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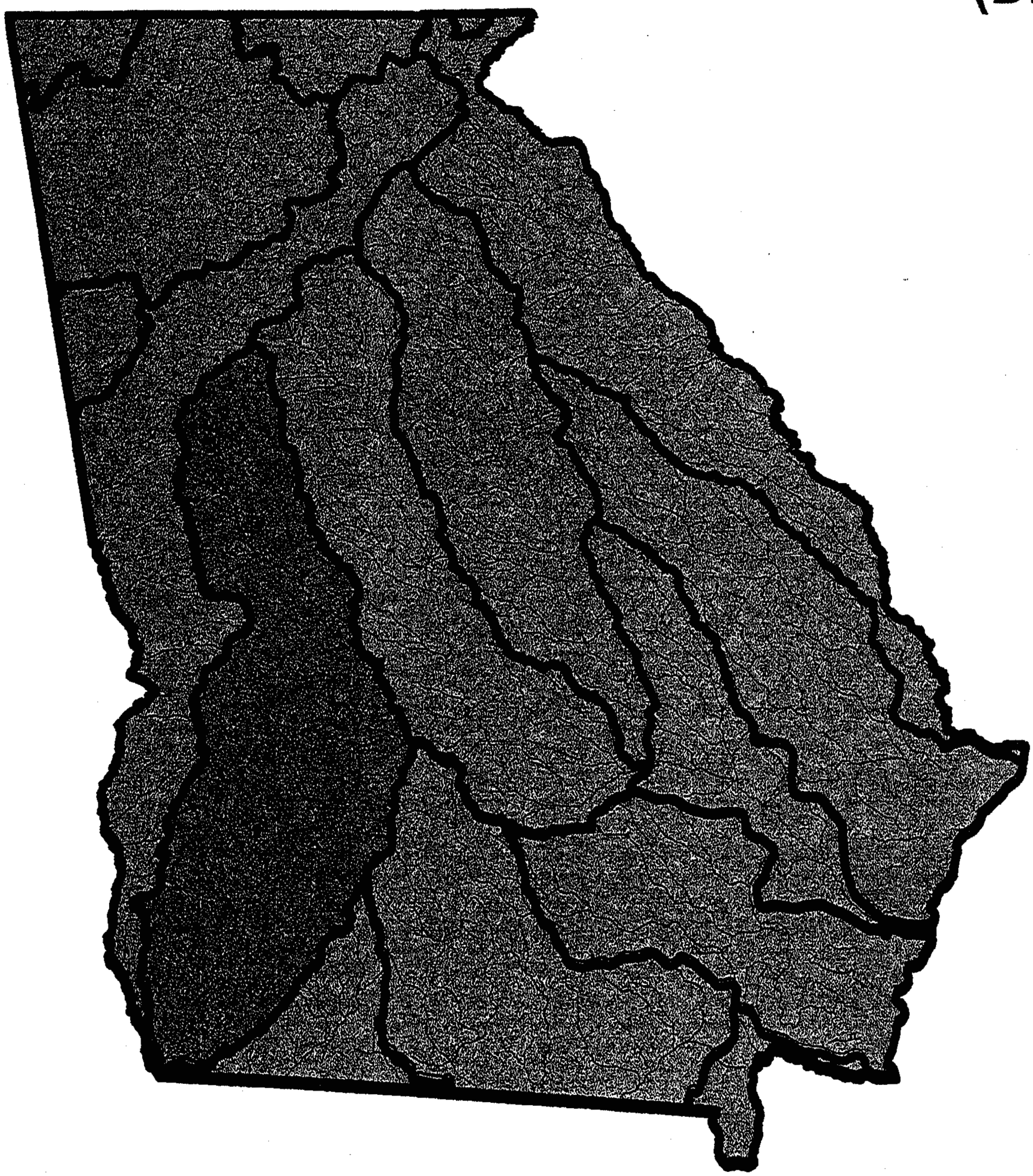
FLINT RIVER BASIN MANAGEMENT PLAN 1997 (DRAFT)



GEORGIA DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION

Flint River Basin Management Plan 1997

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

Figures

Tables

List of Acronyms and Abbreviations

Ac	acre
Ac-ft	acre-feet
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
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
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
GPC	Georgia Power Company
GPD	gallons per day
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
MOU	memorandum of understanding
MPN	most probable number (for quantification of fecal coliform bacteria)
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
NURE	National Uranium Resource Evaluation
NWI	National Wetlands Inventory (USF&WS)
Pb	lead
PCB	polychlorinated biphenyl
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)
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
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

Overview

This document is Georgia's management plan for the Flint River Basin. It has been produced as part of Georgia's new River Basin Management Planning (RBMP) approach to water quality management, begun in 1993. The purposes of this plan are to target and coordinate water quality and quantity management efforts within the Flint River Basin, and to establish a documented basis for future management efforts. This plan provides information on key river basin characteristics, describes the status of water quality and quantity in the Flint River Basin, identifies present and future water resource demands, presents and facilitates the implementation of water protection efforts, and enhances stakeholder understanding and involvement in basin planning.

Georgia's RBMP is an effort to facilitate the protection and enhancement of rivers, streams, lakes, estuaries, and ground water through comprehensive and integrated, regulatory and non-regulatory water resources management. The river basin provides a functional unit for coordinating management efforts that integrate terrestrial, aquatic, geologic, and atmospheric processes. This is the first river basin management plan produced under RBMP for the Flint River Basin. RBMP provides an iterative, cyclical approach to water resources management, and the Flint River Basin plan will be updated every five years. The plan is a draft, and will be reviewed by governmental partners, the Flint River Basin Advisory Committee, and the public. Public meetings will be held to solicit comments and recommendations regarding the river basin management plan.It is a basic premise of RBMP that river basin management is more efficient and effective when all stakeholders—government agencies, local governments, farmers, industries, landowners, environmentalists, etc.—participate in the process, and share knowledge and resources. A major purpose of this plan is to provide information to the public and encourage involvement of interested stakeholders in the management of the resources of the Flint River Basin.

Basin Description

The Flint River Basin is located in the south-western part of Georgia. The mainstem of the river flows 349 miles from metropolitan Atlanta to Lake Seminole near the Florida state line, draining an area of 8,460 square miles, and includes the cities of Albany, Bainbridge and Americus, among others. The Flint River Basin contains parts of the Piedmont and Coastal Plain physiographic provinces that extend throughout the southeastern United States.

The Flint River is largely a free-flowing system, with only two moderately-sized impoundments that form Lake Blackshear near Warwick and Lake Worth near Albany. The basin also encompasses important subsurface water resources, contained in five major underground aquifers—the Floridan, Clairborne, Clayton, Providence, and crystalline rock aquifers.

More than 600,000 people live in the Flint River Basin, but the basin remains largely rural in character. Over 50 percent of the area is forested or in wetlands, and another 40 percent is in agricultural use. Agricultural operations in the basin include poultry, dairy, beef, crop, orchard, and vegetable production. The urban areas include manufacturing and service-related employment.

Water Quantity

Water in the Flint River Basin supports many uses including municipal drinking water, industrial water supply, agricultural irrigation, recreation, hydropower production, navigation, waste assimilation, and habitat for aquatic life. Water withdrawals from surface and ground water sources have increased substantially in the last quarter century, resulting in greater demands on what are essentially finite supplies. This trend is expected to continue, with municipal and industrial demand projected to increase by approximately 30 million gallons per day (MGD) over the next 20 years, and agricultural demand by about 106 MGD for the same period. As demands increase, it may become increasingly difficult to satisfy competing uses.

Concerns about the availability of water for future needs have prompted the States of Alabama, Florida and Georgia to form an interstate compact for management of the Alabama-Coosa-Tallapoosa/ Apalachicola-Chattahoochee-Flint (ACT/ACF) basins. This agreement is expected to establish some form of commitment for Georgia to allow specified quantities of water from the Flint River Basin to pass to Florida. Such a commitment will not establish how water must be used within Georgia, but it is possible that there may be limitations on the total amounts of water that can be utilized within the Flint River Basin.

Water Quality

Water quality within the Flint River Basin is generally good, and has been improving as major point source discharges of wastewater have been placed under stringent controls during the last three decades. For instance, conditions in the Flint below Atlanta have improved dramatically since the early 1970's as more advanced treatment of municipal wastewater was required. Yet, some waters in the basin currently are only partially supporting or not supporting their designated uses, and require additional management.

Protection of water quality in Georgia is regulated by a number of federal and state laws, including the Federal Clean Water Act, and the State Water Quality Control Act. An important component of the state's water quality protection efforts is the promulgation of water quality standards, which consist of water use classifications, numeric standards for water quality parameters and chemical concentrations, and narrative requirements for water quality. Water quality standards serve as a target for water protection efforts and as a baseline for water quality assessment.

Georgia carries out monitoring and assessment of water quality to meet the requirements of state and federal laws and of the state's new RBMP approach. Monitoring includes monthly sampling for a number of parameters at over 100 stations each year, sampling of surface water and fish tissues for toxic substances, assessment of toxicity of point source effluents, monitoring of major lakes, facility compliance sampling, and assessment of fish community structure. As part of the RBMP approach, many monitoring stations are rotated to focus on different basins each year, on a five-year cycle. Every two years, the state publishes a water quality assessment report, required by section 305(b) of the Clean Water Act. Based upon monitoring results and other evidence, waters of the state are assessed as supporting, partially supporting, or not supporting of designated uses, as described in Section 5 of this river basin plan. The most recent water quality assessment report was published in 1996; the assessments of waters of the Flint River Basin are provided in Appendix E. Water quality is affected by changes to the environment (referred to as *stressors*) which adversely affect aquatic life or impair human uses of a waterbody. It may be a direct load of a pollutant, or other source of stress. Identified stressors currently affecting water quality in some segments of the Flint River Basin include nutrients, oxygen-demanding waste, pathogens, toxic substances (such as metals and pesticides), erosion and sedimentation, reduced stream flow due to water withdrawals, habitat degradation and loss, and flooding (a natural phenomenon exacerbated by loss of wetland areas and conversion of forested land to urban or agricultural uses).

Stressors come from many different sources. In the past, the major focus of management was on concentrated *point sources* of municipal and industrial wastewater discharge. But, the pollution impact on Georgia's streams has radically shifted over the last two decades. Streams are no longer dominated by untreated or partially treated sewage discharges which resulted in little or no aquatic life and threats to human health. The sewage is now treated, oxygen levels have recovered, and strong fisheries have followed. However, other sources of pollution are now affecting Georgia's streams. These sources are referred to as *nonpoint*, and consist of mud, litter, bacteria, pesticides, fertilizers, metals, oils, grease, and a variety of other pollutants which are washed from rural and urban lands by stormwater. Expected growth in population and employment in the basin will mean more potential stress from stormwater runoff and nonpoint source loading.

Priority Issues and Management Strategies

Within a few localized waterbody segments of the Flint River Basin, water quality problems are attributed to permitted point source discharges from municipal wastewater treatment plants or industries. Georgia's Environmental Protection Division (EPD) has direct regulatory authority over these discharges, and has instituted corrective actions.

The vast majority of identified water quality problems are attributed, in whole or in part, to nonpoint sources. A full list of priority issues for water quality management in the Flint River Basin is provided in Section 6, and proposed management strategies are discussed in Section 7. Among the most important and widespread issues are the following:

- Violations of water quality standards for fecal coliform bacteria, associated with both urban and rural nonpoint runoff;
- Violations of water quality standards for metals associated with nonpoint urban runoff;
- Erosion and sedimentation, variously associated with construction, agriculture, forestry, and unpaved rural roads, leading to degradation of aquatic habitat; and
- Excess loading of nutrients, derived from municipal wastewater treatment plants and urban and agricultural nonpoint sources, which can produce excess algal growth and degraded conditions in impoundments.
- Insufficient dissolved oxygen, due for the most part to inputs of oxygen-demanding waste from nonpoint sources.

Because there are so many small sources of nonpoint loading spread throughout the basin, they are not amenable to control 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 agencies, individual landowners, agricultural and forestry interests, local county and municipal governments, and Regional Development Councils. A key reason for adopting the RBMP approach is to provide the necessary forum for coordinating the activities of these many partners. Key aspects of this management approach include developing equitable management strategies which do not impose an unfair burden on any one sector, and encouraging planning for the future as population increases and land uses change.

The strategies presented in Section 7 recognize the need to develop cooperative management approaches involving all partners. Accordingly, important aspects of these strategies are the identification of key participants and roles, and documentation of an action plan, laying out what each partner will do to address a specific priority issue over the next five year cycle of the basin plan. Because this is the first basin-wide management plan for the Flint River Basin under RBMP, it is fully expected that these strategies will evolve and improve over time.

Next Steps

This plan constitutes another step in management of the water resources in the Flint River Basin, but not the final step. It is important for all to understand that there will never be a final step. Management is ongoing and dynamic because changes in resource use and condition 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.

Following a brief period for focusing on implementation of this plan, the Flint River Basin will enter into its second iteration of the basin management cycle (scheduled for April, 1999). The next cycle will provide opportunity to review issues that were not fully addressed during the first cycle and to reassess for identification of any new priority issues. Partners will not have to start from scratch during the next iteration. The information in this document provides a historical account of what is known and planned to date. Future management efforts can and should build on the foundation created by previous, ongoing, and already planned management actions, as identified within this document.

Section 1

Introduction

1.1 *Purposes and Organization of This Plan*

This document presents Georgia's river basin management plan for the Flint River, which is being produced as a part of Georgia's River Basin Management Planning (RBMP) approach (described in section 1.2 below).

A river basin management plan is intended to facilitate the coordination of water quality and quantity management efforts of public and private sector partners within the practical management unit that a river basin provides. The purposes of this plan are to provide information on key river basin characteristics, describe the status of water quality and quantity in the Flint 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 should help to achieve goals of river basin management such as providing environmental education, improving water quality, reducing pollution at the source, improving aquatic habitat, reestablishing native species of fish, restoring and protecting wildlife habitat, meeting water supply needs, providing recreational benefits, and other goals.

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 Flint River. RBMP is an iterative, cyclical approach to water resources management; under this approach, the Flint 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.

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 Management Branch and Water Protection Branch compiled the information to generate the plan. The EPD Geologic Survey Division and the United States Geologic Survery (USGS) created the majority of the figures in this report using geographic information system technologies.

This plan is in the draft stage, and is subject to review by governmental partners, the Flint River Basin Advisory Committee, and the public. Public meetings will be held to solicit comments and recommendations regarding the river basin management plan. Following this 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. Section 1.3 below provides more detailed description of the planning cycle for the Flint River Basin, including opportunities for involvement by interested agencies, organizations, citizens, and industry.

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 Flint River Basin's water resources.

1.0 Introduction: The introduction provides an explanation of the legal, programmatic, and ecological bases for a watershed protection approach in Georgia, a description of Georgia's River Basin Management Planning approach, and a presentation of the planning cycle for the Flint River Basin, including opportunities for stakeholder involvement.

2.0 River Basin Characteristics: A thorough description of the basin and its important characteristics is provided, including boundaries, climate, physiology 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: Surface and ground water availability is described, and forecasts are made for future demand. This chapter also includes sections on historic, present and possible proposed permitting activities pertaining to water availability.

4.0 Environmental Stressors: A "stressor" is defined as any physical, chemical or biological factor that may impair water or habitat quality, or result in insufficient water supply to meet the needs of Georgia's citizens. Stressors to water and habitat quality in the basin are examined in detail with a listing of point sources (NPDES permitted discharges) as well as nonpoint sources resulting from land uses and atmospheric deposition.

5.0 Assessment: An assessment of water quality and quantity in the streams, lakes, estuaries, and groundwater is provided along with an assessment of the basin's biological integrity. The data sources and analysis techniques for these assessments are discussed.

6.0 Concerns and Priority Issues: Issues of concern identified through assessment are summarized and prioritized in this section.

7.0 Implementation Strategies: Strategies for addressing issues of concern are presented in the order that they appear on the priority list 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: Due to limited resources (data, time, funding, etc.), some issues will be addressed in future iterations of each basin planning cycle. Long-range goals are discussed, to set the stage for further improvements in managing water resources and water quality.

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

1.2 Georgia's Watershed Protection Approach

1.2.1 The Beginning of RBMP

Georgia's watershed protection approach, river basin management planning (RBMP), is an effort to facilitate the protection and enhancement of its rivers, streams, lakes, estuaries, and ground water aquifers. The water resources of these natural systems support aquatic and terrestrial life, as well as man's beneficial uses including drinking water, recreation, waste assimilation, and others. Increasing growth pressures in areas of Georgia and the accompanying demands on water resources, punctuated by recent droughts and floods, have highlighted the importance of water resources.

The EPD is responsible for facilitating water resources management in the State, including water quality and water supply. Regulatory activities such as pollutant discharge permitting, water withdrawal permitting, water quality monitoring, drinking water and wastewater treatment facility compliance monitoring, and others are the responsibility of EPD. Historically, EPD has used a regulatory approach to address water resources management. Although this type of regulatory approach has been successful in managing water supply and improving the water quality of Georgia's surface waters, it will be less effective in resolving present and future water resources issues and management challenges that fall outside of EPD's authority or that require voluntary actions.

EPD initiated its first watershed planning efforts in the early 1970s in response to provisions in the Federal Water Pollution Control Act Amendments of 1972 and developed river basin plans for each major river basin in Georgia. The plans focused on water quality and pollution from inadequate wastewater treatment and strategies were developed for upgrading municipal an dindustrial wastewater treatment plants. The first edition of *Flint River Basin Water Quality Management Plan* was published in October 1974. The second edition of the plan was completed in 1978 and was updated in 1984. The information on wastewater treatment plant discharges was updated in the plan on an annual basis through 1993. In the mid-1980s attention was focused on water availability and use. EPD developed plans for each river basin and the report *Water Availability and Use — Flint River Basin* was published in 1985. The objectives of the plan were to summarize current use of water resources in the basin, to identify areas with current orprojected problems in meeting water supply needs and protect water resources. In the 1990s across the nation and in Georgia, comprehensive multi-disciplined, multi-jurisdictional, and integrated (i.e., regulatory and nonregulatory) water resources management approaches are gaining acceptance and implementation. This trend has encouraged many agencies and programs at the local, state, and federal levels to use geographic boundaries representing watersheds as the basis for coordinating and integrating water resources management. These are referred to as watershed protection approaches.

Watersheds provide a functional spatial unit for coordinating management efforts that integrate terrestrial, aquatic, geologic, and atmospheric processes. The aquatic portions of

Georgia River Basin Planning Enabling Legislation

In 1992, the Georgia General Assembly passed a law (O.C.G.A. 12-5-520, see Appendix "A") which assigned to EPD the responsibility of developing river basin management plans. The law designated the Chattahoochee, Flint, Coosa, and Oconee Rivers as the first basins to be addressed. The legislation included several requirements for river basin planning as summarized below:

- Provide for the development of river basin management plans for certain rivers;
- Provide for the contents of river basin management plans;
- Provide for the appointment and duties of local advisory committees;
- *Provide for notice and public hearings;*
- Provide for submission of plans to the Board of Natural Resources for approval;
- Provide that this Act shall not enlarge the powers of the Department of Natural Resources.

The law requires that each river basin management plan include a description of the basin or watershed, identification of local governments in each basin, land use inventories, and a description of plan goals which may include providing environmental education, improving water quality, reducing pollution at the source, improving aquatic habitat, reestablishing native species of fish, restoring and protecting wildlife habitat, and providing recreational benefits. A description of the strategies and measures necessary to accomplish the goals is also to be a part of each management plan. The law also requires a seven person local advisory committee be appointed to provide advice and council to EPD during the plan development.

In response to this law, EPD has adopted the RBMP approach to watershed protection. This approach meets, and in some ways exceeds, the requirements of the law. For example, under the scheduling provisions of the RBMP law it would take approximately 16 years to complete the plans for all fourteen river basins. The schedule proposed by EPD provides for the fourteen plans to be completed in approximately 11 years (see section 1.2.2.3 below). Also, the law does not require the river basin plans to be updated on a rotating basis as is currently planned by EPD. Finally, EPD has included water quantity issues in the planning process, which is not required by the law.

watersheds are directly affected by the surface and subsurface terrestrial environment, ground water, adjacent coastal environments, and overlying atmosphere; and are strongly influenced by hydrologic cycles and human interactions. The integrated nature of watersheds provides a framework for supporting resource management. Such an approach can enhance decisions that balance restoration and long-term protection, and promote wise management of watershed resources.

The State of Georgia adopted RBMP in late 1992 (see sidebar). Per provisions of the legislation, local advisory committees for the Chattahoochee, Flint, Coosa, and Oconee River Basins were convened in 1993, consisting of a cross section of stakeholder interests including local governments, agriculture, industry, forestry, environmental groups, and landowners. The four basin committees met together in January, 1994, in a facilitated meeting and finalized the Mission statement and 11 of the 12 Goals presented in Figure 1-1. These statements establish the guiding principles, and convey the purpose of RBMP to stakeholders and staff. The Vision is the contemplated outcome of RBMP, while the Mission statement describes the type of program

VISION: CLEAN WATER
Water Clean to drink, Clean Water to support aquatic life, and Clean Water for recreation.

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.

GOALS:

1) To meet or exceed local, state, and federal laws, rules, and regulations. And be consisten 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 floodplain management guidelines.

Figure 1-1. Georgia River Basin Management Planning Vision, Mission, and Goals

needed to make the Vision a reality. The Mission implies the nature of the program components, goals and objectives, and demonstrates commitment. The Goals describe what must be accomplished to support the Mission.

In order to develop a framework for implementing RBMP in Georgia, a workgroup was convened consisting of representatives of the Water Protection and Water Resources Branches of EPD and WRD. The U. S. Environmental Protection Agency provided funding in 1994 for a consultant with experience in basinwide planning to act as a facilitator to this framework development workgroup. The workgroup developed core components of the framework including a basin planning cycle, basin plan outline, basin groupings, planning schedules, and activity guides. The workgroup also designed the basin team concept, outlining team responsibilities and how the team complements stakeholder forums such as local advisory committees and public meetings. The RBMP framework document produced by this workgroup describes the framework in more detail and provides the guidance to coordinate and integrate EPD and other partner activities within the RBMP framework. An overview of the RBMP framework components is provided in section 1.2.2.

The twelfth goal listed in Figure 1-1 was added by EPD framework development workgroup after further review and discussion. The framework development workgroup also refined a list of objectives (Figure 1-2) that represent activities necessary to achieve the RBMP Goals. Taken

1) Provide Information on Key River Basin Characteristics

- Illustrate river basin and nested watershed boundaries.
- Describe river basin hydrology and hydrogeology.
- Describe water usage within the river basin, along with stream classifications
- Summarize important biological resources in the river basin, including threatened and endangeredspecies, sport fishing populations, and habitat.
- Describe local government jurisdictions, including key watershed protection provisions.
- Summarize land use / land cover within the river basin.
- Identify important water quality stressors, including causes and sources of impairment.

2) Assess Water Quality

- Compare existing water quality with standards and identify water quality issues related to use attainment.
- Identify other water quality issues not related to standards (i.e., biological integrity, habitat).
- Establish priorities among issues for protection, enhancement, or restoration of waters within the river basin.

3) Update Existing Water Usage and Available Supply Plans

- Identify water supply issues.

4) Identify Future Water Resource Demands

- Project point and nonpoint source pollution loadings to predict waste assimilation demands.
- Project water supply demands.
- Identify other key demands.

5) Develop and Implement Management Plans

- Establish pollutant loading allocations, as appropriate, for point and nonpoint sources.
- Identify methods and means for implementing elements of the river basin management plan, including EPD roles and responsibilities.
- Provide guidance to local governments and industries to reduce or limit nonpoint source loadings.
- Develop and implement public education programs to raise awareness of management needs and increase public involvement in river basin management plan implementation.
- Implement monitoring program using environmental indicators and program measures to track and evaluate the effectiveness of the river basin management plan.

Figure 1-2. Georgia River Basin Management Planning Objectives

To meet the stated goals and objectives for RBMP, numerous government programs will need to coordinate their efforts. Many of these programs operate under separate environmental laws. The key laws that apply to water resources management in the State are presented below. These laws represent some of the regulatory mechanisms and strategies to be used to achieve the goals of RBMP.

Federal Clean Water Act
Federal Rivers and Harbors Act
Federal Water Resources Planning Act
Federal Agriculture and Water Policy Coordination Act
Federal Watershed Protection and Flood Protection Act
Federal Flood Control Act
Federal Safe Drinking Water Act
Georgia Water Quality Control Act
Georgia Erosion and Sedimentation Control Act
Georgia Comprehensive Planning Act
Georgia Safe Drinking Water Act
Georgia Mountain and River Corridor Protection Act
Georgia Environmental Policy Act
Surface Mining Act
Ground Water Use Act
Water Well Standards Act
Metropolitan River Protection Act
River Basin Management Planning Act
Lake Water Quality Standards Act

Figure 1-3. Water Resources and Related Environmental Laws and Programs

together, these Vision, Mission, Goals, and Objectives statements represent the foundation of the RBMP framework development and implementation. Figure 1-3 lists some of the laws related to water resources management that can be coordinated to achieve RBMP Goals and Objectives.

Federal, state, and local governments and agencies play a major role in all water resource protection and enhancement programs across Georgia. Creating and supporting governmental partnerships will be another guiding principle of the river basin management planning program in Georgia. Initial efforts to foster partnerships culminated in a governmental partners meeting in January, 1995, hosted by EPD. Federal, state, and local government representatives participated in presentations of the national and Georgia watershed protection approaches and discussed ways to work together on RBMP in Georgia. It should be emphasized that the Georgia program will address both surface and ground water quality and supply issues. This comprehensive approach to water resource management and protection is a cornerstone of Georgia's program for RBMP.

1.2.2 RBMP Framework Elements

The RBMP framework consists of several elements working together to achieve the goals of the approach. These elements include the following and are discussed in further detail in the subsections below:

- River Basin Management Units
- RBMP Cycle
- River Basin Groups and Planning Schedule
- Forums for Involving Stakeholders in RBMP

1.2.2.1 River Basin Management Units

The State's major river basins will provide the geographical framework and focus for RBMP. Fourteen major river basins have been defined in the State of Georgia and are shown on Figure 1-4. These river basins are the Altamaha, Chattahoochee, Coosa, Flint, Ochlockonee, Ocmulgee, Oconee, Ogeechee, Saint Marys, Satilla, Savannah, Suwanee, Tallapoosa, and Tennessee. River basin management plans will be prepared for each of these major river basins. State regulatory programs and support activities, normally allocated statewide, will be focused in each major river basin on a rotating schedule to achieve the following objectives:

- Facilitate efficient use of limited financial and personnel resources for water resource activities.
- Provide opportunities for intergovernmental resource sharing.
- Improve spatial detail of water quality assessments resulting from increased monitoring coverage within river basins (a set of core trend monitoring sites will be maintained statewide).
- Improve basic knowledge of the watershed as well as cumulative impacts within a watershed.
- Provide a framework for centralized data management.
- Improve opportunities for management strategy implementation by increasing stakeholder involvement within the watershed.
- Provide consistent and integrated decision making for water resource issues.

1.2.2.2 RBMP Cycle

A RBMP cycle (Figure 1-5) has been developed to provide the process for the development and implementation of river basin management plans. The RBMP cycle consists of 12 steps organized into five phases designed to develop and implement RBMP over a five year period. The objectives of the individual cycle steps are described below.

1. Organize River Basin Advisory Committee. Public participation or stakeholder involvement is an important aspect of the program. The river basin management planning law requires the Director of EPD to appoint at least seven citizens and a chairman to a local

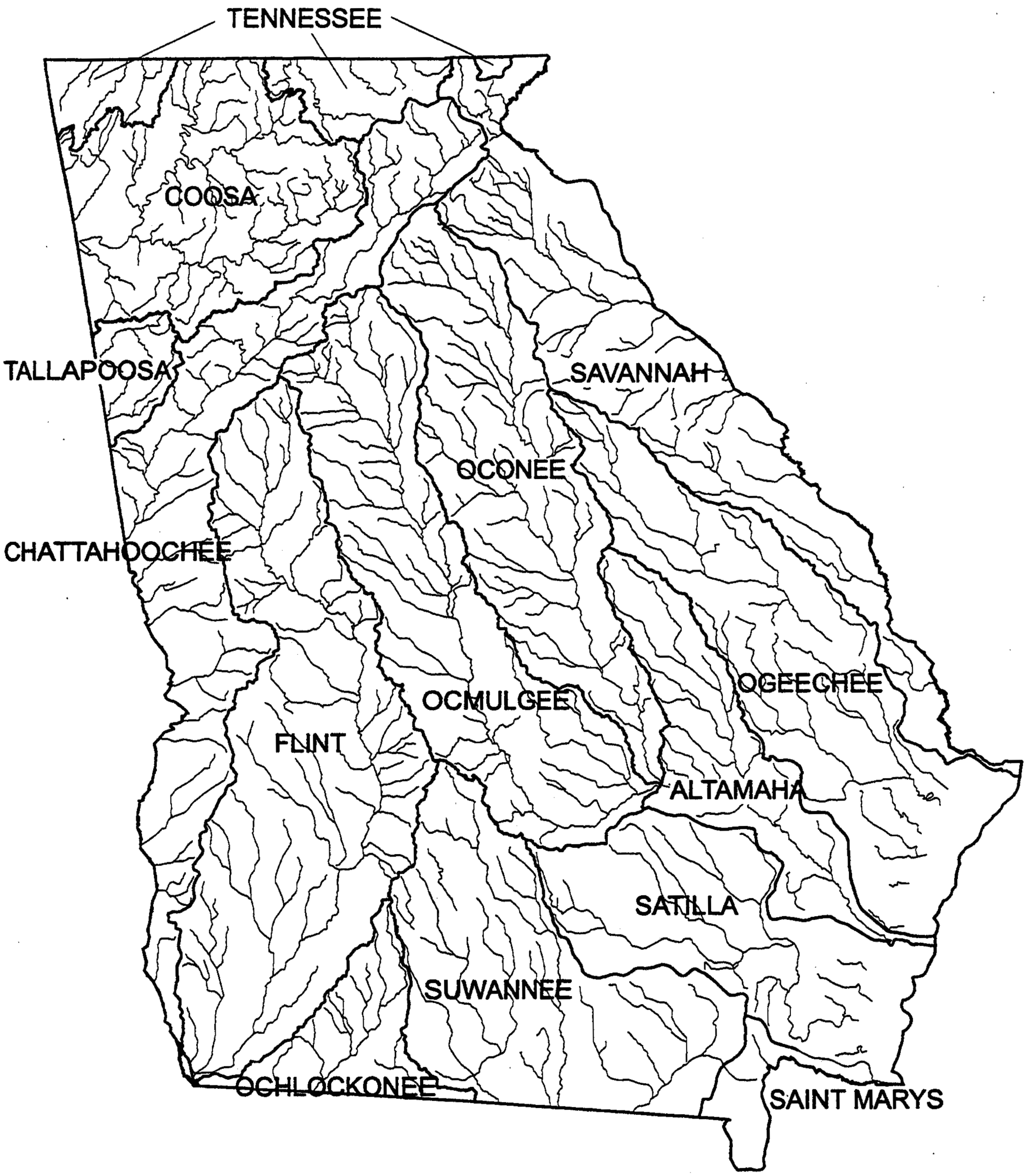

Figure 1-4. Major River Basins in the State of Georgia

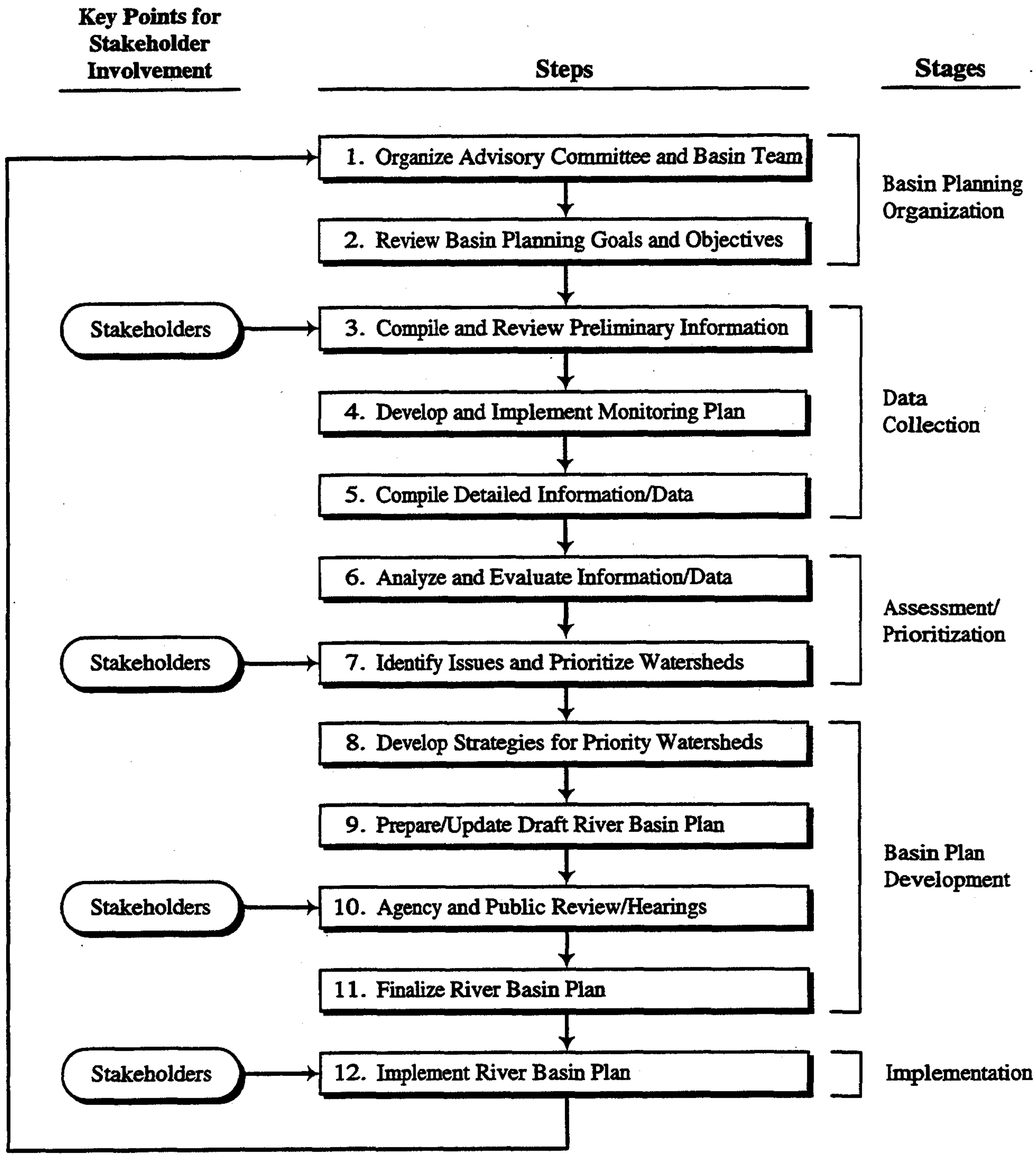

Figure 1-5. Georgia River Basin Management Planning Cycle

advisory committee to provide advice and counsel to the Director during the development of the management plans.

