within the entire Region. Specific measures for implementation are to: (1) eliminate declining block rate structures, (2) perform a rate and revenue analysis, and (3) review and update pricing on a regular basis.	**Vision:** Manage water as a critical resource. Supports WS, RS, ES, and CR goals[1].
WC-2. Develop water conservation goals	Identify achievable, measurable goals to help local governments evaluate long-term water supply needs and to provide benchmarks for determining progress in reducing water supply gaps through conservation. Goals will be both regional and local with focus on areas where water supply gaps exist.	**Vision:** Manage water as a critical resource. Supports WS, CR, ES and BP goals[1].
WC-3. Consistently meter and report agricultural water withdrawals (> 100,000 gallons per day [gpd])	Meter agricultural withdrawals throughout the Region, allowing GAEPD to estimate safe yield and available supplies to more accurately characterize existing conditions.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ and CR goals[1].
WC-4. Implement education and public awareness program	Research existing education programs to determine if one can meet water conservation and water quality improvement awareness needs. If an appropriate program does not exist, develop a Region-wide education and public awareness program. Implement the new program.	**Vision:** Develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, ES, and CR goals[1].

Table 6-1(a): Water Conservation MPs Selected for the Region (Continued)		
Action Needed (MP)	**Description/Definition of Action**	**Relationship of Action or Issue to Vision and Goals (Section 1.3)**
WC-5. Implement golf course water management education program	Develop site-specific plan to conserve water and prevent overwatering on golf courses throughout the Region. Precondition turf grass through agronomic programs to minimize water needs. Identify alternative (non-potable) water sources on or near golf courses, including highly treated wastewater effluent. Link to the Georgia Golf Course Superintendents Association BMP Program.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, ES, and CR goals[1].
WC-6. Encourage variable rate agricultural irrigation systems	Identify watering requirements for various types of crops grown throughout the Region. Identify soil types and associated percolation rates for the Region. Promote variable rate irrigation systems, which allow for different irrigation rates depending on site-specific water needs.	**Vision:** Manage water as a critical resource Supports WS, WQ, BP and CR goals[1].
WC-7. Encourage non-potable reuse	Identify areas with potential for reuse application to offset existing or future withdrawals. Promote irrigation with high quality treated effluent in unrestricted areas, such as golf courses and parks. Encourage industries to use reclaimed water for processes such as cooling when feasible.	**Vision:** Manage water as a critical resource. Supports WS and CR goals[1].
WC-8. Require installation of rain sensor shut-off switches on new irrigation systems	Require installation or retrofitting to utilize irrigation systems that automatically shut off during rain events or moist soil conditions. Investigate the potential for legislation or local government ordinances to require installation in new facilities where shortages are anticipated.	**Vision:** Manage water as a critical resource. Supports WS, BP, and CR goals[1].

Table 6-1(a): Water Conservation MPs Selected for the Region (Continued)		
Action Needed (MP)	**Description/Definition of Action**	**Relationship of Action or Issue to Vision and Goals (Section 1.3)**
WC-9. Require new car washes to recycle water	Require all new car wash establishments to recycle wash water to minimize the amount of potable water used during their processes. Programs can either be mandated for new establishments or voluntary. For voluntary programs, incentives, such as a certification that can be displayed and/or advertised, can be offered.	**Vision:** Manage water as a critical resource. Supports WS, WQ, and CR goals[1].
WC-10. Encourage residential water audits	Develop a regional residential water audit program. Distribute water audit guidelines. Encourage voluntary audits.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, ES, and CR goals[1].
WC-11. Encourage certification of irrigation specialists	Trained irrigation specialists understand the design, installation and maintenance of irrigation application timing and levels of water needed by vegetation as well as the technologies and installations that will increase water use efficiency of irrigation systems in the Region.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ and CR goals[1].
WC-12. Encourage commercial water audits	Identify an agency to conduct commercial audits and train personnel to conduct them throughout the Region. Advertise and promote the commercial water audit program. Conduct commercial audits with interested commercial partners. Report results to commercial partners and encourage use of the results in future decisions related to water use efficiency and conservation.	**Vision:** Develop an educated and engaged citizenry that embraces sound water management. Supports WS, BP and CR goals[1].

Table 6-1(a): Water Conservation MPs Selected for the Region (Continued)		
Action Needed (MP)	**Description/Definition of Action**	**Relationship of Action or Issue to Vision and Goals (Section 1.3)**
[1]Goals were given the following acronyms during the MP ranking and selection process: CR: Conservation and Reuse – Promote alternatives and technologies that conserve, reuse, return, and recycle water within the Region BP: Balance Priorities – Ensure that MPs balance economic development, recreation, and environmental interests ES: Educate Stakeholders – Educate stakeholders in the Region on the importance of water quality and managing water as a resource including practices such as water conservation and increased water efficiency DA: Data Management – Encourage the development and provision of easily accessible data and information to guide management decisions WQ: Water Quality – Identify programs, projects, and educational messages to reduce nonpoint source pollution to protect water quality in lakes and streams RS: Revenue Strategies – Recommend innovative strategies (water, sewer, and/or stormwater) that provide sufficient revenues to maintain a high level of service while promoting water conservation and efficiency WS: Water Supply – Identify and plan measures to ensure sustainable, adequate water supply to meet current and predicted long-term population, environmental, and economic needs WW: Wastewater WC: Water Conservation		

6.2.2 Water Supply Management Practices

MPs that supplement water supply play an important role in addressing the Region's potential water resource gaps that are summarized in Table 5-7. Of the 13 counties in the Region, 3 counties are associated with potential groundwater resource supply gaps, 4 counties are upstream of planning nodes with potential surface water supply resource gaps, and 4 counties have needs in their water supply infrastructure, as described in Section 5. Table 6-1(b) outlines the 7 Water Supply MPs targeted for implementation in the Region to address these potential gaps, needs, and shortages by decreasing water demand, increasing surface and groundwater supplies and returning more water to streams; thus, making more water available for downstream users.

Two of the Council's goals specifically address water supplies or water infrastructure optimization:

Goal #6: Recommend innovative strategies (water, sewer, and/or stormwater) that provide sufficient revenues to maintain a high level of service while promoting water conservation and efficiency.

Goal # 7: Identify and plan measures to ensure sustainable, adequate water supply to meet current and predicted long-term population, environmental, and economic needs.

Table 6-1(b): Water Supply MPs Selected for the Region		
Action Needed (MP)	**Description/Definition of Action**	**Relationship of Action or Issue to Vision and Goals (Section 1.3)**
WS-1. Expand existing reservoirs	Evaluate yield and potential expansion of existing facilities. Evaluate potential for Natural Resources Conservation Service (NRCS) impoundments to serve as water supply sources; estimate yield; identify any potential water quality and environmental issues.	**Vision:** Manage water as a critical resource and build trusting partnerships with neighboring regions. Supports WS, WQ, BP, and CR goals[1].
WS-2. Construct new water supply reservoirs	Water Management Councils and GAEPD to identify the yield of current sources. Identify when potential shortages between available supply and demand will occur. Encourage local governments to coordinate with each other to develop regional water supply projects. Local governments should begin permitting processes early for new water supplies.	**Vision:** Manage water as a critical resource and build trusting partnerships with neighboring regions. Supports WS, BP, and CR goals[1].
WS-3. Develop new groundwater wells	Evaluate potential for groundwater supplies (likely as supplemental source). Permit wells as needed and practicable.	**Vision:** Manage water as a critical resource and build trusting partnerships with neighboring regions. Supports WS, RS and BP goals[1].
WS-4. Encourage development of water master plans with periodic update	Create and utilize a local water master plan with a 30-year planning horizon. Update local water master plans. Develop or update local emergency water plans. Update a minimum of every 5 years.	**Vision:** Manage water as a critical resource, build trusting partnerships with neighboring regions, and develop an educated and engaged citizenry that embraces sound water management. Supports WS, RS, and ES goals[1].
WS-5. Encourage indirect potable reuse	Return highly treated wastewater to water supply reservoirs and streams.	**Vision:** Manage water as a critical resource. Supports WS, BP and CR goals[1].

Table 6-1(b): Water Supply MPs Selected for the Region (Continued)		
Action Needed (MP)	**Description/Definition of Action**	**Relationship of Action or Issue to Vision and Goals (Section 1.3)**
WS-6. Expand existing withdrawals from available reservoirs	Negotiate with Georgia Power on potential expansion of existing withdrawals.	**Vision:** Manage water as a critical resource and build trusting partnerships between neighboring regions. Supports WS, RS, and BP goals[1].
WS-7. Encourage water system asset management	Map water system assets. Develop a water system asset management program. Develop targeted asset replacement/rehabilitation program to prevent catastrophic failures. Coordinate asset management and leak detection programs.	**Vision:** Manage water as a critical resource. Supports WS, BP, ES and CR goals[1].
[1]See endnotes of Table 6-1(a) for goal acronyms.		

