Satilla River Basin Management Plan 2002

Georgia Department of Natural Resources
Environmental Protection Division

Georgia River Basin Management Planning Vision, Mission, and Goals

What is the VISION for the Georgia RBMP Approach?

Clean water to drink, clean water for aquatic life, and clean water for recreation, in adequate amounts to support all these uses in all river basins in the state of Georgia.

What is the RBMP MISSION?

To develop and implement a river basin planning program to protect, enhance, and restore the waters of the State of Georgia, that will provide for effective monitoring, allocation, use, regulation, and management of water resources.

[Established January 1994 by a joint basin advisory committee workgroup.]

What are the GOALS to Guide RBMP?

1) To meet or exceed local, state, and federal laws, rules, and regulations. And be consistent with other applicable plans.
2) To identify existing and future water quality issues, emphasizing nonpoint sources of pollution.
3) To propose water quality improvement practices encouraging local involvement to reduce pollution, and monitor and protect water quality.
4) To involve all interested citizens and appropriate organizations in plan development and implementation.
5) To coordinate with other river plans and regional planning.
6) To facilitate local, state, and federal activities to monitor and protect water quality.
7) To identify existing and potential water availability problems and to coordinate development of alternatives.
8) To provide for education of the general public on matters involving the environment and ecological concerns specific to each river basin.
9) To provide for improving aquatic habitat and exploring the feasibility of re-establishing native species of fish.
10) To provide for restoring and protecting wildlife habitat.
11) To provide for recreational benefits.
12) To identify and protect flood prone areas within each river basin, and encourage local and state compliance with federal flood plain management guidelines.

[Established January 1994 by a joint basin advisory committee workgroup.]

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Preface

This report was prepared by the Environmental Protection Division (EPD), Georgia Department Natural Resources (EPD), as required by O.C.G.A. 12-5-520 and as a public information document. It represents a synoptic extraction of the EPD files and, in certain cases, information has been presented in summary form from those files. The reader is therefore advised to use this condensed information with the knowledge that it is a summary document and more detailed information is available in the EPD files.

Comments or questions related to the content of this report are invited and should be addressed to:

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Contents

List of Figures

List of Tables

List of Acronyms and Abbreviations

Ac	acre
Ac-ft	acre-feet
ACCG	Association of County Commissioners of Georgia
ACF	Apalachicola-Chattahoochee-Flint Basin
ACT/ACF	Alabama-Coosa-Tallapoosa/Apalachicola-Chattahoochee Flint Basin
ADEM	Alabama Department of Environmental Management
ARC	Atlanta Regional Commission
ARS	USDA Agricultural Research Service
ASR	aquifer storage and recovery
BMPs	best management practices
BOD	biochemical oxygen demand
CAES	University of Georgia College of Agricultural and Environmental Sciences
Cd	cadmium
CFR	Code of Federal Regulations
COE	U.S. Army Corps of Engineers
CPUE	catch per unit effort (fishing)
CRMP	Chattahoochee River Modeling Project
CRP	Conservation Reserve Program
CSGWPP	Comprehensive State Ground Water Protection Plan
CSMTF	Community Stream Management Task Force
CSO	Combined Sewer Overflow
Cu	copper
CWA	U.S. Clean Water Act
DCA	Georgia Department of Community Affairs
DNR	Georgia Department of Natural Resources
DO	dissolved oxygen
EPA	U.S. Environmental Protection Agency
EPD	Georgia Environmental Protection Division
EQIP	Environmental Quality Incentives Program
E&SC	Erosion and Sedimentation Control Act
FEMA	Federal Emergency Management Agency
FFY	Federal fiscal year
FIP	Forestry Incentives Program
FSA	Farm Service Agency
ft	feet
ft^2/d	square feet per day
ft^3/s	cubic feet per second
gal/m	gallons per minute
GDA	Georgia Department of Agriculture
GEMA	Georgia Emergency Management Agency
GFA	Georgia Forestry Association
GFC	Georgia Forestry Commission
GMA	Georgia Municipal Association
GPC	Georgia Power Company
GPD	gallons per day
GPM	gallons per minute
GSWCC	Georgia Soil and Water Conservation Commission
Hg	mercury
HUC	Hydrologic unit code (USGS)
IBI	Index of Biotic Integrity
kg	kilogram

km^2	square kilometer
kW	kilowatt
LAS	land application system for wastewater
LUST	leaking undeground storage tank
MCL	Maximum Contaminant Level for drinking water
meq/l	milliequivalent
mg/l	milligrams per liter
MG	million gallons
MGD	million gallons per day
mi^2	square miles
ml	milliliter
MLMP	Major Lakes Monitoring Project
MLRA	major land resource area
MOU	memorandum of understanding
MPN	most probable number (for quantification of fecal coliform bacteria)
MSA	Atlanta Metropolitan Statistic Area
MS4	municipal separate stormwater system
M&I	municipal and industrial
NFIP	National Flood Insurance Program
NOI	notice of intent
NPDES	National Pollution Discharge Elimination System
NPS	nonpoint source
NRCS	Natural Resources Conservation Service of USDA
NSSP	National Shellfish Sanitation Program
NURE	National Uranium Resource Evaluation
NWI	National Wetlands Inventory (USF&WS)
Pb	lead
PCB	polychlorinated biphenyl
PFA	public fishing area
ppm	parts per million; equivalent to mg/l
RBMP	River Basin Management Planning
RBP	Rapid Bioassessment Protocol
RC&D	Resource Conservation and Development Council
RDC	Regional Development Center
RM	river mile
SCS	Soil Conservation Service (now NRCS)
SMZs	Streamside Management Zones
SOCs	Synthetic Organic Chemicals
STATSGO	State Soil Geographic Database (USDA)
SWCD	Soil and Water Conservation District
TMDL	Total Maximum Daily Load, as specified in the CWA
TTSI	Georgia combined lake trophic state index
UGA	University of Georgia
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USF&WS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WET	whole effluent toxicity
WHIP	Wildlife Habitat Incentives Program
WPCP	water pollution control plant
WRD	Georgia Wildlife Resources Division
WRP	Wetland Reserve Program
WWTP	wastewater treatment plant
Zn	zinc
µg/l	micrograms per liter
7Q10	7-day average low flow with a once-in-ten-year recurrence interval

Executive Summary

This document presents Georgia's management plan for the Satilla River basin, which is being produced as a part of Georgia's River Basin Management Planning (RBMP) approach. The Georgia Environmental Protection Division (EPD) has developed this plan in cooperation with several other agency partners including the USDA Natural Resources Conservation Commission, Georgia Soil and Water Conservation Commission, Georgia Forestry Commission, U.S. Geological Survey, Georgia Geological Survey, and Georgia Wildlife Resources Division. The RBMP approach provides the framework for identifying, assessing, and prioritizing water resources issues, developing management strategies, and providing opportunities for targeted, cooperative actions to reduce pollution, enhance aquatic habitat, and provide a dependable water supply.

Purpose of the Basin Plan

The purpose of this plan is to provide relevant information on the characteristics of the Satilla River basin, describe the status of water quality and quantity in the Satilla River basin, identify present and future water resource demands, present and facilitate the implementation of water quality protection efforts, and enhance stakeholder understanding and involvement in basin planning.

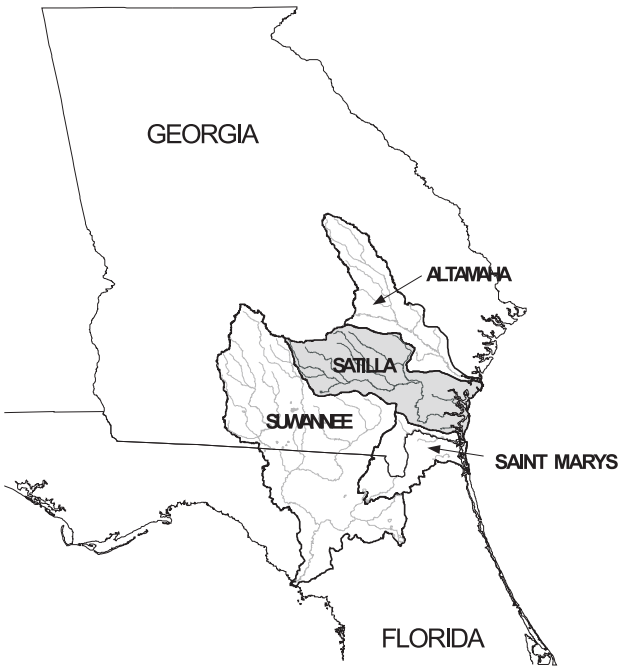
This Satilla River Basin Management Plan includes strategies to address a number of different basinwide objectives. These include:

- Protecting water quality in lakes, rivers, streams, estuaries, and coastal waters through attainment of water quality standards and support for designated uses;
- Providing adequate, high quality water supply for municipal, agricultural, industrial, environmental, and other human activities;
- Preserving habitat suitable for the support of healthy aquatic and riparian ecosystems;
- Protecting human health and welfare through prevention of water-borne disease; minimization of risk from contaminated fish tissue, and reduction of risks from flooding; and
- Ensuring opportunities for economic growth, development, and recreation in the region.

Achieving these objectives is the responsibility of a variety of state and federal agencies, local governments, business, industry, and individual citizens. Coordination among these many partners can be challenging, and impacts of actions in one locale by one partner on conditions elsewhere in the basin are not always understood or considered. River Basin Management Planning is an attempt to bring together stakeholders in the basin to increase coordination and to provide a mechanism for communication and

consideration of actions on a broad scale to support water resource objectives for the entire basin. RBMP provides the framework to begin to understand the consequences of local decisions on basinwide water resources.

This river basin plan will serve as the road map for managing the water resources in the Satilla River basin over the next five years. It contains useful information on the health of the Satilla River basin and recommended strategies to protect the basin now and into the future.



Satilla River Basin Characteristics

The Satilla River basin is located in the southeastrn part of Georgia, occupying an area of 3,940 square miles. The basin lies within the Coastal Plain physiographic province, which extends throughout the southeastern United States. The Satilla River drains into the Atlantic Ocean.

Water Resources

The surface water resources of the basin are divided into three major watersheds or hydrologic units: the Satilla River, Little Satilla River, and the Turtle River.

Biological Resources

The basin encompasses parts of two major land resource areas (Southern Coastal Plains and Atlantic Coast Flatwoods) providing many different ecosystem types. These ecosystems provide habitat for diverse species of aquatic and terrestrial wildlife. Several of the species are currently threatened or endangered.

Population and Land Use Characteristics

The major population centers in the Satilla River basin include the Cities of Douglas, Waycross, St. Simons, and Brunswick. The population is expected to increase at an average growth rate through 2050.

More than 69 percent of the basin is covered by forests and forestry-related activities account for a major part of the basin's economy. Agriculture is also a significant land use activity supporting a variety of animal operations and commodity production.

Local Governments and Planning Authorities

The local governments in the basin consist of counties and incorporated municipalities. The Satilla basin includes part or all of 15 Georgia counties. These counties are members of four different Regional Development Centers.

Water Quantity Conditions

Surface water supplies in the basin include water in rivers, and ponds. Groundwater is the primary water source in the Satilla River basin. In the Coastal Plain Province, aquifer yields are higher and groundwater withdrawals make up the majority of the total water budget. Georgia's Drinking Water Program oversees 52 active and permitted public water systems in the Satilla River basin.

The primary demands for water supply in the basin include municipal and industrial use, agricultural use, and recreation. The demand for drinking water is expected to remain stable in the near future due to average population growth rates. Agricultural water demand in the Satilla River basin is considerable. Future agricultural water demand is expected to increase significantly within the basin.

Water Quality Conditions

The major environmental stressors that impair or threaten water quality in the Satilla River basin include traditional chemical stressors, such as oxygen demanding substances, metals, and bacterial contamination, as well as less traditional stressors, such as stream channel modifications and alteration of physical habitat.

Significant potential sources of environmental stressors in the basin include point source discharges such as municipal and industrial wastewater, and storm sewers; and nonpoint sources that result from diffuse runoff from urban and rural land uses. Based on EPD's 1998-1999 water quality assessment, urban runoff and rural nonpoint sources are now the major sources of failure to support designated uses of water bodies in the Satilla basin.

Point Sources

Point sources are defined as the permitted discharges of treated wastewater to river and tributaries that are regulated under the National Pollutant Discharge Elimination System (NPDES). These permits are issued by EPD for wastewater discharges and storm water discharges.

Municipal discharges. There are currently 5 permitted major municipal wastewater discharges with flows greater than 1 MGD in the Satilla River basin. There are also 12 minor public discharges. EPD monitors compliance of these permits and takes appropriate enforcement action for violations. As of the 1998-1999 water quality assessment, two estuarine areas (totaling 77 square miles) were identified in which municipal discharges contributed to a failure to support designated uses. Total maximum daily loads (TMDLs) were established for these segments in 2001. The TMDLs for these segments are being implemented through the NPDES permitting process and nonpoint source programs.

Industrial discharges. There are a number of industrial wastewater dischargers in the basin including 3 major facilities. EPD identified 7 estuarine areas (totaling 205 square

miles) where permitted industrial discharges contributed to a failure to support designated uses. TMDLs were established by EPA for these segments in 2001. These TMDLs are currently being implemented through the NPDES permitting process.

Permitted storm water discharges. Urban storm water runoff in the Satilla basin has been identified as a source of water quality impairment. Urban runoff which is collected by storm sewers is now subject to NPDES permitting and control.

Nonpoint Sources

Nonpoint sources of pollution include a variety of pollutants that are carried across the ground with rainwater and are deposited in water bodies. The 1998-1999 water quality assessment results for the Satilla basin indicate that urban and rural nonpoint sources contribute significantly to failure to support designated uses of water bodies. The major categories of nonpoint source pollution in the basin include the following:

- Urban, industrial, and residential sources, which may contribute storm water runoff, unauthorized discharges, oxygen-demanding waste, oil and grease, nutrients, metals, bacteria, and sediments.
- Agricultural sources, which may contribute nutrients from animal wastes and fertilizers, sediment, herbicides/pesticides, and bacteria and pathogens.
- Forestry activities, which may contribute sediments and herbicides/pesticides.

Support of Designated Uses

Under Georgia regulations, designated uses and associated water quality standards provide goals for water quality protection. EPD assessed the streams and estuaries in the Satilla basin and reported the results in *the Georgia 2000 305(b)/303(d) list*. This assessment indicated that 6 out of 44 stream segments (64 miles) supported uses, and 8 out of 64 (165 miles) partially supported uses, while 19 out of 64 (212 miles) did not support designated uses. A number of estuarine areas also failed to fully support designated uses.

Key Environmental Stressors

The major threats to water quality in the Satilla River basin are summarized below.

Dissolved Oxygen. The 1998-1999 water quality assessments indicated that listings due to violations of water quality standards for dissolved oxygen were one of the most commonly listed causes of failure to support designated uses. Dissolved oxygen concentrations contributed to lack of full support on 23 stream segments (265 miles) and 2 estuarine areas (77 square miles). Oxygen consuming substances may be discharged to streams from point and nonpoint sources. In general, nonpoint sources are the most significant sources at this time. Severe drought conditions during the 1998-2000 period significantly impacted the southern part of the state, including the Satilla River basin. According to EPD's "1998-2000 Georgia Drought Report," the rainfall shortage in this region amounted to almost 23 inches. The drought conditions likely contributed to the low dissolved oxygen concentrations documented in the Satilla River and its tributaries. In addition it should be noted that dissolved oxygen concentrations are naturally low in parts of the Satilla River basin.

Fecal coliform bacteria. The 1998-1999 water quality assessments indicate that listings due to violations of water quality standards for fecal coliform bacteria were one of the most commonly listed causes of failure to support designated uses. Fecal coliform bacteria concentrations contributed to lack of full support on 209 miles, constituting 17 stream segments. Fecal coliform bacteria may arise from point and nonpoint sources,

such as wastewater treatment plants, agricultural nonpoint sources, leaking septic systems, and storm water runoff. As point sources have been brought under control in the basin, nonpoint sources have become increasingly important as potential sources of fecal coliform bacteria.

Metals. The 1998-1999 water quality assessments indicate few violations of water quality standards for metals in two estuarine areas. Metals concentrations contributed to lack of full support in two square miles. The metals on the segment was attributed to industrial sources.

Nutrient loading. Nutrient loading is potentially an important issue in the Satilla River basin. Excess nutrient loads can promote undesirable growth of algae and degradation of water quality. An estuary receives unassimulated nutrients from the watershed upstream. The major sources of nutrient loading in the Satilla basin are agricultural runoff, urban runoff, storm water, and wastewater treatment facilities.

Fish tissue contamination. Fish consumption guidelines for individual fish species are in effect for two stream segments (99 miles) and five estuarine areas (22 square miles). The guidelines for the waters are due to mercury or PCBs. Mercury may be of atmospheric or natural origin.

Flow and Temperature Modification. Stream flow and temperature affect the kinds of organisms able to survive in the water body. Stream flow and temperature also affect how much oxygen is available to the organisms. The potential threats to temperature regime in streams of the Satilla basin are warming by small impoundments, increases in paved surface area, and the removal of trees which provide shade along stream banks.

Sediment Loading and Habitat Degradation. A healthy aquatic ecosystem requires a healthy physical habitat. One major cause of disturbance to stream habitats is erosion and sedimentation. As sediment is carried into the stream, it can change the stream bottom, and may smother sensitive organisms. Turbidity associated with sediment loading also may potentially impair recreational and drinking water uses. Sediment loading is of greatest concern in developing areas and major transportation corridors. The rural areas of the basin are of lesser concern with the exception of rural unpaved road systems, areas where cultivated cropland exceeds 20 percent of the total land cover, and areas in which foresters are not following appropriate management practices.

Strategies for Water Supply

At this time, water quantity appears to be adequate for all uses within the Georgia portion of the Satilla basin, and there are no major new water supply projects proposed. There are, however, several water quantity concerns in the Satilla basin which are of significance to decision makers.

Strategies for Water Quality

Water quality in the Satilla River basin is generally good at this time, although problems remain to be addressed and proactive planning is needed to protect water quality into the future. Many actions have already been taken to protect water quality. Programs implemented by federal, state, and local governments, farmers, foresters, and other individuals have greatly helped to protect and improve water quality in the basin over the past twenty years.

The primary source of pollution that continues to affect waters of the Satilla River basin results from nonpoint sources. These problems result from the cumulative effect of activities of many individual landowners or managers. Population is growing every year, increasing the potential risks from nonpoint source pollution. Growth is essential to the

economic health of the Satilla River basin, yet growth without proper land use planning and implementation of best management practices to protect streams and rivers can create harmful impacts on the environment.

Because there are many small sources of nonpoint loading spread throughout the watershed, nonpoint sources of pollution cannot effectively be controlled by state agency permitting and enforcement, even where regulatory authority exists. Rather, control of nonpoint loading will require the cooperative efforts of many partners, including state and federal agencies, individual landowners, agricultural and forestry interests, local county and municipal governments, and Regional Development Centers. A combination of regulatory and voluntary land management practices will be necessary to maintain and improve the water quality of rivers, streams, and lakes in the Satilla River basin.

Key Actions by EPD. The Georgia EPD Water Protection Branch has responsibility for establishing water quality standards, monitoring water quality, river basin planning, water quality modeling, permitting and enforcement of point source NPDES permits, and developing Total Maximum Daily Loads (TMDLs) where ongoing actions are not sufficient to achieve water quality standards. Much of this work is regulatory. EPD is also one of several agencies responsible for facilitating, planning, and educating the public about management of nonpoint source pollution. Nonpoint source programs implemented by Georgia and by other states across the nation are voluntary in nature. The Georgia EPD Water Resources Branch regulates the use of Georgia's surface and ground water resources for municipal and agricultural uses, which includes source water assessment and protection activities in compliance with the Safe Drinking Water Act.

Actions being taken by EPD at the state level to address water quality problems in the Satilla River basin include the following:

- **Watershed Assessments and Watershed Protection Implementation Plans.** When local governments propose to expand an existing wastewater facility, or propose a new facility, EPD requires a comprehensive watershed assessment and development of a watershed protection implementation plan.
- **Total Maximum Daily Loads (TMDLs).** Where water quality sampling has documented standards violations and ongoing actions are not sufficient to achieve water quality standard within a two year period, a TMDL will be established for a specific pollutant on the specific stream segment in accordance with EPA guidance. TMDLs were established for 303(d) listed waters in the Satilla River basin in 2001. Implementation plans will be developed in 2002.
- **Source Water Protection.** Most of the public water supply in the Satilla basin is drawn from groundwater. To provide for the protection of public water supplies, Georgia EPD is developing a Source Water Assessment Program in alignment with the 1996 amendments to the Safe Drinking Water Act and corresponding EPA guidelines.
- **Fish Consumption Guidelines.** EPD and the Wildlife Resources Division work to protect public health by testing fish tissue and issuing fish consumption guidelines as needed, indicating the recommended rates of consumption of fish from specific waters. The guidelines are based on conservative assumptions and provide the public with factual information for use in making rational decisions regarding fish consumption.

Key Actions by Resource Management Agencies. Nonpoint source pollution from agriculture and forestry activities in Georgia is managed and controlled with a statewide non-regulatory approach. This approach is based on cooperative partnerships with various agencies and a variety of programs. Agriculture in the Satilla River basin is a mixture of livestock and poultry operations and commodity production. Key partners for

controlling agricultural nonpoint source pollution are the Soil and Water Conservation Districts, Georgia Soil and Water Conservation Commission, and the USDA Natural Resources Conservation Service. These partners promote the use of environmentally-sound Best Management Practices (BMPs) through education, demonstration projects, and financial assistance.

Forestry is a major part of the economy in the Satilla basin and commercial forest lands represent over 69 percent of the total basin land area. The Georgia Forestry Commission (GFC) is the lead agency for controlling silvicultural nonpoint source pollution. The GFC develops forestry practice guidelines, encourages BMP implementation, conducts education, investigates and mediates complaints involving forestry operations, and conducts BMP compliance surveys.

Key Actions by Local Governments. Addressing water quality problems resulting from nonpoint source pollution will primarily depend on actions taken at the local level. Particularly for nonpoint sources associated with urban and residential development, it is only at the local level that regulatory authority exists for zoning and land use planning, control of erosion and sedimentation from construction activities, and regulation of septic systems.

Local governments are increasingly focusing on water resource issues. In many cases, the existence of high quality water has not been recognized and managed as an economic resource by local governments. That situation is now changing due to a variety of factors, including increased public awareness, high levels of population growth in many areas resulting in a need for comprehensive planning, recognition that high quality water supplies are limited, and new state-level actions and requirements. The latter include:

- Requirements for Watershed Assessments and Watershed Protection Implementation Plans when permits for expanded or new municipal wastewater discharges are requested;
- Development of Source Water Protection Plans to protect public drinking water supplies;
- Requirements for local comprehensive planning, including protection of natural and water resources, as promulgated by the Georgia Department of Community Affairs.

In sum, it is the responsibility of local governments to implement planning for future development which takes into account management and protection of the water quality of rivers, streams, and lakes within their jurisdiction. One of the most important actions that local governments should take to ensure recognition of local needs while protecting water resources is to participate in the basin planning process, either directly or through Regional Development Centers.

Continuing RBMP in the Satilla River Basin

This basin plan represents one step in managing the water resources in the Satilla basin. EPD, its resource management agency partners, local governments, and basin stakeholders will need to work together to implement the plan in the coming months and years. Additionally, the basin planning cycle provides the opportunity to update management priorities and strategies every five years. The Satilla River basin team and local advisory committee will both be reorganized to initiate the next iteration of the cycle. Agencies and organizations with technical expertise, available resources, and potential implementation responsibilities are encouraged to become part of the basin team. Other stakeholders can stay involved through working with the local advisory committee, and participating in locally initiated watershed planning and management activities. The next scheduled update of the Satilla River basin plan is planned for 2007.

In This Section

Introduction

What Is the Purpose of This Plan?

This document presents Georgia's river basin management plan for the Satilla River, which is being produced as a part of Georgia's River Basin Management Planning (RBMP) approach. The purpose of this plan is to provide relevant information on the Satilla River basin characteristics, describe the status of water quality and quantity in the Satilla River basin, identify present and future water resource demands, present and facilitate the implementation of water protection efforts, and enhance stakeholder understanding and involvement in basin planning.

This plan has been produced by the Georgia Department of Natural Resources Environmental Protection Division (EPD), based on data and information gathered by EPD, other state and federal agencies, universities, utilities, consultants, and environmental groups. A basin team made up of representatives from the Georgia Soil and Water Conservation Commission (GSWCC), the Natural Resources Conservation Service (NRCS), Georgia Department of Natural Resources Wildlife Resources Division (WRD), Georgia Forestry Commission (GFC), and EPD's Water Resources Branch, Water Protection Branch, and Geologic Survey Branch compiled the information to generate the plan. The U.S. Geological Survey (USGS) and the EPD Geologic Survey Branch created the majority of the figures in this report using geographic information system technologies.

River Basin Management Planning

RBMP is designed to coordinate management of water quantity and quality within river basins by integrating activities across regulatory and non-regulatory programs. The RBMP approach provides the framework for identifying, assessing, and prioritizing water

resources issues, developing management strategies, and providing opportunities for targeted, cooperative actions to reduce pollution, enhance aquatic habitat, and provide a dependable water supply. RBMP includes opportunities for stakeholders in the State's river basins to participate in developing and implementing river basin management plans. These plans will benefit from the collective experience and combined resources of a variety of stakeholders.

A separate document is available from Georgia EPD that describes the RBMP approach in greater detail.

Initial Efforts for the Satilla River Basin

Begun in 1993, RBMP is a new approach to the management of Georgia's water resources. This is the first river basin management plan produced under RBMP for the Satilla River (Figure 1-1). Under the RBMP approach, the Satilla River plan will be updated every five years. During the first iteration of RBMP in Georgia, much effort and resources are being dedicated to making programmatic changes, building the infrastructure of RBMP, cataloging current water management activities and beginning to coordinate with the many agencies, organizations, and individuals that have a stake in river basin management. As a result, some portions of the RBMP cycle have had to be condensed during this first iteration; in particular, it has not been possible to spend as much effort on developing management strategies as is planned for future iterations. Future iterations of the basin planning cycle will provide a better opportunity for developing new, innovative, and cost-effective strategies for managing water quality and quantity.

What's Inside?

This plan is organized into the following sections:

Executive Summary

The executive summary provides a broad perspective on the condition of the basin and the management strategies recommended to protect and enhance the Satilla River basin's water resources.

1.0 Introduction

The introduction provides a brief description of Georgia's River Basin Management Planning approach, the planning cycle for the Satilla River basin, opportunities for stakeholder involvement, and a description on how to use this document.

2.0 River Basin Characteristics

This chapter provides a description of the basin and its important characteristics, including boundaries, climate, physiography and geology, geochemistry, soils, surface water resources, ground water resources, biological resources, population and land use, local government and jurisdictions, and water use classifications.

3.0 Water Quantity

This chapter describes current surface and ground water availability, as well as forecasts for future demand. This chapter also includes sections on historic, present and possible proposed permitting activities pertaining to water availability.

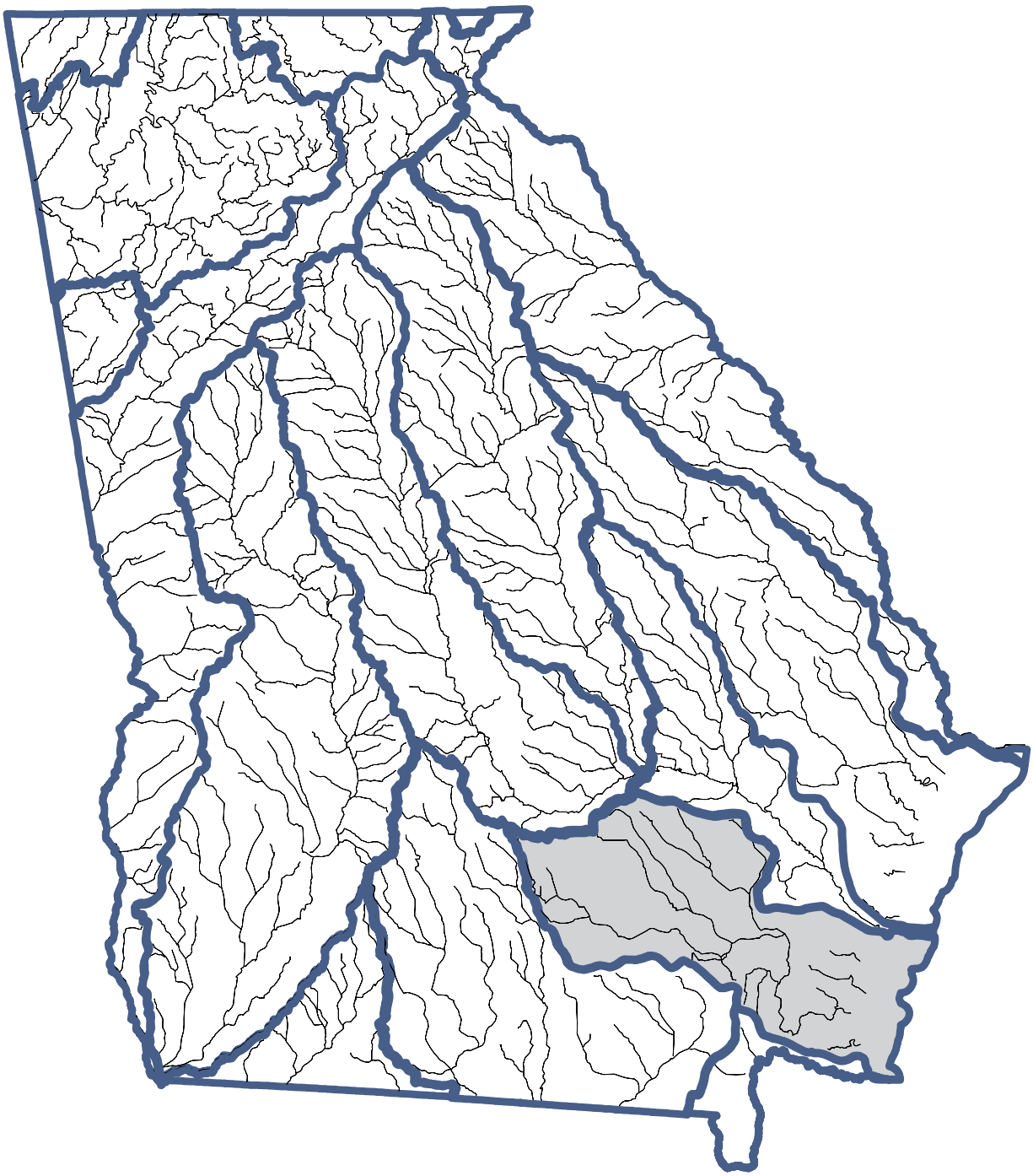


Figure I-1. The Satilla River Basin

4.0 Environmental Stressors

This chapter describes the major stressors in the basin that may impair water or habitat quality. The stressors are divided into point sources (i.e., NPDES permitted discharges) and nonpoint sources.

5.0 Assessment

This chapter provides an assessment of water quality and quantity in the streams, lakes, estuaries, and groundwater along with an assessment of the basin's biological integrity. The data sources and analysis techniques for these assessments are also discussed.

6.0 Concerns and Priority Issues

This chapter summarizes and prioritizes the issues of concern that were identified through the assessment in Chapter 5.

7.0 Implementation Strategies

This chapter presents strategies for addressing the issues of concern in the order that they appear on the priority list in Chapter 6 with a description of each issue, goals and objectives of management, overview of alternatives considered, and descriptions of recommended options for implementation.

8.0 Future Issues and Challenges

This chapter discusses long-range goals to set the stage for further improvements in managing water resources and water quality. Due to limited resources (data, time, funding, etc.), some issues will be addressed in future iterations of each basin planning cycle.

Appendices

The appendices contain technical information for those interested in specific details involved in the planning process.

How Do I Use This Plan?

This river basin plan will serve as the road map for managing the water resources in the Satilla River basin. It contains useful information on the health of the Satilla River basin and recommended strategies to protect the basin now and in the future. The document can be used as a reference tool for watershed conditions in the basin, as well as a planning guide for implementing key guide actions throughout the basin cycle.

Chapter 7 contains the key management strategies that have been identified to address the priority issues and concerns in the basin. The earlier chapters show the reader how the issues were identified and where the specific stressors in the basin occur. Each chapter in this river basin plan builds upon the previous ones. For example, the recommended management strategies in Chapter 7 were formulated based on the priority concerns identified in Chapter 6. Similarly, the priority issues in Chapter 6 were derived as a result of the assessment in Chapter 5.

Links to Other Chapters

Because issues are discussed across several chapters, an explanatory paragraph at the beginning of chapters 4, 5, 6, and 7 will alert the reader that an issue may be discussed

elsewhere. For example, Chapter 4 discusses stressors to the water body from various point and nonpoint sources. Chapter 5 provides an assessment summary of water quality and water quantity based on the sources of environmental stressors. Next, Chapter 6 combines the assessment information from Chapter five to identify priority issues for the development of management strategies. Finally, Chapter 7 provides general goals and strategies to address the most significant existing and future water quality and quantity issues within the Satilla basin.

What Is the Schedule of Activities for the Satilla River Basin?

The schedules of activities for the first two Satilla River basin cycles, i.e., 1997-2002 and 2002-2007, are provided in Figures 1-2 and 1-3.

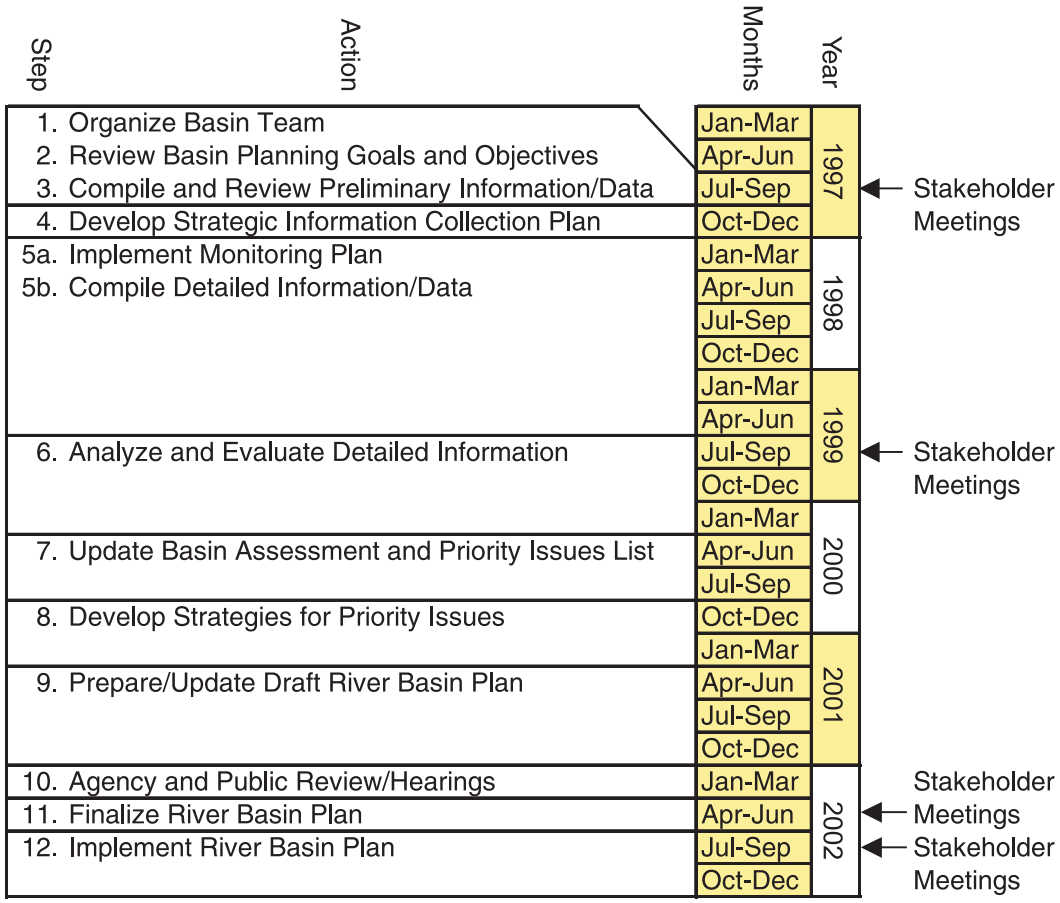


Figure I-2. Satilla River Basin Planning Schedule, I[st] Cycle, 1997-2002

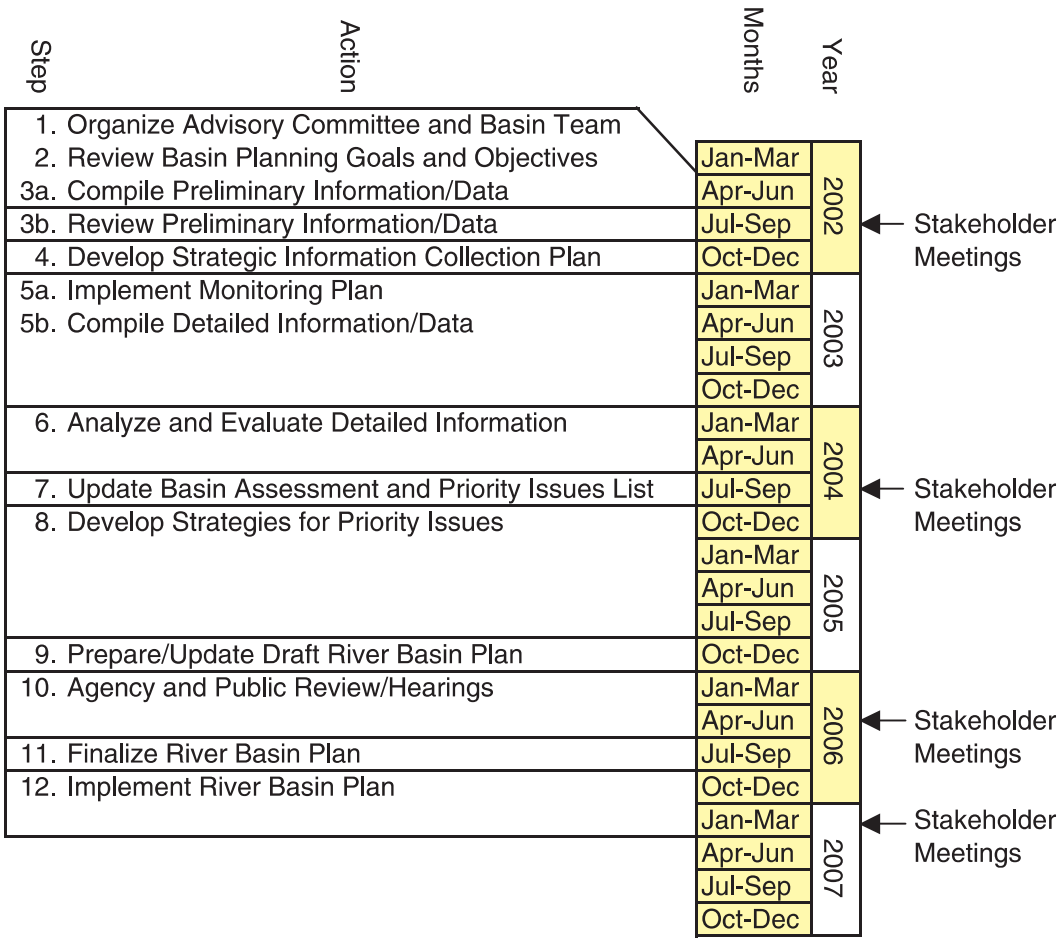


Figure I-3. Satilla River Basin Planning Schedule, 2nd Cycle, 2002-2007

How Do Stakeholders Get Involved in the Basin Planning Process?

A major goal of RBMP is to involve interested citizens and organizations in plan development and implementation. This is intended to improve the identification and prioritization of water quality and quantity problems, maximize the efficient use of resources and expertise, create better and more cost-effective management strategies, and be responsive to stakeholder perceptions and needs. The opportunities for stakeholders to get involved in river basin management planning include the following:

Support the Basin Team

Every basin planning cycle begins with the organization of the basin team. The Satilla River basin team will begin reorganizing itself in 2002.

Members of the basin team are from EPD programs and branches, and other interested governmental partners (e.g., the Department of Community Affairs, GFC, GSWCC, NRCS, and WRD). Emphasis is placed on technical knowledge, available resources, and potential implementation responsibilities. Other agencies may act as partners in the RBMP process, contributing resources and expertise, while not being directly involved in Basin Team activities. Support and provide input to the agency that represents your interests.

Support the Local Advisory Committee

The local advisory committees provide advice and counsel to EPD during river basin management plan development, representing a forum for involving local stakeholders. These local advisory committees form a link between EPD and the regulated community and local watershed interests. The local advisory committee will be reorganized simultaneously with the basin teams.

The committees consist of local people representing a variety of stakeholder interests including local governments, agriculture, industry, forestry, environmental groups, landowners, and citizens. Committee members and chairs are appointed by the EPD Director following a nomination process at the beginning (step 1) of each river basin planning cycle. The committees meet periodically during the planning cycle, and provide input to EPD in the creation of river basin management plans. Meetings are called at the discretion of the chairman of the local advisory committee, and all meetings are open to the public. Table 1-1 lists the members of the Satilla River Basin Local Advisory Committee serving for the first planning cycle (through April 2002).

Table 1-1. Satilla River Basin Local Advisory Committee Members

Mr. Clayton Carter, President South Diamond Hunt Club Route 2, Box 72B Nahunta, Georgia 31553	Honorable Roger Boatright Mayor of Alma POB 429 Alma, Georgia 31513	Mr. Andy Slocum Union Camp Corporation P.O. Box 410 Waycross, Georgia 31502
Mr. Tommy Blount Blount Parts & Equipment Hwy. 121N Hoboken, Georgia 31542	Mr. Carlton Windsor S.E. Forest Superintendent Rayonier Box 528 Jesup, Georgia 31545	Mr. Tommy Nimmer 3491 Twin Lake Road Blackshear, Georgia 31516
Mr. Buck Wynn District Forester Georgia Forestry Commission 5003 Jacksonville Hwy. Waycross, Georgia 31503	Mr. Mickey Whittington Seven Rivers RC and D Council 400 E Park Street, Suite 5 Baxley, Georgia 31513	Mr. Doug Van Valkenburg, Forest Manager Georgia Pacific Rt. 1, Box 684 Hortense, Georgia 31545
Mr. John Strickland Seven Rivers RC and D Council 400 E. Park Street, Sutie 5 Baxley, Georgia 31513	Honorable Bud Baxley Mayor of Baxley Post Office Box 180 Baxley, Georgia 31513	Mr. Kenneth Bennett Satilla River Soil and Water Conservation District 2278 Golf Course Avenue Blackshear, Georgia 31516
Judge Huey Ham Post Office Box 998 Nahunta, Georgia 31533	Dr. Fred Marland Box 636 Darlen, Georgia 31516	Honorable Denward Buchan, Mayor Mayor of Douglas POB 470 Douglas, Georgia 31534
Mr. Lance Futch, Executive Director Southeast Georgia RDC 3395 Harris Road Waycross, Georgia 31503		

Participate in Stakeholder Forums

While River Basin Advisory Committees operate at the major basin level, there is an opportunity under RBMP for more localized stakeholder forums to play an important role in the creation and implementation of water resources management strategies. Some strategies, such as best management practices (BMPs) to control pollutant runoff from urban, agricultural or forestry areas, are best managed at the city, county, or sub-watershed level. These local forums might already exist in the form of conservation districts or watershed associations, or may be created as an outgrowth of RBMP.

Attend a Stakeholder Meeting

The RBMP approach includes regularly-scheduled stakeholder meetings, which provide the opportunity for the general public to learn about the status of water-related issues and management activities in their river basin, as well as contribute input that can influence basin management planning.

Figures 1-2 and 1-3 show the timing of stakeholder meetings that have been and will be held as part of the Satilla basin RBMP cycles. EPD hosted the initial stakeholder meeting in Waycross in early 1998 to invite and encourage stakeholder input early in the planning process for the Satilla River basin. Focused monitoring in the Satilla River basin was conducted in 1998. The data was assessed in the 1999 and waters not meeting water quality standards were public noticed in February, 2000. This work along with priority issues was presented to and discussed with the Local Advisory Committee in October, 2000. Draft strategies to address priority issues were presented to and discussed with the Local Advisory Committee in August, 2001. Due to the extended monitoring program and compressed schedules for problem listing and strategy development, the second stakeholder meeting was not held. A third group of stakeholder meetings—to give stakeholders the opportunity to review this river basin management plan—is planned for the March-April 2002. A final group of meetings in late 2002 will give stakeholders a chance to discuss implementation of management strategies. The next set of stakeholder meetings after the implementation phase of the first cycle is planned for 2002, providing stakeholders an opportunity to be involved in the planning for the next cycle of RBMP in the Satilla basin. The dates of ensuing stakeholder meetings are indicated in Figure 1-3.

What's Next?

This draft plan will be reviewed by governmental partners, the Satilla River Basin Advisory Committee, and the public. A public meeting will be held to solicit comments and recommendations regarding the river basin management plan. Following the review, appropriate modifications will be made to the plan, and the final plan will be submitted for review and acceptance by the Board of the Georgia Department of Natural Resources. After approval and an initial implementation period, partners will enter into the next 5-year cycle iteration to evaluate and update the plan as necessary.

In This Section

River Basin Characteristics

This section describes the following major characteristics of the Satilla River basin:

- *River basin description (Section 2.1): the physical features and natural processes of the basin.*
- *Population and land use (Section 2.2): the sociological features of the basin, including the types of human activities that might affect water quality and water resource use.*
- *Local governments and planning authorities (Section 2.3): identification and roles of the local authorities within the basin.*
- *Water use classifications (Section 2.4): description of water use classifications and baseline goals for management of waters within the basin as defined in the state regulatory framework.*

2.1 River Basin Description

This section describes the important geographical, geological, hydrological, and biological characteristics of the Satilla River basin.

The physical characteristics of the Satilla River basin include its location, physiography, soils, climate, surface water and ground water resources, and natural water quality. These physical characteristics influence the basin's biological habitats and the ways people use the basin's land and water resources.

2.1.1 River Basin Boundaries

The Satilla River basin is located in southeast Georgia, and is flanked by the Altamaha River basin to the north and the Suwannee and St. Marys River basins to the south (Figure 2-1). The main streams of the Satilla basin are the Satilla River itself and its largest tributaries, the Little Satilla River and the Alabaha River. The Satilla River originates in Ben Hill County east of Fitzgerald, while the little Satilla River originates to the east in Jeff Davis County. The Satilla River meanders southeast to the Atlantic Ocean.

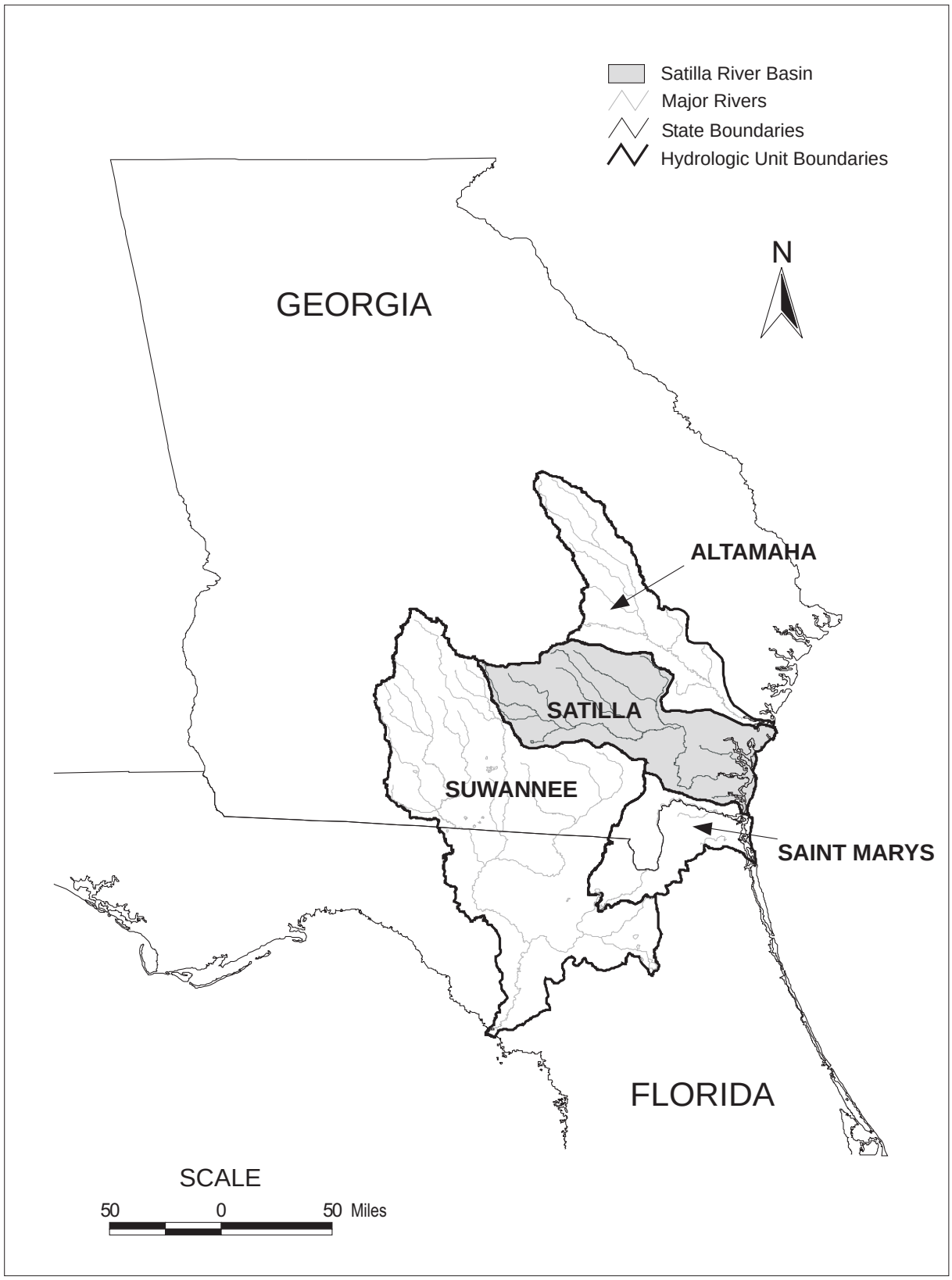


Figure 2-I. Location of the Satilla River Basin

The Satilla River basin or watershed, comprising all land areas draining into the river, occupies a total area of 3,940 square miles.

The U.S. Geological Survey (USGS) has divided the Satilla River basin into three subbasins, or Hydrologic Unit Codes (HUCs; see Table 2-1). These HUCs are referred to repeatedly in this report to distinguish conditions in different parts of the Satilla River basin. Figure 2-2 shows the location of these subbasins and the associated counties within each subbasin.

Table 2-I. Hydrologic Unit Codes (HUCs) of the Satilla River Basin in Georgia

03070201	Satilla River
03070202	Little Satilla River
03070203	Turtle River

2.I.2 Climate

The Satilla River basin is characterized by mild winters and hot summers. Mean annual precipitation ranges from 46 to 54 inches per year. Rainfall is fairly evenly distributed throughout the year, but a distinct dry season occurs from mid-summer to late fall. Rainfall is usually greatest in March and least in October. The mean annual temperature is about 68 degrees Fahrenheit.

2.I.3 Physiography, Geology, Soils, and Hydrogeology

Physiography

The Ochlockonee, Satilla, St. Marys and Suwannee river basins lie entirely within the Coastal Plain physiographic province, which extends throughout the southeastern margin of the United States. The physiography of these river basins reflects a geologic history of repeated periods of land submergence which is typical of the Coastal Plain Province. These basins include all or portions of the Tifton Upland, the Okefenokee Basin, the Bacon Terraces and the Barrier Island Sequence districts of the Coastal Plain. The Ochlockonee River basin lies within the western third of the Tifton Upland District. The Satilla River basin lies entirely within the Bacon Terraces and Barrier Island Sequence districts. The St. Marys River basin lies entirely within the Okefenokee Basin and Barrier Island Sequence districts. The Suwannee River basin lies within the Tifton Upland and Okefenokee Basin districts.