In addition to the local advisory committee, basin stakeholders will be encouraged to participate in developing and implementing the river basin management plan. EPD will host meetings to familiarize the stakeholders with the progress of the individual basin plans and seek input on issues and actions at important points in the planning process.

2. Review River Basin Management Goals and Objectives. The overall Mission, Goals, and Objectives for RBMP were drafted by EPD in 1993. In January, 1994, EPD hosted a combined meeting of the local advisory committees for the Chattahoochee, Flint, Coosa, and Oconee River basins for the purpose of reviewing and reaching consensus on the Mission, Goals, and Objectives. These goals and objectives will be reviewed in the initial steps of each basin planning cycle and goals and objectives specific to the individual basin may be added.

* *Stakeholder Involvement* will be encouraged at this point in the cycle to introduce RBMP and receive information and comments from all interested stakeholders, and to solicit input on water resource and monitoring issues in the river basin. The major objective of this initial stakeholder meeting is to encourage early involvement in the RBMP process.

3. Compile and Review Preliminary Information/Data. Readily available information and data will be compiled and analyzed to begin characterizing each river basin. This initial information and data review will help identify deficiencies in the available information, and provide input to the strategic monitoring plan and future RBMP activities.

4. Develop and Implement Monitoring Plan. A strategic monitoring plan will be implemented to collect data to characterize basin water quality and quality, and monitor the effectiveness of river basin management actions or implementation strategies. The monitoring plan will be developed based on watershed units, review of preliminary information/data, and stakeholder recommendations. The plan will describe the objectives and strategy including specific station locations, water quality parameters, and sampling frequency.

Some water resource issues may require detailed assessments to evaluate the magnitude and define causal relationships. Such detailed assessments or intensive surveys, may include water availability and use studies, assimilative capacity studies, Total Maximum Daily Load (TMDL) evaluations, or use attainment studies.

5. Compile Detailed Information/Data. Existing information and data of varying types will be available for each basin. EPD will use its information resources and databases, and request information from other agencies, organizations, and stakeholders where appropriate. Information and data will be sought for basin characterization (e.g., land use, hydrology, water availability, population and demographics, water supply demand, economics, water quality, resource management). Information and data collected for each river basin may be entered into databases and GIS coverages to facilitate its long-term management.

6. Analyze and Evaluate Information/Data. Analysis of basin wide monitoring data and stakeholder information will focus on issue identification and resource management strategies. Information and data limitations will be identified so that initial findings can be appropriately qualified. Some assessment and quantification of water availability and use requirements, loading estimates, and assimilative capacity may be performed to develop causal relationships.

7. Identify and Prioritize Issues. Water resource issues identified during the initial stakeholder involvement and those identified during the monitoring, information/data collection, and analysis will be prioritized according to need for additional action. Some priority issues identified during the RBMP process may require additional study to facilitate decision making. A variety of assessment tools including Clean Water Act Sections 305(b) and 303(d)-related procedures will be used to identify priorities.

* *Stakeholder Involvement* will be encouraged at this point in the RBMP cycle to receive input on the water resource issues and priorities.

8. Develop Strategies For Priority Issues. EPD will propose strategies to address the issues identified in the river basin. Potential strategies include water supply alternatives, point source and nonpoint source controls, best management practices, stormwater management, erosion and sediment control, and habitat restoration. Where applicable, strategies will be evaluated for their effectiveness in achieving water resource goals using predictive modeling or other methods. Regulatory constraints and procedures will be considered and stakeholder cooperation will be encouraged where voluntary efforts are needed to meet water supply and water quality goals.

9. Prepare/Update Draft River Basin Plan. EPD will prepare a draft river basin management plan documenting the results of the planning process including a comprehensive basin characterization including information on data collected, analyses results and the methods used, issue identification and prioritization, water resource management goals, and management and implementation strategies. For successive river basin management plans, the existing plan will be updated to reflect plan progress and changing conditions in the river basin.

10. Agency and Public Review/Meetings. The draft river basin management plan will be distributed to the local advisory committee, the governmental partners, and made accessible to interested stakeholders. Stakeholder meetings will be conducted to explain the content of the river basin management plan and to solicit stakeholder comments and recommendations to the plan.

* *Stakeholder Involvement* will be encouraged at this point in the RBMP process to obtain comments and recommendations on the plan.

11. Finalize River Basin Plan. Appropriate modifications will be made to the draft river basin management plan based on the comments and recommendations received during the review process. The final plan will be reviewed and adopted by the Board of the Georgia Department of Natural Resources.

12. Implement River Basin Management Plan. The RBMP cycle concludes by initiating implementation of management strategies. Potential activities during this period will include National Pollutant Discharge Elimination System (NPDES) point source and stormwater permitting activities, surface water and groundwater withdrawal permitting, nonpoint source best management practices implementation, voluntary self-monitoring programs, adopt-a-stream programs, habitat protection or enhancement, compliance monitoring, and enforcement actions. EPD will consider implementation strategies that are both within its regulatory capacity, and those that will be voluntary.

* *Stakeholder Involvement* will be encouraged to support and implement the river basin management plan strategies. Some management strategies may be voluntary and their successful implementation can only be achieved by the appropriate stakeholders.

1.2.2.3 *River Basin Groups and Planning Schedule*

The major river basins previously described have been organized into five groups for RBMP. Grouping was necessary to accomplish the following:

- Complete river basin management plans for each major river basin in a timely manner.
- Repeat RBMP activities in each basin every five years.
- Coordinate NPDES permitting (including wasteload allocations) which has a five year renewal period.

The five river basin groups are shown in Figure 1-6 and are: Chattahoochee-Flint, Coosa-Tallapoosa-Tennessee, Oconee-Ocmulgee-Altamaha, Savannah-Ogeechee, and Suwanee-Satilla - Ochlockonee-Saint Marys. These river basin groups were determined based on river basin location, contributing drainage, physiographic features, and related water resource issues. The basin groups are critical to the scheduling of RBMP efforts.

A schedule (Figure 1-7) has been developed to complete plans for each major river basin and to establish a long-term basin planning process involving detailed reassessments of each river basin on a five year rotating basis. For instance, the initial Chattahoochee and Flint River Basin plans will be completed in 1997. These basins will be reassessed beginning in 1999 with the process culminating in updated plans in the year 2003. Similarly, plan implementation for each river basin will be based on a rotating schedule. This approach will provide needed long-term perspectives and a defined schedule. This is a key issue, since the long-term, defined schedule offers the opportunity for many governmental agencies and stakeholders to plan partnerships and participation in the planning and implementation processes.

The initial scheduling process was influenced by several issues. First, the State law requires plans for the Coosa and Oconee River basins, which are in different basin groups (as previously defined), be the second set of plans to be started. Second, there is a significant opportunity to coordinate Georgia's RBMP work with the ongoing Tri-State (Alabama, Florida, Georgia)/U. S. Army Corps of Engineers (USACE) Comprehensive Study of the Alabama-Coosa-Tallapoosa and Appalachicola - Chattahoochee - Flint (ACT-ACF) basins which involves the Chattahoochee, Flint, Coosa, and Tallapoosa River basins. Thus, the Tallapoosa River basin plan is scheduled with the Coosa and Oconee River basin plans. However, program resources are not adequate to develop plans for the Tennessee, Ocmulgee, and Altamaha River basins at the same time. Third, an additional objective is to coordinate planning work with South Carolina on the Savannah River basin. In addition, the USACE, in coordination with other Federal agencies, is proposing a Comprehensive Study of the Savannah River basin which would commence in 1997. Thus, the schedule places the Savannah and Ogeechee River basins in the rotation beginning in 1996. Scheduling Georgia's RBMP to coincide with these other basin initiatives provides opportunities for resource, data, and information sharing.

As shown in the schedule, the program will converge into a long term rotating schedule. The schedule also shows that in a few years RBMP will be ongoing in all the major river basins in Georgia.

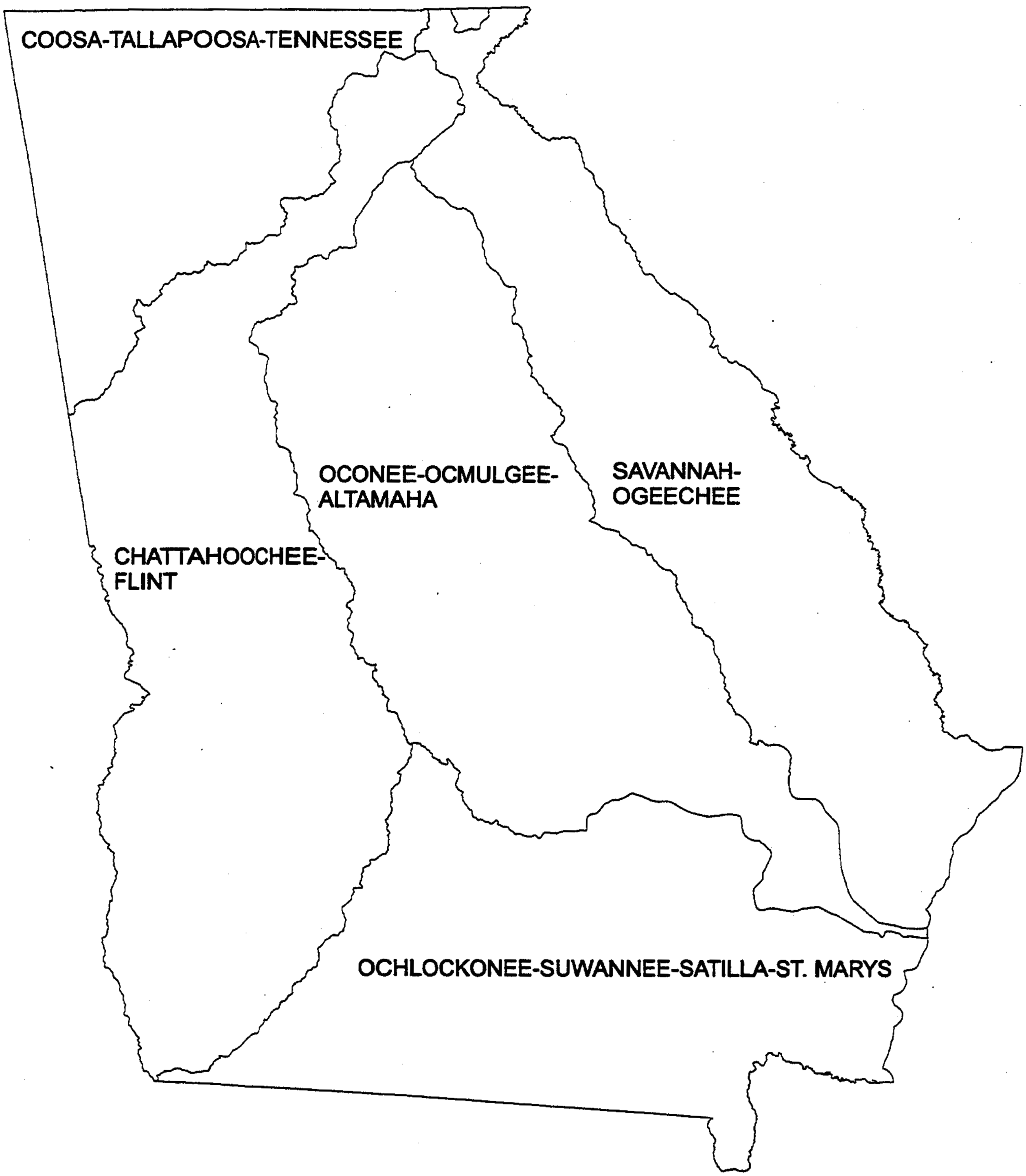

Figure 1-6. Major River Basin Groups for River Basin Management Planning in Georgia

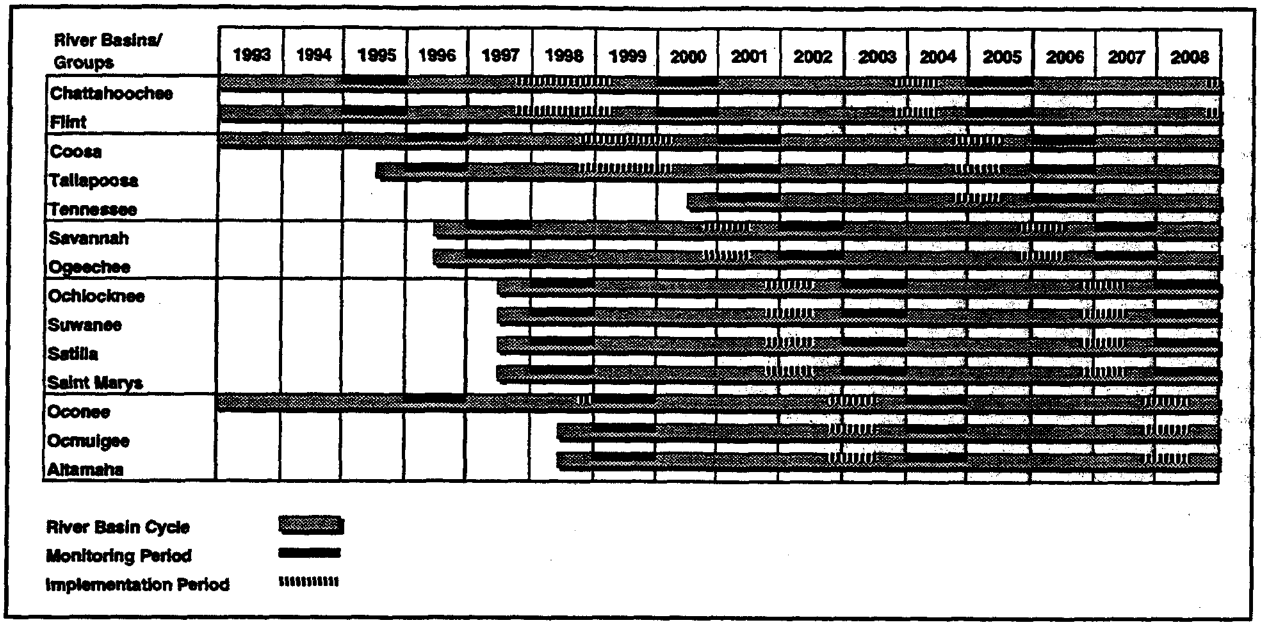

Figure 1-7. Georgia River Basin Management Planning Schedule

1.2.2.4 Forums for Involving Stakeholders in RBMP

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 utilization of resources and expertise, create better and more cost-effective management strategies, and be responsive to stakeholder perceptions and needs. Figure 1-8 shows the interactions between various stakeholder bodies in the RBMP process. The following paragraphs discuss the opportunities for stakeholder involvement in river basin management planning.

A basin team will be assigned to each major river basin group (during step 1 of the basin cycle) and represents a core group of agencies and staff responsible for developing river basin management plans and implementing other components of RBMP. The Basin Team is directly responsible for carrying out the 12 steps of the basin planning cycle. Activities of the team are coordinated and facilitated by the two basin coordinator staff positions within EPD. Members of the basin team are selected from EPD programs and branches, Wildlife Resources Division and other interested governmental partners (e.g., Georgia Soil and Water Conservation Commission, USDA Natural Resources Conservation Service, Georgia Forestry Commission, etc.). Emphasis is placed on technical knowledge, available resources, and potential implementation responsibilities. There is an opportunity for non-agency groups, such as Regional Development Centers, to become a part of basin teams. Other groups and agencies may act as partners in the RBMP process, contributing resources and expertise, while not being directly involved in Basin Team activities.

River Basin Advisory Committees, providing advice and counsel to EPD during river basin management plan development, represent a forum for involving local stakeholders. These local advisory committees form a link between EPD and the regulated community and local watershed interests. The committees consist of at least seven people representing a variety of stakeholder interests including local governments, agriculture, industry, forestry, environmental groups, land-owners, and citizens. The committees are appointed at the

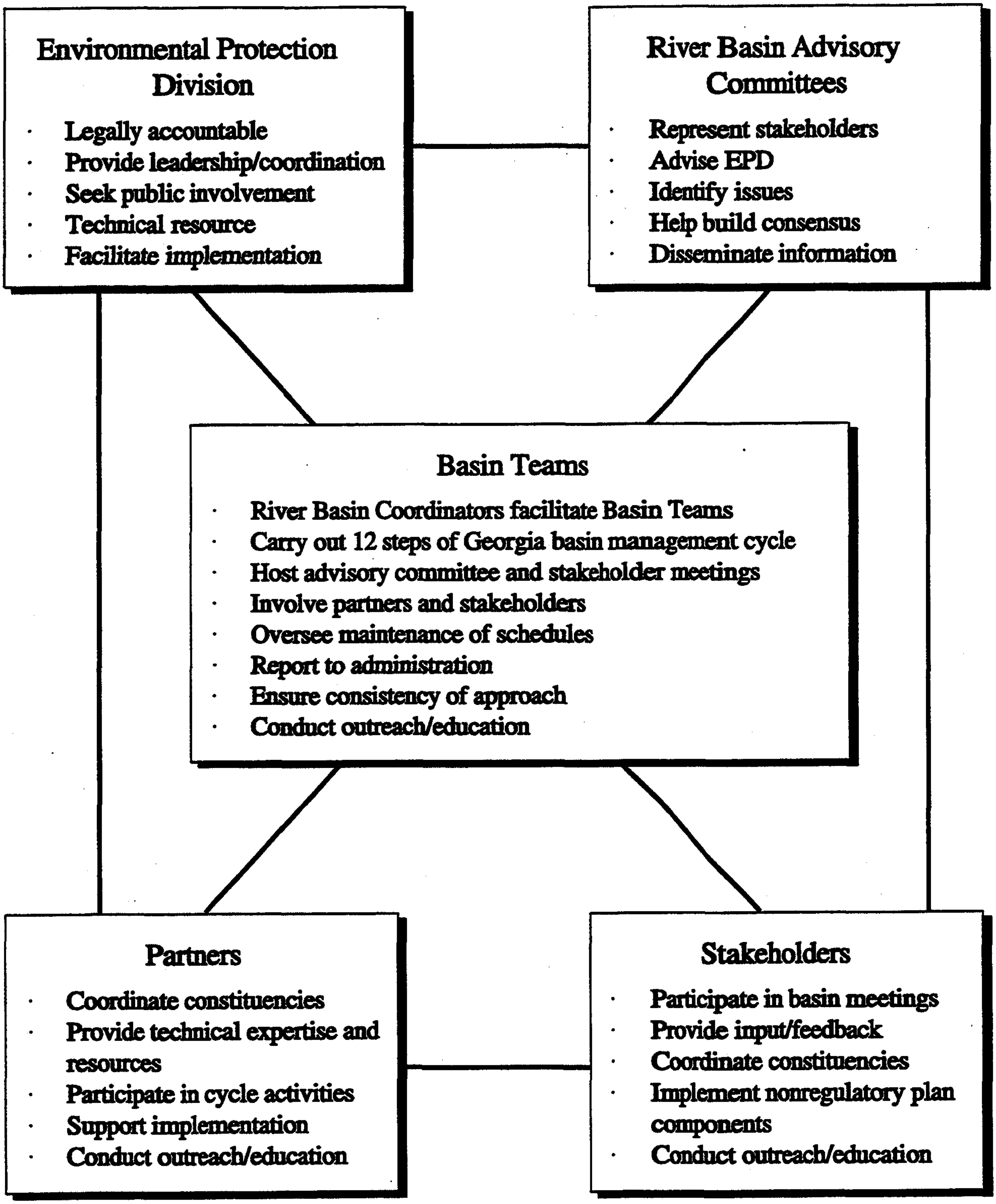

Figure 1-8. Stakeholder Relationships

beginning (step 1) of each river basin planning cycle, meet periodically during the planning cycle, and provide advice and counsel 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.

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.

Finally, 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.

1.2.3 Key Benefits of RBMP

RBMP is designed to coordinate aquatic ecosystem management 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 will provide opportunities for stakeholders in the State's river basins to participate in the development of river basin management plans. These plans will benefit from the collective experience and combined resources of a variety of stakeholders. By adopting a watershed protection approach, Georgia will be changing the focus of its water resources management activities.

RBMP is not a new regulatory program, but rather a framework for improving the coordination and operation of existing regulatory and non regulatory programs for increased environmental benefit and more efficient use of water resources. This is being achieved through organizational changes as well as changes in the focus of staff activities. For example, the Water Protection Branch of EPD is modifying the implementation of its regulatory and non-regulatory activities according to RBMP. There will be a changing focus of staff activities from strictly site-based approaches (i.e., individual discharger, water body) and program-based approaches (i.e. permits, inspections), to more holistic and integrated approaches. RBMP will help to focus the activities of existing regulatory and non-regulatory programs on recognized priority issues within a river basin.

The RBMP program has several features that represent either improvements in the implementation of existing regulatory and non-regulatory programs or new methods for accomplishing water resources management goals. These include:

- *Focus on Watersheds*: A key feature of RBMP is the focus on watersheds to improve the efficiency of State water resources programs by consolidating activities such as monitoring programs, modeling studies, permit public notices, and public meetings within a river basin. Focusing on watersheds will encourage agencies to seek information on all significant issues, and recognize connections in their management roles and responsibilities.

- *Stakeholder Involvement*: RBMP will provide a framework for linking local, state, and federal water resources management efforts throughout the State. RBMP focuses on a watershed, goals, and approaches for the watershed. Successful management therefore depends on the participation of those involved in or affected by such management decisions. The RBMP approach uses cooperative forums (i.e., basin teams, local advisory committees, public meetings) to involve stakeholders, promoting awareness of water related issues and encouraging stakeholders to respond.

- *Environmental Objectives*: RBMP focuses on achieving environmental objectives such as water quality standards and ecological goals. Management success will be evaluated by the progress made toward protecting or restoring specific waters from threats to human health and aquatic life, rather than program activities such as the number of permits issued or samples collected. In other words, RBMP is resource-based rather than program-based.

- *Priority Issues*: RBMP places monitoring and assessment at the forefront of the management process to better identify priority issues within watershed. Geographic targeting methods will be used to provide an objective and rational approach to prioritizing issues and watersheds, as well as targeting resources cost-effectively to address priority issues.

- *Integrated Solutions*: RBMP provides the framework for the expertise and resources of multiple stakeholders to be combined and applied more effectively. RBMP leverages personnel and financial resources to achieve watershed management goals and objectives by connecting basin activities.

- *Resource Protection Options*: RBMP is comprehensive in considering the interacting sources of environmental stressors within a given watershed. Increasing the diversity of stakeholders involved in RBMP will increase the resources and management capabilities to address priority issues within a river basin.

- *Improved Decision Making*: RBMP improves decision making in a variety of ways. First, it improves the scientific basis for management decision-making through multi-disciplinary assessment of a broader base of scientific information. This capability will be enhanced as the use of improved technologies, including geographic information systems (GIS) and database management, become more prevalent. Second, focusing on watersheds will encourage agencies to seek information on all significant stressors. Combining the experience, resources, and data of multiple stakeholders will increase the amount and types of information and data available for the assessment and prioritization of issues and resource management decisions.

- *Continuity and Consistency*: RBMP helps to reduce the tendency of regulatory programs to operate in a reactive or crisis mode by focusing on the watershed goals to be achieved during basin planning cycles. RBMP's iterative structure provides for updating priorities and management strategies. Successive updates of management plans can build on preceding efforts, adding continuity to watershed management. Such continuity provides stakeholders with a stronger foundation for long-term planning, and greater incentive to get involved. Improved consistency is possible because pollution sources across a river basin are evaluated simultaneously and management actions are subject to broad scrutiny during the planning process. Finally, implementation of comprehensive management strategies throughout a river basin promotes consistency.

1.2.4 Making the Transition to RBMP

RBMP is being phased into the activities of EPD to allow time for the approach to mature. During the transition period in moving from a program-based to resource-based approach, technical and administrative procedures will be developed and refined as the coordinating framework becomes established. New information management needs and solutions will be encountered, and not all of the features of RBMP described in the framework document will be implemented immediately. Synchronizing activities within basin management cycles will be dependent on the evolution of administrative procedures that define operation under RBMP.

A great deal of time and effort will be needed to develop the RBMP infrastructure to support initial development of river basin management plans. As a result, initial plans may not be as detailed, and are unlikely to address every issue in all basins. Resource constraints will exist; however, the RBMP schedule will be maintained with the understanding that priorities not addressed in one cycle can be considered in the next cycle. The cyclic nature of RBMP is based on the premise that basin management is a dynamic process and management plans will evolve over time providing for updated assessments, priorities, management plans, and implementation strategies every five years.

1.3 Flint Basin Planning Schedule and Opportunities for Stakeholder Involvement

1.3.1 RBMP Activities

Figures 1-9 and 1-10 show the Flint River Basin management planning schedule of activities for the first two cycles: i.e., 1993-1999 and 1999-2004. The Flint basin was one of the first four basins (along with the Chattahoochee, Oconee, and Coosa basins) to begin the RBMP cycle in 1993. As discussed in section 1.2.2.3, initial scheduling complications and the need to devote resources to development of RBMP infrastructure have caused the first basin cycle to be somewhat condensed. In the Flint basin, this has meant that there was not as much time available in the first cycle (1994-1999) to prioritize watersheds and develop management strategies (steps 7 and 8) as there will be once the program converges into a long-term rotating cycle (after 1999). Also, the implementation stage of the first cycle (step 12 in Figure 1-9) is prolonged in order to bring the basin cycle into phase with the long-term rotating cycle, which has the Flint basin planning cycle beginning in April of 1999 (and every five years thereafter).

This prolonged implementation phase provides an opportunity for the Flint River Basin team and local advisory committee to conduct further outreach activities in order to educate stakeholders about the changes and new opportunities under RBMP. Also, the local advisory committee may wish to use this time to involve stakeholders in a discussion of possible water resources management strategies and the development of infrastructure to support these strategies. For example, this might be a good time to organize small local stakeholder forums that will support the implementation of management strategies (like BMPs) in the next RBMP iteration. EPD considers stakeholder involvement as a continuous process, not limited to scheduled meetings, and encourages stakeholders to provide input and assistance at any time.

It is a basic premise of RBMP that river basin management is more efficient and effective when stakeholders—government agencies, local governments, farmers, industries, landowners, environmentalists, etc.—participate in the process, and share knowledge and resources. One purpose of this river basin management plan is to encourage involvement of interested

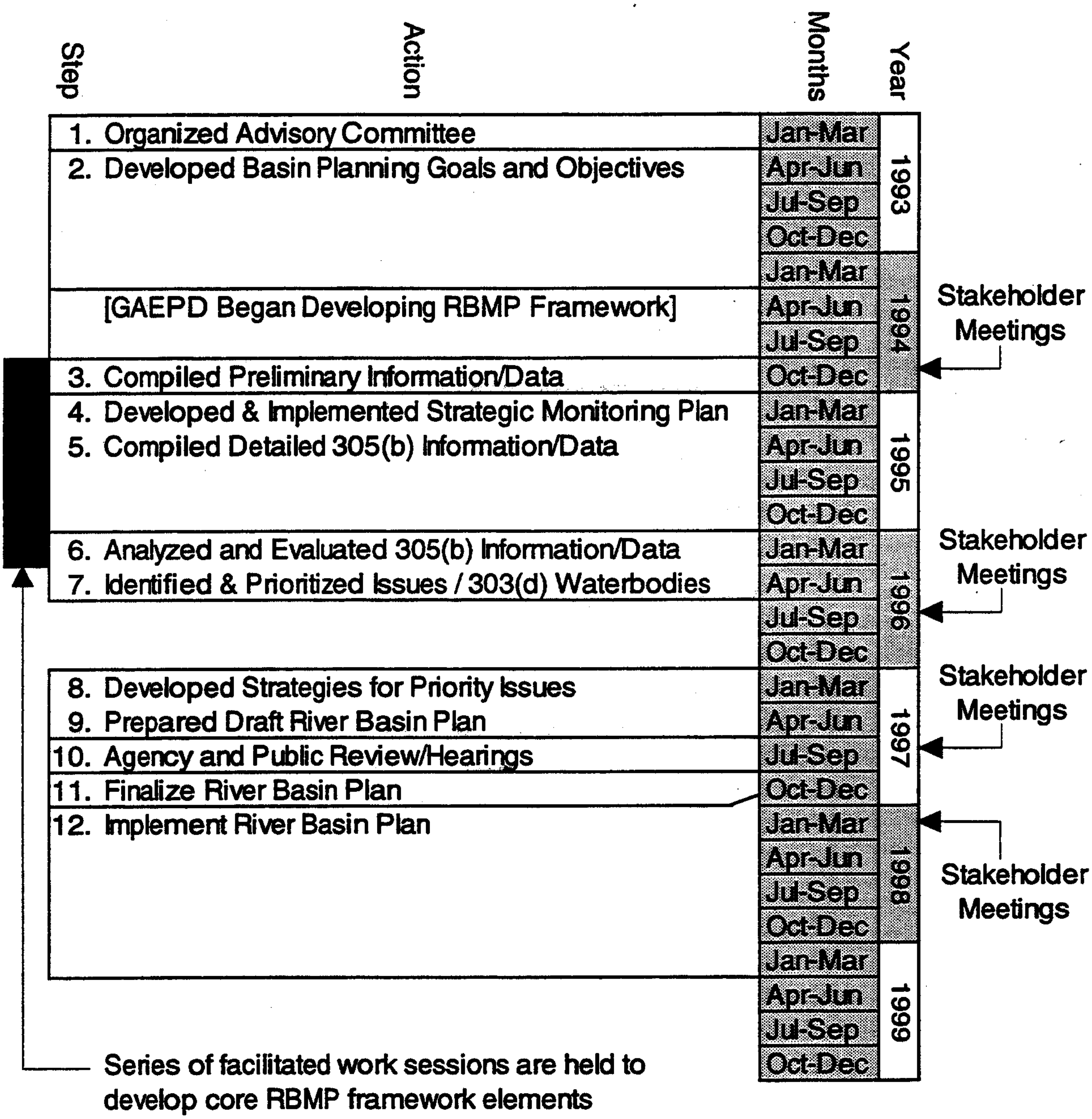

Figure 1-9. Flint River Basin Schedule, 1993-1999

stakeholders in the RBMP process. The following paragraphs describe ways in which individuals, organizations, or governmental bodies may become more involved in future river basin planning for the Flint Basin.