6.2.3 Wastewater Management Practices

The surface water quality Resource Assessments described in Section 5.3 were performed to measure the assimilative capacity, or the ability of surface waters to absorb pollutants from treated wastewater and stormwater without unacceptable degradation of water quality. The Resource Assessments also highlighted the need for nutrient load reductions to Lakes Oconee and Sinclair to address future water quality issues. Table 5-7 summarizes the results of these Resource Assessments and potential Wastewater infrastructure shortages. Seven of the 13 counties in the Region have wastewater infrastructure shortages that necessitate added emphasis on implementation of the seven Wastewater MPs listed in Table 6-1(c). Table 5-7 also lists the 7 counties (which do not necessarily correspond with the wastewater infrastructure shortage counties) with gaps between wastewater demand and the assimilative capacity of surface waters. These counties need to consider the Wastewater MPs and more rigorous implementation of the Water Quality MPs described in Section 6.2.4 to improve the quality of their surface waters.

Two of the Council's goals specifically address wastewater infrastructure:

Goal # 1: Promote alternatives and technologies that conserve, reuse, return, and recycle water within the Upper Oconee region.

Goal # 6: Recommend innovative strategies (water, sewer, and/or stormwater) that provide sufficient revenues to maintain a high level of service while promoting water conservation and efficiency.

Table 6-1(c): Wastewater MPs Selected for the Region		
Action Needed (MP)	**Description/Definition of Action**	**Relationship of Action or Issue to Vision and Goals (Section 1.3)**
WW-1. Encourage implementation of centralized sewer in developing areas where density warrants	Identify areas that would benefit from being served by a centralized sewer versus septic systems. Work with developers to ensure they understand the program.	**Vision:** Manage water as a critical resource and build trusting partnerships with neighboring regions. Supports WS, RS, WQ and BP goals[1].
WW-2. Encourage development of local wastewater master plans / Evaluate wastewater treatment and disposal options to meet future demands	Evaluate future wastewater capacity needs. Identify and evaluate options to treat and dispose of wastewater, including reuse. Focus on existing public utilities. Update a minimum of every 5 years.	**Vision:** Manage water as a critical resource, build trusting partnerships with neighboring regions, and develop an educated and engaged citizenry that embraces sound water management. Supports WS, RS, WQ, and BP goals[1].
WW-3. Develop recommendations for decentralized sewer systems	Evaluate potential for designing decentralized systems so they can potentially connect to a centralized sewer system in the future when available. Identify implementation issues. Develop design standards for smaller, clustered systems. Implement design standards. Work with developers to ensure they understand the program. Establish policies for future connections to centralized sewer. Coordinate with local governments on the development of private wastewater system ordinance(s).	**Vision:** Manage water as a critical resource. Supports WQ, WS, and BP goals[1].

Table 6-1(c): Wastewater MPs Selected for the Region (Continued)		
Action Needed (MP)	**Description/Definition of Action**	**Relationship of Action or Issue to Vision and Goals (Section 1.3)**
WW-4. Develop septic system planning and management policies and guidance	Determine future septic system areas and local requirements. Develop near- and long-term policies for transitioning unsewered areas to sewered areas where feasible. Identify grant funds or other sources to develop and implement education program. Identify and manage septic systems in environmentally sensitive areas. Implement a septic system homeowner education program.	**Vision:** Manage water as a critical resource, build trusting partnerships with neighboring regions, and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, WS and BP goals[1].
WW-5. Develop and implement sewer system capacity, management, operation, and maintenance (CMOM) program	Create a sewer system map. Implement sewer inspection and maintenance programs. Conduct inspection and maintenance training. Implement sewer system rehabilitation programs. Develop sewer system overflow emergency programs. Develop sewer system asset management programs.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, and BP goals[1].
WW-6. Provide local government with acceptable parameters for septage disposal at facilities	Develop a plan and acceptable parameters for septage disposal. Collect septage manifests and provide to County Boards of Health. Consider septage disposal needs when upgrading or designing new wastewater treatment facilities.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that supports sound water management. Supports WQ, WS and ES goals[1].
WW-7. Implement grease management program	Develop procedures for grease control and enforcement. Implement fats, oils, and grease (FOG) education efforts.	**Vision:** Manage water as a critical resource and develop an engaged citizenry that embraces sound water management. Supports WQ and ES goals[1].

[1] See endnotes of Table 6-1(a) for goal acronyms.

6.2.4 Water Quality Management Practices

Significant progress has been made in Georgia in managing pollution from point sources; however, the State's future growth will continue to bring land cover conversion, more intensive land uses, and increases in the volume of pollutants discharged to waters from both point and non-point sources. Table 5-7 notes the 7 counties with assimilative capacity water quality gaps and illustrates that the entire Region needs to focus on the implementation of Water Quality MPs to address the 303(d) listings of impaired waters in each County and achieve nutrient load reductions in watersheds contributing to Lakes Sinclair and Oconee. Implementation of the 12 Water Quality MPs described in Table 6-1(d) would build on the existing TMDL and stormwater management activities already being performed by the MS4 or NPDES permittees within the Region. Some MPs—such as WQ-12, which calls for monitoring of long-term ambient trends—will facilitate the tracking of long-term point and nonpoint source pollutant loads. This will be useful in addressing water quality issues throughout the Region and will help inform future Regional Water Plan updates.

Two of the Council's goals specifically address water quality:

Goal #3: Educate stakeholders in the region on the importance of water quality and managing water as a resource including practices such as water conservation and increased water efficiency.

Goal #5: Identify programs, projects, and educational messages to reduce non-point source pollution to protect water quality in lakes and streams.

Table 6-1(d): Water Quality MPs Selected for the Region

Action Needed (MP)	Description/Definition of Action	Relationship of Action or Issue to Vision and Goals (Section 1.3)
WQ-1. Encourage comprehensive land use planning	Use land use planning to encourage development in certain areas and discourage development in environmentally sensitive areas. Protect open space along riparian corridors, wetlands, and groundwater recharges areas to help protect water resources. Monitor compliance with Part V (environmental criteria).	**Vision:** Manage water as a critical resource, build trusting partnerships with neighboring regions, and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, BP, and CR goals[1].

Table 6-1(d): Water Quality MPs Selected for the Region (Continued)		
Action Needed (MP)	**Description/Definition of Action**	**Relationship of Action or Issue to Vision and Goals (Section 1.3)**
WQ-2. Encourage local government participation in construction erosion and sediment control	Implement practices to reduce runoff from construction sites when a given threshold of land is disturbed. May need to develop compliance monitoring and enforcement procedures for existing programs in some areas. Develop a training program for contractors who implement erosion and sediment control programs. Consider implementation of the *Better Back Roads Manual* recommendations for dirt road maintenance, drainage improvements, stabilization and erosion control (GA RC&D, 2009).	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, ES, and BP goals[1].
WQ-3. Encourage implementation of agricultural nutrient management programs	Utilize existing standards and practices to develop plans for the application of nutrients (including animal waste), typically row crops and hay, at rates that are used by plants to avoid excessive nutrient runoff.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WQ goal[1].
WQ-4. Encourage forestry management practices	Continue to implement the measures and practices outlined in the Georgia Forestry Commission BMP manual.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, ES, and BP goals[1].
WQ-5. Encourage stream buffer protection	Establish or maintain vegetated (often forested) corridors along streams. Consider stream buffer protection that goes beyond current minimum state standards.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, ES, and BP goals[1].

Table 6-1(d): Water Quality MPs Selected for the Region (Continued)		
Action Needed (MP)	**Description/Definition of Action**	**Relationship of Action or Issue to Vision and Goals (Section 1.3)**
WQ-6. Evaluate water quality credit trading	Conduct a feasibility study to evaluate the application of water quality credit trading in the Region.	**Vision:** Manage water as a critical resource, build trusting partnerships with neighboring regions, and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, BP, DA, and ES goals[1].
WQ-7. Encourage floodplain management / flood damage prevention	Implement site plan review practices to prohibit or minimize development in the floodplain.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, ES, and BP goals[1].
WQ-8. Encourage general stormwater practices	Implement practices such as: • Measures to minimize stormwater runoff through site planning (conservation subdivisions and other practices) and land use planning. • Stormwater system inventory and maintenance. • Preventing pollutants from reaching stormwater systems through good housekeeping or illicit discharge detection programs. • Public education. • Capital programs to develop BMPs, regional ponds, and other watershed practices.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, and ES goals[1].

Table 6-1(d): Water Quality MPs Selected for the Region (Continued)		
Action Needed (MP)	**Description/Definition of Action**	**Relationship of Action or Issue to Vision and Goals (Section 1.3)**
WQ-9. Support total maximum daily load (TMDL) implementation	Evaluate existing impaired waters, investigate potential pollutant sources, and participate in the TMDL development and implementation planning processes. Comply with TMDLs.	**Vision:** Manage water as a critical resource, build trusting partnerships with neighboring regions, and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, and ES goals[1].
WQ-10. Encourage agricultural cropland management practices	Encourage the use of agricultural crop practices such as the following: conservation tillage, cover crops, field buffers, riparian forested buffers, land conversion (crop to forest), and strip cropping.	**Vision:** Manage water as a critical resource, build trusting partnerships with neighboring regions, and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, and BP goals[1].
WQ-11. Promote post-development stormwater management	Implement post-development stormwater controls to decrease runoff velocity and promote infiltration, such as stormwater retention ponds, constructed wetlands, grassed swales, and other low-impact development methods, for new development and redevelopment areas to address hydrology and water quality.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, WQ, and ES goals[1].
WQ-12. Monitor long-term ambient trends	Include long-term water quality, habitat, and biological monitoring. Use long-term monitoring to help stakeholders evaluate the extent which watershed practices are working. Implement consistent, equitable monitoring across the Region.	**Vision:** Manage water as a critical resource and develop an educated and engaged citizenry that embraces sound water management. Supports WS, BP, WQ, DA, and ES goals[1].