The Tifton Upland District is characterized by a well developed, extend dendritic stream pattern where narrow, rounded interfluves occur 50 to 200 feet above relatively narrow stream valley floors. The northwestern boundary of the district is the base of the Pelham Escarpment, which rises as much as 200 feet above the Dougherty Plain to the west. The Okefenokee Basin District is typified by very low topographic relief, numerous extensive swamps, and local sand ridges. The Bacon Terraces District displays a very extended, southeast trending dendritic drainage pattern containing ling, narrow interfluves with gently rounded to flat summits that are 50 to 100 feet above narrow, marshy floodplains. The district also contains several low, moderately dissected terraces which are generally parallel to the coastline. From west to east, these are designated the Hazlehurst, Pearson, Claxton, Argyle, Waycross and Penholoway terraces. The Barrier Island Sequence District is characterized by a series of prominent marine terraces which form a step-like progression of decreasing altitudes toward the sea. The former, higher sea levels created barrier island-salt marsh environments parallel to and similar to those found on the present coast. The terraces are composed of sand ridges marking the former barrier

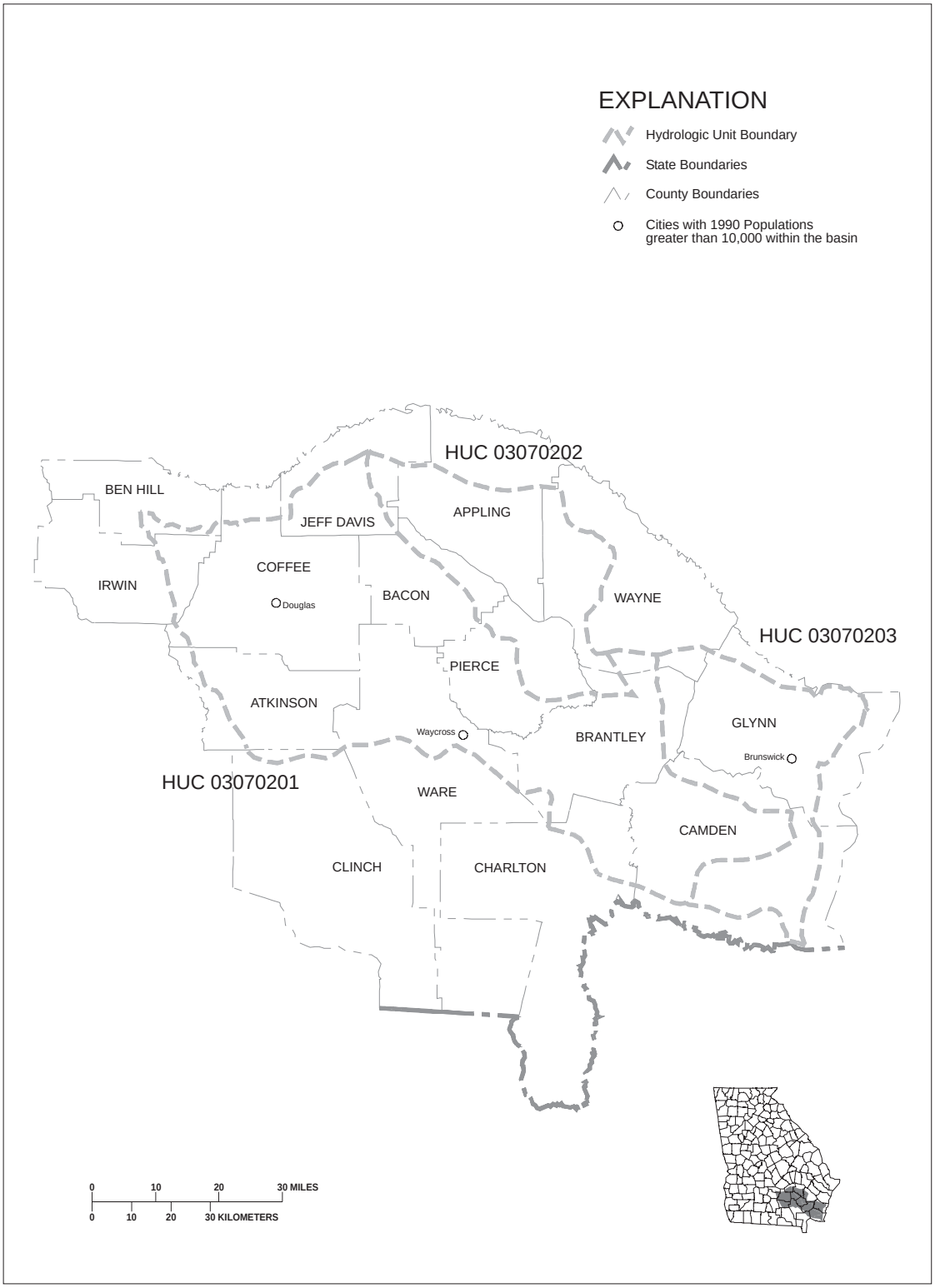


Figure 2-2. Hydrologic Units and Counties of the Satilla River Basin

islands, and are flanked by fresh water marshes at the former salt marsh locations. They have undergone slight to moderate dissection which is generally more advanced at the western edge of the district. Trail Ridge is the most prominent of these terraces with a maximum elevation of approximately 160 feet. It marks the western boundary of the Barrier Island Sequence District where it joins the Bacon Terraces and Okefenokee Basin districts. Other, less prominent terraces in the district, from west to east, are the Wicomico, Penholoway, Talbot, Pamlico, Princess Anne, and Silver Bluff-Holocene terraces.

The streams in these basins are typical of the Coastal Plain. They generally lack the riffles and shoals that are common to streams in the Piedmont Province to the north, and exhibit more extensive floodplain development and greater sinuosity.

Carolina Bays are elliptical or "spoon-shaped" wetland depressions aligned roughly north-northwest and are logically well developed throughout the area east of the Suwannee River basin. Lime sinks and lake-filled sinks are well developed in areas underlain by limestone in the shallow subsurface, notably in the Lake Park area south and west of Valdosta, Lowndes County.

Geology

Weathered, poorly consolidated sediments underlie all of these river basins, and are dominantly composed of sands, clays, and gravels which range from Miocene to Holocene in age. These sediments include the Miccosukee Formation (Pliocene age), Altamaha Formation and various formations of the Hawthorne Group (all Miocene age), as well as barrier island and marsh/lagoon facies of the numerous shoreline complexes (Pleistocene to Holocene age). Local occurrences of calcareous sediments include the Suwannee Limestone (Oligocene age) and Duplin Marl (Pliocene age). Other rock types in the area include dolomite, chert, peat, phosphate and fuller's earth, as well as Quaternary alluvium in the flood plains along the major stream valleys. Most of these sediments were deposited in either terrestrial or shallow marine environments.

Sediments in the area are locally mined for construction sand and fill material. In addition, the Meigs Member of the Coosawhatchie Formation (Hawthorne Group) is the source of the economically important fuller's earth clay deposits being mined in the Ochlockonee River Basin. In the past, crushed stone was produced from some of the limestone deposits, and a few of the larger Carolina Bays were mined for peat

Soils

The Satilla River Basin is within the Southern Coastal Plain and the Atlantic Coast Flatwoods Major Land Resource Areas (MLRA) (Figure 2-3). The soils within the river basin vary considerably, particularly from west to east across the area. The soils in this area can be combined into four major groups for discussion.

The first group of soils covers the western-most portion of the river basin and is in the Southern Coastal Plain. This group is dominated by nearly level and very gently sloping Tifton, Leefield, and Fuquay soils on uplands and nearly level Pelham soils along drainageways and floodplains. Tifton are well drained upland soils that have a sandy surface layer and a yellowish brown or strong brown, loamy subsoil. The surface layer is normally loamy sand and is about 10 inches thick. The subsoil is mostly sandy clay loam. Fuquay and Leefield soils have a thicker sandy surface than Tifton, and Leefield soils have a water table is higher. Characteristic of these soils is a layer of plinthite in the subsoil at a depth of about 30 inches. Plinthite is an iron-rich mixture of clay with quartz and other constituents that can perch water during wet seasons. Pelham soils are nearly level and poorly drained. They have a sandy surface layer 20 to 40 inches thick over a loamy subsoil. Water tables are commonly at or near the surface during wet seasons, and the soils are subject to flooding.

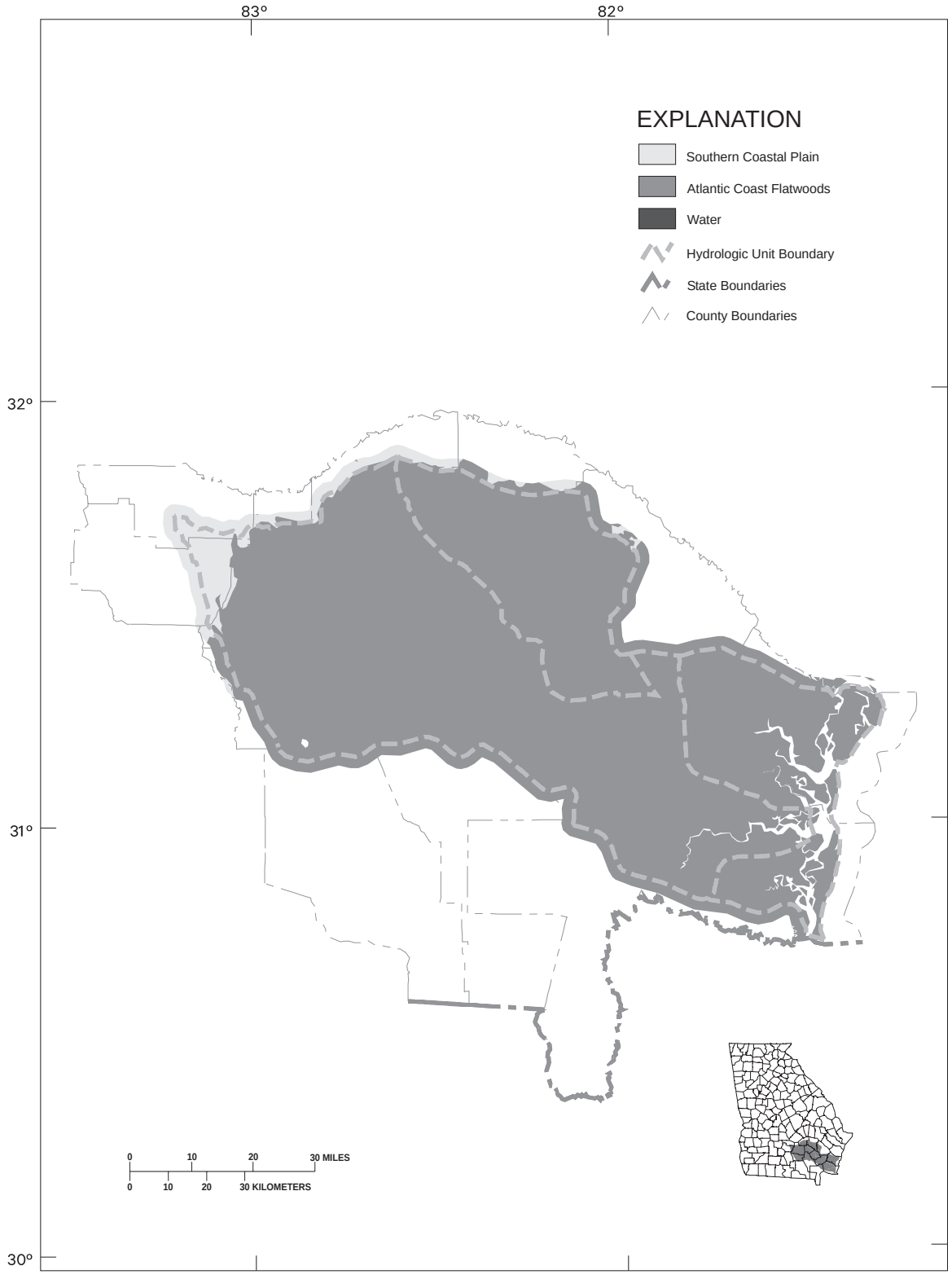


Figure 2-3. Major Land Resource Areas in the Satilla River Basin

The second major group of soils is in the Atlantic Coast Flatwoods MLRA. This area is dominated by nearly level, poorly drained soils on broad flats, and by very poorly drained soils in depressions and along drainageways. This area is characterized by an abundance of Spodosols, which are sandy soils that have a layer where a complex of organic matter and aluminum has accumulated. Most of the soils in this area are sandy, although a loamy subsoil is sometimes found at depth of around 3 feet. Water tables are commonly at or near the surface during wet seasons, and soils in depressions are often ponded. Pelham soils, which are not Spodosols, are also found throughout this area. Tifton, Leefield, and Fuquay soils as described in the previous group occur near drainageways in the western part of this area where the landscape is more dissected.

The third group of soils are nearly level, poorly drained and very poorly drained, clayey soils on low marine terraces and in depressions. These soils are different from most soils in the Atlantic Coast Flatwoods because of their high clay content. They are often ponded or flooded. Brookman, Bladen, and Pooler are common soils in this area.

The fourth group of soils occur in tidal marshes. These soils are continuously saturated with water. They are clayey or silty, and are high in sulpher and salt content. Bohicket and Capers are common soils in this area. Islands and other areas of higher elevation in this area are dominated by sandy Spodosols as outlined in group two above.

Hydrogeology

Coastal Plain sediments underlie the entire region and groundwater is produced from several aquifers. Sources of ground water include, in order of importance, the unconfined Surficial aquifer, the Upper and Lower Brunswick aquifers and the Upper and Lower Floridan aquifers. The Surficial aquifer is up to 230 feet thick and consists of interlayered, Miocene and younger, sand, clay and limestone. It is underlain by the Upper and Lower Brunswick aquifers both of which are composed of 150 and 70 feet, respectively, of poorly sorted sand. The Upper and Lower Floridan aquifers consist of Eocene to Oligocene carbonate rocks (largely limestone and dolostone) 700 to 2,500 feet in thickness. In each of the aquifers, except for the Surficial aquifer, the groundwater is under confined (aquifer) conditions. Most of these aquifers consistently have excellent water quality; however, the Lower Floridan aquifer is saline and generally does not meet drinking water standards.

2.1.4 Surface Water Resources

The Satilla River basins's major surface water body is the Satilla River. The Satilla River rises in Southeast Georgia, 0.3 miles east of Fitzgerald, at an elevation of about 350 feet above mean sea level. It flows in a southeasterly direction for about 250 miles, discharging to the Atlantic Ocean about ten miles south of Brunswick, between Jekyll Island and Cumberland Island. The basin drains a total area of 3,940 square miles which includes all of Bacon, Brantley and Pierce counties and portions of twelve other counties.

Some of the major streams in the basin includes the Little Satilla River, Alabaha River, Big Satilla River, Seventeen Mile Creek and Hurricane Creek. Stream networks within each HUC are shown in Figures 2-4 through 2-6.

2.1.5 Ground Water Resources

Groundwater resources in the Satilla River basin are supplied by the Floridan aquifer system, one of the most productive ground water reservoirs in the United States. The system supplies about 50 percent of the ground water used in the state. It is used as a major water source throughout most of South Georgia. A more detailed description of the Floridan aquifer system is provided below.

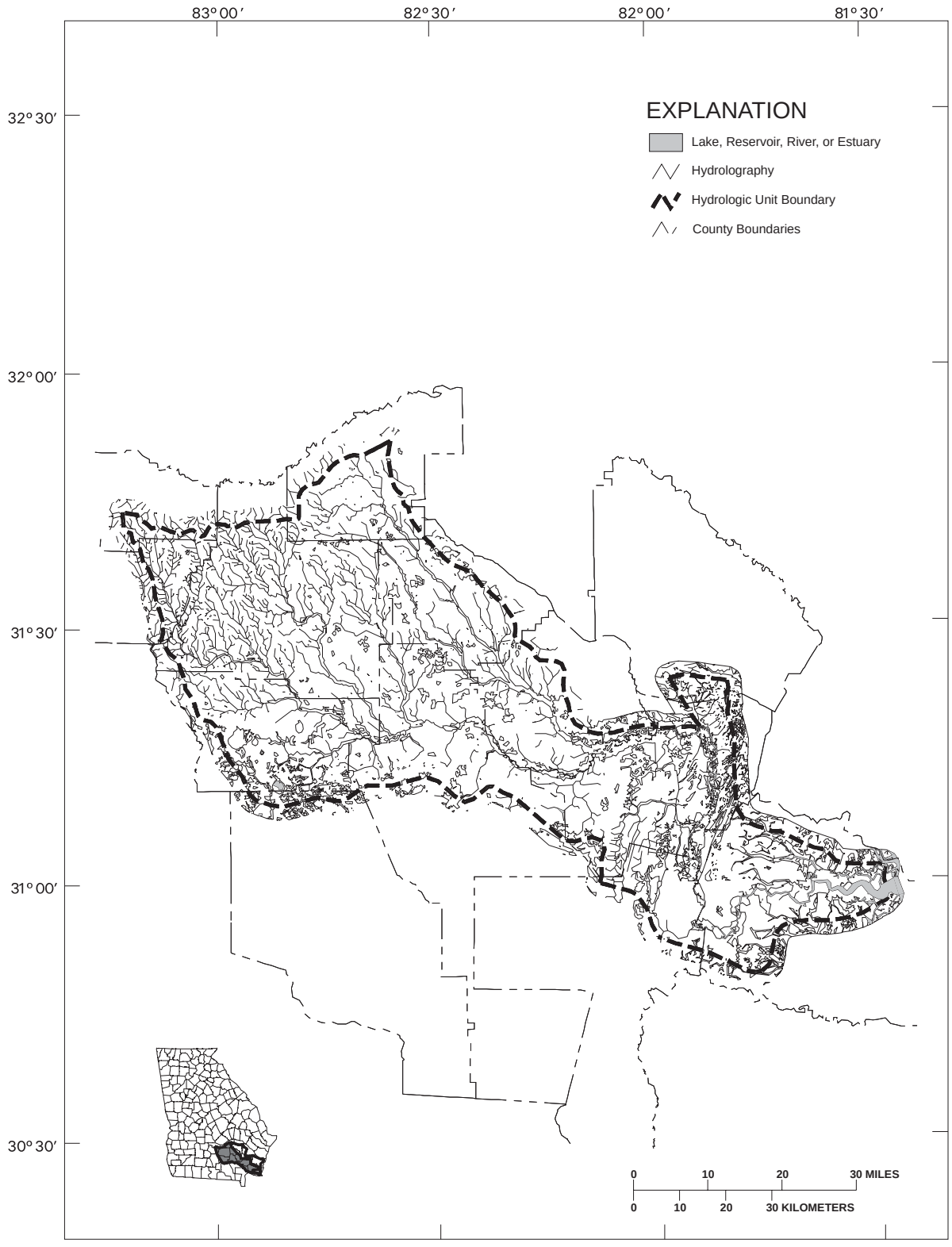


Figure 2-4. Hydrography, Satilla River Basin, HUC 03070201

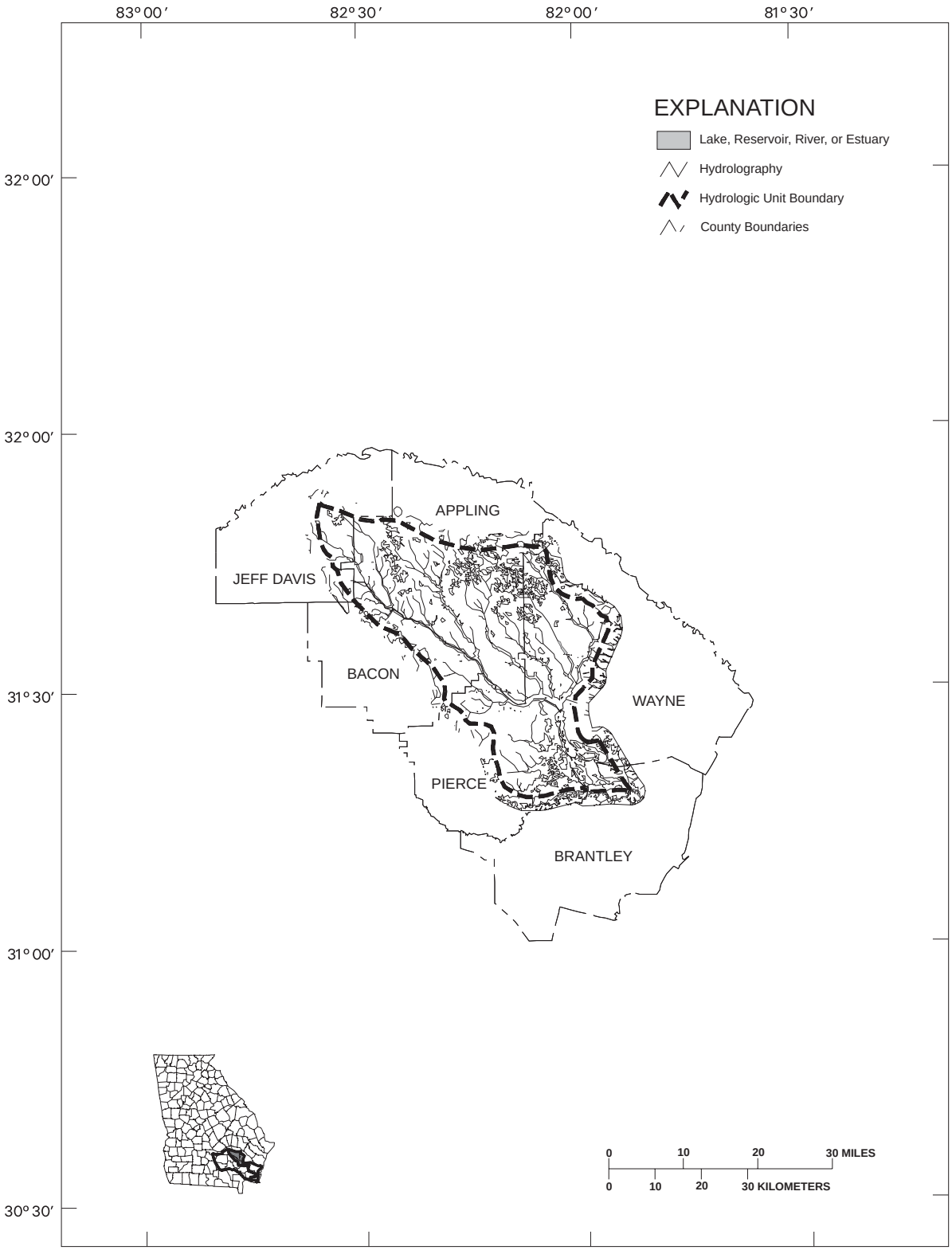


Figure 2-5. Hydrography, Satilla River Basin, HUC 03070202

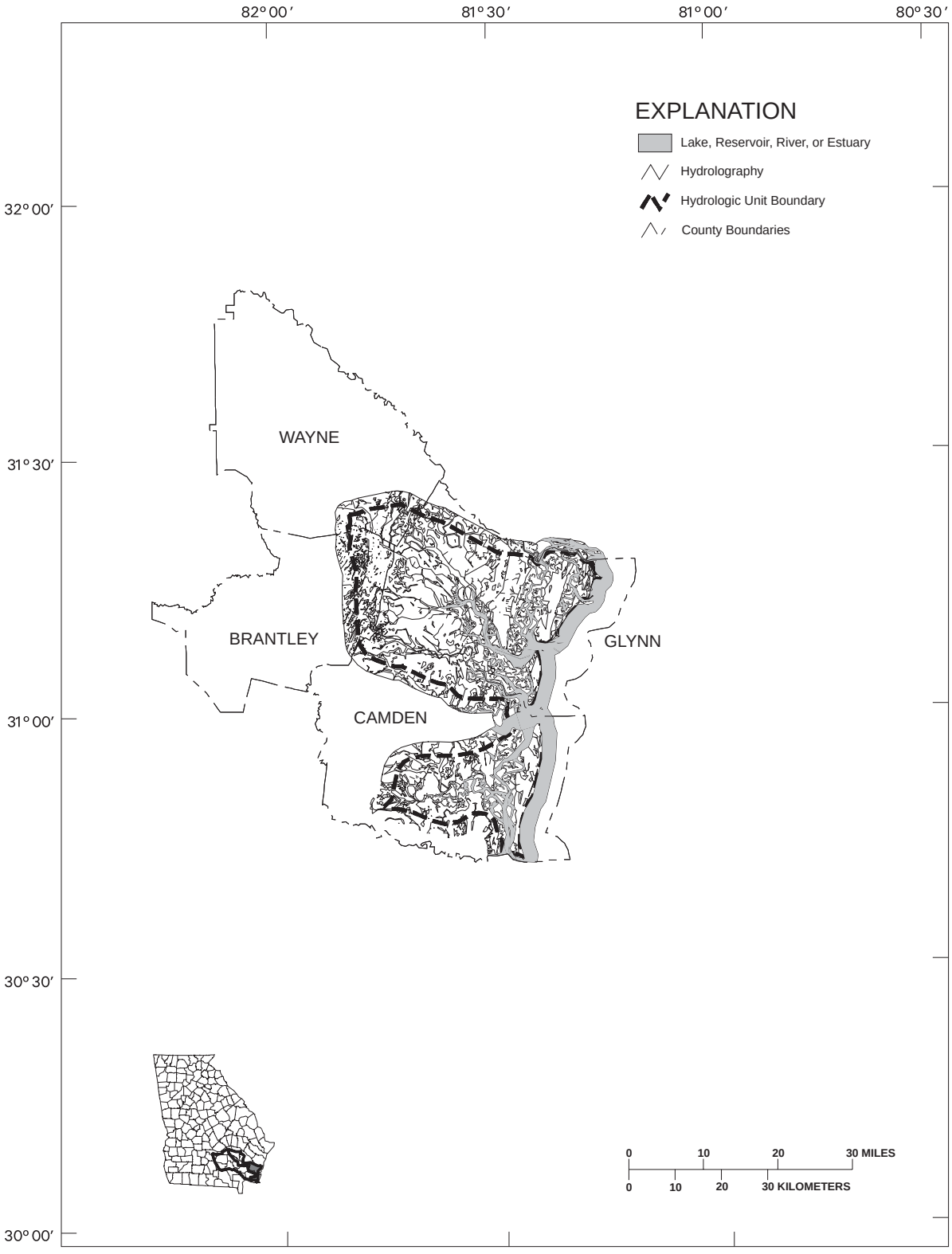


Figure 2-6. Hydrography, Satilla River Basin, HUC 03070203

Floridan Aquifer

The Floridan aquifer underlies the rest of the southern portion of the basin. The aquifer is overlain by approximately 25-125 feet of sandy clay residuum derived from chemical weathering of the underlying rock. The total thickness of the Floridan aquifer in the basin ranges from a few feet in the north to more than 400 feet in the extreme southern portion of the basin. Clastic grains of sand and shale are major components of the Floridan aquifer near its northernmost extent, where it is dominantly limestone in the Ochlockonee basin. Throughout most of the basin, the aquifer can be divided into three thick limestone formations: the Tampa Limestone, the Suwannee Limestone and the Ocala Limestone. The Tampa Limestone consists of whitish gray limestone that has a shale bed at its base. This shale acts as a confining layer to the underlying Suwannee and Ocala limestones (Miller, 1986). Below the Tampa, the Suwannee limestone is a massive chalky unit that is easily dissolved and weathered. For this reason, the many solution cavities in the Tampa provide abundant water to the underlying Ocala Limestone. The Ocala Limestone is the principal unit of the Floridan aquifer, and contains an upper friable, porous unit and a lower fine-grained unit (Miller, 1986). This lower unit contains most of the groundwater in the Floridan aquifer (Torak and others, 1993). The Ocala is underlain by the clay-rich Lisbon Formation, which acts as a slower confining bed to the water-bearing limestones above. Well yields in the Floridan aquifer can range from about 40 GPM in the north to more than 10,000 GPM in the thickest, southern most portion of the Floridan aquifer. The Floridan serves as the main aquifer from Decatur and Burke counties to the coast.

Well yields in the portions of the Crataceous sand aquifer underlying the Satilla River basin have been found to exceed 1,000 GPM. Recharge occurs through the sandy soil in the outcrop area. In the northern portion of basin this unit is seen as one singe aquifer and can be called either the Cretaceous Aquifer or the Dublin Midville Aquifer.

2.1.6 Biological Resources

The Satilla River basin supports a diverse and rich mix of terrestrial and aquatic habitats and is home to several federally and state-protected species. The basin encompasses parts of five major land resource areas. Some of the biological resources of the basin are summarized below.

Fish Fauna

The Satilla River has the typical fish assemblage of a coastal plain blackwater stream. The fish assemblage of the Satilla River basin is comprised of 52 species representing 16 families, and is not as diverse as many of the piedmont and mountain streams which are dominated by the family Cyprinidae. Fifteen species from the family Centrarchidae are present, making it the dominant family in the Satilla River basin. As in many coastal plain streams, species diversity is limited by acidic water, low alkalinity, extreme variation in flows, and the relatively homogenous habitat present through most of the river.

Fisheries

The Satilla River is a blackwater stream that flows unimpeded from its origin in Ben Hill County approximately 260 miles to the Atlantic Ocean, emptying into St. Andrew Sound between Jekyll and Cumberland islands. The basin drains 3,390 square miles, which is 5.8 percent of the state's total area. The Satilla River supports major fisheries for redbreast sunfish and catfish. Less dominant fisheries exist for other sunfish species, chain pickerel, warmouth, and largemouth bass. The banded topminnow is a state-listed rare species that occurs in the basin.

The Laura Walker State Park is the only publically-owned lake in the Satilla River basin. This blackwater lake is approximately 110 acres in size and has fisheries for largemouth bass, bluegill, catfish, chain pickerel, and flier.

Flathead catfish have been illegally stocked into the Satilla River. On the nearby Altamaha River, the illegal introduction of these non-native predators caused an 80 percent reduction in the highly regarded redbreast sunfish population, and virtual elimination of bullhead catfish. The Fisheries Section has an aggressive removal program in an attempt to keep flathead catfish numbers low so they will not negatively impact native fishes.

2.2 Population and Land Use

2.2.1 Population

As of 1995, about 101,000 people lived in the Satilla watershed (DRI/McGraw-Hill, 1996). Population distribution in the basin at the time of the 1990 census by census blocks is shown in Figure 2-7. Population centers in the Satilla watershed include the development surrounding Waycross, Brunswick and Douglas.

Between 1975 and 1995, the population in the Satilla River basin increased by 1 percent per year (DRI/McGraw-Hill, 1996). Basin population is projected to increase at a faster than average growth rate through 2050.

The river basin will mirror state trends in terms of its elderly population with the 65 and older age group showing the largest gains in share through 2050, at which time 19 percent of the population will be in this age group. This share will be only slightly smaller than the 20.5 percent share for young children. Large youth and elderly populations will mean a decline in the working age population.

2.2.2 Employment

The Satilla River basin supported 182,100 jobs in 1995. It is moving from a manufacturing- to a service-based economy. In the coming years, a decrease in jobs is expected in manufacturing and durable goods, offset by an increase in jobs in the service and trade sectors.

The Satilla River basin has historically been less dependent on manufacturing industries than is the rest of Georgia. In 1975, only 21 percent of the river basin's jobs were in industrial sectors, as compared with 24 percent statewide. As manufacturing sectors have declined across the state, Georgia as a whole is beginning to look more like Satilla in terms of industrial mix. In fact, by 2050, only 4 percent of jobs, both within the river basin and within the state, are forecast to be in manufacturing sectors. One important sector for Satilla is paper, in which the river basin's 4,800 jobs constitute 14 percent of the state's paper industry. In terms of job losses between 1995 and 2050, however, the most significant sector is durable goods, in which more than one-half of the 28,800 jobs will no longer be present in 2050. This decline accounts for 47 percent of all employment losses in industrial sectors. The nonmanufacturing sectors, in particular the service sector, will offset these job losses. By 2050, services will account for 40 percent of river basin employment, growing at an annual rate of 1.9 percent. The trade sector will also remain important for the area, keeping a nearly constant employment share of 24 percent until the end of the 55-year forecast horizon.

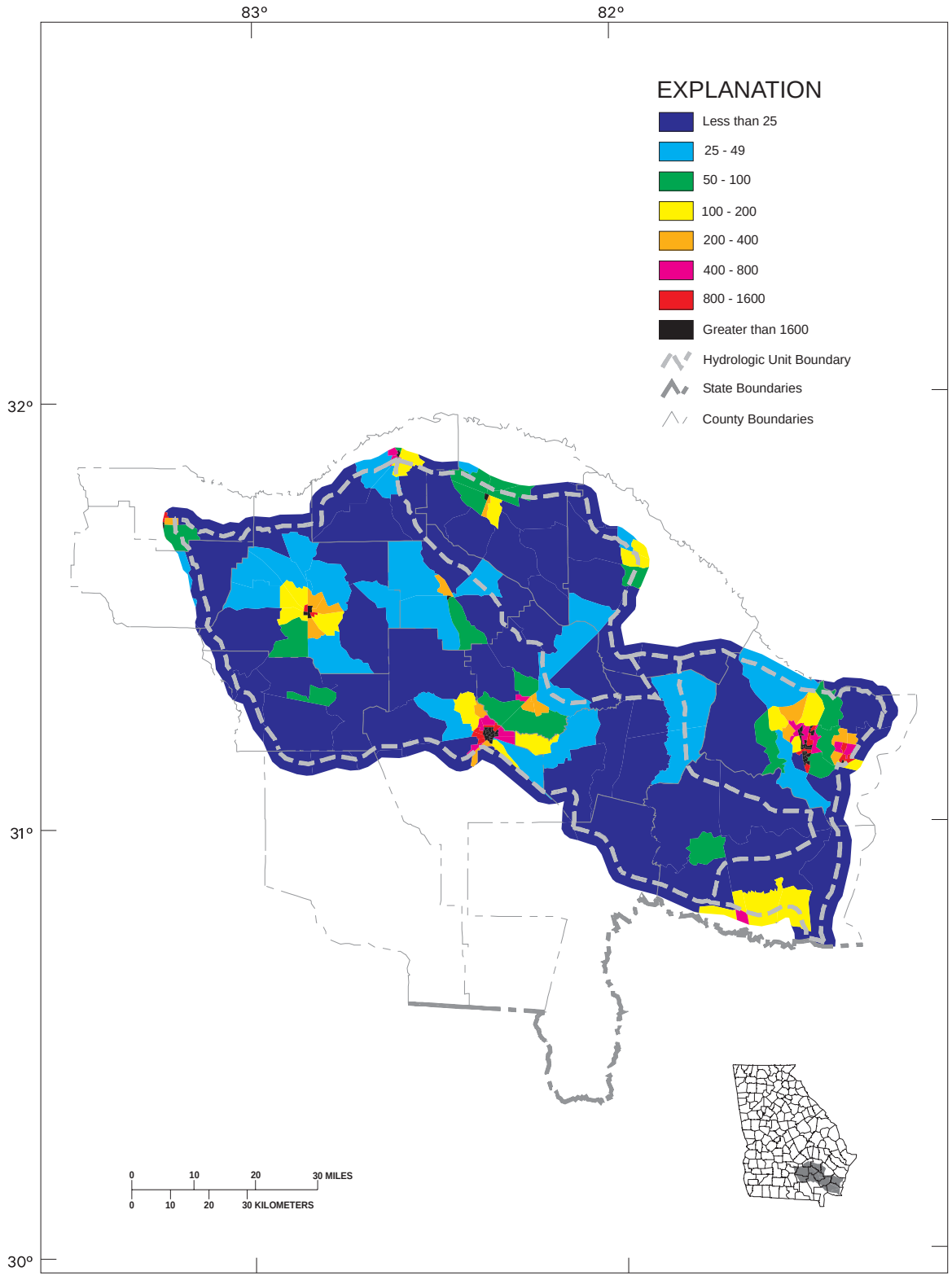


Figure 2-7. Population Density in the Satilla River Basin, 1990 (persons per square mile)

2.2.3 Land Cover and Use

Land use/land cover classification (Figure 2-8 through 2-13) was determined for the Satilla River Basin based on high-altitude aerial photography for 1972-76 (U.S. Geological Survey, 1972-78). Subsequently in 1991 land cover data were developed based on interpretation of Landsat TM satellite image data obtained during 1988-90, leaf-off conditions. These two coverages differ significantly. Aerial photography allows identification of both land cover and land uses. Satellite imagery, however, detects primarily land cover, and not land use, such that a forest and a wooded subdivision may, for instance, appear similar. Satellite interpretation also tends to be less accurate than aerial photography.

The 1988-90 land cover interpretation showed 37 percent of the basin in forest cover, 24 percent in wetlands, 2 percent in urban land cover, and 18 percent in agriculture (Figures 2-11 through 2-13). Statistics for 15 landcover classes in the Georgia portion of the Satilla River basin for the 1988-90 coverage are presented in Table 2-2 (GA DNR, 1996).

Table 2-2. Land Cover Statistics for the Satilla Basin

Class Name	%	Acres
Open Water	2.4	61,992.9
Clear Cut/Young Pine	17.0	449,475.7
Pasture	4.1	107,009.6
Cultivated/Exposed Earth	14.3	378,019.0
Low Density Urban	1.4	37,565.8
High Density Urban	0.5	12,637.3
Emergent Wetland	1.8	47,038.8
Scrub/Shrub Wetland	0.6	15,024.9
Forested Wetland	16.3	429,619.8
Coniferous Forest	16.0	421,808.0
Mixed Forest	14.5	383,597.5
Hardwood Forest	6.3	164,872.1
Salt Marsh	3.0	80,118.8
Brackish Marsh	1.6	40,772.4
Tidal Flats/Beaches	0.3	6,821.9
Total	*100.0*	*2,637,771.0*

Forestry

Forestry is a major part of the economy within the basin. Markets for forest products afford landowners excellent investment opportunities to manage and sell their timber, pine straw, naval stores, etc., products. Statewide, the forest industry output for 1997 grew to approximately $19.5 billion dollars. The value added by this production, which includes wages, profits, interest, rent, depreciation and taxes paid into the economy reached a record high $9.3 billion dollars. Georgians are benefited directly by 177,000 job opportunities created by the manufacture of paper, lumber, furniture and various other wood products as well as benefiting the consumers of these products. Other benefits of the forest include hunting, fishing, aesthetics, wildlife watching, hiking, camping and other recreational opportunities as well as providing important environmental benefits such as clean air and water and wildlife habitat.

According to the US Forest Service's Forest Statistics for Georgia, 1997 report (Thompson, 1997), there is approximately 3,365,100 acres of commercial forestland for the entire counties within the basin. Approximately 69 percent of the total land area is

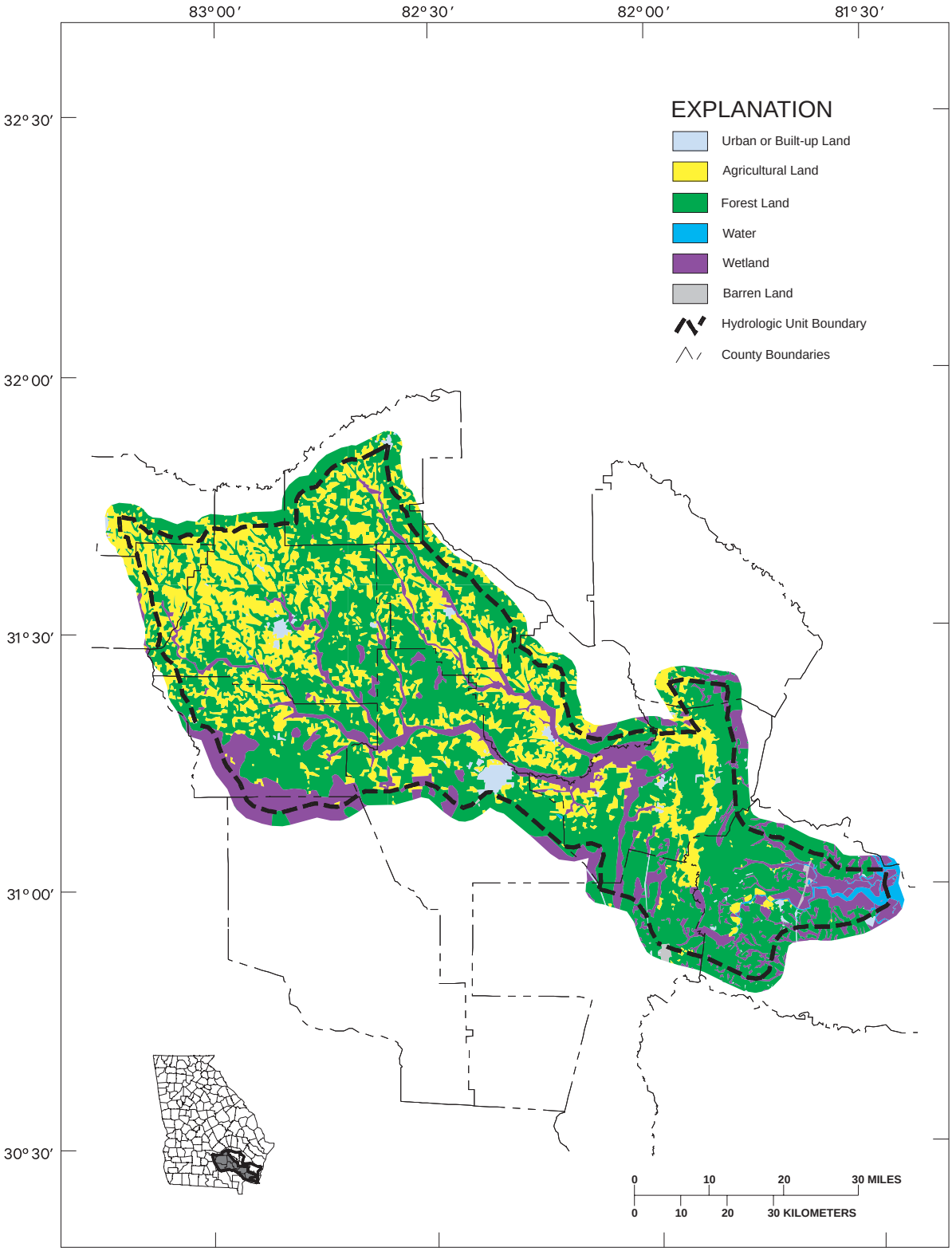


Figure 2-8. Land Use, Satilla River Basin, HUC 03070201, USGS 1972-76 Classification Updated with 1990 Urban Areas

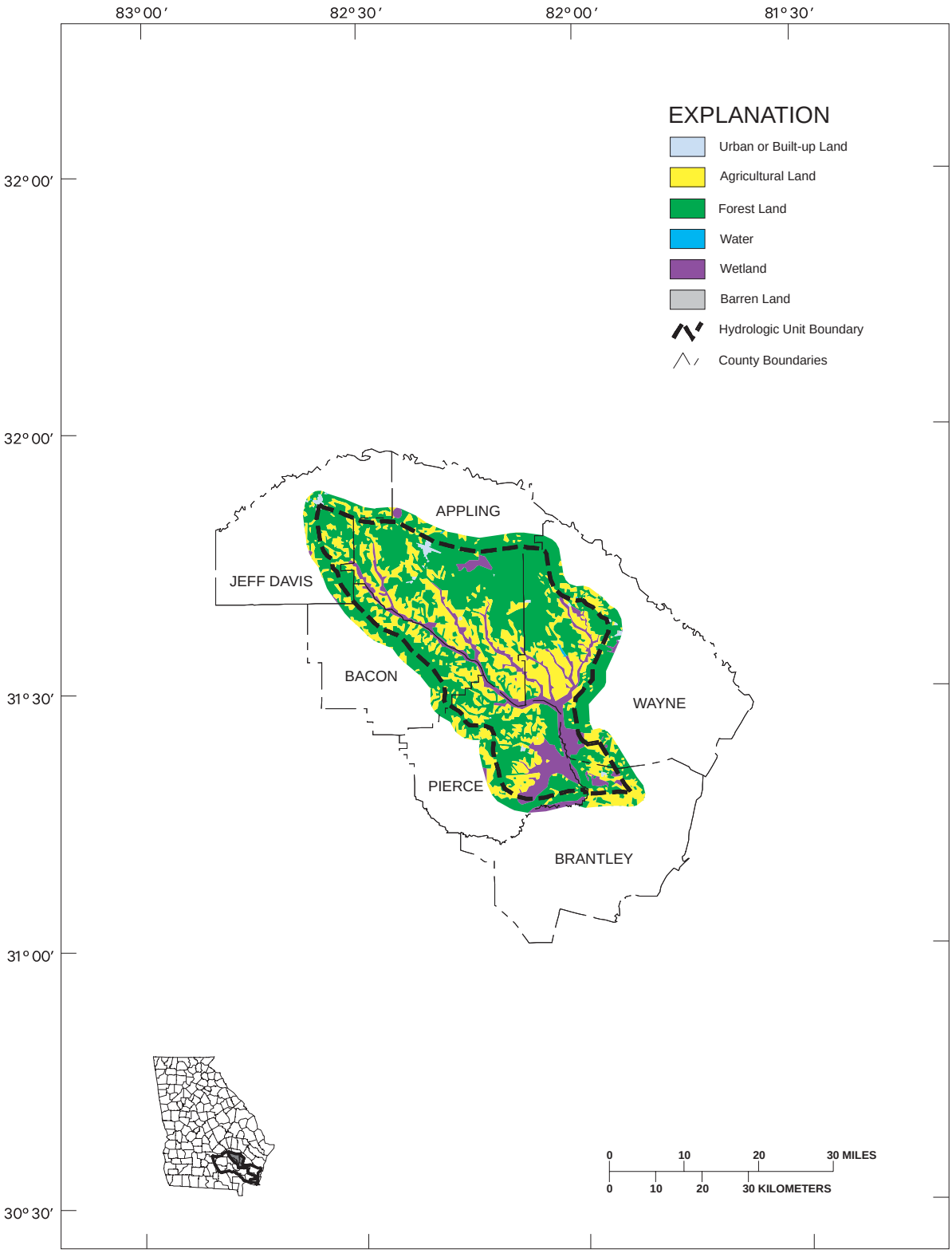


Figure 2-9. Land Use, Satilla River Basin, HUC 03070202, USGS 1972-76 Classification Updated with 1990 Urban Areas

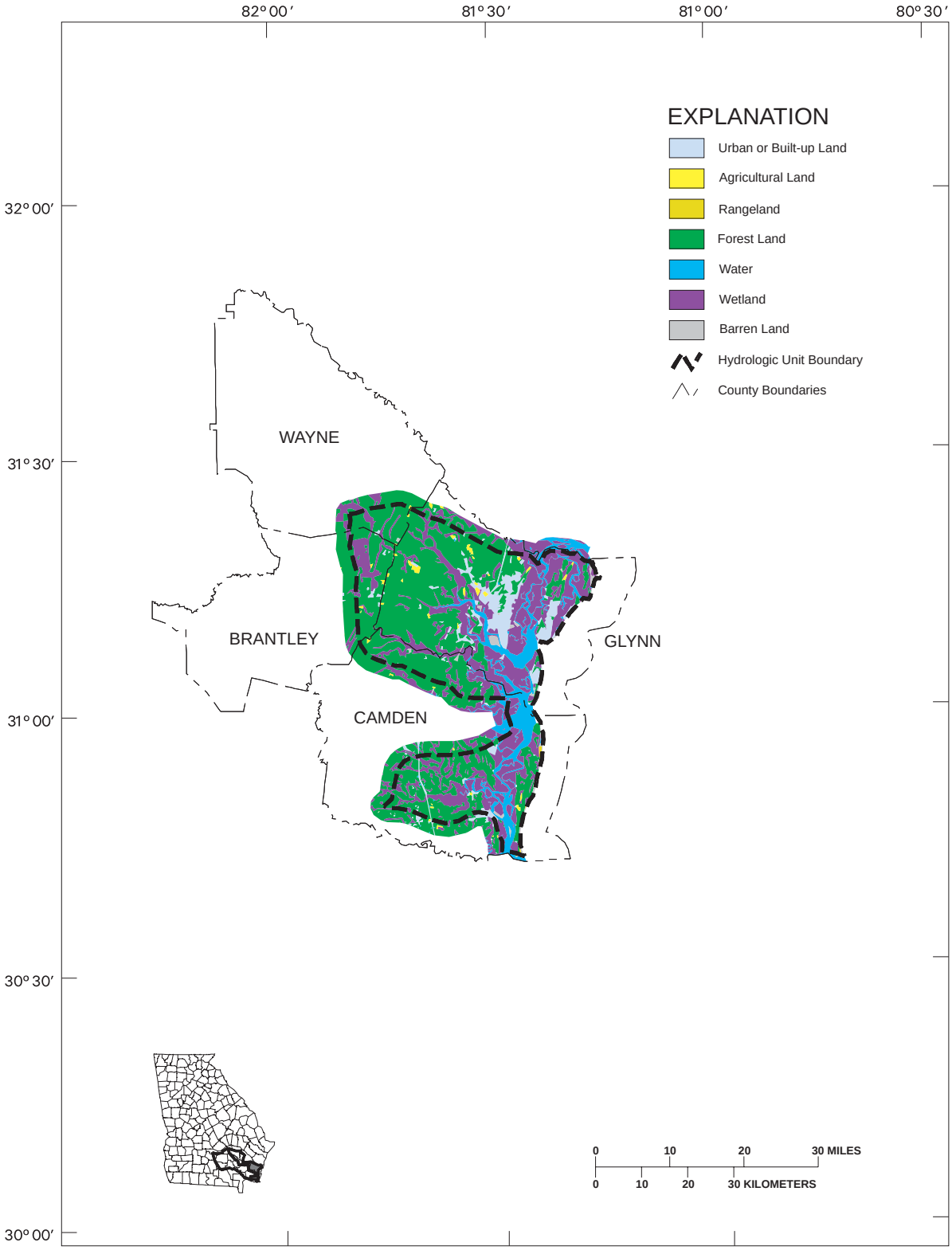


Figure 2-10. Land Use, Satilla River Basin, HUC 03070203, USGS 1972-76 Classification Updated with 1990 Urban Areas

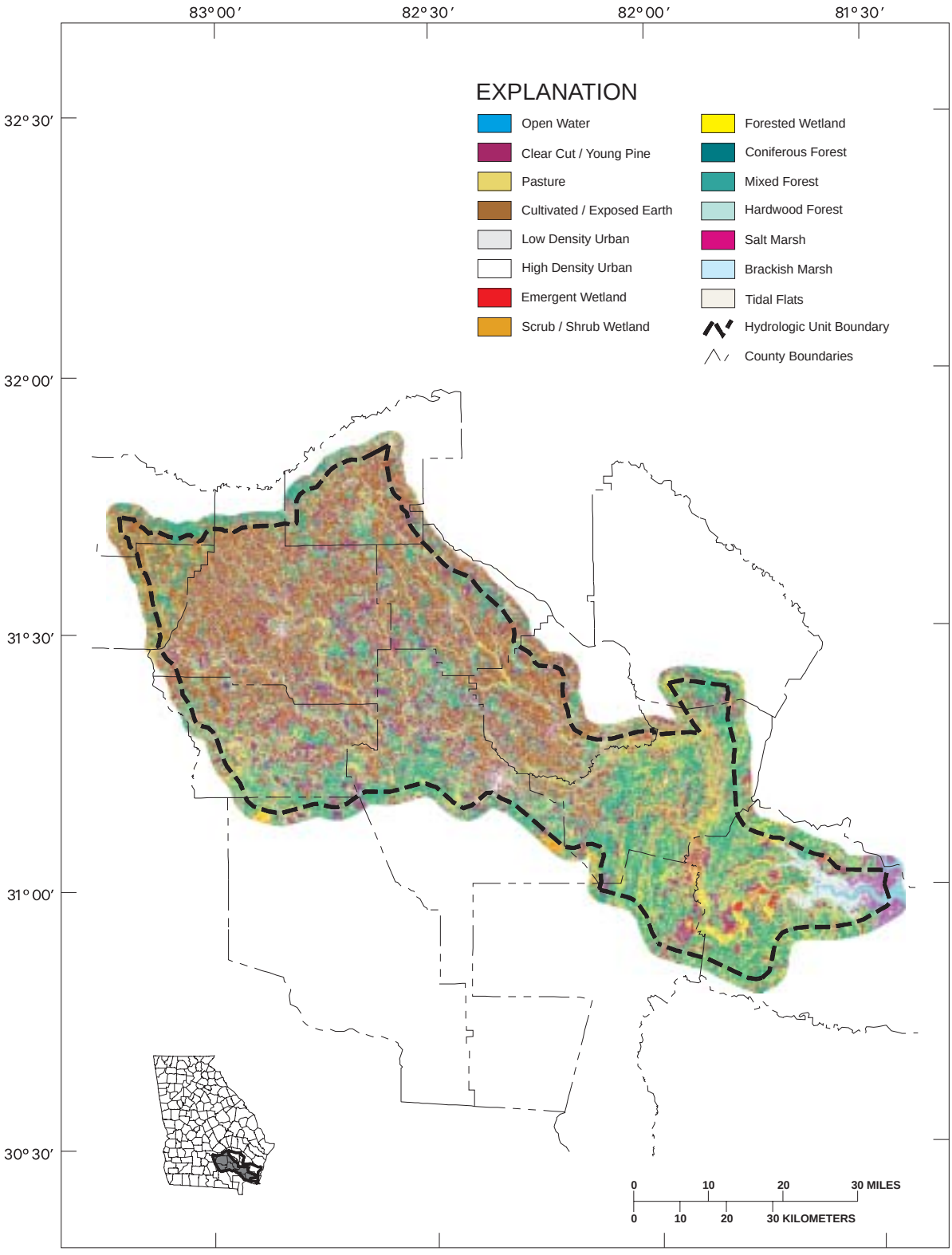


Figure 2-II. Land Cover 1990, Satilla River Basin, HUC 03070201

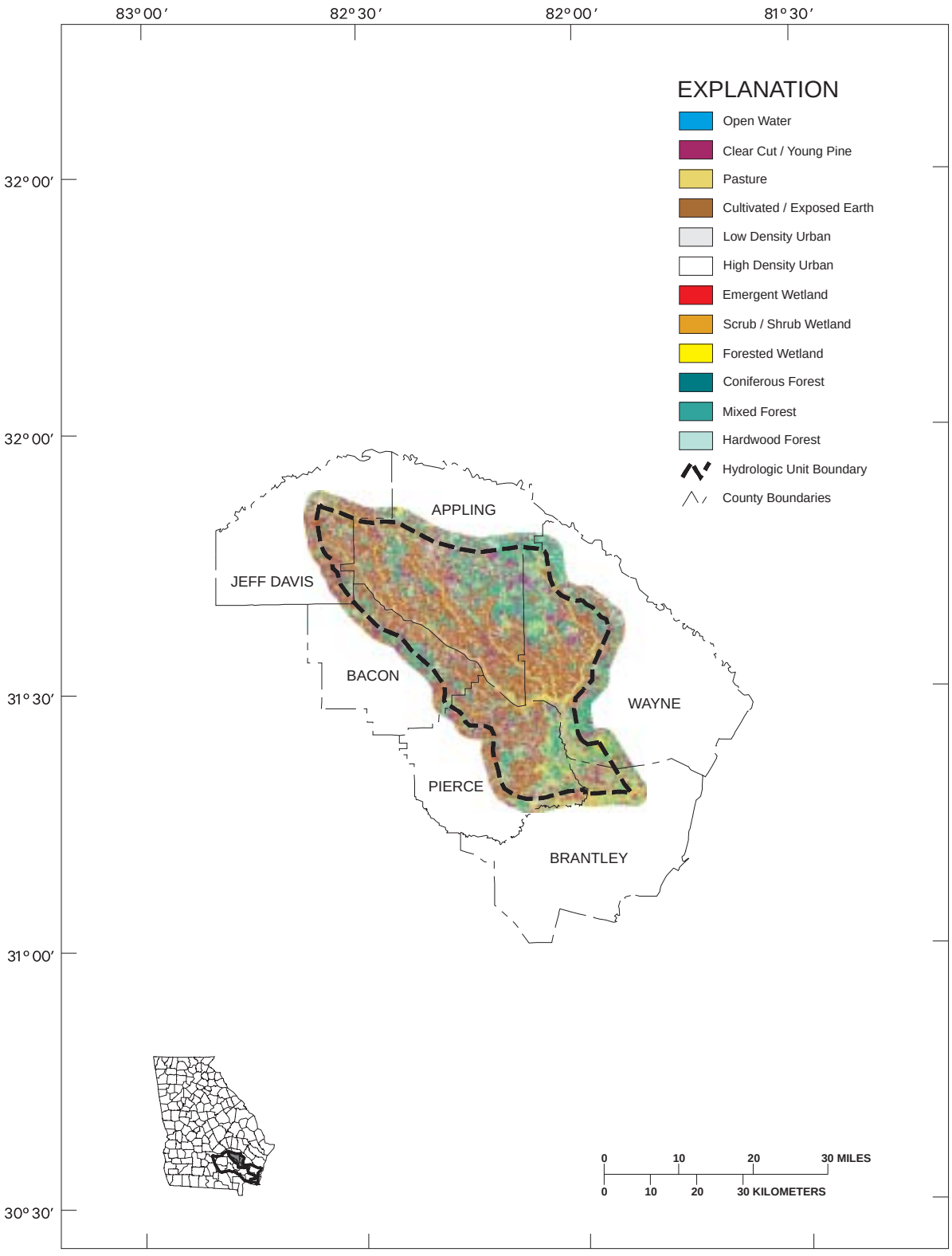


Figure 2-I2. Land Cover I990, Satilla River Basin, HUC 03070202

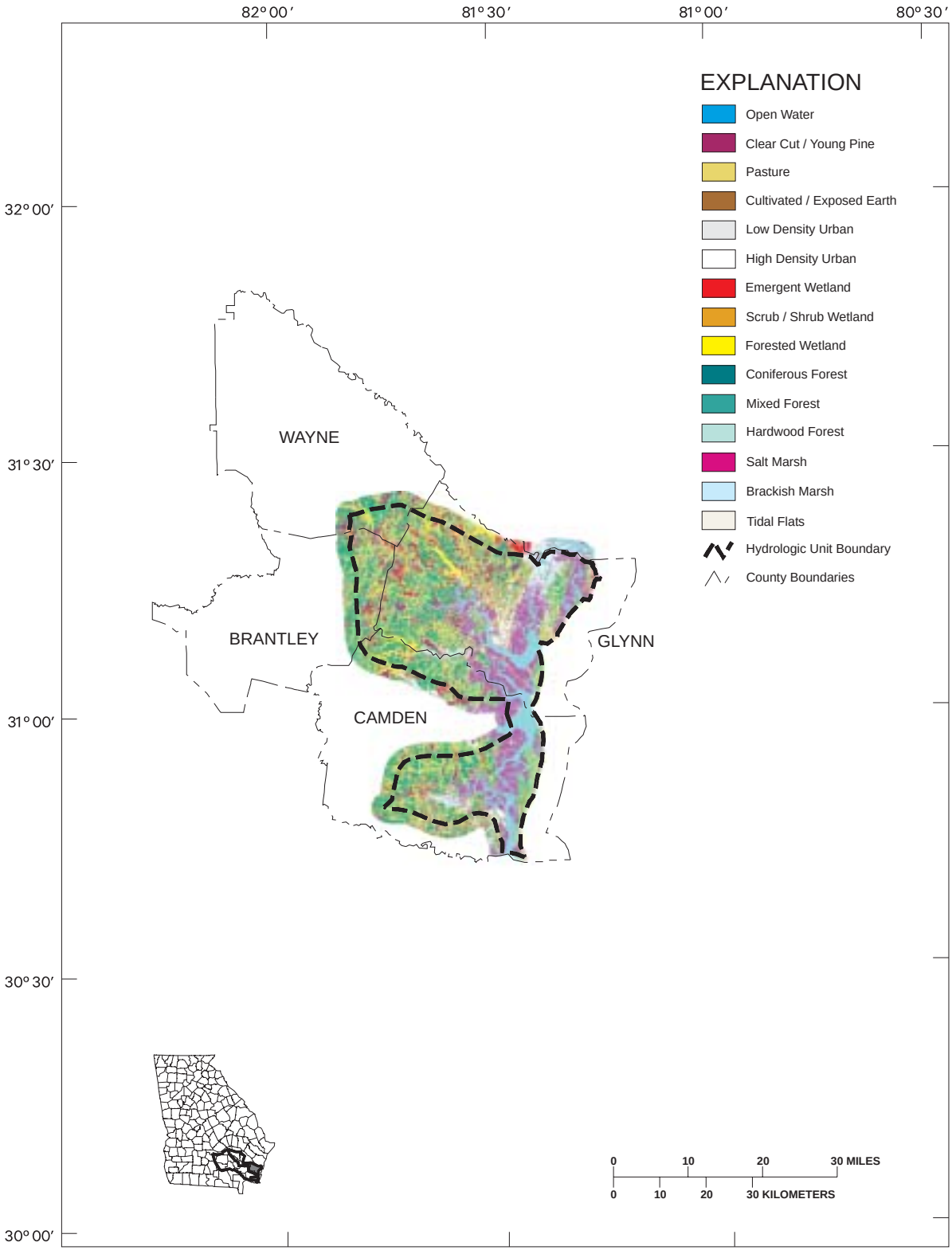


Figure 2-I3. Land Cover I990, Satilla River Basin, HUC 03070203

commercial forest. Private landowners account for 54 percent of the commercial forest ownership while the forest industry companies account for 43 percent. Governmental entities account for about 3 percent of the forestland. Figure 2-14 depicts silvicultural land use in the Satilla basin. Forestry acreage in the Satilla River basin is summarized in Table 2-3.