As shown in Figure 1-5, every basin planning cycle begins with the organization of the basin team. Figure 1-10 shows that the Flint River Basin team will be re-organizing itself in April to June of 1999. This is an opportunity to review basin team membership and recruit any new members that can contribute significant resources and expertise to the planning process.

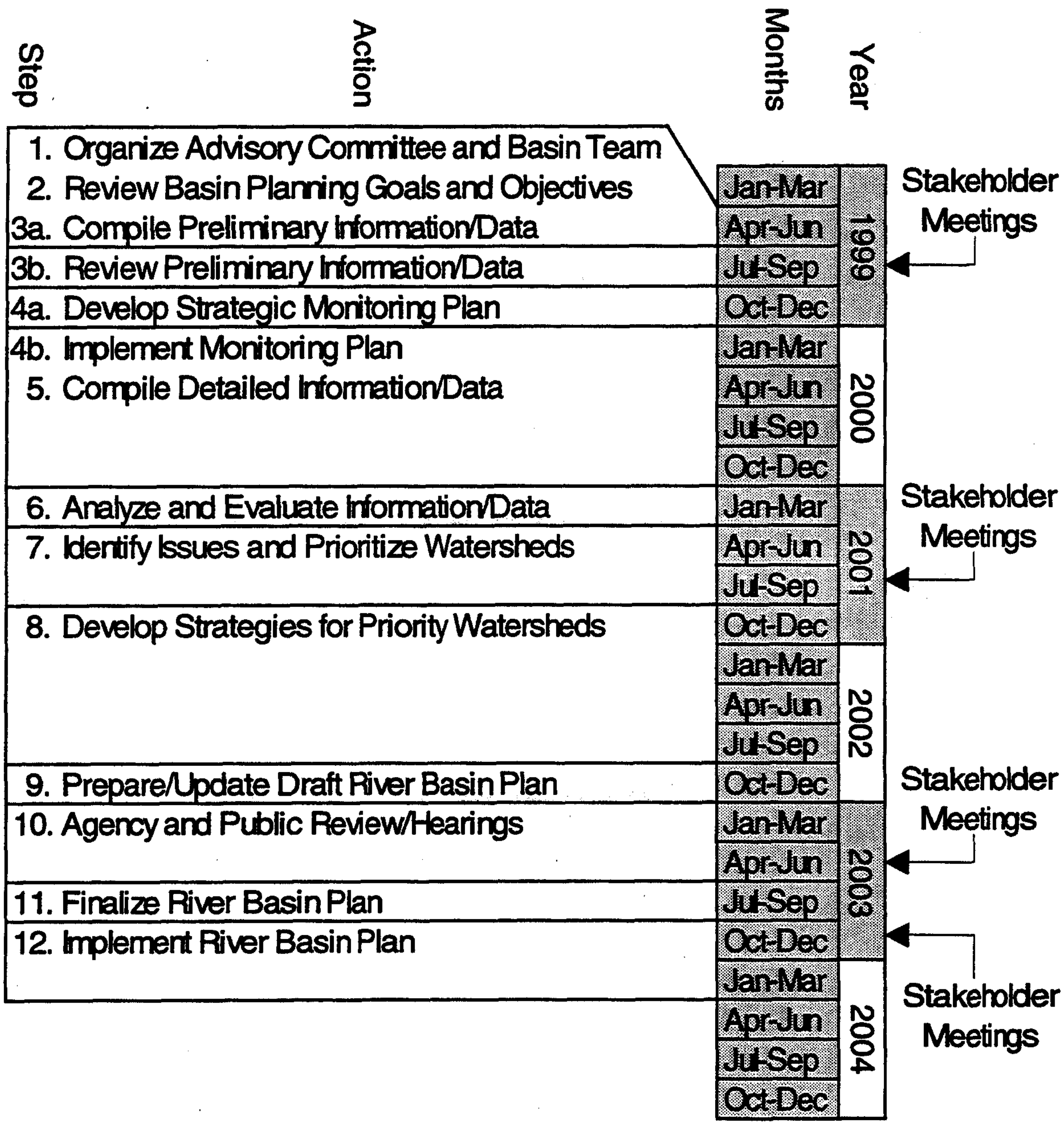

Figure 1-10. Flint River Basin Planning Schedule, 1999-2004

The local advisory committee will also be re-organized during this same time period; if it is perceived that certain stakeholder interests have not been well-represented, this is an opportunity to adjust the membership of the committee. The current members of the Flint River Basin Advisory Committee, and the stakeholder interests they represent, are listed in Figure 1-11.

Figures 1-9 and 1-10 show the timing of stakeholder meetings that have been and will be held as part of the Flint basin RBMP cycles. The specific purposes of each stakeholder meeting are described above in section 1.2.3.2, and indicated in Figure 1-5. The first two groups of stakeholder meetings have already been held for the current planning cycle. EPD hosted initial

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Figure 1-11. Flint River Basin Local Advisory Committee Members

stakeholder meetings in Griffin and Albany in late 1994 to invite and encourage stakeholder input early in the planning process for the Flint River Basin. Second stakeholder meetings were held in Griffin and Albany in 1996 to discuss water quality assessment results, problem areas, and prioritization of actions to address problem areas. A third group of stakeholder meetings—to give stakeholders the opportunity to review this river basin management plan—is planned for the fall of 1997. A fourth group of meetings in 1998 will give stakeholders a chance to discuss implementation of management strategies. The next group of stakeholder meetings will be held in mid to late 1999, providing stakeholders an opportunity to be involved in the planning for the next cycle of focused water quality monitoring in the Flint basin. The dates of ensuing stakeholder meetings are indicated in Figure 1-10.

1.3.2 ACF Comprehensive Study

In 1990 the State of Alabama, concerned about the availability of water for its future needs, filed suit in U.S. District Court to prevent the Corps of Engineers from reallocating water from Lakes Lanier, Carters, and Allatoona to increase the water supply for metropolitan Atlanta; Florida later joined this suit. Under a letter of agreement signed by the three states and the Corps, the ACT/ACF (Alabama- Coosa-Tallapoosa/ Apalachicola-Chattahoochee-Flint) Comprehensive Study was initiated in 1991. During the spring of 1997 the three state legislatures approved separate Interstate Compacts which establish the legal and functional basis for future management of the ACT and ACF basins. Congress will consider these compacts later this year.

Although neither Compact contains a specific allocation of water for the states, this will be the first consideration of the Commissions when they are established. In fact, there is a provision in the compacts which requires that allocations be developed before the end of 1998. Obviously the allocation for the ACF Basin will have a potentially significant effect on water resource planning in the Chattahoochee and Flint basins in Georgia. It is expected that the allocation will establish some form of a commitment for Georgia to allow certain quantities of water to pass downstream for use by Alabama and Florida. Such a commitment will not establish how the water must be used within Georgia; those decisions will remain the prerogative of Georgia's governments and citizens. However, it is possible that there may be limitations on quantities of water which will be available for various uses in the Flint Basin. Although this potential constraint is recognized, this initial Flint River Basin Plan can not consider any specific water allocation limitation. Frequent reference is made to the ACT/ACF Study throughout this Plan where data, Study results, or potential Compact constraints may apply.

Section 2
River Basin Characteristics

Effective management of the Flint River Basin starts with an understanding of the salient features of this geographic management unit. These provide the context, constraints, and opportunities for management actions. Important aspects include:

- *River basin characteristics* (Section 2.1): the physical features and natural processes of the basin, which determine how waters within the basin respond to conditions;
- *Population and land use* (Section 2.2): the sociological features of the basin, including the types of human activities which may impact water quality;
- *Local governments and jurisdictions* (Section 2.3): identification of the local authorities whose decisions may influence man's impact on water quality;
- *Water use classifications* (Section 2.4): the expression in the state regulatory framework of best uses and baseline goals for management of waters within the basin.

2.1 River Basin Description

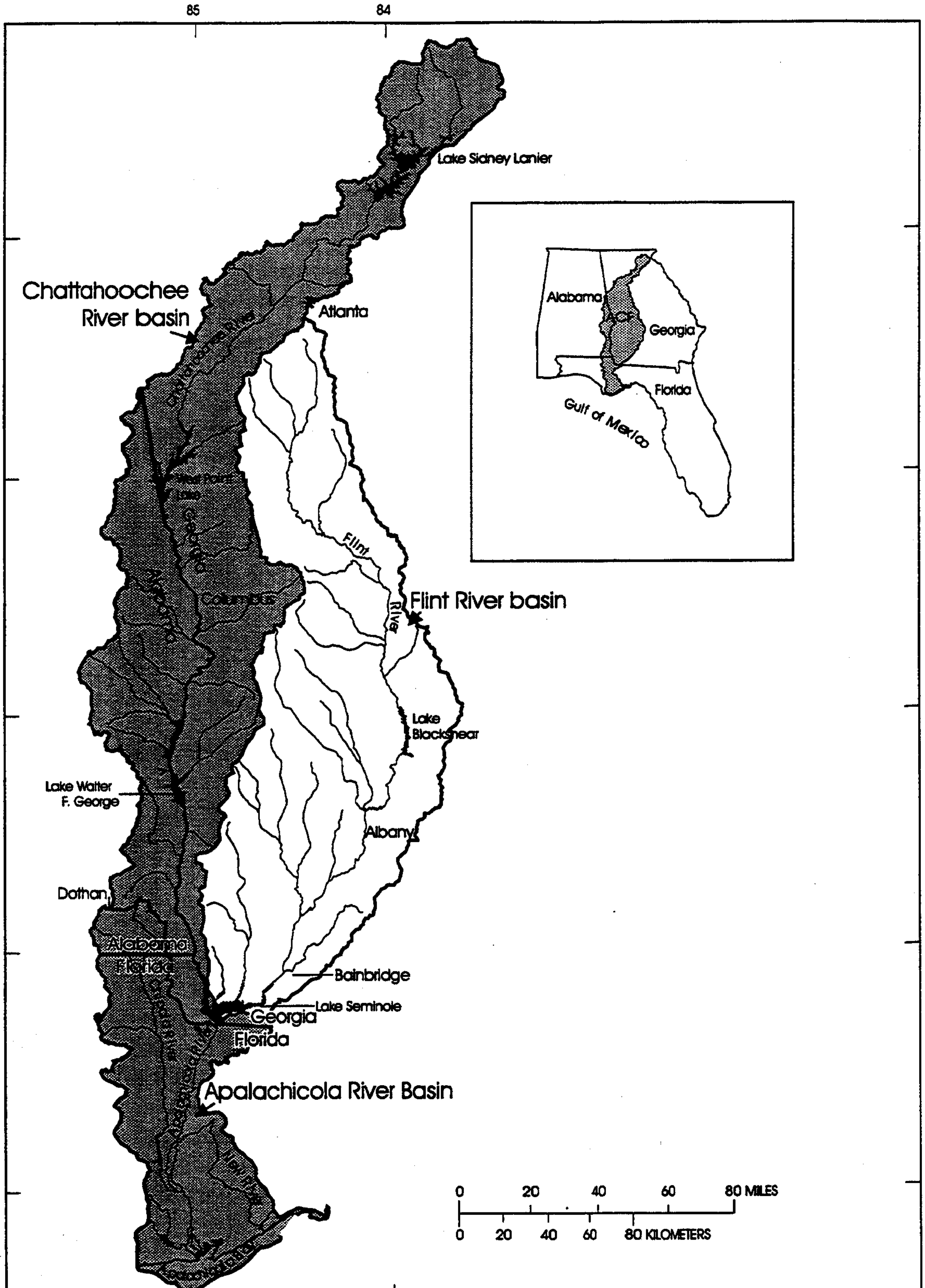
This section describes the important geographical, geological, hydrological, and biological characteristics of the Flint River Basin. It is largely adapted from Couch *et al.* (1996). Additional material is drawn from EPD (1996), and other sources.

The physical characteristics of the Flint River Basin includes its location, physiography and geology, geochemistry, soils, climate, surface water and groundwater resources, and natural water quality. These physical factors provide the natural template that influences the basin's biological habitats and diversity, and the way in which people use the basin's land and water resources.

2.1.1 River Basin Boundaries

The Flint River Basin is located in the western third of the state and extends from Atlanta to the Florida state line (Figure 2-1). The basin is long and narrow. The length of the main stem of the Flint River is 349 river miles and drains an area of 8,460 square miles (mi^2). The Flint River, which is contained entirely within the state of Georgia, originates from the southern edge of the Atlanta Metropolitan Area, in Clayton County, and flows southerly in a wide eastward arc to Decatur County in southwestern Georgia, where it flows into Lake Seminole near the Florida line. Lake Seminole is formed by a dam placed below the confluence of the Flint and Chattahoochee Rivers. The outflow from Lake Seminole forms the Appalichicola River in Florida, which ultimately discharges to the Gulf of Mexico at Apalichicola Bay.

The USGS has divided the Flint basin into six subbasins, or Hydrologic Unit Codes (HUCs) (see Table 2-1). These HUCs are referred to throughout this report to distinguish conditions in different sub-parts of the basin. Figure 2-2 shows the location of these subbasins and the counties within each subbasin. For discussion purposes these subbasins are grouped into three



Base modified from U.S. Geological Survey digital files

Figure 2-1. Location of the Flint River Basin within the Apalachicola-Chattahoochee-Flint River Basin (modified from Couch et al., 1996)

Table 2-1. Hydrologic Unit Codes (HUCs) of the Flint River Basin

HUC	Associated Areas
03130005	Upper Flint, extending from the headwaters in southeastern Atlanta to the confluence of Whitewater Creek in Macon County.
03130006	Middle Flint, Whitewater Creek to Flint River Dam in Dougherty County.
03130007	Middle Flint, Headwaters of Muckalee and Kinchafoonee Creeks to Lake Worth Dam.
03130008	Lower Flint, Flint River Dam to the Jim Woodruff Dam.
03130009	Lower Flint, Headwaters of Ichawaynochaway Creek to the confluence of the Flint River.
03130010	Lower Flint, Headwaters of Spring Creek at Fish Pond Drain to the confluence of Lake Seminole.

major categories based on their similarities in geography, land use patterns, and pollutants of concern—the Upper Flint, Middle Flint, and the Lower Flint.

2.1.2 Climate

The Flint River Basin is characterized by a warm and humid, temperate climate. Major factors influencing climate variability in the basin are latitude, altitude, and proximity to the Gulf of Mexico.

Average annual temperature ranges from about 60 °F in the north to 70 °F in the south. Average daily temperatures in the basin for the month of January range from about 40 °F to 50 °F, and for July from 75 °F to 80 °F. In the winter, cold winds from the northwest cause the minimum temperature to dip below freezing for only short periods. Summer temperatures commonly range from the 70s to the 90s.

Precipitation is greatest at the north end of the basin, and at the south end near the Gulf of Mexico as a result of the availability of moist air. Average annual precipitation in the basin, primarily as rainfall, is about 50 inches (in.), but ranges from a low of 45 in. in the east-central part of the basin to a high of 55 in. in the southern region of the basin (U.S. Geological Survey, 1986).

Evapotranspiration generally increases from north to south and ranges from about 32 to 42 in. per year. In the east-central part of the basin, precipitation and evapotranspiration are about equal. Average annual runoff ranges from 15 to almost 25 in. Areal distribution of average annual runoff from 1951 to 1980 reflects basinwide patterns in precipitation and soil-runoff potential. Runoff is greatest in a small region just below the Fall Line (see section 2.1.3) around Marion and Schley counties, and at the northern and southernmost ends of the basin (Gebert et al, 1987).

2.1.3 Physiography and Geology

The Flint River Basin contains parts of the Piedmont and Coastal Plain physiographic provinces, which extend throughout the southeastern United States. The Upper Flint subbasin contains both the Piedmont and Coastal Plain Provinces while the remaining subbasins lie entirely within the Coastal Plain. Similar to much of the Southeast, the basin's physiography reflects a geologic history of mountain building in the Appalachian Mountains, and long periods of repeated land submergence in the Coastal Plain Province. Glaciers, which

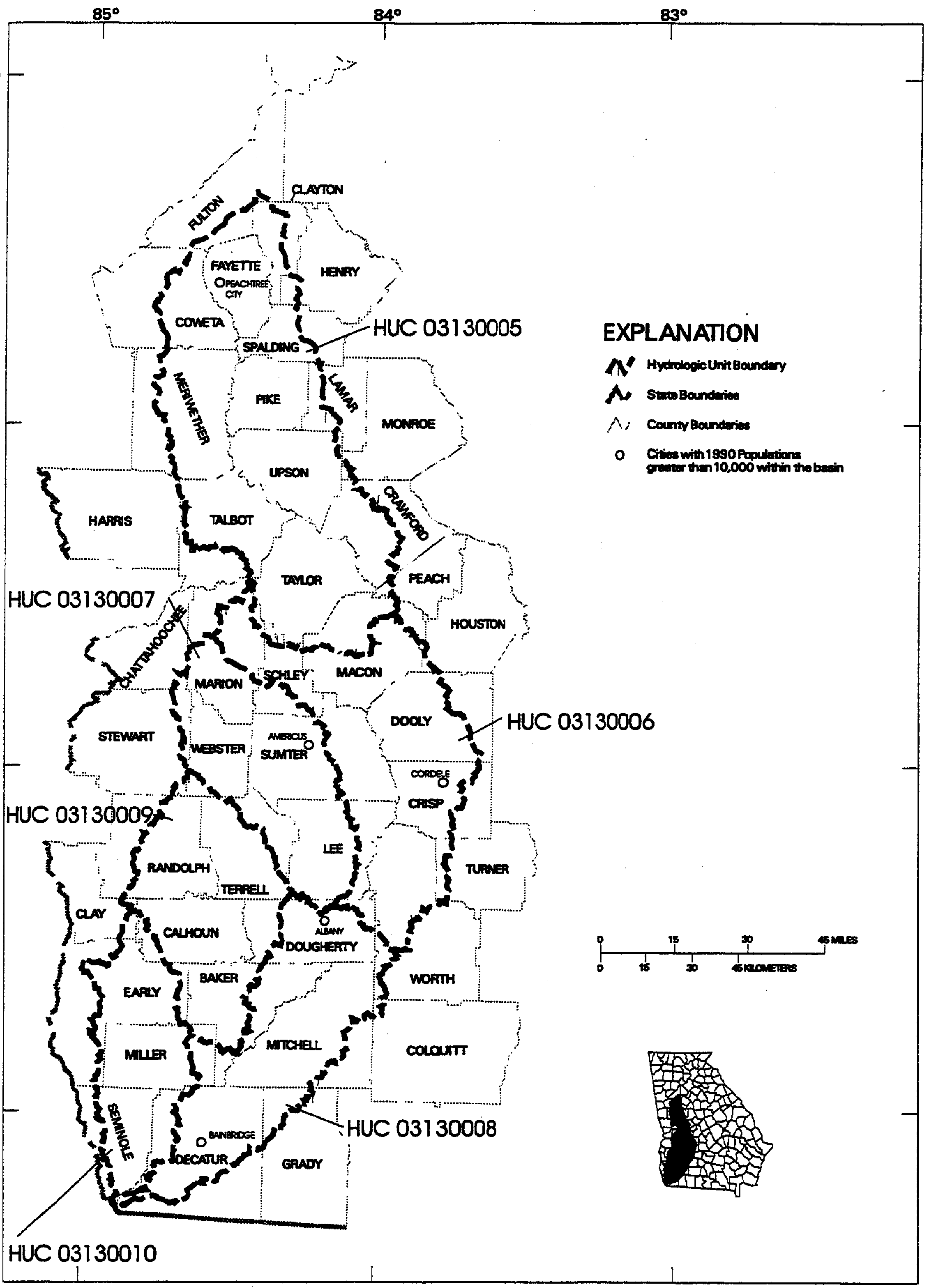


Figure 2-2. Hydrologic Units and Counties of the Flint River Basin

influenced the physiography of much of North America, never extended to the southeastern United States.

The Piedmont Province is underlain by mostly Precambrian and older Paleozoic crystalline rocks that include mica schist, felsic gneiss and schist, and granite gneiss. Less extensive outcrops of quartzites are also present.

The Fall Line is the boundary between the Piedmont and Coastal Plain Provinces. This boundary approximately follows the contact between crystalline rocks of the Piedmont Province and the unconsolidated Cretaceous and Tertiary sediments of the Coastal Plain Province. As implied by the name, streams flowing across the Fall Line can undergo abrupt changes in gradient, which are marked by the presence of rapids and shoals. Geomorphic characteristics of streams differ between the Piedmont and Coastal Plain Provinces. In the Coastal Plain, streams typically lack the riffles and shoals common to streams in the Piedmont and exhibit greater floodplain development and increased sinuosity.

The Coastal Plain Province contains two distinct regions – a hilly region immediately below the Fall Line (Fall Line Hills District or Georgia Sand Hills); and a region of karst topography. The Fall Line Hills District is highly dissected with relief ranging 50-250 ft. Cretaceous sediments lie in a band immediately below the Fall Line and crop out into younger Eocene-Paleocene sediments of the low-lying Dougherty Plain District.

A significant feature in the eastern edge of the Flint River Basin is the Dougherty Plain. The Dougherty Plain is characterized by outcrops of limestone that results in karst topography. The Dougherty Plain slopes southwestward with altitudes of 300 ft in the northeast to less than 100 ft near Lake Seminole. The flat to very gently rolling topography contains numerous sinkholes and associated marshes and ponds. Small streams in the Dougherty Plain District are frequently intermittent during the summer (Couch et al., 1996).

Geology

The geology of the Flint River Basin strongly influences its physiography, geochemistry, soils, surface and ground water resources (Cocker, in review). The Flint River Basin in Georgia is underlain by older (Precambrian and Paleozoic) crystalline rocks in the northern 25 percent of the basin and by younger (Cretaceous and Tertiary) sedimentary rocks in the southern 75 percent of the basin. The crystalline rocks are predominantly schists (10 percent of the basin), gneiss (8 percent), and granites (4 percent), with lesser amounts of metamorphosed volcanic rocks (2 percent) and metamorphosed sedimentary rocks (1 percent). Important regional structures that consist of intensely sheared or crushed rock include the Towaliga Fault Zone and the Goat Rock Fault Zone.

The Inner Piedmont geologic terrane underlies the northern part of the basin north of the Towaliga Fault Zone. The Pine Mountain terrane lies between the Towaliga Fault Zone and the Goat Rock Fault Zone. Between the Goat Rock Fault Zone and the Fall Line is the Uchee terrane. The Inner Piedmont terrane generally contains metamorphosed sedimentary rocks such as gneisses, schists and quartzites. Granitic intrusions in the Atlanta area are important sources of crushed stone. The Pine Mountain terrane contains metamorphosed sedimentary rocks such as quartzites and schists, and granitic rocks. Quartzites underlie the ridges of Pine Mountain. The Uchee terrane contains metamorphosed volcanic rocks that are mainly amphibolites and gneisses. Higher concnetrations of metals may be associated with metamorphosed volcanic rocks of the Uchee terrane. Rock units in the Piedmont are generally aligned to the northeast parallel to these regional structures. In the northern part of the basin, the Flint River cuts southward across both resistant and less resistant rock units of the Piedmont and the Coastal Plain. Local drainage patterns in the northern part of the basin are affected by resistant rock units and faults. Pegmatite (mica) mines and crushed stone quarries have been the principal mining operations in the northern part of the Flint River Basin.

Deep weathering of Piedmont rocks produced a residuum referred to as saprolite. Saprolites may serve as local aquifers in the Piedmont. Soils are developed through weathering of the near-surface portions of the saprolite.

The southern third of the basin is underlain by Cretaceous and Tertiary sedimentary rocks of the Coastal Plain. These rocks are predominantly older sands and clays near the Fall Line and younger carbonate rocks in the southernmost part of the basin. These rocks dip gently on the order of a few tens of feet per mile to the southeast. Several important aquifers are associated with the more permeable rock units. Recharge areas for these aquifers are generally located where these rock units crop out in the northern part of the Coastal Plain. Rock composition and permeability have a strong influence on water that flows through them. A large portion of the Coastal Plain in the Flint River Basin is underlain by carbonate rocks. Karst terrain that consists of sinkholes, ephemeral streams and caverns are developed in this region. Iron ores, kaolin, and bauxite are found and have been mined from the northern part of the Coastal Plain, and limestones and attapulgite ("fuller's earth") have been mined in the southern portion of the Coastal Plain.

Quaternary alluvium deposits are found in stream and river valleys with the larger and thicker deposits in the major river valleys. Commonly, these underlie the floodplains of the river systems.

Geochemistry

Background stream sediment and stream geochemistry of the Flint River Basin has been documented and analyzed by Cocker (in review) using data collected as part of the U.S. Department of Energy's National Uranium Resource Evaluation (NURE) program. Data was collected and analyzed for the period 1976 to 1978. The number of sample sites for this river basin is 660. Geochemical data included aluminum, barium, beryllium, cobalt, chromium, copper, iron, magnesium, manganese, nickel, lead, silver, titanium, vanadium, zinc, pH, alkalinity, and conductivity. Geochemical data were contoured and spatially related to specific rock units shown on the Geologic Map of Georgia (Georgia Geologic Survey, 1976) with the aid of a Geographical Information System (GIS).

The Flint River Basin cuts across five regions that differ in stream pH, conductivity and alaklinity and that are spatially coincident with regional geology and related stream sediment geochemical trends particularly in the Coastal Plain. Two regions in the basin have higher pH (greater than 7), higher conductivity (greater than 43 micromhos/cm), and higher alkalinity (greater than 0.3 meq/L) and separate regions of lower pH, conductivity and alkalinity. These parameters may affect or measure the amount of dissolved metals in the surface and ground water. Streams in the northernmost part of the Coastal Plain that is underlain by permeable sands and clays have very low pH (4.1 to 6.7), conductivities (1 to 45 micromhos/cm) and alkalinities (0.02 to 0.10 meq/L). Stream and river pH, alkalinity, and conductivity increase south of Montezuma as a result of dissolution of the carbonate rocks underlying this portion of the basin (Cocker, in review).

Primary pollutant data from stream sediments are available for only 220 of the 660 samples, and the distribution of those 220 samples does not provide a good representation of the basin. Some of the data suggest that stream sediments with anomalous metals may be spatially related to particular geologic units. Data from a few sample sites may be influenced anthropogenic sources (Cocker, in review).

Soils

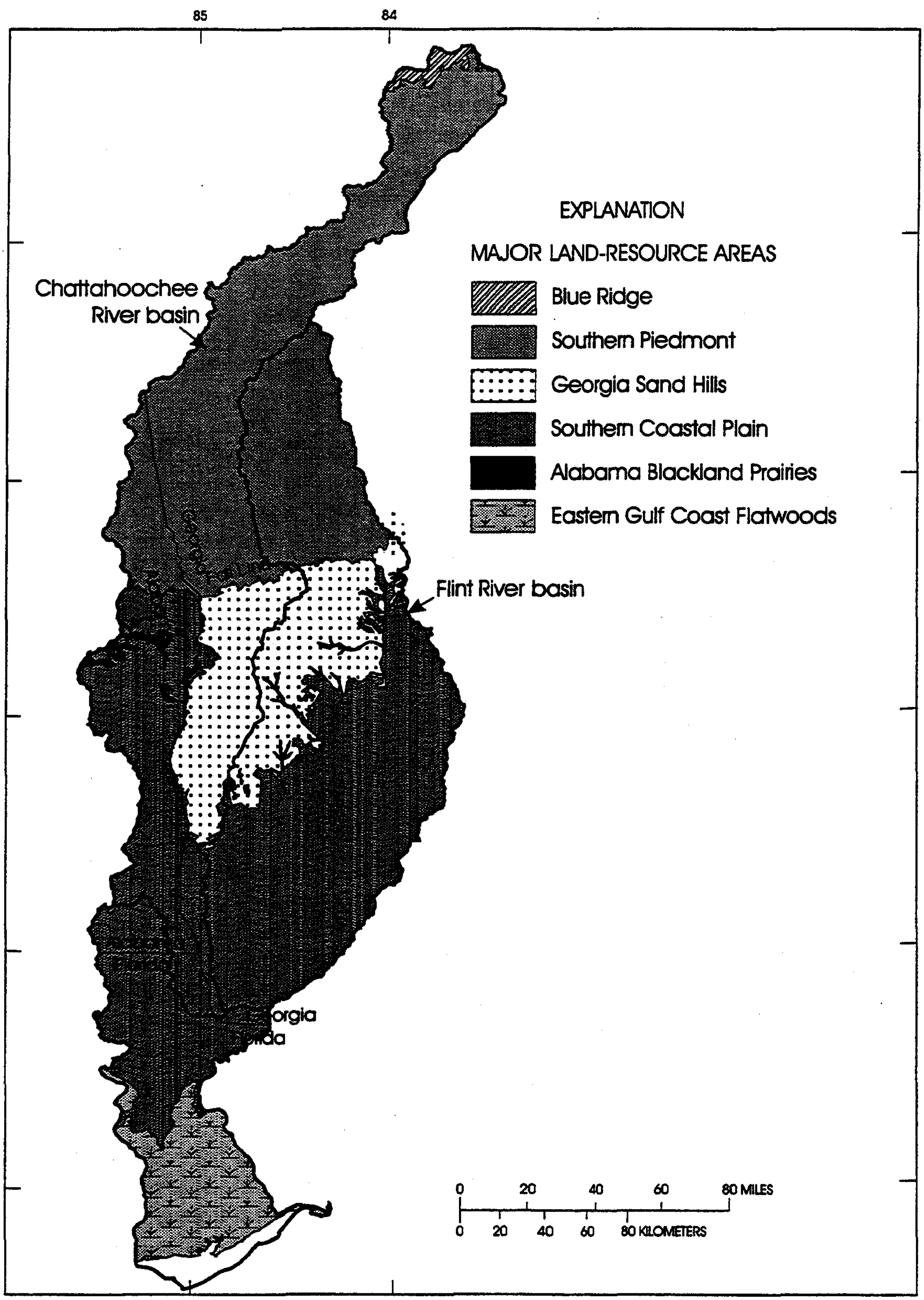
Soils of the Flint River Basin are divided into three major land-resource areas (formerly called soil provinces), which generally reflect the physiographic provinces and are shown in Figure 2-3. These are the Southern Piedmont, Georgia Sand Hills, and the Southern Coastal Plain areas.

Two major soil orders, ultisols and entisols, are present in the Flint basin. The Southern Piedmont land resource area is dominated by ultisols. Piedmont ultisol soils are acidic, are low in nitrogen and phosphorus, and generally lack the original topsoil. Topsoil erosion began with intensive cultivation of cotton in the 1800's (Wharton, 1978). Ultisols are characterized by sandy or loamy surface horizons and loamy or clayey subsurface horizons. These deeply weathered soils are derived from underlying crystalline rock.

Soils in the Southern Coastal Plain and the Georgia Sand Hills land-resource areas are derived from marine and fluvial sediments eroded from the Appalachian and Piedmont Plateaus. Ultisols are found throughout the Southern Coastal Plain, with the exception of some areas in the Georgia Sand Hills where entisols are present. Entisols are young soils with little or no change from parent material and with poorly developed subhorizons. These soils are frequently infertile and dry because they are deep, sandy, well-drained, and subject to active erosion.

Basinwide patterns in soil leaching and runoff potential provide information on areas that may be susceptible to greater contaminant transport through infiltration or runoff. Maps of soil leaching and runoff potential have been constructed for soils in the Flint River Basin using data from the digital State Soil Geographic Database (STATSGO) of the U.S. Department of Agriculture, Natural Resources Conservation Service (formerly called the Soil Conservation Service) (see Couch et al., 1996). A high leaching rate is assigned to soils with a permeability of 6.0 inches per hour or more (Brown *et al.*, 1991). Soils with high leaching rates are concentrated in the sandy Cretaceous sediments below the Fall Line.

Runoff ratings are based on the inherent capacity of bare soil to permit infiltration, and consider slope, frequency of flooding during the growing season, and permeability (Brown *et al.*, 1991). Soils with high runoff ratings are distributed throughout the basin, but are concentrated in areas having low permeability, steep slopes; or where flooding is frequent or the water table is near the surface, such as in floodplains and other low-lying areas. In the Flint River Basin, soils with the highest runoff ratings are found near the Fall Line.