[1] See endnotes of Table 6-1(a) for goal acronyms.

Section 7. Implementing Water Management Practices

Section Summary

The Council has developed a roadmap for implementing the Management Practices identified in Section 6. The roadmap specifies the initial (2012), short-term (2013-2016) and long-term (beyond 2017) actions needed to implement the Management Practices for the corresponding responsible parties.

Responsibility for most of the implementation actions falls to local governments and utilities and their respective Regional Commissions; however, extensive support will be needed from various State entities for initial activities, in particular.

This Section presents the Council's roadmap for implementing the water MPs identified in Section 6. As the State Water Plan indicates, this Regional Water Plan will be primarily implemented by the various water users in the Region along with the other responsible parties described below.

Once adopted, this Regional Water Plan will be used to guide permitting decisions by GAEPD and guide the awarding of State grants and loans from the Georgia Environmental Finance Authority (GEFA) for water-related projects. And this plan can help inform and guide other GAEPD programs such as the awarding of Section 319(h) Nonpoint Source Implementation Grant funds.

7.1 Implementation Schedule and Roles of Responsible Parties

Tables 7-1(a) to 7-1(d) identify the initial, short- and long-term actions needed to implement the MPs detailed in Tables 6-1(a) to 6-1(d) and the corresponding responsible parties for each series of actions. Actions for implementation are framed as either initial activities expected to occur in the first year, 2012, or as short- and long-term actions. The Council has defined short-term as occurring between 2013 and 2016 and long-term as the year 2017 and beyond. It is assumed that all long-term activities would occur after the 5-year Regional Water Plan update, allowing for the Council to revisit these actions using an adaptive management approach.

While the bulk of implementation actions noted in Tables 7-1(a) to 7-1(d) fall to local governments and utilities and their respective RCs, extensive support for initial activities, in particular, will be needed from State entities, such as GAEPD, DCA, Georgia Department of Community Health (DCH), Division of Public Health, Environmental Health Section, and GEFA. This Regional Water Plan also assumes continued support from the Council in some capacity beyond its current 3-year appointment. Support from other organizations, such as the Association of County Commissioners of Georgia (ACCG), Georgia Green Industry Association (GGIA), Georgia Municipal Association (GMA), Georgia Rural Water Association (GRWA), and Georgia Association of Water Professionals (GAWP), will also be needed to implement the MPs in an efficient, cost-effective manner.

7.1.1 Implementation of Water Conservation Management Practices

Table 7-1(a) lists implementation details for the 12 Water Conservation MPs selected by the Council and detailed in Table 6-1(a). The list includes a wide variety of practices, such as practices that benefit all communities (e.g., WC-4, Implement education and public awareness program) and practices that may be appropriate for some communities, but not for others (e.g., WC-7, Encourage non-potable reuse). Each community will need to evaluate all the practices to determine which are appropriate for it to implement. Communities with Resource Assessment gaps or infrastructure needs/shortages are strongly encouraged to implement these Water Conservation practices to address these water resource issues. All communities will need to track and report on their implementation activities as described in Section 8 to help monitor progress in meeting the benchmarks.

Table 7-1(a): Water Conservation MP Implementation Schedule

Management Practice	Permittee Category of Responsible Parties[a]	Initial Implementation Actions: Year 1 (2012)	Short-term Actions: Years 2 through 5 (2013 to 2016)	Long-term Actions: Year 6 (2017), i.e. after 5-year Regional Water Plan update.	Responsible Parties[b]
WC-1. Encourage conservation pricing	MU	Review existing rate structure and perform a Rate Study, if needed, to eliminate declining block rate structures.	Implement Conservation Pricing, if needed.	Revise Rate Study and Rates, if needed.	Local governments and utilities.
WC-2. Develop water conservation goals	MU	Identify achievable, measurable goals (and benchmarks) to help local governments evaluate progress and success in reducing water supply gaps through conservation.	Develop ways to track progress in meeting conservation goals and reporting of progress.	• Administer Survey to gauge progress toward meeting water conservation goals during Years 2 through 5. • Revise program during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	GAEPD and Regional Councils working with the RCs noted in Section 2.3 with support from organizations such as the ACCG, GMA, GRWA, and GAWP.

Table 7-1(a): Water Conservation MP Implementation Schedule (Continued)

Management Practice	Permittee Category of Responsible Parties[a]	Initial Implementation Actions: Year 1 (2012)	Short-term Actions: Years 2 through 5 (2013 to 2016)	Long-term Actions: Year 6 (2017), i.e. after 5-year Regional Water Plan update.	Responsible Parties[b]
WC-3. Consistently meter and report agricultural water withdrawals (>100,000 gpd)	AG	Encourage GAEPD to revise its Agriculture Water Permitting program to consistently meter and report agricultural water withdrawals (> 100,000 gpd).	Coordinate with the agricultural community regarding the metering and reporting of their water withdrawals (>100,000 gpd). Compile and track agricultural water withdrawals (>100,000 gpd) via reporting data.	Utilize information for the 5-year Regional Water Plan update.	Initial Implementation: GAEPD Agriculture Water Permitting Unit and Regional Councils working with the GSWCC Agriculture Meter Program. Short-term Actions: Agricultural community, GAEPD and GSWCC Long-term Actions: GAEPD, Regional Councils and GSWCC
WC-4. Implement education and public awareness program	MU and MS4	Review existing education programs and build on readily available examples from within Georgia to develop either a Region-wide public education program or template for local implementation.	Implement the Education and Public Awareness program.	• Administer Survey to gauge effectiveness of program during Years 2 through 5. • Revise Education and Public Awareness program during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	Initial Implementation: GAEPD and Regional Councils working with the RCs noted in Section 2.3 with support from organizations such as ACCG, GMA, GRWA, and GAWP. Short-term Actions: Local governments noted in Section 2.1.1. Long-term Actions: GAEPD and Regional Councils working with the RC.

Table 7-1(a): Water Conservation MP Implementation Schedule (Continued)

Management Practice	Permittee Category of Responsible Parties[a]	Initial Implementation Actions: Year 1 (2012)	Short-term Actions: Years 2 through 5 (2013 to 2016)	Long-term Actions: Year 6 (2017), i.e. after 5-year Regional Water Plan update.	Responsible Parties[b]
WC-5. Implement golf course water management education program	GC	Develop regional guidelines / program materials or templates for golf course water management education program.	• Implement with the support of the Georgia Golf Course Superintendents Association (GGCSA). • Integrate message into the Public Education and Awareness Program (see WC-4)	• Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness. • Identify potential, alternative (non-potable) water sources on or near golf courses, including highly treated wastewater effluent.	Initial Implementation: GAEPD and Regional Councils working with the RCs with support from GGCSA. Short-term Actions: GGCSA, local governments and utilities. Long-term Actions: GAEPD and Regional Councils working with the GGCSA.
WC-6. Encourage variable rate agricultural irrigation systems	AG	Identify incentives to encourage the installation and use of variable rate irrigation systems.	• Implement with the support of the GSWCC. • Integrate message regarding cost-effectiveness of variable rate irrigation into the Public Education and Awareness Program (see WC-4).	• Evaluate requiring variable rate irrigation systems in water-limited areas. • Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	Initial Implementation: GAEPD Agriculture Water Permitting Unit and Regional Councils working with GSWCC. Short-term Actions: GAEPD and GSWCC Long-term Actions: GAEPD, Regional Councils and GSWCC
WC-7. Encourage non-potable reuse	MU and MUWW	Identify areas with potential for reuse application such as golf courses and parks. Identify incentives to encourage non-potable reuse.	Develop implementation costs and assess feasibility of serving non-potable reuse water.	Encourage industries to use reclaimed water for processes, such as cooling, when technically and economically feasible.	GEFA, Industry, local governments, and utilities.

Table 7-1(a): Water Conservation MP Implementation Schedule (Continued)					
Management Practice	**Permittee Category of Responsible Parties[a]**	**Initial Implementation Actions: Year 1 (2012)**	**Short-term Actions: Years 2 through 5 (2013 to 2016)**	**Long-term Actions: Year 6 (2017), i.e. after 5-year Regional Water Plan update.**	**Responsible Parties[b]**
WC-8. Require installation of rain sensor shut-off switches on new irrigation systems	MU	Develop regional guidelines / educational materials for local implementation.	Require installation or retrofitting to utilize irrigation systems that automatically shut off during rain events or moist soil conditions.	• Require switches in water-limited areas and revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness. • Develop maintenance program to ensure long-term effectiveness of sensors.	Initial Implementation: GAEPD and Regional Councils working with the Regional Commissions noted in Section 2.3 with support from organizations such as the ACCG, GMA and GAWP. Short-term Actions: Local governments and utilities. Long-term Actions: GAEPD and Regional Councils working with the RCs.
WC-9. Require new car washes to recycle water	MU and MS4	Develop regional guidelines / program materials or templates requiring all new car wash establishments to recycle wash water. Integrate with GAEPD's existing Carwash BMP program.	• Implement with the support of the local government business licensing process. • Integrate message into the Public Education and Awareness Program (see WC-4).	Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	Initial Implementation: GAEPD and Regional Councils working with the RCs noted in Section 2.3 with support from organizations such as the ACCG, GMA and GAWP. Short-term Actions: Local governments and utilities. Long-term Actions: GAEPD and Regional Councils working with the RCs.