Table 2-3. Forestry Acreage in the Satilla River Basin

County	Commercial Forest	Pine	Oak-pine	Upland Hardwood	Lowland Hardwood
Appling	222,000	145,800	23,800	5,800	40,100
Atkinson	169,900	94,500	11,300	10,600	42,200
Bacon	122,100	75,400	10,700	6,300	26,900
Ben Hill	109,500	67,200	16,800	2,300	15,200
Brantley	237,100	129,500	31,600	5,500	63,200
Camden	267,600	138,600	29,700	9,000	86,000
Charlton	307,100	202,000	41,200	7,300	38,400
Clinch	469,100	309,600	36,400	0	108,400
Coffee	240,900	137,900	30,400	8,800	53,000
Glynn	147,400	88,400	10,700	5,200	31,400
Irwin	117,500	58,600	24,300	9,500	25,100
Jeff Davis	151,600	101,100	20,400	4,900	20,300
Pierce	135,900	62,600	16,000	6,100	41,900
Ware	345,100	228,700	32,400	0	66,400
Wayne	322,300	197,100	32,600	25,100	54,000
Total	*3,365,100*	*2,037,000*	*368,300*	*106,400*	*712,500*

For the period from 1982 to 1997, for the entire counties within the basin, the area classified as commercial forestland decreased approximately 1/2 percent. The area classified as pine type decreased approximately 6 percent. The area classified as oak-pine type increased approximately 19 percent. The area classified as upland hardwood decreased approximately 35 percent. The area classified as bottomland hardwood decreased approximately 6 percent. Approximately 141,100 acres were classified as non-stocked.

Agriculture

Agriculture in the Satilla River Basin is a varied mix on animal operations and commodity production. Some 17 percent of the land use in the basin soils that vary considerably from west to east across the area.

In 1997, there were some 464,292 acres devoted to agricultural production (Figure 2-15). All major commodities that are grown in Georgia (peanuts, corn, cotton, oats, rye, sorghum, soybeans, and tobacco) are produced in the Basin. Irwin County ranks 6th in the State in corn production. Coffee County is among the state leaders in cotton and tobacco production.

Orchard production is relatively limited in the Basin. However, Bacon County is 10th in peach production. Vegetable production is also active in the area.

Georgia's irrigation permit database shows 1,925 irrigation permits have been issued for the purpose of agricultural irrigation in the Satilla River Basin. Commodity producers, in the counties that comprise the Basin, applied some 47.05 million gallons of water per day for supplemental irrigation to over 85,912 acres. This equates to an average of 7.3 inches per acre for 1995. A majority of agricultural water use for irrigation came from groundwater sources, some 67 percent, in 1995. Coffee and Pierce Counties contain the largest number of irrigated acres in the Basin.

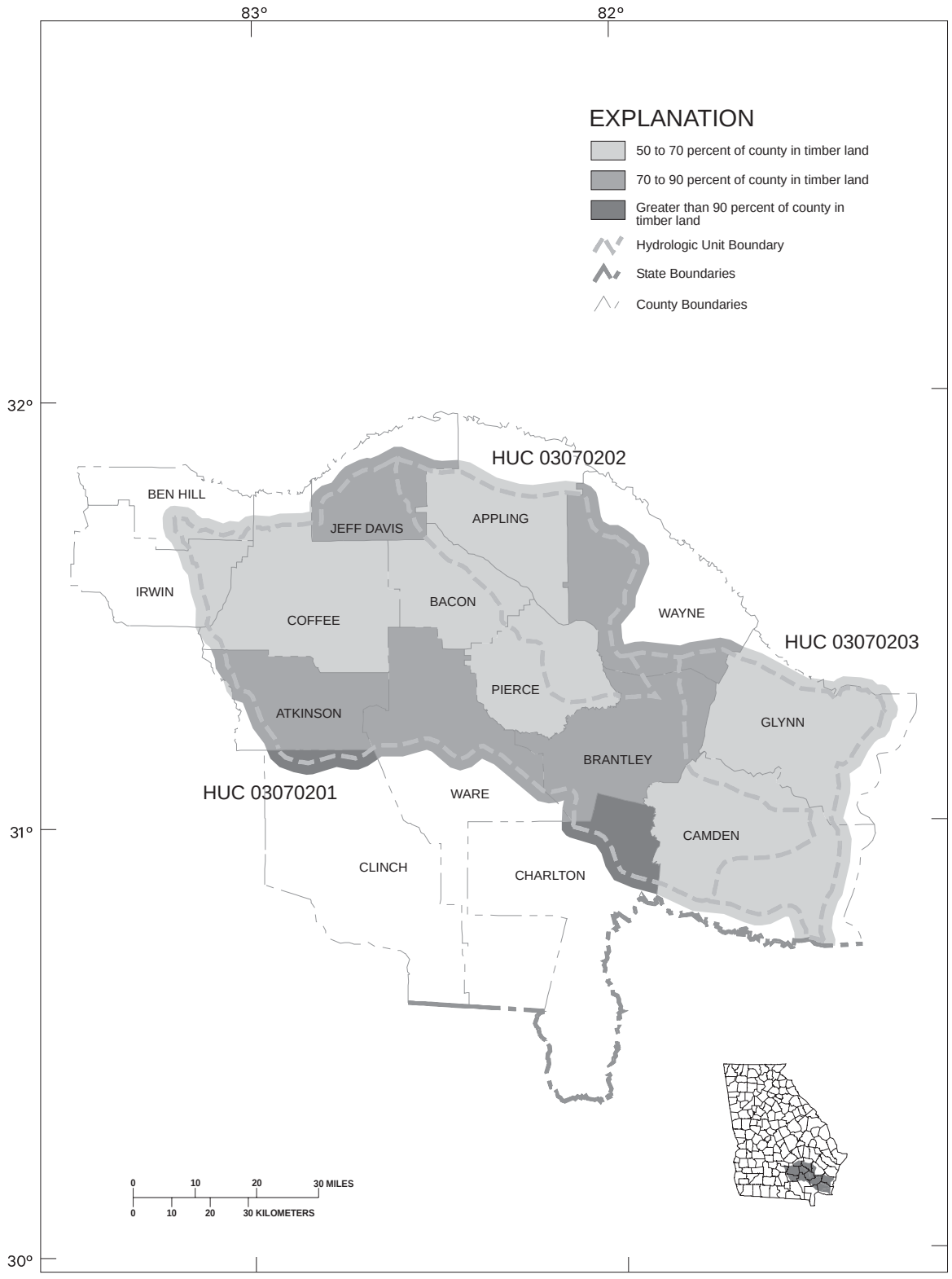


Figure 2-14. Silvicultural Land in the Satilla River Basin

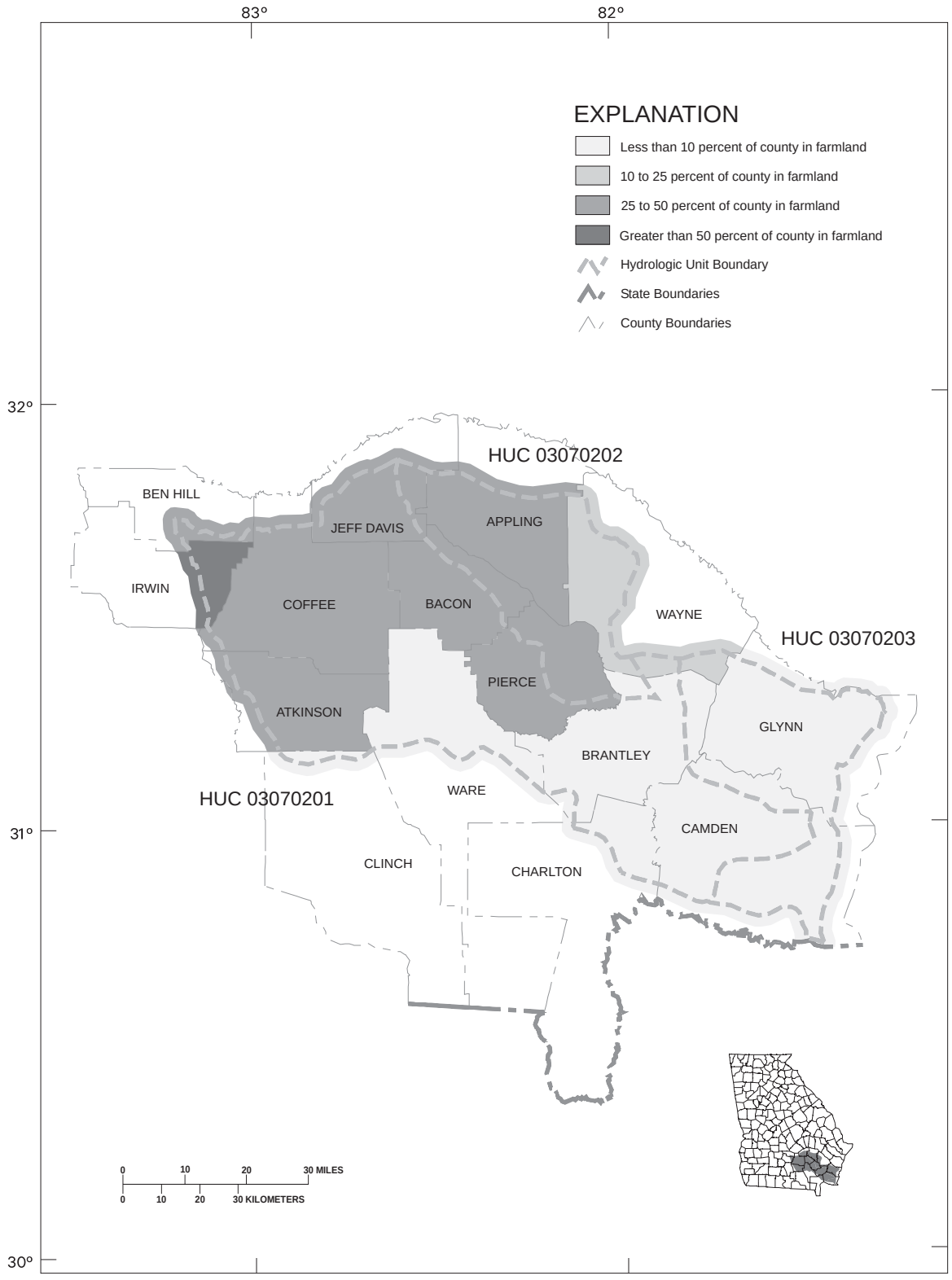


Figure 2-15. Agricultural Land in the Satilla River Basin

In addition to commodity production, animal agriculture is prominent in the Satilla River Basin as well. Table 2-4 shows number of animals by sector within the animal agricultural industry in the Basin. Coffee County, a major agricultural county, ranks the State's highest producers in cattle, swine, broiler, and layer production. Appling County has significant milk production from dairies ranking them 5th in Georgia with the number of dairy cattle on farm.

Table 2-4. Agricultural Operations in the Satilla River Basin (data supplied by NRCS)

Element	Watershed 03070201	Watershed 03070202	Watershed 03070203	Satilla Basin Total
Acres	271758	109822	14164	395743
Dairy Cattle (Head 1997)	2313	3783	19	6116
All Cattle and Calves (Head 1997)	38535	10497	1473	50505
Hogs and Pigs (Head 1996)	50544	12492	454	63490
Boilers (thousands, 1997)	51340907	4220693	0	55561600
Layers (thousands, 1997)	2142717	309967	215720	2668403
Irrigated Acres (1995)	39664	10956	472	51091
Total Agriculture Acres (1989-1997)	323179	125991	15122	464292

Collectively, across all animal operations, there are an estimated 212,044 Animal Units [AUs] in the Basin. AUs are defined here as 1000 lb. Animal Equivalents. Animal operations, in the counties that comprise the Basin, used some 2.27 million gallons of water per day in 1995. Additionally, some 2.9 million tons per year of animal waste was generated on these operations. Producers handle animal waste through various management activities that utilize nutrients, and other soil amendment benefits, for commodity production.

Agriculture is a key component of the Satilla River Basin's economy. In 1997, agriculture contributed over $2.2 billion to the local economy. Along with significant agricultural production, however, comes an increased potential for agricultural non-point source pollution. As a part of the river basin planning process, the Georgia Soil and Water Conservation Commission (GSWCC)—with technical assistance from the Natural Resources Conservation Service (NRCS)—assess agricultural impacts on water quantity and water quality. Historical, present, and future agricultural water demand is assessed in Section 3; while agricultural non-point source pollution is assessed in Section 4.

2.3 Local Governments and Planning Authorities

Many aspects of basin management and water quality protection depend on decisions regarding zoning, land use, and land management practices. These are particularly important for the control of nonpoint pollution—pollution that arises in storm water runoff from agriculture, urban or residential development, and other land uses. The authority and responsibility for planning and control of these factors lies with local governments, making local governments and jurisdictions important partners in basin management.

The Department of Community Affairs (DCA) is the state's principal department with responsibilities for implementing the coordinated planning process established by the Georgia Planning Act. Its responsibilities include promulgation of minimum standards for preparation and implementation of plans by local governments, review of local and regional plans, certification of qualified local governments, development of a state plan, and provision of technical assistance to local governments. Activities under the Planning Act are coordinated with the Environmental Protection Division (EPD), Regional Development Centers (RDCs), and local governments.

2.3.1 Counties and Municipalities

Local governments in Georgia consist of counties and incorporated municipalities. As entities with constitutional responsibility for land management, local governments have a significant role in the management and protection of water quality. The role of local governments includes enacting and enforcing zoning, storm water and development ordinances; undertaking water supply and wastewater treatment planning; and participating in programs to protect wellheads and significant ground water recharge areas. Many local governments are also responsible for operation of water supply and wastewater treatment facilities.

The Satilla River basin includes part or all of 15 Georgia counties (Table 2-5 and Figure 2-2); however, only two are entirely within the basin, and four counties have a small fraction (<20 percent) of their land area within the basin. Thus there are a total of 9 counties with significant jurisdictional area in the basin. Municipalities or cities are communities officially incorporated by the General Assembly. Georgia has more than 530 municipalities. Table 2-6 lists the municipalities in the Satilla River basin.

Table 2-5. Georgia Counties in the Satilla River Basin

Counties Entirely Within the Satilla River Basin	Counties Partially Within the Satilla River Basin	Counties With Less Than 20% Area Within the Basin
Bacon, Pierce	Coffee, Atkinson, Ware, Camden, Glynn, Brantley, Appling, Wayne, Jeff Davis	Ben Hill, Irwin, Clinch, Charlton

Table 2-6. Georgia Municipalities in the Satilla River Basin

HUC 03070201				
Alma	Bushnell	Millwood	Rovkingham	West Green
Ambrose	Denton	Mora	Sessoms	White Oak
Atkinson	Dixie Union	Nahunta	Silco	Winokur
Axson	Douglas	Nicholls	Snipesville	Withlaacoochee
Beach	Hickox	Osterfield	Tarboro	Woodbine
Blackshera	Hoboken	Pearson	Upton	Wray
Bolen	Jerusalem	Pridgen	Waresboro	
Brickley	Kirkland	Raybon	Waverly	
Broxton	Lulaton	Roper	Waycross	
HUC 03070202				
Baxley	Hortense	Offerman	Screven	
Bristol	Mershon	Patterson	Surrency	
Hazlehurst	Ocum	Pine Grove	Trudie	
HUC 03070203				
Arco	Glynn Haven	Pyles Marsh	St. Simons	Thalmann
Brunswick	Harrington	Sea Island	Sterling	Waynesboro

2.3.2 Regional Development Centers

Regional Development Centers (RDCs) are agencies of local governments, with memberships consisting of all the cities and counties within each RDC's territorial area. There are currently 16 RDCs in Georgia. RDCs facilitate coordinated and comprehensive planning at local and regional levels, assist their member governments with conformity to minimum standards and procedures, and can have a key role in promoting and supporting management of urban runoff, including watershed management initiatives. RDCs also serve as liaisons with state and federal agencies for local governments in each region.

Funding sources include members' dues and funds available through DCA. Table 2-7 summarizes the RDCs and the associated counties within the Satilla River basin.

Table 2-7. Regional Development Centers in the Satilla River Basin

Regional Development Center	Member Counties with Land Area in the Satilla Basin
Southeast Georgia	Coffee, Atkinson, Clinch, Ware, Charlton, Brantley, Pierce, Bacon
Heart of Georgia – Altamaha	Appling, Wayne, Jeff Davis
South Georgia	Ben Hill, Irwin
Coastal Georgia	Glynn, Camden

2.4 Water Use Classifications

2.4.1 Georgia's Water Use Classification System

The Board of Natural Resources was authorized through the Rules and Regulations for Water Quality Control promulgated under the Georgia Water Quality Control Act of 1964, as amended, to establish water use classifications and water quality standards for the surface waters of the State.

The water use classifications and standards were first established by the Georgia Water Quality Control Board in 1966. Georgia was the second state in the nation to have its water use classifications and standards for intrastate waters approved by the federal government in 1967. For each water use classification, water quality standards or criteria were developed which established a framework to be used by the Water Quality Control Board and later the Environmental Protection Division in making water use regulatory decisions.

The water use classification system was applied to interstate waters in 1972 by the EPD. Georgia was again one of the first states to receive federal approval of a statewide system of water use classifications and standards. Table 2-8 provides a summary of water use classifications and criteria for each use.

Congress made changes in the CWA in 1987 that required each state to adopt numeric limits for toxic substances for the protection of aquatic life and human health. To comply with these requirements, the Board of Natural Resources adopted 31 numeric standards for protection of aquatic life and 90 numeric standards for the protection of human health. Appendix B provides a summary of toxic substance standards that apply to all waters in Georgia. Water quality standards are discussed in more detail in Section 5.2.1.

Table 2-8. Georgia Water Use Classifications and Instream Water Quality Standards for Each Use

	Bacteria (fecal coliform)		Dissolved Oxygen (other than trout streams)[2]		pH	Temperature (other than trout streams)[2]	
Use Classification[1]	30-Day Geometric Mean[3] (no/100 ml)	Maximum (no./100ml)	Daily Average (mg/l)	Minimum (mg/l)	Std. Units	Maximum Rise above Ambient (°F)	Maximum (°F)
Drinking Water requiring treatment	1,000 (Nov-April) 200 (May-October)	4,000 (Nov-April)	5.0	4.0	6.0-8.5	5	90
Recreation	200 (Freshwater) 100 Coastal)	--	5.0	4.0	6.0-8.5	5	90
Fishing	1,000 (Nov-April)	4,000 (Nov-April)	5.0	4.0	6.0-8.5	5	90
Coastal Fishing[4]	200 (May-October)						
Wild River	No alteration of natural water quality						
Scenic River	No alteration of natural water quality						

[1] Improvements in water quality since the water use classifications and standards were originally adopted in 1972 provided the opportunity for Georgia to upgrade all stream classifications and eliminate separate use designations for "Agriculture", "Industrial", "Navigation", and "Urban Stream" in 1993.

[2] Standards for Trout Streams for dissolved oxygen are an average of 6.0 mg/l and a minimum of 5.0 mg/l. No temperature alteration is allowed in Primary Trout Streams and a temperature change of 2°F is allowed in Secondary Trout Streams.

[3] Geometric means should be "based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours." The geometric mean of a series of N terms is the Nth root of their product. Example: the geometric mean of 2 and 18 is the square root of 36.

[4] Standards are same as fishing with the exception of dissolved oxygen which is site specific.

In the latter 1960s through the mid-1970s there were many water quality problems in Georgia. Many stream segments were classified for the uses of navigation, industrial, or urban stream. Major improvements in wastewater treatment over the years have allowed the stream segments to be raised to the uses of fishing or coastal fishing which include more stringent water quality standards. The final two segments in Georgia were upgraded as a part of the triennial review of standards completed in 1989. All of Georgia's waters are currently classified as either fishing, recreation, drinking water, wild river, scenic river, or coastal fishing.

2.4.2 Water Use Classifications for the Satilla River Basin

Waters in the Satilla River basin are classified as fishing, recreation, drinking water, or wild and scenic. Most of the waters are classified as fishing. Those waters explicitly classified in Georgia regulations are shown in Table 2-9; all waters not explicitly classified are classified as fishing.

Table 2-9. Satilla River Basin Waters Classified in Georgia Regulations[1]

Waterbody	Segment Description	Use Classification
Littoral Waters	All littoral waters on the ocean side of Cumberland and Jekyll Islands	Recreation

[1] Rules and Regulations for Water Quality Control, Chapter 391-3-6(13). Waters within the Satilla River basin not explicitly classified and listed above are classified as Fishing.

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In This Section

- Drinking Water Supply
- Surface Water Quantity
- Ground Water Quantity

Section 3

Water Quantity

This section addresses water quantity issues (availability and use), while water quality in the Satilla basin is the subject of Section 4. Water use in the Satilla River basin is measured by estimates of freshwater withdrawn from groundwater and surface water. Uses of water include both consumptive and nonconsumptive uses.

Groundwater is the primary water source in the Coastal Plain Province of the Satilla River basin. Principal aquifers of the Coastal Plain include the Floridan aquifer system, the Upper Brunswick and Lower Brunswick aquifers, the Claiborne and Clayton aquifers and the Cretaceous system.

The Floridan aquifer system supplies most of the ground water used in the Satilla basin. This system consists primarily of limestone, dolostone, and calcareous sand. It is generally confined, but is semiconfined to unconfined near its northern limit. Wells in this aquifer system are generally high-yielding and are extensively used for irrigation, municipal supplies, industries and private domestic supply.

Water use in the Satilla River Basin is expected to increase in the near future due to average population growth rates.

In the following sections, water availability is discussed from a number of viewpoints. First, the important topic of drinking water is presented, which includes both surface and ground water supplies. Then, general surface water availability is presented, followed by ground water availability.

3.1 Drinking Water Supply

3.1.1 Drinking Water Supplies in the Satilla River Basin

A public water system pipes water for human consumption and has at least 15 service connections or regularly serves at least 25 individuals 60 or more days out of the year. Public water system sources include surface water pumped from rivers and creeks or ground water pumped to the surface from wells or naturally flowing water from springs.

Unlike other basins in Georgia, the main source of drinking water in the Satilla basin is provided by ground water. There are three different types of public water systems: community, non-community non-transient, and non-community transient.

Types of Public Water Systems

A community public water system serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents. Examples of community water systems are municipalities, such as cities, counties, and authorities which serve residential homes and businesses located in the areas. Other types of community public water systems include rural subdivisions or mobile home parks which have a large number of homes connected to a private public water system, usually a small number of wells.

A non-community non-transient public water system serves at least 25 of the same persons over six months per year. Examples of non-community non-transient systems are schools, office buildings, and factories which are served by a well.

A non-community transient public water system does not meet the definition of a non-community non-transient system. A non-community transient public water system provides piped water for human consumption to at least 15 service connections or which regularly serves at least 25 persons at least 60 days a year. Examples of a non-community transient are highway rest stops, restaurants, motels, and golf courses.

Private domestic wells serving individual houses are not covered by the state's public water system regulations. However, the regulations for drilling domestic wells are set by the Water Well Standards Act and the local health department is responsible for insuring water quality.

3.1.2 Drinking Water Demands

Over the next few years it is estimated that there will be an increase in the use of groundwater to be used for drinking water from the Satilla River basin. Areas that are expected to increase include Ware, Camden and Glynn counties

3.1.3 Drinking Water Permitting

The Georgia Safe Drinking Water Act of 1997, the Rules for Safe Drinking Water (391-3-5) adopted under the act require any person who owns and/or operates a public water system to obtain a permit to operate a public water system from the Environmental Protection Division. The permitting process has three phases: Inquiry and Discovery, Technical Review, and Permitting. During these phases the owners must provide a detailed description of the project; demonstrate the reliability of the water source; render engineering plans and specifications prepared by a professional engineer demonstrating the construction integrity of wells, treatment and distribution; conduct preliminary water sample testing; and legal documentation including an application to operate a public water system. Permits contain specific conditions the owner must meet for different types of public water systems, including a list of approved water sources, filter rates, disinfection and treatment requirements, compliance with sample testing schedule, and number of allowed service connections. Permits are issued for 10 years and are renewable.

3.2 Surface Water Quantity

3.2.1 Surface Water Supply Sources

The Satilla River basin is a 3940 square-mile landmass, which includes all of Bacon, Brantley, and Pierce counties and portions of twelve others. The basin's major surface water body, the Satilla River meanders easterly for almost 250 miles prior to discharging into the Atlantic Ocean about ten miles south of Brunswick, between Jekyll Island and Cumberland Island.

As the basin name implies, the major surface water body is the Satilla River with an average annual discharge at its mouth of approximately 2700 cfs. However, there are several tributaries with significant flows of their own. Among the major streams are the Little Satilla River, Alabaha River, Big Satilla River, Seventeen Mile Creek and Hurricane Creek.

The areas of least surface water availability are the headwaters of most of the tributaries along the northern boundary of the Satilla River basin. As the tributaries approach their lower extremities and merge with other streams, the available flow becomes much more reliable. However, the topographical characteristics of the Satilla and other Coastal Plain basin are such that they do not produce surface runoff to the extent that the basins of the Piedmont, Valley and Ridge and Blue Ridge Mountains provinces do. Relatively small streams flow rates during low-flow periods typify rivers in the Coastal Plain. Indeed, many of the smaller streams have virtually no flow during extended dry periods.

3.2.2 Surface Water Supply Demands and Uses

Municipal and Industrial Demand

Municipal and Industrial (M&I) water demands include public supplied needs such as residential, commercial, governmental, institutional, manufacturing and other demands such as distribution system losses.

Currently, the Satilla River basin contains only two industrial surface water withdrawal permits. These are listed in Table 3-1, sorted by county. These permits are for users equal to or greater than 100,000 gallons per day. Users below this amount of surface water are not required to have a permit for their withdrawals.

Table 3-I. Surface Water Withdrawals

Facility	Type	Source	Mon Avg (Mgd)	Max Day (Mgd)	County
Brunswick Pulp and Paper Co.	Industrial	Turtle River	56.0	58.0	Glynn
Georgia Power Co- Mc Manus	Industrial	Turtle Creek	155.0	155.0	Glynn

Agricultural Water Demand

The demands on water resources for agricultural activities include irrigation for crops, nursery, and turf; drinking water for livestock and poultry; and, to a much lesser extent, water for aquacultural purposes. As of 1996, the EPD had issued 1829 agricultural permits for water withdrawal permits to entities located within the Satilla River Basin. Within Georgia, agricultural permit holders are by law (O.C.G.A. Section 12-5-31 et seq.) exempted from requirements to report their water use, which make determining exact historical, current, and future agricultural water demand rather challenging.

Irrigated Acreage

The total water demand from agriculture, including both surface water and ground water demand, may be estimated using a variety of agricultural data collected by multiple sources. NRCS has attempted to combine this information for the purpose of estimating historical, current, and future, agricultural water use in the basin. Table 3-2 shows historical irrigated acreage in the basin from 1974 to 1998.

Table 3-2. Irrigated Acres in the Satilla River Basin, 1974-1998.

Satilla River Basin - Irrigated Acres				
year	Sub-Basin 3070201	Sub-Basin 3070202	Sub-Basin 3070203	Basin Total
1974	3,646	1,454	171	5,271
1978	16,686	9,704	1,128	27,518
1979	23,168	10,414	890	34,472
1980	31,268	13,050	2,150	46,467
1981	26,113	16,943	2,035	45,091
1982	34,653	16,798	1,788	53,239
1984	31,761	17,010	2,275	51,047
1986	31,785	16,413	2,191	50,389
1989	26,887	27,984	2,014	56,886
1992	32,554	25,756	2,655	60,965
1995	33,143	26,222	2,703	62,069
1998	33,571	26,560	2,738	62,869

Source: USDA-NRCS estimates are based on county level data extrapolated to the basin.

Irrigated acres in the Satilla River Basin grew from 5,721 in 1974 to an all time maximum, for the Basin, of 62,869 in 1998. This represents an annual growth rate of 14.96 percent during the period of record. Much of this growth occurred in the 1970's during an extensive increase in the number of irrigation systems statewide, principally cable tow and center pivot systems. Since 1982, irrigated acreage across Georgia has continued to grow, but at a much slower rate, approximately 1.6 percent annually. Despite recent expansions in irrigated acreage, the Satilla River Basin over the same time period has experienced a slower an annual growth rate of 1.3 percent. Cotton, peanuts, and corn are the primary crops under irrigation.

Water Demand

Agricultural water demand is dependent upon a number of variable that include, but are not limited to, irrigated acreage, cropping mix and patterns, soil characteristics, climatic conditions, type of animal operation, best management practices, and market conditions. Water use in the Satilla River basin reflects the influence of these variables (Table 3-3). No distinct trend can be observed. From 1980 to 1995 there was an increase of 3 MGD from 21 MGD in 1980 to 24 MGD in 1995.

Over 93 percent of the agricultural water used in 1995 was for irrigation purposes (22.33 MGD). The remaining 7 percent (1.6 MGD) was used for animal operations. Ground water sources provided 58 percent of the water used by this industry in 1995.

Table 3-3. Historical Agricultural Water Use in the Satilla River Basin, 1980-1995.

Satilla River Basin - Agricultural Water Use				
year	3070201	3070202	3070203	Basin total
1980	13.94	6.64	0.82	21.40
1985	11.16	7.55	1.00	19.71
1987	10.40	10.91	1.17	22.48
1990	8.41	7.52	0.68	16.61
1995	14.95	8.11	0.86	23.92

Source: Georgia Geological Survey

Future Water Use

Agricultural producers are constantly reacting to changing climate and market conditions; thus, rendering any projections regarding future agricultural water use extremely difficult. Projecting irrigated acreage based on historical trends, and then assuming various water application rates, is likely the most stable approach to estimating future water use in this industry. Irrigation systems represent a significant investment for agricultural producers. Operational modifications based on changing climate and market conditions will occur on land under irrigation.

Table 3-4 shows the historical and projected acres under irrigation for the Satilla River Basin and each sub-basin. Assuming the 2.06 percent annual growth rate, observed in the Satilla River Basin between 1992 and 1998, continues; irrigated acreage in the Basin will reach 95,478 acres by the year 2020.

Table 3-4. Irrigated Acreage 1974-1998, Projected through 2020.

Satilla River Basin - Irrigated Acres				
year	Sub-Basin 3070201	Sub-Basin 3070202	Sub-Basin 3070203	Basin Total
1974	3,646	1,454	171	5,271
1978	16,686	9,704	1,128	27,518
1979	23,168	10,414	890	34,472
1980	31,268	13,050	2,150	46,467
1981	26,113	16,943	2,035	45,091
1982	34,653	16,798	1,788	53,239
1984	31,761	17,010	2,275	51,047
1986	31,785	16,413	2,191	50,389
1989	26,887	27,984	2,014	56,886
1992	32,554	25,756	2,655	60,965
1995	33,143	26,222	2,703	62,069
1998	33,571	26,560	2,738	62,869
2000	33,909	26,828	2,766	63,503
2005	37,549	29,707	3,063	70,319
2010	41,579	32,896	3,391	77,866
2015	46,042	36,426	3,756	86,224
2020	50,983	40,336	4,159	95,478

Source: USDA-NRCS estimates are based on county level data extrapolated to the basin.

Future agricultural water demand is expected to increase significantly within the basin to 53.27 MGD by the year 2020. Undesirable climate and favorable market conditions could force producers to demand as much as 85.22 MGD on the projected 95,478 acres under irrigation by that time. Conversely, desirable climate conditions and unfavorable market conditions may result in a much lower demand, 35.51 MGD by 2020. Table 3-5 shows the likely range of agricultural water demand in the basin through the year 2020.

The reader should note that significant increases in irrigated acreage will have the potential to result in a much higher demand.

Table 3-5. Projected Agricultural Water Use [MGD] through 2020.

Satilla River Basin - Agricultural Water Use			
Year	Low Scenario	Expected Scenario	High Scenario
2000	23.62	35.43	56.68
2005	26.15	39.23	62.77
2010	28.96	43.44	69.50
2015	32.07	48.10	76.96
2020	35.51	53.27	85.22

Source: USDA-NRCS estimates are based on average water application rates for all commodities.

Power Generation Water Demand

There are no power generating plants located within the Satilla basin that use the water resources of the basin.

Navigational Water Demand

There is no commercial navigation in the Satilla basin.

Recreation

Recreation activities in the Satilla River basin includes fishing, camping, boating, swimming, picnicking, and other activities.

Waste Assimilation Water Demand

Water quantity, wastewater treatment, and wastewater discharge permitting are addressed in Section 4. However, it should be noted that the guidelines for discharge of treated effluent into the rivers and streams of the Satilla River basin assume that sufficient surface water flow will be available to assimilate waste and ensure that water quality criteria will be met.

Environmental Water Demands

EPD recognizes the importance of maintaining suitable aquatic habitat in Georgia's lakes and streams to support viable communities of fish and other aquatic organisms. A significant issue that is receiving increasing attention from EPD is the minimum stream flow policy. EPD's current miimum stream flow policy is to protect the lowest seven-day average flow, which would have occured during any ten-year period for a stream (commonly called the 7Q10). EPD is considering increasing the minimum flow requirement under recommendations of the Wildlife Resources Division.

3.2.3 Surface Water Withdrawal Permitting

The 1977 Surface Water Amendments to the Georgia Water Quality Control Act of 1964 require all non-agricultural users of more than 100,000 GPD on a monthly average (from any Georgia surface water body) to obtain a permit for this withdrawal from EPD. These users include municipalities, industries, military installations, and all other non-agricultural users. The statute stipulates that all pre-1977 users who could establish the quantity of their use prior to 1977 would be "grandfathered" for that amount of withdrawal. Table 3-6 lists the permits in effect in the Satilla River basin.

Table 3-6 Active Municipal and Industrial Ground Water Withdrawal Permits in the Satilla River Basin

GEORGIA COUNTY	PERMIT NUMBER	PERMIT USER NAME	PERMITTED MONTHLY AVG W/D (MGD)	PERMITTED YEARLY AVG W/D (MGD)	PERMITTED AQUIFER
Glynn	063-0028	Glynn Brunswick Memorial Hospital	0.134	0.134	Floridan
Glynn	063-0003	Georgia-Pacific Corp (Brunswick Pulp Operation)	49.000	45.000	Floridan
Glynn	063-0008	Hercules, Incorporated	14.000	12.000	Floridan
Glynn	063-0011	Brunswick, City of - City System	6.400	5.900	Floridan
Glynn	063-0010	St. Simons Water & Sewer District	5.670	4.350	Floridan
Ware	148-0004	Waycross, City of - Ware County Industrial Park	3.400	3.000	Floridan
Ware	148-0001	Waycross, City of	3.160	2.600	Floridan
Glynn	063-0002	Jekyll Island Authority - Public Water System	2.150	1.850	Floridan
Camden	020-0007	Aventis CropScience USA LP	1.700	1.700	Floridan
Glynn	063-0009	Sea Island Services, Inc.	2.200	1.600	Floridan, Miocene
Appling	001-0002	Baxley, City of	1.400	1.400	Floridan
Ware	148-0005	Ware County Water Department	1.700	1.300	Floridan
Jeff Davis	080-0001	Amoco Fabrics & Fibers Co	1.000	1.000	Floridan
Glynn	063-0038	Glynn County - Golden Isles	1.000	1.000	Miocene
Ware	148-0006	Waycross Moulded Products, Inc	0.800	0.800	Floridan
Glynn	063-0014	Millennium Specialty Chemicals	0.860	0.760	Floridan, Miocene
Bacon	003-0001	Alma, City of	0.900	0.670	Floridan
Glynn	063-0022	Jekyll Island Authority - Golf Course	1.000	0.550	Miocene, Floridan
Glynn	063-0032	Skarpalezos Realty Company, Inc	0.550	0.550	Miocene (Brunswick)
Glynn	063-0018	Brunswick, City of - I95 & 341 Interchange	0.600	0.540	Floridan
Glynn	063-0033	Sea Island Co - Ocean Forest Golf Course	0.500	0.500	Miocene
Glynn	063-0027	Hampton Group	0.800	0.500	Miocene
Pierce	113-0001	Blackshear, City of	0.550	0.480	Floridan
Bacon	003-0002	Milliken & Co - Alma Plant	0.520	0.470	Floridan
Ware	148-0002	CSX Transportation	0.640	0.470	Floridan
Glynn	063-0037	Jekyll Island Authority - Oleander Golf Course	0.500	0.450	Miocene
Glynn	063-0020	Sea Island Co - Sea Island Golf Course	0.850	0.420	Miocene, Floridan
Glynn	063-0024	Sea Palms Development Corp	0.688	0.400	Floridan
Glynn	063-0036	Jekyll Island Authority - Indian Mounds Golf Course	0.400	0.360	Miocene
Glynn	063-0015	Rich-SeaPak Corporation	0.350	0.350	Floridan
Glynn	063-0039	Georgia-Pacific - Thalmann Woodyard	0.350	0.350	Floridan, Miocene
Glynn	063-0023	Glynn County W&S - North Mainland	0.450	0.350	Floridan
Glynn	063-0013	Lewis Crab Factory	0.310	0.300	Floridan
Ware	148-0007	International Paper - Waycross Plant	0.300	0.300	Floridan, Miocene
Atkinson	002-0001	Pearson, City of	0.350	0.300	Floridan
Glynn	063-0025	Glynn County - I95 & US17 Interchange System	0.300	0.300	Floridan
Glynn	063-0001	King & Prince Seafood Corp	0.325	0.270	Floridan
Glynn	063-0040	Wade & Claire - Coastal Pines Golf Club	0.300	0.250	Miocene
Camden	020-0006	Woodbine, City of	0.325	0.250	Floridan

GEORGIA COUNTY	PERMIT NUMBER	PERMIT USER NAME	PERMITTED MONTHLY AVG W/D (MGD)	PERMITTED YEARLY AVG W/D (MGD)	PERMITTED AQUIFER
Glynn	063-0029	Georgia-Pacific- Gypsum Corporation	0.225	0.225	Floridan
Glynn	063-0021	Sea Island Co - Island Club Golf Course	0.500	0.200	Miocene, Floridan
Atkinson	002-0003	Cady Bag Company	0.200	0.200	Miocene
Glynn	063-0026	Georgia Ports Authority	0.200	0.200	Miocene (Basal)
Glynn	063-0031	Glynn County - Hampton Plantation	0.280	0.170	Floridan
Glynn	063-0006	Georgia Power Company - Plant McManus	0.150	0.150	Floridan
Brantley	013-0001	Nahunta, City of	0.150	0.150	Floridan
Glynn	063-0019	Georgia Ports Authority - Colonels Island	0.150	0.150	Floridan
Wayne	151-0003	Screven, City of	0.125	0.125	Floridan
Glynn	063-0012	Glynco Golf Course	0.250	0.100	Floridan
Glynn	063-0030	Oak Grove Island Plantation Water Co	0.065	0.065	Floridan
Jeff Davis	080-0002	Hazelhurst, City of	1.010	0.850	Floridan
Atkinson	002-0002	Willacoochee, City of	0.500	0.400	Floridan

Applicants are required to submit details relating to the source of withdrawals, demand projections, water conservation measures, low flow protection measures (for non-grandfathered withdrawals), and raw water storage capacities. EPD issued permit identifies the source of withdrawal, the monthly average and maximum 24-hour withdrawal, the standard and special conditions under which the permit is valid, and the expiration date of the permit. The standard conditions section of the permit generally defines the reporting requirements (usually annual submission of monthly average withdrawals); the special conditions section of the permit usually specifies measures the permittee is required to undertake so as to protect downstream users and instream uses (e.g. waste assimilation, aquatic habitat). The objective of these permits is to manage and allocate water resources in a manner that both efficiently and equitably meets the needs of all the users.

Farm Irrigation Permits

The 1988 Amendments to the Water Quality Control Act establish the permitting authority within EPD to issue farm irrigation water use permits. As with the previously mentioned surface water permitting statute, the lower threshold is 100,000 GPD; however users of less water may apply for and be granted a permit. With two exceptions, farm use is defined as irrigation of any land used for general farming, aquaculture, pasture, turf production, orchards, nurseries, watering for farm animals and poultry, and related farm activities. One relevant exception is that the processing of perishable agricultural products is not considered a farm use.

Applicants for these permits who can establish that their use existed prior to July 1, 1988, *and* when these applications are received prior to July 1, 1991, are "grandfathered" for the operating capacity in place prior to July 1, 1988. Other applications are reviewed and granted with an eye towards protection of grandfathered users and the integrity of the resource. Generally, agricultural users are not required to submit any water use reports.

3.2.4 Flooding and Floodplain Management

The Satilla River basin was unaffected by the massive flooding that occurred in parts of Georgia in 1994, however, many counties within the Satilla, Suwannee, Ochlockonee and St. Marys basins were included in Federal Disaster Declaration #1209 as a result of the 1998 floods. The Floods of 1998 further substantiated the fact that flooding is the number one natural hazard in Georgia.

In March 1991, severe storms caused flooding in counties within Satilla, Suwannee and St. Marys river basins. Also, the counties of Appling, Atkinson, Bacon, Berrien, Clinch, Coffee, Jeff Davis, Johnson, Lanier, Laurens, Lowndes, Pierce, Thomas and Ware were declared disaster areas.

All of the counties within the Satilla River basin currently participate in the National Flood Insurance Program (NFIP).

Floodplain development is a constant concern, because development within floodplain areas can increase flood levels, thereby increasing the number of people and the amount of property at risk. The term "floodplain management" is often used as a synonym for program or agency-specific projects and regulations. It is in fact quite a broad concept. Floodplain management is a continuous process of making decisions about whether flood plains are to be used for development and how they are to be developed.

Floodplain Management Activities

To increase understanding and maintain a working knowledge of floodplain management, Georgia's Floodplain Management Office periodically conducts training workshops throughout the State for local officials. On May 13, 1999, the Floodplain Management Office held a workshop for local officials from Glynn and Camden counties at the City of Brunswick government offices. The workshop covered the related aspects of the National Flood Insurance Program (NFIP), administration and enforcement of local flood ordinance, the effects of floodplain management on flood insurance rates and flood hazard mitigation. The Floodplain Management Office also participates in the annual Governor's Severe Weather conference at Jekyll Island. This conference provides information to the public about the NFIP, floodplain management and other related topics.

3.3 Ground Water Quantity

3.3.1 Ground Water Sources

The Satilla River basin in Georgia is in the physiographic province known as the Coastal Plain province. South of the fall line is the Coastal Plain area, a region underlain by alternating layers of sand, clay, and limestone which get deeper and thicker to the southeast.

The Satilla basin includes all of Bacon, Brantley, and Pierce counties and portions of twelve other counties. The main groundwater source in these counties is the Floridan Aquifer. This aquifer system delivers tremendous amounts of water quickly, leading to very heavy municipal, industrial and agricultural usage from this source.

3.3.2 Ground Water Supply Demands

Municipal and Industrial Uses

Municipal and Industrial (M&I) water demands include public supplied and private supplied residential, commercial, governmental, institutional, manufacturing and other demands such as distribution system losses.

Existing permitted municipal and industrial groundwater users are shown on Table 3-6, by county. These permits are for users equal to or greater than 100,000 gallons per day. Users below this amount of groundwater are not required to have a permit for their withdrawals.

Agricultural Water Demand

Agricultural groundwater demand in the Satilla River basin is large. Generally agricultural areas use the Floridan aquifer for their source of groundwater.

3.3.3 Ground Water Supply Permitting

Nonagricultural Permits

The Georgia Ground Water Use Act of 1972 requires permits from EPD for all non-agricultural users of ground water of more than 100,000 GPD. General information required of the applicant includes location (latitude and longitude), past, present, and expected water demand, expected unreasonable adverse effects on other users, the aquifer system from which the water is to be withdrawn, and well construction data. The permits issued by EPD stipulate both the allowable monthly average and annual average withdrawal rates, standard and special conditions under which the permit is valid, and the expiration date of the permit. Ground water use reports are generally required of the applicant on a semi-annual basis. The objective here is the same as with surface water permits. A list of active Georgia municipal and industrial ground water withdrawal permits is provided in Table 3-6.

Farm Irrigation Permits

The 1988 Amendments to the Ground Water Use Act establishes the permitting authority within EPD to issue farm irrigation water use permits. As with the previously mentioned ground water permitting statute, the lower threshold is 100,000 GPD; however users of less water may apply and be granted a permit. Agricultural withdrawal permits are too numerous to list in this document.

Applicants for these permits who could establish that their use existed prior to July 1, 1988, *and* when their applications were received prior to July 1, 1991, were "grandfathered" for the operating capacity in place prior to July 1, 1988. Other applications are reviewed and granted with an eye towards protection of grandfathered users and the integrity of the resource. Generally, agricultural users are not required to submit any water use reports.

Excessive Ground Water Withdrawals

Excessive ground water withdrawal can lead to lowering or drawdown of the water table. Localized groundwater drawdowns are generally discovered only after the fact of permitting has occurred and withdrawal operations begun. To avoid such a possibility, if an application for a very large use of groundwater is received, the Water Resources Management Program of the Georgia EPD can take certain steps to possibly contain drawdowns effects. Modeling the hydrogeologic impact of such a large user may be required of the potential permittee. If this computer analysis indicates no unreasonable impact on existing users, such a water use permit may be approved. Another recommended possibility is a negotiated reduction in permit amounts to a more moderate amount of withdrawal, with lessened impacts. Prior to full scale production of a well field, well pumping tests run at or near actual production rates can be required. These may give the permittee and the EPD some real idea of the amount of water that may pumped safely, without endangering other users nor drawing down the aquifer too greatly. Permit withdrawal limits may then be set at some safer yield which is determined by these pumping tests. These tests may also indicate that proposed pumping amounts may require more wells drilled to spread out the ultimate production impact on the aquifer.

References

DRI/McGraw-Hill. 1996. The Regional Economic Forecast of Population and Employment Comprehensive Study Volume 1. Prepared for: The Georgia Department of Natural Resources Environmental Protection Division. DRI/McGraw-Hill, Lexington, MA

Georgia Environmental Protection Division. 1987. Water Availability And Use Report, Coastal Plain River Basins.

In This Section

- Sources and Types of Environmental Stressors
- Summary of Stressors Affecting Water Quality

Section 4

Water Quality: Environmental Stressors

Sections 4, 5, 6, and 7 are closely linked, providing the foundation for the water quality concerns in the basin, identifying the priority issues based on these concerns, and finally, recommending management strategies to address these concerns. Therefore, the reader will probably want to flip back and forth between sections to track specific issues.

This section describes the important environmental stressors that impair or threaten water quality in the Satilla River basin. Section 4.1 first discusses the major sources of environmental stressors. Section 4.2 then provides a summary of individual stressor types as they relate to all sources. These include both traditional chemical stressors, such as metals or oxygen demanding waste, and less traditional stressors, such as modification of the flow regime (hydromodification) and alteration of physical habitat.

4.1 Sources and Types of Environmental Stressors

Environmental stressors are first catalogued by type of source in this section. This is the traditional programmatic approach, and it provides a match to regulatory lines of authority for permitting and management. Assessment requires an integration of stressor loads across all sources, as described in Section 4.2.

4.1.1 Point Sources and Non-discharging Waste Disposal Facilities

Point sources are defined as discharges of treated wastewater to the river and its tributaries, regulated under the National Pollutant Discharge Elimination System (NPDES). These are divided into two main types—permitted wastewater discharges, which tend to be discharged at relatively stable rates, and permitted storm water

discharges, which tend to be discharged at highly irregular, intermittent rates, depending on precipitation. Nondischarging waste disposal facilities, including land application systems and landfills, which are not intended to discharge treated effluent to surface waters, are also discussed in this section.

NPDES Permitted Wastewater Discharges

The EPD NPDES permit program regulates municipal and industrial waste discharges, monitors compliance with limitations, and takes appropriate enforcement action for violations. For point source discharges, the permit establishes specific effluent limitations and specifies compliance schedules that must be met by the discharger. Effluent limitations are designed to achieve water quality standards in the receiving water and are reevaluated periodically (at least every 5 years).

Municipal Wastewater Discharges

Municipal wastewater treatment plants are among the most significant point sources regulated under the NPDES program in the Satilla River basin, accounting for the majority of the total point source effluent flow (exclusive of cooling water). These plants collect, treat, and release large volumes of treated wastewater. Pollutants associated with treated wastewater include pathogens, nutrients, oxygen-demanding waste, metals, and chlorine residuals. Over the past several decades, Georgia has invested more than $12.5 million in construction and upgrade of municipal water pollution control plants in the Satilla River basin; a summary of these investments is provided in Appendix C. These upgrades have resulted in significant reductions in pollutant loading and consequent improvements in water quality below wastewater treatment plant outfalls. As of the 2000 water quality assessment, several estuarine waterbodies were identified in which municipal or industrial discharges contributed to not fully supporting designated uses, which are being addressed through the NPDES permitting and hazardous waste cleanup processes.

Table 4-1 displays the major municipal wastewater treatment plants with permitted discharges of 1 million gallons per day (MGD) or greater in the Satilla River basin. The geographic distribution of dischargers is shown in Figure 4-1. In addition, there are discharges from a variety of smaller wastewater treatment plants, including both public facilities (small public water pollution control plants, schools, marinas, etc.) and private facilities (package plants associated with non-sewered developments and mobile home parks) with less than a 1-MGD flow. These minor discharges might have the potential to cause localized stream impacts, but they are relatively insignificant from a basin perspective. A complete list of permitted dischargers in the Satilla River Basin in presented in Appendix D.