Base modified from U.S. Geological Survey digital files

Figure 2-3. Major Land-Resource Areas in the Apalachicola-Chattahoochee-Flint River Basin (modified from Couch et al., 1996)

2.1.4 Surface Water Resources

The Flint River is about 349 miles long and drains an area of 8,460 mi^2. Many large tributaries are located in the Coastal Plain Province of the Flint River system. These tributaries include the Ichawaynochaway Creek, Chickasawhatchee Creek, Kinchafoonee Creek, and Muckalee Creek. The Flint River has one of only 42 free-flowing river reaches longer than 125 mi remaining in the contiguous 48 states (Couch et al, 1996).

Spring Creek, formerly a Flint River tributary that now discharges directly into Lake Seminole, drains 585 mi^2 in a region of karst topography. As implied by its name, flow in Spring Creek is dominated by groundwater discharge directly into its limestone bed. Stream networks within the six subbasins of the Flint basin are shown in Figures 2-4 through 2-9.

From 1956 to 1996, the median discharge of the Flint River, based on mean daily flows at Newton, Georgia, was 4,780 cubic feet per second (ft^3/s). Newton is located between Albany and Bainbridge, and is the southernmost active USGS gaging station located on the Flint mainstem, representing a drainage area of 5,740 mi^2, or about 68% of the Flint River Basin. Mean daily discharge ranged from a low of 922 ft^3/s in 1990 to a high of 100,000 ft^3/s in 1994, as summarized in Figure 2-10. The highest daily flow occurred following the passage of Tropical Storm Alberto on July 3-7, 1994, which resulted in record flooding on the Flint and Ocmulgee Rivers.

Higher flows during winter months are evident in the Flint River, Ichawaynochaway Creek, and Spring Creek. During winter months, Coastal Plain streams, such as Ichawaynochaway and Spring Creeks, flow for sustained periods through their floodplains.

Reservoirs

The Flint basin contains three major dams and associated impoundments (including Lake Seminole, which is an impoundment of the Apalachicola River below the confluence of the Chattahoochee and Flint Rivers), as shown in Table 2-2 and Figure 2-11. The two hydropower dams located on the Flint River impound run-of-the-river reservoirs and do not appreciably influence the flow of the Flint River.

Lake Blackshear was formed in 1930 after the construction of the concrete-earthern Warwick Dam and hydroelectric power station on the Flint River near Warwick, Georgia. The Crisp County Power Commission is the controlling authority. Lake surface area has been reported between 8,525-8,700 acres, with a total drainage area at the Warwick Dam of approximately 3,764 square miles. In addition to the Flint River, inflow to Lake Blackshear is contributed by the Turkey, Lime, Limestone, Spring, Gum, Gulley, Cedar and Swift Creek watersheds, other local small streams, and an undetermined quantity of groundwater discharge/recharge that occurs through springs located within the body of the impoundment. Normal pool elevation is 237 feet (mean sea level), and lake levels typically vary by less than one foot except during the drawdowns conducted to achieve dock repair and shoreline maintenance (2 year cycle, during October-November, drawdown ≈ 3 feet). A principal use of Lake Blackshear is power generation, but lake levels are managed primarily to support recreational uses, including sport fishing. The Georgia DNR operates the Georgia Veterans State Park, which has approximately 5 miles of shoreline along the lake, with various recreational facilities provided.

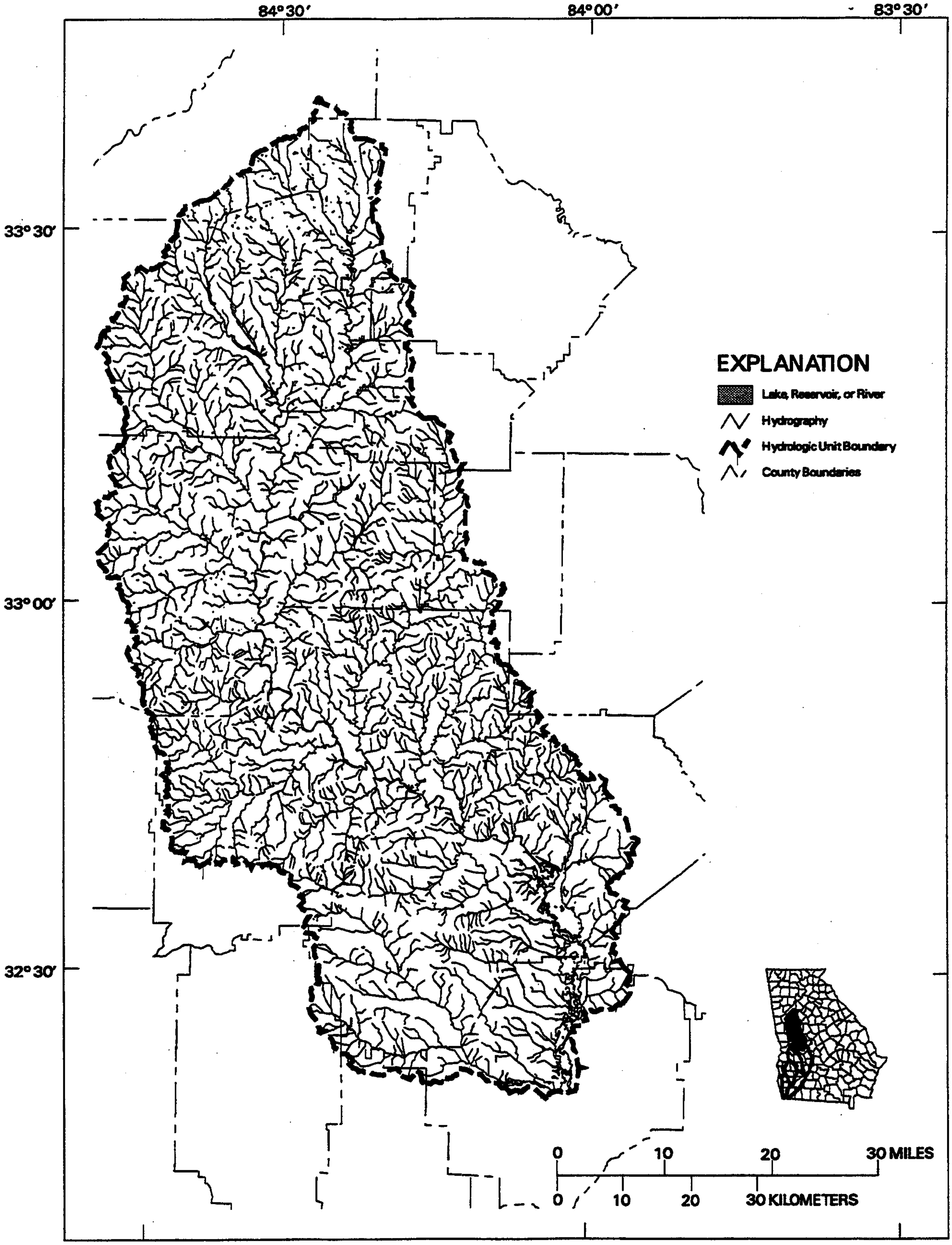


Figure 2-4. Hydrography, Upper Flint River Basin, HUC 03130005

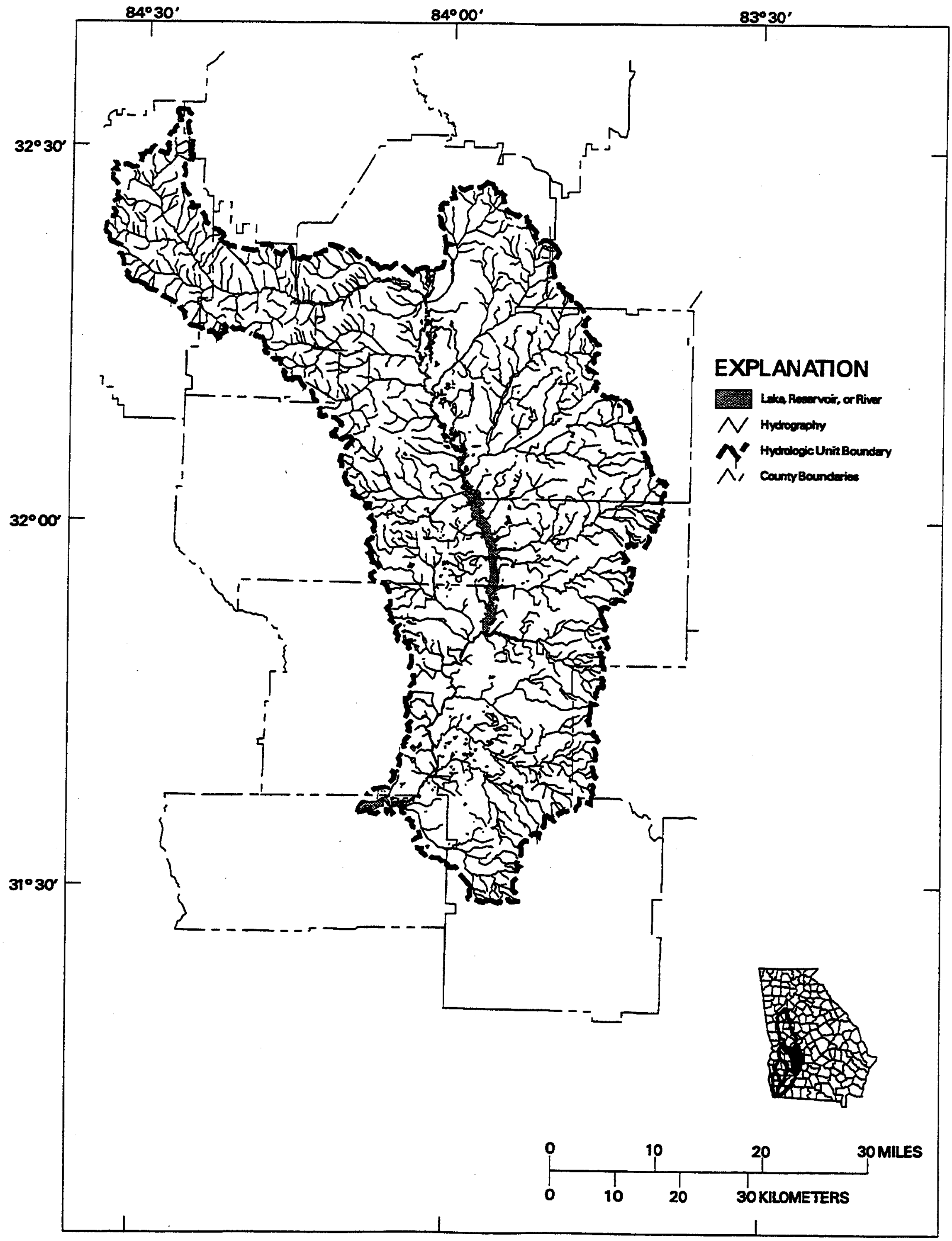


Figure 2-5. Hydrography, Middle Flint River Basin, HUC 03130006

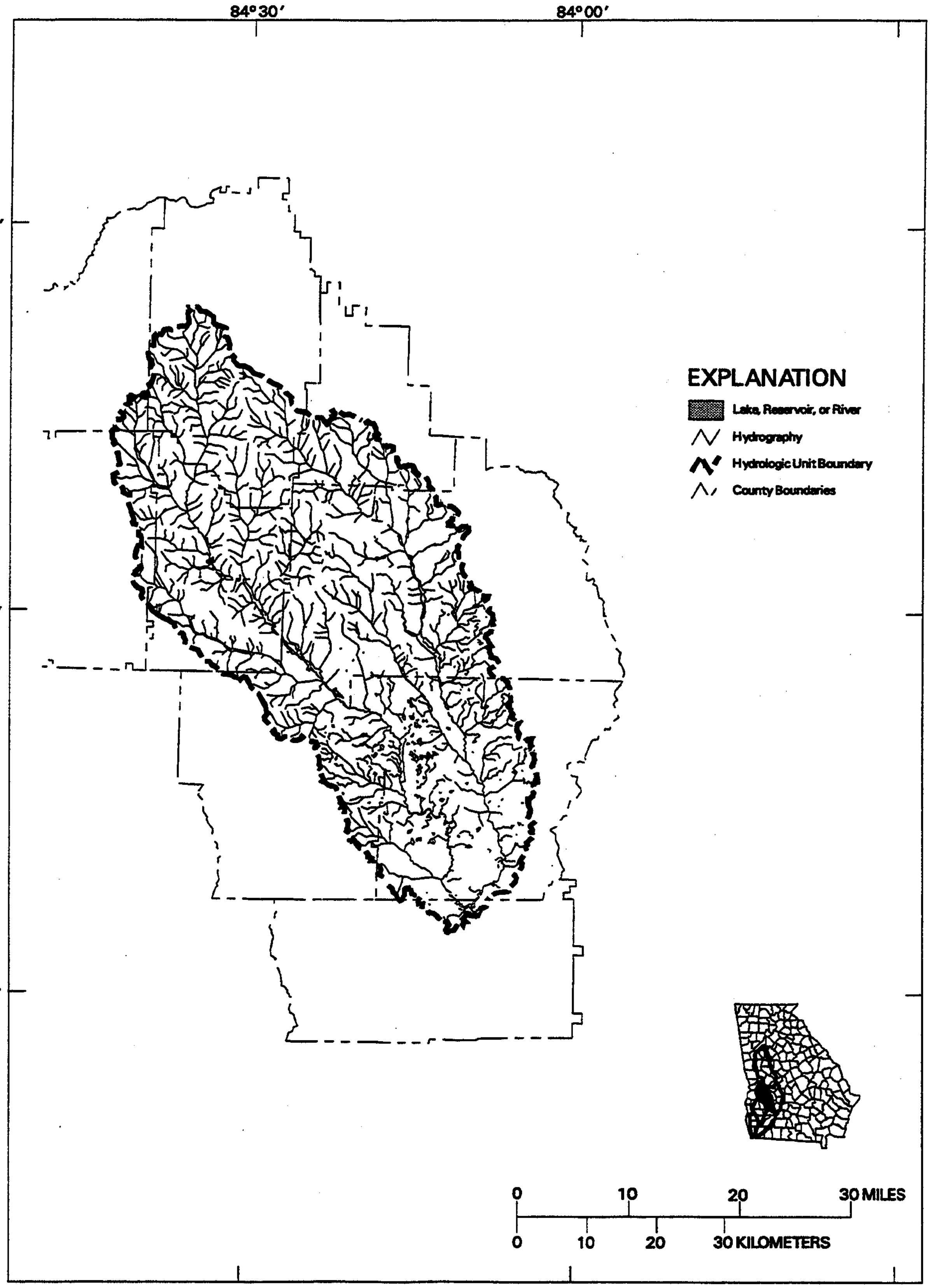


Figure 2-6. Hydrography, Kinchafoonee-Muckalee Creeks Basin, HUC 03130007

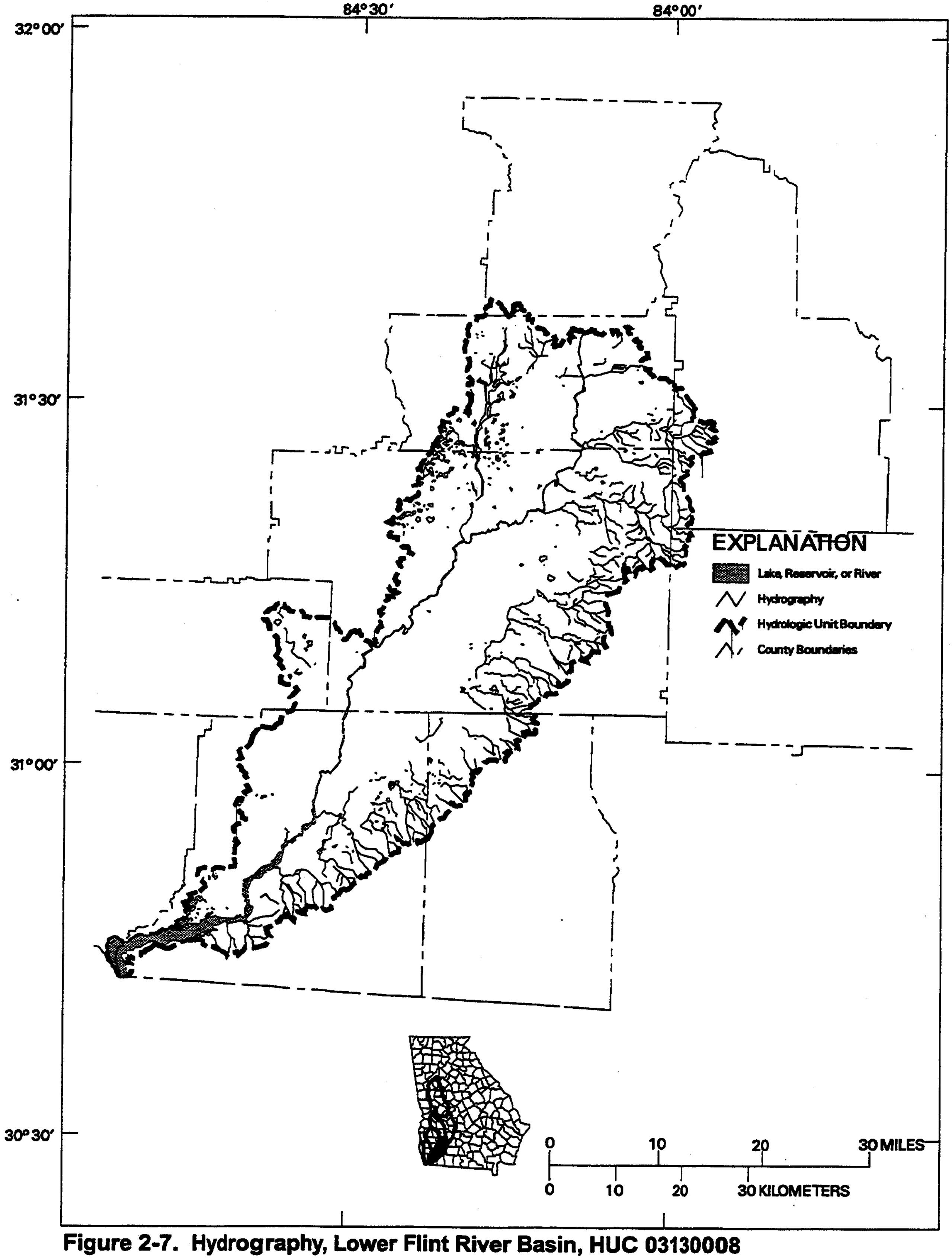


Figure 2-7. Hydrography, Lower Flint River Basin, HUC 03130008

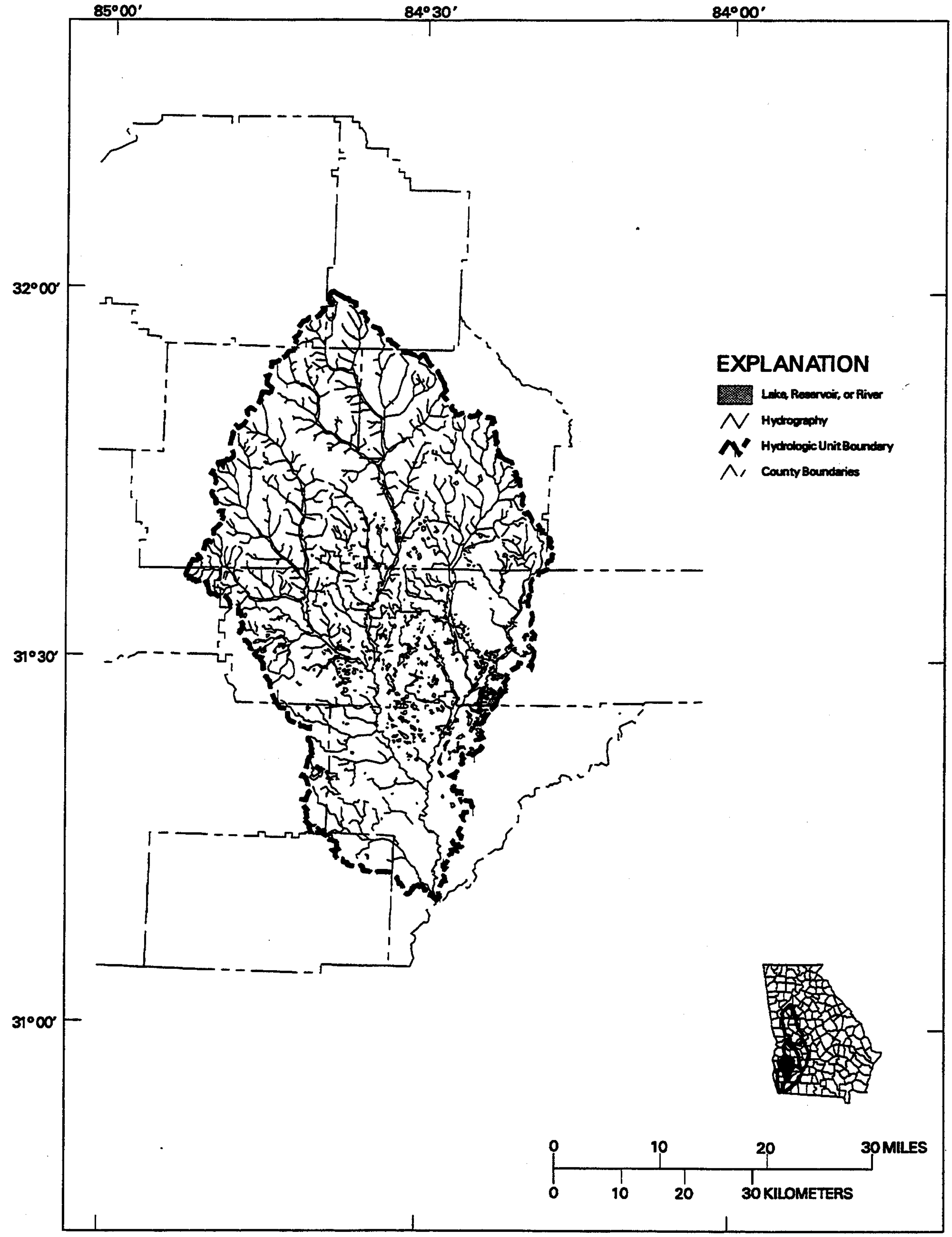


Figure 2-8. Hydrography, Ichawaynochaway Creek Basin, HUC 03130009

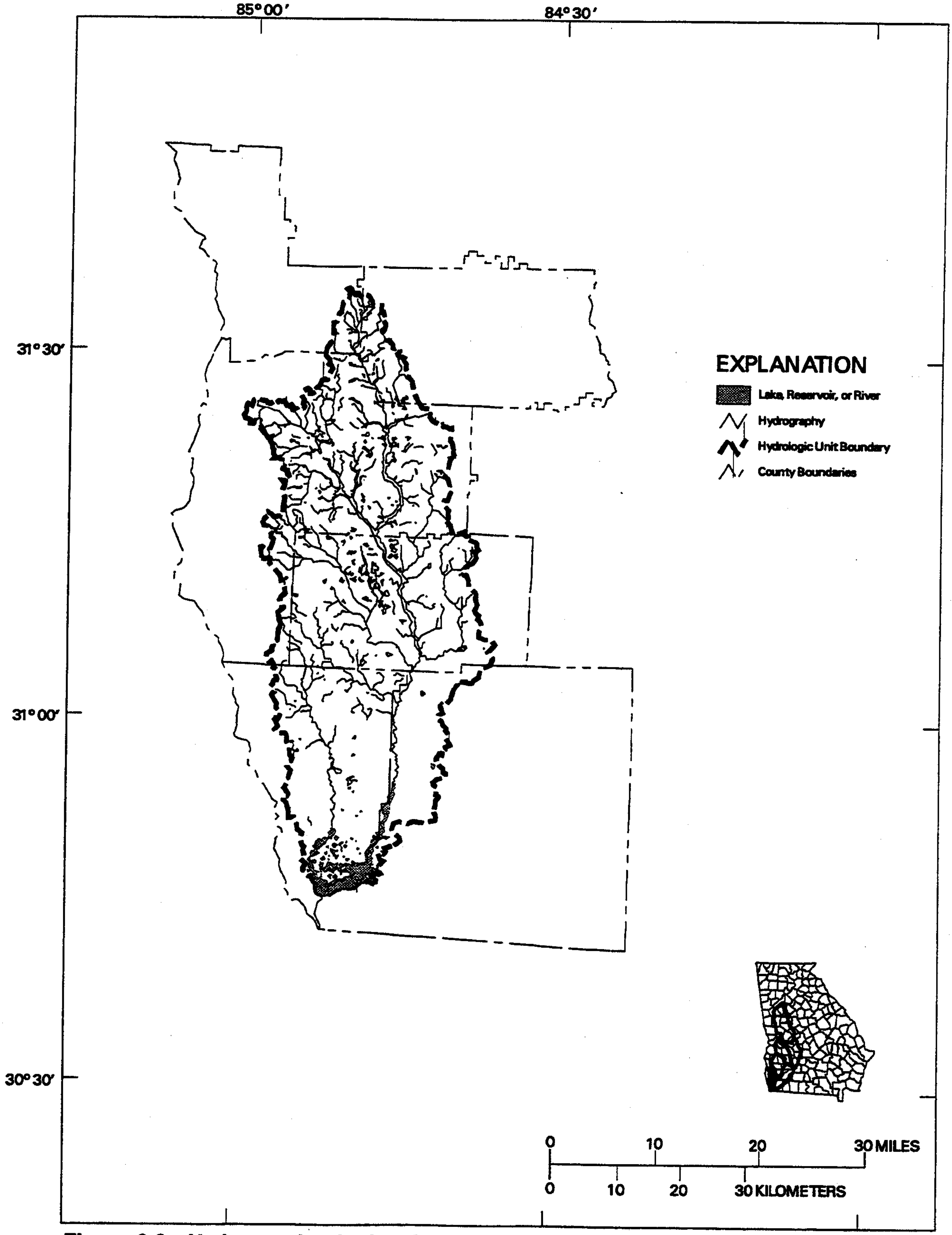


Figure 2-9. Hydrography, Spring Creek Basin, HUC 03130010

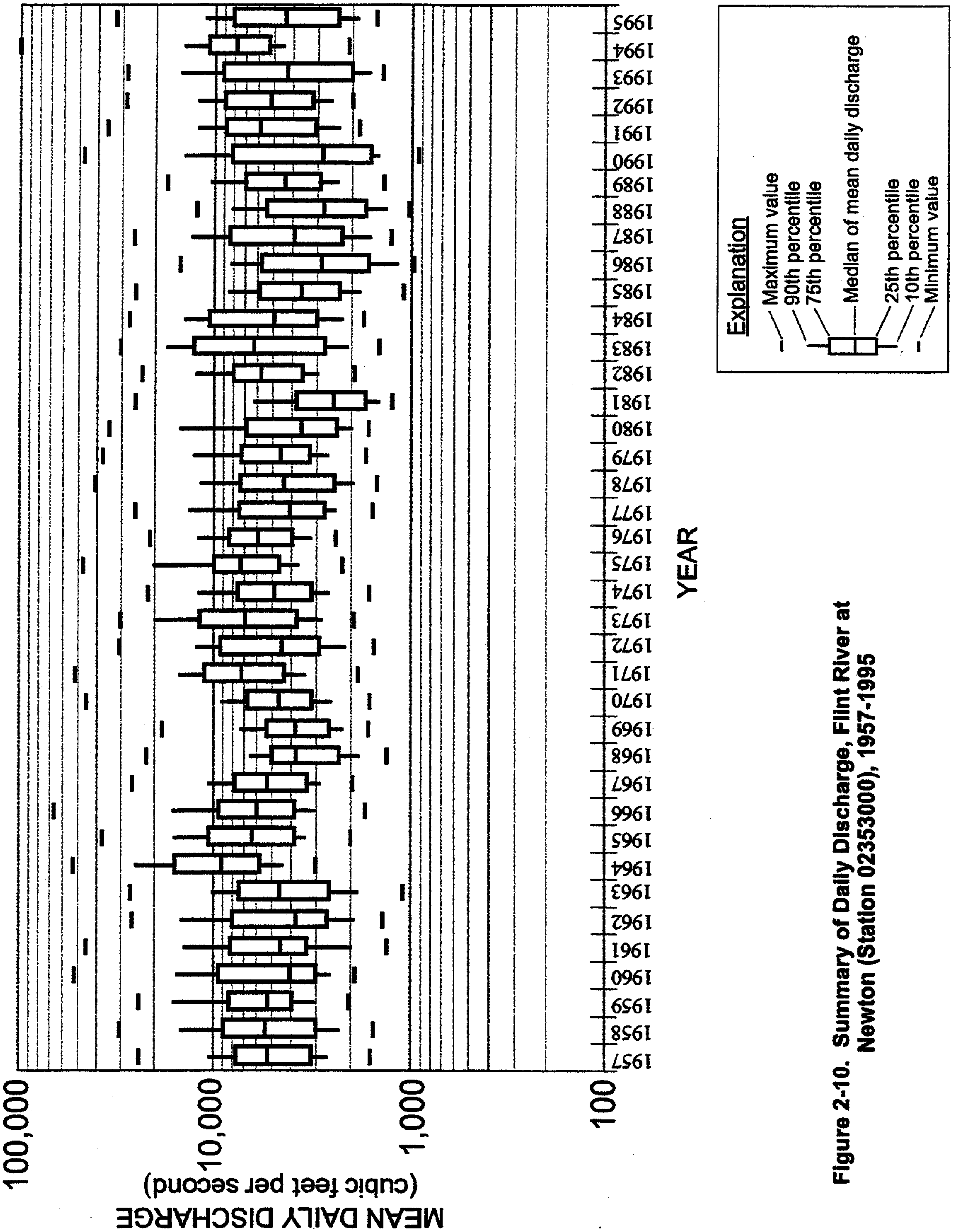


Figure 2-10. Summary of Daily Discharge, Flint River at Newton (Station 02353000), 1957-1995

Table 2-2. Major Dams and Impoundments in the Flint River Basin

Project Name	Owner / Year Initially Completed	River mile	Drainage Area (mi^2)	Reservoir Size (Ac)	Reservoir Storage Volume (Ac-Ft)	Normal Lake Elevation (ft)
Warwick Dam / Lake Blackshear	Crisp County / 1903	134.8	3,764	8,600	5,700	237.0
Flint River Dam / Lake Worth	Georgia Power / 1920	104.1	5,310	1,400	--	182.3
Jim Woodruff Lock and Dam / Lake Seminole	COE / 1957	--	17,230	37,500	367,320	77.0

Lake Blackshear is a run-of-river impoundment, having average and maximum depths of approximately 17 and 45 feet, respectively, and backwater areas and embayments characterized by shallows and many small islands. The theoretical mean hydraulic retention time is 16 days. Analysis of bottom profile data has been cited by investigators as indicating that during low to medium inflow periods the old river channel likely carries the majority of flow, short circuiting, with little dispersion through the side channels and embayments of the lake. The Warwick Dam was badly damaged in the 1994 flood, requiring the lake to be drained for nearly two years while repairs were made.

Lake Worth was originally formed with the construction of the Muckafoonee Diversion Dam begun in 1905 forming a run-of-river impoundment of Muckalee and Kinchafoonee Creeks. A second dam was constructed on the Flint River (Flint River Dam) forming the Flint River Reservoir and became operational in 1920 with a dredged canal providing a direct connection of the two impoundments. The Georgia Power Company operates both, referring to the combined reservoir as the Flint River Project, and individually as Lake Worth and the Flint River Reservoir (Lake Worth/Flint River). The Flint River Project is considered run-of-river with the operational objective to match unit discharge with reservoir inflow, and lake water levels remain fairly constant as a result. The Muckafoonee Diversion Dam was used for power generation from 1906 to 1938 and provides an additional discharge point (during high input flow periods when capacity of Flint River Dam turbines exceeded), to the Flint River 0.2 miles downstream of the Flint River Dam, via Muckafoonee Creek. During normal flows, inflow from Muckalee and Kinchafoonee Creeks enters the Flint River Reservoir via the open channel connection.

The total surface area of both Lake Worth impoundments is approximately 1400 acres at the normal full pool elevation of 182.3 feet with an upstream drainage area at the Flint River Dam of approximately 5,310 square miles. The principal use of Lake Worth (Flint) is power generation. Chehaw City Park (previously a State Park) is located along the Muckalee Creek arm. The Flint River Dam was also heavily damaged during the 1994 flood, requiring the lake to be drained for several months.