Table 7-1(a): Water Conservation MP Implementation Schedule (Continued)

Management Practice	Permittee Category of Responsible Parties[a]	Initial Implementation Actions: Year 1 (2012)	Short-term Actions: Years 2 through 5 (2013 to 2016)	Long-term Actions: Year 6 (2017), i.e. after 5-year Regional Water Plan update.	Responsible Parties[b]
WC-10. Encourage residential water audits	MU	Develop regional water audit program materials or template for local implementation.	Implement regional program via Public Education and Awareness (see WC-4) to encourage voluntary audits and educate the public about water audit guidelines.	• Administer Survey to gauge progress toward meeting water conservation goals during Years 2 through 5. • Revise program during 5-year Regional Water Plan update, if necessary, to improve effectiveness. • Identify/create incentive program	Initial Implementation: GAEPD and Regional Councils working with the Regional Commissions noted in Section 2.3 with support from organizations such as the ACCG, GMA, GRWA, and GAWP. Short-term Actions: Local governments and utilities. Long-term Actions: GAEPD and Regional Councils working with the RCs.
WC-11. Encourage certification of irrigation specialists	AG and MU	Consider creating a certification requirement and process for irrigation specialists. Develop regional educational materials regarding the value of using a trained, certified residential/commercial irrigation specialist to increase water use efficiency within the agricultural and green industry.	Encourage certification of irrigation specialists via Public Education and Awareness Program (see WC-4).	Evaluate whether requirement for certified irrigation specialists should be considered in plan update.	Initial Implementation: GAEPD Agriculture Water Permitting Unit and Regional Councils working with the GSWCC Agriculture Meter Program, and GGIA. Short-term Actions: GAEPD, GGIA, and GSWCC.

Table 7-1(a): Water Conservation MP Implementation Schedule (Continued)

Management Practice	Permittee Category of Responsible Parties[a]	Initial Implementation Actions: Year 1 (2012)	Short-term Actions: Years 2 through 5 (2013 to 2016)	Long-term Actions: Year 6 (2017), i.e. after 5-year Regional Water Plan update.	Responsible Parties[b]
WC-12. Encourage commercial water audits	MU	Develop regional commercial water audit program materials or template for local implementation.	• Implement regional program via Public Education and Awareness Program (see WC-4). • Advertise and promote the water audit program. • Conduct audits with interested commercial partners.	• Administer Survey to gauge Results during Years 2 through 5. • Report results to commercial partners and revise program during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	Initial Implementation: GAEPD and Regional Councils working with the Regional Commissions noted in Section 2.3 with support from organizations such as the ACCG, GMA and GAWP. GADNR Sustainability Division assisting in the development of the audits. Short-term Actions: Local governments and utilities. Long-term Actions: GAEPD and Regional Councils working with the RCs and GADNR Sustainability Division.

[a] Permittee Categories of Responsible Parties have the following acronyms and refer to the entities who may have permits of various types through GAEPD:
AG: Agricultural Water Withdrawal
CST: Construction Stormwater
GC: Golf Course Water Withdrawal
IND: Industrial Water Withdrawal
INDST: Industrial Stormwater
INDWW: Industrial Wastewater
MU: Municipal Water Withdrawal
MS4: Municipal Stormwater
MUWW: Municipal Wastewater
SD: Safe Dams Program

[b] Assumes continued support from the Council in some capacity beyond their 3-year appointment.

7.1.2 Implementation of Water Supply Management Practices

Table 7-1(b) lists implementation details for the 7 Water Supply MPs selected by the Council and as indicated in Table 6-1(b). The list includes a wide variety of practices, such as practices that benefit all communities (e.g., WS-4, Encourage development of water master plans with periodic updates), and practices that may be appropriate for some communities, but not for others (e.g., WS-2 Construct new water supply reservoirs). Each community will need to evaluate all the practices to determine which are appropriate for it to implement. Communities with Resource Assessment gaps or infrastructure needs/shortages are strongly encouraged to implement these MPs to address their water resource issues. All communities will need to track and report on their implementation activities as described in Section 8 to help monitor progress in meeting the benchmarks.

Table 7-1(b): Water Supply MP Implementation Schedule

Management Practice	Permittee Category of Responsible Parties[a]	Initial Implementation Actions: Year 1 (2012)	Short-term Actions: Years 2 through 5 (2013 to 2016)	Long-term Actions: Year 6 (2017), i.e. after 5-year Regional Water Plan update.	Responsible Parties[b]
WS-1. Expand existing reservoirs	MU and SD	• Evaluate potential expansion of existing reservoirs. • Identify and evaluate potential for retrofitting NRCS impoundments for water supply use.	Begin process of expanding existing reservoirs.	Revise local Water Master Plan based on 5-year Regional Water Plan update, if necessary. Continue to maximize existing reservoir capacities.	Local governments and utilities with support from GAEPD and NRCS.
WS-2. Construct new water supply reservoirs	MU	• Identify site-specific needs for new water supply reservoirs over the next 30 years via the local Water Master Planning Process and Regional Water Plan. • Identify opportunities to create regional reservoirs for cost sharing and efficiency.	Begin permitting process for new water supplies.	• Continue permitting process for new water supplies and construct as needed and as funding allows. • Revise local Water Master Plan based on 5-year Regional Water Plan update, if necessary.	Local governments and utilities with support from GAEPD.

Table 7-1(b): Water Supply MP Implementation Schedule (Continued)

Management Practice	Permittee Category of Responsible Parties[a]	Initial Implementation Actions: Year 1 (2012)	Short-term Actions: Years 2 through 5 (2013 to 2016)	Long-term Actions: Year 6 (2017), i.e. after 5-year Regional Water Plan update.	Responsible Parties[b]
WS-3. Develop new groundwater wells	IND and MU	Identify site-specific needs for new groundwater wells over the next 30 years via the local Water Master Planning Process.	Begin permitting process for new wells and construct as needed and as funding allows.	• Continue permitting process for new wells and construct as needed and as funding allows. • Revise local Water Master Plan based on 5-year Regional Water Plan update, if necessary.	Industry, local governments, and utilities with support from GAEPD.
WS-4. Encourage development of water master plans with periodic updates	MU	Consider developing (or revising) a local Water Master Plan to: • Include a 30-year planning horizon. • Include an emergency water plan. • Reflect implementation of Regional Water Plan water MPs.	Implement local water master plan. (See WW-2)	Revise local Water Master Plan periodically based on 5-year Regional Water Plan update.	Local governments and utilities with support from GAEPD.
WS-5 Encourage indirect potable reuse	MU and MUWW	• Identify opportunities to augment water supplies with highly treated wastewater via the local Water Master Planning Process. • Identify incentives to encourage potable reuse.	Implement via local water master plan. (See WS-4)	Revise local Water Master Plan based on 5-year Regional Water Plan update, if necessary.	Local governments and utilities with support from GAEPD and GEFA.

Table 7-1(b): Water Supply MP Implementation Schedule (Continued)

Management Practice	Permittee Category of Responsible Parties[a]	Initial Implementation Actions: Year 1 (2012)	Short-term Actions: Years 2 through 5 (2013 to 2016)	Long-term Actions: Year 6 (2017), i.e. after 5-year Regional Water Plan update.	Responsible Parties[b]
WS-6. Expand existing withdrawals from available reservoirs	MU	Coordinate with current reservoir owners / operators to establish a clear process for local governments and utilities to follow when future water supply needs arise.	Identify need for expansion of future water withdrawals from existing reservoirs via local Water Master Planning process.	• Revise local Water Master Plan based on 5-year Regional Water Plan update, if necessary, to include this water MP. • Coordinate with current reservoir owners / operators and FERC, as needed, to meet future water supply needs.	Initial Implementation: GAEPD, Regional Councils, local governments and utilities working with Georgia Power and FERC. Short-term Actions: Local governments and utilities. Long-term Actions: Local governments and utilities, GAEPD, and Regional Councils working with Georgia Power and FERC.
WS-7. Encourage water system asset management	MU	• Develop a water system asset management program, if one does not already exist. • Begin mapping of water system assets.	• Develop targeted asset replacement/reha-bilitation program to prevent catastrophic failures. • Continue mapping of water system assets. • Coordinate asset management and leak detection programs.	• Continue asset management and leak detection programs. • Revise program based on 5-year Regional Water Plan update, if necessary.	Local governments and utilities with support from GAEPD.

Table 7-1(b): Water Supply MP Implementation Schedule (Continued)					
Management Practice	**Permittee Category of Responsible Parties[a]**	**Initial Implementation Actions: Year 1 (2012)**	**Short-term Actions: Years 2 through 5 (2013 to 2016)**	**Long-term Actions: Year 6 (2017), i.e. after 5-year Regional Water Plan update.**	**Responsible Parties[b]**

[a] See Table 7-1(a) for acronyms of Permittee Categories of Responsible Parties.