Table 4-I. Major Municipal Wastewater Treatment Plant Discharges with Permitted Monthly Flow Greater than I MGD in the Satilla River Basin

NPDES Permit No.	Facility Name	County	Receiving Stream	Permitted Monthly Avg. Flow
HUC 03070201				
GA0024431	Douglass Southeast	Coffee	Seveenteen Mile Creek	6.0
GA0020966	Waycross WPCP	Ware	Satilla River	6.7
HUC03070203				
GA0025313	Brunswick Academy	Glynn	Acadamy Creek	13.5
GA0020508	Jekyll WPCP	Glynn	Jeykll River	1.0
GA0021521	Saint Simons Island	Glynn	Dunbar Creek	3.0

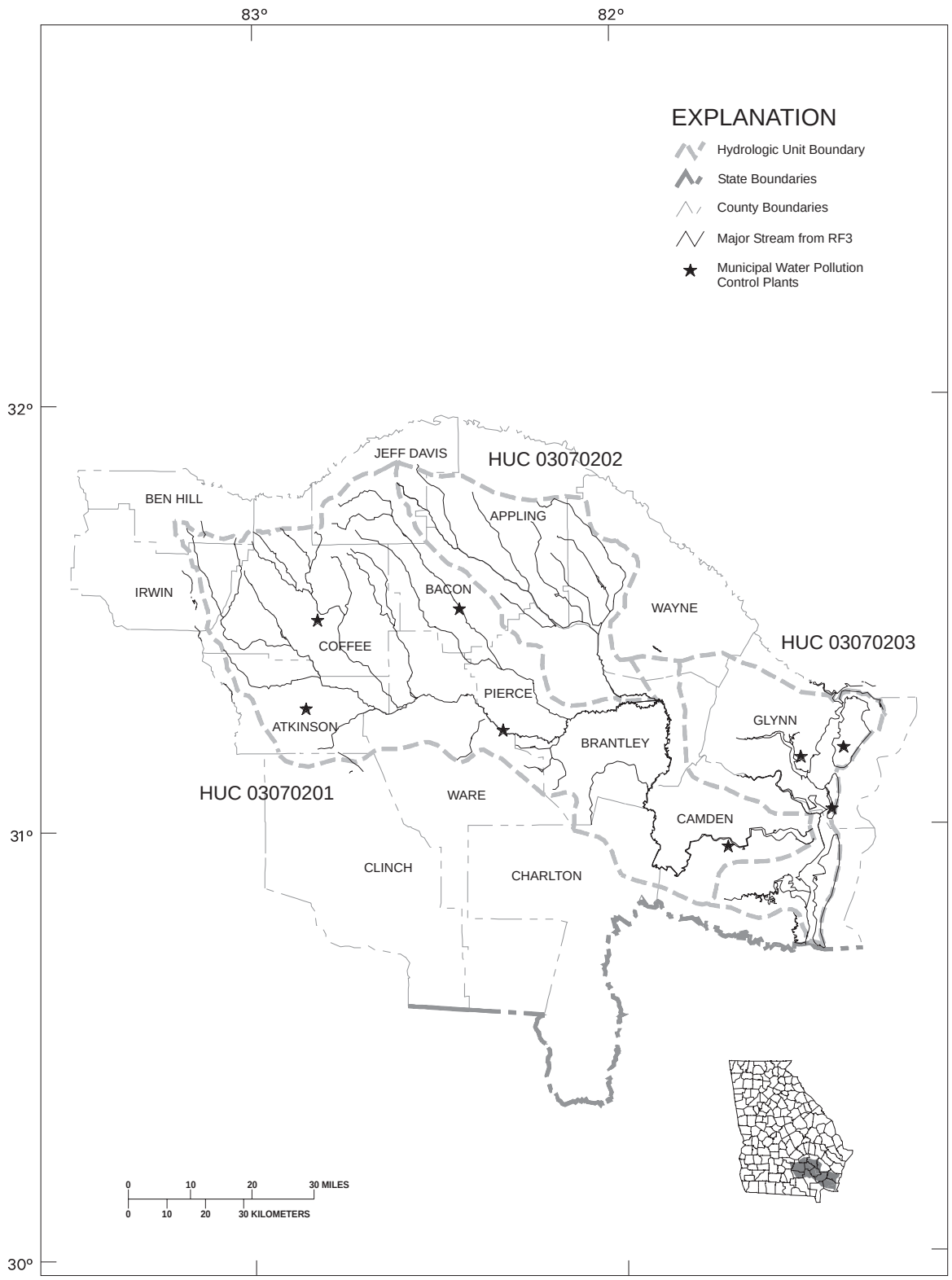

Figure 4-I. Location of Municipal Wastewater Treatment Plants in the Satilla River Basin

Most urban wastewater treatment plants also receive industrial process and nonprocess wastewater, which can contain a variety of conventional and toxic pollutants. The control of industrial pollutants in municipal wastewater is addressed through pretreatment programs. The major publicly owned wastewater treatment plants in this basin have developed and implemented approved local industrial pretreatment programs. Through these programs, the wastewater treatment plants are required to establish effluent limitations for their significant industrial dischargers (those which discharge in excess of 25,000 gallons per day of process wastewater or are regulated by a Federal Categorical Standard) and to monitor the industrial user's compliance with those limits. The treatment plants are able to control the discharge of organics and metals into their sewerage system through the controls placed on their industrial users.

Industrial Wastewater Discharges

Industrial and federal wastewater discharges are also significant point sources regulated under the NPDES program. There are a total of 34 permitted municipal, state, federal, private, and industrial wastewater and process water discharges in the Satilla River basin, as summarized in Table 4-2. The complete permit list is summarized in Appendix D.

Table 4-2. Summary of NPDES Permits in the Satilla River Basin

HUC	Major Municipal Facilities	Major Industrial and Federal Facilities	MinorPublic Facilities	Minor Private and Industrial Facilities	Total
03070201	2	0	3	8	13
03070202	0	0	2	2	4
03070203	3	2	0	12	17
Total	5	2	5	22	34

The nature of industrial discharges varies widely compared to discharges from municipal plants. Effluent flow is not usually a good measure of the significance of an industrial discharge. Industrial discharges can consist of organic, heavy oxygen-demanding waste loads from facilities such as pulp and paper mills; large quantities of noncontact cooling water from facilities such as power plants; pit pumpout and surface runoff from mining and quarrying operations, where the principal source of pollutants is the land-disturbing activity rather than the addition of any chemicals or organic material; or complex mixtures of organic and inorganic pollutants from chemical manufacturing, textile processing, metal finishing, etc. Pathogens and chlorine residuals are rarely of concern with industrial discharges, but other conventional and toxic pollutants must be addressed on a case-by-case basis through the NPDES permitting process. Table 4-3 lists the major industrial and federal wastewater treatment plants with discharges into the Satilla River basin in Georgia.

Table 4-3. Major Industrial and Federal Wastewater Treatment Facilities in the Satilla River Basin

NPDES Permit No.	Facility Name	County	Description	Flow(Mgd)	Receiving Stream
HUC 03070203					
GA0003654	Georgia Pacific Brunswick	Glynn	Pulp and Paper	32.2	Turtle River
GA0003735	Hercules Brunswick	Glynn	Pulp and Paper	8.7	Dupree Creek

There are also minor industrial discharges which may have the potential to cause localized stream impacts, but are relatively insignificant from a basin perspective. The locations of permitted point source discharges of treated wastewater in the Satilla River basin are shown in Figures 4-2 through 4-4.

Combined Sewer Overflows

Combined sewers are sewers that carry both storm water runoff and sanitary sewage in the same pipe. Most of these combined sewers were built at the turn of the century and were present in most large cities. At that time both sewage and storm water runoff were piped from the buildings and streets to the small streams that originated in the heart of the city. When these streams were enclosed in pipes, they became today's combined sewer systems. As the cities grew, their combined sewer systems expanded. Often new combined sewers were laid to move the untreated wastewater discharge to the outskirts of the town or to the nearest waterbody.

In later years wastewater treatment facilities were built and smaller sanitary sewers were constructed to carry the sewage (dry weather flows) from the termination of the combined sewers to these facilities for treatment. However, during wet weather, when significant storm water is carried in the combined system, the sanitary sewer capacity is exceeded and a combined sewer overflow (CSO) occurs. The surface discharge is a mixture of storm water and sanitary waste. Uncontrolled CSOs thus discharge raw diluted sewage and can introduce elevated concentrations of bacteria, BOD, and solids into a receiving water body. In some cases, CSOs discharge into relatively small creeks.

CSOs are considered a point source of pollution and are subject to the requirements of the Clean Water Act. Although CSOs are not required to meet secondary treatment effluent limits, sufficient controls are required to protect water quality standards for the designated use of the receiving stream. In its 1990 session, the Georgia Legislature passed a CSO law requiring all Georgia cities to eliminate or treat CSOs.

There are no known combined sewer overflows in the Satilla River basin.

NPDES Permitted Storm Water Discharges

Urban storm water runoff in the Satilla basin has been identified as a source of stressors from pollutants such as oxygen-demanding waste (BOD) and fecal coliform bacteria. Storm water may flow directly to streams as a diffuse, nonpoint process, or may be collected and discharged through a storm sewer system. Storm sewers are now subject to NPDES permitting and are discussed in this section. Contributions from nonpoint storm water is discussed in later sections.

Pollutants typically found in urban storm water runoff include pathogens (such as bacteria and viruses from human and animal waste), heavy metals, debris, oil and grease, petroleum hydrocarbons and a variety of compounds toxic to aquatic life. In addition, the runoff often contains sediment, excess organic material, fertilizers (particularly nitrogen and phosphorus compounds), herbicides, and pesticides which can upset the natural balance of aquatic life in lakes and streams. Storm water runoff may also increase the temperature of a receiving stream during warm weather, which potentially threatens valuable fisheries in the Satilla River basin. All of these pollutants, and many others, influence the quality of storm water runoff. There are also many potential problems related to the quantity of urban runoff, which can contribute to flooding and erosion in the immediate drainage area and downstream.

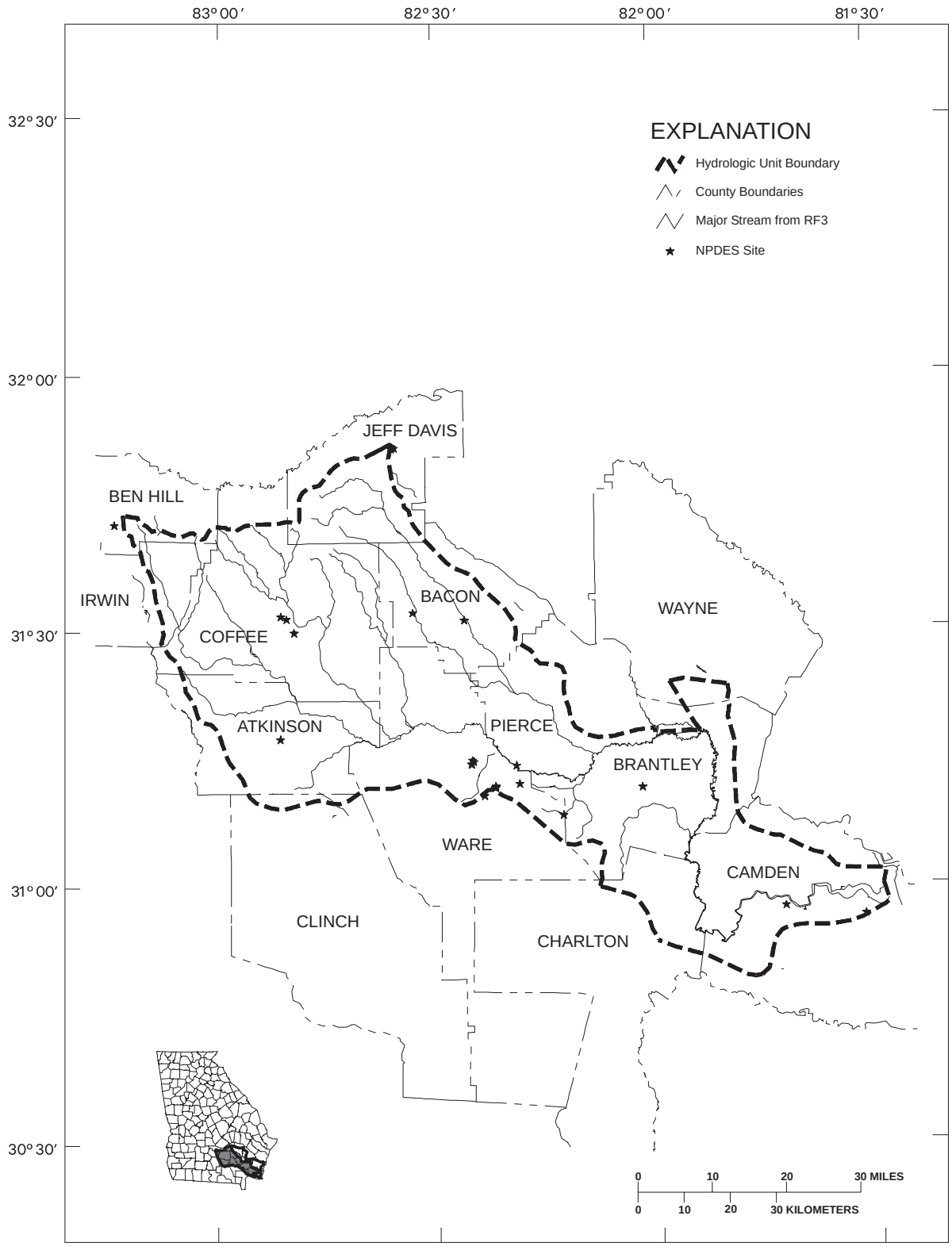

Figure 4-2. NPDES Sites Permitted by GAEPD, Satilla River Basin, HUC 03070201

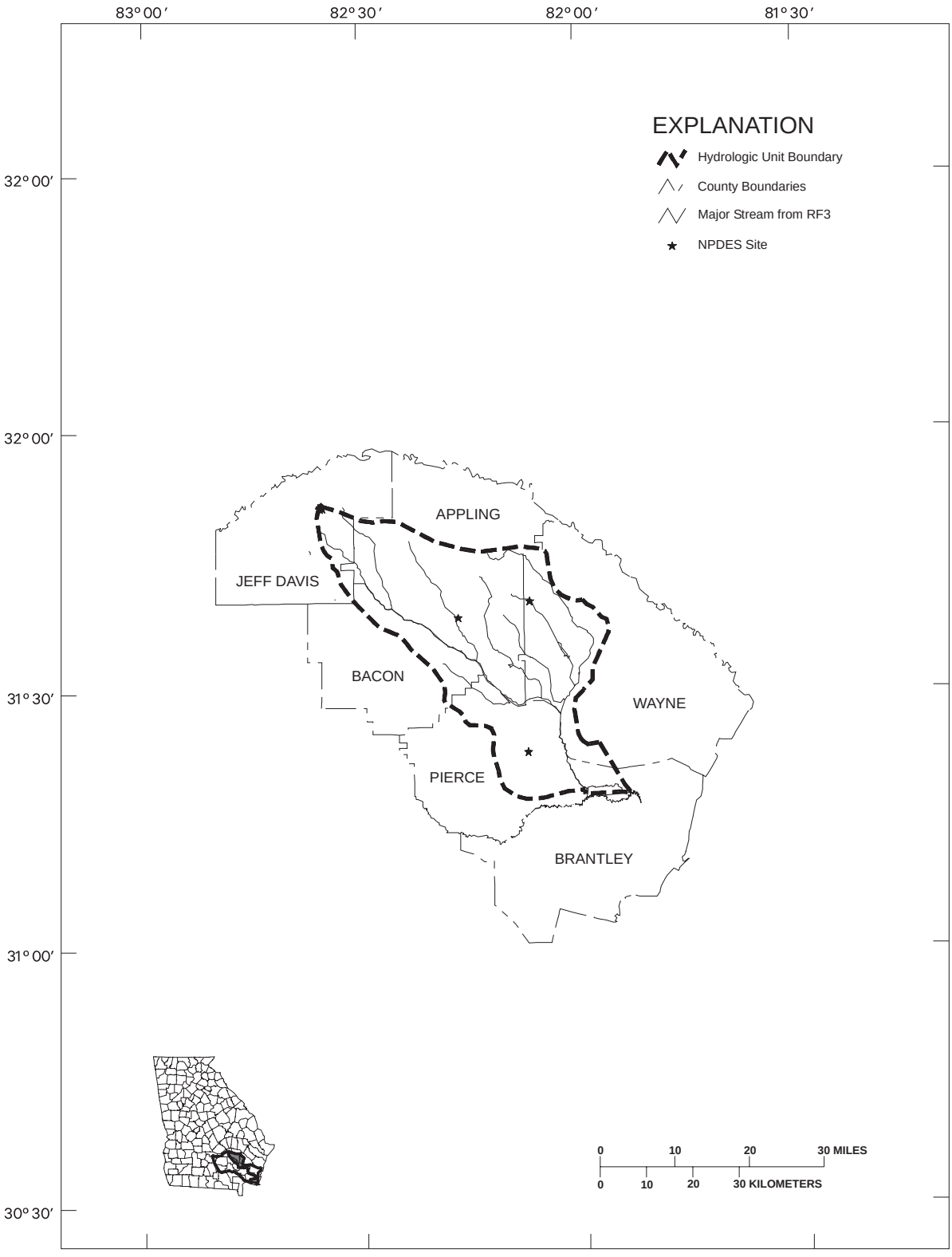

Figure 4-3. NPDES Sites Permitted by GAEPD, Satilla River Basin, HUC 03070202

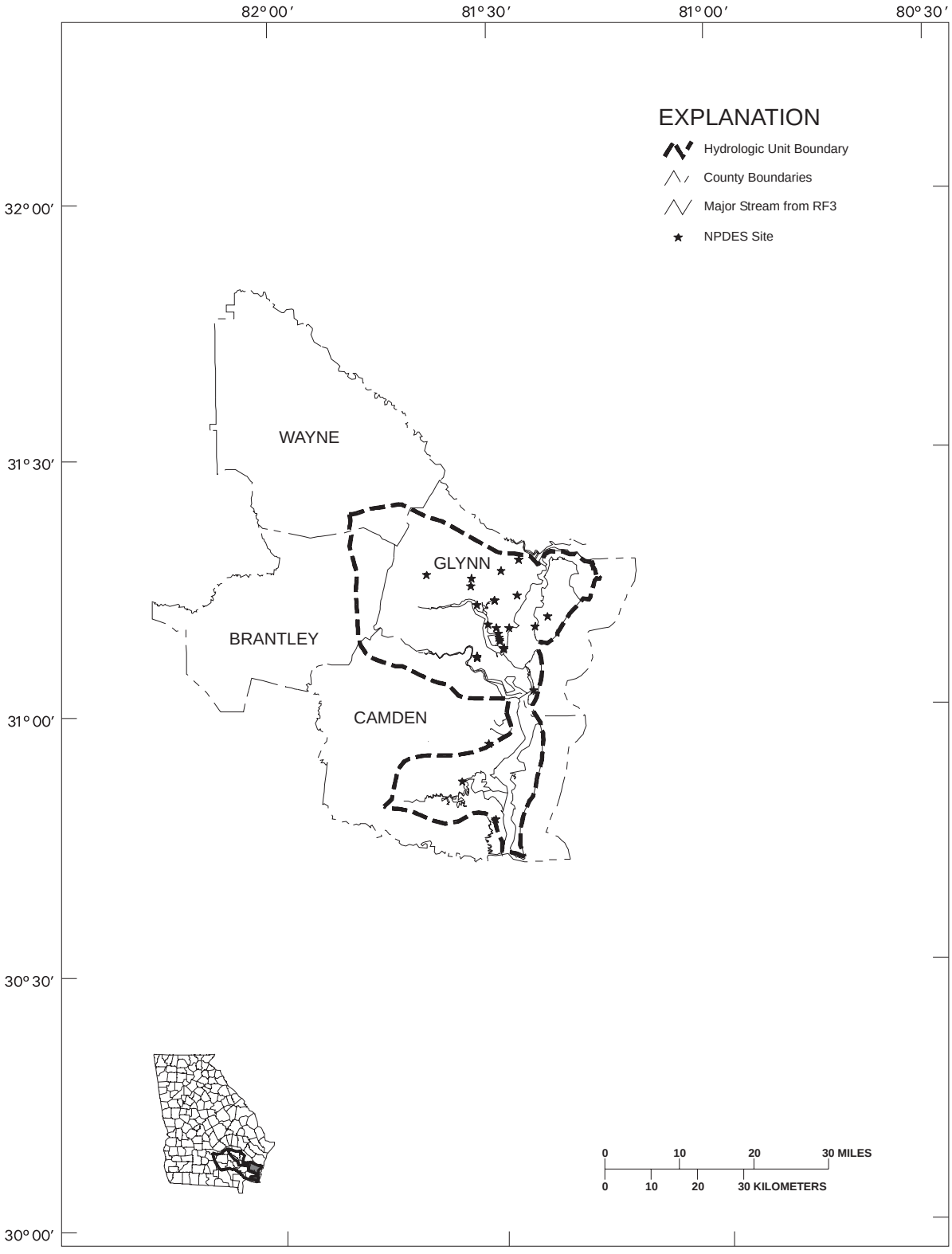

Figure 4-4. NPDES Sites Permitted by GAEPD, Satilla River Basin, HUC 03070203

Municipal Storm Water Discharges

In accordance with Federal "Phase I" storm water regulations, the state of Georgia has issued individual areawide NPDES municipal separate storm sewer system (MS4) permits to 58 cities and counties in municipal areas with populations greater than 100,000 persons. There were no permits issued in the Satilla River basin.

Industrial Storm Water Discharges

Industrial sites often have their own storm water conveyance systems. The volume and quality of storm water discharges associated with industrial activity is dependent on a number of factors, such as the industrial activities occurring at the facility, the nature of the precipitation, and the degree of surface imperviousness (hard surfaces). These discharges are of intermittent duration with short-term pollutant loadings that can be high enough to have shock loading effects on the receiving waters. The types of pollutants from industrial facilities are generally similar to those found in storm water discharges from commercial and residential sites; however, industrial facilities have a significant potential for discharging at higher pollutant concentrations, and may include specific types of pollutants associated with a given industrial activity.

EPD has issued one general permit regulating storm water discharges for 10 of 11 federally regulated industrial subcategories. The general permit for industrial activities requires the submission of a Notice of Intent (NOI) for coverage under the general permit; the preparation and implementation of storm water pollution prevention plan; and, in some cases, analytical testing of storm water discharges from the facility. As with the municipal storm water permits, implementation of site-specific best management practices is the preferred method for controlling storm water runoff.

The 11th federally regulated industrial subcategory (construction activities) is covered under NPDES General Permit No. GAR100000. This general permit regulates storm water discharges associated with construction activity at sites and common developments disturbing more than five acres. The general permit requires the submission of a Notice of Intent (NOI) to obtain coverage under the permit, the preparation and implementation of an Erosion, Sedimentation, and Pollution Control Plan, and the preparation and implementation of a Comprehensive Monitoring Program which provides for monitoring of turbidity levels in the receiving stream(s) and/or storm water outfalls(s) during certain rain events. The general permit became effective on August 1, 2000 and will expire on July 31, 2003.

Nondischarging Waste Disposal Facilities

Land Application Systems (LASs)

In addition to permits for point source discharges, EPD has developed and implemented a permit system for land application systems (LASs). LASs for final disposal of treated wastewaters have been encouraged in Georgia and are designed to eliminate surface discharges of effluent to waterbodies. LASs are used as an alternative to advanced levels of treatment or as the only alternative in some environmentally sensitive areas.

When properly operated, an LAS should not be a source of stressors to surface waters. The locations of LASs are, however, worth noting because of the (small) possibility that a LAS could malfunction and become a source of stressor loading.

A total of 147 municipal and 53 industrial permits for land application systems were in effect in Georgia in 2000. Municipal and other wastewater land application systems within the Satilla Basin are listed in Table 4-4. The locations of all LASs within the basin are shown in Figures 4-5 through 4-7.

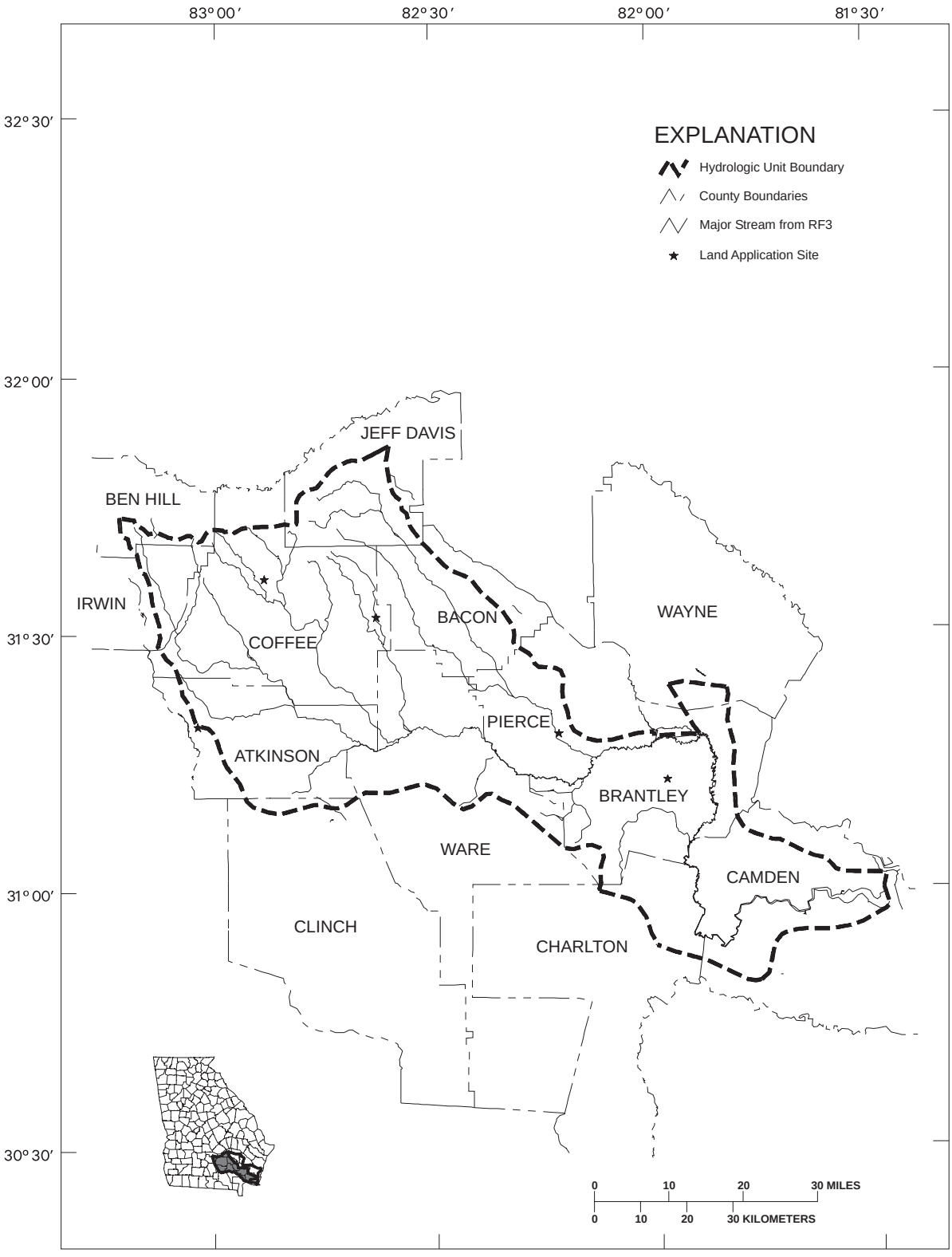

Figure 4-5. Land Application Systems, Satilla River Basin, HUC 03070201

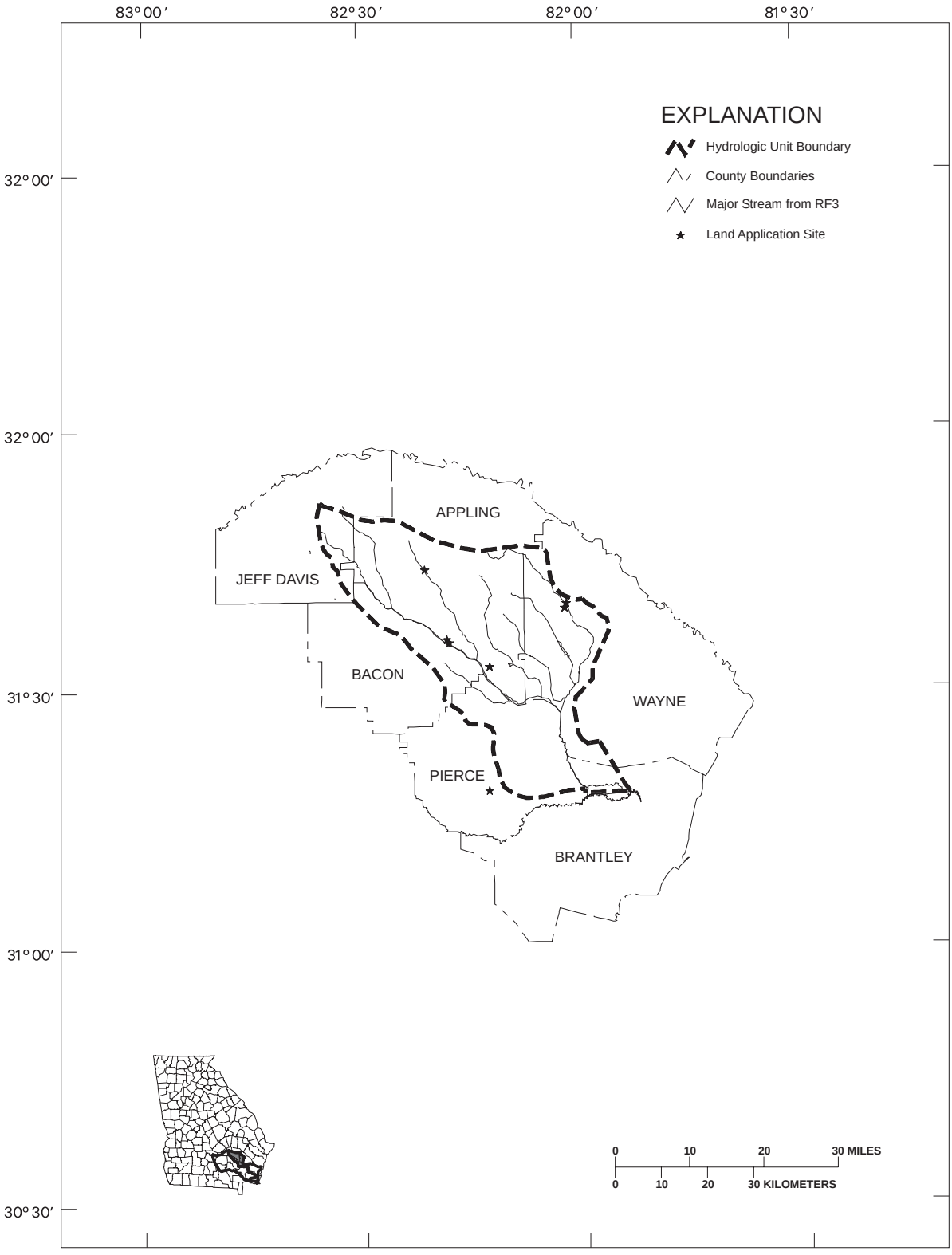

Figure 4-6. Land Application Systems, Satilla River Basin, HUC 03070202

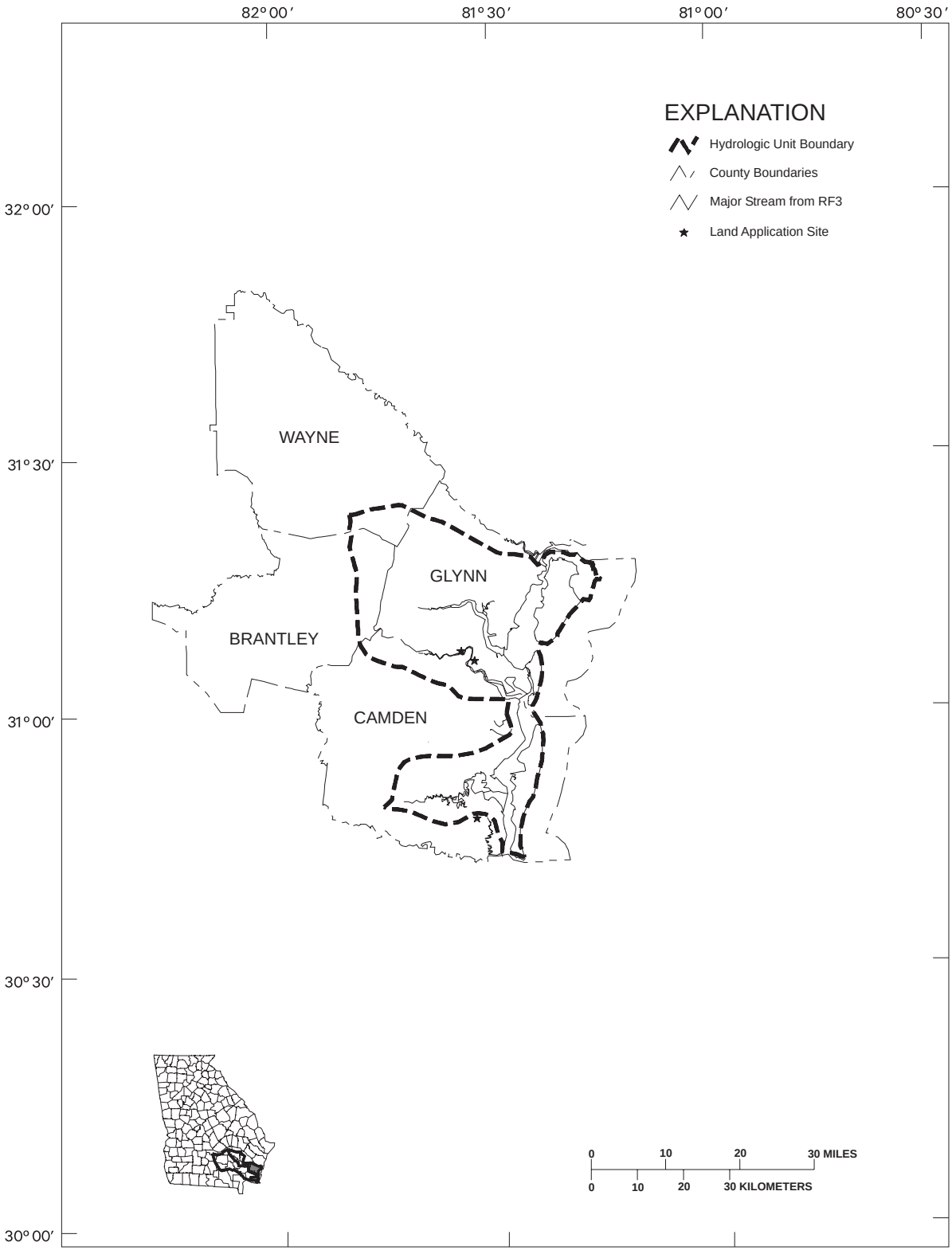

Figure 4-7. Land Application Systems, Satilla River Basin, HUC 03070203

Table 4-4. Wastewater Land Application Systems in the Satilla River Basin

Facility Name	County	Permit No.	Permitted Flow (Mgd)
Baxley	Appling	GA02-182	1.4
Blackshear	Pierce	GA02-001	0.35
Broxton	Coffee	GA02-124	0.162
Dixon Dairy Farms	Appling	GA01-374	
Glyynn Co.I-95/US 17	Glynn	GA02-059	0.3
Lee Meats	Bacon	GA01-321	0.1
Mickey's Meats Inc.	Wayne	GA01-449	0.005
Millenium Specialty Chem	Glynn	GA01-519	0.04
Nahunta LAS	Brantley	GA02-062	0.12
Nichills LAS	Coffee	GA02-267	0.242
Odum LAS	Wayne	GA02-027	0.075
Pierce Co. Bd of Ed.	Pierce	GA02-035	0.028
Willachoochee	Atkinson	GA02-164	0.355
Whright's Appling Co Dairy	Appling	GA01-594	0.109
Wright's Appling Co Farms Inc	Appling	GA01-365	0.109

Landfills

Permitted landfills are required to contain and treat any leachate or contaminated runoff prior to discharge to any surface water. The permitting process encourages either direct connection to a publicly owned treatment works (although vehicular transportation is allowed in certain cases) or treatment and recirculation on site to achieve a no-discharge system. Direct discharge in compliance with NPDES requirements is allowed but is not currently practiced any landfills in Georgia. Groundwater contaminated by landfill leachate from older, unlined landfills represents a potential threat to waters of the state. Ground water and surface water monitoring and corrective action requirements are in place for all landfills operated after 1988 to identify and rededicate potential threats. The provisions of the Hazardous Sites Response Act address threats posed by older landfills as releases of hazardous constituents are identified. All new municipal solid waste landfills are required to be lined and to have a leachate collection system installed.

EPD's Land Protection Branch is responsible for permitting and compliance of municipal and industrial Subtitle D landfills. The location of permitted landfills within the basin is shown in Figures 4-8 through 4-10.

4.I.2 Nonpoint Sources

The pollution impact on Georgia's streams has radically shifted over the last two decades. Steams are no longer dominated by untreated or partially treated sewage discharges, which had resulted in little or no oxygen and little or no aquatic life. The sewage is now treated, oxygen levels have recovered, and healthy fisheries have followed. Industrial discharges have also been placed under strict regulation. However, other sources of pollution are still affecting Georgia's streams. These sources are referred to as *nonpoint sources*. Nonpoint sources are diffuse in nature. Nonpoint source pollution can generally be defined as the pollution caused by rainfall or snowmelt moving over and through the ground. As water moves over and through the soil, it picks up and carries away natural pollutants and pollutants resulting from human activities, finally depositing them in lakes, rivers, wetlands, coastal waters, or ground water. Habitat alteration (e.g., removal of riparian vegetation) and hydrological modification (e.g., channelization,

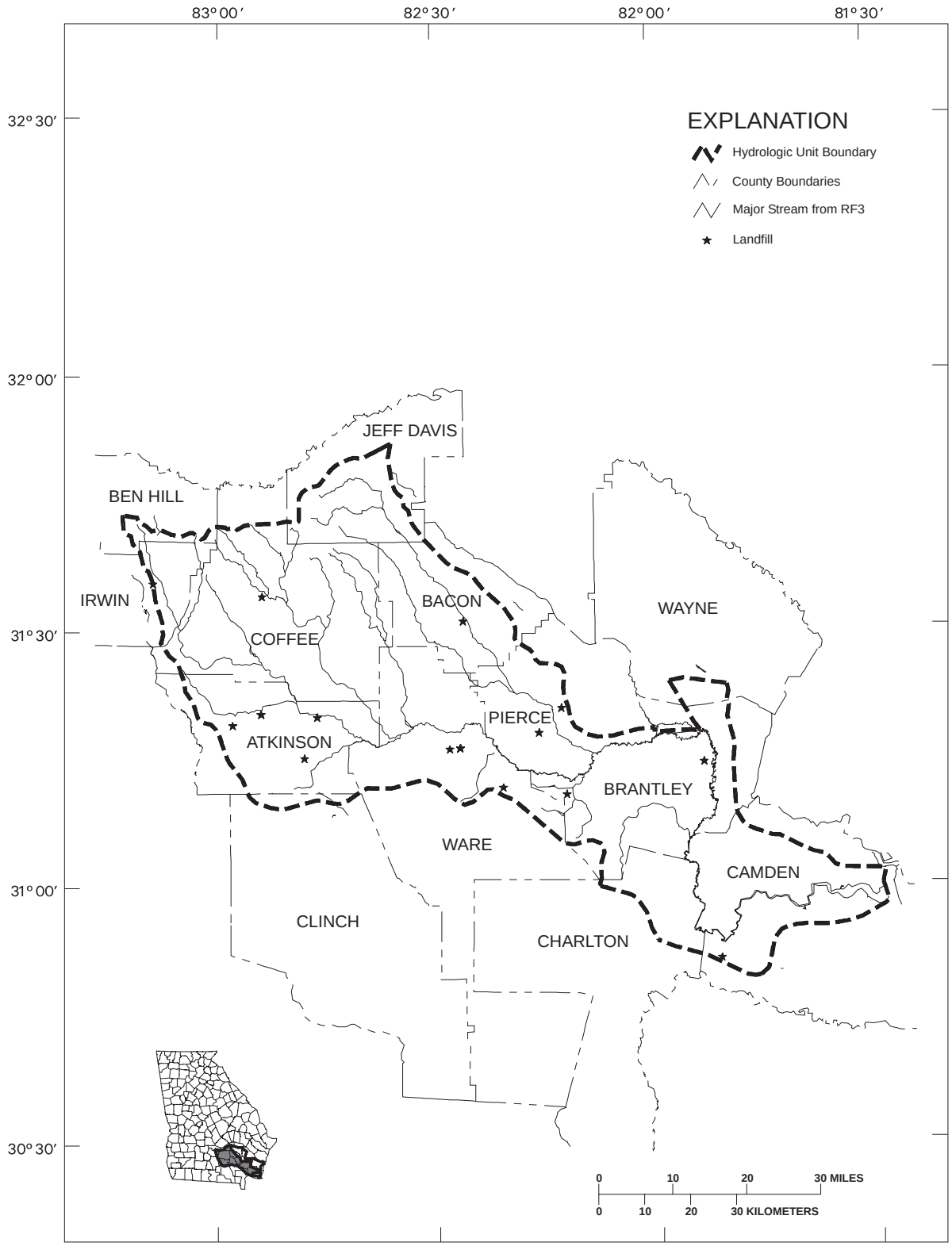

Figure 4-8. Landfills, Satilla River Basin, HUC 03070201

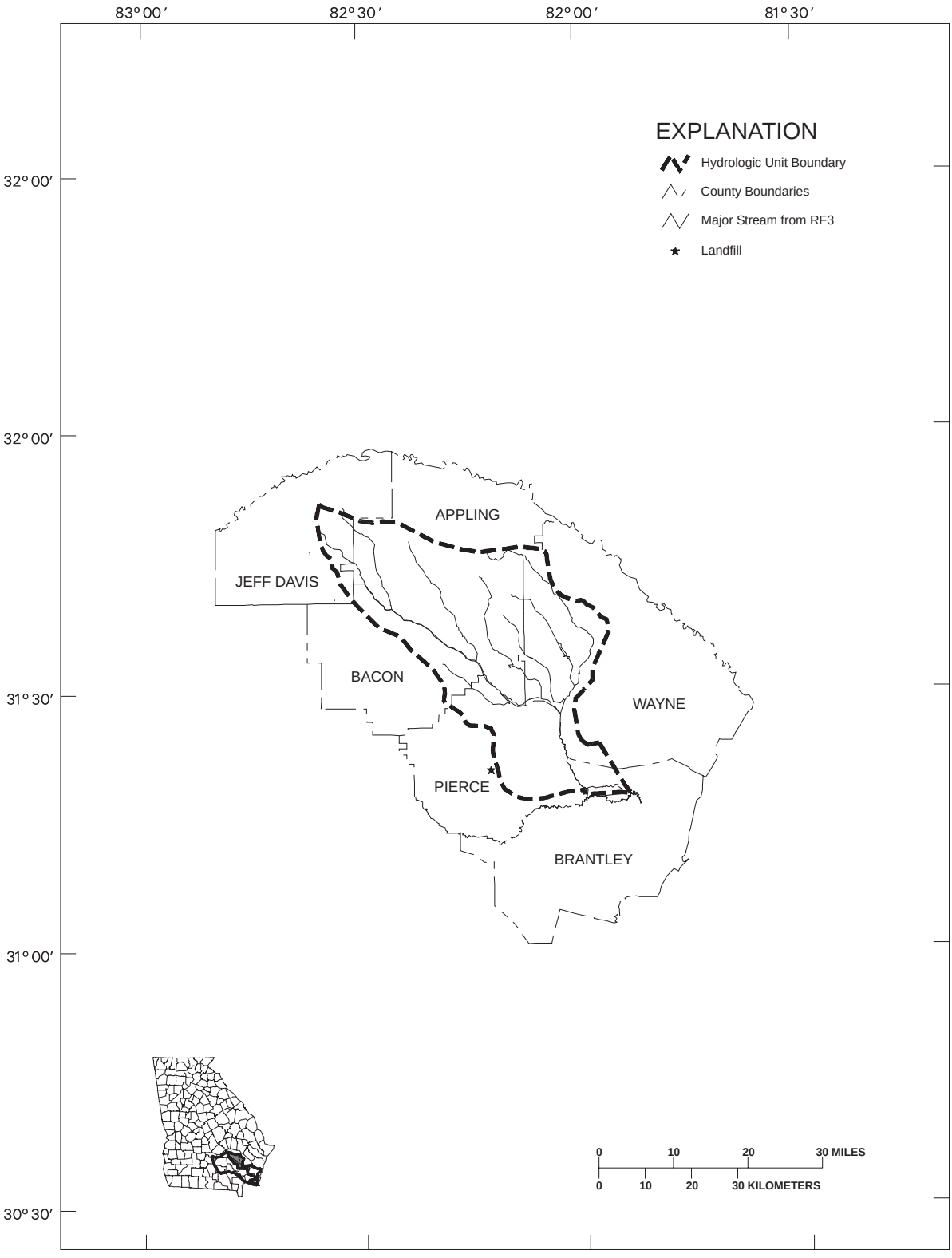

Figure 4-9. Landfills, Satilla River Basin, HUC 03070202

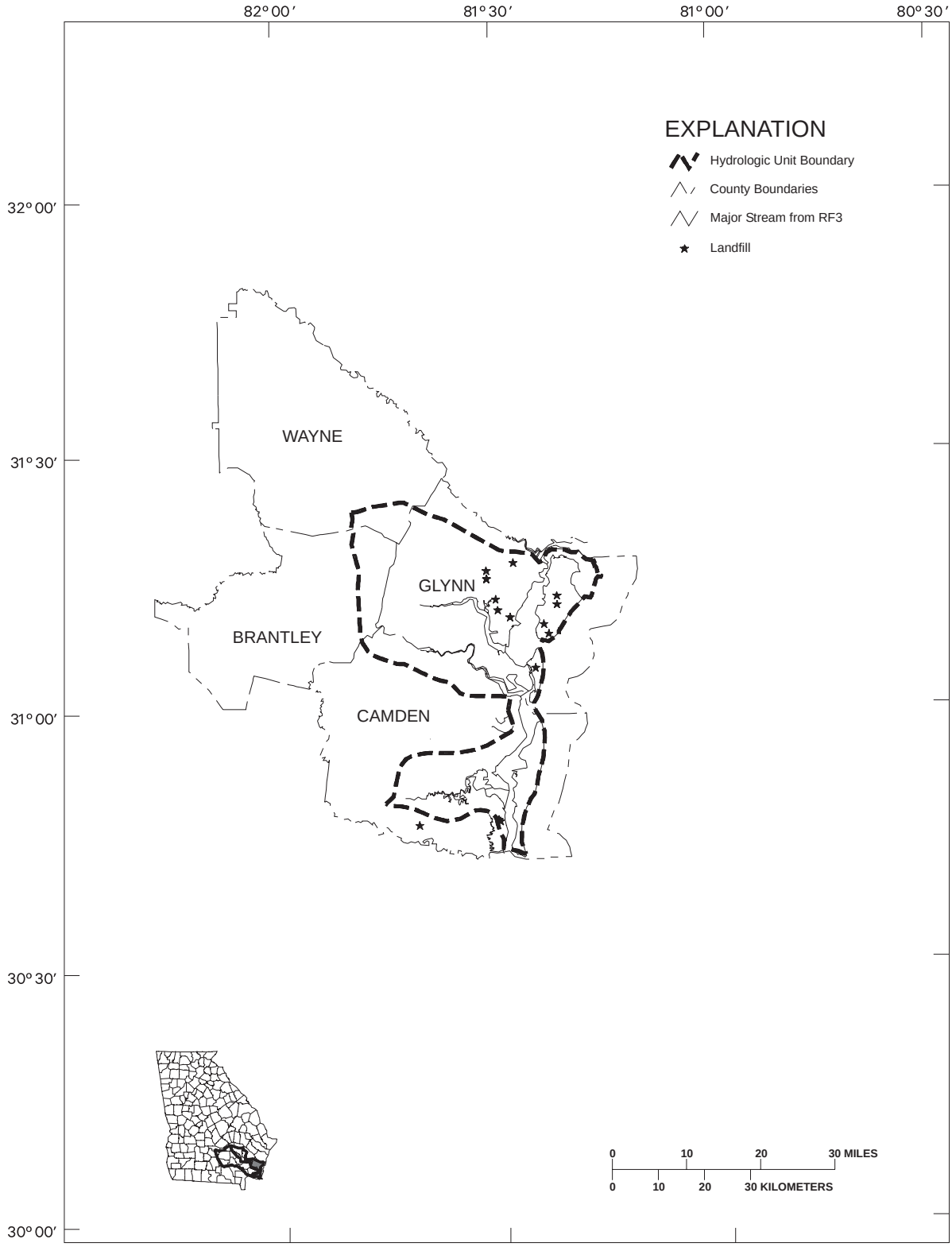

Figure 4-I0. Landfills, Satilla River Basin, HUC 03070203

bridge construction) can also cause adverse effects on the biological integrity of surface waters and are also treated as nonpoint sources of pollution.

Nonpoint pollutant loading comprises a wide variety of sources not subject to point source control through NPDES permits. The most significant nonpoint sources are those associated with precipitation, washoff, and erosion, which can move pollutants from the land surface to water bodies. Both rural and urban land uses can contribute significant amounts of nonpoint pollution. A review of the 1998-1999 water quality assessment results for the Satilla basin indicates that urban runoff and rural nonpoint sources contribute significantly to lack of full support for designated uses. The major categories of stressors for nonpoint sources are discussed below.

Nonpoint Sources from Agriculture

Agricultural operations can contribute stressors to water bodies in a variety of ways. Tillage and other soil-disturbing activities can promote erosion and loading of sediment to water bodies unless controlled by management practices. Nutrients contained in fertilizers, animal wastes, or natural soils may be transported from agricultural land to streams in either sediment-attached or dissolved forms. Loading of pesticides and pathogens is also of concern for various agricultural operations.

Sediment and Nutrients

Sediment is the most common pollutant resulting from agricultural operations. It consists mainly of mineral fragments resulting from the erosion of soils, but is can also include crop debris and animal wastes. Excess sediment loads can damage aquatic habitat by smothering and shading food organisms, alter natural substrate, and destroying spawning areas. Runoff with elevated sediment concentrations can also scour aquatic habitat, causing significant impacts on the biological community. Excess sediment can also increase water treatment costs, interfere with recreational uses of water bodies, create navigation problems, and increase flooding damage. In addition, a high percentage of nutrients lost from agricultural lands, particularly phosphorus, are transported attached to sediment. Many organic chemicals used as pesticides or herbicides are also transported predominantly attached to sediment.

Agriculture can be a significant source of nutrients, which can lead to excess or nuisance growth of aquatic plants and depletion of dissolved oxygen. The nutrients of most concern from agricultural land uses are nitrogen (N) and phosphorus (P), which may come from commercial fertilizer or land application of animal wastes. Both nutrients assume a variety of chemical forms, including soluble ionic forms (nitrate and phosphate) and less-soluble organic forms. Less soluble forms tend to travel with sediment, whereas more soluble forms move with water. Nitrate-nitrogen is very weakly adsorbed by soil and sediment and is therefore transported entirely in water. Because of the mobility of nitrate-nitrogen, the major route of nitrate loss is to streams by interflow or ground water in deep seepage.

Phosphorus transport is a complex process that involves different components of phosphorus. Soil and sediment contain a pool of adsorbed phosphorus, which tends to be in equilibrium with the phosphorus in solution (phosphate) as water flows over the soil surface. The concentrations established in solution are determined by soil properties and fertility status. Adsorbed phosphorus attached to soil particles suspended in runoff also equilibrates with phosphorus in solution.

Animal Waste

In addition to contributing to nutrient loads, animal waste may contribute high loads of oxygen-demanding chemicals and bacterial and microbial pathogens. The waste may reach surface waters through direct runoff as solids or in their soluble form. Soluble forms may reach ground water through runoff, seepage, or percolation and reach surface

waters as return flow. As the organic materials decompose, they place an oxygen demand on the receiving waters, which may adversely affect fisheries, and cause other problems with taste, odor, and color. When waters are contaminated by waste from mammals the possible presence of pathogens that affect human health, include fecal bacteria, is of particular concern. In addition to being a source of bacteria, cattle waste might be an important source of the infectious oocysts of the protozoan parasite *Cryptosporidium parvum*.

Pesticides

Pesticides applied in agricultural production can be insoluble or soluble and include herbicides, insecticides, miticides, and fungicides. They are primarily transported directly through surface runoff, either in dissolved forms or attached to sediment particles. Some pesticides can cause acute and chronic toxicity problems in the water or throughout the entire food chain. Others are suspected human carcinogens, although the use of such pesticides has generally been discouraged in recent years.

The major agricultural pesticide/herbicides use within the basin include 2,4-d, Prowl, Blazer/Basagran/Trifluralin/Treflan/Trilin, Aatrex/Atizine, Gramoxone, Classic, Lexone/Sencor, and Lasso (alachlor) (compiled from the Georgia Herbicide Use Survey summary (Monks and Brown 1991)). Since 1990, the use of alachlor in Georgia has decreased dramatically since peanut wholesalers no longer buy peanuts with alachlor.

Nonherbicide pesticide use is difficult to estimate. According to Stell et al. (1995), pesticides other than herbicides are currently used only when necessary to control some type of infestation (nematodes, fungi, and insects). Other common nonherbicie pesticides include chlorothalonil, aldicarb, chlorpyifos, methomyl, thiodicarb, carbaryl, acephate, fonofos, methyl parathion, terbufos, disulfoton, phorate, triphenyltin hydroxide (TPTH), and synthetic pyrethroids/pyrethrins. Application periods of principal agricultural pesticides span the calendar year in the basin. However, agricultural pesticides are applied most intensively and on a broader rang of crops from March 1 to September 30 in any given year.

It should be noted that past uses of persistent agricultural pesticides that are now banned might continue to affect water quality within the basin, particularly through residual concentrations present in bottom sediments. A survey of pesticide concentration data by Stell et al. (1995) found that two groups of compounds had concentrations at or above minimum reporting levels in 56 percent of the water and sediment analyses. The first group included DDT and metabolites, and the second group included chlordane and related compounds (heptachlor, heptachlor epoxide)—while dieldrin was also frequently detected. The USEPA now bans all of these pesticides for use in the United States, but they might persist in the environment for long periods of time.

Nonpoint Sources from Urban, Industrial, and Residential Lands

Water quality in urban waterbodies is affected by both point source discharges and diverse land use activities in the drainage basin (i.e., nonpoint sources). One of the most important sources of environmental stressors in the Satilla River basin, particularly in the developed and rapidly growing areas is diffuse runoff from urban, industrial, and residential land uses (jointly referred to as “urban runoff”). Nonpoint source contamination an impair streams that drain extensive commercial and industrial areas due to inputs of storm water runoff, unauthorized discharges, and accidental spills. Wet weather urban runoff can carry high concentrations of many of the same pollutants found in point source discharges, such as oxygen-demanding waste, suspended solids, synthetic organic chemicals, oil and grease, nutrients, lead and other metals, and bacteria The major difference is that urban runoff occurs only intermittently, in response to precipitation events.

The characteristics of nonpoint urban sources of pollution are generally similar to those of NPDES permitted storm water discharges (these are discussed in the previous section). Nonpoint urban sources of pollution include drainage from areas with impervious surfaces, but also includes less highly developed areas with greater amounts of pervious surfaces such as lawns, gardens, and septic tanks, all of which may be sources of nutrient loading.

There is little site-specific data available to quantify loading in nonpoint urban runoff in the Satilla River basin, although estimates of loading rates by land use types have been widely applied in other areas.