Lake Seminole is located in the extreme southwestern corner of Georgia, formed at the junction of the Chattahoochee and Flint Rivers, and has a surface area of 37,500 acres. The reservoir, impounded by Jim Woodruff Dam (Apalachicola River Mile 107.6) is operated by the Corps of Engineers for navigation, power generation, recreation, and fish and wildlife purposes. Lake Seminole is addressed as part of the Chattahoochee River Basin Plan.

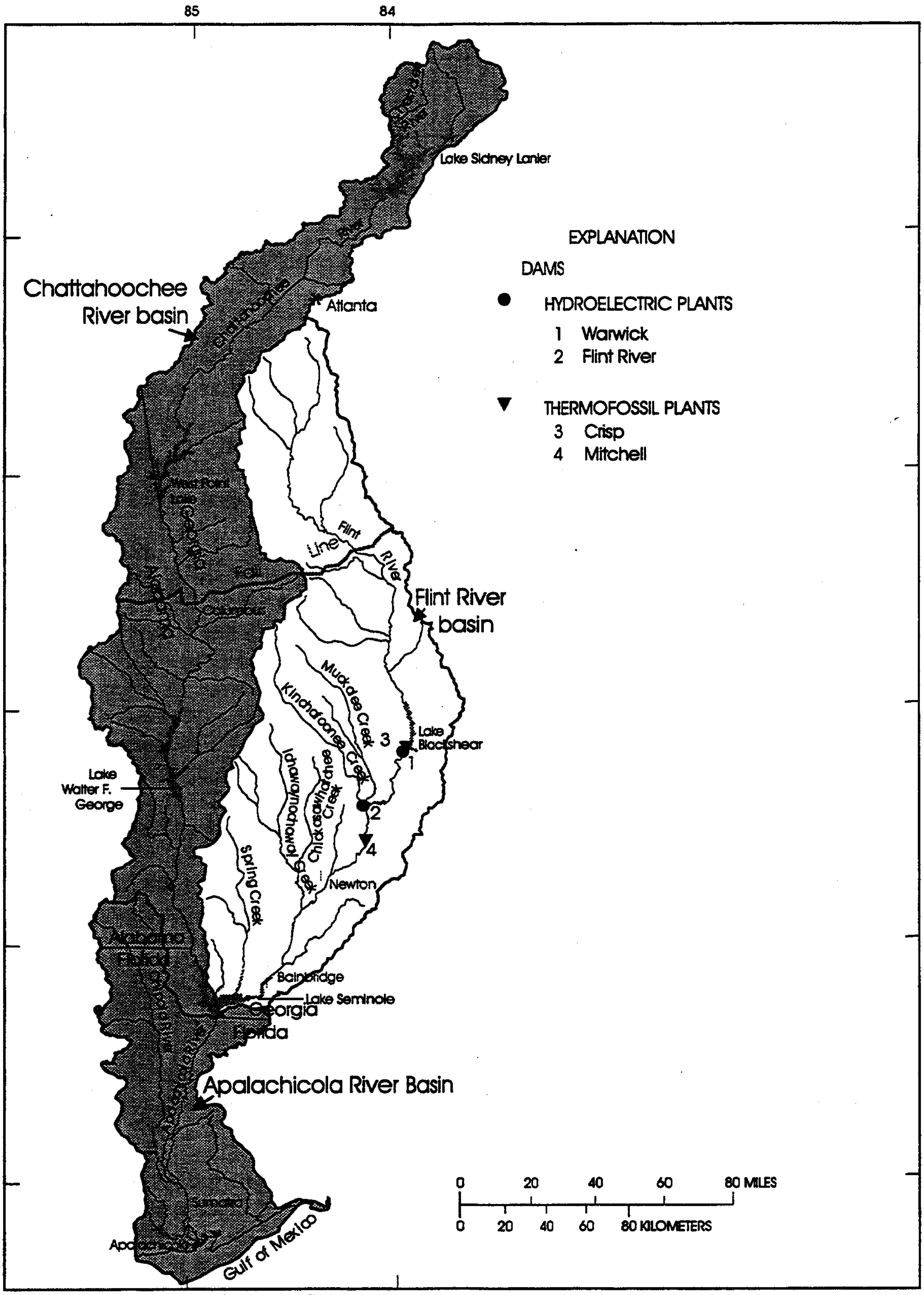


Figure 2-11. Location of Mainstem Dams and Power-Generating Plants in the Flint River Basin (modified from Couch et al., 1996)

2.1.5 Ground Water Resources

The Flint River Basin is a dynamic hydrological system containing interactions between aquifers, streams, reservoirs, floodplains, and estuaries. Many principal rivers receive a substantial contribution of water from groundwater baseflow during dry periods. Five major aquifers, listed below in order of descending stratigraphy and increasing age, underlie the Flint River Basin. Generalized outcrop areas and the stratigraphy of aquifers underlying the Coastal Plain Province are shown in Figure 2-12. These aquifers are generally separated by confining units.

- The Floridan aquifer system is one of the most productive groundwater reservoirs in the United States. This system supplies about 50 percent of the groundwater used in the state. It is used as a major water source throughout the Coastal Plain region of the state. The Floridan aquifer 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 are generally high-yielding and are extensively used for irrigation, municipal supplies, industry, and private domestic supply.

- The Claiborne aquifer is an important source of water in part of southwestern Georgia. It is made up of sand and sandy limestone and is mostly confined. It supplies industrial and municipal users in Dougherty, Crisp, and Dooly counties and provides irrigation water north of the Dougherty Plain.

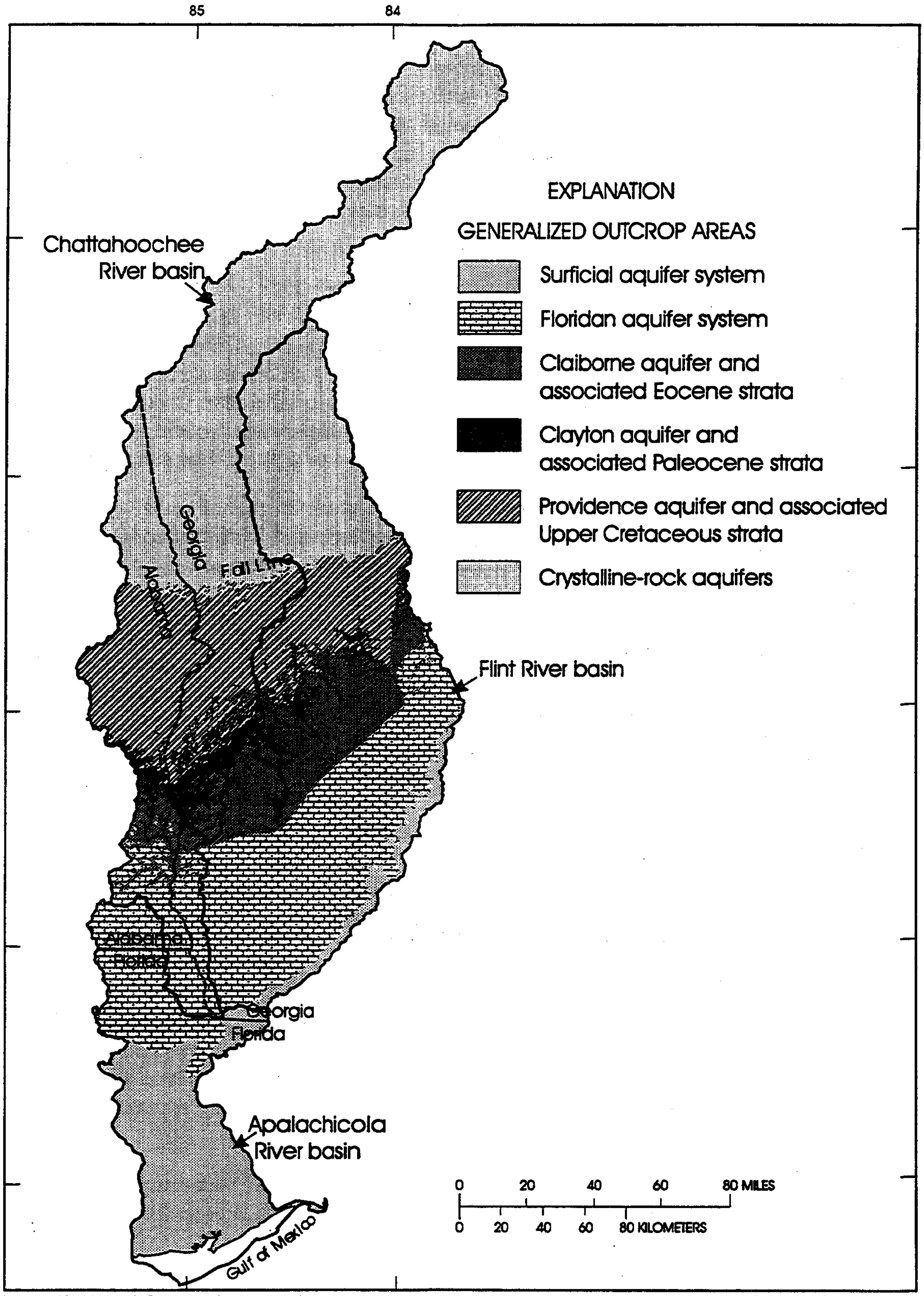
- The Clayton aquifer is another important source of water in southwestern Georgia. It is made up of sand and limestone and is generally confined. The majority of water pumped from this aquifer is used for public supply and irrigation. Due to increased pumping from this aquifer during the 1970s and 1980s, water levels have dropped, particularly in the Albany area. There is some concern now about overuse of this aquifer.

- The Providence aquifer system is the deepest of the principle aquifers in South Georgia. It serves as a major source of water in the northern one-third of the Coastal Plain. The aquifer system consists of sand and gravel that locally contains layers of clay and silt which function as confining beds. These confining beds locally separate the aquifer system into two or more aquifers. In southwestern Georgia, the Providence aquifer is part of the Cretaceous system.

- The Piedmont Province section of the Upper Flint River Basin is underlain by bedrock consisting primarily of granite, gneiss, schist, and quartzite. These rock formations make up the crystalline rock aquifers which are generally unconfined and not laterally extensive. These rocks tend to be impermeable, and thus where groundwater is present, it is stored in joints and fractures in the rock.

Presently, the crystalline rock aquifers are used primarily for private water supplies and livestock watering. It is commonly believed that groundwater in this part of the state is not sufficient to supply such uses as municipal supplies and industry.

North of the Fall Line (which extends through Columbus, Macon, and Augusta) the primary aquifers of the Chattahoochee and Flint River Basins are relatively low-yielding, with wells typically yielding about 20 gallons per minute. This hydrogeologic province is the



Base modified from U.S. Geological Survey digital files

Figure 2-12. Hydrogeologic Units Underlying the Apalachicola-Chattahoochee-Flint River Basin (modified from Couch et al., 1996)

Piedmont/Blue Ridge, and here water is stored in a mantle of soil and saprolite (i.e., decomposed rock) and transmitted to wells via fractures or other geologic discontinuities in the bedrock. Each surface water drainage basin or watershed is also a ground water drainage basin or watershed; surface and ground water are in such close hydraulic interconnection, they can be considered as a single and inseparable system. In the Piedmont, the decomposed rock or saprolite contains considerable clay that acts as a barrier to ground water pollution. This section of the Chattahoochee and Flint River Basins has below average pollution susceptibility.

South of the Fall Line, the Chattahoochee and Flint rivers flow through the Coastal Plain hydrogeologic province. Here, the aquifers are porous sands and carbonates, and include alternating units of sand, clay, sandstone, dolomite, and limestone that dip gently and thicken to the southeast. Several of these are prolific producers of ground water. Unlike the Piedmont, ground water is the dominant source of water. In this area, the aquifers are of two types: unconfined and confined. The unconfined aquifers are hydraulically interconnected to surface water bodies and the two form a single system; the confined or artesian aquifers, however, are buried and hydraulically isolated from surface water bodies. Confining units between these aquifers are mostly silt and clay. The unconfined aquifers in this area are susceptible to pollution. Generally, the unconfined Chattahoochee River basin aquifers of the Coastal Plain have average pollution susceptibility, whereas the unconfined Flint River Basin aquifers have above average pollution susceptibility. The confined aquifers of both river basins, because they buried and isolated, are somewhat immune to pollution from ground level activities.

From the Fall Line to Lake Seminole, progressively younger sediments crop out and overlie older sediments. The complex interbedded clastic rocks and sediments of Coastal Plain aquifers range in age from Quaternary to Cretaceous. Because of gradational changes in hydrologic properties, aquifer and stratigraphic boundaries are not always coincident.

The regional direction of ground-water flow in the Coastal Plain is from north to south; however, local flow directions vary, especially in the vicinity of streams and areas having large ground-water withdrawals. Rivers and streams in the Coastal Plain Province commonly are deeply incised into underlying aquifers and receive substantial amounts of ground-water discharge. Strata associated with the Floridan aquifer system are exposed along sections of the both the Flint and Chattahoochee Rivers (Maslia and Hayes, 1988). As a result of the greater hydraulic connection between the Floridan aquifer system and the Flint River, however, ground-water discharge contributes more significantly to baseflow in the Flint River than in the Chattahoochee River. Aquifer discharge to the Flint River is estimated to be five times that to the Chattahoochee River (Torak *et al.*, 1991).

2.1.6 Biological Resources

Human activity has transformed much of the Flint River Basin; yet, the basin's environment is noteworthy for its remaining biological diversity. The uniqueness of the basin's environment and biological diversity is a consequence of the basin's relation to regional, ecological, and zoogeographic patterns. The Flint River Basin contains parts of the Piedmont and Southeastern Plains Ecoregions (Omernik, 1987). The Piedmont Ecoregion is contained within the northern part of the Flint River Basin. The Southeastern Plains Ecoregion encompasses all of the Flint River Basin in the Piedmont and Coastal Plain Provinces. These ecoregions are intended to identify areas of relatively homogeneous ecological systems and are partially based on the distribution of terrestrial biota.

Terrestrial Habitats

The health of aquatic ecosystems is linked to the health of terrestrial ecosystems. Many parts of the Flint River Basin have been subject to varying degrees of forest-cover alteration. Small-scale disturbance of native forests began with American Indians, who used fire to manage pinelands and create fields for cultivation. Forest disturbance was greatly accelerated by European settlers, who logged throughout the basin and extensively cleared land for agriculture in the Piedmont and Coastal Plain.

Prior to European settlement, the Flint River Basin was mostly forested. Native forests in the Piedmont Province were dominantly deciduous hardwoods and mixed stands of pine and hardwoods. The Coastal Plain supported oak-sweetgum-pine forests, with gum-cypress in floodplain forests. Parts of the lower Coastal Plain were vegetated by open savannahs of wiregrass and longleaf pine (Wharton, 1978).

The Piedmont Province, located in the northern part of the Flint River Basin, experienced three phases of land abandonment—(1) after the Civil War, (2) during the agricultural depression of the late 1880s, and (3) after the bollweevil infestation in the late 1920s. Cotton production in the Piedmont Province left the land relatively infertile and almost devoid of topsoil. Nearly all the topsoil in the Piedmont Province had been eroded by 1935. Abandoned agricultural lands were replaced by the secondary forests that cover most of the Piedmont today.

Forest cover probably reached a low between 1910 and 1919 basinwide when agriculture was at a peak acreage. By the 1920s, about 87 percent of the Piedmont had been cultivated. By the mid-1970's, approximately 59 percent of the land cover in the entire Apalachicola-Chattahoochee-Flint River Basin was forests of second growth stands and large acreages of planted pine (U.S. Geological Survey, 1972-78).

Wetland Habitats

Wetlands are transitional lands between terrestrial and deep-water habitats where the water table is at or near the land surface or the land is covered by shallow water (Cowardin *et al.*, 1979). Most wetlands in the Flint River Basin are forested wetlands located in the floodplains of streams and rivers. Forested-floodplain wetlands are maintained by the natural flooding regime of rivers and streams and, in turn, influence the water and habitat quality of riverine ecosystems.

The Flint River Basin contains many wetlands of significant size (see Figures 2-14 through 2-19 in section 2.2.3). Using satellite imagery, total wetland acreage in the Flint basin has been estimated at about 412,000 acres (see section below on wetland inventories); approximately 90,000 acres are in the forested floodplain of the Flint River Basin and floodplains and swamps associated with Chickasawhatchee and Spring Creeks.

Wetlands Inventories. Assessments of wetland resources in Georgia have been carried out with varying degrees of success by the Natural Resources Conservation Service (Soil Conservation Service-USDA), the US Fish and Wildlife Service National Wetland Inventory, and Georgia's Department of Natural Resources.

Hydric soils as mapped in county soil surveys are useful indicators of the location and extent of wetlands for the majority of Georgia counties. The dates of photography from which the survey maps are derived vary widely across the state, and no effort has been made to develop digital databases at the soil mapping unit level. However, soil surveys have proven useful in wetland delineation in the field and in the development of wetland inventories. County acreage summaries provide useful information on the distribution of wetlands across the state.

The National Wetland Inventory (NWI) of the U.S. Fish and Wildlife Service utilizes soil survey information during photo-interpretation in the development of the 7.5 minute, 1:24,000 scale products of this nationwide wetland inventory effort. Wetlands are classified according to the Cowardin system, providing some level of detail as to the characterization of individual wetlands. Draft products are available for the 1,017 7.5 minute quadrangles in the state of Georgia, and many final map products have been produced. More than 100 of these quadrangles are available in a digital format. Although not intended for use in jurisdictional determinations of wetlands, these products are invaluable for site surveys, trends analysis, and land-use planning.

A complementary database was completed by Georgia DNR in 1991 and is based on classification of Landsat Thematic Mapper (TM) satellite imagery taken during 1988-1990 (see Figures 2-20 through 2-25 in section 2.2.3). Due to the limitations of remote sensing technology, the classification scheme is simplified in comparison to the Cowardin system used with NWI. Total wetland acreage based on Landsat TM imagery is 412,365 acres or about 8 percent of land area in the Flint basin. These data underestimate the acreage of forested wetlands in the Piedmont and Coastal Plain, where considerable acreage may have been classified as hardwood or mixed forest.

Aquatic Fauna

This section focuses on aquatic or wetland species including fishes, amphibians, aquatic reptiles, and aquatic invertebrates. However, the Flint River Basin is rich in many other fauna that rely on the water resources of the basin, including many species of breeding birds and mammals. Although a description of these bird and mammal species is beyond the scope of this report, the water needs of these species, such as bald eagles, fish-eating mammals, and migratory water fowl, should be considered in water-resource planning and management.

Fish Fauna. The Apalachicola-Chattahoochee-Flint (ACF) basin has the largest diversity of fish fauna among the Gulf Coast river drainages east of the Mississippi River. The Flint River Basin is dominated by a warm-water fishery. Warm-water species of recreational importance include largemouth bass, white bass, the hybrid sunshine bass, redeye bass, shoal bass, spotted bass, crappie, yellow perch, pickerel, channel catfish, and several varieties of sunfish and suckers.

The diverse fish fauna of the Flint River Basin includes 85 extant species representing 19 families. The largest number of species (22) are in the minnow family Cyprinidae. Minnows are small fish that can be seen darting around in streams that are only a few feet wide. Other families with large numbers of species are the sunfish and bass family, the catfish family, and the sucker family. Species that have the largest numbers of individuals living in streams typically are minnows and suckers. These species are often not well known because unlike sunfish, bass, and catfish, people do not fish for them, although certain minnows may be used as bait. Minnows have an important role in the aquatic food chain as prey for larger fish, snakes, turtles, and wading birds such as herons. Suckers can grow to more than one foot long and are named for their down-turned mouth that they use to "vacuum" food from stream bottoms. Although suckers are not popular game fish, they are ecologically important because they often account for the largest fish biomass in streams.

Seventeen species have been introduced into the ACF basin by humans. Introduced species include the rainbow and brown trout, white catfish, flathead catfish, black bullhead, goldfish, carp, rough shiner, red shiner, white bass, spotted bass, bock bassappie, yellow perch, sauger, and walleye.

There are several lakes within the Flint River Basin that provide excellent habitat for various freshwater fisheries. The Wildlife Resources Division owns and manages Big Lazer Public Fishing Area, a 195 acre lake on a tributary of the Flint River in Talbot County. This lake offers excellent fishing for bluegill, channel catfish, and largemouth bass. The lake lies within the Big Lazer Creek Wildlife Management Area, a 5,850 acre tract of state-owned land managed primarily for public hunting.

Lake Blackshear, a Crisp County Power Commission lake on the Flint River, is a shallow impoundment built for electric power production. The Lake Blackshear dam was badly damaged in the 1994 flood, requiring the lake to be drained for nearly two years while repairs were made. The fish population is therefore much like that in a new reservoir. Historically, the lake has had good fisheries for largemouth bass, hybrid bass, catfish, and crappie. Lake Blackshear is currently being stocked with Gulf strain striped bass in an effort to develop a successful spawning run up the Flint River and thus aid in maintaining the strain in its native river system.

Downstream from Lake Blackshear, the Flint River flows for about 30 miles before being impounded again by the Flint River Dam, a small Georgia Power Company dam in Albany. This dam forms the 1,400 acre Lake Worth. This dam was also heavily damaged during the 1994 flood, and had to be drained for several months. Lake Worth supports a modest recreational fishery for largemouth bass, hybrid bass, sunfish, and catfish.

Below Albany, the Flint River flows unabated to Lake Seminole. This section of the Flint River is the only portion in Georgia where striped bass are known to successfully reproduce. Striped bass in excess of 50 pounds have been documented in this river section. These large fish are highly dependent on groundwater springs along the Flint River that provide cool water refuges during the summer months.

Amphibians and Reptiles. In addition to the diversity of fish fauna, the Flint River is noteworthy for its diversity of amphibians and reptiles. The lower part of the Flint River Basin, together with the upper part of the Apalachicola basin, has the highest species density of amphibians and reptiles on the continent north of Mexico. Means (1977) provides a checklist of amphibian and reptile species in the Apalachicola River basin, and Martof (1956) provides a checklist with distributional notes for species in Georgia. These checklists indicate that the Apalichicola-Chattahoochee-Flint River Basin is inhabited by 16 species of freshwater aquatic turtles, 21 species of salamanders, 26 species of frogs, and the American alligator. All require freshwater to complete or sustain their lifecycles. In addition, numerous species of snakes and lizards inhabit streams and wetlands.

Fifteen species of amphibians or reptiles are noteworthy because of their rarity or protected status. The alligator snapping turtle, the worlds largest freshwater turtle, is designated as threatened as a result of commercial overharvesting for its meat. Barbour's map turtle, a federal candidate species under the Endangered Species Act, is endemic to the Coastal Plain part of the ACF basin. The natural range of the turtle was decreased by the formation of Lake Seminole, which caused a decline in the population. Its population has further declined because of harvesting for meat.

Aquatic Invertebrate Fauna. With the possible exception of the mollusc (Heard, 1977) and crayfish species (Hobbs, 1942, 1981), knowledge of the number and distribution of aquatic invertebrate species that inhabit the Flint River Basin is limited. The largest diversity of macrofaunal aquatic organisms occurs among the insects. Hobbs (1942, 1981) lists 20 species of crayfish that occur in the Chattahoochee or Flint River Basins.

Aquatic Vegetation

The Georgia Natural Heritage Program has identified 92 Special Concern plant species occurring in the Flint River Basin. Among these, there are 24 wetland or aquatic species with state threatened or endangered status, as listed in Table 2-3.

Throughout the Flint River Basin, aquatic vegetation and algae can exhibit uncontrolled or noxious growth in response to changes in water quality such as nutrient enrichment or altered hydraulic conditions. These problems are most likely to occur in reservoirs in the Coastal Plain Province, where stable water levels, shallow depths, sedimentation, excessive nutrient inputs, and a mild climate provide conditions favorable to the proliferation of aquatic vegetation, particularly introduced species. In the Flint River Basin, Lakes Blackshear and Seminole have experienced noxious growths of aquatic plants.

The problem is severe in Lake Seminole, where as much as 80 percent of the lake's surface area has been covered by aquatic plants. Noxious growth of aquatic plants in Lake Seminole began in 1955 at the time water began to be impounded. In 1973, an aquatic plant survey of Lake Seminole identified more than 400 species, of which 70 were classified as noxious or potentially noxious plants. Several introduced species have established themselves, including Eurasian milfoil (*Myriophyllum spicatum*), giant cutgrass (*Zizaniopsis miliacea*), water hyacinth (*Eichorina crassipes*), and Hydrillae (*Hydrilla verticillata*).

2.2 Population and Land Use

2.2.1 Population

Population of the Flint River Basin was estimated at about 640,000 people as of 1990, with about 251,000 occupied housing units (EPA Geographic Information Query System). Population distribution in the basin at the time of the 1990 Census is shown in Figure 2-13. Metropolitan Atlanta, the largest metropolitan area in the southeastern United States, is partly within the northern portion of the Flint River Basin. The two other major population centers in the Flint River Basin include Albany, with a population of 85,000, and Bainbridge, with a population of almost 11,000. A summary of 1990 population estimates by HUC units based on census tract/block centroids (EPA Geographic Information Query System) is shown in Table 2-4.

Between 1985 and 1995, the population in the Flint River Basin increased 1.3 percent per year. With moderate job creation expected, the population resident within the Flint basin is expected to continue to increase (DRI/McGraw-Hill, 1996). Basin population is projected to increase by

Table 2-3. Threatened or Endangered Wetland and Aquatic Plant Species in the Flint Basin

Common Name	Species	Status	Habitat
Variable-Leaf Indian-Plantain	*Amoglossum diversifolium*	T	Calcareous swamps
Harper Fimbry	*Fimbristylis perpusilla*	E	Exposed muddy margins of pineland ponds
Dwarf Witch-Alder	*Fothergilla gardenii*	T	Openings in low woods; swamps
Shoals Spiderlily	*Hymenocallis coronaria*	E	River shoals
Florida Anise-Tree	*Illicium floridanum*	E	Steepheads; floodplain forests
Pondberry	*Lindera melissifolia*	E	Pond margins and wet savannas
Pondspice	*Litsea aestivalis*	T	Cypress ponds; swamp margins
Curtiss Loosestrife	*Lythrum curtisii*	T	Openings in calcareous swamps
Lax Water-milfoil	*Myriophyllum laxum*	T	Bluehole spring runs; shallow, sandy, swift-flowing creeks; clear, cool ponds
Canby Dropwort	*Oxypolis canbyi*	E	Cypress ponds and sloughs; wet savannas
Hirst Panic Grass	*Panicum hirstii*	E	Cypress ponds; wet savannas and sloughs
False Dragon-Head	*Physostegia leptophylla*	T	Wet savannas; bogs; freshwater marshes
Southern Butterwort	*Pinguicula primuliflora*	T	Sandy, clearwater streams and seeps; Atlantic white cedar swamps
Whitetop Pitcherplant	*Sarracenia leucophylla*	E	Wet savannas, pitcherplant bogs
Green Pitcherplant	*Sarracenia oreophila*	E	Wet meadows; upland bogs
Parrot Pitcherplant	*Sarracenia psittacina*	T	Wet savannas, pitcherplant bogs
Purple Pitcherplant	*Sarracenia purpurea*	E	Swamps, wet rhododendron thickets
Sweet Pitcherplant	*Sarracenia rubra*	E	Atlantic white cedar swamps; wet meadows
Bay Starvine	*Schisandra glabra*	T	Stream terraces
Chaffseed	*Schwalbea americana*	E	Pond margins and wet savannas; upland ridge forests
Swamp Buckthorn	*Sideroxylon thornei*	E	Forested limesink depressions; calcareous swamps
Cooley Meadowrue	*Thalictrum cooleyi*	E	Pond margins and wet savannas
Piedmont Barren Strawberry	*Waldsteinia lobata*	T	Stream terraces and adjacent gneiss outcrops

1.1 percent per year through 2010. The largest increases in population are projected for the Metropolitan Atlanta area. The predominantly rural counties of the southern part of the basin are projected to have nearly stable or somewhat declining populations (DRI/McGraw-Hill, 1996).

2.2.2 Employment

Since 1975, employment in the Flint River Basin has risen at a fairly vigorous 3.6 percent annual rate. The Flint River Basin definitionally runs the gamut from the near-urbanized metropolitan

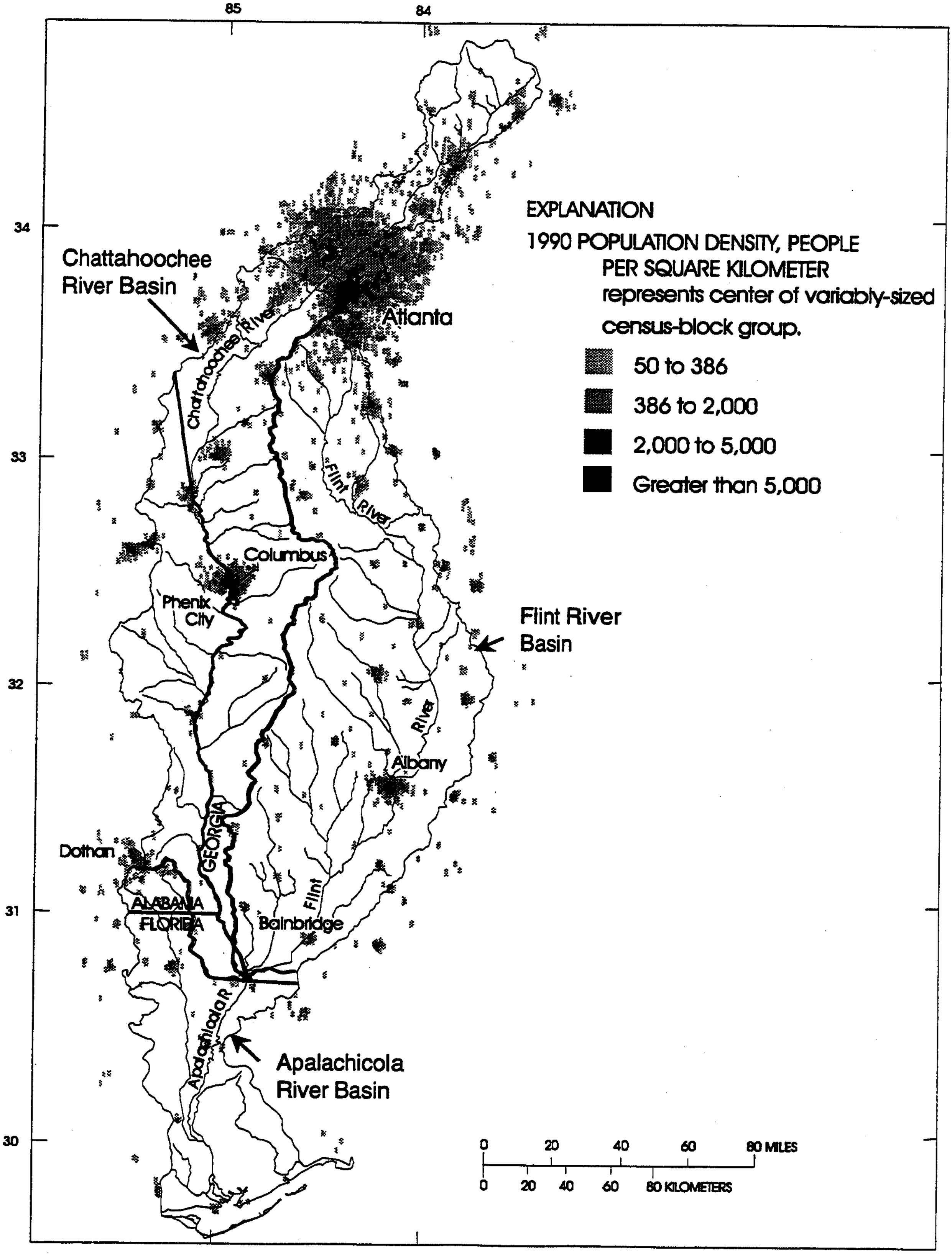


Figure 2-13. Population Density in the Apalachicola-Chattahoochee-Flint River Basin, 1990 (modified from Couch et al., 1996)

Table 2-4. Population Estimates by HUC Unit (1990)

HUC	Population	Household Units
03130005	355,455	140,299
03130006	67,505	26,560
03130007	51,427	19,047
03130008	119,446	46,499
03130009	22,391	8,844
03130010	23,715	9,728
Total	*639,939*	*250,977*

counties of Atlanta in the north to the southwestern rural counties of Georgia, including the city of Albany. Thus, the basin captures some of the vigorous employment growth of dynamic Atlanta and the more moderate employment growth of Albany.