[b] Assumes continued support from the Council in some capacity beyond their 3-year appointment.

7.1.3 Implementation of Wastewater Management Practices

Table 7-1(c) lists implementation details for the 7 Wastewater MPs selected by the Council and as described in Table 6-1(c). The list includes a wide variety of practices, such as practices that benefit all communities (e.g., WW-2, Encourage development of local wastewater master plans/Evaluate wastewater treatment and disposal options to meet future demands) and practices that may be appropriate for some communities, but not for others (e.g., WW-3, Develop recommendations for decentralized sewer systems). Each community will need to evaluate all the practices to determine which are appropriate for it to implement. Communities with Resource Assessment gaps or infrastructure needs/shortages are strongly encouraged to implement these MPs to address their water resource issues. All communities will need to track and report on their implementation activities as described in Section 8 to help monitor progress in meeting the benchmarks.

Table 7-1(c): Wastewater MP Implementation Schedule

Management Practice	Permittee Category of Responsible Parties[a]	Initial Implementation Actions: Year 1 (2012)	Short-term Actions: Years 2 through 5 (2013 to 2016)	Long-term Actions: Year 6 (2017), i.e. after 5-year Regional Water Plan update.	Responsible Parties[b]
WW-1. Encourage Implementation of centralized sewer in developing areas where density warrants	MUWW	As part of local planning: • Identify areas where centralized sewer would benefit water quality (areas around lake; smaller lots that would not support septic systems). • Develop a mechanism within the local government review process that triggers consideration of centralized sewer above certain density thresholds.	Implement local Wastewater Master Plan (See WW-2), working with developers to secure their participation.	Revise local Wastewater Master Plan based on 5-year Regional Water Plan update, if necessary.	Local governments and utilities with support from GAEPD.

Table 7-1(c): Wastewater MP Implementation Schedule (Continued)

Management Practice	Permittee Category of Responsible Parties[a]	Initial Implementation Actions: Year 1 (2012)	Short-term Actions: Years 2 through 5 (2013 to 2016)	Long-term Actions: Year 6 (2017), i.e. after 5-year Regional Water Plan update.	Responsible Parties [b]
WW-2. Encourage development of local wastewater master plans / Evaluate wastewater treatment and disposal options to meet future demands	MUWW	Consider the development of (or revision to) a local Wastewater Master Plan, that: • Integrates the Regional Water Plan MPs. • Evaluates local, future wastewater capacity needs. • Identifies and evaluates options to treat and dispose of wastewater. • Considers opportunities for reuse (indirect potable, non-potable, etc.).	Implement local Wastewater Master Plan.	Revise local Wastewater Master Plan based on 5-year Regional Water Plan update.	Local governments and utilities with support from GAEPD.
WW-3. Develop recommenda-tions for decentralized sewer systems	MUWW	Coordinate with Georgia Division of Public Health to: • Revise Chapter 290-5-26, On-site Sewage Management Systems, if needed, to provide consistent, minimum design standards that anticipate future centralized sewer connections, where appropriate. • Develop example policies for connections to public sewer. • Develop regional recommendations and a model ordinance for decentralized and smaller, clustered sewer systems.	• Local governments to consider adoption of model ordinance for decentralized and clustered sewer systems. • Local Public Health Departments to implement revised minimum design standards.	Revise guidelines during 5-year Regional Water Plan update, if necessary.	Initial Implementation: GAEPD and Regional Councils working with Georgia Division of Public Health and local Public Health Department representatives with support from organizations such as the ACCG, GMA, and GAWP. Short-term Actions: Local governments and local Public Health Departments. Long-term Actions: GAEPD and Regional Councils working with State and local Public Health Department representatives.

Table 7-1(c): Wastewater MP Implementation Schedule (Continued)

Management Practice	Permittee Category of Responsible Parties[a]	Initial Implementation Actions: Year 1 (2012)	Short-term Actions: Years 2 through 5 (2013 to 2016)	Long-term Actions: Year 6 (2017), i.e. after 5-year Regional Water Plan update.	Responsible Parties[b]
WW-4. Develop septic system planning and management policies and guidance	MUWW	As part of local planning efforts: • Develop near- and long-term policies for transitioning to sewer in areas where feasible. • Identify grant funds or other sources to develop and implement Septic System Homeowner Education program. • Develop template materials for Septic System Homeowner Education efforts.	Integrate Septic System Homeowner Education component into the Public Education and Awareness Program (see WC-4).	Track implementation and revise Regional Water Plan, if necessary.	Initial Implementation: GAEPD and Regional Councils working with Georgia DCH, Division of Public Health, Environmental Health Section and local Public Health Department representatives with support from organizations such as the ACCG, GMA, GRWA, and GAWP. Short-term Actions: Local governments and utilities. Long-term Actions: GAEPD and Regional Councils working with State and local Public Health Department representatives
WW-5. Develop and implement sewer system capacity, management, operation, and maintenance (CMOM) program	MUWW	Develop regional CMOM guidelines or templates for local government and utility implementation.	• Implement local CMOM programs. • Integrate CMOM topics into the Public Education and Awareness Program (see WC-4).	Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	Initial Implementation: GAEPD and Regional Councils with support from GAWP. Short-term Actions: Local governments and utilities. Long-term Actions: GAEPD and Regional Councils with support from GAWP.

Table 7-1(c): Wastewater MP Implementation Schedule (Continued)

Management Practice	Permittee Category of Responsible Parties[a]	Initial Implementation Actions: Year 1 (2012)	Short-term Actions: Years 2 through 5 (2013 to 2016)	Long-term Actions: Year 6 (2017), i.e. after 5-year Regional Water Plan update.	Responsible Parties [b]
WW-6. Provide local government with acceptable parameters for septage disposal at facilities	MUWW	Work with Georgia DCH, Division of Public Health, Environmental Health Section, to: • Develop consistent, minimum parameters for local governments in utilize in determining whether septage is acceptable for disposal at their facilities. • Evaluate whether a mechanism for transmitting septage transport manifests between local public health and municipal National Pollutant Discharge Elimination System (NPDES) officials is needed. • Evaluate whether septage disposal needs to be integrated into GAEPD's Waste Load Allocation process.	• Propose legislative changes, if needed, to define allow for consistent, minimum parameters for local governments in utilize in determining whether septage is acceptable for disposal at their facilities. • Local governments and utilities to implement minimum septage disposal standards and regularly convey manifests to local Public Health officials.	Revise guidelines during 5-year Regional Water Plan update, if necessary.	Initial Implementation: GAEPD and Georgia DCH, Division of Public Health, Environmental Health Section. Short-term Actions: Georgia State legislature, local governments and utilities working with local Public Health Department representatives. Long-term Actions: GAEPD and Regional Councils working with Georgia Division of Public Health and local Public Health Department representatives.

Table 7-1(c): Wastewater MP Implementation Schedule (Continued)

Management Practice	Permittee Category of Responsible Parties[a]	Initial Implementation Actions: Year 1 (2012)	Short-term Actions: Years 2 through 5 (2013 to 2016)	Long-term Actions: Year 6 (2017), i.e. after 5-year Regional Water Plan update.	Responsible Parties[b]
WW-7. Implement grease management program	MUWW	Develop regional Grease Management Program guidelines or templates for local government and utility implementation.	• Implement local Grease Management Program. • Integrate FOG reduction message into the Public Education and Awareness Program (see WC-4).	Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	Initial Implementation: GAEPD and Regional Councils working with the RCs. Short-term Actions: Local governments and utilities. Long-term Actions: GAEPD and Regional Councils working with the RCs.

[a] See Table 7-1(a) for acronyms of Permittee Categories of Responsible Parties.
[b] Assumes continued support from the Council in some capacity beyond their 3-year appointment.

7.1.4 Implementation of Water Quality Management Practices

Table 7-1(d) lists implementation details for the 12 Water Quality MPs selected by the Council and as described in Table 6-1(d). The list includes a wide variety of practices, such as practices required by state law (e.g., WQ-2. Encourage local government participation in construction erosion and sediment control), practices that benefit all communities (e.g., WQ-4, Encourage forestry management practices), and practices that may be appropriate for some communities, but not for others (e.g., WQ-6. Evaluate water quality credit trading). Each community will need to evaluate all the practices to determine which are appropriate for it to implement. Communities with Resource Assessment gaps or infrastructure needs/shortages are strongly encouraged to implement these MPs to address their water resource issues. All communities will need to track and report on their implementation activities as described in Section 8 to help monitor progress in meeting the benchmarks.

Table 7-1(d): Water Quality MP Implementation Schedule

Management Practice	Permittee Category of Responsible Parties[a]	Initial Implementation Actions: Year 1 (2012)	Short-term Actions: Years 2 through 5 (2013 to 2016)	Long-term Actions: Year 6 (2017), i.e. after 5-year Regional Water Plan update.	Responsible Parties[b]
WQ-1. Encourage comprehensive land use planning		Implement current Part V Environmental Planning Criteria.	Integrate any needed revisions into local comprehensive plans during the next, regular 10-year update or 5-year updates to the Short-Term Work Program portion of the Community Agenda from the comprehensive plan.	• Implement comprehensive plan. • Coordinate with DCA regarding potential revisions to Chapter 110-12-1, Standards and Procedures for Local Comprehensive Planning, and the Part V Environmental Planning Criteria to facilitate implementation of the State Water Plan water MPs.	Initial Implementation: Local governments and utilities. Short-term Actions: Regional Councils, local governments and utilities. Long-term Actions: GAEPD and Regional Councils working with DCA and the RCs as well as local governments and utilities.