Pesticides and Herbicides from Urban and Residential Lands

Urban and suburban land uses are also a potential source of pesticides and herbicides through application to lawns and turf, roadsides, and gardens and beds. As an example Stell et al. (1995) provide a summary of usage in the Atlanta Metropolitan Statistic Area (MSA). The herbicides most commonly used by the lawn-care industry are combinations of dicamba, 2,4-D, mecoprop (MCPP), 2,4-DP, and MCPA, or other phenoxy-acid herbicides, while most commercially available weed control products contain one or more of the following compounds: glyphosphate, methyl sulfometuron, benefin (benfluralin), bensulide, acifluorfen, 2,4-D, 2,4-DP, or dicamba. Atrazine was also available for purchase until it was restricted by the State of Georgia on January 1, 1993. The main herbicides used by local and state governments are glyphosphate, methyl sulfometuron, MSMA, 2,4-D, 2,4-DP, dicamba, and chlorsulforon. Herbicides are used for preemergent control of crabgrass in February and October, and in the summer for postemergent control. Data from the 1991 Georgia Pest Control Handbook (Delaplane, 1991) and a survey of CES and SCS personnel conducted by Stell et al. indicate that several insecticides could be considered ubiquitous in urban/suburban use, including chlorpyrifos, diazinon, malathion, acephate, carbaryl, lindane, and dimethoate. Chlorothalonil, a fungicide, is also widely used in urban and suburban areas.

Other Urban/Residential Sources

Urban and residential storm water also potentially includes pollutant loads from a number of other terrestrial sources:

Septic Systems. Poorly sited and improperly operating septic systems can contribute to the discharge of pathogens and oxygen-demanding pollutants to receiving streams. This problem is addressed through septic system inspections by the appropriate County Health Department, extension of sanitary sewer service and local regulations governing minimum lot sizes and required pump-out schedules for septic systems.

Leaking Underground Storage Tanks. The identification and remediation of leaking underground storage tanks (LUSTs) is the responsibility of the EPD Land Protection Branch. Petroleum hydrocarbons and lead are typically the pollutants associated with LUSTs.

Nonpoint Sources from Forestry

Silvicultural operations may serve as sources of stressors, particularly excess sediment loads to streams, when Best Management Practices (BMPs) are not followed. From a water quality standpoint, woods roads pose the greatest potential threat of any of the typical forest practices. It has been documented that 90 percent of the sediment that entered streams from a forestry operation was directly related to either poorly located or poorly constructed roads. The potential impact to water quality from erosion and sedimentation is increased if BMPs are not adhered to.

Silviculture is also a potential source of pesticides/herbicides. According to Stell et al. (1995), pesticides are mainly applied during site preparation after clear-cutting and during the first few years of new forest growth. Site preparation occurs on a 25-year cycle on most pine plantation land, so the area of commercial forest with pesticide application in a given year is relatively small. The herbicides glyphosate (Accord), sulfometuron methyl (Oust), hexazinone (Velpar), imazapyr (Arsenal), and metsulfuron methyl (Escort) account for 95 percent of the herbicides used for site preparation to control grasses, weeds, and broadleaves in pine stands. Dicamba, 2,4-D, 2,4,-DP (Banvel), triclopyr (Garlon), and picloram (Tordon) are minor use chemicals used to control hard to kill hardwoods and kudzu. The use of triclopyr and picloram has decreased since the early 1970's.

Most herbicides are not mobile in the soil and are targeted to plants, not animals. Applications made following the label and in conjunction with BMPs should pose little threat to water quality.

Chemical control of insects and diseases is not widely practices except in forest tree nurseries which is a very minor land use. Insects in pine stands are controlled by chlorpyrifos, diazinon, malathion, acephate, carbaryl, lindane, and dimethoate. Diseases are controlled using chlorothalonil, dichloropropene, and mancozeb. There are five commercial forest tree nurseries within the basin.

According to the Water Quality in Georgia 1998 Report, no streams were identified in the basin as impacted due to commercial forestry activities.

Statewide BMP Implementation Survey

The Georgia Forestry Commission (GFC) conducted statewide BMP implementation surveys in 1991 and 1992 and most recently completed its third survey in 1998. The purposes of these surveys are to determine to what extent forestry BMPs are being implemented and are they effective in minimizing erosion. The surveys were set up to evaluate streamside management zones (SMZs), roads, stream crossings, timber harvesting, mechanical site preparation, chemical treatments, burning, and regeneration operations typically associated with forestry.

During the 1992 survey, the GFC evaluated 2,523 acres of land on 28 sites within the Satilla Basin. Sixteen (16) sites involving 1,188 acres were on private lands and 12 sites involving 1,335 acres were on forest industry land. Overall compliance with BMPs was 89 percent. By ownership, compliance was approximately 96 percent on private lands and 98 percent on forest industry lands.

Approximately 99 percent of the 15.1 miles of main haul roads evaluated on 21 sites were in compliance with BMPs. By ownership, road compliance for private lands and forest industry was 100 percent and 99 percent, respectively.

Specific road construction BMPs identified where improvements are needed include reshaping and stabilizing road surfaces in critical areas such as stream crossings and locating roads outside streamside management zones.

Approximately 96 percent of the 2,123 harvested acres evaluated on the 27 sites were in compliance with BMPs. By ownership, harvesting compliance for private lands was 94 percent and forest industry was 98 percent. Specific harvesting BMPs identified where improvements are needed include stabilizing log decks, minimizing rutting within SMZs, removing logging debris left in the streams, and minimizing the number of temporary stream crossings.

One site was evaluated for site preparation (control burning) and that occurred on private land. Of the 400acres evaluated all were in compliance with BMPs.

No sites were evaluated for reforestation.

During the 1998 survey, the GFC evaluated 4,381.2 acres on 30 sites within the Satilla River Basin. Twenty sites involving 1,807.1 acres were on private land and ten sites involving 2,574.1 acres were on forest industry land. Overall, the percentage of applicable BMPs implemented was 92 percent. By ownership, implementation was 87 percent on private land and 99 percent on forest industry land. The percentage of acres in compliance with BMPs was 99.8 percent on both forest industry and private lands.

Streamside Management Zones: Approximately 130.4 acres of SMZs were evaluated on 12 sites. Five sites were on forest industry land and 7 were on private land. Overall the percentage of applicable BMPs implemented was 92 percent. By ownership, the percentage of applicable BMPs implemented was 85 percent on private land and 100 percent on forest industry. Overall, the percentage of acres in compliance with the BMPs was 98 percent. By ownership, the percentage of acres in BMP compliance was 77 percent on private land and 100 percent on forest industry. Most noted problems on private land involved inadequate stabilization of roads and skid trails within the SMZ, logging debris left in streams and log decks within the SMZ.

Main Haul Roads: Approximately 17.6 miles of main haul roads were evaluated on 16 sites. Eight sites on both ownerships were evaluated. The percentage of applicable BMPs implemented was 91 percent. By ownership, BMP implementation was 81 percent on private land and 100 percent on forest industry land. Overall, the percentage of actual miles in compliance with the BMPs was 97 percent. By ownership, the percentage of miles in BMP compliance was 84 percent on private land and 100 percent on forest industry. Most noted problems on private land involved inadequate water diversion measures and stabilization of roads.

Stream Crossings: Fourteen stream crossings were evaluated on 6 sites. Three sites involving 9 crossings were evaluated on private land and 3 sites involving 5 crossings were evaluated on forest industry land. The percentage of applicable BMPs implemented was 78 percent. By ownership, BMP implementation was 50 percent on private land and 96 percent on forest industry land. Overall, the percentage of actual crossings in compliance with BMPs was 29 percent. By ownership compliance was 11 percent on private lands and 60 percent on forest industry land. Most noted problems on private land involved skidders randomly using fords in streams for crossings and not stabilizing the approaches. On forest industry land, the problem was road ditches tied directly into streams.

Timber Harvesting Outside the SMZ: Approximately 1,786.6 acres were evaluated on 17 sites. Six sites involving 1,314 acres were on forest industry land and 11 sites involving 472.6 acres were on private land. The percentage of applicable BMPs implemented was 96 percent and averaged 100 percent on forest industry land and 94 percent on private land. Overall, the percentage of acres in BMP compliance was over 99 percent and averaged 100 percent on forest industry and 94 percent on private land.

Mechanical Site Preparation Outside the SMZ: Approximately 963.1 acres were evaluated on 14 sites. Four sites involving 382 acres were on forest industry and 10 sites involving 581.1 acres were on private land. The percentage of applicable BMPs implemented was 98 percent and averaged 100 percent on forest industry land and 97 percent on private land. The percentage of acres in BMP compliance was 100 percent for both ownerships. Trash was not removed from one private site.

Chemical Treatments Outside the SMZ: Approximately 463 acres were evaluated on 4 sites. Three sites involving 263 acres were on forest industry land and 1 site involving 200 acres was on private land. The percentage of applicable BMPs implemented was 100

percent on both ownerships. The percentage of acres in BMP compliance was 100 percent on both ownerships.

Control Burning Outside the SMZ: Approximately 219 acres were evaluated on 1 private and 1 forest industry land site. The percentage of applicable BMPs implemented was 100 percent on both and the percentage of acres in BMP compliance was 100 percent on both.

Artificial Regeneration Outside the SMZ: Approximately 819.1 acres were evaluated on 12 sites. Four sites involving 303 acres were on forest industry land and 8 sites involving 516.1 acres were on private land. The percentage of applicable BMPs implemented was over 99 percent and averaged 89 percent on industry land and 100 percent of private land. The percentage of acres in BMP compliance was over 99 percent and averaged over 98 percent on forest industry and 100 percent on private land.

Stream Miles: Approximately 6.87 miles of stream were evaluated on 12 sites. Five site involving 4.5 miles were on forest industry and 7 sites involving 2.37 miles were on private land. The percentage of miles in compliance with BMPs was 95 percent and averaged 100 percent on forest industry and 86 percent on private land. A stream habitat assessment was conducted above and below 5 sites. The above site stream assessment was the reference section and used to compare against the downstream section below the forestry operation that would typically show up any potential impairment. The downstream segments were comparable to the upstream reference.

Another statewide BMP survey is scheduled for calendar year 2001.

Atmospheric Deposition

Atmospheric deposition can be a significant source of nitrogen and acidity in watersheds. Nutrients from atmospheric deposition, primarily nitrogen, are distributed throughout the entire basin in precipitation. The primary source of nitrogen in atmospheric deposition is nitrogen oxide emissions from combustion of fossil fuels. The rate of atmospheric deposition is a function of topography, nutrient sources, and spatial and temporal variations in climatic conditions.

Atmospheric deposition can also be a source of certain mobile toxic pollutants, including mercury, PCBs, and other organic chemicals.

4.I.3 Flow and Temperature Modification

Many species of aquatic life are adapted to specific flow and temperature regimes. In addition, both flow and temperature affect the dissolved oxygen balance in water, and changes in flow regime can have important impacts on physical habitat.

Thus, flow and temperature modifications can be important environmental stressors. They also interact with one another to affect the oxygen balance: flow energy helps control reaeration rate, while water temperature controls the solubility of dissolved oxygen, and higher water temperatures reduce oxygen solubility and thus tend to reduce dissolved oxygen concentrations. Further, increased water temperature increases the rate of metabolic activity in natural waters, which in turn may increase oxygen consumption by aquatic species.

4.I.4 Physical Habitat Alteration

Many forms of aquatic life are sensitive to physical habitat disturbances. Probably the major disturbing factor is erosion and loading of excess sediment, which changes the nature of the stream substrate. Thus, any land use practices that cause excess sediment input can have significant impacts.

Physical habitat disturbance is also evident in many urban streams. Increased impervious cover in urban areas can result in high flow peaks, which increase bank erosion. In addition, construction and other land-disturbing activities in these areas often provide an excess sediment load, resulting in a smothering of the natural substrate and physical form of streams with banks of sand and silt.

4.2 Summary of Stressors Affecting Water Quality

Section 4.1 described the major sources of loads of pollutants (and other types of stressors) to the Satilla basin. What happens in a river is often the result of the combined impact of many different types of loading, including point and nonpoint sources. For instance, excess concentrations of nutrients may result from the combined loads of wastewater treatment plant discharges, runoff from agriculture, runoff from residential lots, and other sources. Accordingly, Section 4.2 brings together the information contained in Section 4.1 to focus on individual stressor types, as derived from all sources.

4.2.1 Nutrients

All plants require certain nutrients for growth, including the algae and rooted plants found in lakes, rivers, and streams. Nutrients required in the greatest amounts include nitrogen and phosphorus. Some loading of these nutrients is needed to support normal growth of aquatic plants, an important part of the food chain. Too much loading of nutrients can, however, result in an overabundance of algal growth with a variety of undesirable impacts. The condition of excessive nutrient-induced plant production is known as eutrophication, and waters affected by this condition are said to be eutrophic. Eutrophic waters often experience dense blooms of algae, which can lead to unaesthetic scums and odors and interfere with recreation. In addition, overnight respiration of living algae, and decay of dead algae and other plant material, can deplete oxygen from the water, stressing or killing fish. Eutrophication of lakes typically results in a shift in fish populations to less desirable, pollution-tolerant species. Finally, eutrophication may result in blooms of certain species of blue-green algae which have the capability of producing toxins.

For freshwater aquatic systems, the nutrient in the shortest supply relative to plant demands is usually phosphorus. Phosphorus is then said to be the "limiting nutrient" because the concentration of phosphorus limits potential plant growth. Control of nutrient loading to reduce eutrophication thus focuses on phosphorus control.

Point and nonpoint sources to the Satilla also discharge large quantities of nitrogen, but nitrogen is usually present in excess of amounts required to match the available phosphorus. Nitrogen (unlike phosphorus) is also readily available in the atmosphere and ground water, so it is not usually the target of management to control eutrophication in freshwater. The bulk of the nitrogen in fresh-water systems is found in three ionic forms—ammonium (NH_4^+), nitrite (NO_2^-), or nitrate (NO_3^-). Nitrite and nitrate are more readily taken up by most algae, but ammonia is of particular concern because it can be toxic to fish and other aquatic life. Accordingly, wastewater treatment plant upgrades have focused on reducing the toxic ammonia component of nitrogen discharges, with corresponding increase in the nitrate fraction.

Sources of Nutrient Loading

The major sources of nutrient loading in the Satilla basin are wastewater treatment facilities, urban runoff and storm water, and agricultural runoff. Concentrations found in the streams and rivers of the Satilla basin represent a combination of a variety of point and nonpoint source contributions.

Point source loads can be quantified from permit and effluent monitoring data, but nonpoint loads are difficult to quantify. Rough estimates of average nutrient loading rates from agriculture are available; however, nonpoint loads from urban/residential sources in the basin have not yet been quantified. The long-term trends in phosphorus within the Satilla River basin can be obtained by examining results from EPD long-term trend monitoring stations. The trend in instream total phosphorus concentrations at one site in the Satilla River basin is shown in Figure 4-11. In general, phosphorus concentrations have declined over time as a result of improvements in wastewater treatment technology.

4.2.2 Oxygen Depletion

Oxygen is required to support aquatic life, and Georgia water quality standards specify minimum and daily average dissolved oxygen concentration standards for all waters. Violations of water quality standards for dissolved oxygen was the most commonly listed cause of nonsupport of designated uses in 1998-1999. Problems with oxygen depletion in rivers and streams of the Satilla basin are associated with oxygen-demanding wastes from point and nonpoint sources. Historically, the greatest threat to maintaining adequate oxygen levels to support aquatic life has come from the discharge of oxygen-demanding wastes from wastewater treatment plants. Treatment upgrades and more stringent permit limits have reduced this threat substantially. Today, dissolved oxygen issues in the Satilla River basin are mainly associated with nonpoint source discharges. It should be noted that dissolved oxygen concentrations are naturally lower in parts of the Satilla River basin.

The trend in instream dissolved oxygen concentrations at one site in the Satilla River basin is shown in Figure 4-12. All waters in the Satilla basin have a state water quality standard of 4.0 mg/L. As shown in Figure 4-12, dissolved oxygen concentrations are usually above this standard.

4.2.3 Metals

A violation of water quality standards for metals attributed to nonpoint sources was detected in one estuarine segment of the Satilla River during the 1998 sampling.

4.2.4 Fecal Coliform Bacteria

Violations of the standard for fecal coliform bacteria were the second most commonly listed cause of nonsupport of designated uses in the 1998-1999 water quality assessment. Fecal coliform bacteria are monitored as an indicator of fecal contamination and the possible presence of human bacterial and protozoan pathogens in water. Fecal coliform bacteria may arise from many of the different point and nonpoint sources discussed in Section 4.1.

Human waste is of greatest concern as a potential source of bacteria and other pathogens. One primary function of wastewater treatment plants is to reduce this risk through disinfection. Observed violations of the fecal coliform standard below several wastewater treatment plants on the Satilla River have generally been rapidly corrected in recent years.

The trend in instream fecal coliform concentrations at one site in the Satilla River basin is shown in Figure 4-13.

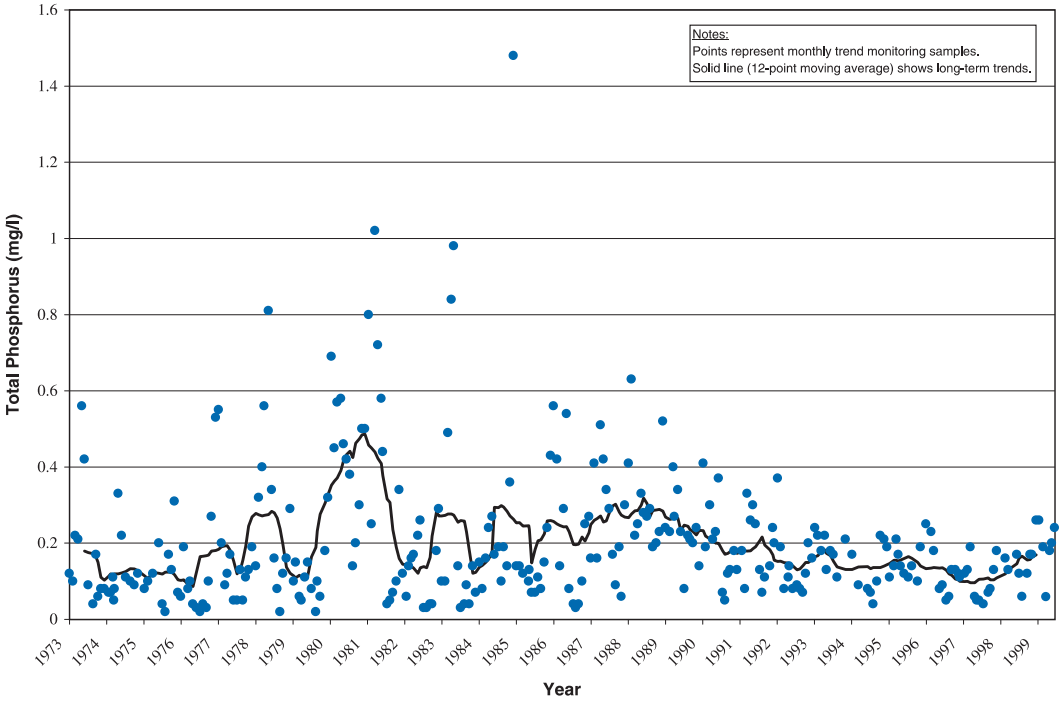

Figure 4-11.Total Phosphorus Concentrations, Satilla River at Georgia Highways 15 and 121

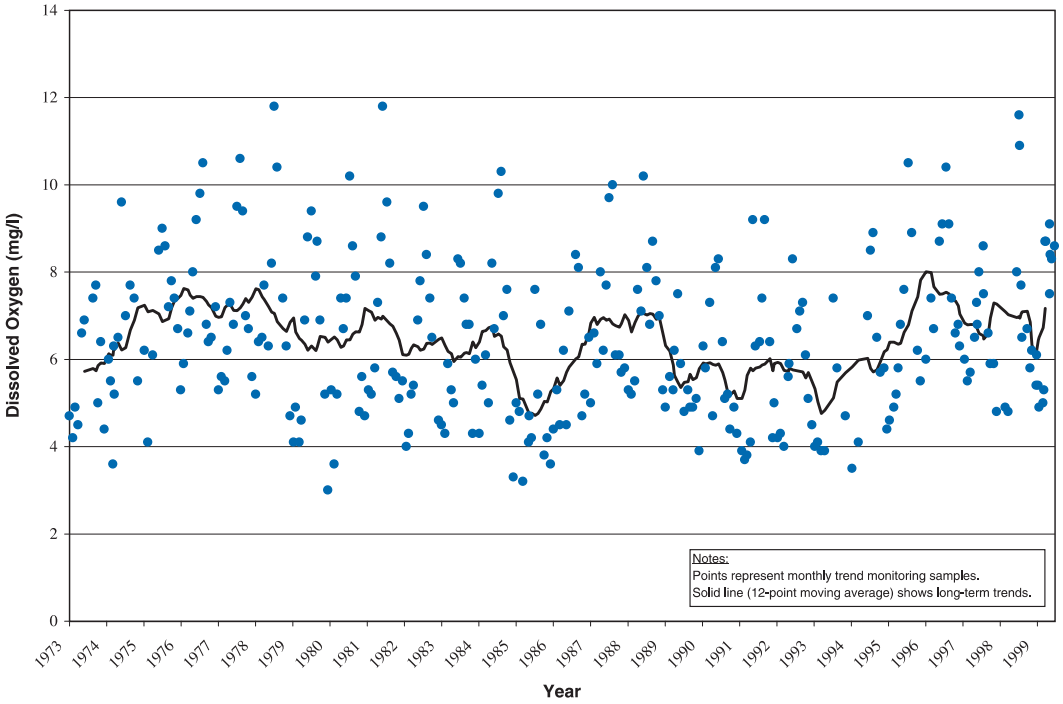

Figure 4-12. Dissolved Oxygen Concentrations, Satilla River at Georgia Highways 15 and 121

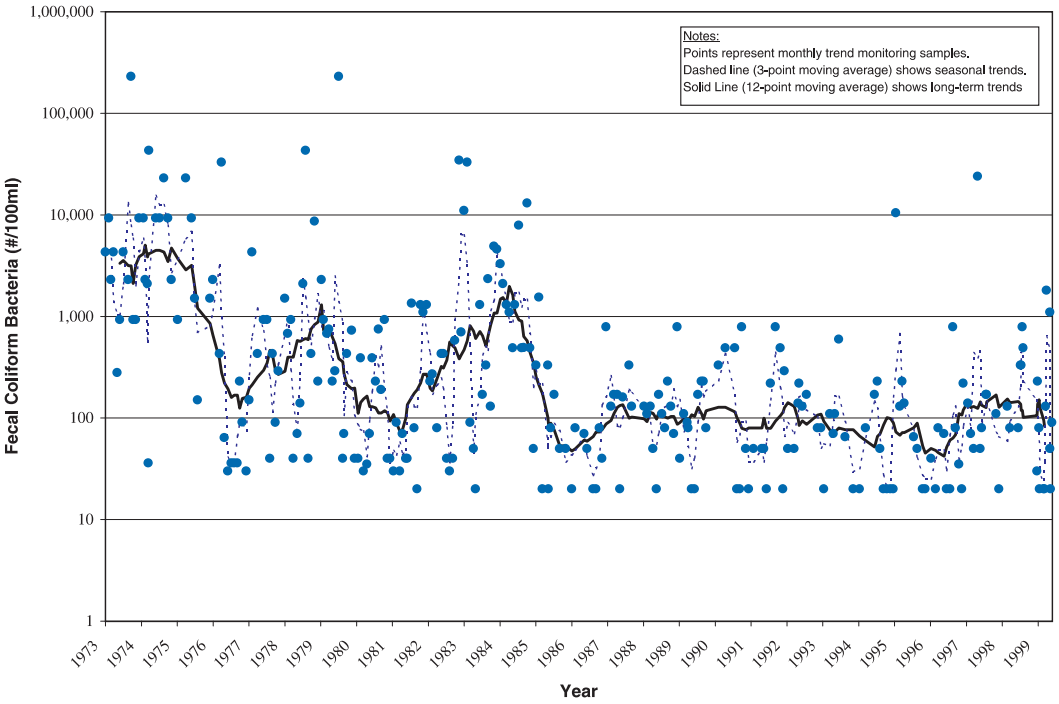

Figure 4-13. Fecal Coliform Bacteria Concentrations, Satilla River at Georgia Highways 15 and 121

As point sources have been brought under control, nonpoint sources have become increasingly important as potential sources of fecal coliform bacteria. Nonpoint sources may include

- Agricultural nonpoint sources, including concentrated animal operations and spreading and/or disposal of animal wastes.
- Runoff from urban areas transporting surface dirt and litter, which may include both human and animal fecal matter, as well as a fecal component derived from sanitary sewer overflows.
- Urban and rural input from failed or ponding septic systems.

4.2.5 Synthetic Organic Chemicals

Synthetic organic chemicals (SOCs) include pesticides, herbicides, and other man-made toxic chemicals. SOCs may be discharged to waterbodies in a variety of ways, including

- Industrial point source discharges.
- Wastewater treatment plant point source discharges, which often include industrial effluent as well as SOCs from household disposal of products such as cleaning agents and insecticides.
- Nonpoint runoff from agricultural and silvicultural land with pesticide and herbicide applications.
- Nonpoint runoff from urban areas, which may load a variety of SOCs such as horticultural chemicals and termiticides.
- Illegal disposal and dumping of wastes.

SOCs were not detected in the surface waters of the Satilla River basin in problem concentrations. It should be noted, however, that most monitoring has been targeted to

waters located below point sources where potential problems were suspected. Agricultural sources were potentially important in the past, particularly from cotton production in the Coastal Plain, but the risk has apparently greatly declined with a switch to less persistent pesticides. Recent research by USGS Hippe et al., 1994; Stell et al., 1995) suggests pesticide/herbicide loading in urban runoff and storm water may be of greater concern than agricultural loading, particularly in streams of the metropolitan Atlanta area.

4.2.6 Stressors from Flow Modification

Stress from flow modification is primarily associated with stormflow in smaller streams associated with development and increased impervious area.

4.2.7 Sediment

Erosion and discharge of sediment can have a number of adverse impacts on water quality. First, sediment can carry attached nutrients, pesticides, and metals into streams. Second, sediment is itself a stressor. Excess sediment loads can alter habitat, destroy spawning substrate, and choke aquatic life, while high turbidity also impairs recreational and drinking water uses. Sediment loading is of concern throughout the basin, but is of greatest concern in the developing urban areas and major transportation corridors. The rural areas are of lesser concern with the exception of rural unpaved road systems and areas where cultivated cropland exceeds 20 percent of the total land cover.

Long term observation of river bathymetry associated with fisheries studies indicate evidence of fish habitat alteration through sedimentation. Suspended sediments for the most part appear to be originating from the upper part of the watershed where agriculture (i.e. cotton) is expanding again.

4.2.8 Habitat Degradation and Loss

In many parts of the Satilla basin, support for native aquatic life is potentially threatened by degradation of aquatic habitat. Habitat degradation is closely tied to sediment loading, and excess sediment is the main threat to habitat in rural areas with extensive land-disturbing activities, as well as in urban areas where increased flow peaks and construction can choke and alter stream bottom substrates. A second important type of habitat degradation in the Satilla basin is loss of riparian tree cover, which can lead to increased water temperatures.

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In This Section

- Assessment of Water Quantity
- Assessment of Water Quality

Section 5

Assessments of Water Quantity and Quality

This section provides an evaluation of the current conditions in the Satilla River basin, in terms of both water quantity (Section 5.1) and water quality (Section 5.2) issues. The assessment results are then combined with the evaluation of environmental stressors from Section 4 to produce a listing of Concerns and Priority Issues in Section 6.

5.1 Assessment of Water Quantity

General information about water quantity issues in the Satilla basin is taken from the Georgia Environmental Protection Water Availability and Use Report, Coastal Plain River Basins, The Regional Economic Forecast of Population and Employment Comprehensive Study, Volume 1, and updated from other Georgia Environmental Protection Division sources where available.

5.1.1 Municipal and Industrial Water Uses

Water use in the basin is almost exclusively groundwater for municipal and industrial supplies. The City of Brunswick (6.40 mgd), St. Simons Water and Sewer (5.67 mgd) and the City of Waycross (3.160 mgd) are the major municipal groundwater users in the basin.

Georgia Pacific's Brunswick Pulp and Paper (56.0 mgd) and Georgia Power Company's Plant Mc Manus (155.0) are the largest industrial surface water users in the basin and use Turtle River as the water source.

Overview of Surface Public Water Systems

Most surface water system plants, in the State of Georgia, are facilities that utilize conventional treatment which includes coagulation, flocculation, sedimentation, filtration, and disinfection. There are a number of small package plants which use the same treatment but on a smaller scale. Intakes located in urban areas with upstream development or in rural areas with large amounts of agriculture upstream have higher amounts of sediments (turbidity) in the rivers, streams and creeks that provide the raw surface water. These waters are prone to sudden erosion and sedimentation problems,

also known as flashing, during hard rain storms which increases the amount of sediment (dirt, mud, and sand) in the water. Water with excess sediment or turbidity can clog intakes (also known as muddying) and filters requiring more sophisticated treatment and higher cost. Many plants have reservoirs to store large amounts of water and to settle out excess sediment (turbidity). Often taste and odor problems come from a natural sources of iron and manganese or algae blooms in shallow surface water. However, algae blooms can also indicate an increase in the level of nutrients in the water. There are no drinking water plants located in this basin and no known and potential raw water quality problems.

5.1.2 Recreation

Recreation activities include boating, swimming, camping, fishing, hiking and picnicking.

5.1.3 Hydropower

There are no hydropower facilities in the Satilla basin.

5.1.4 Navigation

There is no commercial navigation in the Satilla basin.

5.1.5 Waste Assimilation Capacity

Water quality, wastewater treatment, and wastewater discharge permitting are addressed in Section 4. However, it should be noted that the guidelines for discharge of treated effluent into the rivers and streams of the Satilla River basin assume that sufficient surface water flow will be available to assimilate waste and ensure that water quality criteria will be met.

5.1.6 Assessment of Ground Water

There is a significant amount of irrigation withdrawals from the Floridan aquifer in the upstream portions of the basin (Coffee through Pierce counties) and major industrial and domestic usage downstream in Glynn and Camden counties. All municipal, industrial, and agricultural users withdrawing water from the Floridan Aquifer throughout the basin contribute to the salt-water problem discussed below.

The general regional use of groundwater throughout coastal Georgia and into northeast Florida is leading to declining water levels in the Floridan aquifer. Such declines are reducing pressures in the aquifer sufficiently to allow seawater to enter the aquifer locally in the nearby Jacksonville area of Florida and potentially in the St Marys area of Georgia. In Brunswick, Glynn County, reduced aquifer pressure allows underlying salt brines to rise through fractures and other pathways and is presently contaminating the fresh water in the Floridan aquifer.

To deal with this problem, an “Interim Strategy for Managing Salt Water Intrusion in the Upper Floridan Aquifer of Southeast Georgia” was developed and is the current policy under which existing and additional groundwater use is handled for any users east of Jeff Davis, Coffee or Atkinson counties. In these areas, there are no policy restrictions on additional usage. In the downstream coastal area, there are policy limits such as a complete ban on new users in the capped area of Glynn County, and limited additional withdrawals for users elsewhere. There remains only a small amount of Floridan groundwater still available for agriculture, municipal or industrial permitting in this portion of the basin, after which time no further additional withdrawals will be approved without associated reduction in usage elsewhere.

5.2 Assessment of Water Quality

This assessment of water quality is generally consistent with Georgia's water quality assessments for CWA Section 305(b) reporting to EPA. It begins with a discussion of (1) water quality standards, (2) monitoring programs, and (3) data analyses to assess compliance with water quality standards and determine use support. Following this introductory material, detailed assessment results by subbasin are presented in Section 5.2.4.

5.2.1 Water Quality Standards

Assessment of water quality requires a baseline for comparison. A statewide baseline is provided by Georgia's water quality standards, which contain water use classifications, numeric standards for chemical concentrations, and narrative requirements for water quality.

Georgia's water use classifications and standards were first established by the Georgia Water Quality Control Board in 1966. The water use classification system was applied to interstate waters in 1972 by EPD. Table 5-1 provides a summary of water use classifications and basic water quality criteria for each water use. Georgia also has general narrative water quality standards, which apply to all waters. These narrative standards are summarized in Table 5-2.

In addition to the basic water quality standards shown above, Congress made changes in the Clean Water Act in 1987 which required each state to adopt numeric limits for toxic substances for the protection of aquatic life and human health. In order to comply with these requirements, in 1989 the Board of Natural Resources adopted 31 numeric standards for protection of aquatic life and 90 numeric standards for the protection of human health. Appendix B provides a complete list of the toxic substance standards that apply to all waters in Georgia. Georgia has adopted all numeric standards for toxic

Table 5-I. Georgia Water Use Classifications and Instream Water Quality Standards for Each Use

	Bacteria (fecal coliform)		Dissolved Oxygen (other than trout streams)[1]		pH	Temperature (other than trout streams)[1]	
Use Classification	30-Day Geometric Mean[2] (MPN/100 ml)	Maximum (MPN./100 ml)	Daily Average (mg/l)	Minimum (mg/l)	Std. Units	Maximum Rise (°F)	Maximum (°F)
Drinking Water requiring treatment	1,000 (Nov-April) 200 (May-Oct)	4,000 (Nov-April)	5.0	4.0	6.0-8.5	5	90
Recreation	200 (Freshwater) 100 (Coastal)	--	5.0	4.0	6.0-8.5	5	90
Fishing Coastal Fishing[3]	1,000 (Nov-April) 200 (May-Oct)	4,000 (Nov-April)	5.0	4.0	6.0-8.5	5	90
Wild River	No alteration of natural water quality						
Scenic River	No alteration of natural water quality						

1 Standards for Trout Streams for dissolved oxygen are an average of 6.0 mg/l and a minimum of 5.0 mg/l. No temperature alteration is allowed in Primary Trout Streams and a temperature change of 2EF is allowed in Secondary Trout Streams.

2 Geometric means should be "based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours." The geometric mean of a series of N terms is the Nth root of their product. Example: the geometric mean of 2 and 18 is the square root of 36.

3 Standards are same as fishing with the exception of dissolved oxygen which is site specific.

Table 5-2. Georgia Narrative Water Quality Standards for All Waters (Excerpt from Georgia Rules and Regulations for Water Quality Control Chapter 391-3-6-.03 - Water Use Classifications and Water Quality Standards)

(5) General Criteria for All Waters. The following criteria are deemed to be necessary and applicable to all waters of the State:

(a) All waters shall be free from materials associated with municipal or domestic sewage, industrial waste or any other waste which will settle to form sludge deposits that become putrescent, unsightly or otherwise objectionable.

(b) All waters shall be free from oil, scum and floating debris associated with municipal or domestic sewage, industrial waste or other discharges in amounts sufficient to be unsightly or to interfere with legitimate water uses.

(c) All waters shall be free from material related to municipal, industrial or other discharges which produce turbidity, color, odor or other objectionable conditions which interfere with legitimate water uses.

(d) All waters shall be free from toxic, corrosive, acidic and caustic substances discharged from municipalities, industries or other sources, such as nonpoint sources, in amounts, concentrations or combinations which are harmful to humans, animals or aquatic life.

(e) All waters shall be free from turbidity which results in a substantial visual contrast in a waterbody due to man-made activity. The upstream appearance of a body of water shall be observed at a point immediately upstream of a turbidity-causing man-made activity. The upstream appearance shall be compared to a point which is located sufficiently downstream from the activity so as to provide an appropriate mixing zone. For land disturbing activities, proper design, installation and maintenance of best management practices and compliance with issued permits shall constitute compliance with [this] Paragraph...

substances promulgated by the USEPA. Georgia is also developing site-specific standards for major lakes where control of nutrient loading is required to prevent problems associated with eutrophication.

5.2.2 Surface Water Quality Monitoring

EPD's monitoring program integrates physical, chemical, and biological monitoring to provide information for water quality and use attainment assessments and for basin planning. EPD monitors the surface waters of the state to:

- collect baseline and trend data,
- document existing conditions,
- study impacts of specific discharges,
- determine improvements resulting from upgraded water pollution control plants,
- support enforcement actions,
- establish wasteload allocations for new and existing facilities,
- verify water pollution control plant compliance,
- document water use impairment and reasons for problems causing less than full support of designated water uses, and
- develop Total Maximum Daily Loads.

EPD used a variety of monitoring tools to collect information for water quality measurements and for basin planning. These tools include trend monitoring, intensive surveys, lake, coastal, biological, fish tissue, toxic substance monitoring, and facility compliance sampling. Each of these is briefly described in the following sections.

Trend Monitoring

Long term monitoring of streams at strategic locations throughout Georgia, trend or ambient monitoring, was initiated by EPD during the late 1960s. This work was and continues to be accomplished to a large extent through cooperative agreements with federal, state, and local agencies who collect samples from groups of stations at specific, fixed locations throughout the year. The cooperating agencies conduct certain tests in the field and send stream samples to EPD for additional laboratory analyses. Although there have been a number of changes over the years, routine chemical trend monitoring is still accomplished through similar cooperative agreements.

Today EPD contracts with the United States Geological Survey (USGS) for the majority of the trend sampling work. In addition to monthly stream sampling, a portion of the work with the USGS involves continuous monitoring at several locations across the state. EPD associates also collect water and sediment samples for toxic substance analyses, as well as macroinvertebrate samples to characterize the biological community at selected locations as a part of the trend monitoring effort. WRD associates assess fish communities as a part of the monitoring effort. Additional samples used in the assessment were collected by other federal, state and local governments, universities, contracted Clean Lakes projects and utility companies.

Focused Monitoring in the Satilla River Basin

In 1995, EPD adopted and implemented significant changes to the strategy for trend monitoring in Georgia. The changes were implemented to support the River Basin Management Planning program. The number of fixed stations statewide was reduced in order to focus resources for sampling and analysis in a particular group of basins in any one year in accordance with the basin planning schedule. Sampling focus was placed on the Satilla, Ochlockonee, Suwannee, and St. Marys River basins during 1998.

Figure 5-1 shows the focused monitoring network for the Satilla River basin used in 1997-1998. During this period statewide trend monitoring was continued at a number of station locations statewide, in the Savannah Harbor, and at all continuous monitoring locations. The remainder of the trend monitoring resources were devoted to the Savannah and Satilla River basins. As a result, more sampling was conducted in the focus river basins. Increasing the resolution of the water quality monitoring improves the opportunity to identify impaired waters, as well as the causes of impairment.

Intensive Surveys

Intensive surveys complement long-term fixed station fixed station monitoring to focus on a particular issue or problem over a shorter period of time. Several basic types of intensive surveys are conducted, including model calibration surveys and impact studies. The purpose of a model calibration survey is to collect data to calibrate a mathematical water quality mode. Models are used for wasteload allocations and/or TMDLs and as tools for use in making regulatory decisions. Impact studies are conducted when information on the cause-and-effect relationships between pollutant sources and receiving waters is needed. In many cases biological information is collected along with chemical data for use in assessing environmental impacts.

Lake Monitoring

EPD has maintained monitoring programs for Georgia's public access lakes for many years. In the late 1960s, a comprehensive statewide study was conducted to assess fecal coliform levels at public beaches on major lakes in Georgia as the basis for water use classifications and establishment of water quality standards for recreational waters. In 1972, EPD staff participated in the USEPA National Eutrophication Survey, which

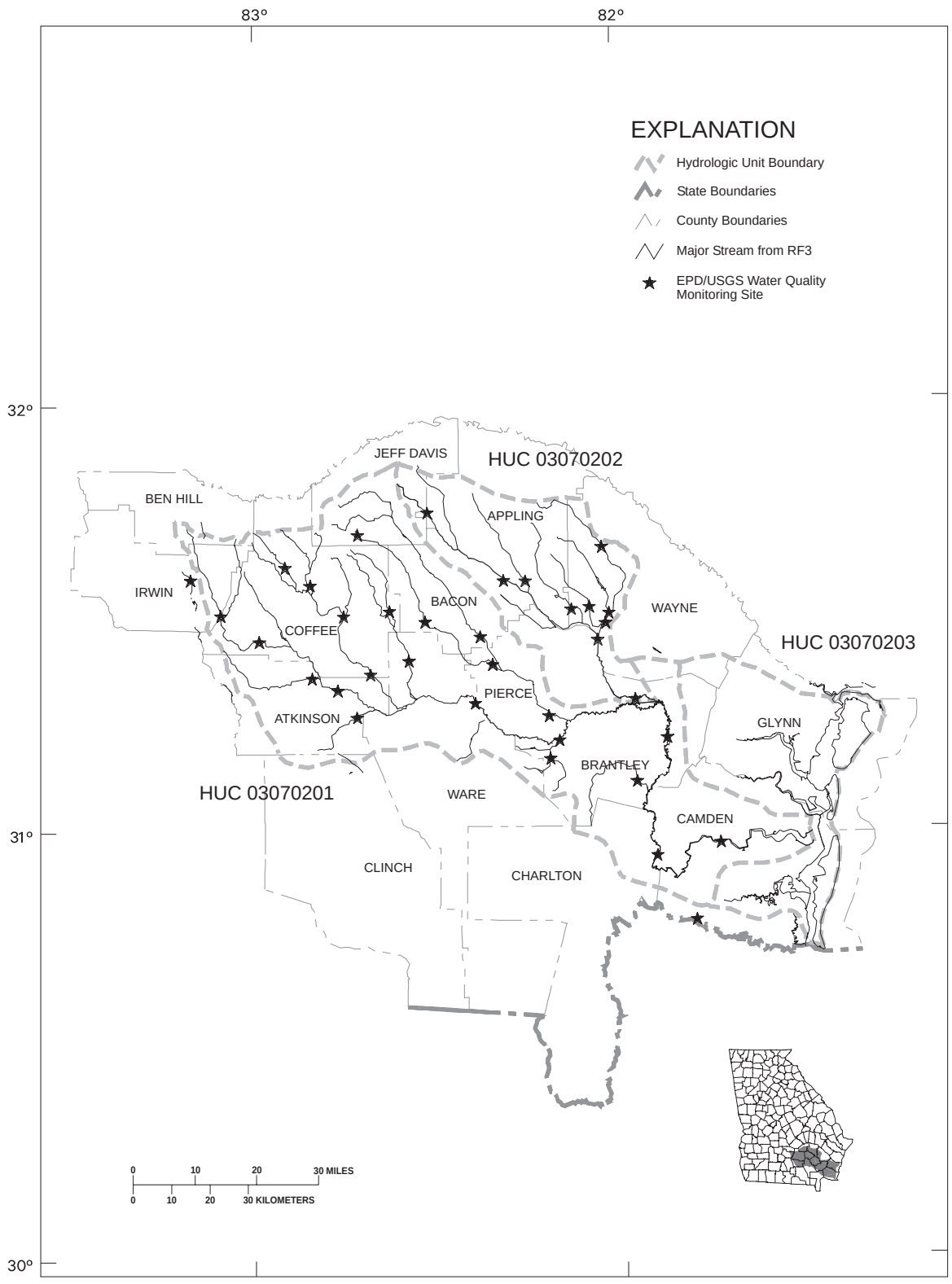

Figure 5-I. Satilla River Basin Trend Monitoring Network Station Locations

included 14 lakes in Georgia. A postimpoundment study was conducted for West Point Lake in 1974. Additional lake monitoring continued through the 1970s. The focus of these studies was primarily problem/solution-oriented and served as the basis for regulatory decisions. In the 1990s, EPD conducted Clean Lakes Phase 1 Diagnostic – Feasiblility studies on several major lakes. The study results were used as the basis for establishing lake-specific water quality standards.

Trophic Condition Monitoring

In 1980-1981, EPD conducted a statewide survey of public access freshwater lakes. The study was funded in part by USEPA Clean Lakes Program funds. The survey objectives were to identify freshwater lakes with public access, assess each lake's trophic condition, and develop a priority listing of lakes as to need for restoration and/or protection. In the course of the survey, data and information were collected on 175 identified lakes in 340 sampling trips. The data collected included depth profiles for dissolved oxygen, temperature, pH, specific conductance, and Secchi disk transparency and chemical analyses for chlorophyll *a*, total phosphorus, nitrogen compounds, and turbidity.

Fish Tissue Monitoring

The DNR conducts fish tissue monitoring for toxic chemicals and issues fish consumption guidelines as needed to protect human health. It is not possible for the DNR to sample fish from every stream and lake in the state. However, high priority has been placed on the 26 major reservoirs which make up more than 90 percent of the total lake acreage. These lakes will continue to be sampled as part of the River Basin Management Planning 5-year rotating schedule to track trends in fish contaminant levels. The DNR has also made sampling fish in rivers and streams down-stream of urban and/or industrial areas a high priority. In addition, DNR will focus attention on areas which are frequented by a large number of anglers.

The program includes testing of fish tissue samples for the substances listed in Table 5-3. Of the 43 constituents tested, only PCBs, chlordane, and mercury have been found in fish at concentrations which could create risk to human health from fish consumption.

Table 5-3. Parameters for Fish Tissue Testing

Antimony	a-BHC	Heptachlor
Arsenic	b-BHC	Heptachlor Epoxide
Beryllium	d-BHC	Toxaphene
Cadmium	g-BHC (Lindane)	PCB-1016
Chromium, Total	Chlordane	PCB-1221
Copper	4,4-DDD	PCB-1232
Lead	4,4-DDE	PCB-1242
Mercury	4,4-DDT	PCB-1248
Nickel	Dieldrin	PCB-1254
Selenium	Endosulfan I	PCB-1260
Silver	Endosulfan II	Methoxychlor
Thallium	Endosulfan Sulfate	HCB
Zinc	Endrin	Mirex
Aldrin	Endrin Aldehyde	Pentachloroanisole
		Chlorpyrifos

The test results have been used to develop consumption guidelines which are updated annually and provided to fishermen when they purchase fishing licenses. This program

will continue and will be coordinated as a part of the River Basin Management Planning process in the future.

In 1994, EPD began utilizing a "risk-based" approach to develop fish consumption guidelines for the state's waters. The EPD's guidelines are based on the use of USEPA potency factors for carcinogenicity and reference doses for noncancer toxicity, whichever is most protective. Inputs used in the derivation of guidelines include a 1 X 10^{-4} risk level for cancer, a 30 year exposure duration, 70 kg as body weight for an adult, and 70 years as the lifetime duration. A range of possible intakes from a low of 3g/day to a high of 30 g/day is evaluated and one of four different recommendations made: no restriction, limit consumption to 1 meal per week, limit consumption to 1 meal per month, or do not eat.

Toxic Substance Stream Monitoring

EPD has focused resources on the management and control of toxic substances in the state's waters for many years. Toxic substance analyses were conducted on samples from selected trend monitoring stations from 1973-1991. Wherever discharges were found to have toxic impacts or to include toxic pollutants, EPD has incorporated specific limitations on toxic pollutants in NPDES discharge permits.

In 1983 EPD intensified toxic substance stream monitoring efforts. This expanded toxic substance stream monitoring project includes facility effluent, stream, sediment, and fish sampling at specific sites downstream of selected industrial and municipal discharges. From 1983 through 1991, 10 to 20 sites per year were sampled as part of this project. Future work will be conducted as a part of the River Basin Management Planning process.

Facility Compliance Sampling

In addition to surface water quality monitoring, EPD conducts evaluations and compliance sampling inspections of municipal and industrial water pollution control plants. Compliance sampling inspections include the collection of 24-hour composite samples, as well as evaluation of the permittee's sampling and flow monitoring requirements.

More than 280 sampling inspections were conducted by EPD staff statewide in 1998. The results were used, in part, to verify the validity of permittee self-monitoring data and as supporting evidence, as applicable, in enforcement actions. Also, sampling inspections can lead to identification of illegal discharges. In 1998, this work was focused on facilities in the Satilla, St. Marys, Suwannee, and Ochlockonee River basins in support of the basin planning process.

Aquatic Toxicity Testing

In 1982 EPD incorporated aquatic toxicity testing into selected industrial NPDES permits. In January 1995, EPD issued approved NPDES Reasonable Potential Procedures, which further delineated required conditions for conducting whole effluent toxicity (WET) testing for municipal and industrial discharges. All major permitted discharges (flow greater than 1 MGD) are required to have WET tests run with each permit reissuance. Certain minor dischargers are also subject to this requirement if EPD determines that aquatic toxicity is a potential issue.

5.2.3 Data Analysis

Assessment of Use Support - General Procedures

EPD assesses water quality data to determine if water quality standards are met and if the waterbody supports its classified use. If monitoring data shows that standards are not

achieved, depending on the frequency with which standards are not met, the waterbody is said to be not supporting or partially supporting the designated use (see box).

Appendix E includes lists of all streams and rivers in the basin for which data have been assessed. The lists include information on the location, data source, designated water use classification, criterion violated, potential cause, actions planned to alleviate the problem, and estimates of stream miles affected. The list is further coded to indicate status of each waterbody under several sections of the Federal Clean Water Act (CWA). Different sections of the CWA require states to assess water quality (Section 305(b)), to list waters still requiring TMDLs (Section 303(d)), and to document waters with nonpoint source problems (Section 319).

The assessed waters are described in three categories: waters supporting designated uses, waters partially supporting designated uses, and waters not supporting designated uses. Waters were placed on the partially supporting list if:

- The chemical data (dissolved oxygen, pH, temperature) indicated an excursion of a water quality standard in 11 percent to 25 percent of the samples collected.
- A fish consumption guideline was in place for the waterbody.

The partially supporting list may also include stream reaches based on predicted concentrations of metals at low stream flow (7Q10 flows) in excess of state standards as opposed to actual measurements on a stream sample. Generally, a stream reach was placed on the not supporting list if:

- The chemical data (dissolved oxygen, pH, temperature) indicated an excursion of a water quality standard in greater than 25 percent of the samples collected.
- A fish consumption ban was in place for the waterbody.
- Acute or chronic toxicity tests documented or predicted toxicity at low stream flow (7Q10) due to a municipal or industrial discharge to the waterbody.

Additional specific detail is provided in the following paragraphs (see box) on analysis of data for fecal coliform bacteria, metals, toxicity, dissolved oxygen, fish/shellfish consumption advisories, and biotic data.

5.2.4 Assessment of Water Quality and Use Support

This section provides a summary of the assessment of water quality and support of designated uses for streams and major lakes in the Satilla River basin. Most of these results were previously summarized in the Georgia 2000 305(b)/303(d) listing (Georgia DNR, 2000). Results are presented by HUC. A geographic summary of assessment results is provided by HUC in Figures 5-2 through 5-4.

Satilla River Subbasin (HUC 03070201)

Appendix E summarizes the determination of support for designated uses of all assessed rivers and streams within this hydrologic unit (GA DNR, 2000).

Monitoring data was collected from 23 monitoring stations located within this subbasin during 1998. Historically, four trend monitoring stations were sampled within this subbasin. The following assessment is based on data from these monitoring stations.

Low Dissolved Oxygen

The water use classification of fishing was not fully supported in thirteen tributary segments and three Satilla River mainstem segments due to dissolved oxygen concentrations less than standards. Dissolved oxygen may be lower in these areas due to natural conditions.

Analysis of data for fecal coliform bacteria, metals, toxicity, dissolved oxygen, fish/shellfish consumption advisories, and biotic data

Fecal Coliform Bacteria

Georgia water quality standards establish a fecal coliform criterion of a geometric mean (four samples collected over a 30-day period) of 200 MPN/100 mL for all waters in Georgia during the recreational season of May through October. This is the year-round standard for waters with the water use classification of recreation. For waters classified as drinking water, fishing, or coastal fishing, for the period of November through April, the fecal coliform criterion is a geometric mean (four samples collected over a 30-day period) of 1000 per 100 ml and not to exceed 4000 per 100 ml for any one sample. The goal of fecal coliform sampling in the Satilla River basin focused mointoring in 1998 was to collect four samples in a thirty day period in each of four quarters. If one geometric was in excess of the standard then the stream segment was placed on the partial support list. If more than one geometric mean was in excess of the standard the stream segment was placed on the not support list.

In some cases the number of samples was not adequate to calculate geometric means. In these cases, the USEPA recommends the use of a review criterion of 400 per 100 ml to evaluate sample results. This bacterial density was used to evaluate data for the months of May through October and the maximum criterion of 4000 per 100 ml was used in assessing the data from the months of November through April. Thus, where geometric mean data was not available, waters were deemed not supporting uses when 26 percent of the samples had fecal coliform bacteria densities greater than the applicable review criteria (400 or 4000 MPN/100 mL) and partially supporting when 11 to 25 percent of the samples were in excess of the review criterion.

Metals

Since data on metals from any one given site are typically infrequent, using the general evaluation technique of 26 percent excursion to indicate nonsupport and 11 to 25 percent excursion to indicate partial support was not meaningful. Streams were placed in the nonsupporting category if multiple excursions of state criteria occurred and the data were based on more than four samples per year. With less frequent sampling, streams with excursions were placed on the partially supporting list. In addition, an asterisk appears beside metals data in those cases where there is a minimal database. Data were collected in the winter and the summer seasons in 1998 for comparison to water quality standards. Clean techniques were used. If one of the samples was in excess of the standard the stream segment was placed on the partial support list. This approach is in accordance with USEPA guidance, which suggests any single excursion of a metals criteria be listed.

Toxicity Testing/Toxic Substances

Data from EPD toxicity testing of water pollution control plant effluents were used to predict toxicity in the receiving waterbody at critical, 7Q10 low flows. Effluent data for metals were used to designate either partial support or nonsupport based on whether instream corroborating metals data were available. When instream metals data were available the stream was determined to be not supporting if a metal concentration exceeded stream standards; when instream data were not available, the stream was listed as partially supporting.

Dissolved Oxygen, pH, Temperature

When available data indicated that these parameters were out of compliance with state standards more than 25 percent of the time, the waters were evaluated as not supporting the designated use. Between 11 percent and 25 percent noncompliance resulted in a partially supporting evaluation.

Fish/Shellfish Consumption Guidelines

A waterbody was included in the not supporting category when an advisory for “no consumption” of fish, a commercial fishing ban, or a shellfishing ban based on actual data was in effect. A waterbody was placed in the partially supporting category if a guideline for restricted consumption of fish had been issued for the waters.

Biotic Data

A “Biota Impacted” designation for “Criterion Violated” indicates that studies showed a modification of the biotic community. Communities used were fish. Studies of fish populations by the DNR Wildlife Resources Division used the Index of Biotic Integrity (IBI) to identify affected fish populations. The IBI values were used to classify the population as Excellent, Good, Fair, Poor, or Very Poor. Stream segments with fish populations rated as “Poor” or “Very Poor” were included in the partially supporting list.