Manufacturing employment is projected to decline sharply over the next few decades, from a 28.2 percent share of total employment within the basin to a 4.7 percent share by 2050. Textiles will be a major source of the job cutbacks, potentially dropping 8,000 positions between 1995 and 2050. Industrial production will be strong overall, with other nondurables production growing more than 450 percent and durables production more than tripling. Despite the reduction in employment, textile production will double. Meanwhile, the nonmanufacturing sector will surge, led by significant gains within the service sector. Service-related employment will experience a rise in the share of jobs from 10.2 percent in 1975 to 29.8 percent share in 2050 (DRI/McGraw-Hill, 1996).

2.2.3 Land Cover and Use

The land use activities in the Flint River Basin are primarily agriculture and forestry-related. Urban land cover is mostly found adjacent to the population centers of Atlanta, Albany, and Bainbridge. Forested lands are concentrated in the upper half of the basin, while agricultural lands are predominantly located in the lower half of the basin.

Land use/land cover classification has been determined for the Flint 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 use. It also tends to be less accurate than aerial photography. The targeted accuracy level for the overall landcover assessment using Landsat imagery was 85%. However, the percent error was not necessarily distributed equally throughout all classes.

The 1972-76 classification indicates that 48 percent of the basin land area was forest, 42 percent was agriculture, and 3 percent was urban land cover, with 7 percent in other land uses, including about 5 percent wetlands (Figures 2-14 through 2-19). In contrast to the Piedmont Province, agriculture comprised a larger percentage of land cover in the Coastal Plain. Urban land cover was concentrated in the upper part of the Flint River Basin in the Metropolitan Atlanta area.

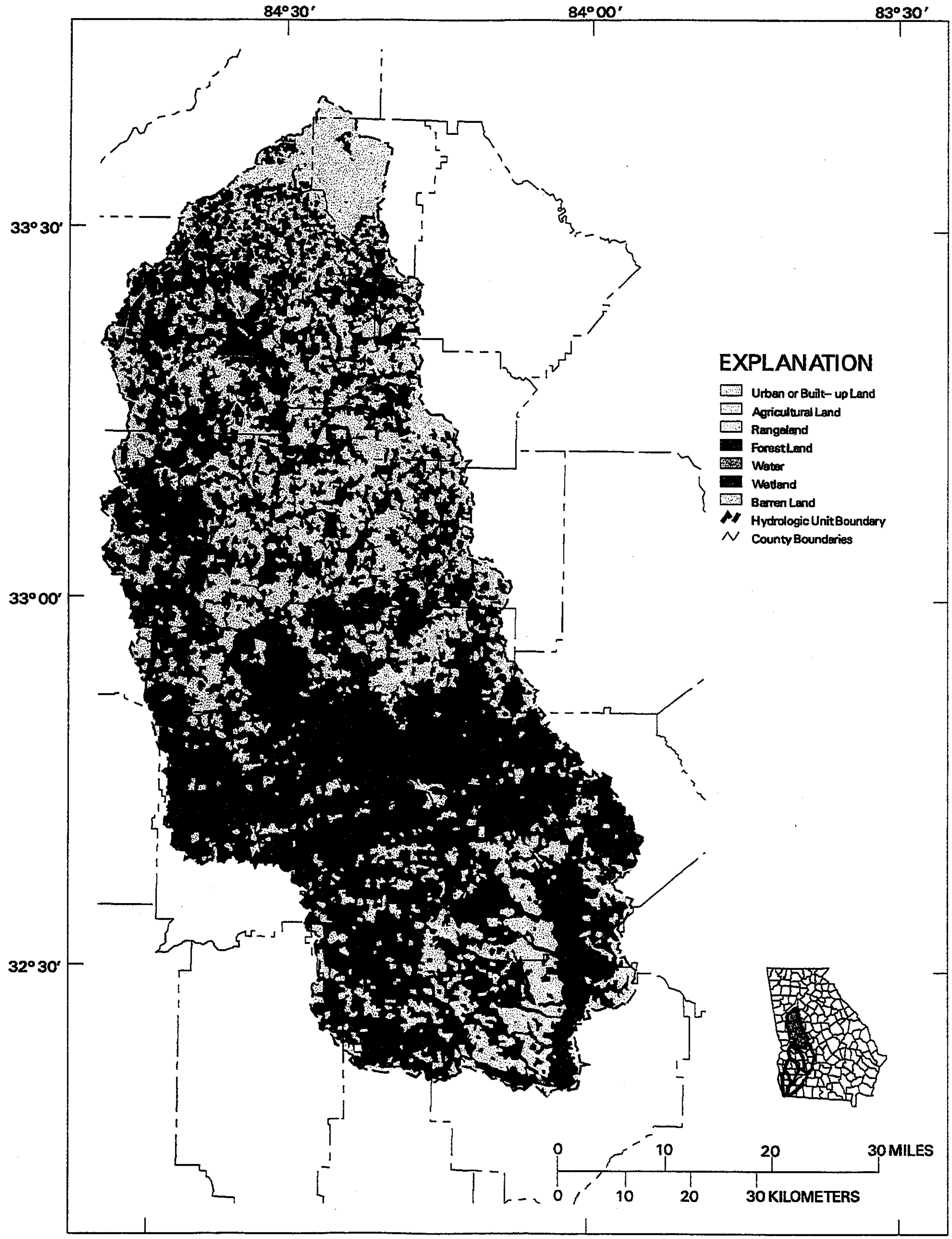


Figure 2-14. Land Use, Upper Flint River Basin, HUC 03130005, USGS 1972-76 Classification Updated with 1990 Urban Areas

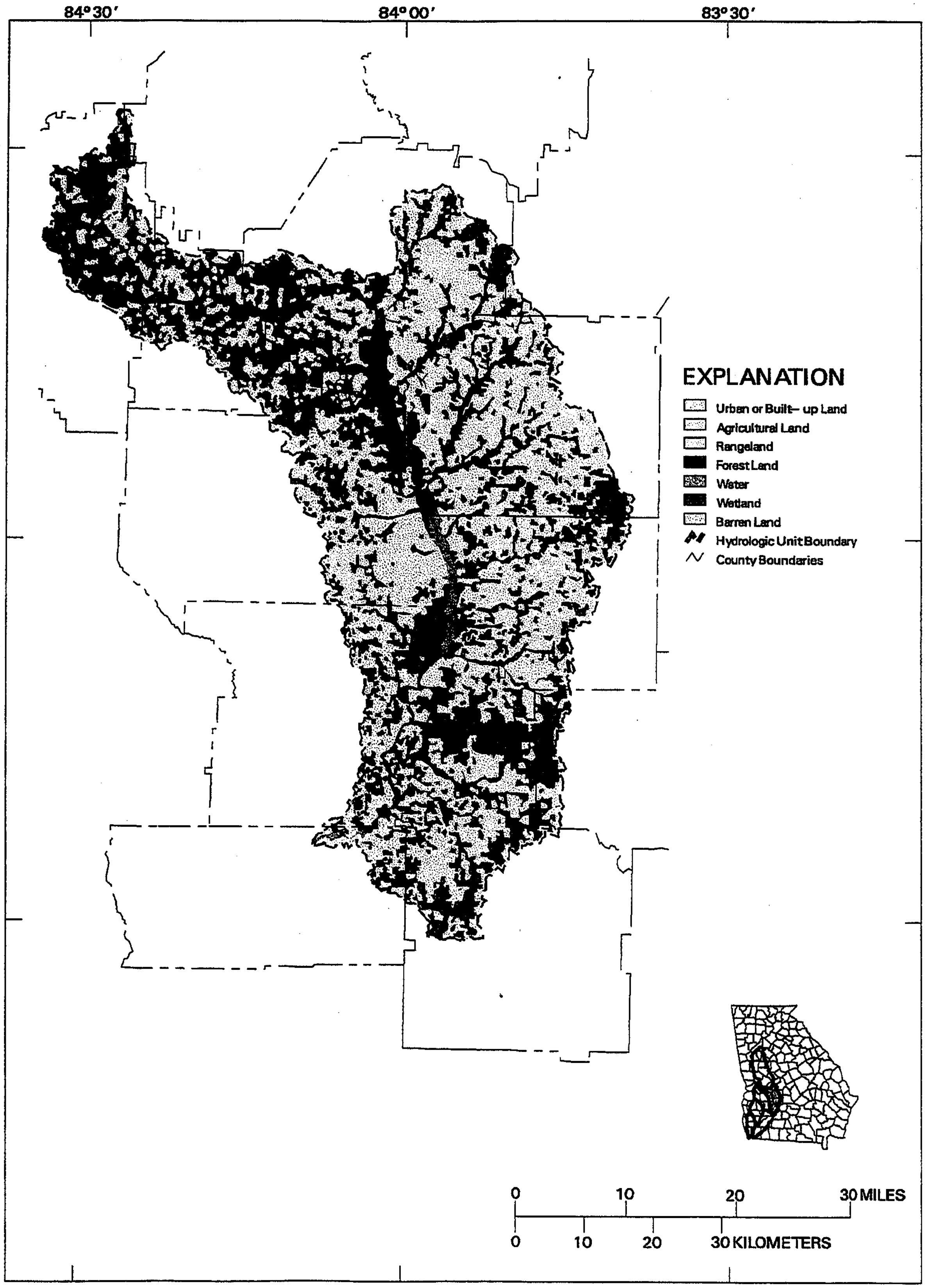


Figure 2-15. Land Use, Middle Flint River Basin, HUC 03130006, USGS 1972-76 Classification Updated with 1990 Urban Areas

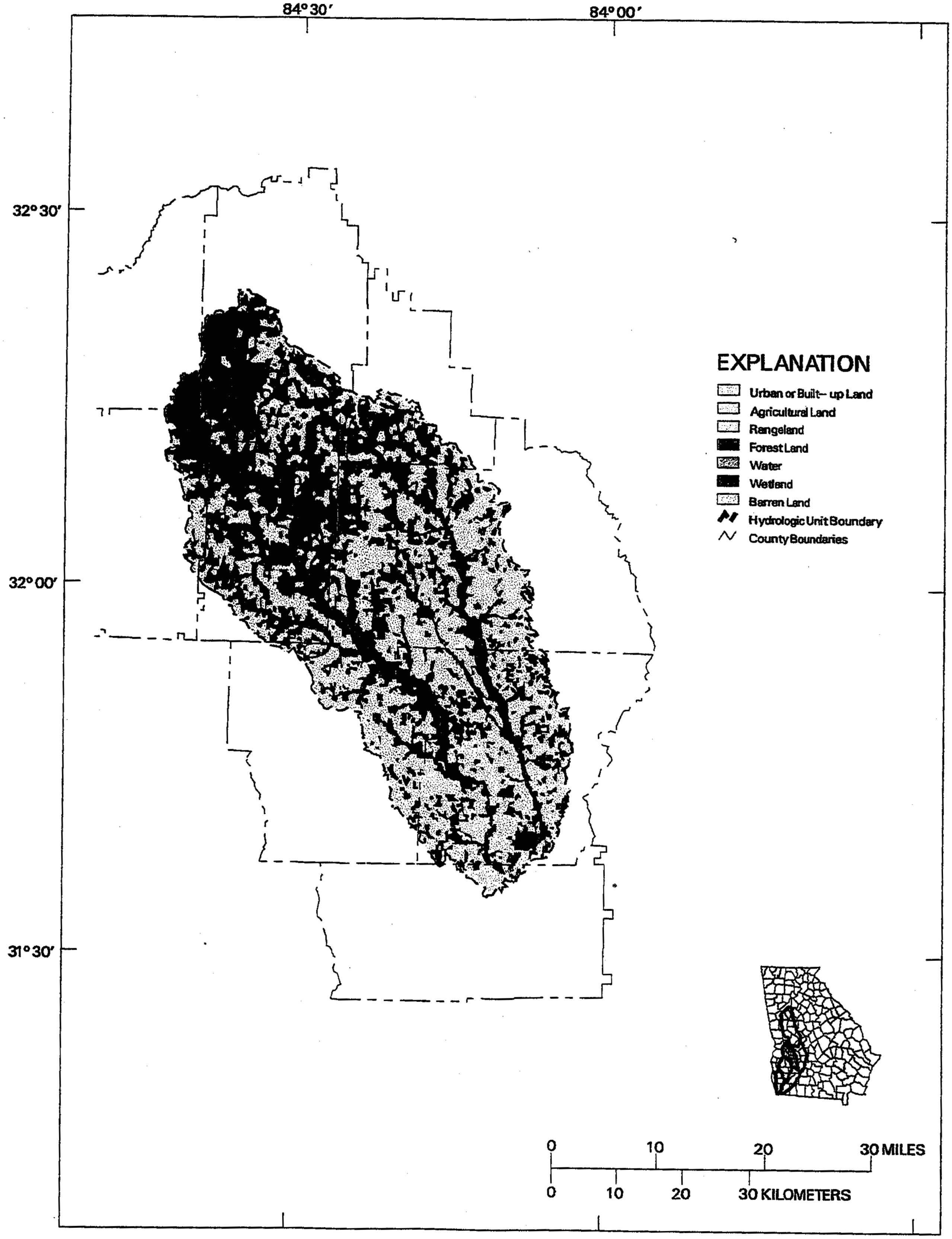


Figure 2-16. Land Use, Kinchafoonee-Muckalee Creeks, HUC 03130007, USGS 1972-76 Classification Updated with 1990 Urban Areas Basin

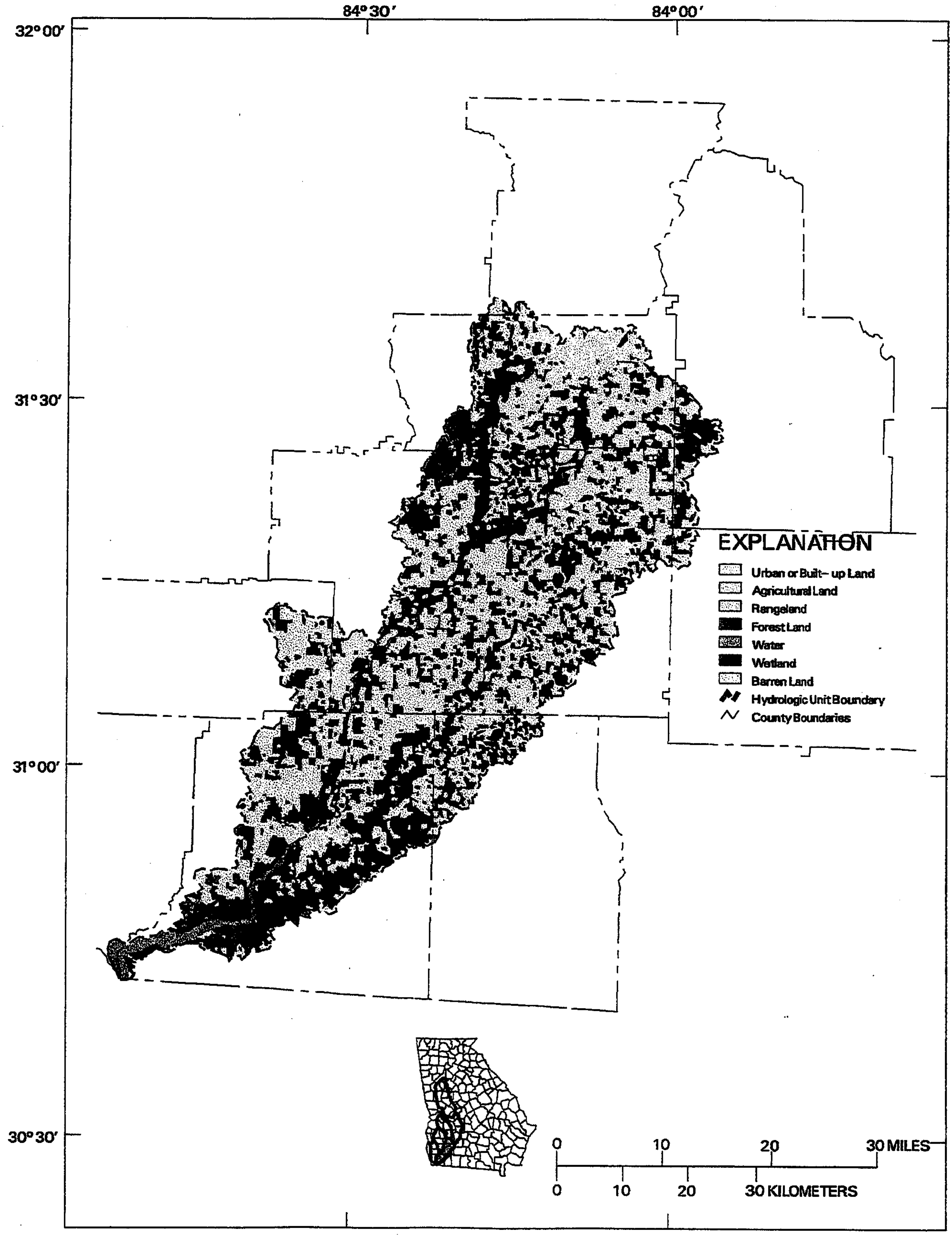


Figure 2-17. Land Use, Lower Flint River Basin, HUC 03130008, USGS 1972-76 Classification Updated with 1990 Urban Areas

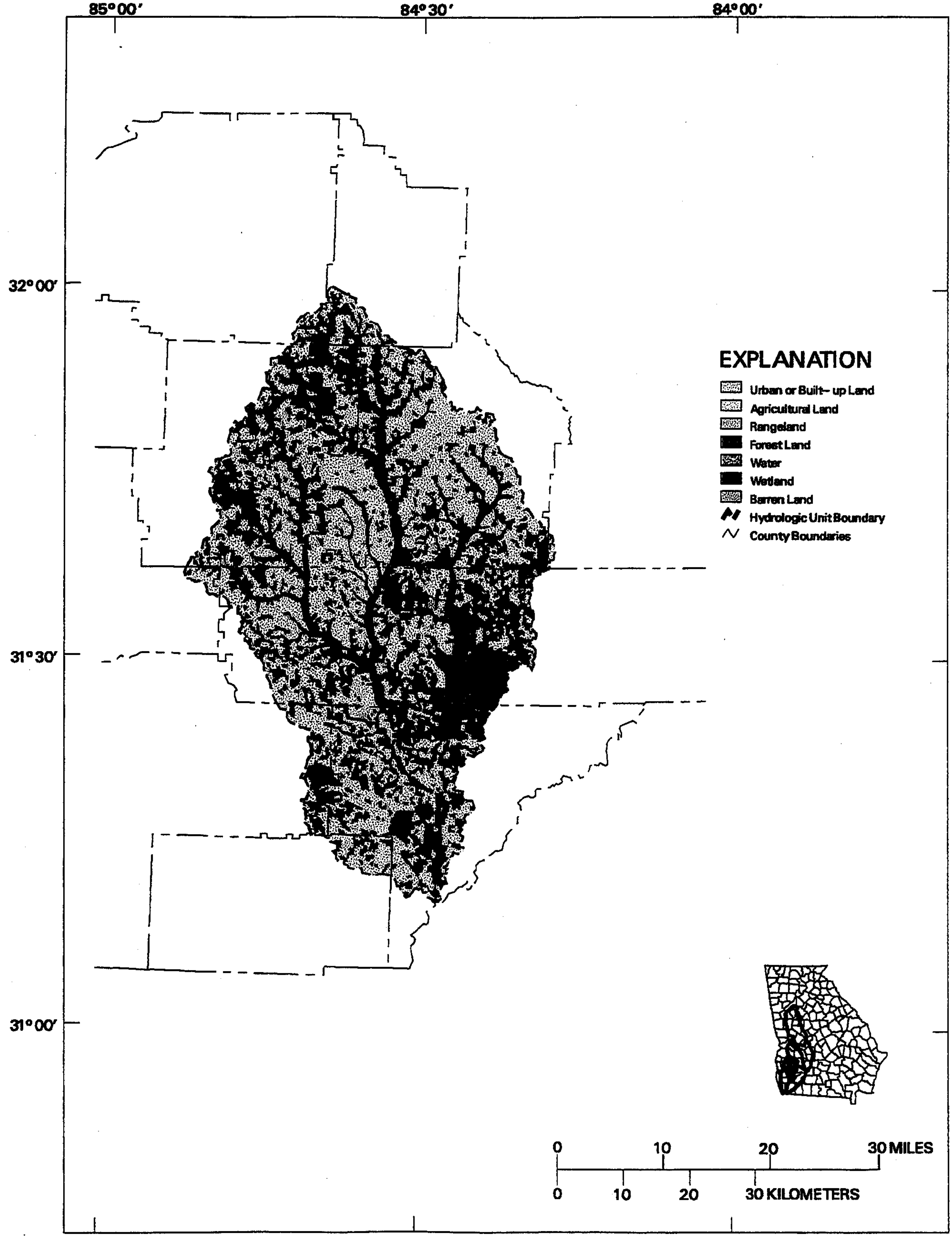


Figure 2-18. Land Use, Ichawaynochaway Creek Basin, HUC 03130009, USGS 1972-76 Classification Updated with 1990 Urban Areas

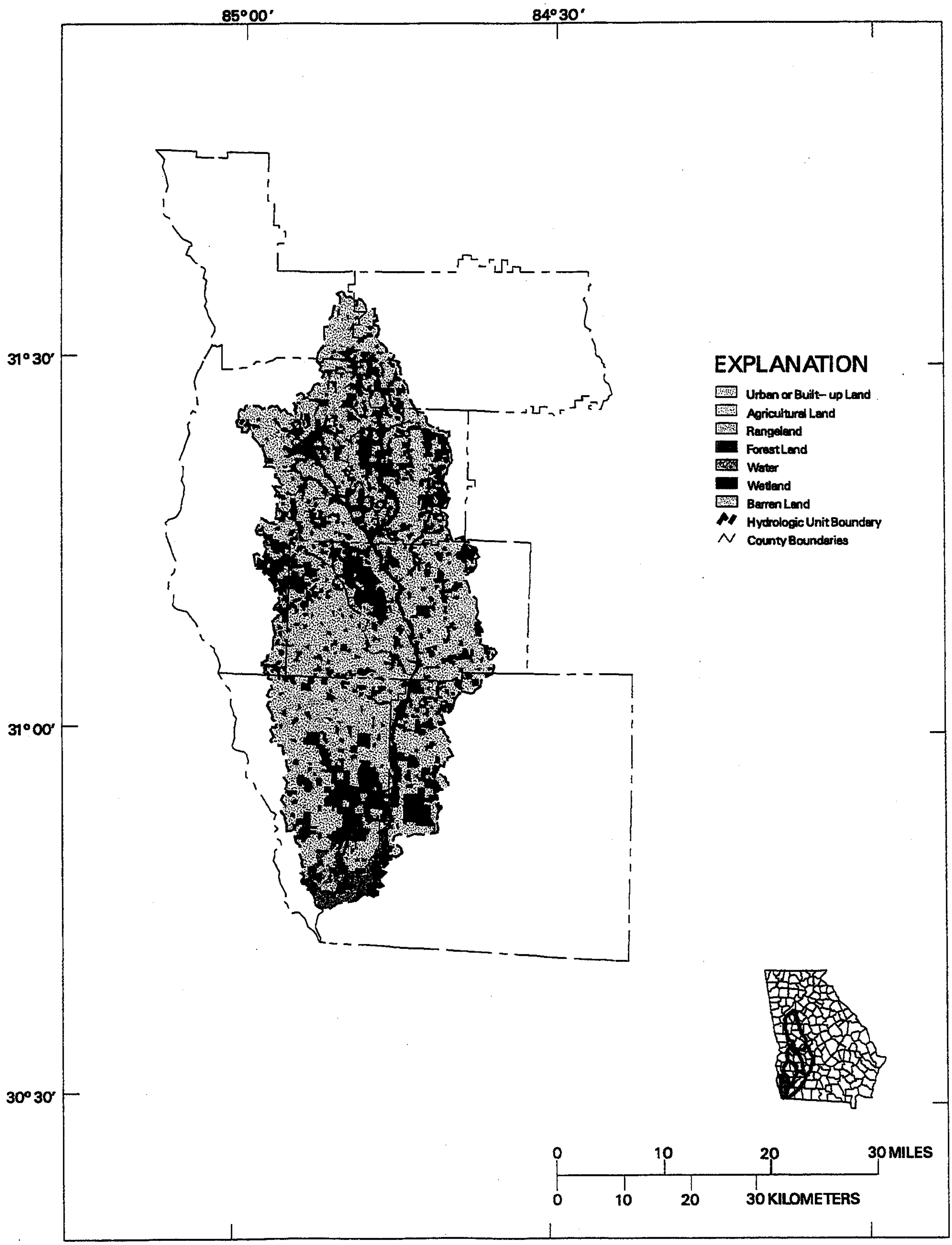


Figure 2-19. Land Use, Spring Creek Basin, HUC 03130010, USGa 1972-76 Classification Updated with 1990 Urban Areas

The 1991 land cover interpretation showed 50% of the basin in forest cover, 7.1 % in wetlands, 1.4 % in urban land cover, and 40% in agriculture (Figures 2-20 through 2-25). Statistics for 15 landcover classes in the Flint basin are presented in Table 2-5.

Forestry

The Flint River Basin contains approximately 3.6 million acres of commercial forest land according to the U.S. Forest Service's Forest Statistics for Georgia, 1989 report. This represents about 55 percent of the total land area in the basin. (Note that these U.S. Forest Service statistics include data for entire counties instead of exact watershed boundaries, which leads to some inconsistency with figures based on the land use and land cover assessments previously described.) Private landowners account for 81 percent of the ownership, while the forest industry companies account for 18 percent. Governmental entities account for about 1 percent of the forest land. The basin's forest cover consists chiefly of second-growth hardwoods and natural pine. The silvicultural land use is concentrated in the upper half of the Flint basin, above and below the Fall Line (Figure 2-26).

Timber is the leading cash crop in the Flint 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 1996 grew to approximately $ 17.3 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 $ 7.9 billion dollars. Georgians are benefitted directly by 177,000 job opportunities created by the manufacture of paper, lumber, furniture and various other wood products as well as benefitting 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.

Since 1982, there has been a statewide trend of loss of forest acreage, resulting from both conversion to urban and related uses and clearing for agricultural uses. Within the Flint basin itself, commercial forest land has actually increased by 108,622 acres over this same period. Since 1982 the area classified as pine type (plantation and natural) has increased 47,356 acres (3 percent) from 1,520,196 acres to 1,567,552 acres, of which 731,231 acres are plantation pine and 836,321 acres are natural pine stands. The area classified as oak-pine type increased 30,131 acres (7.6 percent) from 394,578 acres to 424,709 acres. Upland hardwood acreage increased 41,776 acres (4 percent) from 1,027,079 acres to 1,068,855 acres. Bottomland hardwood acres decreased 10,641 acres (1.6 percent) from 645,799 acres to 635,158 acres.

A comparison of the 1989 net annual growth versus net annual removals by species in the basin shows that removals of pine exceeds growth by 130 percent and removals of hardwoods exceeds growth by 103 percent.

Agriculture

Agricultural operations in the basin include poultry production, milk production, and beef production, along with crop, orchard, and vegetable production. Figure 2-27 displays the percent of counties in farmland in the Flint River Basin. The Coastal Plain Province (south of Cordele) is the predominant agricultural region of the Flint basin, containing over half of the