Table 7-1(d): Water Quality MP Implementation Schedule (Continued)

Management Practice	Permittee Category of Responsible Parties[a]	Initial Implementation Actions: Year 1 (2012)	Short-term Actions: Years 2 through 5 (2013 to 2016)	Long-term Actions: Year 6 (2017), i.e. after 5-year Regional Water Plan update.	Responsible Parties[b]
WQ-2. Encourage local government participation in construction erosion and sediment control	CST	• Continue to implement existing Construction NPDES Program. • Consider modifying (limiting) the extent of exemptions found in O.C.G.A. § 12-7-17 regarding the Erosion and Sedimentation Control Act.	Integrate construction erosion and sedimentation component into the Public Education and Awareness Program (see WC-4). Consider implementation of Better Back Roads program.	Revisit Resource Assessment results during the 5-year Regional Water Plan update to evaluate whether recommendations for changes to the existing Construction NPDES Program are needed.	Initial Implementation: GAEPD and local governments. Short-term Actions: Regional Councils, local governments and GSWCC supervisors Long-term Actions: GAEPD and Regional Councils
WQ-3. Encourage Implementation of agricultural nutrient management programs	AG	• Develop regional Nutrient Management guidelines for the major crops grown in the Region. • Identify incentives to encourage local implementation of Nutrient Management guidelines.	• Implement with the support of the GSWCC. • Integrate message into the Public Education and Awareness Program (see WC-4).	Revisit Resource Assessment results during the 5-year Regional Water Plan update to evaluate whether changes to guidelines are needed.	Initial Implementation: GAEPD Agriculture Water Permitting Unit and Regional Councils working with GSWCC, and NRCS Resource Conservation and Development (RC&D) Short-term Actions: Agricultural Water Users, GSWCC, Regional Council, and NRCS. Long-term Actions: GAEPD, Regional Councils, GSWCC, and NRCS.

Table 7-1(d): Water Quality MP Implementation Schedule (Continued)

Management Practice	Permittee Category of Responsible Parties[a]	Initial Implementation Actions: Year 1 (2012)	Short-term Actions: Years 2 through 5 (2013 to 2016)	Long-term Actions: Year 6 (2017), i.e. after 5-year Regional Water Plan update.	Responsible Parties [b]
WQ-4. Encourage forestry management practices		Continue to implement the measures and practices outlined in the Georgia Forestry Commission BMP manual.	Expand education and enforcement of the measures and practices outlined in the Georgia Forestry Commission BMP manual.	Revisit Resource Assessment results during the 5-year Regional Water Plan update to evaluate whether recommendations for changes to the Georgia Forestry Commission BMP manual are needed.	Initial Implementation: Private foresters and the Georgia Forestry Commission Short-term Actions: Private foresters and the Georgia Forestry Commission Long-term Actions: the Georgia Forestry Commission
WQ-5. Encourage stream buffer protection		• Develop regional recommendations and a model stream buffer protection ordinance that goes beyond current minimum State standards. • Develop educational materials emphasizing the importance of stream buffer protection. • Identify incentives and potential funding sources to encourage local implementation.	• Consider adoption of model stream buffer protection ordinance. • Revise development review process, if needed. • Integrate message into the Public Education and Awareness Program (see WC-4).	Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	Initial Implementation: GAEPD and Regional Councils working with the Regional Commissions with support from organizations such as the ACCG, GMA and GAWP. Short-term Actions: Regional Councils, local governments and utilities. Long-term Actions: GAEPD and Regional Councils working with the Regional Commissions.

Table 7-1(d): Water Quality MP Implementation Schedule (Continued)					
Management Practice	**Permittee Category of Responsible Parties[a]**	**Initial Implementation Actions: Year 1 (2012)**	**Short-term Actions: Years 2 through 5 (2013 to 2016)**	**Long-term Actions: Year 6 (2017), i.e. after 5-year Regional Water Plan update.**	**Responsible Parties[b]**
WQ-6. Evaluate water quality credit trading	MUWW, INDWW, MS4, and INDST	• Perform feasibility study to assess the development of a regulatory framework, including the need for legislation, and guidelines for water quality credit trading in Georgia. • Propose legislative changes to allow for water quality credit trading, if needed.	• Consider implementation framework and initiate pilot study. • Utilize results of pilot study to implement broader water quality trading program state-wide.	• Pending the results of the feasibility and pilot studies, Implement water quality credit trading program state-wide. • Track progress via WQ-12, long-term ambient trend monitoring.	Initial Implementation: State legislature, GAEPD, industry, local governments and utilities. Short-term Actions: GAEPD, industry, local governments and utilities. Long-term Actions: GAEPD

Table 7-1(d): Water Quality MP Implementation Schedule (Continued)					
Management Practice	**Permittee Category of Responsible Parties[a]**	**Initial Implementation Actions: Year 1 (2012)**	**Short-term Actions: Years 2 through 5 (2013 to 2016)**	**Long-term Actions: Year 6 (2017), i.e. after 5-year Regional Water Plan update.**	**Responsible Parties[b]**
WQ-7. Encourage floodplain management/ flood damage prevention		Coordinate with Georgia Emergency Management Agency (GEMA) on development of a model flood damage prevention ordinance.	• Develop regional recommendations and a model flood damage prevention ordinance. • Develop educational materials emphasizing the importance of preventing flood damage. • Identify incentives and potential funding sources to encourage local implementation.	• Integrate message into the Public Education and Awareness Program (see WC-4). • Consider adoption of flood damage prevention ordinance. • Revise development review process, if needed. • Begin mapping location of future floodplains. • Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	Initial Implementation: GAEPD and GEMA. Short-term Actions: Regional Councils, GAEPD and GEMA. Long-term Actions: GAEPD and Regional Councils working with local governments and utilities.

Table 7-1(d): Water Quality MP Implementation Schedule (Continued)

Management Practice	Permittee Category of Responsible Parties[a]	Initial Implementation Actions: Year 1 (2012)	Short-term Actions: Years 2 through 5 (2013 to 2016)	Long-term Actions: Year 6 (2017), i.e. after 5-year Regional Water Plan update.	Responsible Parties[b]
WQ-8. Encourage general stormwater practices	MS4	• Develop regional, minimum guidelines for general stormwater management for those local governments not operating under an MS4 NPDES permit. • Develop educational materials and a training program for local government staff. • Identify incentives and potential funding sources to encourage local implementation.	• Consider implementation of regional guidelines for general stormwater management in non-MS4 communities. • Implement regional guidelines for general stormwater management in MS4 communities. • Integrate general stormwater management message into the Public Education and Awareness Program (see WC-4).	Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	Initial Implementation: GAEPD and Regional Councils working with the RCs and current MS4 permittees, or those likely to become permittees after the 2010 census results become available, with support from organizations such as the ACCG, GMA and GAWP. Short-term Actions: Regional Councils, MS4 and Non-MS4 local governments and utilities. Long-term Actions: GAEPD and Regional Councils working with the RCs.
WQ-9. Support total maximum daily load (TMDL) implementation	MUWW and MUST	Continue to follow TMDL implementation plans and to participate in GAEPD updates.	Continue to follow TMDL implementation plans and to participate in GAEPD updates.	Update TMDL implementation plans, as needed, based on water quality and biological monitoring data as well as Resource Assessment results.	Initial Implementation: GAEPD, industry, local governments and utilities. Short-term Actions: GAEPD, industry, local governments and utilities. Long-term Actions: GAEPD and Regional Councils working with the RCs.

Table 7-1(d): Water Quality MP Implementation Schedule (Continued)					
Management Practice	**Permittee Category of Responsible Parties[a]**	**Initial Implementation Actions: Year 1 (2012)**	**Short-term Actions: Years 2 through 5 (2013 to 2016)**	**Long-term Actions: Year 6 (2017), i.e. after 5-year Regional Water Plan update.**	**Responsible Parties[b]**
WQ-10. Encourage agricultural cropland management practices	AG	• Develop regional cropland management practices for the major crops grown in the Region. • Identify incentives to encourage local implementation of cropland management practices.	• Implement with the support of the GSWCC. • Integrate message into the Public Education and Awareness Program (see WC-4).	Revisit Resource Assessment results during the 5-year Regional Water Plan update to evaluate whether changes to guidelines are needed.	Initial Implementation: GAEPD Agriculture Water Permitting Unit and Regional Councils working with GSWCC, and NRCS RC&D. Short-term Actions: Agricultural Water Users, GSWCC, Regional Councils, and NRCS. Long-term Actions: GAEPD, Regional Councils, GSWCC, and NRCS

Table 7-1(d): Water Quality MP Implementation Schedule (Continued)

Management Practice	Permittee Category of Responsible Parties[a]	Initial Implementation Actions: Year 1 (2012)	Short-term Actions: Years 2 through 5 (2013 to 2016)	Long-term Actions: Year 6 (2017), i.e. after 5-year Regional Water Plan update.	Responsible Parties[b]
WQ-11. Promote post-development stormwater management	MS4	• Develop regional guidelines and model ordinances to assist local governments with the implementation of post-development stormwater controls for new development and redevelopment. • Develop educational materials and a training program for local government staff to assist with the post-development stormwater control review process.	• Consider adopting model ordinance and establish development review process. • If adopted, implement educational materials and a training program for local developers. • Integrate message into the Public Education and Awareness Program (see WC-4).	Revise guidelines during 5-year Regional Water Plan update, if necessary, to improve effectiveness.	Initial Implementation: GAEPD and Regional Councils working with the RCs noted in Section 2.3 with support from organizations such as the ACCG, GMA, and GAWP. Existing MS4 stormwater permittees have primary responsibility. Short-term Actions: Regional Councils, local governments with MS4 stormwater permits. Long-term Actions: GAEPD and future MS4 permittees working with the RCs.