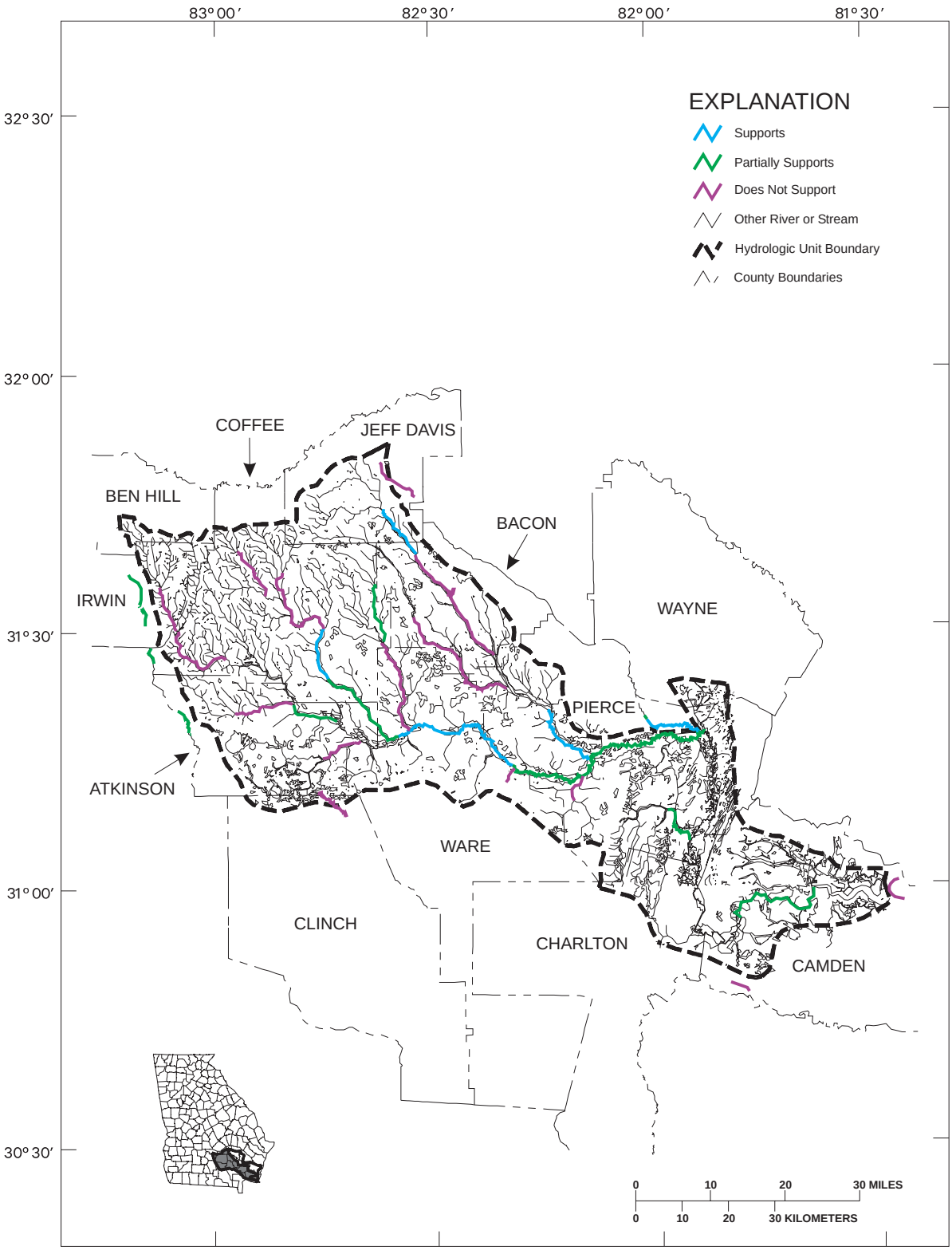

Figure 5-2. Assessment of Water Quality Use Support in the Satilla River Basin, HUC 03070201

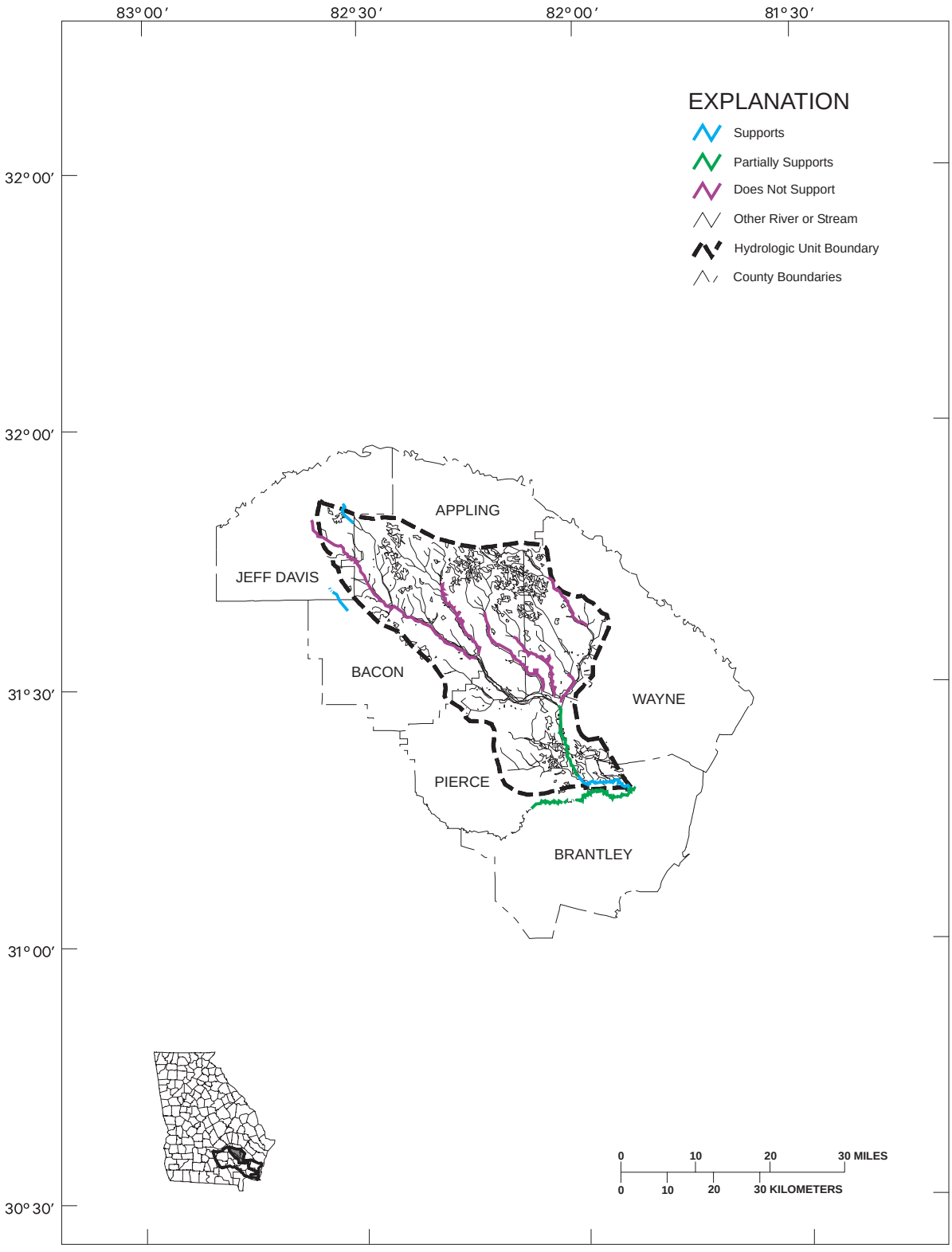

Figure 5-3. Assessment of Water Quality Use Support in the Satilla River Basin, HUC 03070202

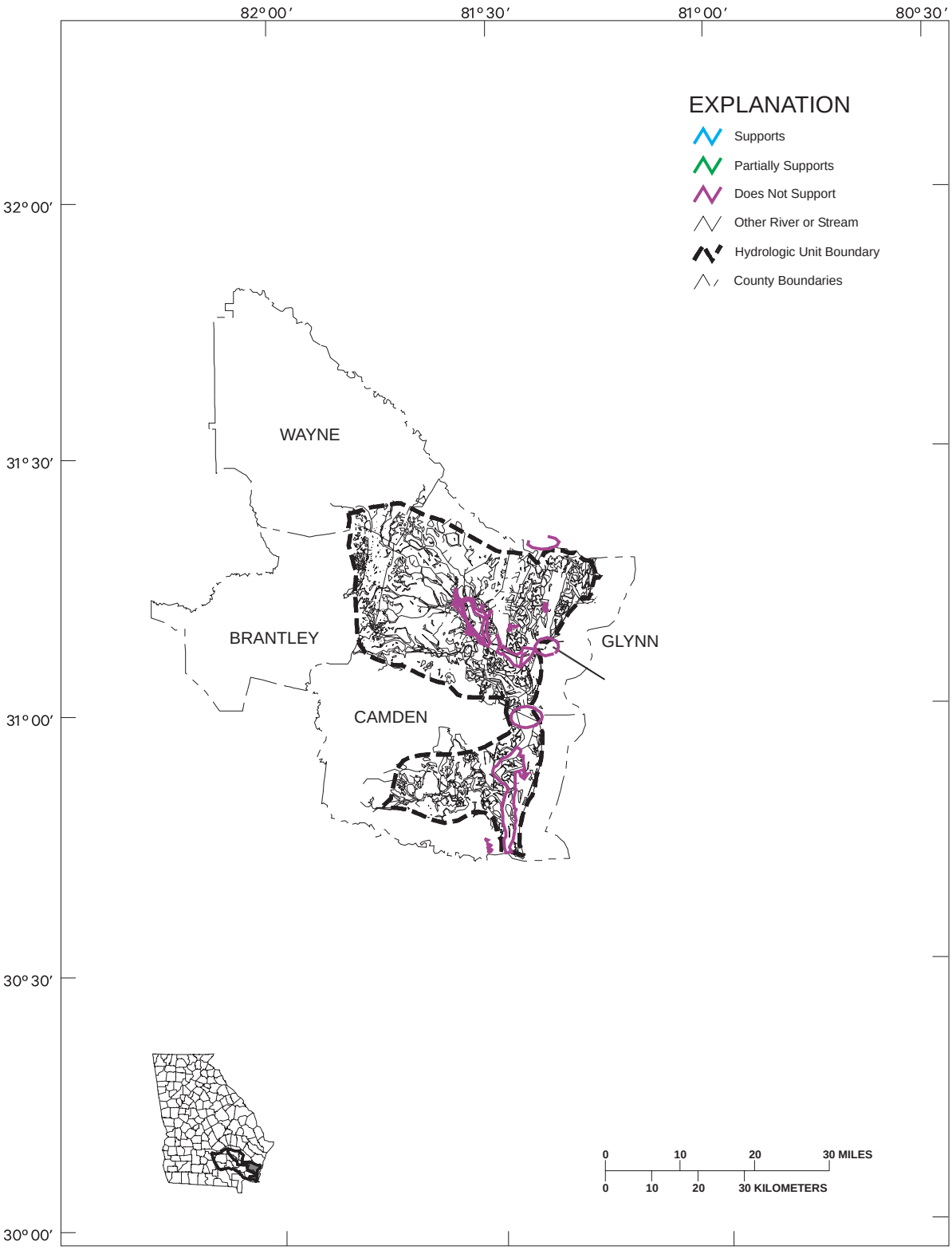

Figure 5-4. Assessment of Water Quality Use Support in the Satilla River Basin, HUC 03070203

Fecal Coliform Bacteria

The water use classification of fishing was not fully supported in eleven Satilla River tributary stream segments due to exceedances of the water quality standard for fecal coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources and/or animal wastes.

Fish Consumption Guidelines

The water use classification of fishing was not fully supported in two Satilla River mainstem segments due to fish consumption guidelines recommended because of mercury residues. The guidelines are for largemouth bass, redbreast sunfish and/or channel catfish.

Erosion and Sedimentation

The water use classifications of fishing, recreation, and drinking water are potentially threatened in waterbodies by erosion and loading of sediment which can alter stream morphology, impact habitat, and reduce water clarity. Potential sources include urban runoff and development (particularly construction), unpaved rural roads, forestry practices, and agriculture. There are no stream segments listed at this time in this subbasin as not fully supporting designated water uses due to poor fish communities or sedimentation.

Satilla River Subbasin (HUC 03070202)

Appendix E summarizes the determination of support for designated uses of all assessed rivers and streams within this hydrologic unit (GA DNR, 2000).

Monitoring data was collected from 10 monitoring stations located within this subbasin during the 1998. Historically, one trend monitoring station has been sampled within this subbasin. The following assessment is based on data from these monitoring stations.

Fecal Coliform Bacteria

The water use classification of fishing was not fully supported in six tributary stream segments due to exceedances of the water quality standard for fecal coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources and/or animal wastes.

Erosion and Sedimentation

The water use classifications of fishing, recreation, and drinking water are potentially threatened in waterbodies by erosion and loading of sediment which can alter stream morphology, impact habitat, and reduce water clarity. Potential sources include urban runoff and development (particularly construction), unpaved rural roads, forestry practices, and agriculture. There are no stream segments listed at this time in this subbasin as not fully supporting designated water uses due to poor fish communities or sedimentation.

Low Dissolved Oxygen

The water use classification of fishing was not fully supported in seven tributaries due to dissolved oxygen concentrations less than standards. Low dissolved oxygen in the tributaries was attributed to nonpoint sources. Dissolved oxygen may be lower in these areas due to natural conditions.

Satilla River Subbasin (HUC 03070203)

Appendix E summarizes the determination of support for designated uses of all assessed rivers and streams within this hydrologic unit (GA DNR, 2000).

Monitoring data was collected from 3 monitoring stations located within this subbasin during 1998. Historically, two trend monitoring stations were sampled within this subbasin. The following assessment is based on data from these trend monitoring stations.

Fish Consumption Guidelines

The water use classification of fishing was not fully supported in five estuarine areas based on fish consumption guidelines due to PCBs, mercury and toxaphene. The guidelines are for several fish and shellfish species.

Low Dissolved Oxygen

The water use classification of fishing was not fully supported in two estuarine areas due to dissolved oxygen concentrations less than standards. Low dissolved oxygen was attributed to point and nonpoint sources. Dissolved oxygen may be lower in these estuarine areas due to natural conditions.

Metals

The water use classification of fishing was not fully supported in two estuarine areas (Gibson and Purvis Creeks) due to an industrial hazardous waste site.

References

DRI/McGraw Hill. 1996. The Regional Economic Forecast of Population and Employment Comprehensive Study, Volume 1. Prepared for: Georgia Department of Natural Resources Environmental Protection Division. DRI/McGraw-Hill, Lexington, MA.

Georgia Environmental Protection Division 1987. Water Availability and Use Report, Coastal Plain River Basins.

In This Section

- Identified Basin Planning and Management Concerns
- Priorities for Water Quality Concerns
- Priorities for Water Quantity Concerns

Concerns and Priority Issues

The assessments in Section 5 present a number of water quality and quantity concerns within the Satilla River basin. This section aggregates the assessment data to identify priority issues for development of management strategies.

6.1 Identified Basin Planning and Management Concerns

Section 4 and 5 identified both site-specific and generalized sources of water quality stressors. Some issues are limited to specific segments, but a number of water quality concerns apply throughout the basin. The criterion listed most frequently in the Georgia 2000 305(b)/303(d) List as contributor to nonsupporting or partial supporting status was low dissolved oxygen followed by fecal coliform bacteria and fish consumption guidelines. Low dissolved oxygen conditions have been documented for many years in the waters of the Satilla River and this situation is likely due primarily to natural conditions. Fish consumption issues are associated primarily with mercury as a result of air deposition and possibly naturally occurring sources and fecal coliform is associated primarily with urban runoff or nonpoint sources.

Within some individual stream reaches, other sources may be of greater importance (e.g., WPCP effluent); however, urban runoff and general nonpoint sources represent a basin-wide concern. Further, strong population growth and development pressure in parts of the basin will tend to increase the importance of urban runoff as a stressor of concern. For such widespread concerns, basin-wide management strategies will be needed.

Major water quality and quantity concerns for the Satilla River basin are summarized by geographic area in terms of the concerns and sources of these concerns in Table 6-1. Table 6-2 summarizes the pollutants identified as causing impairment of designated uses in the basin; however, not all identified concerns are related to pollutant loads. Ongoing control strategies are expected to result in support of designated uses in a number of waters. In other waters, however, the development of additional management strategies may be required or implemented in order to achieve water quality standards.

Table 6-I. Summary of Concerns in the Satilla River Basin

Stressors of Concern	Potential Source of the Stressor by HUC		
	HUC 03070201	HUC 03070202	HUC 03070203
Dissolved Oxygen	Urban and Rural NPS	Urban and Rural NPS	Multiple source potential
Metals			Industrial source
Fecal Coliform Bacteria	Multiple source potential	Multiple source potential	
Fish Consumption Guidelines	Nonpoint mercury		Industrial source, nonpoint source, PCBs persisting in environment
Erosion and Sedimentation	Urban and Rural NPS	Urban and Rural NPS	Urban and Rural NPS
Drought Conditions	Lack of Rainfall	Lack of Rainfall	
Widespread Flooding	Heavy Rainfall	Heavy Rainfall	Heavy Rainfall
Saltwater Intrusion			Heavy pumping in coastal areas for municipal and industrial purposes

Table 6-2. Summary of Pollutants Causing Water Quality Impairment in the Satilla River Basin

Use Classification of Waterbody Segments	Pollutants Causing Impairment by HUC		
	HUC 03070201	HUC 03070202	HUC 03070203
Fishing (Support for Aquatic Life)	DO, Fecal Coliform	DO, Fecal Coliform	DO, Metals
Fishing (Fish Consumption)	Mercury		PCBs, Mercury
Drinking Water			

In the following pages, priority water quality and quantity concerns are presented by Hydrologic Unit. For some water quality and quantity concerns, problem statements are identical for each HUC, others differ between HUCs. Detailed strategies for addressing these concerns are then supplied in Section 7.

Each concern is listed in the form of a "Problem Statement" which summarizes the linkage between stressor sources and water quality impacts. The order in which concerns are listed for each HUC should not be considered to be significant. Prioritization of basin concerns requires consensus among all stakeholders, and has not been finalized; however, short-term water quality action priorities for EPD are summarized in Section 6.2.

6.1.1 Problem Statements

Satilla River Subbasin (HUC 03070201)

Low Dissolved Oxygen

The water use classification of fishing was not fully supported in thirteen tributary segments and three Satilla River mainstem segments due to dissolved oxygen concentrations less than standards. Dissolved oxygen may be lower in these areas due to natural conditions.

Fecal Coliform Bacteria

The water use classification of fishing was not fully supported in eleven Satilla River tributary stream segments due to exceedances of the water quality standard for fecal

coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources and/or animal wastes.

Fish Consumption Guidelines

The water use classification of fishing was not fully supported in two Satilla River mainstem segments due to fish consumption guidelines recommended because of mercury residues. The guidelines are for largemouth bass, redbreast sunfish and/or channel catfish.

Erosion and Sedimentation

The water use classifications of fishing, recreation, and drinking water are potentially threatened in waterbodies by erosion and loading of sediment which can alter stream morphology, impact habitat, and reduce water clarity. Potential sources include urban runoff and development (particularly construction), unpaved rural roads, forestry practices, and agriculture. There are no stream segments listed at this time in this subbasin as not fully supporting designated water uses due to poor fish communities or sedimentation.

Drought Conditions

Drought conditions during the 1998-2000 period impacted the Atlantic Coastal Plain region of the state, which includes the Ocmulgee, Oconee, Altamaha, Ogeechee, Savannah, St. Marys and Satilla river basins. According to EPD's 1998-2000 "Georgia Drought Report," the rainfall shortage in this region amounted to almost 25 inches. The report provides a summary of the environmental, economic, and social impacts of the drought and an objective assessment of the state's vulnerability and mitigation efforts. In addition, the report evaluates the management actions implemented by state and local authorities during the drought and presents a set of recommendations for improving drought preparedness and response.

Widespread Flooding

In March 1998, Georgia experienced widespread flooding due to heavy rainfall. The severity of the rain and the damages that resulted from flooding caused more than 65 percent of Georgia's counties to be declared federal disaster areas under Presidential Disaster Declaration 1209. Counties that experienced flooding in the Satilla River basin during the 1998 floods include Appling, Atkinson, Bacon, Brantley, Coffee, Glynn and Jeff Davis.

Satilla River Subbasin (HUC 03070202)

Fecal Coliform Bacteria

The water use classification of fishing was not fully supported in six tributary stream segments due to exceedances of the water quality standard for fecal coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources and/or animal wastes.

Erosion and Sedimentation

The water use classifications of fishing, recreation, and drinking water are potentially threatened in waterbodies by erosion and loading of sediment which can alter stream morphology, impact habitat, and reduce water clarity. Potential sources include urban runoff and development (particularly construction), unpaved rural roads, forestry practices, and agriculture. There are no stream segments listed at this time in this subbasin as not fully supporting designated water uses due to poor fish communities or sedimentation.

Low Dissolved Oxygen

The water use classification of fishing was not fully supported in seven tributaries due to dissolved oxygen concentrations less than standards. Low dissolved oxygen in the tributaries was attributed to nonpoint sources. Dissolved oxygen may be lower in these areas due to natural conditions.

Drought Conditions

Drought conditions during the 1998-2000 period impacted the Atlantic Coastal Plain region of the state, which includes the Ocmulgee, Oconee, Altamaha, Ogeechee, Savannah, St. Marys and Satilla river basins. According to EPD's 1998-2000 "Georgia Drought Report," the rainfall shortage in this region amounted to almost 25 inches. The report provides a summary of the environmental, economic, and social impacts of the drought and an objective assessment of the state's vulnerability and mitigation efforts. In addition, the report evaluates the management actions implemented by state and local authorities during the drought and presents a set of recommendations for improving drought preparedness and response.

Flooding

In March 1998, Georgia experienced widespread flooding due to heavy rainfall. The severity of the rain and the damages that resulted from flooding caused more than 65 percent of Georgia's counties to be declared federal disaster areas under Presidential Disaster Declaration 1209.

Satilla River Subbasin (HUC 03070203)

Fish Consumption Guidelines

The water use classification of fishing was not fully supported in five estuarine areas based on fish consumption guidelines due to PCBs, mercury and toxaphene. The guidelines are for several fish and shellfish species.

Low Dissolved Oxygen

The water use classification of fishing was not fully supported in two estuarine areas due to dissolved oxygen concentrations less than standards. Low dissolved oxygen was attributed to point and nonpoint sources. Dissolved oxygen may be lower in these estuarine areas due to natural conditions.

Metals

The water use classification of fishing was not fully supported in two estuarine areas (Gibson and Purvis Creeks) due to an industrial hazardous waste site.

Salt Water Intrusion

The potential of saltwater intrusion in the coastal areas is caused by heavy pumping of groundwater for municipal and industrial purposes. The demand for water due to population growth has decreased water pressure in the Upper Floridan aquifer, which increases the potential for saltwater entering the fresh water supply of the of the aquifer. Saltwater contamination threatens not only groundwater quality in coaster Georgia, but portions of northeast Florida and southeast South Carolina.

Flooding

In March 1998, Georgia experienced widespread flooding due to heavy rainfall. The severity of the rain and the damages that resulted from flooding caused more than 65 percent of Georgia's counties to be declared federal disaster areas under Presidential Disaster Declaration 1209. Counties that experienced flooding in the Satilla basin include Appling, Atkinson, Bacon, Brantley, Coffee, Glynn, and Jeff Davis. Before 1998, the last

major flooding event in Georgia occurred in July 1994, when tropical storm Alberto moved into southwest Georgia and caused the worst flooding in the State's history.

6.2 Priorities for Water Quality Concerns

6.2.1 Short-Term Water Quality Action Priorities for EPD

Section 6.1 identifies known priority concerns for which management and planning are needed in the Satilla River basin. Because of limited resources, and, in some cases, limitations to technical knowledge, not all of these concerns can be addressed at the same level of detail within the current 5-year cycle of basin management. It is therefore necessary to assign action priorities for the short term based on where the greatest return for available effort can be expected.

Current priorities for action by EPD (2000) are summarized in Table 6-3 and discussed below. These reflect EPD's assessment of where the greatest short-term return can be obtained from available resources. These priorities were presented to and discussed with the local advisory committee in March 2000. The priorities were also public noticed and approved by the USEPA as part of the Georgia CWA 303(d) listing process in 2000 and discussed in the report, *Water Quality in Georgia, 1998-1999.*

Assigning Priorities for Stream Segments

For several waters in the Satilla River basin and other river basins around the state, currently planned control strategies are expected to result in attainment of designated uses. EPD resources will be directed to ensure that the ongoing pollution control strategies are implemented as planned and water quality improvements are achieved. These waters on the Georgia 2000 305(b)/303(d) List are identified as active 305(b) waters, and are the highest priority waters, as these segments will continue to require resources to complete actions and ensure standards are achieved. These stream segments have been assigned priority one (See Appendix E).

Table 6-3. EPD's Short-Term Priorities for Addressing Waters Not Fully Supporting Designated Use

Priority	Type
1	Segments where ongoing pollution control strategies are expected to result in achieving support of designated uses; active special projects.
2	Segments with multiple data points which showed metals in excess of water quality standards and segments in which dissolved oxygen is an issue.
3	Waters for which urban runoff and generalized nonpoint sources have resulted in violations of standards for fecal coliform bacteria and waters for which fish consumption guidelines are in place due to air deposition of mercury.

Second priority was allocated to segments with multiple data points which showed metals concentrations from nonpoint sources in excess of water quality standards and to segments in which dissolved oxygen concentration was an issue.

Third priority was assigned to waters where air deposition, urban runoff or general nonpoint sources caused fish consumption guidelines listings, and/or metal or fecal coliform bacteria standards violations. Waters added to the Georgia 303(d) list by EPA were also assigned to third priority. Within the current round of basin planning these sources will be addressed primarily through general strategies of encouraging best management practices for control of stressor loadings. In addition, additional work will

be initiated to implement approved TMDLs on waters in this group. TMDLs have been completed on those waters in Appendix E that have a "3" in the column labeled 303(d).

Several issues helped forge the rationale for priorities. First, strategies are currently in place to address the significant water quality problems in the Satilla River basin and significant resources will be required to ensure that these actions are completed. Second, the vast majority of waters for which no control strategy is currently in place are listed due to fish consumption guidelines or as a result of exceedance of fecal coliform bacteria due to urban runoff or nonpoint At the present time, the efficacy of the standards for fecal coliform bacteria standard are in question in the scientific community, as described in Section 4.2. Also, there is no national strategy in place to address air deposition of mercury which is thought to cause the mercury which contributes to the fish tissue guidance listings.

6.2.2 General Long-Term Priorities for Water Quality Concerns

Long-term priorities for water quality management in the Satilla River basin will need to be developed by EPD and all other stakeholders during the next iteration of the basin management cycle. Long-term priorities must seek a balance between a number of different basinwide objectives. These objectives include:

- Protecting water quality in lakes, rivers, streams, and estuaries through attainment of water quality standards and support for designated uses;
- Providing adequate, high quality water supply for municipal, agricultural, industrial, and other human activities;
- Preserving habitat suitable for the support of healthy aquatic and riparian ecosystems;
- Protecting human health and welfare through prevention of water-borne disease; minimization of risk from contaminated fish tissue, and reduction of risks from flooding; and
- Ensuring opportunities for economic growth, development, and recreation in the region.

6.3 Priorities for Water Quantity Concerns

Groundwater overuse and saltwater intrusion is a major concern for water quantity in the Satilla basin. EPD has placed limitations on additional withdrawals of groundwater in the affected areas. This has effectively slowed the rate of additional contamination. In April, 1997, EPD implemented an Interim Strategy to protect the Upper Floridan Aquifer in the 24 coastal counties from salt-water intrusion which includes 12 counties in the Ogeechee basin. The strategy, developed in consultation with South Carolina and Florida, will continue until December 31, 2005 at which time EPD plans to implement a Final Strategy that will (a) stop salt-water intrusion before municipal water supply wells on Hilton Head Island, South Carolina and Savannah, Georgia are contaminated and (b) prevent an existing salt-water problem at Brunswick, Georgia from worsening. To accomplish this objective, EPD will do the following:

(1) The General Assembly has provided funds to conduct expanded scientific and feasibility studies to determine with certainty how to permanently stop the salt-water intrusion moving towards Hilton Head Island, South Carolina and Savannah, Georgia and how to prevent the existing salt-water intrusion at Brunswick, Georgia from worsening.

(2) Require the development of comprehensive local water supply plans in a 24 county area of southeast Georgia. These are required by December 31, 2000 from all 24 counties as a condition of issuing any future proposed public water, agriculture, or industry water withdrawal permits. This work has been completed.

(3) Impose caps on Upper Floridan groundwater use in Glynn County, Chatham County, and portions of Bryan and Effingham Counties, to avoid worsening the rate of salt-water intrusion at HiltonHead-Savannah and at Brunswick.

(4) Reduce groundwater use in Chatham County by at least 10 million gallons per day by December 31, 2005 through conservation and substitution of surface water for groundwater. This will be affirmed through reductions in groundwater use permits. The commitment will be met by 2005.

(5) Allow, on an interim basis, increases in groundwater withdrawals in the areas of southeast Georgia that have little impact on salt-water intrusion problems. In a policy modification dated September 19, 2001, no further increases in the Upper Floridan aquifer production in the coastal counties will be permitted without associated decreases elsewhere. Use of alternate aquifers may be considered.

(6) Encourage and promote water conservation and reduced groundwater usage wherever feasible, throughout southeast Georgia.

6.3.1 Priorities for Competing Demands

With regard to the priority to be placed on meeting competing demands for future water use, the EPD (in conjunction with a broad group of stakeholders from north, central, and southwest Georgia) has established a set of "guiding principles" which will be followed in developing the state's position regarding the allocation of water. These principles are partially based upon the prioritization given to meeting categories of water needs under Georgia law (i.e., municipal needs are the first priority, and agricultural water needs are second; all other water needs follow these two). The principles are summarized below:

1. Municipal (M&I) demands have the highest priority.
2. Agriculture needs must be satisfied.
3. Minimum instream flow rates must be met in order to preserve water quality.
4. If other demands (e.g., industrial, recreation, hydropower, navigation, and environment) can not be met under conditions of water shortage, efforts will be made to optimize the mix of economic and environmental values.

In This Section

Section 7

Implementation Strategies

This section builds on the priority issues identified in Section 6 and proposes strategies to address the major water quality problems in the Satilla River basin.

Georgia's Mission Statement for river basin management planning is "to develop and implement a river basin planning program to protect, enhance, and restore the waters of the state of Georgia that will provide for effective monitoring, allocation, use, regulation, and management of water resources". Associated with this mission are a variety of goals which emphasize coordinated planning necessary to meet all applicable local, state, and federal laws, rules, and regulations, and provide for water quality, habitat, and recreation. For the Satilla basin, these goals will be implemented through a combination of a variety of general strategies, which apply across the basin and across the state, and targeted or site-specific strategies. Section 7.1 describes the big-picture management goals for the Satilla River basin. Section 7.2 describes the general and basinwide implementation strategies most relevant to the Satilla River. Targeted strategies for specific priority concerns within each subbasin, as identified in Section 6, are then presented in 7.3.

7.1 "Big Picture" Overview for the Satilla River Basin

This Satilla River Basin Management Plan includes strategies to address a number of different basinwide objectives. These include:

- Protecting water quality in lakes, rivers, streams, estuaries, and coastal waters through attainment of water quality standards and support for designated uses;
- Providing adequate, high quality water supply for municipal, agricultural, industrial, and other human activities;
- Preserving habitat suitable for the support of healthy aquatic and riparian ecosystems;

- Protecting human health and welfare through prevention of water-borne disease; minimization of risk from contaminated fish tissue, and reduction of risks from flooding; and
- Ensuring opportunities for economic growth, development, and recreation in the region.

Achieving these objectives is the responsibility of a variety of state and federal agencies, local governments, business, industry, and individual citizens. Coordination between partners is difficult, and impacts of actions in one locale by one partner on conditions elsewhere in the basin are not always understood or considered. River Basin Management Planning (RBMP) is an attempt to bring together stakeholders in the basin to increase coordination and to provide a mechanism for communication and consideration of actions on a broad scale to support water resource objectives for the entire basin. RBMP provides the framework to begin to understand the consequences of local decisions on basinwide water resources.

RBMP, begun in 1993, is changing the way EPD and other state agencies coordinate business. At the same time, local government comprehensive planning requirements require a higher degree of effort and awareness by local governments to address resource protection and planning for the future.

This plan presents general broad-scale goals and strategies for addressing the most significant existing and future water quality and quantity issues within the Satilla basin. The basin plan provides a whole-basin framework for appropriate local initiatives and controls, but cannot specify all the individual local efforts which will be required. The basin plan will, however, provide a context and general management goals for the local-scale plans needed to address local-scale nonpoint loads in detail. EPD expects local governments and agencies to take the initiative to develop local strategies consistent with the basin-scale strategies presented in this plan.

A number of concerns identified in this plan will affect planning and decision-making by local governments, state agencies, and business interests. Detailed strategies for addressing identified concerns are presented in Section 7.4. This section provides an overview of the key "big picture" issues and planning opportunities in the Satilla River basin.

7.1.1 Water Quality Overview

As discussed in Section 5, water quality in the Satilla River basin is generally good at this time, although problems remain to be addressed and proactive planning is needed to protect water quality into the future. Many actions have already been taken to protect water quality. Programs implemented by federal, state, and local governments, farmers, foresters, and other individuals have greatly helped to protect and improve water quality in the basin over the past twenty years. Streams are no longer dominated by untreated or partially treated sewage or industrial discharges, which resulted in little oxygen and impaired aquatic life. For the most part, local government and industrial wastewaters are properly treated, oxygen levels have returned, and fish have followed.

The primary source of pollution that continues to affect waters of the Satilla River basin results from nonpoint sources. Key types of nonpoint source pollution impairing or potentially threatening water quality in the Satilla River basin include erosion and sedimentation, bacteria and oxygen demanding substances from urban and rural nonpoint sources, and nonpoint of mercury (particularly air deposition) which accumulates in fish tissue. These problems result from the cumulative effect of activities of many individual landowners or managers. Population is growing every year, increasing the potential risks from nonpoint source pollution. Growth is essential to the economic health of the Satilla River basin, yet growth without proper land use planning and implementation of best

management practices to protect streams and rivers can create harmful impacts on the environment.

Because there are so many small sources of nonpoint loading spread throughout the watershed, nonpoint sources of pollution cannot effectively be controlled by state agency permitting and enforcement, even where regulatory authority exists. Rather, control of nonpoint loading will require the cooperative efforts of many partners, including state and federal agencies, individual landowners, agricultural and forestry interests, local county and municipal governments, and Regional Development Centers. A combination of regulatory and voluntary land management practices will be necessary to maintain and improve the water quality of rivers, streams, and lakes in the Satilla River basin.

Key Actions by EPD

The Georgia EPD Water Protection Branch has responsibility for establishing water quality standards, monitoring water quality, river basin planning, water quality modeling, permitting and enforcement of point source NPDES permits, and developing Total Maximum Daily Loads (TMDLs) where ongoing actions are not sufficient to achieve water quality standards. Much of this work is regulatory. EPD is also one of several agencies responsible for facilitating, planning, and educating the public about management of nonpoint source pollution. Nonpoint source programs implemented by Georgia and by other states across the nation are voluntary in nature. The Georgia EPD Water Resources Branch regulates the use of Georgia's surface and ground water resources for municipal and agricultural uses, which includes source water assessment and protection activities in compliance with the Safe Drinking Water Act.

Actions being taken by EPD at the state level to address water quality problems in the Satilla River basin include the following:

- **Watershed Assessments and Watershed Protection Implementation Plans.** When local governments propose to expand an existing wastewater facility, or propose a new facility with a design flow greater than 0.5 million gallons per day, EPD requires a comprehensive watershed assessment and development of a watershed protection implementation plan. The watershed assessment includes monitoring and assessment of current water quality and land use in the watershed and evaluation of the impacts of future land use changes. A watershed protection implementation plan includes specific strategies such as land use plans and local actions designed to ensure that existing problems are being addressed and that future development will be conducted in a way to prevent water quality standards violations.
- **Total Maximum Daily Loads (TMDLs).** Where water quality sampling has documented standards violations and ongoing actions are not sufficient to achieve water quality standards in a two year period, a TMDL will be established for a specific pollutant on the specific stream segment in accordance with EPA guidance. The TMDL will specify the allowable loading of a pollutant from both point and nonpoint sources. EPD will implement TMDLs through a watershed approach using a combination of regulatory and non-regulatory tools.
- **Source Water Protection.** The public water supply in the Satilla basin is drawn from groundwater. To provide for the protection of public water supplies, Georgia EPD is developing a Source Water Assessment Program in alignment with the 1996 amendments to the Safe Drinking Water Act and corresponding recent EPA initiatives. This new initiative is expected to result in assessments of threats to drinking water supplies and, ultimately, local Source Water Protection Plans. Recent "Criteria for Watershed Protection" (a sub-section of the Rules for Environmental Planning Criteria) produced by the Department of Community

Affairs set minimum guidelines for protection of watersheds above "governmentally owned" water supply intakes.

- **Fish Consumption Guidelines.** EPD and the Wildlife Resources Division work to protect public human health by testing fish tissue and issuing fish consumption guidelines as needed, indicating the recommended rates of consumption of fish from specific waters. The guidelines are based on conservative assumptions and provide the public with factual information for use in making rational decisions regarding fish consumption.

Key Actions by Resource Management Agencies

Nonpoint source pollution from agriculture and forestry activities in Georgia is managed and controlled with a statewide non-regulatory approach. This approach is based on cooperative partnerships with various agencies and a variety of programs.

Agriculture in the Satilla River basin is primarily restricted to livestock and poultry operations. Key partners for controlling agricultural nonpoint source pollution are the Soil and Water Conservation Districts, the Georgia Soil and Water Conservation Commission, and the USDA Natural Resources Conservation Service. These partners promote the use of environmentally sound best management practices (BMPs) through education, demonstration projects, and financial assistance. In addition to incentive payments and cost-sharing for BMPs, three major conservation programs from USDA will be available to producers and rural landowners. These are the Conservation Reserve Program, which protects highly erodible and environmentally sensitive land; the Wetland Reserve Program, designed to protect, restore, and enhance wetlands with cost-share incentives; and the Wildlife Habitat Incentives Program, which will help landowners develop and improve wildlife habitat.

Forestry is a major part of the economy in the Satilla basin. The Georgia Forestry Commission (GFC) is the lead agency for controlling silvicultural nonpoint source pollution. The GFC develops forestry practice guidelines, encourages BMP implementation, conducts education, investigates and mediates complaints involving forestry operations, and conducts BMP compliance surveys. Recently, the State Board of Registration for Foresters adopted procedures to sanction or revoke the licenses of foresters involved in unresolved complaints where the lack of BMP implementation has resulted in water quality violations.

Key Actions by Local Governments

Addressing water quality problems resulting from nonpoint source pollution will primarily depend on actions taken at the local level. Particularly for nonpoint sources associated with urban and residential development, it is only at the local level that regulatory authority exists for zoning and land use planning, control of erosion and sedimentation from construction activities, and regulation of septic systems.

Local governments are increasingly focusing on water resource issues. In many cases, the existence of high quality water has not been recognized and managed as an economic resource by local governments. That situation is now changing due to a variety of factors, including increased public awareness, high levels of population growth in many areas resulting in a need for comprehensive planning, recognition that high quality water supplies are limited, and new state-level actions and requirements. The latter include:

- Requirements for Watershed Assessments and Watershed Protection Implementation Plans when permits for expanded or new municipal wastewater discharges are requested;
- Development of Source Water Protection Plans to protect public drinking water supplies;

- Requirements for local comprehensive planning, including protection of natural and water resources, as promulgated by the Georgia Department of Community Affairs.

In sum, it is the responsibility of local governments to implement planning for future development which takes into account management and protection of the water quality of rivers, streams, and lakes within their jurisdiction. One of the most important actions that local governments should take to ensure recognition of local needs while protecting water resources is to participate in the basin planning process, either directly or through Regional Development Centers.

7.1.2 Water Quantity Overview

In addition to protecting water quality, it is essential to plan for water supply in the Satilla River basin. The Georgia EPD Water Resources Branch regulates the use of Georgia's surface and ground water resources for municipal and agricultural uses, and is responsible for ensuring sufficient instream flows are available during a critical drought condition to meet permitted withdrawal requirements without significant impact to the environment. The withdrawal permit process must not overuse the available resources. The Water Resources Branch is also responsible for regulation of public water systems for compliance with the Safe Drinking Water Act, and regulation of dams for compliance with the Safe Dams Act.

In 1997, to address concerns regarding overuse of groundwater in coastal Georgia, Georgia EPD developed the "Interim Strategy for Managing Salt Water Intrusion in the Upper Floridan Aquifer of Southeast Georgia" to address concerns regarding the general regional use of groundwater throughout coastal Georgia that is leading to declining water levels in the Floridan aquifer. Among the interim strategy inclusion policies such as establishing caps on ground water use in the capped areas of Glynn County, Chatham County and southern portions of Bryan and Effingham Counties, reduction in ground water use in Chatham County by at least 10 million gallons per day by December 2005.

In response to the severe drought conditions in Georgia during the May 1998-2000 period, EPD developed a Georgia Drought Report that summarizes the drought impacts and provides an objective assessment of the state's vulnerability and mitigation efforts; evaluates the management actions implemented by state and local authorities during the drought of 1998-2000; and presents a set of recommendations for improving drought preparedness and response. Among the recommendations included are for the state to develop an effective method to evaluate consumptive use of water for agricultural irrigation, and implement programs for reducing water use while protecting the prosperity of farmers and agricultural communities.

7.2 General Basinwide Management Strategies

There are many statewide programs and strategies that play an important role in the maintenance and protection of water quality in the Satilla basin. These general strategies are applicable throughout the basin to address both point and nonpoint source controls.

7.2.1 General Surface Water Protection Strategies

Antidegradation

The State of Georgia considers all waters of the state as high quality and applies a stringent level of protection for each waterbody. Georgia Rules and Regulations for Water Quality Control, Chapter 391-3-6-03(2)(b) contains specific antidegradation provisions as follows:

(b) Those waters in the State whose existing quality is better than the minimum levels established in standards on the date standards become effective will be maintained at high quality; with the State having the power to authorize new developments, when it has been affirmatively demonstrated to the State that a change is justifiable to provide necessary social or economic development and provided further that the level of treatment required is the highest and best practicable under existing technology to protect existing beneficial water uses. Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected. All requirements in the Federal Regulations, 40 C.F.R. 131.12, will be achieved before lowering of water quality is allowed for high quality water.

The antidegradation review process is triggered at such time as a new or expanded point source discharge is proposed that may have some effect on surface water quality. Such proposals are reviewed to determine if the new discharge is justifiable to provide necessary social or economic development and that the level of treatment required is the highest and best practicable under existing technology to protect existing beneficial water uses.

Applicants for new or expanded point source discharges into any surface water must perform an alternative analysis comparing the proposed discharge alternative to a "no-discharge" land application or urban reuse alternative. The application for discharge to surface waters will only be considered if the less degrading alternatives are determined to be economically or technically infeasible. In all cases, existing instream water uses and the level of water quality necessary to protect the existing use shall be maintained and protected.

Water Supply Watershed Protection Strategy

As population continues to increase within the Satilla River basin, it will become ever more important to protect the water quality of already developed raw water sources. EPD is acting in concert with the Department of Community Affairs to produce a set of "guidelines" which define, among other things, measures that local governments are encouraged to take to protect drinking water sources. The "guidelines" are entitled Rules for Environmental Planning Criteria, and establish environmental protection criteria for five environmental categories: water supply watersheds, groundwater recharge areas, mountains, river corridors and wetlands. The *Criteria for Watershed Protection* (a sub-section of the Rules for Environmental Planning Criteria) set minimum guidelines for protection of watersheds above "governmentally owned" water supply intakes. The degree of protection depends upon the size of the watershed; watersheds with drainage areas of less than 100 square miles are subject to more strict criteria as summarized below:

- Impervious surface densities limited to 25 percent over the entire watershed.
- Buffer/setback requirements equal to 100/150 feet within seven (7) mile radius of the intake and 50/75 feet outside the seven (7) mile radius; and
- A reservoir management plan (including 150 foot buffer around the perimeter of the reservoir).

Watersheds with drainage areas of 100 square miles or more are subject to less strict criteria as summarized below:

- An intake on a flowing stream (as opposed to being located within a reservoir) shall have no specified minimum criteria; and

- An intake with a water supply reservoir shall have a minimum of 100 feet natural buffer within a seven mile radius of the reservoir, and no impervious cover constructed within a 150 foot setback area on both banks of the stream.

EPD is also actively working toward meeting the national goal that, by the year 2005, 60 percent of the population served by community water systems will receive their water from systems with source water protection programs (SWPP) in place under both wellhead protection and watershed protection programs. EPD intends to accomplish this goal by developing and implementing a source water assessment program (SWAP) in alignment with EPA's initiatives.

EPA approved EPD's Source Water Assessment and Protection Implementation Plan for Public Drinking Water Sources on April 24, 2000. The Plan specifies how source water assessment areas are to be delineated, lists potential contaminants of concern needing to be identified in the delineated areas, provides methodology for determining the susceptibility of a public water supply source and provides the basis for preparing local individual source water protection plans for public water supply systems. EPA has given the Drinking Water Program (DWP) the flexibility to help complete the local source water protection plans for contracted public water systems and provide financial and technical assistance to help develop long range source water protection strategies for the public water system. The Source Water Assessment program builds upon EPD's other assessment and prevention programs, including the Well Head Protection Program, the Vulnerability Assessment and Waiver Program, and the River Basin Management Plans, by soliciting active public participation from the local communities and assisting in the preparation of the local water system's protection plan.

Total Maximum Daily Loads

Section 303(d) of the Clean Water Act (CWA) establishes the TMDL, or total maximum daily load, process as a tool to implement water quality standards. Georgia is required by the CWA to identify and list waterbodies where water quality standards are not met following the application of technology based controls, and to establish TMDLs for the listed stream segments. The USEPA is required to approve or disapprove Georgia's 303(d) list of waters and TMDLs.

The most recent requirement for 303(d) list submittal occurred in 2000. Georgia public noticed and submitted a draft 303(d) list package to the EPA in February 2000. The public and EPA reviewed the draft 303(d) list package and provided comments in March 2000. Georgia reviewed the input, made appropriate changes and submitted a final 303(d) listing to the EPA in April 2000. EPA approved the Georgia list in August 2000.

Georgia's 2000 303(d) listing is based on the Georgia 305(b) water quality assessments. The 305(b) assessment is presented in the report *Water Quality in Georgia, 1998-1999*. The 305(b) assessment tables are reprinted in Appendix E of this report. The tables provide a code indicating the 303(d) listing status of assessed segments within the Satilla River basin. An "X" in the 303(d) column indicates the segment is on the Georgia 303(d) list. A complete explanation of the codes in the 303(d) column is given below.

NA Waters assessed as supporting designated uses. These waters are not part of the Georgia 303(d) list.

1 Segments identified as not supporting or partially supporting designated uses where actions have been taken and compliance with water quality standards achieved. These segments are not part of the Georgia 303(d) list.

2 Segments identified as not supporting or partially supporting designated uses where existing enforceable State, local, or Federal requirements are expected to

lead to attainment of water quality standards within two years without additional control strategies. These segments are not part of the Georgia 303(d) list.

3 Segments where TMDLs were completed and approved by EPA in 1998-2001. These waters are not part of the Georgia 303(d) list.

X Waters on the Georgia 303(d) list. These segments are assessed as not supporting or partially supporting designated uses, and may require additional controls to achieve designated uses. These segments make up the Georgia 303(d) list.

Georgia and/or EPA developed and publicly noticed TMDLs for all listed waters in the Satilla River basin in 2000. Each of the TMDLs with the exception of one for dissolved oxygen for Seventeen Mile Creek was finalized and approved the EPA in 2001. The TMDL for dissolved oxygen for Seventeen Mile Creek was finalized in 2002. The TMDLs are incorporated herein by reference. The TMDLs are too voluminous to be attached, however, copies of any or all of the TMDLs adopted by reference may be obtained by contracting the Water Protection Branch.

7.2.2 Management of Permitted Point Sources

The strategies in this section strive to minimize adverse effects from municipal, industrial, and concentrated discharges. Permitted discharges of treated wastewater are managed via the National Pollutant Discharge Elimination system (NPDES) permit program. The NPDES permit program provides a basis for regulating municipal and industrial discharges, monitoring compliance with effluent limitations, and initiating appropriate enforcement action for violations. EPD has formulated general strategies for a number of types of environmental stressors under the NPDES program.

Analysis of Alternatives

Applicants for new or expanded point source discharges into any surface water must perform an alternative analysis comparing the proposed discharge alternative to a “no discharge”, land application or urban reuse alternative. The application for discharge to surface waters will only be considered if the less degrading alternatives are determined to be economically or technically infeasible. In all cases, existing instream water uses and the level of water quality necessary to protect the existing use shall be maintained and protected.

Permit Issuance/Reissuance Strategies

During the basin plan implementation phase, issues identified in the written basin plan pertaining to point source discharges will be assessed. The assessment will include such things as 1) identified point source discharge problem areas, 2) data evaluations, 3) wasteload allocations and/or TMDLs with identified problem point sources, and 4) toxic pollutants identified with point source discharges. Permits associated with identified problems will be evaluated to determine if a reopening of the permit is appropriate to adequately address the problem.

Watershed Assessment Requirements

A watershed assessment is generally initiated when, due to growth and development, a local government sees a need to increase the hydraulic capacity of an existing wastewater treatment facility (or propose a new facility) and contacts the EPD for a NPDES permit modification. If an antidegradation review demonstrates that it is not feasible to handle the additional capacity needs with a land treatment or other no discharge system, the community may pursue an increase in its surface water discharge. The initial step in this process is the completion of a watershed assessment, which is the first step towards assuring that all water quality standards will be maintained throughout a watershed during

both critical dry and wet weather conditions in response to both point and nonpoint source loads.

The watershed assessment is actually a study, an assessment, and a plan. It is about collecting data and learning relationships between what is going on in a watershed and how these activities (land uses, etc.) impact water quality, then using this knowledge to develop both short and long term plans designed to ensure the attainment of water quality standards. The assessment should address current conditions and consider projected land use changes. Only when it can be demonstrated that water quality standards are and will continue to be maintained, can the EPD develop a wasteload allocation and prepare a defensible permit for a proposed new wastewater treatment facility or proposed hydraulic expansion of an existing wastewater treatment facility discharging to the watershed. The assessment should include a detailed plan to address both current water quality and biological problems and any predicted future water quality and biological problems. Key components of such a plan may be adopted by EPD as "special conditions" of the pertinent new or modified NPDES permit.

Facility Construction/Improvements

EPD has promoted continuing improvement in the quality of return flows from permitted point sources in the basin. Upgrading wastewater treatment facilities is a significant strategy to meet effluent limits from discharges. In the past ten years, various upgrades and improvements have been made to industrial and municipal treatment systems throughout the Satilla River basin. The funding for these projects has come from state and federal construction grants and loans and the citizens of local municipalities. Appendix C provides detailed information on expenditures by city and county governments on upgrading wastewater treatment facilities in the basin.

Domestic Wastewater Systems

The collecting, treating and disposing of wastewater in Georgia is regulated by a number of environmental laws that are administered by various agencies in local and state government. When a local government or private concern (owner) identifies a need for a wastewater treatment and disposal system it is imperative that thorough and adequate planning take place.

Wastewater systems that discharge treated wastewater to a surface stream must be permitted through the Georgia National Pollution Discharge Elimination System (NPDES) and meet all the requirements of that system. In Georgia, with very few exceptions, surface discharge permits will only be issued to publicly owned systems.

Wastewater systems that do not result in a discharge to surface waters, such as slow rate land treatment systems and urban reuse systems (no discharge), are permitted through the State of Georgia's land application system (LAS) permitting process. Both publicly and privately owned systems can apply for and receive LAS permits.

Chlorine

If a chlorine limit is not already required in an NPDES permit, all major municipal wastewater facilities (i.e., those with design flows greater than or equal to 1.0 million gallons per day [MGD]) are required to meet a chronic toxicity-based chlorine limitation when the permit comes up for routine reissuance. The limitation is calculated based on a maximum instream concentration of 0.011 mg/l, the facility's design flow, and the 7Q10 low flow of the receiving stream. No facilities are given a limitation higher than 0.5 mg/l as this is deemed to be an operationally achievable number even if a facility does not have dechlorination equipment installed. Facilities which are given a limitation more stringent than 0.5 mg/l which do not already have dechlorination equipment installed, are given up to a two year schedule in which to meet the limitation. All discharging facilities

which are upgrading are required to meet a chlorine limitation as part of the upgrade, based on the same criteria noted above.

Ammonia

Ammonia in effluents poses a problem both as a source of toxicity to aquatic life and as an oxygen-demanding waste. New facilities and facilities proposed for upgrade are required to meet ammonia limits for toxicity if those limits are more stringent than instream dissolved oxygen based limits. Existing facilities are not required to meet ammonia limits based on calculated toxicity unless instream toxicity has been identified through toxicity testing.

Metals/Priority Pollutants/Aquatic Toxicity

Major municipal and industrial facilities are required to conduct and submit results of periodic priority pollutant scans and aquatic toxicity tests to EPD as part of their permit monitoring requirements or upon submittal of a permit application for permit reissuance. The data are assessed in accordance with the Georgia Rules and Regulations for Water Quality Control. The results of the assessments can be used to trigger either additional priority pollutant monitoring, a toxicity reduction evaluation or permit limits for certain parameters.

Color

The State's narrative water quality standard for color requires that all waters shall be free from material related to discharges which produce color which interferes with legitimate water uses. EPD's color strategy will address this standard for industrial and municipal discharges by implementing permit limits and/or color removal requirements. EPD requires new facilities or discharges to prevent any noticeable color effect on the receiving stream. EPD requires existing facilities with color in their effluent to collect upstream and downstream color samples when their NPDES permit is reissued. The facility must conduct an assessment of the sources of color. Also, a color removal evaluation may be required at permit reissuance. EPD will also target facilities for color removal requirements based on significant citizen complaints of discoloration in streams.

Phosphorus

EPD establishes phosphorus control strategies where needed to address water bodies where water quality is limited by excess phosphorus loading. At the present time, there are no data to suggest phosphorus loading problems in the Satilla River basin.

Temperature

Permits issued for facilities which discharge to primary trout streams are required to have no elevation of natural stream temperatures. Permits issued for facilities which discharge to secondary trout streams are required to not elevate the receiving stream more than 2 degrees Fahrenheit. There are no trout stream in the Satilla River basin.

Storm Water Permitting

The 1987 Amendments to the federal Clean Water Act require permits to be issued for certain types of discharges, with primary focus on runoff from industrial operations and large urban areas. The EPA promulgated Storm Water Regulations on November 16, 1990. EPD subsequently received delegation from the EPA in January 1991 to issue General Permits and regulate storm water in Georgia. EPD has developed and implemented a strategy which assures compliance with the federal regulations.