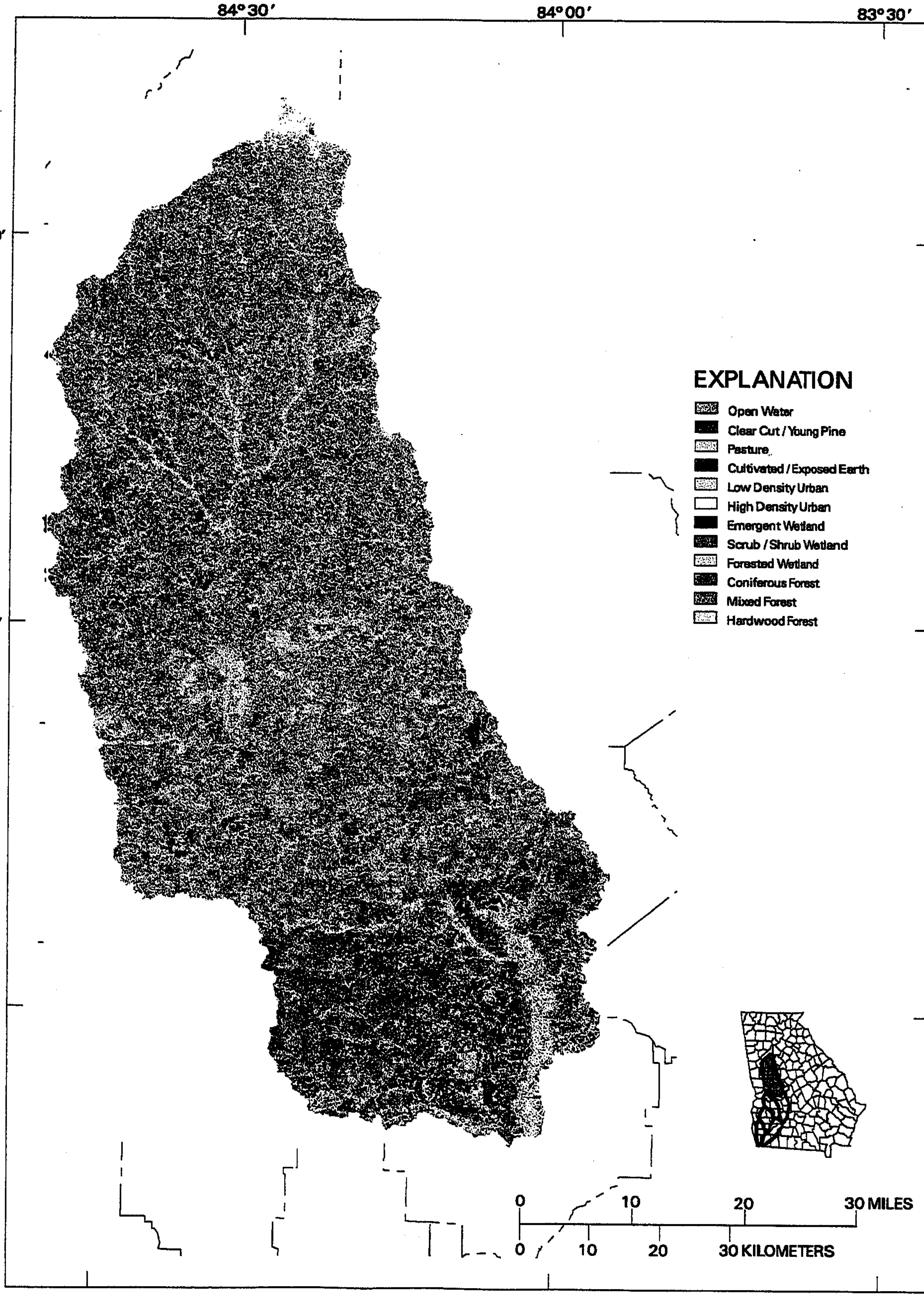


Figure 2-20. Land Cover 1990, Upper Flint River Basin, HUC 03130005

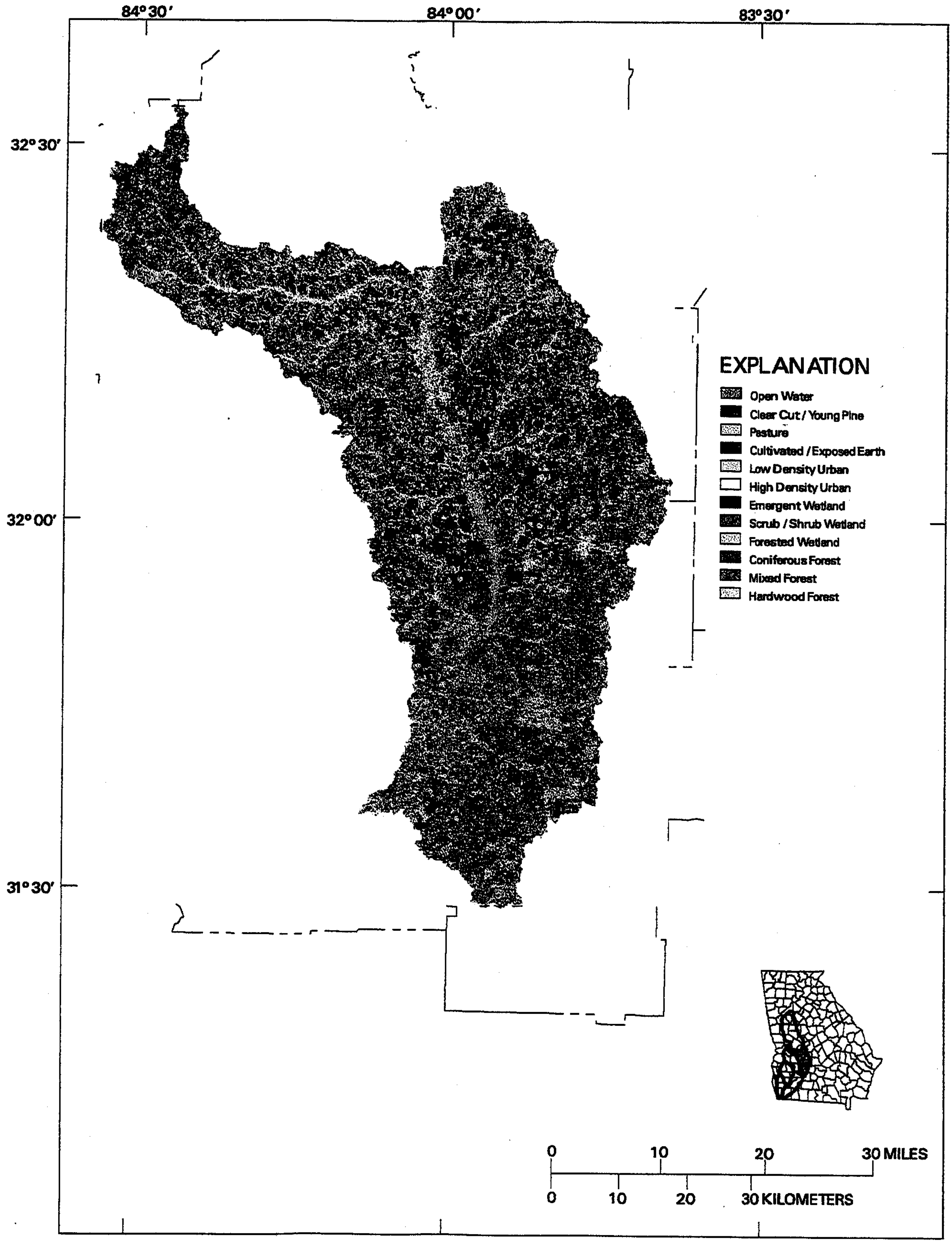
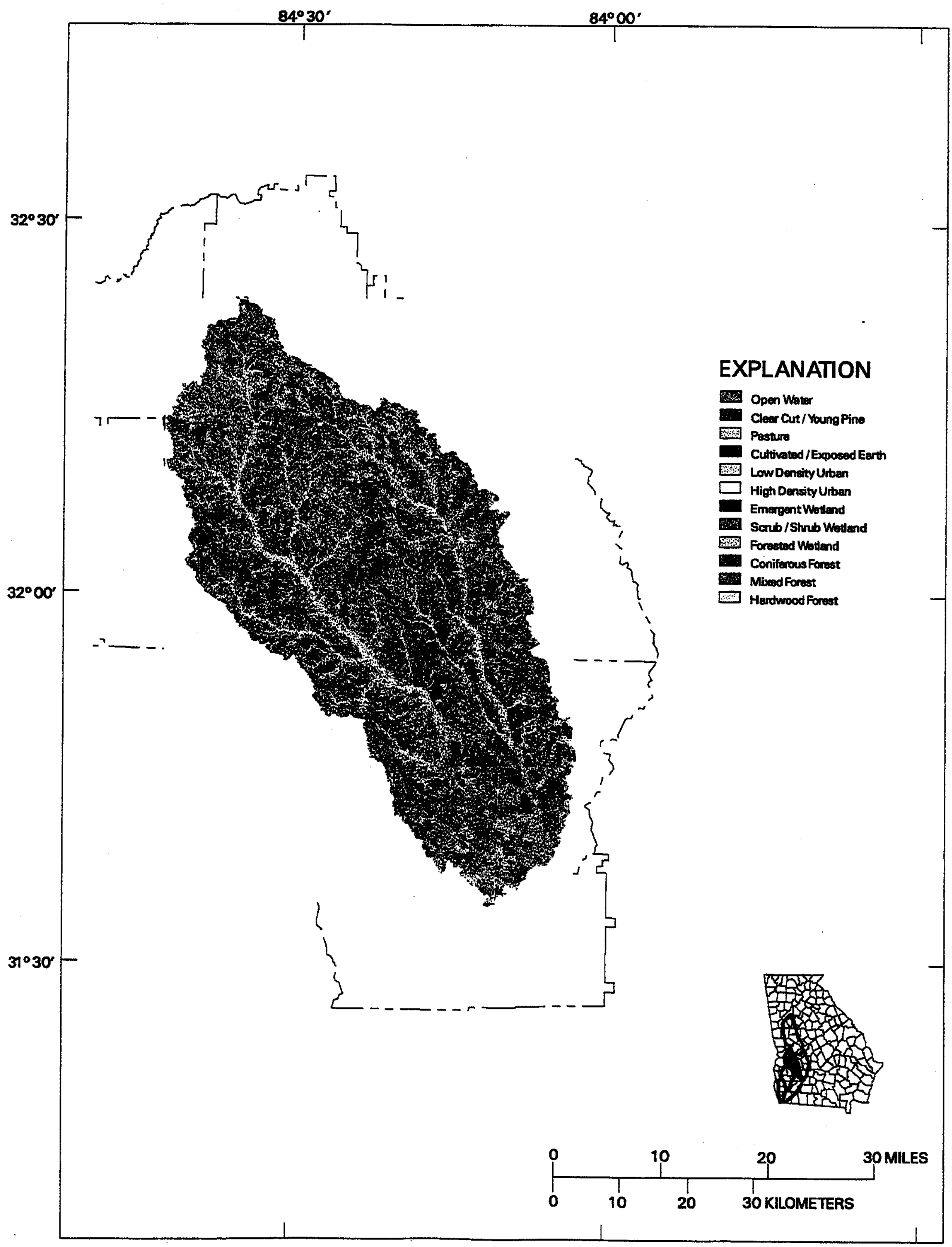


Figure 2-21. Land Cover 1990, Middle Flint River Basin, HUC 03130006



Flint 2-22. Land Cover 1990, Kinchafoonee-Muckalee Creeks Basin, HUC 03130007

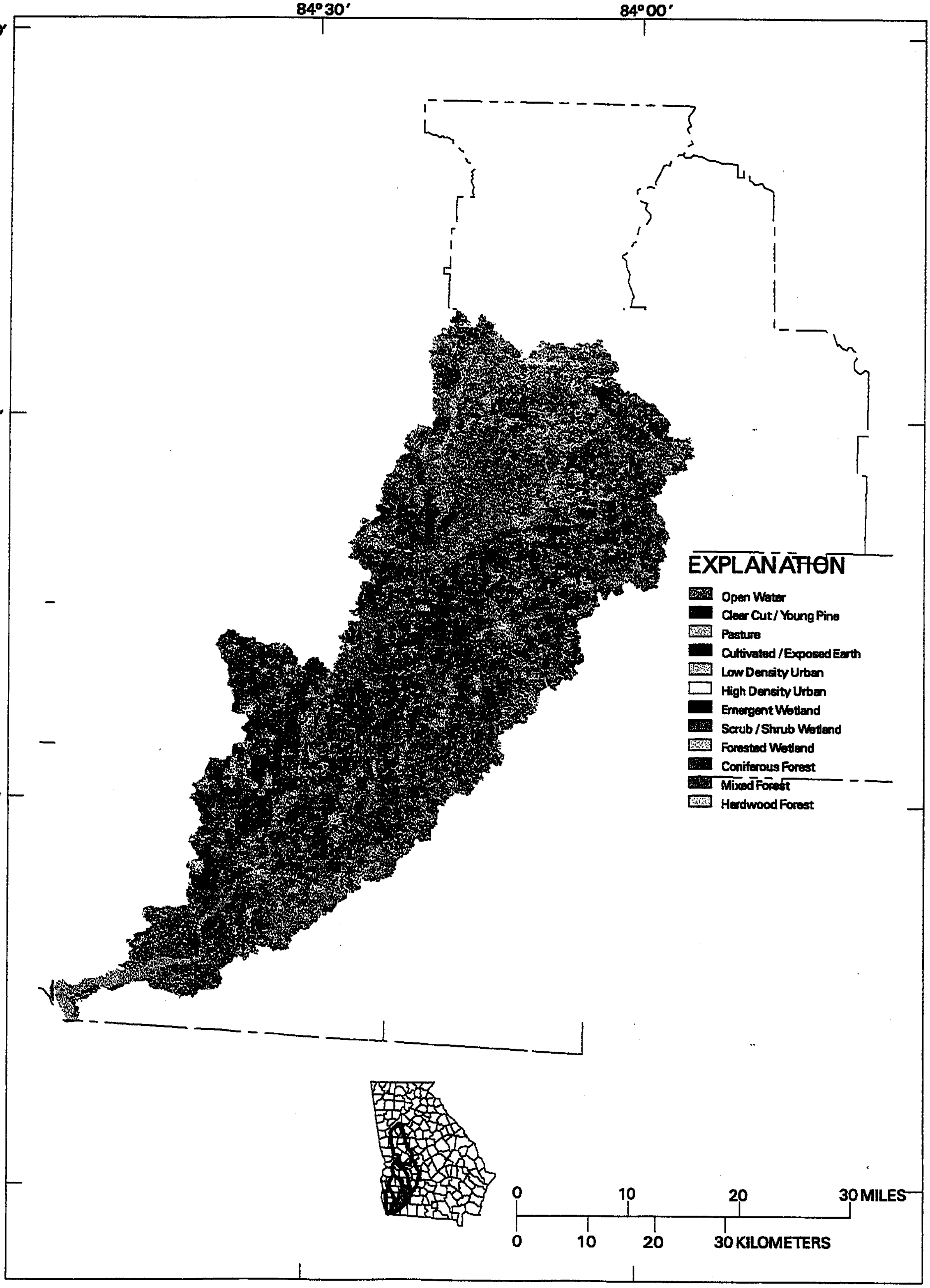


Figure 2-23. Land Cover 1990, Kinchafoonee-Muckalee Creeks Basin, HUC 03130008

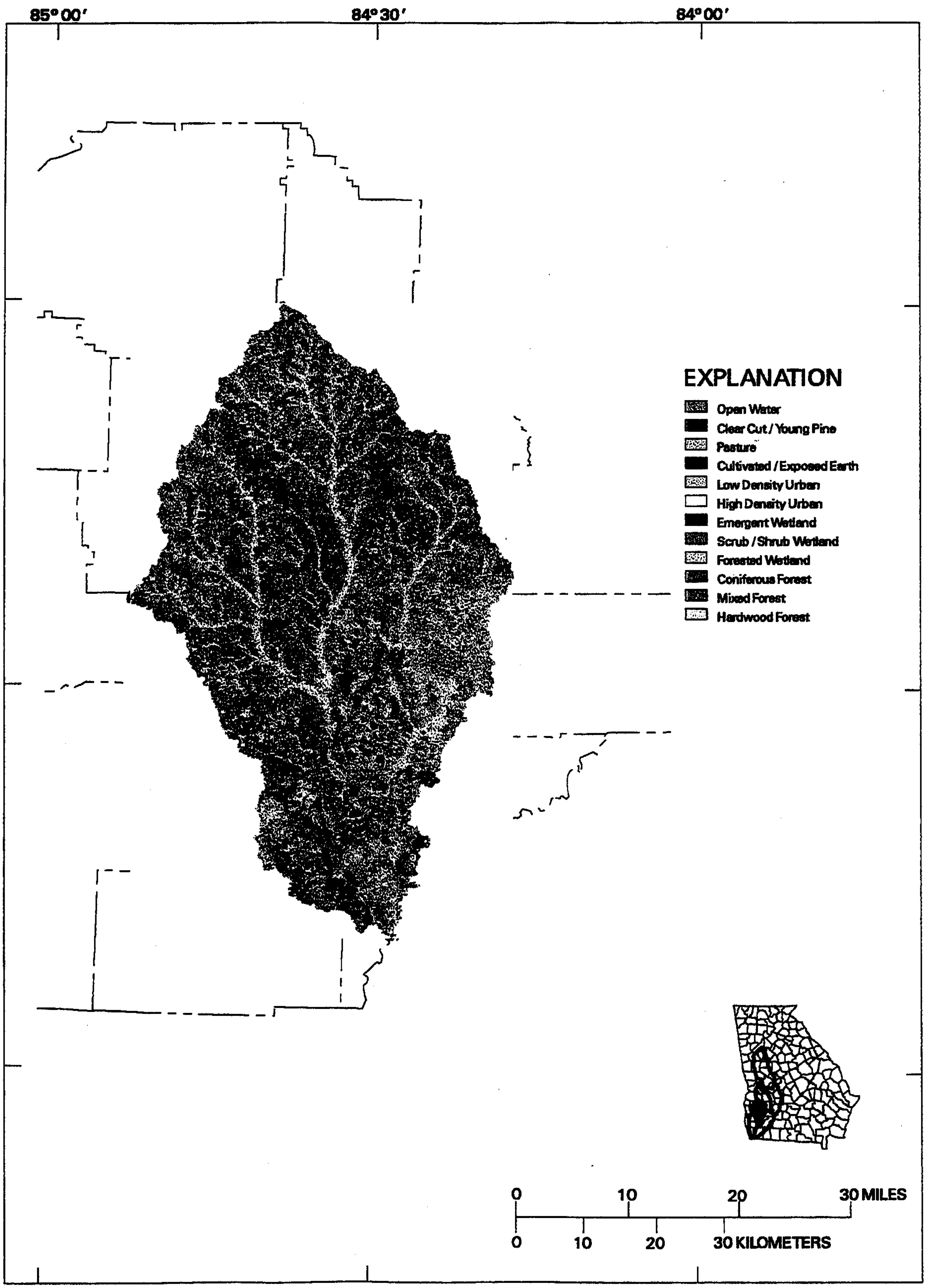


Figure 2-24. Land Cover 1990, Ichawaynochaway Creek Basin, HUC 03130009

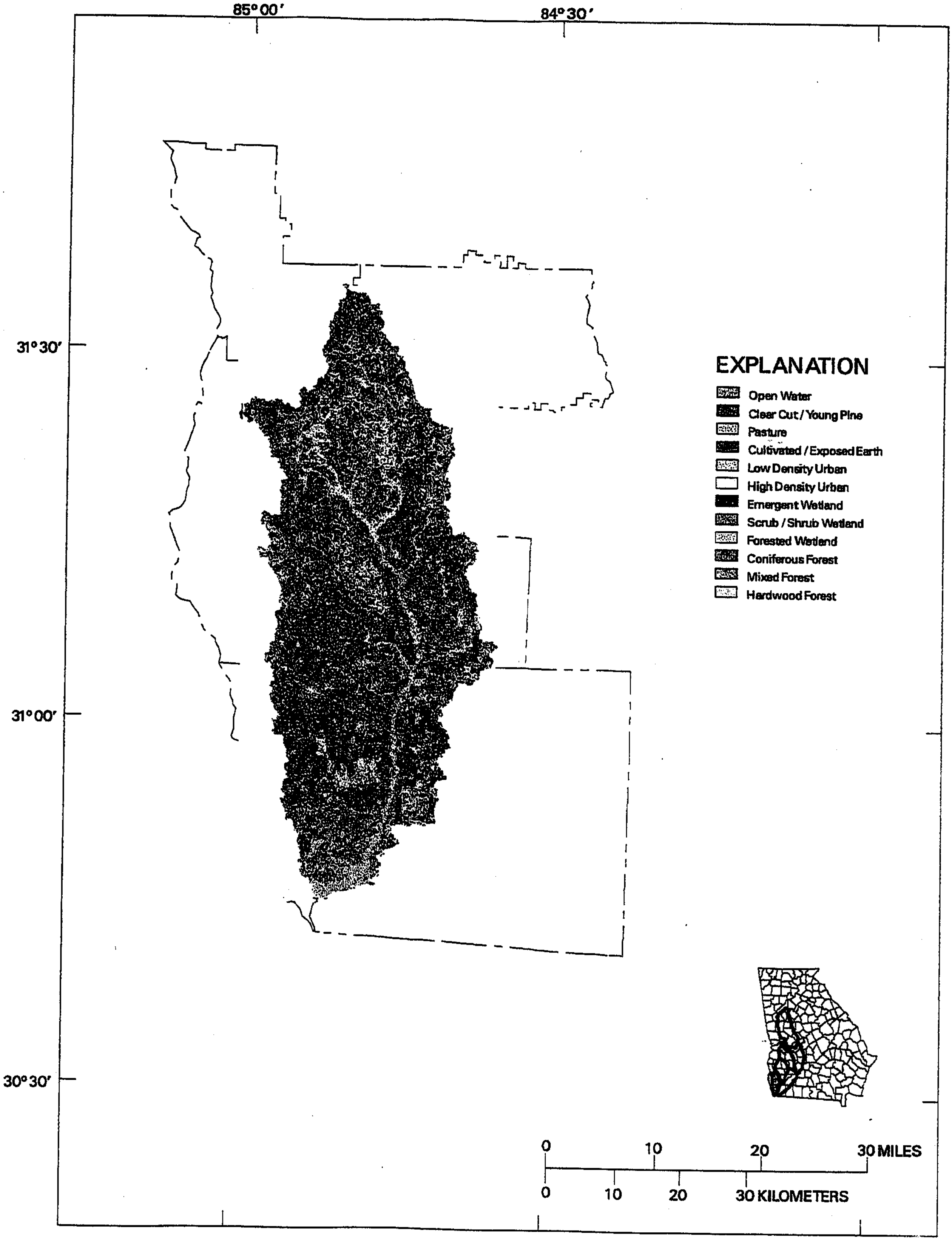


Figure 2-25. Land Cover 1990, Spring Creek Basin, HUC 03130010

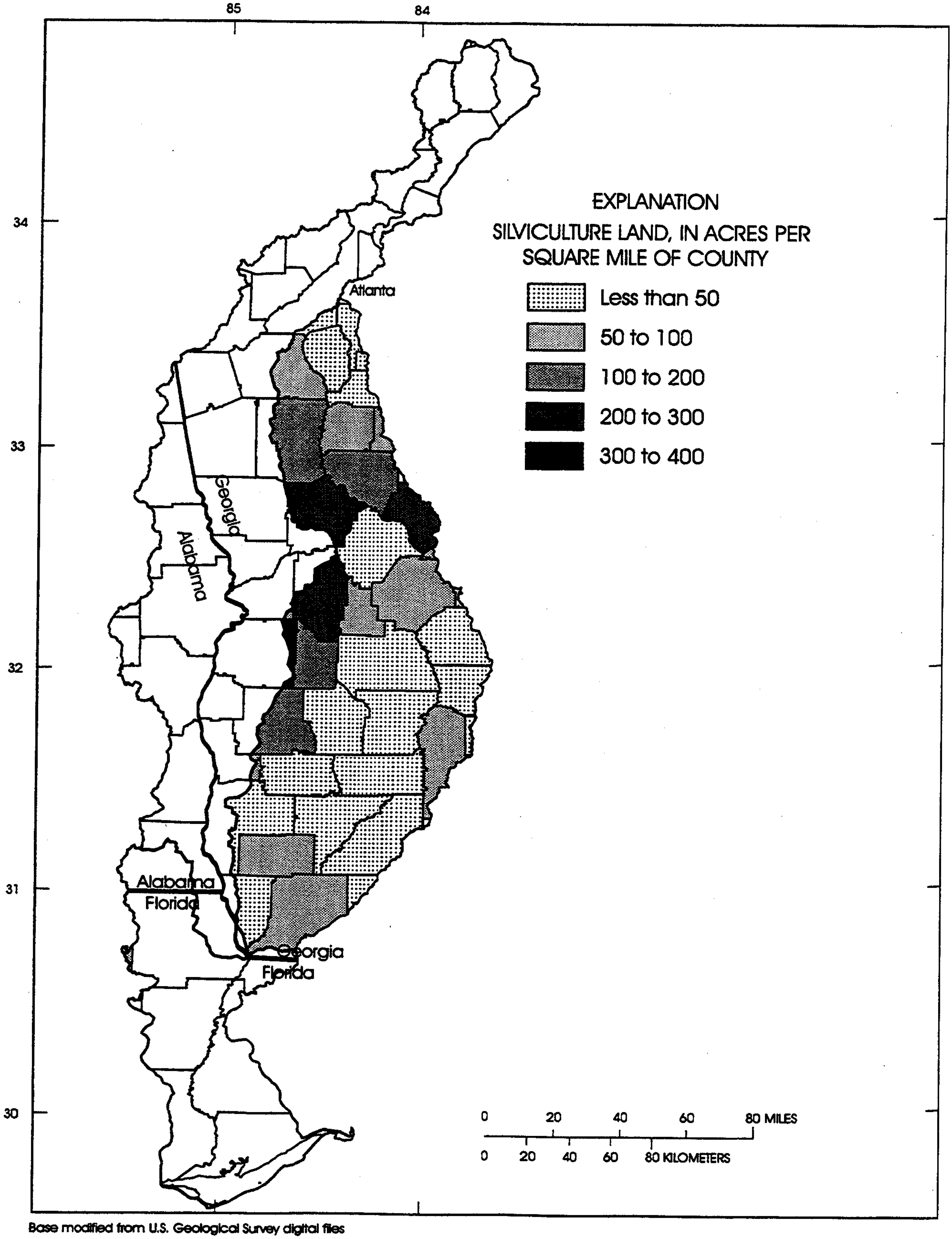
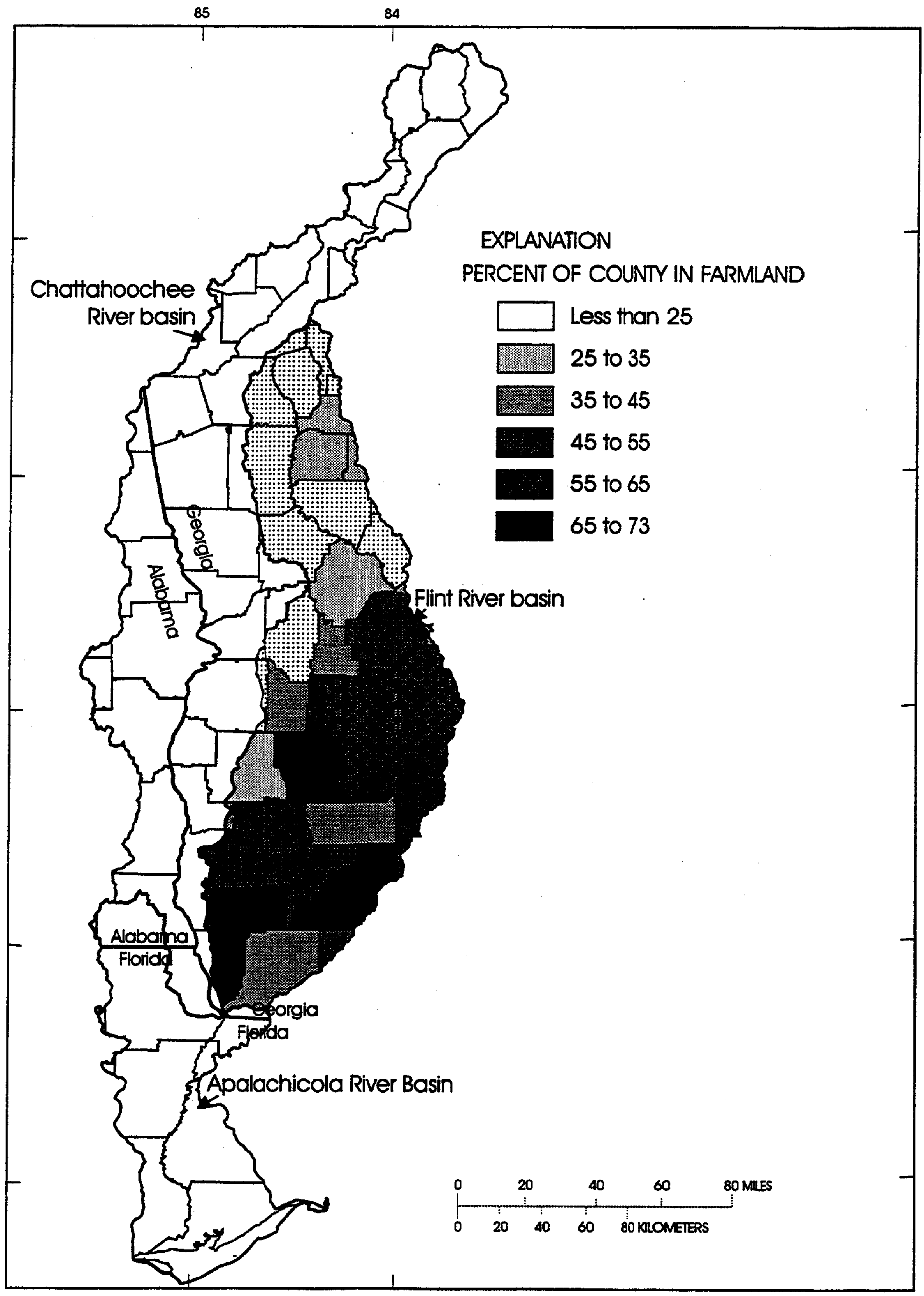


Figure 2-26. Silvicultural Land in the Flint River Basin (modified from Couch et al, 1996)



Base modified from U.S. Geological Survey digital files

Figure 2-27. Agricultural Land in the Flint River Basin (modified from Couch et al., 1996)

Table 2-5. Land Cover Statistics for the Flint River Basin

Class Name	Percent %	Acres
Open Water	1.5	81,067.4
Clear Cut/Young Pine	7.1	383,525.9
Pasture	13.7	745,054.5
Cultivated/Exposed Earth	26.3	1,423,399.0
Low Density Urban	1.0	55,524.6
High Density Urban	0.4	23,392.2
Emergent Wetland	0.5	26,264.6
Scrub/Shrub Wetland	0.6	31,061.7
Forested Wetland	6.6	355,039.1
Coniferous Forest	12.2	662,356.3
Mixed Forest	15.1	817,954.7
Hardwood Forest	15.1	818,097.9
Salt Marsh	0.00	0.00
Brackish Marsh	0.00	0.00
Tidal Flats/Beaches	0.00	0.00
Total	**100.0**	**5,422,872.0**

total acres devoted to harvestable commodities and 70 percent of the irrigated acreage. Row crops and orchards dominate agricultural land use in the Coastal Plain Province. The dominant agricultural land uses in the Piedmont Province are pasture and confined feeding for poultry and livestock production, and hay production.

In 1991, approximately 32 million broiler chickens, 248 thousand cattle, and 125 thousand swine were produced in the basin (see Table 2-6). Approximately 1.3 million acres, about 24 percent of the total land area of the Flint River Basin, are devoted to the production of crops, orchards, forages, nursery, and turf.

Crops with the largest harvested acreage include peanuts, corn, soybeans, and cotton. Other important crops include wheat, hay, vegetables, and tobacco. In 1987, 80,000 acres were planted in orchards. The orchard crop with most acres is pecans. Peaches are also grown in the basin. The ranking of harvested acres among these crops varies from year to year in response to market conditions, government subsidy programs, and weather.

2.3 *Local Governments and Jurisdictions*

Many aspects of basin management and water quality depend on decisions regarding zoning, land use, and land management practices. These are particularly important for the control of nonpoint pollution — pollution which arises in stormwater runoff from agriculture, development, and other land uses. The authority and responsibility for planning and control of these factors lies primarily 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. Responsibilities include promulgation of minimum standards for preparation

Table 2-6. Agricultural Operations in the Flint River Basin, 1987-1991

Element	HUC 03130005	HUC 03130006	HUC 03130007	HUC 03130008	HUC 03130009	HUC 03130010	Total for Basin
Dairy Cows	9,043	9,254	6,649	4,032	330	0	29,308
Beef Cows	67,957	26,065	24,393	38,027	27,864	34,671	218,977
Hogs	11,864	28,529	14,370	35,349	17,078	17,333	124,523
Layer Hens	90,000	2,000	0	333	0	1,667	94,000
Broilers (millions)	10.553	9.946	9.850	0.450	1.265	0	32.065
Turkeys	83,333	0	0	0	0	0	83,333
Row Crops (acres)	96,436	295,047	127,138	192,802	189,360	156,941	1,057,724
Orchard (acres)	8,754	15,797	9,193	29,531	6,650	1,623	71,548
Hay (acres)	60,993	14,365	14,964	24,021	16,974	18,686	150,003
Total Agriculture (acres)	353,381	449,589	254,021	349,707	304,118	269,214	1,980,030

(data supplied by NRCS)

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, 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 include enacting and enforcing zoning, stormwater and development ordinances; undertaking water supply and wastewater treatment planning; and participating in programs to protect wellheads and significant groundwater recharge areas.

The Flint Basin includes part or all of 42 Georgia counties (Table 2-7 and Figure 2-2); however, only ten counties are entirely within the basin, and six counties have an insignificant fraction of their land area within the basin. There are thus a total of 36 counties with significant jurisdictional authority in the basin.

Municipalities or cities are communities officially incorporated by the General Assembly. Georgia has over 530 municipalities. Table 2-8 lists the municipalities in the basin.

2.3.2 Regional Development Centers

Regional Development Centers are agencies of local governments, with memberships consisting of all the cities and counties within each RDC's territorial area. There are currently 17 RDCs in Georgia. RDCs facilitate coordinated and comprehensive planning at local and regional levels, assist their member governments with conformity with 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

Table 2-7. Georgia Counties in the Flint River Basin

Counties Entirely within the Flint Basin	Counties Partially within the Flint Basin		Counties with Insignificant Area within the Basin
Baker	Clay	Meriwether	Chattahoochee
Calhoun	Clayton	Mitchell	Colquitt
Dougherty	Coweta	Peach	Harris
Fayette	Crawford	Randolph	Henry
Lee	Crisp	Seminole	Houston
Miller	Decatur	Spalding	Monroe
Pike	Dooly	Stewart	
Schley	Early	Talbot	
Sumter	Fulton	Taylor	
Terrell	Grady	Turner	
	Lamar	Upson	
	Macon	Webster	
	Marion	Worth	

and federal agencies for local governments in each region. Funding sources include members' dues and funds available through DCA.

RDCs including counties within the Flint basin are summarized in Table 2-9.

Table 2-8. Georgia Municipalities in the Flint River Basin

Albany	Concord	Lake City	Riverdale
Aldora	Cordele	Leesburg	Roberta
Americus	Culloden	Leslie	Sasser
Andersonville	Cuthbert	Luthersville	Senoia
Arabi	Damascus	Manchester	Shellman
Arlington	Dawson	Marshallville	Smithville
Attapulgus	Donalsonville	Meansville	Talbotton
Baconton	Edison	Montezuma	Thomaston
Bainbridge	Ellaville	Morgan	Turin
Barnesville	Fayetteville	Morrow	Tyrone
Brinson	Forest Park	Newton	Union City
Bronwood	Gay	Oglethorpe	Vienna
Brooks	Greenville	Parrott	Warm Springs
Butler	Griffin	Peachtree City	Warwick
Buena Vista	Hapeville	Pelham	Williamson
Byromville	Ideal	Pinehurst	Woodbury
Camilla	Iron City	Plains	Woodland
College Park	Jonesboro	Preston	Woosley
Colquitt	Junction City	Reynolds	Zebulon

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 EPD. Georgia was again one of the first states to receive federal approval of a statewide system of water use classifications and standards. Table 2-10 provides a summary of water use classifications and criteria for each use.

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 fishing, recreation, drinking water, wild river, scenic river, or coastal fishing.

Congress made changes to the Clean Water Act 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.

Table 2-9. Regional Development Centers in the Flint River Basin

Regional Development Center	Member Counties with Land Area in the Flint Basin
Atlanta Regional Commission	Fulton, Clayton, Fayette, Henry
Chattahoochee Flint RDC	Coweta, Meriwether
McIntosh Trail RDC	Spalding, Pike, Lamar, Upson
Middle Georgia RDC	Crawford, Peach, Monroe, Houston
Lower Chattahoochee RDC	Chattahoochee, Clay, Harris, Randolph, Stewart, Talbot
Middle Flint RDC	Marion, Taylor, Macon, Schley, Dooly, Crisp, Sumter, Webster
Southwest Georgia RDC	Early, Seminole, Terrell, Lee, Worth, Calhoun, Dougherty, Baker, Mitchell, Miller, Decatur, Grady, Colquit
South Georgia RDC*	Turner

* The South Georgia RDC has an insignificant portion of its area within the Flint basin.