Table 7-1(d): Water Quality MP Implementation Schedule (Continued)

Management Practice	Permittee Category of Responsible Parties[a]	Initial Implementation Actions: Year 1 (2012)	Short-term Actions: Years 2 through 5 (2013 to 2016)	Long-term Actions: Year 6 (2017), i.e. after 5-year Regional Water Plan update.	Responsible Parties [b]
WQ-12. Monitor long-term ambient trends	MUWW, INDWW, MS4, and INDST	• Build on existing GAEPD monitoring program to develop a regional long-term ambient trend monitoring network for the Region. • Identify potential funding sources or cost share opportunities for any locally sponsored network locations.	• Implement regional long-term ambient trend monitoring network for the Region. • Utilize GAEPD's online data management system to maximize use of and access to these data.	Utilize results of regional long-term ambient trend monitoring network to help guide the 5-year Regional Water Plan update and revise monitoring program, if needed.	Initial Implementation: GAEPD, industry, agriculture, local governments and utilities. Short-term Actions: GAEPD with support from industry, local governments and utilities. Long-term Actions: GAEPD

[a] See Table 7-1(a) for acronyms of Permittee Categories of Responsible Parties.
[b] Assumes continued support from the Council in some capacity beyond their 3-year appointment.

7.2 Fiscal Implications of Selected Water Management Practices

This Section outlines the general planning level costs for implementation of the MPs selected by the Council and potential funding sources and options. Estimated unit costs are provided in Table 7-2.

Table 7-2: Cost Estimates for the Implementation Responsibilities

Management Practice	Capital/ Programmatic Cost	Funding Sources and Options	Notes and Sources for Costs[7]
WC-1. Encourage conservation pricing	$0-500 /MG	Utilities	GAEPD Cost Guidance WD-5
WC-2. Develop water conservation goals	$0-0.50 /capita	State, Local, Utilities	GAEPD Cost Guidance – various Ordinance and Policy MPs
WC-3. Consistently meter and report agricultural water withdrawals (> 100,000 gpd)	$600-2,500 /well	State	GAEPD Cost Guidance
WC-4. Implement education and public awareness program	$0.10-2.25 /capita	State, Local, Utilities	GAEPD Cost Guidance E-2
WC-5. Implement golf course water management education program	$0.10-2.25 /capita	State, Local, Utilities	GAEPD Cost Guidance E-2
WC-6. Encourage variable rate agricultural irrigation systems	$2,000-4,000 /MG	State	GAEPD Cost Guidance WD-3
WC-7. Encourage non-potable reuse	$0-0.50 /capita	State, Local, Utilities	GAEPD Cost Guidance OP-9
WC-8. Require installation of rain sensor shut-off switches on new irrigation systems	$25-1000 /MG	Local, Utilities	GAEPD Cost Guidance WD-6
WC-9. Require new car washes to recycle water	$0-0.50 /capita	State, Local	GAEPD Cost Guidance – various Ordinance and Policy MPs
WC-10. Encourage residential water audits	$0.10-2.25 /capita	State, Local, Utilities	GAEPD Cost Guidance E-2

[7] GAEPD Cost Guidance, http//www.georgiawaterplanning.org/

Table 7-2: Cost Estimates for the Implementation Responsibilities (Continued)

Management Practice	Capital/ Programmatic Cost	Funding Sources and Options	Notes and Sources for Costs[7]
WC-11. Encourage certification of irrigation specialists	$0-0.50 /capita	State	GAEPD Cost Guidance – various Ordinance and Policy MPs
WC-12. Encourage commercial water audits	$25-1,000 /MG	State, Local, Utilities	GAEPD Cost Guidance WD-2
WS-1. Expand existing reservoirs	$10,000-150,000 /MG	State, Local, Utilities	GAEPD Cost Guidance WS-2
WS-2. Construct new water supply reservoirs	$10,000-350,000 /MG	State, Local, Utilities	GAEPD Cost Guidance WS-1
WS-3. Develop new groundwater wells	$1,000-100,000 /MG	State, Local, Utilities	GAEPD Cost Guidance WS-3
WS-4. Encourage development of water master plans with periodic update	$1,000-2,000 /MG	Utilities	GAEPD Cost Guidance – various Ordinance and Policy MPs
WS-5. Encourage indirect potable reuse	$0-0.50 /capita	State, Local, Utilities	GAEPD Cost Guidance OP-9
WS-6. Expand existing withdrawals from available reservoirs	$1.5-4 million/MGD	Utilities	GAEPD Cost Guidance WT-2 – assume would need to expand intake and add treatment capacity; used low end
WS-7. Encourage water system asset management	$1,000-3,000 /MG	Utilities	GAEPD Cost Guidance WD-4
WW-1. Encourage implementation of centralized sewer in developing areas where density warrants	$0-$1 million /MGD	State, Local, Utilities	GAEPD Cost Guidance WW-8
WW-2. Encourage development of local wastewater master plans / Evaluate wastewater treatment and disposal options to meet future demands	$1,000-2,000 /MG	Utilities	GAEPD Cost Guidance – various Ordinance and Policy MPs
WW-3. Develop recommendations for decentralized sewer systems	$0-0.50 /capita	Local, Utilities	GAEPD Cost Guidance OP-9

Table 7-2: Cost Estimates for the Implementation Responsibilities (Continued)

Management Practice	Capital/ Programmatic Cost	Funding Sources and Options	Notes and Sources for Costs[7]
WW-4. Develop septic system planning and management policies and guidance	$0-0.50 /capita	State, Local, Utilities	GAEPD Cost Guidance OP-9
WW-5. Develop and implement sewer system capacity, management, operation and maintenance (CMOM) program	$0-$1 million /MGD	State, Local, Utilities	GAEPD Cost Guidance WW-6
WW-6. Provide local government with acceptable parameters for septage disposal at facilities	$0-0.50 /capita	State, Local, Utilities	GAEPD Cost Guidance OP-9
WW-7. Implement grease management program	$0.10 - 2.25 /capita	State, Local, Utilities	GAEPD Cost Guidance E-2
WQ-1. Encourage comprehensive land use planning	$0-0.50 /capita	State, Local	GAEPD Cost Guidance OP-7 and OP-9
WQ-2. Encourage local government participation in construction erosion and sediment control	$1-3 /capita	State, Local	GAEPD Cost Guidance E-1
WQ-3. Encourage implementation of agricultural nutrient management programs	$5,000-7,000 /Farm	State	RCS, 2003
WQ-4. Encourage forestry best management practices	$5-100 /acre	State	Cubbage, F, J. Scott, T. Pressley, and S. Moore. Undated. *Costs of Forestry Best Management Practices in the South: A Review*. North Carolina State University. Department of Forestry. Costs vary by region, slope and practice.
WQ-5. Encourage effective stream buffer protection	$0-0.50 /capita	Local	GAEPD Cost Guidance OP-7

Table 7-2: Cost Estimates for the Implementation Responsibilities (Continued)			
Management Practice	**Capital/ Programmatic Cost**	**Funding Sources and Options**	**Notes and Sources for Costs[7]**
WQ-6. Evaluate water quality credit trading	$0.0-0.50 /capita	Federal, State	GAEPD Cost Guidance for Ordinance and Policy; includes only feasibility and not actual trading program
WQ-7. Encourage floodplain management / flood damage prevention	$0-0.50 /capita	Local	GAEPD Cost Guidance OP-7
WQ-8. Encourage general stormwater practices	$0-0.50 /capita	State, Local	GAEPD Cost Guidance OP-1
WQ-9. Support TMDL implementation	$0-2 /capita	Federal, State, Local, Utilities	GAEPD Cost Guidance for Education; assume would be similar level of effort and would vary depending on the complexity and cost of TMDL implementation
WQ-10. Encourage agricultural cropland management practices	$15-$300 /acre	State	CH2M HILL, 2008 – "Jordan lake Watershed Trading Project – BMP Cost Estimates and Cost-Effectiveness". Land conversion at high end; cover crops at low end. Operation and maintenance (O&M) costs not included
WQ-11. Promote post-development stormwater management	$0-0.50 /capita	State, Local	GAEPD Cost Guidance OP-1; cost to develop ordinance which would probably be similar to developing educational materials; costs do not include staff to review stormwater plans or any increased development costs
WQ-12. Monitor long-term ambient trends	$4,000-8,000 /site	State, Local	GAEPD Cost Guidance; assumes no metals monitoring; grab sample techniques

7.3 Alignment with Other Plans

As discussed in Section 6, a review of regional and local plans served as the basis for the development of the Region's selected MPs; a summary of the local and regional plans reviewed is provided in the supplemental document titled *Review and Summary of Existing Plans*, which is available on the Council website[8]. As a result, this Regional Water Plan is generally aligned and consistent with these efforts; however, the following sections describe ongoing efforts and/or differences that are worth noting and revisiting during future Regional Water Plan updates.