The “Phase I” Federal Regulations set specific application submittal requirements for large (population 250,000 or more) and medium (population 100,000 to 250,000) municipal separate storm sewer systems. Accordingly, Georgia has issued individual

area-wide NPDES municipal separate storm sewer system (MS4) permits to 58 cities and counties in municipal areas with populations greater than 100,000 persons. These permits authorize the municipalities to discharge storm water from the MS4s which they own or operate, and incorporate detailed storm water management programs. These programs may include such measures as structural and non-structural controls, best management practices, inspections, enforcement and public education efforts. Storm water management ordinances, erosion and sediment control ordinances, development regulations and other local regulations provide the necessary legal authority to implement the storm water management programs. Illicit discharge detection and long-term wet weather sampling plans are also included in the management programs. The permit requires the submission of Annual Reports to EPD, describing the implementation of the storm water management program. Among other things, the Annual Report includes a detailed description of the municipality's implementation of its Storm Water Management Plan.

EPA's Phase I Rule addresses only municipalities with populations greater than 100,000 people and construction sites larger than five acres. EPA is proposing a Phase II Rule for municipalities with populations less than 100,000 people and construction sites smaller than five acres. This rule is not expected to be finalized until at least March, 1999. The Phase II Rule will eventually impact some of the municipalities within the basin.

EPD has issued one general permit regulating storm water discharges for 10 of 11 federally regulated industrial subcategories defined in the Phase I Federal regulations. The eleventh subcategory, construction activities, will be covered under a separate general permit, which is not yet finalized. The general permit for industrial activities requires the submission of a Notice of Intent (NOI) for coverage under the general permit, the preparation and implementation of a storm water pollution prevention plan, and in some cases, the monitoring of storm water discharges from the facility. As with the municipal storm water permits, implementation of site-specific best management practices is the preferred method for controlling storm water runoff.

7.2.3 Nonpoint Source Management

The strategies in this section address sources of environmental stressors which are not subject to NPDES permitting and typically originate from diffuse or nonpoint sources associated with land uses. Most strategies that address nonpoint source concerns are not regulatory in nature, but involve a variety of approaches such as technical assistance and education to prevent and reduce nonpoint source pollution in the basin. Strong stakeholder involvement will be essential to effectively implement many of these strategies.

Georgia Nonpoint Source Management Program

Georgia's initial *Nonpoint Source Assessment Report* and *Nonpoint Source Management Program* were completed in compliance with the Clean Water Act of 1987 and approved by the U.S. Environmental Protection Agency in January 1990. The biennial reports, *Water Quality in Georgia*, as required by Section 305(b) of Public Law 92-500, serve as the current process for updating the *Nonpoint Source Assessment Report*.

The State's *Nonpoint Source Management Program* combines regulatory and non-regulatory approaches, in cooperation with other State and Federal agencies, local and regional governments, State colleges and universities, businesses and industries, nonprofit organizations and individual citizens. The State's *Nonpoint Source Management Program* was updated and approved by the U.S. Environmental Protection Agency in September 2000. This revision was intended to satisfy the requirements for funding under

Section 319(b) of the Clean Water Act of 1987 and to delineate short- and long-term goals and implementation strategies. Just as important, it was designed to be an information resource for the wide range of stakeholders across the State who are involved in the prevention, control and abatement of nonpoint sources of pollution. It has been developed as an inventory of the full breadth of nonpoint source management (regulatory and non-regulatory) in Georgia, including activities which are currently underway or planned for in the time period FFY 2000 through FFY 2004.

The State's *Nonpoint Source Management Program* focuses on the comprehensive categories of nonpoint sources of pollution identified by the U.S. Environmental Protection Agency: Agriculture, Silviculture, Construction, Urban Runoff, Resource Extraction, Land Disposal, Hydrologic/Habitat Modification and Other Nonpoint Sources. The Georgia Environmental Protection Division solicited participation from State and Federal agencies, local and regional governments, State colleges and universities, businesses and industries, and nonprofit organizations with significant programs directed towards nonpoint source management. The State's *Nonpoint Source Management Program* comprehensively describes a framework for stakeholder coordination and cooperation and serves to implement a strategy for employing effective management measures and programs to control nonpoint source pollution statewide.

Agricultural Nonpoint Source Control Strategies

Agricultural nonpoint source pollution continues to be managed and controlled with a statewide non-regulatory approach. This approach uses cooperative partnerships with various agencies and a variety of programs. A brief description of these agencies and outline of their functions and programs is provided below.

Soil and Water Conservation Districts (SWCDs)

Georgia's SWCDs were formed by Act No. 339 of the Georgia General Assembly on March 26, 1937. Their role is to provide leadership in the protection, conservation, and improvement of Georgia's soil, water, and related resources. This is accomplished through promotion efforts related to the voluntary adoption of agricultural best management practices (BMPs).

Georgia Soil and Water Conservation Commission (GSWCC)

Georgia's SWCDs receive no annual appropriations and are not regulatory or enforcement agencies. Therefore, the GSWCC was also formed in 1937 to support the SWCDs. GSWCC has been designated as the administering or lead agency for agricultural nonpoint source (NPS) pollution prevention in the state. The GSWCC develops NPS water quality programs and conducts educational activities to promote conservation and protection of land and water resources devoted to agricultural uses. Primary functions of the GSWCC are to provide guidance and assistance to the Soil and Water Conservation Districts and provide education and oversight for the Georgia Erosion and Sedimentation Act.

There are a number of other agricultural agencies administering programs to address water quality and natural resource management issues. Resource Conservation and Development (RC&D) Councils are organized groups of local citizens supported by USDA involved in a program to encourage economic development, as well as the wise conservation of natural and human resources. The University of Georgia College of Agricultural and Environmental Sciences (CAES) conducts an education and outreach campaign that encourages producers to increase productivity using environmentally sound techniques. This is accomplished through a number of programs like Farm*A*Syst, Well Water Testing, Nutrient Management, Soil and Water Laboratory Analysis, and informational material on a wide range of subjects. Georgia's Department of Agriculture (GDA) administers a wide variety of insect and plant disease control programs to help

regulate the use of pesticides. GDA also inspects irrigation system requirements, such as check valves and back flow prevention devices, for protection of groundwater. The Agricultural Research Service (ARS) conducts research designed to improve the effectiveness of agricultural conservation techniques and promote sustainability. The Natural Resources Conservation Service (NRCS), along with the Farm Services Agency (FSA) and through local Soil and Water Conservation Districts, administers Farm Bill Programs that provide technical and financial incentives to producers to implement agricultural BMPs. The Agricultural Water Use Coordinating Committee, through individual members regularly applies for, and receives, funds under section 319(h) of the Clean Water Act to best management practices and demonstration projects throughout the state. The Georgia Soil and Water Conservation Commission has provided state leadership with many of these efforts.

Collectively, these programs will serve to address resource concerns related to agricultural land uses in a coordinated fashion over the next five years until the second iteration of the River Basin Management Planning Cycle. Much of the information regarding opportunities to participate under this voluntary approach to complying with water quality standards is disseminated through commodity commissions and organizations such as the Farm Bureau Federation, Agribusiness Council, Cattlemen's Association, Milk Producers Association, Pork Producers Association, Poultry Federation, and other agricultural support industries.

Prioritization Activities under the Farm Bill

The 1996 Farm Bill provides a number of programs, and processes, designed to address those environmental stressors related to nonpoint sources from Agriculture which were identified in section 4.1.2. A new flagship conservation program, the Environmental Quality Incentives Program (EQIP), will provide the lion's share of funding for technical, educational, and financial assistance. The USDA Natural Resources Conservation Service (NRCS) has leadership for EQIP and works with the USDA Farm Service Agency (FSA) to set policies, priorities, and guidelines. These two agencies take recommendations from local work groups and a State Technical Committee, comprised of resource professionals from a variety of disciplines, when addressing actual, and potential, resource impairments associated with agricultural land uses.

EQIP provides incentive payments and cost-sharing for conservation practices through 5 to10 year contracts. Producers may receive federal cost-sharing up to 75 percent of the average cost of certain conservation practices such as terraces, grassed waterways, filter strips, buffer strips, manure management facilities, animal waste utilization, and 46 other conservation practices important to improving and maintaining the health of natural resources in an area. An individual producer can receive as much a $50,000 in EQIP funds to implement needed conservation practices.

A majority of funds allocated to Georgia (65 percent) will be spent in priority areas where there are serious and critical environmental needs and concerns. High priority is given to areas where state and local governments offer financial and technical assistance, and where agricultural improvements will help meet water quality and other environmental objectives.

The remaining 35 percent of funds allocated to Georgia can be extended outside priority areas to other parts of the state. Eligibility is limited to persons who are engaged in agricultural productions. Eligible land includes cropland, pastureland, forestland, and other farm lands.

In addition to EQIP there are three major conservation programs from USDA that will be available to producers, and rural landowners. The first is the Conservation Reserve Program (CRP), which protects highly erodible and environmentally sensitive land with

grass, trees, and other long-term cover. The Wetland Reserve Program (WRP) is a voluntary program designed to protect, restore, and enhance wetlands with cost-share incentives. Also, the Wildlife Habitat Incentives Program (WHIP) will help landowners develop and improve habitats for upland wildlife, wetland wildlife, endangered species, fisheries, and other wildlife.

Forestry Nonpoint Source Control Strategies

In 1977, the Governor's Silviculture Task Force prepared a report which recommended a voluntary approach to the implementation of best management practices (BMPs) and the designation of the Georgia Forestry Commission (GFC) as the lead agency for implementing the Silviculture portion of the State Section 208 Water Quality Management Plan. The GFC was designated as the lead agency for silvicultural nonpoint source pollution prevention in the state in November, 1979. The Forestry Nonpoint Source Control Program is managed and implemented by the GFC, with the support of the forest industry, for the voluntary implementation of best management practices.

The Forestry Nonpoint Source Control Program is managed by a Statewide Coordinator and appointed foresters serving as District Coordinators from each of the 12 GFC districts. The Statewide and District Coordinators conduct educational workshops, training programs and field demonstrations for the forest community (i.e., landowners, land management and procurement foresters, consulting foresters, timber buyers, loggers, site preparation contractors). The GFC investigates and mediates complaints involving forestry operations. In addition, the GFC conducts BMP compliance surveys to assess the effectiveness of BMP in the forest community. The GFC has established procedures for installing water control structures in firebreaks to reduce soil erosion and sedimentation.

Recently, the State Board of Registration for Foresters adopted procedures to sanction or revoke the licenses of professional foresters involved in unresolved complaints where the lack of BMP implementation has resulted in state water quality or federal wetlands requirement violations.

Additional requirements are imposed within the National Forest areas of Georgia. Each National Forest produces and regularly updates and Land and Resource Management Plan to guide timber harvest and other activities. These plans establish long range goals and objectives; specific management prescriptions and the vicinity in which they will occur; standards and guidelines on how management prescriptions will be applied; and monitoring procedures to assure the Plan is followed.

Urban Nonpoint Source Control Strategies

The 1990 report of the Community Stream Management Task Force, *We All Live Downstream*, established a road map for urban nonpoint source management in Georgia. The Task Force recognized two major impediments to effectively managing the quality of urban water bodies. The first is the division between 1) statutory responsibilities for management of water quality, granted to EPD, and 2) local government's Constitutional responsibility for management of the land activities which affect urban water bodies. The second impediment is the widespread nature of the nonpoint sources and the variety of activities which may contribute to impacts from urban runoff. They concluded that management of urban nonpoint source pollution would require ". . . a cooperative partnership between layers of government, the private sector, and the general public. The development of such a partnership will require a strong impetus to accept new institutional roles and make the structural changes necessary to support and sustain the stream management process."

EPD has a primary role in facilitating the management of urban runoff, and is responsible for administering and enforcing a variety of permit programs, including

permitting of discharges. In addition to these regulatory activities, EPD seeks to assist in development of local solutions to water quality problems; provides technical information on the water resources of the state; and administers grant programs, with funds from various sources to support non-point source planning and assessment, implementation of BMPs, and regional or local watershed management initiatives. EPD also conducts a variety of outreach and educational activities addressing urban runoff in general, regulatory requirements, and cooperative or non-regulatory approaches.

For urban runoff, activities of the Nonpoint Source Management Program interact strongly with point source controls for combined sewers and storm sewers, both of which discharge urban runoff through point conveyances. While the state continues to have an important regulatory role, aspects of the cooperative intergovernmental partnerships envisioned by the Task Force have emerged and are being strengthened. EPD is implementing programs which go beyond traditional regulation, providing the regulated community with greater flexibility and responsibility for determining management practices. Current activities for urban surface runoff control include the following:

- Implement local nonpoint source (NPS) management programs, streambank and stream restoration activities, and community Adopt-A-Stream programs.
- Develop and disseminate local watershed planning and management procedures.
- Implement state and local Erosion and Sedimentation Control Programs.
- Prepare and disseminate technical information on best management practices and nonpoint source monitoring and assessment.
- Implement NPS education programs for grades K through 12 through Project WET (Water Education for Teachers), as described in Section 7.3.6.
- Implement the Georgia Adopt-A-Stream Program, as described below in Section 7.3.6.
- Identify and evaluate resources to support urban watershed planning and management.

7.2.4 Floodplain Management

Floodplain Management Strategies

Floodplain Management in the State of Georgia is administered under federal regulations and local ordinances. The federal statues are found in Title 44 of the Code of Federal Regulations Parts 59-79. As a condition of participation in the National Flood Insurance Program (NFIP), local political jurisdictions voluntarily adopt Flood Damage Prevention Ordinances, which are based on federal regulations, to enforce and administer floodplain development. Georgia's Floodplain Management Office does not issue permits for floodplain development.

Georgia's Floodplain Management Office, located within the Department of Natural Resources, Environmental Protection Division, serves as liaison between the Federal Emergency Management Agency (FEMA) and local communities participating in the NFIP. However, Georgia's Floodplain Management Office has no regulatory authority. Participation by the local communities in the NFIP is a requirement for the Federal Government to make flood insurance available to all property owners. Through workshops, newsletters, technical assistance and community visits, the Floodplain Management Office assists local governments to maintain compliance with NFIP requirements. The Floodplain Management Office also provides technical data, floodplain maps, and training workshops to various public and private entities involved in floodplain management and floodplain determinations. In addition, the Floodplain Management Office reviews all state-funded and federal-funded projects for development

in designated Special Flood Hazard Areas. A major thrust of the Floodplain Management Office is to increase the number of political jurisdictions participating in the NFIP, thereby increasing the number of flood insured structures in Georgia.

River Care 2000 Program

Georgia also has strategies to protect and manage riparian floodplain areas. Of particular relevance is River Care 2000, a conservation program which Governor Miller established in September 1995. One key objective of this program is acquisition of river-corridor lands for purposes of protection and to forestall unwise development in flood-prone areas. The Coordinating Committee has approved procedures for three types of projects: Riverway Demonstration Projects, which improve public access to a river with scenic and recreation uses, and protects natural and historic resources by acquiring and managing land in the river corridor; Significant Sites, which are tracts of land which DNR will acquire and operate as a traditional state public-use facility: wildlife management or public fishing area, park or historic site, natural area, or greenway; and Restoration Sites, which are tracts of land which the state will identify, acquire, and manage to reduce nonpoint-source water pollution.

The River Care 2000 program is also charged with assessing important river resources throughout the state and identifying more effective management tools for river corridors. The program recently released a state-wide assessment of resources associated with rivers throughout the state (GA DNR, 1998).

7.2.5 Wetland Management Strategies

The loss of wetlands, because of the associated adverse impacts to flood control, water quality, aquatic wildlife habitat, rare and endangered species habitat, aesthetics, and recreational benefits, has become an issue of increasing concern to the general public as they become better informed of the values and functions of wetlands. There is a lack of accurate assessments for current and historic wetland acreage, but, regardless of the method used to measure total acreage or wetland losses, Georgia still retains the highest percentage of precolonial wetland acreage of any southeastern state.

Efforts to Track No Net Loss of Wetlands

While the 1993 Federal Administration Wetlands Plan calls for a concerted effort by EPA and other federal agencies to work cooperatively toward achieving a no overall net loss of wetlands in the short term and a net increase in the quantity of the nation's wetlands in the long run, there have been no statutory or executive level directives to carry out this policy. Achievement of the goal of no net loss is dependent upon limited changes to regulations, memoranda of understanding, cooperative agreements, and other partnerships between federal, state, and local governments, conservation organizations, and private citizens.

All dredge and fill activities in freshwater wetlands are regulated in Georgia by the U.S. Army Corps of Engineers (COE) under Section 404 of the Clean Water Act. The majority of wetland alterations occur under nationwide or general permits, which include permits for bridge building, minor road crossing fills, and fills of less than ten acres above the “headwaters” point of non-tidal streams where the annual average flow is less than 5 cubic feet per second. Enforcement is carried out by the COE and EPA in freshwater wetlands. Normal agricultural and silvicultural operations are exempted under Section 404 regulations.

The COE may require wetland mitigation activities in association were permitting, including creation, restoration, and protection of wetlands. COE may also require wetland restoration in case of violations.

Land Acquisition

The Department of Natural Resources (DNR), Wildlife Resources Division (WRD), began a land acquisition program in 1987 to acquire 60,000 acres of additional lands for Wildlife Management Areas (WMAs) and Public Fishing Areas (PFAs). This initiative was funded by $30 million of 20-year obligation bonds to be paid off by hunting and fishing license increases and WMA permit fees.

Beginning in 1990 Governor Zell Miller initiated Preservation 2000, a $60 million program to acquire 100,000 acres of lands to be used for wildlife and fisheries management, parks and recreation, natural area preservation, and general conservation. Additional wetlands acquisition occurs as part of the River Care 2000 initiative, discussed above.

7.2.6 Stakeholder Involvement/Stewardship Strategies

Effective nonpoint source management must address the numerous activities of individuals, businesses, industries, and governments which can adversely affect urban and rural waters. In many cases, these groups are unaware of the potential impacts of their activities or corrective actions which may be taken. Stakeholder involvement and stewardship are essential to address these major challenges.

Georgia has chosen a two-pronged approach to encourage stewardship via education and citizen monitoring. EPD is the lead agency in these education and citizen monitoring programs, but, like other aspects of the state's nonpoint source management effort, cooperative efforts with local governments and community-based groups are critical to their implementation. Outreach and education, including citizen monitoring, lays the groundwork for behavior change and is often an important pre-requisite for effective implementation of BMPs and comprehensive watershed management programs.

General goals for stakeholder involvement and stewardship strategies are:

- Generate local support for nonpoint source management through public involvement and monitoring of streams and other water bodies and of results of management actions.
- Increase individual's awareness of how they contribute to nonpoint source pollution problems and implement appropriate strategies to motivate behavior change and actions to address those problems.
- Provide the educational tools, assistance, and support for addressing NPS problems to target audiences across the state.

Georgia Adopt-A-Stream

The *Georgia Adopt-A-Stream Program* is a citizen monitoring and stream protection program with two staff positions in the Georgia EPD and five Regional Training Centers. The Regional Training Centers are a network of college-based training centers located in Americus, Columbus, Milledgeville, Savannah, and Valdosta, Georgia. This network of training centers allows the Georgia Adopt-A-Stream Program to be accessible to all areas of the State. The Regional Training Centers ensure that volunteers are trained consistently and that the monitoring data is professionally assessed for quality assurance and quality control.

Stakeholder involvement and stewardship are essential to implementing Georgia's River Basin Management Planning (RBMP) approach to water resource management. The Georgia Adopt-A-Stream Program objectives support the RBMP strategies for stakeholder involvement and stewardship: (1) increase individual's awareness of how they contribute to nonpoint source pollution problems, (2) generate local support for nonpoint source management through public involvement and monitoring of waterbodies,

and (3) provide educational resources and technical assistance for addressing nonpoint source pollution problems statewide.

Currently, more than 10,000 volunteers participate in 200 individual and 45 community sponsored Adopt-A-Stream Programs. Volunteers conduct cleanups, stabilize streambanks, monitor waterbodies using biological and chemical methods, and evaluate habitats and watersheds at over 235 sites throughout the State. These activities lead to a greater awareness of water quality and nonpoint source pollution, active cooperation between the public and local governments in protecting water resources, and the collection of basic water quality data. The Georgia Adopt-A-Stream Program focuses on what individuals and communities can do to protect from nonpoint sources of pollution.

Volunteers are offered different levels of involvement. Each level involves an education and action component on a local waterbody. The introductory level consists of setting up a project (i.e., identifying a stream segment, lake, estuary, or wetland, identifying partners, registering with the Georgia Adopt-A-Stream Program), evaluating land use and stream conditions during a watershed walk, conducting quarterly visual operations and cleanups, and public outreach activities. Volunteers create a "Who to Call for Questions or Problems" list so that if something unusual is noted, immediate professional attention can be obtained. Advanced levels of involvement include biological monitoring, chemical monitoring, habitat improvement or riparian restoration projects.

In addition, the *Georgia Adopt-A-Stream Program* and *Keep Georgia Beautiful Program* coordinate *Rivers Alive*, Georgia's annual volunteer river cleanup event held throughout the month of October that targets the cleanup of streams, rivers, lakes, and wetlands statewide. The mission of *Rivers Alive* is to create awareness of and involvement in the preservation of Georgia's water resources.

Rivers Alive 2000 included 85 local cleanup events and attracted more than 14,000 volunteers statewide. During October 2000, volunteers worked over 68,000 hours to remove more than 182,000 pounds of trash and garbage from 332 miles of the State's waterways. Previous river cleanup events in Georgia have been successful but pale in comparison to the success that has been achieved by *Rivers Alive 2000*. Volunteers have conducted cleanup events and continue to monitor sites along Jekyll Creek in Glynn County.

The goals for *Rivers Alive 2001* are to have at least 16,000 volunteers with at least 100 local events statewide. These goals represent increased efforts that will result in cleaner waters in the State. Organizers and volunteers receive free t-shirts, watershed posters and signs, press releases and public service announcements. Additional information about *Rivers Alive 2001* is available on the website, www.riversalive.org.

The Georgia Adopt-A-Stream Program provides volunteers with additional resources such as the *Getting to Know Your Watershed and Visual Stream Survey, Biological and Chemical Stream Monitoring, Adopt-A-Wetland, Adopt-A-Lake*, and *Adopt-A-Stream Teacher's Guide* manuals, PowerPoint presentations, and promotional and instructional training videos. In addition, a bi-monthly newsletter is published and distributed to over 3000 volunteers statewide with program updates, workshop schedules, and information about available resources. Additional information about the Georgia Adopt-A-Stream Program is available on the *Rivers Alive* website, www.riversalive.org/aas.htm.

In addition, the Georgia Adopt-A-Stream Program activities have been correlated to the Georgia Quality Core Curriculum (QCC) Science Standards for grades K-12 and certified teachers in Georgia participating in Georgia Adopt-A-Stream Program training workshops will receive Staff Development Unit (SDU) credits. Additional information about the QCC correlations and SDU credits and the Georgia Adopt-A-Stream

QuickTime Training Videos are available on the National Science Center's website, tech.ncdiscovery.org/ee/aas.htm.

In March 2001, the Georgia Adopt-A-Stream Program partnered with the Environmental Education Alliance of Georgia to conduct an annual conference and awards ceremony. The 2001 conference, *Georgia Environment – Reaching and Teaching Communities*, was held in Columbus, Georgia with over 200 participants.

Georgia Project WET (Water Education for Teachers) Program

A report outlining a plan for nonpoint source education in Georgia was completed in 1994. The Georgia Urban Waterbody Education Plan and Program delineated nonpoint source education strategies for seven target audiences: general public, environmental interest organizations, civic associations, educators, business associations, local government officials and State government officials. Given the limited resources and the scope of efforts required to target each of these audiences concurrently, statewide nonpoint source education and outreach programs have been limited to the Georgia Adopt-A-Stream and Project WET Programs.

In October 1996, the Georgia EPD selected Project WET (Water Education for Teachers) curriculum as the most appropriate water science and nonpoint source education curriculum for the State. The Project WET curriculum is an interdisciplinary water science and education curriculum that can be easily integrated into the existing curriculum of a school, museum, university pre-service class, or a community organization. The goals of the Georgia Project WET Program are to facilitate and to promote awareness, appreciation, knowledge and stewardship of water resources through the development and dissemination of classroom (K-12) ready teaching aids.

The success of the Georgia Project WET Program has been phenomenal. Since 1997, several Project WET facilitator training workshops have been successfully completed in Athens, Atlanta, Dahlonega, Macon, Savannah and Warner Robbins with over 200 Project WET facilitators trained statewide. In addition, 220 Project WET educator workshops have been completed in Georgia with more than 4000 formal and non-formal educators implementing the Project WET curriculum in Georgia with a substantial number of students—over 600,000 students annually!

The University of Georgia, Oglethorpe University, Georgia College and State University, North Georgia College and State University, Georgia Southern University and Kennesaw State University have successfully conducted numerous Project WET educator workshops for university pre-service classes with more than 700 education students certified as Project WET educators. In addition, the Oatland Island Environmental Education Center offers Project WET educator workshops for formal and non-formal educators in the Satilla and St. Marys River Basins. Currently, there are 15 Project WET facilitators with over 250 educators having received certified Project WET training in the Satilla and St. Marys River Basins.

The Georgia Project WET Program provides educators with additional resources such as the Enviroscape Nonpoint Source, Wetlands, and Groundwater Flow Models—demonstration tools used to emphasize the impacts of nonpoint source pollution to surface and ground waters, scripted theatrical performances and costumes for *Mama Bass and the Mudsliders*, and promotional and instructional training videos. In addition, the *Dragonfly Gazette*, a quarterly newsletter, and the *Georgia River of Words Art and Poetry Journal* are published and distributed to over 3000 educators statewide and nationally.

The Georgia Project WET Program has been nationally recognized as a model program for its training strengths and techniques—specifically, the use of arts in

environmental education. The Georgia Project WET Program offers educators in Georgia the opportunity to participate in the *River of Words*, an international poetry and art contest for students (K-12). This contest provides students with the opportunity to explore their own watersheds and to learn their "ecological" addresses through poetry and art. National winners are selected by the former U.S. Poet Laureate, Robert Hass, and the International Children's Art Museum. Annually, only eight students are selected as National Grand Prize Winners to be honored at the Library of Congress in Washington, DC.

Over 20,000 entries were submitted to the *River of Words 2001* contest—three out of the eight National Grand Prize Winners selected in April 2001 were from Georgia! Since 1997, eight students from Georgia have been recognized as National Grand Prize Winners and an additional 60 students have been selected as National Finalists and Merit Winners.

The students' original art and poetry have been returned from the international competition and is currently on display in the *Georgia River of Words Exhibition*. The Georgia Project WET Program offers a guidebook for teachers with specific information about Georgia's watersheds. In addition, several nature centers throughout Georgia offer *River of Words* field trips for students and teachers.

7.2.7 Ground Water Protection Strategies

In 1984, EPD developed its first management plan to guide the management and protection of Georgia's ground water quantity and quality. The current version, Georgia Geologic Survey Circular 11, published in 1996, is the basis of Georgia's application to be certified by U.S. EPA for a Comprehensive State Ground Water Protection Plan (CSGWPP). The goal of Georgia's ground water management plan is:

> . . . to protect human health and environmental health by preventing and mitigating significant ground water pollution. To do this, Georgia will assess, protect, and, where practical, enhance the quality of ground waters to levels necessary for current and projected future uses for public health and significant ecological systems.

The goal recognizes that not all ground water is of the same value. The Division's goal is primarily preventive, rather than curative; but it recognizes that nearly all ground water in the state is usable for drinking water purposes and should remain so. EPD pursues this goal through a policy of anti-degradation by which ground water resources are prevented from deteriorating significantly, preserving them for present and future generations. Selection of this goal means that aquifers are protected to varying degrees according to their value and vulnerability, as well as their existing quality, current use, and potential for future use.

EPD has adequate legal authority to prevent ground water from being significantly polluted and to clean-up ground water in the unlikely event pollution were to occur. Extensive monitoring has shown that incidents of ground water pollution or contamination are uncommon in Georgia; no part of the population is known to be at risk.

In general, the prevention of ground water pollution includes—(1) the proper siting, construction, and operation of environmental facilities and activities through a permitting system; (2) implementation of environmental planning criteria by incorporation in land-use planning by local government; (3) implementation of a Wellhead Protection Program for municipal drinking water wells; (4) detection and mitigation of existing problems; (5) development of other protective standards, as appropriate, where permits are not required; and (6) education of the public to the consequences of ground water contamination and the need for ground water protection.

Ground water pollution is prevented in Georgia through various regulatory programs (administered by the State's Department of Natural Resources) which regulate the proper siting, construction, and operation of the following:

- Public water supply wells, large irrigation wells and industrial wells withdrawing more than 100,000 gallons per day.
- Injection wells of all types.
- Oil and gas wells (including oil and gas production).
- Solid waste handling facilities.
- Hazardous waste treatment/storage/disposal facilities.
- Municipal and industrial land treatment facilities for waste and wastewater sludge.
- Municipal and industrial discharges to rivers and streams.
- Storage/concentration/burial of radioactive wastes.
- Underground storage tanks.

EPD prevents the contamination of ground water used for municipal drinking water through an EPA-approved Wellhead Protection Program. As a result of this program, certain new potentially polluting facilities or operations are restricted from wellhead protection areas, or are subject to higher standards of operation and/or construction. EPD also encourages local governments to adhere to the *Criteria for the Protection of Groundwater Recharge Areas* (a section of the Rules for Environmental Planning Criteria), which define higher standards for facility siting, operation, and clean-up in significant ground water recharge areas. The most stringent guidelines of these criteria pertain to those recharge areas with above average ground water pollution susceptibility indexes.

Additionally, EPD has legal authority under the Georgia Water Quality Control Act to clean up ground water pollution incidents. Additional clean up authority occurs as special trust funds established to clean up leaking underground storage tanks, abandoned hazardous waste sites, and scrap tire dumps.

Most laws providing for protection and management of ground water are administered by EPD. Laws regulating pesticides are administered by the Department of Agriculture, environmental planning by the Department of Community Affairs; and on-site sewage disposal, by the Department of Human Resources. EPD has established formal Memoranda of Understanding (MOU) with these agencies. The Georgia Groundwater Protection Coordinating Committee was established in 1992 to coordinate groundwater management activities between the various departments of state government and the several branches of EPD.

7.3 Targeted Management Strategies

This section describes specific management strategies that are targeted to address concerns and priority issues for the Satilla River basin which were described in Section 6. Strategies are presented for each issue of concern, with divisions by geographic area and/or HUC Unit as appropriate. For each of the identified concerns, the management strategy consists of five components: a problem statement (identical to that given in Section 6), general goals, ongoing efforts, identified gaps and needs, and strategies for action. The purpose of these statements is to provide a starting point for key participants in the subbasin to work together and implement strategies to address each priority concern. In some cases, a strategy may simply consist of increased monitoring; in other situations, the stakeholders in the subbasin will need to develop innovative solutions to

these water quality issues. While EPD will continue to provide technical oversight, conduct monitoring surveys as needed, and evaluate data on a basin-wide scale, locally-led efforts in the subbasins will be required to help to monitor, assess, restore, and maintain water quality throughout the Satilla River basin.

7.3.1 Low Dissolved Oxygen

Problem Statement

Water use classification for fishing was not fully supported in several water body segments due to excursions of the water quality standards for dissolved oxygen. These excursions are primarily attributed to nonpoint sources and to natural conditions.

Satilla River Subbasin (HUC 03070201)

The water use classification of fishing was not fully supported in thirteen tributary segments and three Satilla River mainstem segments due to dissolved oxygen concentrations less than standards. Dissolved oxygen may be lower in these areas due to natural conditions.

Satilla River Subbasin (HUC 03070202)

The water use classification of fishing was not fully supported in seven tributaries due to dissolved oxygen concentrations less than standards. Low dissolved oxygen in the tributaries was attributed to nonpoint sources. Dissolved oxygen may be lower in these areas due to natural conditions.

Satilla River Subbasin (HUC 03070203)

The water use classification of fishing was not fully supported in two estuarine areas due to dissolved oxygen concentrations less than standards. Low dissolved oxygen was attributed to point and nonpoint sources. Dissolved oxygen may be lower in these estuarine areas due to natural conditions.

General Goals

Meet water quality standards to support designated water uses.

Ongoing Efforts

TMDLs have been completed for each stream segment. TMDL implementation plans will be developed in 2002.

The Satilla River is a Priority Area for USDA Cost-Share funds to implement agricultural BMPs through NRCS's EQIP Program. Local Soil and Water Conservation Districts and RC&D Councils are working with producers to utilize animal waste according to Nutrient Management Plans through their Lagoon Pumpout Program.

Identified Gaps and Needs

Low dissolved oxygen concentrations in this part of the state are often due to natural environmental conditions. Work is needed to identify and characterize natural background dissolved oxygen concentrations in this area.

General Strategies for Action

Low dissolved oxygen concentrations in the various streams in the Satilla River basin were due to nonpoint sources and/or natural environmental conditions. EPD will address nonpoint sources through a watershed protection strategy for the basin.

Specific Management Objectives

Maintain dissolved oxygen concentrations adequate to support aquatic life and meet water quality standards.

Action Plan

- EPD: monitor and assess use support in the listed waters and develop a watershed strategy for addressing nonpoint sources; develop TMDL implementation plans.
- Local governments will implement storm water management strategies and manage operations of water pollution control plants, participate in development and implementation of TMDL implementation plans.
- NRCS and GFC will continue BMP implementation.
- Local S&WC Districts and RC&D Councils will continue Lagoon Pumpout Program.

Methods for Tracking Performance

A reevaluation of the status of the listed waterbodies will be made coincident with the next iteration of the RBMP management cycle for the Satilla River basin in 2002-2006.

7.3.2 Metals

Satilla River Subbasin (HUC 03070202)

Problem Statement

The water use classification of fishing was not fully supported in two estuarine areas (Gibson and Purvis Creeks) due to an industrial hazardous waste site.

General Goals

Meet water quality standards to support designated stream classification of fishing.

Ongoing Efforts

The EPA and EPD will continue to implement the ongoing hazardous waste cleanup efforts. TMDLs have been completed for each stream segment. TMDL implementation plans will be developed in 2002.

General Strategies for Action

The EPA and EPD will continue to implement the ongoing hazardous waste cleanup efforts.

Specific Management Objectives

Monitor ambient metals concentrations in the Gibson and Purvis Creeks to assess current water quality status.

Action Plan

Additional sampling of Gibson and Purvis Creeks will be conducted as a part of the EPA Hazardous Waste Cleanup project. TMDL implementation plans will be developed in 2002.

7.3.3 Fecal Coliform Bacteria

Problem Statement

The water use classification of fishing was not fully supported in six tributary stream segments due to exceedences of the water quality standards for fecal coliform bacteria.

These water quality exceedences are found in a number of stream segments in the Satilla River basin and are primarily attributed to urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources, and/or animal wastes. A common strategy is proposed for addressing fecal coliform bacteria throughout the basin. However, achieving standards in individual stream segments will depend on the development of site specific local management plans.

Satilla River Subbasin (HUC 03070201)

The water use classification of fishing was not fully supported in eleven Satilla River tributary stream segments due to exceedences of the water quality standard for fecal coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources and/or animal wastes.

Satilla River Subbasin (HUC 03070202)

The water use classification of fishing was not fully supported in six tributary stream segments due to exceedences of the water quality standard for fecal coliform bacteria. These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, rural nonpoint sources and/or animal wastes.

General Goals

Meet water quality standards to support designated water uses. Increase public awareness of fecal coliform bacteria pollution through coordinated education and outreach efforts.

Ongoing Efforts

EPD administers and enforces a variety of permit programs designed to facilitate the management of urban runoff, including both point and nonpoint source controls. EPD's Nonpoint Source Program regulates municipal and industrial storm water discharges through the National Pollutant Discharge Elimination System (NPDES) permitting process. Sanitary sewer overflows are managed through EPD's Permitting Compliance and Enforcement Program. Animal wastes in Georgia are addressed through the Memorandum of Agreement (MOA) with NRCS and SWCC and through recently adopted rules designed to regulate Concentrated Animal Feeding Operations (CAFOs) for swine. This includes a requirement for certain operations to obtain individual NPDES permits. TMDLs were completed for each stream segment in 2001. TMDL implementation plans will be completed in 2002.

In addition to regulatory activities, EPD assists in the development of local solutions to water quality problems by administering grant programs and providing technical assistance to various regional and local watershed management initiatives. EPD also conducts a variety of outreach and public education programs addressing urban runoff in general, point and Nonpoint source pollution, BMP implementation, regulatory requirements, and cooperative or non-regulatory approaches.

The Georgia Department of Human Resources (DHR) Division of Public Health - Environmental Services has promulgated new rules (O.C.G.A Chapter 290.5.26) developed to regulate the design, operation, and maintenance of on-site sewage management systems. DHR subsequently formed the Onsite Sewage Management Systems Technical Review Committee in 1999. The Committee's function will be to make recommendations to the department regarding the approval of new systems, assist the Department with the development and revision of standards and guidelines for new technology, assist with the adoption of periodic updates to the Manual for On-Site Sewage Management Systems, and serve as the final authority in contested interpretation issues regarding the Rules and the Manual for On-site Sewage Management Systems.

Agriculture is making progress in controlling bacterial loads. Considerable effort has been directed toward animal confinement areas. Georgia universities and agricultural agencies or groups are conducting several agricultural efforts with statewide implementations. Sustainable Agriculture and Farm-A-Syst Training will be scheduled within the basin. The University of Georgia and ARS have proposals for assessing nutrient and fecal coliform bacteria reducing BMPs on 10 farms that will have statewide implications. Soil and Water Conservation Districts annually convene Local Work Groups (LWGs), which are comprised of resource professionals from a variety of disciplines and interested stakeholders at the local level, to identify resource concerns in their areas. The LWGs develop proposals for USDA or other funding to address identified resource concerns.

The University of Georgia College of Agriculture and Environmental Sciences' Animal Waste Awareness in Research & Extension (AWARE) program conducts research on animal waste management and provides public education through Southeast Sustainable Animal Waste Workshops and a variety of Internet publications.

Local Soil and Water Conservation Districts (SWCDs) and Resource Conservation and Development (RC&D) Councils are working with producers to utilize animal waste according to Nutrient Management Plans through their Lagoon Pumpout Program.

Identified Gaps and Needs

Sources of fecal coliform bacteria in many stream segments are not clearly defined. In some cases, fecal bacterial loads may be attributable to natural sources (e.g. wildlife); alternative bacteriological sampling methods may be useful to distinguish between human, other mammalian, and avian fecal coliform bacteria sources. Sanitary sewer leaks and overflows may be a source of fecal coliform bacteria as well. Previous sampling was not conducted at a sufficient frequency to determine whether the monthly geometric mean criterion specified in the standard has actually been violated. Thus, an initial effort in the next RBMP cycle may be to continue to collect an adequate number of samples (four over a 30-day period) to support geometric mean calculations to determine if water quality standards are actually being exceeded.

Many fecal coliform bacteria reducing practices are relatively expensive and the percentage of reduction is often unknown. Many landowners are reluctant to spend today's dollars for long term amortization in uncertain future markets. Agricultural BMPs and cost share dollars (Farm Bill), grants (Section 319) and should be concentrated in priority watersheds with sufficient technical workforce to implement BMPs through long term agreements or contracts to reduce sediment loading.

Additional efforts should be directed toward increasing public awareness of fecal coliform bacteria pollution, with an emphasis on potential sources and BMPs. State and basin-wide coordination between agencies and organizations providing public education and technical assistance may help to extend outreach efforts.

Strategies for Action

Separate strategies are needed to address Nonpoint fecal coliform bacteria loadings for urban and rural sources.

A. General Strategies for Urban Sources

Addressing urban runoff will be a complex task, and will require implementation of watershed pollution control programs by local governments. Management of urban runoff is needed to address a variety of water quality problems, including metals, fecal coliform bacteria, nutrients, and habitat degradation. For this five-year phase of the basin management cycle, management will concentrate on source control and planning. Evaluation of the efficacy of this approach will be made during the basin strategy

reevaluation scheduled for 2006 in accordance with the statewide RBMP management cycle. In addition, EPD and EPA have developed TMDLs for 303(d) listed streams in the Satilla River Basin. EPD will, along with partner agencies such as local governments, NRCS, GSWCC, GFC, be implementing the TMDLs.

Specific Management Objectives

Stakeholders should work together to encourage and facilitate local watershed planning and management to ensure that designated water uses are supported.

Agricultural agencies will provide technical and educational assistance to producers for the purpose of facilitating agricultural BMP implementation.

Management Option Evaluation

Integrated management options will be proposed, implemented, and evaluated by local governments.

Action Plan

TMDLs were completed for each stream segment in 2001. TMDL implementation plans will be developed in 2002.

EPD will continue to ensure that all permitted sources remain in compliance with permitted effluent limitations for fecal coliform bacteria. EPD will also request a comprehensive watershed assessment, focusing on both point and nonpoint sources, from localities applying for new or expanded NPDES point source discharge permits. The intent is to direct localities' attention toward current and future nonpoint source issues in their watersheds and to have them consider ways to prevent or control water quality impacts due to growth. Approved watershed management steps will be included as a condition for expansion of existing water pollution control plants or construction of new plants.

EPD will continue to administer the NPDES and Permitting and Compliance and Enforcement (PCEP) Programs and encourage local planning to address management on a basin-wide scale. EPD will implement approved TMDLs.

Local governments will continue to operate and maintain their sewer systems and wastewater treatment plants, monitor land application systems, develop and implement regulations, zoning and land use planning, and implement local watershed initiatives and monitoring programs. EPD will encourage local authorities to institute programs to identify and address illicit sewage discharges, leaks and overflows of sanitary sewers, and failing septic tanks within their jurisdiction.

DHR will continue to regulate on-site sewage management systems and will work to educate local governments and citizen groups about the need for proper design, construction, and maintenance of septic systems to protect water quality. DHR will also utilize the criteria presented in the Growth Planning Act for septic system setbacks from high value waters. Local municipalities should work with the local health departments to identify locations of septic systems and educate owners about the proper care and maintenance of septic systems.

EPD will encourage citizen involvement through Adopt-A-Stream groups to address restoration of urban streams. Citizen groups will implement Adopt-A-Stream programs, and work with local governments in implementing watershed initiatives.

Method for Tracking Performance

EPD tracks point source discharges through inspections and evaluations of self-monitoring data. An evaluation of the status of listed water bodies will be made coincident with the next iteration of the RBMP cycle for the Satilla River basin in 2006.

B. General Strategies for Rural Sources

Agricultural cost share dollars (Farm Bill), grants (Section 319), and loans (Clean Water Act State Revolving Fund) need to be concentrated in priority watersheds with sufficient technical workforce to implement BMPs through long term agreements or contracts.

Specific Management Objectives

Stakeholders should work together to encourage and facilitate local watershed planning and management to ensure that designated water uses are supported.

Agricultural agencies will provide technical and educational assistance to producers for the purpose of facilitating agricultural BMP implementation.

Management Option Evaluation

Evaluation will be on a site-by-site basis. For agricultural BMP support, existing prioritization methods will be used.

Action Plan

EPD will assess use support in streams, encourage local planning efforts, and regulate point sources under the NPDES program. EPD will continue to ensure that all permitted sources remain in compliance with fecal coliform bacteria limits. EPD will also continue monitoring and assessment of Land Application Systems. EPD will implement approved TMDLs. TMDLs were completed for each stream segment in 2001. TMDL implementation plans will be developed in 2002.

GSWCC and local SWCDs and RC&D councils, with assistance from NRCS, will continue to support adoption of BMPs for animal waste handling and will follow up on complaints related to fecal coliform bacteria associated with agriculture. Methods for prioritization and implementation of cost-share incentives under the 1996 Farm Bill will be targeted to areas of apparent water quality impact, including rural streams which may contain excessive fecal coliform loads from animal and cropland operations.

Local SWCDs will convene Local Work Groups to identify local resource concerns and develop proposals for funding to address these concerns.

The DHR will continue to regulate on-site sewage management systems and will work to educate local governments and citizen groups about the need for need for proper design, construction, and maintenance of septic systems to protect water quality. The DHR will also utilize the criteria presented in the Growth Planning Act for septic system setbacks from high value waters. Local municipalities should work with the local health departments to identify locations of septic systems and educate owners about the proper care and maintenance of septic systems.

The University of Georgia will provide on-farm assistance to local producers through their Farm-A-Syst Program.

EPD will encourage citizen involvement through Adopt-A-Stream groups to address restoration of urban streams. Citizen groups will implement Adopt-A-Stream programs and work with local governments in implementing watershed initiatives.

Method for Tracking Performance

Agricultural agencies will track rates of BMP implementation for cropland and animal operations. An evaluation of the status of listed water bodies will be made coincident with the next iteration of the RBMP cycle for the Satilla River basin in 2002-2006.

7.3.4 Fish Consumption Guidelines

Problem Statement

The water use classifications were not fully supported in several water body segments due to fish consumption guidelines for mercury and in one segment due to dieldrin. There are no known point source discharges or other identifiable anthropogenic sources of mercury or dieldrin in these watersheds. Mercury may be present in fish due to mercury content in the natural soils, from municipal or industrial sources, or from fossil fuel use. It is also possible that the elevated mercury level is related to global atmospheric transport and deposition.

Satilla River Subbasin (HUC 03070201)

The water use classification of fishing was not fully supported in two Satilla River mainstem due to fish consumption guidelines recommended because of mercury residues. The guidelines are for largemouth bass, redbreast sunfish, and/or channel catfish.

Satilla River Subbasin (HUC 03070203)

The water use classification of fishing was not fully supported in five estuarine areas based on fish consumption guidelines due to PCBs, mercury and toxaphene. The guidelines are for several fish and shellfish species.

General Goals

Work to protect human health by providing guidelines for consumption of fish.

Ongoing Efforts

DNR has monitored fish and issued fish consumption guidelines. There are no known point source discharges or other identifiable anthropogenic sources of mercury in the Satilla River basin watersheds. Ongoing efforts will focus on continued monitoring of residue levels and issuance of updated consumption guidelines. TMDLs were completed for each stream segment in 2001. TMDL implementation plans will be developed in 2002.

Parts of the Satilla are coastal plain blackwater swamp systems. These systems are characterized by a high content of organic carbon (organic ligand humic substances), low alkalinity and pH, and naturally lower dissolved oxygen content. Blackwater systems have been found to have physico-chemical characteristics that provide both a sink for the accumulation of mercury from atmospheric deposition or other sources, and to provide an environment conducive to the methylation of mercury. As a result, baseline mercury residues found in fish tissues are higher than that found in other waterbodies having a different chemistry.

PCBs have been detected in fish tissue from coastal estuarine waters of Gibson, Terry, and Purvis Creeks as well as the Turtle River System near Brunswick. Toxaphene has been detected in fish tissue in Dupree and Terry Creeks. The PCBs and toxaphene are attributed to industrial operations in the Brunswick area. The USEPA has initiated Superfund cleanup operations to address the issues and anticipates that Superfund remediation actions will provide for attainment of water quality goals in the future. TMDLs were completed for each stream segment in 2001. TMDL implementation plans will be completed in 2002.

Identified Gaps and Needs

The source of mercury in the basin is not well quantified. Mercury within these watersheds is likely derived from natural sources or from atmospheric deposition.

General Strategies for Action

Because mercury is not originating from any known point or other identifiable anthropogenic sources, the strategy is to keep the fishing public notified of risks associated with fish consumption.

EPD and WRD will work to protect public human health by issuing fish consumption guidelines as needed, indicating the recommended rates of consumption of fish from specific waters. The guidelines are based on conservative assumptions and provide the public with factual information for use in making rational decisions regarding fish consumption.

Action Plan

- WRD and EPD will continue to sample and analyze fish tissue and issue fish consumption guidelines as needed. The next round of fish tissue sampling for this watershed will be considered in fiscal year 2003 in accordance with the river basin monitoring cycle. TMDL implementation plans will be developed in 2002.
- The USEPA will continue to implement Superfund remediation actions to address the contaminated sites.

Method of Tracking Performance

Trends in fish tissue concentration; number of Fish Consumption Guidelines.

7.3.5 Erosion and Sedimentation

Problem Statement

Water use classifications for fishing and/or recreation are potentially threatened in many water body segments by erosion and loading of sediment which can alter stream morphology, impact habitat, and reduce water clarity. Potential sources include urban runoff and development (particularly construction), unpaved rural roads, stream erosion (including head cutting, bank erosion, and shifting of the bedload), forestry practices, and agriculture. Potential threats from sediment loading are possible throughout the Satilla River Basin, although there are no stream segments listed at this time in the basin as not fully supporting designated water uses due to poor fish communities or sedimentation. A common strategy is proposed for addressing erosion and sedimentation throughout the basin. However, achieving standards in individual stream segments will depend on the development of site-specific local management plans.

Satilla River Subbasin (HUC 03070201)

The 1992 Georgia Forestry Commission (GFC) compliance survey examined 17 sites involving 1,290 acres in this subbasin. Twelve sites each were evaluated on private lands and five on forest industry lands. Overall, 96 percent of harvested acres and 99 percent of main haul road miles were in compliance with BMPs. No site-prepared acres or regenerated acres were evaluated. By ownership, compliance for roads and harvesting on private lands was 100 percent and 96 percent, respectively. Compliance on forest industry land for roads and harvesting was 98 percent and 96 percent, respectively.

During the 1998 BMP survey, the GFC evaluated 20 sites involving 2,917.6 acres in the sub-basin. Fifteen sites involving 1,415.5 acres were on private land and 5 sites involving 1,502 acres were on forest industry land. Except for the roads and stream crossing practice categories, BMP implementation was 90 percent or better. BMP implementation for stream crossing was 76 percent and 85 percent for roads. The percentage of acres in BMP compliance for Streamside Management Zones, timber harvesting, mechanical site preparation, chemical treatments, control burning, and

artificial regeneration averaged 99.8 percent. Compliance for stream crossings was 36 percent and 94 percent for miles of road and 94 percent on stream miles assessed.

By ownership, the 1998 results show forest industry land averaged 100 percent BMP implementation over all practice categories, including stream crossings, except for artificial regeneration where planting did not follow the contour on 1 site. On forest industry land 99 percent of the acres were in compliance with BMPs and 100 percent of the roads, stream crossings, and miles of stream were in compliance with BMPs.

On private lands, BMP implementation averaged 79 percent for streamside management zones, 36 percent for stream crossings, 74 percent for roads, 93 percent for timber harvesting, 96 percent for mechanical site preparation and 100 percent for chemical treatments, control burning, and artificial regeneration. The percentage of acres in compliance was 62 percent for SMZs while the other practices were 100 percent. Compliance on stream crossings was 12 percent and road miles was 77 percent and stream miles was 82 percent.

Another statewide BMP survey is scheduled for calendar year 2001.

Forestry BMP education is being targeted toward foresters, timber buyers, and loggers in the area to increase compliance. From December 1995 through December 2000, approximately 222 personnel affiliated with timber buyers and loggers living within the Satilla River Basin have completed the three day Master Timber Harvester Workshop sponsored by the American Forest &Paper Association (AF&PA). BMP training was conducted by the GFC.

Little Satilla River Subbasin (HUC 03070202)

The 1992 Georgia Forestry Commission (GFC) compliance survey examined 5 sites involving 413 acres in this subbasin. Two sites were evaluated on private land and three were on forest industry lands. Overall, 95 percent of harvested acres and 100 percent of main haul road miles were in compliance with BMPs. No site preparation or regenerated acres were evaluated. By ownership, compliance for roads and harvesting on private lands was 33 percent. Compliance on forest industry land for roads and harvesting was 100 percent and 100 percent respectively.

During the 1998 BMP survey, the GFC evaluated 5 sites involving 1,258.6 acres in the sub-basin. Three sites involving 320.6 acres were on private land and 2 sites involving 938 acres were on forest industry land. BMP implementation was 100 percent for all categories of practices except for stream crossing where BMP implementation was 89 percent. No sites were evaluated for chemical treatments or control burning. The percentage of acres in BMP compliance for Streamside Management Zones, timber harvesting, mechanical site preparation, and artificial regeneration averaged 100 percent. Compliance for stream crossings was 0 percent and 100 percent for miles of road and 100 percent on stream miles assessed.

By ownership, the 1998 results show forest industry land averaged 100 percent BMP implementation over streamside management zones, roads, and harvesting. Stream crossing implementation was 89 percent. No mechanical site preparation, chemical treatment, control burning, or artificial regeneration sites were evaluated. On forest industry land 100 percent of the acres, the road miles, and the miles of stream were in compliance with BMPs. Stream crossing compliance was 0 percent.

On private lands, BMP implementation was 100 percent on SMZs, timber harvesting, mechanical site preparation and artificial regeneration. The sites evaluated contained no stream crossings, roads, chemical treatments, or control burning operations. The percentage of acres in BMP compliance was 100 percent over the categories.

Another statewide BMP survey is scheduled for calendar year 2001.

Forestry BMP education is being targeted toward foresters, timber buyers, and loggers in the area to increase compliance. From December 1995 through December 2000, approximately 90 personnel affiliated with timber buyers and loggers living within the Little Satilla River Basin have completed the three day Master Timber Harvester Workshop sponsored by the AF&PA. BMP training was conducted by the GFC.

Turtle River Subbasin (HUC 03070203)

The 1992 Georgia Forestry Commission (GFC) compliance survey examined 6 sites involving 820 acres in this subbasin. Two sites were evaluated on private lands and four on forest industry lands. Overall, 100 percent of harvested acres and 100 percent of main haul road miles were in compliance with BMPs. One site prepared (control burning) tract was evaluated. By ownership, compliance for roads and harvesting on private lands was 100 percent and 100 percent respectively. Compliance on forest industry lands for roads and harvesting was 100 percent and 100 percent respectively. The control burned tract was on private land and was 100 percent in compliance.

During the 1998 BMP survey, the GFC evaluated 5 sites involving 205 acres in the sub-basin. Two sites involving 71 acres were on private land and 3 sites involving 134 acres were on forest industry land. BMP implementation was 100 percent for all categories of practices except for stream crossing where BMP implementation was 71 percent. No sites were evaluated for chemical treatments or control burning. The percentage of acres in BMP compliance for Streamside Management Zones, timber harvesting, mechanical site preparation, and artificial regeneration averaged 100 percent. Compliance for stream crossings was 0 percent and 100 percent for miles of road and 98 percent on stream miles assessed.

By ownership, the 1998 results show forest industry land averaged 100 percent BMP implementation over roads, harvesting, mechanical site preparation, and artificial regeneration sites. The sites did not contain streams and therefore no SMZs or stream crossings were evaluated. No chemical treatment or control burning occurred on these sites. On forest industry land 100 percent of the acres and the road miles were in compliance with BMPs.