7.3.1 Metro Water District Plans

The Metro Water District was created by the Georgia General Assembly in 2001 to establish policy, create plans, and promote intergovernmental coordination within the 15-county metro Atlanta region, which includes more than 90 cities. The Metro Water District is therefore governed by a separate authorizing legislation than the Region, though the two are similar in some respects. For example, the Metro Water District is funded by State appropriations and per capita local government dues; it is governed by an elected/appointed Governing Board, which sets policy and direction. Metro Water District staffing is provided by the Atlanta Regional Commission Environmental Planning Division, while plans and policies are guided by the Board Executive and Finance Committees, the Technical Coordinating Committee, and the Basin Advisory Councils (Metro Water District, 2011).

Local governments and utilities are responsible for implementing the Regional Water Plans at the local level, and compliance with the plans is directly enforced through the GAEPD's permitting process. However, while this Regional Water Plan will guide GAEPD's future permitting decisions, local governments must be in compliance with the Metro Water District's plans to obtain a permit for an increased water withdrawal or a new or increased discharge, or to obtain an MS4 permit. GAEPD is responsible for auditing local governments to determine compliance with the plans, including audit checklists and site visits.

In May 2009, the Metro Water District adopted comprehensive updates to the plans the District first adopted in 2003; these long-term water management plans address water supply and water conservation, wastewater management, and watershed management. The Metro Water District plans were referenced extensively during development of the Upper Oconee Council's MPs; however, substantial differences remain between the District plans and this Regional Water Plan due to data availability and resolution, resources, and legislative mandate.

[8] http://www.upperoconee.org/pages/our_plan/index.php

7.4 Recommendations to the State

This subsection describes the Council's recommendations to the State of Georgia for actions that will support the implementation of this Regional Water Plan. Table 7-3 summarizes these recommendations by type and reflects the role the Council envisions the State taking in support of the activities described in Section 7.1.

Table 7-3: Recommendations to the State

	Recommendation
Funding	Identify long-term funding mechanism, beyond grants, to assist responsible parties with implementation.
	Work with existing organizations such as the GSWCC to identify incentives to encourage the installation and use of variable rate irrigation systems by a certified irrigation professional.
Coordination	Coordinate with DCA and the RCs to serve as the clearing house and coordinator for ongoing Regional Water Plan planning activities.
	To provide continuity between Regional Water Plan updates, a minimum of six to nine members of the original Council should be re-appointed.
	The Council should meet bi-annually to track implementation and address potential issues or questions regarding implementation or plan amendments.
	Work with existing organizations, such as ACCG, GMA and GAWP to develop templates and materials that each Regional Council, with the assistance of DCA or the RCs noted in Section 2.3, can adapt for regional / local implementation. Topic areas from Table 7-1 could include: public education program, water conservation goals regional residential and commercial water audit program materials, golf course water management, grease management, CMOM, general stormwater management and stream buffer protection.
	Work with existing organizations such as the GSWCC and the State's University System to develop regional watering, nutrient management, cropland management guidelines for the major crops grown in the Region.
	Coordinate with State and local Public Health Departments to: • Develop consistent, minimum design standards that anticipate future centralized sewer connections where appropriate. • Develop example policies for connections to public sewer. • Develop regional recommendations and a model ordinance for decentralized sewer systems.
	Coordinate with GEMA on development of a model flood damage prevention ordinance.

Table 7-3: Recommendations to the State (Continued)	
	Recommendation
Policy / Programmatic	Develop and implement a consistent program to meter and report agricultural water withdrawals greater than 100,000 gallons per day.
	Consider modifying (limiting) the extent of exemptions found in O.C.G.A. § 12-7-17 regarding the Erosion and Sedimentation Control Act.
	Revisit DO criteria for South Georgia, and the Region in particular, to consider naturally low background levels found in the Region.
	Develop regulatory framework and guidelines for water quality credit trading in Georgia.
	Build on existing GAEPD monitoring program to develop a regional long-term ambient trend monitoring network for the Region.
Next 5-Year Update	Refine Resource Assessment models to allow presentation of results at a finer resolution.
	Conduct further study on the Cretaceous aquifer in Washington, Wilkinson, and Laurens Counties to clarify sustainable yields.
	Collect and monitor withdrawal and discharge data from the kaolin industry to refine the water balance and wastewater return ratio assumptions.
	Support the evaluation of the current in-stream flow policy to determine whether revisions are needed to protect aquatic resources.

Section 8. Monitoring and Reporting Progress

Section Summary

Monitoring of the progress toward implementation of the recommendations will be based on key benchmarks for water conservation, water supply, wastewater, and water quality Management Practices.

Progress will be evaluated annually, biennially, or at each of the 5-year plan updates, depending on the Management Practice.

The selected MPs identified in Section 6 will be primarily implemented (as described in Section 7) by the various water users in the Region, including local governments and others with the capacity to develop water infrastructure and apply for the required permits, grants and loans.

The benchmarks prepared by the Council and listed in Table 8-1 will be used to assess the effectiveness of implementation and to identify changes that need to be addressed during the 5-year Regional Water Plan update anticipated to occur by 2017. As detailed below, the Council selected both qualitative and quantitative benchmarks that will be used to assess the extent to which the MPs are closing gaps and shortages over time and allowing the Region to meet its vision and goals.

8.1 Benchmarks

The State Water Plan guided the Council's selection of benchmarks that are specific, measurable, achievable, realistic, and time-phased. Table 8-1 outlines the benchmarks for implementing this Regional Water Plan; the initial and short-term actions outlined in Table 7-1 will serve as overall benchmarks to be measured via an annual survey. While details on administration of the annual survey are pending Regional Water Plan adoption, it is assumed that GAEPD and DCA will coordinate this online measurement tool with the support of the RCs. GAEPD and DCA will track the results of these surveys for needed adaptation and Regional Water Plan adjustments during the 5-year update.

Table 8-1 also provides resource-specific benchmarks that allow a mechanism for tracking realistic and measureable progress in the long-term in addressing the water resource gaps, or issues, described in Section 5. For example, due to the time it takes to develop or expand water and wastewater infrastructure, it is appropriate to measure overall progress during the 5-year Regional Water Plan update cycle by revisiting the infrastructure shortages by County summarized in the tables in Section 5. The resource benchmarks also build on existing measurement tools, such as the biennial update of the Clean Water Act 305(b)/303(d) list of waters not meeting their designated uses.

Table 8-1: Benchmarks for Water Management Plans

Category of Benchmark	Benchmark	Measurement Tools	Time Period
All Practices	Implementation of initial and short term actions	Annual Survey	Annual
Water Conservation (WC)			
	Maintenance or reduction of residential per capita water use	Update of Regional Water Plan per capita Water Use Estimates	Every 5 years
	Implementation of recommended Water Conservation MPs	Survey via Annual Water Conservation Plan Progress Report	Annual
Water Supply Practices (WS)			
	Improvement in water supply gap and maintenance of flow regime.	Resource Assessments	Every 5 years
	Reduction in future facility / infrastructure shortages between existing permitted water withdrawals (surface and groundwater) and future demands.	Update of Regional Water Plan Forecasts	Every 5 years
Wastewater Practices (WW)			
	Availability of permitted assimilative capacity in the major tributaries of the Region.	Resource Assessments	Every 5 years
	Reduction of the future wastewater facility shortages via expansions or development of new facilities to meet projected future wastewater demands.	Update of Regional Water Plan Forecasts	Every 5 years
Water Quality Practices (WQ)			
	Support of designated use	305(b)/303(d) List of Waters	Biennial
	Reduction in pollutant loads observed in the watershed modeling.	Resource Assessments	Every 5 years
	Observed improvements in water quality monitoring results.	GAEPD Online Water Quality Database[9]	Annual

[9] http://www.gaepd.org/Documents/EPDOnlineWaterQualityData.html

8.2 Plan Updates

Meeting current and future water needs will require periodic review and revision of Regional Water Plans. The State Water Plan and associated rules provide that each Regional Water Plan will be subject to review by the appropriate Regional Water Planning Council every 5 years and in accordance with guidance provided by the Director, unless otherwise required by the Director for earlier review. These reviews and updates will allow an opportunity for the Regional Water Plan to be adapted based on changed circumstances and new information that becomes available in the 5 years after GAEPD's adoption of these plans. These benchmarks will guide GAEPD during Regional Water Plan review.

8.3 Plan Amendments

This Regional Water Plan will be amended on a 5-year basis, as required, unless additional changes (triggering events) are identified in the interim period. Triggering events may include major droughts or significant water quality problems. Council members may request a full meeting of the Council to address potential Regional Water Plan amendments in the interim period between Regional Water Plan updates by contacting the acting Council chairperson.

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