On private lands, BMP implementation was 100 percent on SMZs, roads, timber harvesting, and mechanical site preparation sites. Stream crossing BMP implementation was 71 percent. No chemical treatments, control burning, or artificial regenerations operations occurred on these sites. The percentage of acres in BMP compliance was 100 percent over the categories. Stream crossing compliance was 0 percent, road miles was 100 percent.

Another statewide BMP survey is scheduled for calendar year 2001.

Forestry BMP education is being targeted toward foresters, timber buyers, and loggers in the area to increase compliance. From December 1995 through December 2000, approximately 48 personnel affiliated with timber buyers and loggers living within the Turtle River Basin have completed the three day Master Timber Harvester Workshop sponsored by the AF&PA. BMP training was conducted by the GFC.

General Goals

Control erosion and sedimentation from land disturbing activities in order to meet narrative turbidity water quality standards and support designated uses. Increase public awareness of erosion and sedimentation through coordinated education and outreach efforts.

The GFC will encourage implementation of the newly revised 1999 forestry BMPs through workshops and demonstrations.

Ongoing Efforts

Forestry and Agriculture both have voluntary E&SC programs built around implementation of BMPs and water complaint resolution procedures in place. GSWCC recently updated and is distributing the Manual for Erosion and Sediment Control in Georgia and the Field Manual for Erosion and Sediment Control in Georgia. The GSWCC, with its agricultural partners, has produced and distributed three E&SC pamphlets; "Guidelines for Streambank Restoration", "A Guide to Controlling Erosion with Vegetation", and "Agricultural Management Practices". These, along with a number E&SC related pamphlets and other informational materials are available in agricultural offices throughout the State. Soil and Water Conservation Districts annually convene Local Work Groups (LWGs) which are comprised of resource professionals from a variety of disciplines and interested stakeholders at the local level to identify resource concerns in their areas. These LWGs develop proposals for USDA or other funding to address identified resource concerns.

Forestry has made significant E&SC progress. GFC has been and is specifically targeting those landowner groups and regions with low compliance for increased BMP education throughout local talks, workshops, etc. The Georgia Forestry Association and the American Forest and Paper Association (AF&PA) sponsor Master Timber Harvesters Workshops with the goal of training every logger in the State on BMPs. In addition, the Georgia State Board of Registration for Foresters requires every licensed forester to implement BMPs as a minimum standard of practice. As they become standard within the industry, the new Forestry BMP Guidelines, printed in January, 1999, will result in additional sedimentation reductions with more riparian tree cover left over perennial and intermittent streams.

EPD serves as the "Issuing Authority" providing permitting, inspection, and compliance enforcement services in those localities across the State where local Erosion and Sedimentation Control Ordinances or Programs are not yet established. EPD is also continuing its efforts to develop a NPDES General Permit (No. GAR100000) for storm water discharges associated with construction activity. The permit will provide guidelines and regulations for effective control of silt, sediment and other pollutants which are carried by storm water runoff from construction sites. The General Permit has been issued, appealed, and overturned four times between 1992 and 1998, but was approved in 2000.

An Erosion and Sedimentation Control (E&SC) Advisory Committee developed an Erosion and Sediment Control Complaint Resolution Procedure by which concerned citizens or other parties may register E&SC complaints. The procedure is a three-step process with Local Issuing Authorities serving as the primary contact, followed by the local Soil and Water Conservation District, and finally EPD in some cases. The purpose of the procedure is to provide timely and workable solutions to E&SC control complaints through local Soil and Water Conservation Districts.

There are several erosion educational initiatives underway which have an urban focus. Each year GSWCC and EPD conduct five formal E&SC courses to provide training to the regulated community, regulators, consultants, and interested citizens. GSWCC also provides detailed E&SC training for 8 to 11 units of government each year. A task force established by the Lieutenant Governor and the Erosion and Sediment Control Technical Study Committee, known as DIRT II, is assessing the economic and environmental impacts of erosion prevention and sediment control BMPs for urban construction sites. Another urban initiative is the U.S. Forest Service's Planting Along Stream Sides (PASS) which deals with vegetative plantings to reduce erosion from stream banks.

In 1997, EPD, in cooperation with the University of Georgia, prepared and distributed the Land Development Provisions to Protect Georgia Water Quality report. The report

describes provisions which may be modified or added to local development programs to better protect water quality. Portions of the report address water quality impacts from storm water runoff and its relationship to urban development.

Local Soil and Water Conservation Districts and Resource Conservation and Development (RC&D) Councils are working with crop producers to reduce erosion and sedimentation through their No-Till Drill Program in the Satilla River basin.

Identified Gaps and Needs

A key for addressing erosion, sedimentation, and habitat issues on highly impacted streams is the definition of appropriate management goals. Many highly impacted streams cannot be returned to "natural" conditions. An appropriate restoration goal needs to be established in consultation between EPD partners and other stakeholders.

Many privately owned sawmills are not members of the AF&PA. These mills and their producers are not required to attend the Master Timber Harvesters Workshops at this time. The GFC, UGA, GFA, and the Southeastern Wood Producers Association are working on a solution. A need still exists for education of private landowners who are selling timber for the last time prior to land development. Many such landowners attempt to maximize return on timber, sometimes at the expense of BMPs.

Much of the sediment being produced and adversely impacting streams and lakes is associated with development and maintenance of unpaved rural roads. In many instances E&SC plans, implementation, inspection, and enforcement are not adequate on unpaved rural road projects. Without aggressive inspection and enforcement, contractors sometimes tend to allow erosion to occur and attempt mitigation after the fact. Georgia DOT and other agencies charged with E&SC need to work with county road departments in identifying road segments that are high sediment producers and recommend abatement measures. Additional monitoring may be needed to quantify the impact of unpaved rural roads as a source of sedimentation into streams.

Additional efforts should be directed toward increasing public awareness of erosion and sedimentation, with an emphasis on potential sources and controls. State and basin-wide coordination between agencies and organizations providing public education and technical assistance may help extend outreach efforts.

Adverse impacts of excess sediment loading include degradation of habitat and reduction of species diversity. These types of impacts are best evaluated through biological monitoring, for which improved capabilities are needed. EPD is developing increased capability for biomonitoring using Rapid Bioassessment Protocols (RBPs) for benthic macroinvertebrates. The EPD protocols also include habitat assessment. The WRD is working with the IBI (Index of Biologic Integrity) to assess fish communities. These tools will provide methods to detect and quantify impairment of aquatic life resulting from habitat-modifying stressors such as sediment, as well as impacts from other stressors.

General Strategies for Action

Many agricultural sediment reduction practices are relatively expensive and landowners are reluctant to spend today's dollars for long term BMP amortization in uncertain future markets. Agricultural cost share dollars (Farm Bill) and perhaps low interest loans (Clean Water State Revolving Fund) should be concentrated in priority watersheds with sufficient technical workforce to implement BMPs through long term agreements or contracts to reduce sediment loading. An understanding of the role of erosion and sedimentation in urban streams is incomplete at this time. Most of these streams are impacted by a variety of stressors. An incremental or phased approach is needed to address these issues.

Key Participants and Roles

GFC: encourage implementation of the newly revised 1999 forestry BMPs through workshops and demonstrations.

American Forest and Paper Association (AF&PA): The forest products industry has a strong record of stewardship on the land it owns and manages. Member companies have agreed to a Sustainable Forestry Initiative (SFI) program. The goal of the program is to improve the performance of member companies and licensees, and set new standards for the entire forest industry as well as for other forest landowners through implementation of the following twelve objectives:

1. Broaden the practice of sustainable forestry by employing an array of scientifically, environmentally, and economically sound forest practices in the growth, harvest, and use of forests.
2. Promptly reforest harvested acres to ensure long-term forest productivity and conservation of forest resources.
3. Protect the water quality in streams, lakes, and other water bodies by establishing riparian protection measures based on soil type, terrain, vegetation, and other applicable factors, and by using EPA approved Best Management Practices in all forest management operations.
4. Enhance the quality of wildlife habitat by developing and implementing measures that promote habitat diversity and the conservation of plant and animal populations found in forest communities.
5. Minimize the visual impact by designing harvests to blend into the terrain by restricting clear-cut size (120 acres average) and/or by using harvest methods, age classes, and judicious placement of harvest units to promote diversity in forest cover.
6. Manage company lands of ecologic, geologic, or historic significance in a manner that accounts for their special qualities.
7. Contribute to bio-diversity by enhancing landscape diversity and providing an array of habitats.
8. Continue to improve forest utilization to help ensure the most efficient use of forest resources.
9. Continue the prudent use of forest chemicals to improve forest health and growth while protecting employees, neighbors, the public, and sensitive lands.
10. Broaden the practice of sustainable forestry by further involving non-industrial landowners, loggers, consulting foresters, and company employees who are active in wood procurement and landowner assistance programs.
11. Publicly report Program Participants' progress in fulfilling their commitment to sustainable forestry.
12. Provide opportunities for the public and the forestry community to participate in the commitment to sustainable forestry.

From a water quality perspective, Objectives 3 and 10 are extremely important. Performance measures for Objective 3 state:

- Participants will meet or exceed all established BMPs, all applicable state water quality laws and regulations, and the requirements of the Clean Water Act for forestland.

- Participants will establish and implement riparian protection measures for all perennial streams and lakes and involve a panel of experts at the state level to help identify goals and objectives for riparian protection.
- Participants will individually, through cooperative efforts or through AF&PA, provide funding for water quality research.

Performance measures for Objective 10 state:

- Participants will encourage landowners that sell timber to reforest, following harvest, and to use BMPs by providing these landowners with information on the environmental and economic advantages of these practices.
- Participants will work closely with the Southeastern Wood Producers Association, the Georgia Forestry Association, the University of Georgia School of Forest Resources, the GFC, the Georgia Wildlife Resources Division, and others in the forestry community to further improve the professionalism of loggers through the Master Timber Harvesters program by establishing and/or cooperating with existing state groups to promote the training and education of loggers in:
    1. BMPs, including road construction and retirement, site preparation, streamside management, etc.
    2. Awareness of responsibilities under the Endangered Species Act and other wildlife consideration.
    3. Regeneration and forest resource conservation.
    4. Logging safety.
    5. OSHA and wage and hour rules.
    6. Transportation.
    7. Business management including employee training, public relations, etc.

Specific Management Objectives

Control erosion and sedimentation from land disturbing activities in order to meet narrative water quality standards.

Management Option Evaluation

During this iteration of the basin cycle, management will focus on source control BMPs.

Action Plan

Following the 1998 BMP survey, the GFC met with the Georgia Forestry Association (GFA) Environmental subcommittee and Executive Board, members from the Society of American Foresters (SAF), the Association of Consulting Foresters (ACF), and the Georgia State Board of Registration for Foresters to develop an action plan to improve BMP implementation, especially for stream crossings.

GFC will target landowner and user groups with low implementation rates for BMP education to encourage compliance with forestry BMP guidelines. GFC will work with AF&PA and forestry community to provide BMP training. The GFC also met with the Executive Board of the Association of Conservation Districts to request speaking at any local meetings to educate landowners about BMPs and their responsibilities and liabilities.

GFC will continue to monitor BMP implementation rates through biennial surveys and determine effectiveness of BMPs through habitat assessments and rapid bio-assessments of the aquatic organisms above and below forestry operations.

Member companies of the American Forest and Paper Association (AF&PA) will document performance measures for each objective through annual reports to AF&PA as required for Objective 11. AF&PA will issue an annual report to the public.

Method for Tracking Performance

GSWCC, GFC, EPD, and issuing authorities will track BMP implementation: GSWCC by the number of E&SC plans reviewed and DAT evaluations and recommendations; GFC through its biennial surveys, and EPD through routine inspections of permitted projects, surveillance for any incidences of noncompliance, and enforcement activities. NRCS will track BMP implementation through its NIMS reporting system.

7.3.6 Groundwater Quality and Quantity

Satilla River Subbasins

Issue A. Drought Conditions

Problem Statement

Drought conditions in Georgia during the May 1998- August 2000 period significantly impacted river basins throughout the state including the St Marys, Satilla, Suwannee and Ochlockonee basins. According to the National Oceanic and Atmospheric Administration (NOAA) and the state climate office, rainfall shortages in the state during the May 1998-August 2000 period range from just over 20 inches in North Central Georgia to just over 30 inches in West Central Georgia. Recorded rainfall shortages in the Suwannee and Ochlockonee regions were just over 22 inches and almost 25 inches in the St Marys and Satilla regions.

In 2000, EPD developed a Georgia Drought Report that documents and evaluates the management actions implemented by state and local authorities during the drought of 1998-2000; provides a summary of drought impacts and an objective assessment of the state's vulnerability and mitigation efforts; and presents a clear set of recommendations for improving drought preparedness and response.

Among the recommendations included are for the state to develop an effective method to evaluate consumptive use of water for agricultural irrigation, and implement programs for reducing water use while protecting the prosperity of farmers and agricultural communities.

General Goals

Georgia's goals are to control its level of drought preparedness, reduce its drought vulnerability and effectively manage its resources to meet the complex water demands of its natural environment, citizens and economic prosperity.

Ongoing Efforts

Comprehensive drought planning measures will be ongoing with the assistance of experts and stakeholders from within Georgia and the state has contracted with a team of experts from across the nation to guide and facilitate the process. The result of this effort will be a drought plan that provides a statewide framework, regional approach, and linkages with local drought plans.

Strategies for Action

The 1998-2000 Georgia Drought Report provides recommendations that are designed to supplement actions taken by all Georgians to better manage their water resources, and can be facilitated by a number of state agencies, including EPD. Among the recommendations, are the following:

1. Emergency Relief: The State of Georgia should provide emergency grants and loans to assist local governments with critical or threatened water supplies.
2. Water Conservation: The State of Georgia must develop a comprehensive water conservation plan to address a wide range of water conserving measures that can be implemented to reduce water demand in Georgia.
3. Agricultural Water Use: The State of Georgia must develop an effective method to evaluate consumptive use of water for agricultural irrigation, an implement programs for reducing water use while protecting the prosperity of farmers and agricultural communities.
4. State Water Plan: The State of Georgia must perform a detailed review of existing water policy and laws and develop a comprehensive state water plans that will provide the framework and support for effective management of Georgia's water resources.
5. State Drought Plan: The State of Georgia must continue developing a comprehensive drought plans and drought management process in order to implement appropriate drought response, preparedness and mitigation measures in future droughts.

Issue B. Flooding

Problem Statement

In March 1998, Georgia experienced widespread flooding due to heavy rainfall. The severity of the rain and the damages that resulted from flooding caused more than 65 percent of Georgia's counties to be declared federal disaster areas under Presidential Disaster Declaration 1209. May of the counties within the St Marys, Satilla, Suwannee, and Ochlockonee river basins were included in the disaster declaration. Before 1998, the last major flooding event occurred in July 1994, when tropical storm Alberto moved into southwest Georgia and caused the worst flooding in the state's history. In some parts of Georgia, the rainfall total was up to 27 inches.

General Goals

Continue to promote awareness and understanding of the need for floodplain and participation in the National Flood Insurance Program.

Ongoing Efforts

Although not as severe as the flood of 1994, the 1998 flooding affected a larger geographical area – more than 100 counties – mostly the central and southern parts of the state were impacted. In addition, to residential and commercial structures there was also damage to infrastructures. The majority of the counties within the Ochlockonee, St. Marys, Satilla and Suwannee river basins were included in the Presidential disaster declaration.

Strategies

Communities participating in the National Flood Insurance Program (NFIP) are to continue enforcing local floodplain management requirements for new and substantially damaged or improved buildings located in Special Flood Hazard Areas.

Acquisition of structures in the floodway of communities affected by the flooding disaster.

Target affected structures in the floodplain for voluntary buyouts, elevation – in-place or relocation.

Update and revise community mitigation plan and strategies based on flooding event.

Initiate or enhance public awareness and education regarding the hazards of flooding and the availability of flood insurance.

Target non-NFIP communities for future participation.

Key Participants

Federal: Emergency Management Agency (FEMA) – ensures coordination among Federal departments and agencies in delivery of disaster related assistance.

State: Georgia Emergency Management Agency (GEMA) – coordinate the state's response and recovery efforts.

State: Floodplain Management Office – provides technical assistance and guidance to local communities.

Local: Local Governments – provide for the protection of life and property, and reduce future flood related issues.

Satilla River Subbasin (HUC 03070203)

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References

The President's Long Term Recovery Action Plan for the March 1998 Georgia Flood

Spring Disasters 1998: Helping Communities Respond and Rebuild – Georgia Emergency Agency (GEMA)

In This Section

Section 8

Future Issues and Challenges

8.1 Where Do We Go From Here?

The Dynamic Process of Basin Management

This plan represents another step in managing the water resources in the Satilla River basin, but not the final step. It is important to recognize that effective basin management is ongoing and dynamic because changes in resource use and conditions occur continually, as do changes in management resources and perspectives. Therefore, management planning and implementation must remain flexible and adapt to changing needs and capabilities.

Building on Past Improvements

As discussed previously in Section 7.3, there is more work to do to adequately restore and protect all of Georgia's water resources. After focusing on the implementation of this plan, the Satilla River basin will enter into its second iteration of the basin management cycle (beginning in late 2002). The next cycle will provide an opportunity to review issues that were not fully addressed during the first cycle and to reassesses or identify any new priority issues. In other words, future management efforts can and should build on the foundation created by previous, ongoing, and already planned management actions.

Participation by Many Different Stakeholders

Partners will not have to start from scratch during the next iteration of the basin planning cycle. The information in this document provides an historical account of what is known and planned to date. Stakeholders in the Satilla basin will know what was accomplished in the first iteration, and can therefore focus on enhancing ongoing efforts or filling gaps. Data collection and public discussion activities scheduled early in the next cycle can draw on information in the plan to identify areas in need of additional monitoring, assessment, and strategy development.

Blending Regulatory and Voluntary Approaches

Although the regulatory authorities of agencies such as EPD are important for protection and restoration of Georgia's waters, RBMP partners will continue to emphasize voluntary and cooperative approaches to watershed management. This will take time and be very challenging. Long-term protection means that the people, local governments, and businesses must learn collectively what is needed for protection and adapt their lifestyle and operations accordingly. Experience indicates that we are much more likely to buy into proposed management solutions in which we have a say and control over how we spend our time and money. The challenge in the future, therefore, is to continue to "build bridges" between regulatory and voluntary efforts, using each where they best serve the people and natural resource of Georgia.

8.2 Working to Strengthen Planning and Implementation Capabilities

Understanding One Another's Roles

Increasing awareness and understanding of the roles and capabilities of local, state, and federal partners is one of the keys to future success in basin management for the Satilla River. Lack of understanding can lead to finger pointing and frustration on the part of all involved. Increasing opportunities for stakeholders to develop this awareness and understanding should result in more effective management actions.

This basin plan provides one opportunity for stakeholders to increase their awareness of conditions in the basin and to learn about ongoing and proposed new management strategies. Within this context, stakeholders can develop a better understanding of certain roles and responsibilities. For example, this basin plan points out several areas where EPD has regulatory authority and corresponding duties, including

- Establishing water quality use classifications and standards.
- Assessing and reporting on water quality conditions.
- Facilitating development of River Basin Management Plans.
- Developing TMDLs.
- Issuing permits for point source discharges of treated wastewater, municipal storm water discharges as required, and land application systems.
- Issuing water supply permits.
- Enforcing compliance with permit conditions.

In many areas, however, organizations or entities other than EPD are responsible; for example,

- Septic tank permitting and inspection (County Health Departments) and maintenance (individual landowners).
- Land development (land use) and zoning ordinances (local governments).
- Sanitary sewer and storm water ordinances (local governments).
- Water supply source water protection ordinances (local governments).
- Urban storm water and drainage (local governments).
- Erosion and sediment control (local governments).

- Siting of industrial parks, landfills, and wastewater treatment facilities (local governments).
- Floodplain management (FEMA, local governments).
- Implementation of forestry best management practices (Georgia Forestry Commission with support from the American Forest and Paper Association, the Georgia Forestry Association, the University of Georgia School of Forest Resources, Southeastern Wood Producers Association, and the American Pulpwood Association).
- Implementation of agricultural best management practices (landowners with support from state and federal agricultural agencies).
- Proper use, handling, storage, and disposal of chemicals (businesses, landowners, municipalities, counties, etc.).

These are but a few of the areas involved, but they illustrate how responsibilities are spread across many stakeholders in each basin. Additionally, other agencies and organizations—regional development centers; federal, state, and local technical assistance programs; citizens groups; and business associations—assist in planning and implementation in many of these areas. As stakeholders become more familiar with one another's responsibilities and capabilities, they will become increasingly aware of appropriate partners to work with in addressing their issues of concern.

Using the RBMP Framework to Improve Communication

Raising awareness frequently involves two-way communication. The RBMP framework's interactive planning and outreach sessions provide additional opportunities for two-way communication. For example, Basin Technical Planning Team meetings provide opportunities for partners to share information on their responsibilities and capabilities with each other. Similarly, River Basin Advisory Committee meetings and Stakeholder meetings provide opportunities for citizens, businesses, government agencies, associations, and others. to share information and learn from each other. Although these interactions often require considerable time, they are critical to the future of management in the basin because they build the working relationships and trust that are essential to carrying out effective, integrated actions.

Continuing to Streamline Our Efforts

Increased coordination will also result if partners in this approach continue to streamline their efforts. There are many laws and requirements with related and complementary goals, e.g., Georgia's Growth Strategies Act, Planning Act, River Corridor Protection Act, Comprehensive Ground Water Management Plan, and River Basin Management Planning requirements, in addition to federal Clean Water Act water quality regulations and Safe Drinking Water Act source water protection requirements. Partners should continue to find ways to make actions under these laws consistent and complementary by eliminating redundancy and leveraging efforts. Again, partners can use the forums in the RBMP framework (e.g., river basin team and advisory committees) to discuss and implement ideas to streamline roles and make the best use of their funds and staff resources.

8.3 Addressing the Impacts from Continued Population Growth and Land Development

Supporting Consistent Implementation of Protection Measures

In addressing the impacts from anticipated population growth and increased land development in the basin, future managers will need to increase their understanding of roles and use forums to coordinate and develop more specific action plans. Historically, mitigating impacts from newly developed areas has been approached mostly on a case-by-case basis. Unfortunately, this approach has resulted in inconsistent planning and implementation of water resource protection measures. River basin planning offers an opportunity for a more consistent approach by making it easier for landowners, local governments, and businesses to work together at the watershed and basin levels.

One way that Georgia EPD will address this issue is by approving only new and expanding permits for water withdrawals and wastewater discharges that are consistent with the basin plan and that meet the intent of the Georgia Planning Act. Rather than waiting for the permit application process, however, local governments can work together and with EPD to work out some of these issues in advance. There are incentives for organizations such as the Georgia Water Pollution Control Association (WPCA), the Georgia Municipal Association (GMA), the Association of County Commissioners of Georgia (ACCG), and the Regional Development Centers (RDCs) to work out consistent methods to conduct watershed assessments in developing areas and to improve the implementation of protection measures as development occurs. EPD, DCA, and other partners can coordinate by facilitating discussion at RBMP meetings and supporting local initiatives aimed at this issue.

8.4 The Next Iteration of the Basin Cycle

Building on Previous, Ongoing, Planned Efforts

As discussed above and in Section 7.3, there is more work to do to adequately restore and protect all of Georgia's water resources. After focusing on the implementation of this plan, the Satilla River basin will enter into its second iteration of the basin management cycle. The next cycle will provide an opportunity to review issues that were not fully addressed during the first cycle and to reassess or identify any new priority issues. In other words, future management efforts can and should build on the foundation created by previous, ongoing, and already planned management actions.

8.5 Priorities for Additional Data Collection

In 1998 monitoring efforts were focused on the Ocholockonee, Suwannee, Satilla, and St. Marys River basins in accordance with the EPD basin planning schedule. Intensive monitoring will return to the Satilla basin in support of the next iteration of the basin planning cycle in 2003. Prior to this time, EPD and partners will develop a monitoring plan for the Satilla. The monitoring plan will have two major components: general assessment of water quality status within the basin, and targeted assessment to address priority issues and concerns.

River Basin Planning Act

(O.C.G.A. 12-5-520 to 525)

92 SB637/AP

Senate Bill 637

By: Senators Johnson of the 47th, Pollard of the 24th, Edge of the 28th and Egan of the 40th.

An Act

To amend Chapter 5 of Title 12 of the Official Code of Georgia Annotated, relating to water resources, so as to define certain terms; to provide for the development of river basin management plans for certain rivers; to provide for the contents of such plans; to provide for the appointment and duties of local advisory committees; to provide for notice and public hearings; to provide for submission to and approval of plans to the Board of Natural Resources; to make certain provisions relative to issuing certain permits; to provide for the application for and use of certain funds; to provide that this Act shall not enlarge the powers of the Department of Natural Resources; to repeal conflicting laws; and for other purposes.

Be It Enacted by the General Assembly of Georgia:

Section 1. Chapter 5 of Title 12 of the Official Code of Georgia Annotated, relating to water resources, is amended by inserting at the end thereof the following:

Article 8

12-5-520. As used in this article, the term:

(1) "Board" means the Board of Natural Resources.

(2) "Director" means the director of the Environmental Protection Division of the Department of Natural Resources.

12-5-521. The director shall develop river basin management plans for the following rivers: Alapaha, Altamaha, Canoochee, Chattahoochee, Coosa, Flint, Ochlocknee, Ocmulgee, Oconee, Ogeechee, St. Marys, Satilla, Savannah, Suwanee, Tallapoosa, and Tennessee. The director shall consult the chairmen of the local advisory committees on all aspects of developing the management plans. The director shall begin development of the management plan for the Chattahoochee and Flint river basins by December 31, 1992, and for the Coosa and Oconee river basins by December 31, 1993. Beginning in 1994, the director shall begin development of one management plan per calendar year until all required management plans have been begun. All

management plans shall be completed not later than five years after they were begun and shall be made available to the public within 180 days after completion.

12-5-522. The management plans provided by Code Section 12-5-521 shall include, but not be limited to, the following:

(1) A description of the watershed, including the geographic boundaries, historical, current, and projected uses, hydrology, and a description of water quality, including the current water quality conditions;

(2) An identification of all governmental units that have jurisdiction over the watershed and its drainage basin;

(3) An inventory of land uses within the drainage basin and important tributaries including point and nonpoint sources of pollution;

(4) A description of the goals of the management plan, which may include educating the general public on matters involving the environmental and ecological concerns specific to the river basin, improving water quality and reducing pollution at the source, improving aquatic habitat and reestablishing native species of fish, restoring and protecting wildlife habitat, and providing recreational benefits; and

(5) A description of the strategies and measures necessary to accomplish the goals of the management plan.

12-5-523. As an initial action in the development of a management plan, the director shall appoint local advisory committees for each river basin to consist of at least seven citizens and a chairman appointed by the director. The local advisory committees shall provide advice and counsel to the director during the development of the management plan. Each committee shall meet at the call of the chairman but not less than once every four months. The chairman and members of the local advisory committees shall serve without compensation or reimbursement of expenses.

12-5-524.

(a) Upon completion of the penultimate draft of a management plan, the director shall conduct public hearings within the river basin. At least one public hearing shall be held in each river basin named in Code Section 12-5-521. The director shall publish notice of each such public hearing in a newspaper of general circulation in the area announcing the date, time, place, and purpose of the public hearing. A draft of the management plan shall be made available to the public at least 30 days prior to the public hearing. The director shall receive public comment at the public hearing and for a period of at least ten days after the public hearing.

(b) The division shall evaluate the comments received as a result of the public hearings and shall develop the final draft of the management plan for submission to the board for consideration within 60 days of the public hearing.

(c) The board shall consider the management plan within 60 days after submission by the director. The department shall publish the management plan adopted by the board and shall make copies available to all interested

local governmental officials and citizens within the river basin covered by such management plan.

(d) Upon the board's adoption of a final river basin management plan, all permitting and other activities conducted by or under the control of the Department of Natural Resources shall be consistent with such plan.

(e) No provision of this article shall constitute an enlargement of the existing statutory powers of the department.

12-5-525. The director is directed to apply for the maximum amount of available funds pursuant to Sections 106, 314, 319, and 104(b)(2) of Public Law 95-217, the federal Clean Water Act, and any other available source for the development of river basin management plans.

Section 2. All laws and parts of laws in conflict with this Act are repealed.

Georgia Instream Water Quality Standards For All Waters: Toxic Substances

(Excerpt From Georgia Rules and Regulations for Water Quality Control Chapter 391-3-6-.03 Water Use Classifications and Water Quality Standards)

I Instream concentrations of the following chemical constituents which are considered to be other toxic pollutants of concern in the State of Georgia shall not exceed the criteria indicated below under 7-day, 10-year minimum flow (7Q10) or higher stream flow conditions except within established mixing zones:

1. 2,4-Dichlorophenoxyacetic acid (2,4-D) 70 µg/l
2. Methoxychlor* 0.03 µg/l
3. 2,4,5-Trichlorophenoxy propionic acid (TP Silvex) 50 µg/l

II Instream concentrations of the following chemical constituents listed by the U.S. Environmental Protection Agency as toxic priority pollutants pursuant to Section 307(a)(1) of the Federal Clean Water Act (as amended) shall not exceed criteria indicated below under 7-day, 10-year minimum flow (7Q10) or higher stream flow conditions except within established mixing zones or in accordance with site specific effluent limitations developed in accordance with procedures presented in 391-3-6-.06.

1. Arsenic

(a) Freshwater 50 µg/l

(b) Coastal and Marine Estuarine Waters 36 µg/l

2. Cadmium

(a) Freshwater
(at hardness levels less than 100 mg/l) 0.7 µg/l*
(at hardness levels of 100 mg/l to 199 mg/l) 1.1 µg/l*
(at hardness levels greater than or equal to 200 mg/l) 2.0 µg/l*

Note: Total hardness expressed as $CaCO_3$.

(b) Coastal and Marine Waters 9.3 µg/l

3. Chlordane*
(a) Freshwater 0.0043 µg/l
(b) Coastal and Marine Estuarine Waters 0.004 µg/l

4. Chromium (VI)
(a) Freshwater 11 µg/l
(b) Coastal and Marine Estuarine Waters 50 µg/l

5. Total Chromium
(at hardness levels less than 100 mg/l) 120 µg/l
(at hardness levels of 100 mg/l to 199 mg/l) 210 µg/l
(at hardness levels greater than or equal to 200 mg/l) 370 µg/l

Note: Total hardness expressed as $CaC0_3$.

6. Copper
(a) Freshwater
(at hardness levels less than 100 mg/l) 6.5 µg/l*
(at hardness levels of 100 mg/l to 199 mg/l) 12 µg/l
(at hardness levels greater than or equal to 200 mg/l) 21 µg/l

Note: Total hardness expressed as $CaCO_3$.

(b) Coastal and Marine Estuarine Waters 2.9 µg/l*

7. Cyanide*
(a) Freshwater 5.2 µg/l
(b) Coastal and Marine Estuarine Waters 1.0 µg/l

8. Dieldrin* 0.0019 µg/l

9. 4,4'-DDT* 0.001 µg/l

10. a-Endosulfan*
    (a) Freshwater 0.056 µg/l
    (b) Coastal and Marine Estuarine Waters 0.0087 µg/l

11. b-Endosulfan*
    (a) Freshwater 0.056 µg/l
    (b) Coastal and Marine Estuarine Waters 0.0087 µg/l

12. Endrin* 0.002 µg/l

13. Heptachlor*
    (a) Freshwater 0.0038 µg/l
    (b) Coastal and Marine Estuarine Waters 0.0036 µg/l

14. Heptachlor Epoxide*
    (a) Freshwater 0.0038 µg/l
    (b) Coastal and Marine Estuarine Waters 0.0036 µg/l

15. Lead*
    (a) Freshwater
        (at hardness levels less than 100 mg/l) 1.3 µg/l
        (at hardness levels of 100 mg/l to 199 mg/l) 3.2 µg/l
        (at hardness levels greater than or equal to 200 mg/l) 7.7 µg/l
        Note: Total hardness expressed as $CaCO_3$.
    (b) Coastal and Marine Estuarine Waters 5.6 µg/l

16. Lindane [Hexachlorocyclohexane (g-BHC-Gamma)] 0.08 µg/l

17. Mercury*
    (a) Freshwater 0.012 µg/l
    (b) Coastal and Marine Estuarine Waters 0.025 µg/l

18. Nickel
    (a) Freshwater
        (at hardness levels less than 100 mg/l) 88 µg/l
        (at hardness levels of 100 mg/l to 199 mg/l) 160 µg/l
        (at hardness levels greater than or equal to 200 mg/) 280 µg/l
        Note: Total hardness expressed as $CaCO_3$.
    (b) Coastal and Marine Estuarine Waters 8.3 µg/l

19. Pentachlorophenol*
    (a) Freshwater 2.1 µg/l
    (b) Coastal and Marine Estuarine Waters 7.9 µg/l

20. PCB-1016 0.014 µg/l

21. PCB-1221 0.014 µg/l

22. PCB-1232 0.014 µg/l

23. PCB-1242 0.014 µg/l

24. PCB-1248 0.014 µg/l

25. PCB-1254 0.014 µg/l

26. PCB-1260 0.014 µg/l

27. Phenol 300 µg/l

28. Selenium
    (a) Freshwater 5.0 µg/l
    (b) Coastal and Marine Estuarine Waters 71 µg/l

29. Silver **

30. Toxaphene 0.0002 µg/l

31. Zinc
    (a) Freshwater
        (at hardness levels less than 100 mg/l) 60 µg/l
        (at hardness levels of 100 mg/l to 199 mg/l) 110 µg/l
        (at hardness levels greater than or equal to 200 mg/l) 190 µg/l
        Note: Total hardness expressed as $CaCO_3$.
    (b) Coastal and Marine Estuarine Waters 86 µg/l

Notes:

* The in-stream criterion is lower than the EPD laboratory detection limits.

** Numeric limits are not specified. This pollutant is addressed in 391-3-6-.06.

III Instream concentrations of the following chemical constituents listed by the U. S. Environmental Protection Agency as toxic priority pollutants pursuant to Section 307(a)(1) of the Federal Clean Water Act (as amended) shall not exceed criteria indicated below under annual average or higher stream flow conditions:

1. Acenaphthene **
2. Acenaphthylene **
3. Acrolein 780 µg/l
4. Acrylonitrile 0.665 µg/l
5. Aldrin 0.000136 µg/l
6. Anthracene 110000 µg/l
7. Antimony 4308 µg/l
8. Arsenic 0.14 µg/l
9. Benzidine 0.000535 µg/l
10. Benzo(a)Anthracene 0.0311 µg/l
11. Benzo(a)Pyrene 0.0311 µg/l
12. 3,4-Benzofluoranthene 0.0311 µg/l
13. Benzene 71.28 µg/l
14. Benzo(ghi)Perylene **

15. Benzo(k)Fluoranthene	0.0311 µg/l
16. Beryllium	**
17. a-BHC-Alpha	0.0131 µg/l
18. b-BHC-Beta	0.046 µg/l
19. Bis(2-Chloroethyl)Ethe	1.42 µg/l
20. Bis(2-Chloroisopropyl)Ether	170000 µg/l
21. Bis(2-Ethylhexyl)Phthalate	5.92 µg/l
22. Bromoform (Tribromomethane)	360 µg/l
23. Carbon Tetrachloride	4.42 µg/l
24. Chlorobenzene	21000 µg/l
25. Chlorodibromomethane	34 µg/l
26. 2-Chloroethylvinyl Ether	**
27. Chlordane	0.000588 µg/l
28. Chloroform (Trichloromethane)	470.8 µg/l
29. 2-Chlorophenol	**
30. Chrysene	0.0311 µg/l
31. Dibenzo(a,h)Anthracene	0.0311 µg/l
32. Dichlorobromomethane	22 µg/l
33. 1,2-Dichloroethane	98.6 µg/l
34. 1,1-Dichloroethylene	3.2 µg/l
35. 1,3-Dichloropropylene (Cis)	1700 µg/l
36. 1,3-Dichloropropylene (Trans)	1700 µg/l
37. 2,4-Dichlorophenol	790 µg/l
38. 1,2-Dichlorobenzene	17000 µg/l
39. 1,3-Dichlorobenzene	2600 µg/l
40. 1,4-Dichlorobenzene	2600 µg/l
41. 3,3'-Dichlorobenzidine	0.077 µg/l
42. 4,4'-DDT	0.00059 µg/l
43. 4,4'-DDD	0.00084 µg/l
44. 4,4'-DDE	0.00059 µg/l
45. Dieldrin	0.000144 µg/l
46. Diethyl Phthalate	120000 µg/l
47. Dimethyl Phthalate	2900000 µg/l
48. 2,4-Dimethylphenol	**
49. 2,4-Dinitrophenol	14264 µg/l
50. Di-n-Butyl Phthalate	12100 µg/l
51. 2,4-Dinitrotoluene	9.1 µg/l
52. 1,2-Diphenylhydrazine	0.54 µg/l
53. Endrin Aldehyde	0.81 µg/l
54. Endosulfan Sulfate	2.0 µg/l
55. Ethylbenzene	28718 µg/l
56. Fluoranthene	370 µg/l
57. Fluorene	14000 µg/l
58. Heptachlor	0.000214 µg/l
59. Heptachlor Epoxide	0.00011 µg/l
60. Hexachlorobenzene	0.00077 µg/l
61. Hexachlorobutadiene	49.7 µg/l
62. Hexachlorocyclopentadiene	17000 µg/l
63. Hexachloroethane	8.85 µg/l
64. Indeno(1,2,3-cd)Pyrene	0.0311 µg/l
65. Isophorone	600 µg/l
66. Lindane [Hexachlorocyclohexane g-BHC-Gamma)]	0.0625 µg/l
67. Methyl Bromide (Bromomethane)	4000 µg/l
68. Methyl Chloride (Chloromethane)	**
69. Methylene Chloride	H
70. 2-Methyl-4,6-Dinitrophenol	765 µg/l
71. 3-Methyl-4-Chlorophenol	**
72. Nitrobenzene	1900 µg/l
73. N-Nitrosodimethylamine	8.12 µg/l
74. N-Nitrosodi-n-Propylamine	**
75. N-Nitrosodiphenylamine	16.2 µg/l
76. PCB-1016	0.00045 µg/l
77. PCB-1221	0.00045 µg/l
78. PCB-1232	0.00045 µg/l
79. PCB-1242	0.00045 µg/l
80. PCB-1248	0.00045 µg/l
81. PCB-1254	0.00045 µg/l
82. PCB-1260	0.00045 µg/l
83. Phenanthrene	**
84. Phenol	4,600,000 µg/l
84. Pyrene	11,000 µg/l
85. 1,1,2,2-Tetrachloroethane	10.8 µg/l
85. Tetrachloroethylene	8.85 µg/l
87. Thallium	48 (6.3) µg/l I
88. Toluene	200000 µg/l
89. 1,2-Trans-Dichloroethylene	**
90. 1,1,2-Trichloroethane	41.99 µg/l
91. Trichloroethylene	80.7 µg/l
92. 2,4,6-Trichlorophenol	6.5 µg/l
93. 1,2,4-Trichlorobenzene	**
94. Vinyl Chloride	525 µg/l

Notes:

** Numeric limits are not specified. These pollutants are addressed in 391-3-6-.06.

† EPD has proposed to the Board of Natural Resources changing numeric limits for methylene chloride from

unspecified to 1600 µg/l consistent with EPA's National Toxics Rule.

‡ EPD has proposed to the Board of Natural Resources changing numeric limits for thallium from 48 to 6.3 µg/l consistent with EPA's National Toxics Rule.

IV Site specific criteria for the following chemical constituents will be developed on an as-needed basis through toxic pollutant monitoring efforts at new or existing discharges that are suspected to be a source of the pollutant at levels sufficient to interfere with designated uses:

1. Asbestos

V Instream concentrations of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) must not exceed 0.0000012 µg/l under long-term average stream flow conditions.

(e) Applicable State and Federal requirements and regulations for the discharge of radioactive substances shall be met at all times.

Point Source Control Efforts

Georgia DNR's management has promoted continuing improvement in the quality of return flows from permitted point sources in the basin. During the past twenty-five years, the majority of our municipal wastewater treatment plants were constructed or updated to meet State and/or federally mandated effluent standards. State and federal grants and the citizens of local municipalities funded these projects. This massive construction program has been so successful that over 90% of all these facilities in Georgia are currently meeting their effluent limits. We must protect our investments in these facilities and in the State's water quality.

The history of construction improvements for permitted dischargers within the Satilla basin is summarized in the following table:

HUC 03070201

1958	City of Waycross trickling filter plant constructed.
1963	Rhone-Poulenc, Inc. built facilities with pH adjustment.
1982	City of Waycross rapid infiltration system constructed for $6,000,000.
1993	D. L. Lee and Sons, Inc. pretreatment system constructed with discharge to the Waycross sewerage system.
2001	City of Nichols built a 0.5 MGD land application system for $2,500,000.
2001	City of Waycross converting to activated sludge process scheduled to be complete April 2002 for $8,000,000.

HUC 03070202 - None

HUC 03070203

1960s	Driftwood Mobile Home Park built two oxidation ponds.
1982	Golden Isles Marina installed a 48,000 gpd activated sludge package plant.
1989	Glynn County constructed the 0.3 MGD I-95 Exit 29 wastewater treatment plant for $1,235,935.
2001	Golden Isles Marina installing a new 31,000 gpd upflow sludge blanket filtration package treatment facility for $267,000.

NPDES Permits for Discharges in the Satilla River Basin

FACILITY NAME	NPDES #	PERMITTED FLOW (MGD)	MAJOR	COUNTY	RECEIVING STREAM
ALMA WPCP	GA0032328	0.75		BACON	HURRICANE CREEK TRIB
AVENTIS CROPSCIENCE USA	GA0003468			CAMDEN	TIDAL ESTUARIES/FLOYD CR
BRUNSWICK ACADEMY CR	GA0025313	13.5	Y	GLYNN	ACADAMY CR
CHRISTAIN SALVASEN	GA0029751			COFFEE	MILL POND TRIB TO 17 MILE RV
CSX TRANSPORTATION	GA0046680	0.09		WARE	WAYCROSS CANAL
CSX TRANSPORTATION WAYCROSS	GA0002241			WARE	WAYCROSS CANAL
DOOR WAYNE CO STATE PRISON	GA0049573	0.02		WAYNE	DRY CR-LITTLE SATILLA CR
DOUGLAS SOUTHEAST	GA0024431	6	Y	COFFEE	SEVENTEEN MILE CR
DRIFTWOOD MHP#1-BRUNSWICK	GA0033901	0.015		GLYNN	ALTAMAHA CANAL
DRIFTWOOD MHP#2-BRUNSWICK	GA0033910	0.015		GLYNN	ALTAMAHA CANAL
GA BAPTIST CHILDREN'S HOME	GA0049531	0.04		APPLING	SWEETWATER CR
GA PORTS AUTHORITY	GA0047937	0.008		GLYNN	SOUTH BRUNSWICK RV
GEORGIA PACIFIC BRUNSWICK	GA0003654		Y	GLYNN	TURTLE RV
GEORGIA PACIFIC CORP	GA0037591			GLYNN	WHITE OAK SWAMP TRIB/TURTLE RV

FACILITY NAME	NPDES #	PERMITTED FLOW (MGD)	MAJOR	COUNTY	RECEIVING STREAM
GEORGIA POWER MCMANUS	GA0003794			GLYNN	GIBSON CR
GOLD KIST FEED MILL	GA0038296			COFFEE	
GOLDEN ISLES MARINA	GA0030767	0.048		GLYNN	FREDERICA RV
HERCULES BRUNSWICK	GA0003735		Y	GLYNN	DUPREE CR
INTERNATIONAL PAPER CORP	GA0002771			WARE	KETTLE CR
JEKYLL ISLAND WPCP	GA0020508	1	Y	GLYNN	JEKYLL RV
LEWIS CRAB FACTORY BRUNSWICK	GA0003701	0.1		GLYNN	EAST BRUNSICK RV
MILLENNIUM SPEC CHEMICALS	GA0050016			GLYNN	LITTLE SATILLA RV TRIB
MILLIKEN ALMA PLANT	GA0024619			BACON	LITTLE HURRICANE CR
PATTERSON	GA0037206	0.208		PIERCE	PATTERSON CREEK
PEARSON WPCP	GA0025445	0.36		ATKINSON	TRIB TO LITTLE RED BLUFF CR
SAINT SIMONS ISLAND	GA0021521	3	Y	GLYNN	DUNBAR CR
SEA HARVEST PACKING COMPANY	GA0002607	0.023		GLYNN	GLYNCO NAVAL BASE CANAL
SECOND BAPTIST CHURCH	GA0031569	0.008		WARE	HERRIN CR
SHADY ACRES MHP BRUNSWICK	GA0022489	0.039		GLYNN	COWPEN CR
STERLING MHP BRUNSWICK	GA0034754	0.009		GLYNN	COWPEN CR-TURTLE RV
THOMPSON HARDWOODS	GA0038113			JEFF DAVIS	BISHOP CR
WAYCROSS MOLDED PRODUCTS INC	GA0034517	0.9		WARE	TRIB/KETTLE CR
WAYCROSS WPCP	GA0020966	6.7	Y	WARE	SATILLA RV
WOODBINE WPCP	GA0023701	0.368		CAMDEN	SATILLA RIVER
ALMA WPCP	GA0032328	0.75		BACON	HURRICANE CREEK TRIB

Support of Designated Uses for Rivers, Streams, and Lakes in the Satilla River Basin, 1998-1999

Rivers/Streams Supporting Designated Uses

BASIN/STREAM (Data Source)	LOCATION	WATER USE CLASSIFICATION	MILES
SATILLA RIVER BASIN			
HUC 03070201			
Alabaha River (1)	Tan Trough Cr. to Satilla River (Pierce Co.)	Fishing	12
Hurricane Creek (1)	Whitehead Cr. to d/s Little Cr.(Jeff Davis/Bacon Co.)	Fishing	9
Satilla River (1)	Seventeen Mile River to US Hwy 84/Ga. Hwy. 38 (Ware Co.)	Fishing	27
Seventeen Mile River (1)	Otter Cr. (Douglas) to Twentynine Mile Cr. (Coffee Co.)	Fishing	8
HUC 03070202			
Bishop Creek (1)	Downstream Hazelhurst (Jeff Davis Co.)	Fishing	2
Little Satilla River (1)	Sixty Foot Branch to Satilla River (Pierce/Wayne/Brantley Co.)	Fishing	6

Rivers/Streams Partially Supporting Designated Uses

BASIN/STREAM (Data Source)	LOCATION	WATER USE CLASSIFICATION	CRITERION VIOLATED	EVALUATED CAUSE(S)	ACTIONS TO ALLEVIATE	MILES	305(b)	303(d)	Priority
SATILLA RIVER BASIN									
HUC 03070201									
Buffalo Creek (1)	Little Buffalo Cr. to Satilla River (Brantley Co.)	Fishing	DO	NP	EPD will address nonpoint sources through a watershed protection strategy.	6	X	3*	2
Hog Creek (1)	Downstream CR185 to Hurricane Cr. near Nicholls (Coffee Co.)	Fishing	FC	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy.	10	X	3	3
Little Satilla River (1,10)	Big Satilla Cr. to Sixty Foot Branch (Pierce/Wayne/ Brantley Co.)	Fishing	DO,FC	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	10	X	3	2
Satilla River (1)	Pudding Cr. to Smut Br. near Pearson (Atkinson Co.)	Fishing	DO	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	8	X	3	2
Satilla River (1)	U.S. Highway 84/Ga. Hwy. 38 to 6 miles downstream Hwy 15/121 (Ware/Pierce/ Brantley Co.)	Fishing	FCG	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy. Note: FCG is a partial support.	23	X	3	3
Satilla River (1)	Six miles d/s of Ga. Hwy. 15 to Bullhead Bluff (Pierce/Brantley/ Camden Co.)	Fishing	FCG	NP	EPD will address nonpoint sources through a watershed protection strategy. Note: Fish Consumption Guidelines due to mercury in fish tissue.	76	X	3	3
Satilla River (1)	Rose Cr. to White Oak Cr. (Camden Co.)	Fishing	DO	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy.	19	X	3	2
Seventeen Mile River (1)	Twentynine Mile Cr. to Satilla River (Coffee Co.)	Fishing	DO,FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	13	X	3	2
HUC 03070202 – None									

*Note: the "3" in the 303(d) column denotes the fact that the TMDL has been established for each pollutant and the segment is no longer on the Geogia 303(d) list.

Rivers/Streams Not Supporting Designated Uses

BASIN/STREAM (Data Source)	LOCATION	WATER USE CLASSIFICATION	CRITERION VIOLATED	POTENTIAL CAUSE(S)	ACTIONS TO ALLEVIATE	MILES	305(b)	303(d)	Priority
SATILLA RIVER BASIN									
HUC 03070201									
Big Creek (1)	S. Prong Big Cr. to Satilla River (Brantley Co.)	Fishing	DO	NP	EPD will address nonpoint sources through a watershed protection strategy.	5	X	3	2
Broxton Creek (1)	Seven Cr. to Seventeen Mile River near Broxton (Coffee Co.)	Fishing	DO,FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	6	X	3	2
City Drainage Canal (2)	Trib. to Satilla River, Waycross (Ware Co.)	Fishing	FC	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy.	3	X	3	3
Hog Creek (1)	Hurricane Cr. to Satilla River S. of Nicholls near Bickley (Coffee/Ware Co.)	Fishing	DO,FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	15	X	3	2
Hurricane Creek (1)	Downstream Little Cr. to Ten Mile Cr. near Alma (Bacon Co.)	Fishing	DO,FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	20	X	3	2
Little Hurricane Creek (1)	Ga. Hwy. 32 to Hurricane Cr. (Bacon/Ware/Pierce Co.)	Fishing	DO,FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	22	X	3	2
Pudding Creek (1)	Park Bay to Satilla River N. of Pearson (Atkinson Co.)	Fishing	DO	NP	EPD will address nonpoint sources through a watershed protection strategy.	9	X	3	2
Red Bluff Creek (1)	Little Red Bluff Cr. to Satilla River E. of Pearson (Atkinson Co.)	Fishing	DO	NP	EPD will address nonpoint sources through a watershed protection strategy.	7	X	3	2
Roses Creek (1)	Upstream Ga. Hwy. 206 to Seventeen Mile River near Broxton (Coffee Co.)	Fishing	DO,FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	9	X	3	2

BASIN/STREAM (Data Source)	LOCATION	WATER USE CLASSIFICATION	CRITERION VIOLATED	POTENTIAL CAUSE(S)	ACTIONS TO ALLEVIATE	MILES	305(b)	303(d)	Priority
SATILLA RIVER BASIN									
Satilla Creek (1)	Hunters Cr. E. of Ocilla to Satilla River (Irwin/Coffee Co.)	Fishing	DO,FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	7	X	3	2
Satilla River (1)	Satilla Cr. to Reedy Cr. near Douglas (Coffee Co.)	Fishing	DO	NP	EPD will address nonpoint sources through a watershed protection strategy.	12	X	3	2
Seventeen Mile River (1)	Twenty Mile Cr. N. of Douglas to Otter Cr. downstream Gen. Coffee St. Park (Coffee Co.)	Fishing	DO,FC	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy.	7	X	3	2
HUC 03070202									
Big Satilla Creek (1)	Headwaters near Hazlehurst to Sweetwater Cr. near Baxley (Jeff Davis/Appling Co.)	Fishing	DO,FC	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy.	34	X	3	2
Boggy Creek (1)	Dry Creek to Little Satilla Cr. N. of Screven (Wayne Co.)	Fishing	DO,FC	NP	EPD will address nonpoint sources through a watershed protection strategy.	1	X	3	2
Colemans Creek (1)	Dry Branch S. of Surrency to Big Satilla Cr. near Screven (Appling/Wayne Co.)	Fishing	DO,FC	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy.	17	X	3	2
Little Satilla Creek (1)	Keene Bay Branch to Dry Branch near Odum (Wayne Co.)	Fishing	DO,FC	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy.	10	X	3	2
Little Satilla Creek (1)	Boggy Cr. to Little Satilla River near Screven (Wayne Co.)	Fishing	DO	NP	EPD will address nonpoint sources through a watershed protection strategy.	3	X	3	2
Reedy Creek (1)	Headwaters to Big Satilla Cr. near Screven (Appling/Wayne Co.)	Fishing	DO,FC	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy.	13	X	3	2

BASIN/STREAM (Data Source)	LOCATION	WATER USE CLASSIFICATION	CRITERION VIOLATED	POTENTIAL CAUSE(S)	ACTIONS TO ALLEVIATE	MILES	305(b)	303(d)	Priority
SATILLA RIVER BASIN									
Sweetwater Creek (1)	Black Water Cr. to Big Satilla Cr. near Baxley (Appling Co.)	Fishing	DO,FC	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy.	12	X	3	2

Estuarine Waters Not Fully Supporting Designated Uses

ESTUARY NAME (Data Source)	LOCATION	BASIN	WATER USE CLASSIFICATION	USE SUPPORT CATEGORY	CRITERION VIOLATED	POTENTIAL CAUSE(S)	SQUARE MILES AFFECTED	305(b)	303(d)	Priority
SATILLA RIVER BASIN										
HUC 03070203										
Brunswick Harbor (1,5)	Brunswick	Satilla	Fishing	N	SB	I1,M,UR	1	X	N/A	N/A
Brunswick River (1,5)	Brunswick	Satilla	Fishing	N	DO,SB	I1,M	11	X	3,N/A	2,N/A
Cumberland Estuary (5)	Cumberland	Satilla	Fishing	N	SB	NP	27	X	N/A	N/A
Dunbar Creek (5)	St. Simons Island	Satilla	Fishing	N	SB	M	2	X	N/A	N/A
Dupree Creek (3,5)	Brunswick	Satilla	Fishing	N	SB,FCG	I1	1	X	N/A,3	N/A,3
Gibson Creek (1,5)	Brunswick	Satilla	Fishing	N	PCBs,Hg,FCG,SB	I2	1	X	3,N/A	2,N/A
Purvis Creek (1,5)	Brunswick	Satilla	Fishing	N	Hg,Cd,PCBs,CFB,FCG,SB	I1,I2	1	X	3,N/A	2,N/A
St. Andrews Sound (5)	St. Andrews Sound	Satilla	Fishing	N	SB	M.NP	12	X	N/A	N/A
St. Simons Sound (1,5)	Brunswick	Satilla	Fishing	N	DO,SB	I1,M,UR,NP	66	X	N/A	N/A
Terry Creek (1)	Brunswick	Satilla	Fishing	N	FCG,SB	I1,I2	1	X	3,N/A	3,N/A
Turtle River System (1,5)	Brunswick: Turtle River, Buffalo River, and South Brunswick River (Glynn Co.)	Satilla	Fishing	N	FCG,SB	I1,M	18	X	3,N/A	3,N/A