Table 2-10. Georgia Water Use Classifications and Instream Water Quality Standards for Each Use

Use Classification[1]	Bacteria (fecal coliform)		Dissolved Oxygen (other than trout streams)[2]		pH	Temperature (other than trout streams)[2]	
	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 Coastal Fishing[4]	1,000 (Nov-April) 200 (May-October)	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] 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.

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.

2.4.2 Water Use Classifications for the Flint River Basin

All of the waters within the Flint basin are classified as fishing, drinking water, or recreation. The majority of the waters are classified as fishing. Table 2-11 lists those waters which are classified as drinking water or recreation.

Table 2-11. Waters in the Flint River Basin Classified as Drinking Water or Recreation

Waterbody	Description of Segment	Use Classification
Flint River	Woolsey Road (Fayette and Clayton Counties) to Georgia Hwy. 16	Drinking Water
Flint River	Georgia Hwy. 27 to Flint River Dam at Lake Worth, Albany (includes both Lake Blackshear and Lake Worth)	Recreation
Flint River	Bainbridge, U.S. Hwy. 84 Bridge to Jim Woodruff Dam, Lake Seminole	Recreation

References

Cocker, M.D., in review, Stream sediment geochemistry, stream hydrogeochemistry, lithogeochemistry and geology of the Flint River Basin, Georgia: Georgia Geologic Survey Bulletin 129.

Couch, C.A., E.H. Hopkins, and P.S. Hardy. 1996. Influences of Environmental Settings on Aquatic Ecosystems in the Apalachicola-Chattahoochee-Flint River Basin. Water-Resources Investigations Report 95-4278. U.S. Geological Survey, Atlanta, GA.

Cowardin, L.M., Carter, V., Golet, F.C., and LaRoe, E.T., 1979, Classification of wetlands and deepwater habitats of the United States: U.S. Fish and Wildlife Service, FWS/OBS-79/31.

DRI/McGraw-Hill. 1996. The Regional Economic Forecast of Population and Employment Comprehensive Study. Prepared for: The ACT/ACF Comprehensive Study, U.S. Army Corps of Engineers, Mobile District. DRI/McGraw-Hill, Lexington, MA.

EPD. 1996. Water Quality in Georgia, 1994-1995. Georgia Department of Natural Resources, Environmental Protection Division, Atlanta, GA.

Gebert, W.A., Gracyzk, D.J., and Krug, W.R., 1987, Average annual runoff in the United States, 1951-80: U.S. Gelogical Survey Hydrologic Investigations Atlas HA-710.

Heard, W.H., 1977, Freshwater mollusca of the Apalachicola drainage in Proceedings of the Conference on the Apalachicola Drainage System, April 23-24, 1976, Gainesville, Fla., Livingston, R.J., and Joyce, E.A., Jr. [eds]: Florida Department of Natural Resources, Marine Research Laboratory, Florida Marine Research Publication, v. 26, p. 37-67.

Hobbs, H.H., Jr., 1981, The crayfishes of Georgia: Smithsonian Contributions to Zoology, no. 318.

Martof, B.S., 1956, Amphibians and reptiles of Georgia: Athens, Ga., University of Georgia, Department of Zoology.

Maslia, M.L, and Hayes, L.R., 1988, Hydrogeology and simulated effects of ground-water development of the Floridan aquifer system, southwest Georgia, northwest Florida, and southernmost Alabama, U.S. Geological Survey Professional Paper 1403-H.

Means, D.B., 1977, Aspects of the significance to terrestrial vertebrates of the Apalachicola River drainage basin, Florida in Proceedings of the Conference on the Apalachicola Drainage System, Livingston, R.J., and Joyce, E.A., Jr. [eds.]: Florida Marine Resources, no. 26, p. 37-67.

Omernik, J.M., 1987, Ecoregions of the conterminous United States: Annals of the Association of American Geographers, v. 77, p. 118-125.

Torak, L.J., Davis, G.D., Herndon, J.G., and Strain, G.A., 1991, Geohydrology and evaluation of water-resource potential of the Upper Floridan aquifer in the Albany area, southwestern Georgia: U.S. Geological Survey Open-File Report 91-52.

U.S. Bureau of the Census, 1981c, Census of agriculture, 1978, Georgia state and county data: Washington, D.C., U.S. Department of Commerce, Bureau of the Census, part 10, v. 1, 698 p.

U.S. Bureau of the Census, 1989c, Census of agriculture, 1987, Georgia state and county data: Washington, D.C., U.S. Department of Commerce, Bureau of the Census, part 10, v. 1, 698 p.

U.S. Geological Survey, 1972-78, Land use and land cover digital data, 1972-78, Apalachicola, Atlanta, Dothan, Greenville, Macon, Phenix City, Rome, Tallahassee, and Waycross quadrangles, scale 1:250,000.

U.S. Geological Survey, 1986, Hydrologic events and surface-water resources in National Water Summary: U.S. Geological Survey Water-Supply Paper 2300.

Wharton, C.H., 1978, The natural environments of Georgia: Georgia Geologic Survey Bulletin 114.

Section 3

Water Quantity

Georgia historically has been blessed with an abundant supply of freshwater. However, population growth and economic development have led to competing demands for water in areas where water resources are limited.

This section addresses water quantity issues (availability and use), while water quality in the Flint basin is the subject of Section 4. Water use in the Flint River Basin is measured by estimates of freshwater withdrawn from ground and surface water sources, while water availability is assessed based on annual surface water flows and groundwater storage. Saline water is not used in the basin. Uses of water include both consumptive uses (in which the water is no longer available to the basin) and non-consumptive uses (in which the water is returned to the basin after use).

Surface water is the primary water source in the Piedmont Province of the Flint River Basin because groundwater yields from crystalline rock aquifers tend to be low. Within the Coastal Plain province, aquifer yields are higher and groundwater withdrawals are an important part of the total water budget. Although most public-supply withdrawals in the Piedmont Province are from surface-water sources, with the exception of counties near or immediately below the Fall Line, all public-supply water in the Coastal Plain comes from groundwater sources. The Floridan aquifer system supplied most of the ground water used in the basin in 1990, followed by the Claiborne, Clayton, crystalline-rock, and the Providence aquifer systems. As previously mentioned, the two sources of supply are not independent, because groundwater discharge to streams is important in maintaining dry-weather flow. Thus, withdrawal of ground water can, under certain conditions, also result in reduction in surface water flow.

Water use in the Flint basin is increasing, resulting in greater demands on what are essentially finite supplies. Total water withdrawals in the Apalachicola-Chattahoochee-Flint basin increased by 42 percent between 1970 and 1990 (Couch et al., 1996). During this period, total surface-water withdrawals increased by 29 percent; however, groundwater withdrawals increased by 240 percent.

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 groundwater supplies. Then, general surface water availability is presented, followed by ground water availability.

3.1 *Drinking Water Supply*

3.1.1 Drinking Water Sources

The Flint River Basin is the drinking water source for a majority of the Southwest Atlanta metro population including Clayton, Fayette and Coweta counties, as well as the city of Albany. Most surface water intakes are located on the headwaters and smaller tributaries of the Flint River. However, below Talbot County, the majority of the communities including Albany utilize ground water pumped from wells as a source of drinking water. The locations of surface water intakes within each of the six Hydrologic Units of the Flint River Basin are shown in Figures 3-1 through 3-6.

The Flint River Basin provides drinking water for about 554,100 people in the state of Georgia by municipal or privately owned public water systems. 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 systems sources include surface water pumped from rivers and creeks or ground water pumped to the surface from wells or naturally flowing from springs. There are three different types of public water systems: community, non-community non-transient, and non-community transient.

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. 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.

In the Flint River Basin there are approximately 16 community public water systems utilizing surface water and serving 317,545 people and 200 community public water systems utilizing ground water and serving approximately 236,127 people.

3.1.2 Drinking Water Demands

Drinking water demands are expected to increase due to the growth in the Atlanta Metro area including the subdivision communities in Clayton, Fayette and Coweta counties. Due to current and forecasted growth, many of the Atlanta Metro counties have adopted water conservation techniques, including ordinances for low flow household plumbing in new construction, limits on outside watering during the summer months, increased water rates to curb excess use, and public education. Demands on ground water are expected to increase in south Georgia especially in the Albany which is utilizing the Floridan, Claiborne, Clayton and Providence aquifer systems. Projections of drinking water demands are discussed in Section 3.2 and 3.3.

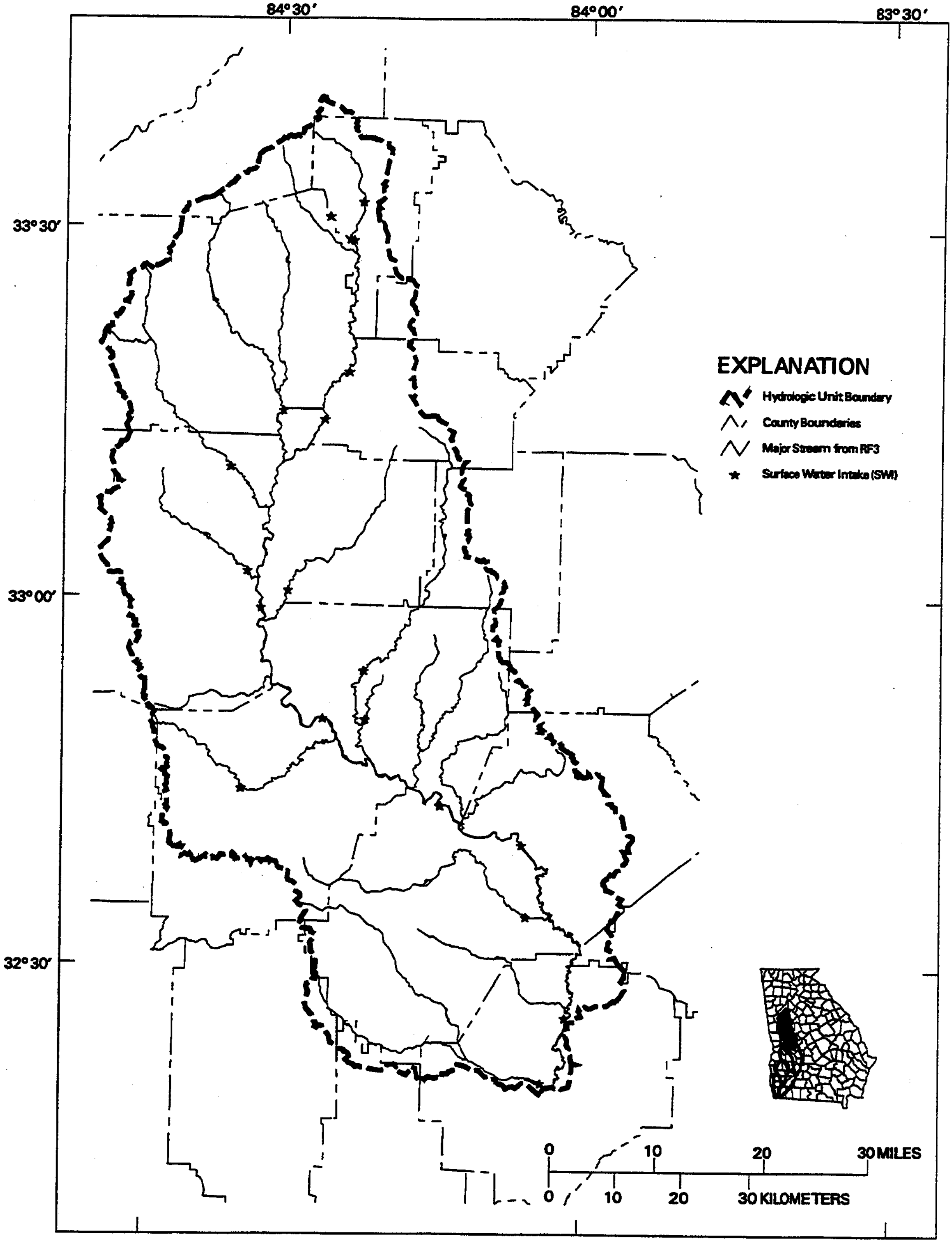


Figure 3.1. Surface Water Intakes, Upper Flint River Basin, HUC 03130005

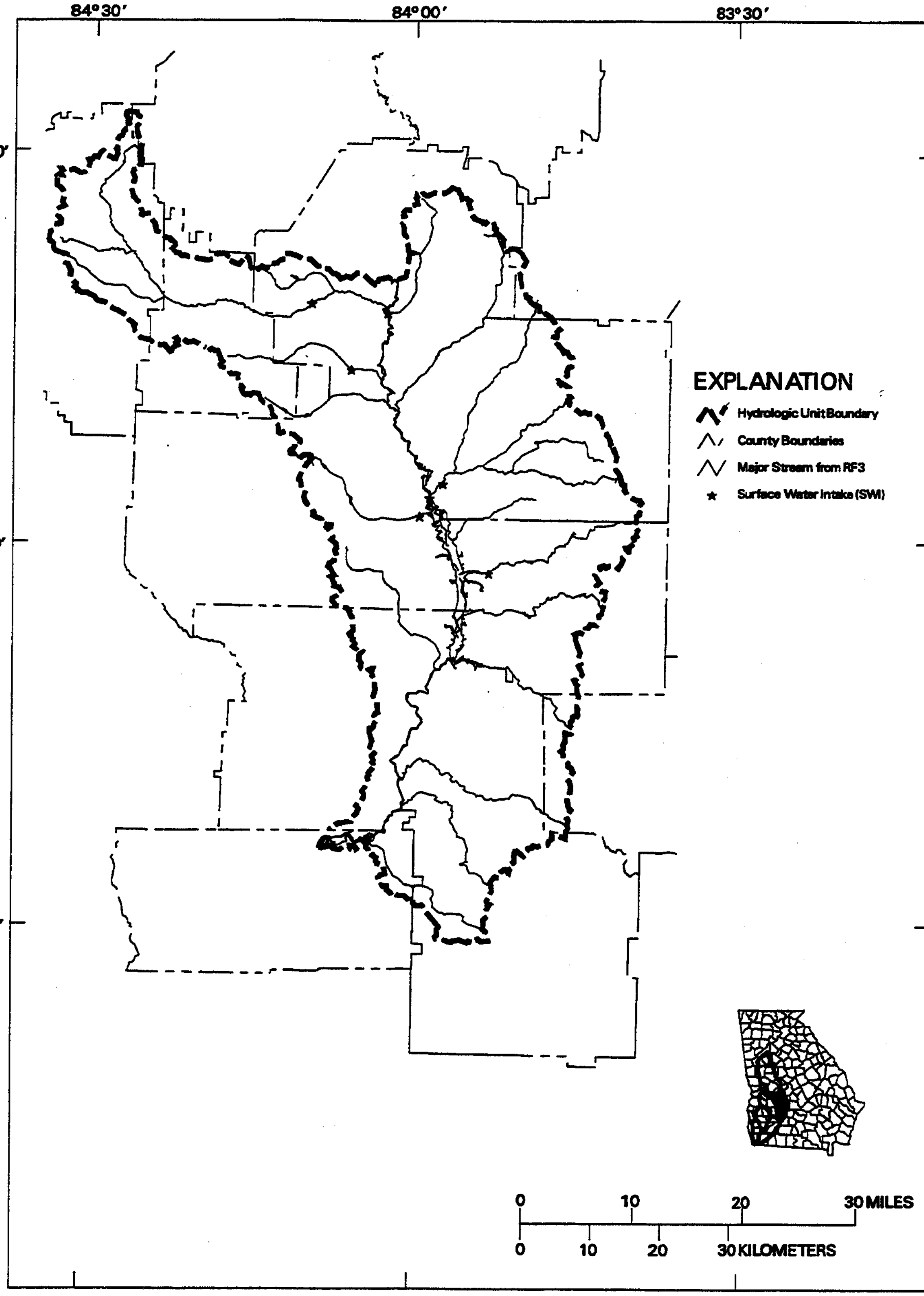


Figure 3-2. Surface Water Intakes, Middle Flint River Basin, HUC 03130006

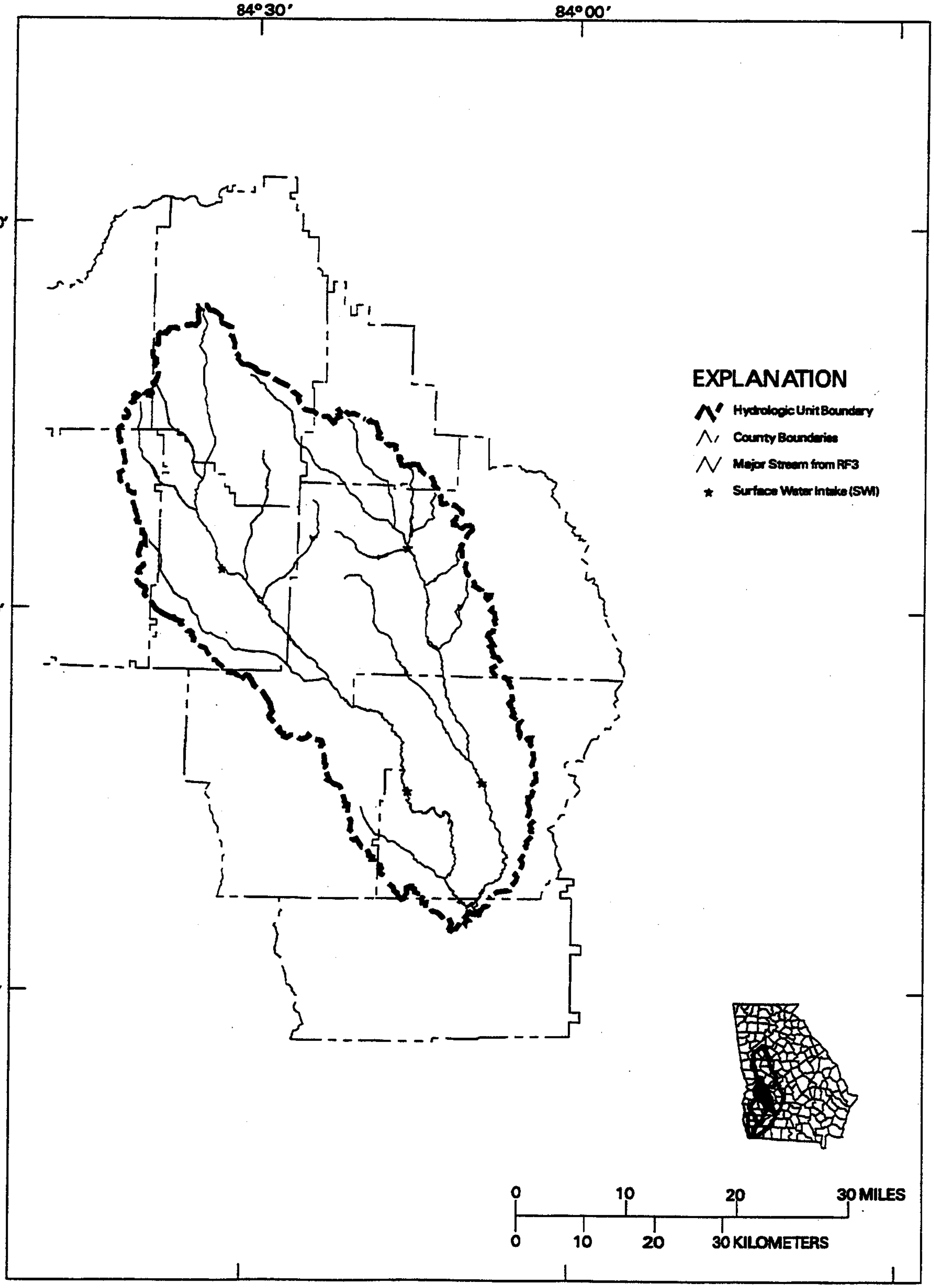


Figure 3-3. Surface Water Intakes, Kinchafoonee-Muckalee Creeks Basin, HUC 03130007

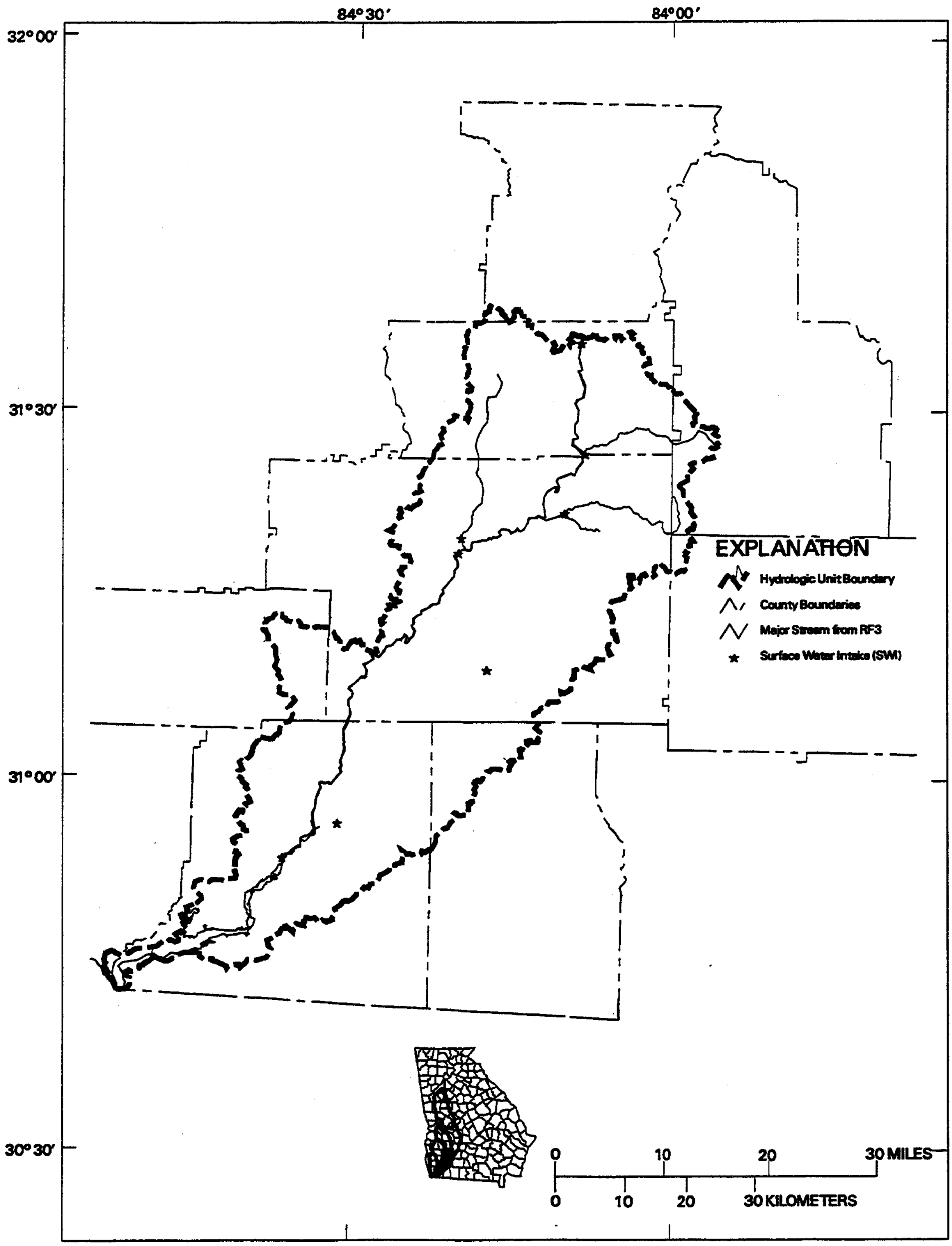


Figure 3-4. Surface Water Intakes, Lower Flint River Basin, HUC 03130008

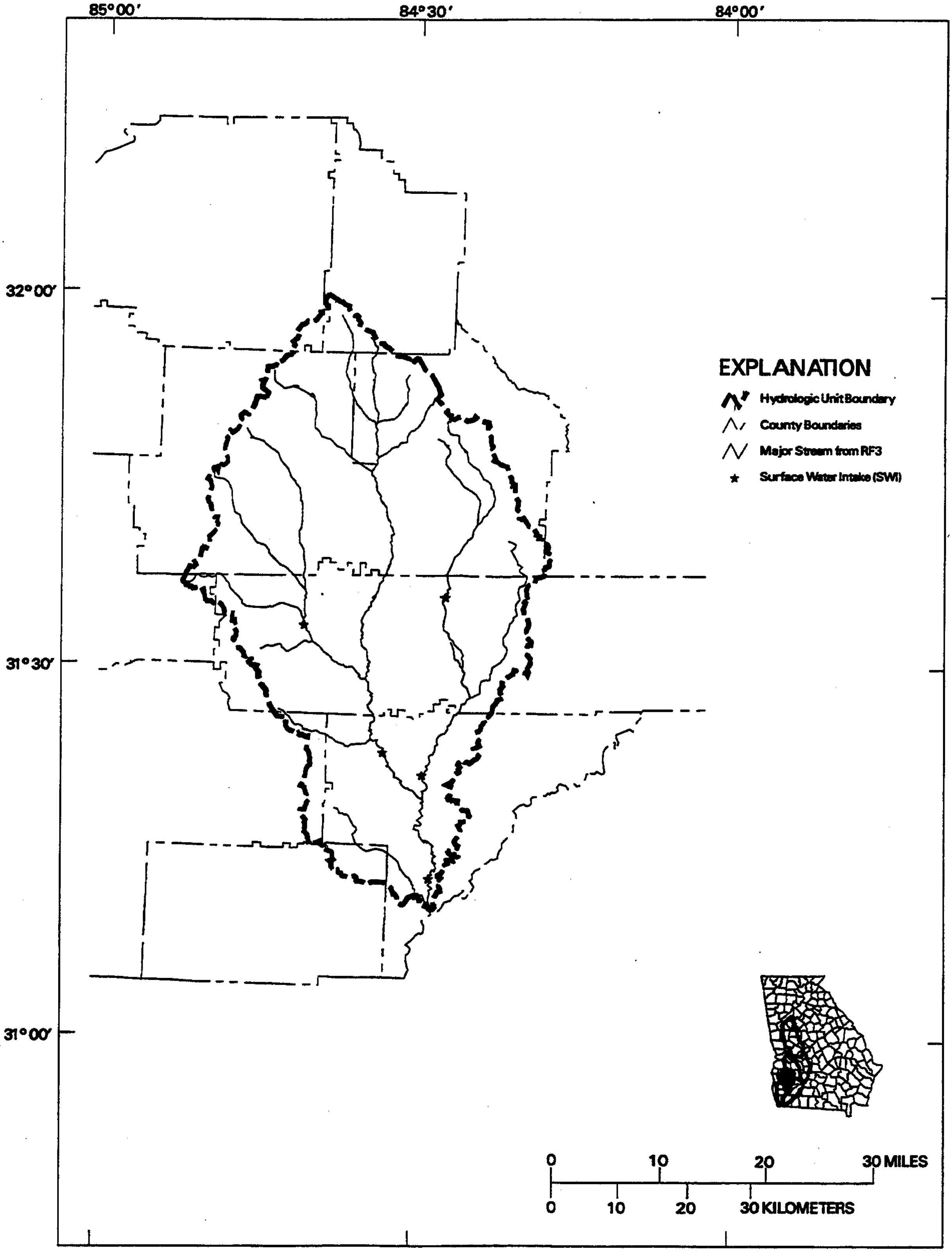


Figure 3-5. Surface Water Intakes, Ichawaynochaway Creek Basin, HUC 03130009

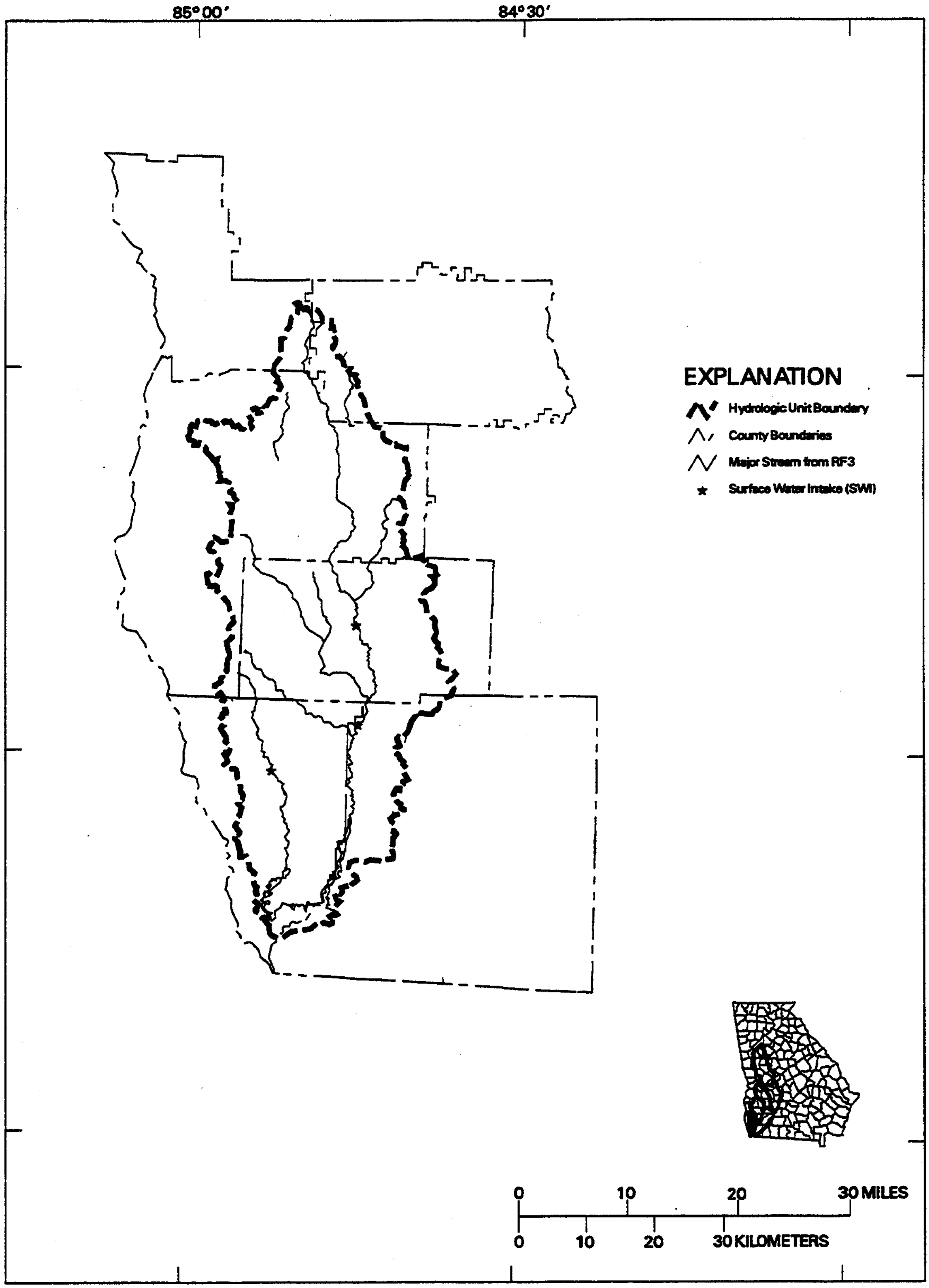


Figure 3-6. Surface Water Intakes, Spring Creek Basin, HUC 03130010

3.1.3 Drinking Water Permitting

3.1.3 Drinking Water Permitting

The Georgia Safe Drinking Water Act of 1977 and 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 is set in three phases: Inquiry & Discovery, Technical Review and Permitting. During these phases the owner must provide detailed description of the project; demonstrate the reliability of water source site; render plans and specifications of demonstrating construction integrity of wells, plants and distribution system; conduct preliminary water sample testing; and submit legal documentation including application to operate a public water system. Permits contain specific conditions the owner must meet for different types of water sources, plants, and distribution systems, including list of approved water sources, filter rates, disinfection and treatment requirements, operator certification, documentation and reporting requirements, compliance with water sample testing schedule, and number of allowed service connections. Permits are issued for ten (10) years and are renewable. There are 315 active and permitted systems in the Flint River Basin

3.1.3.1 Summary of the EPD Drinking Water Program

The Federal Environmental Protection Agency (EPA) promulgates the rules and regulations for drinking water and passes the responsibility of enforcing the rules to the states with primacy, such as the state of Georgia. In Georgia, public water systems are regulated by the Drinking Water Program (DWP) of the Environmental Protection Division (EPD). The Drinking Water Program in the state of Georgia is divided into Drinking Water Compliance Program (DWCP) and Drinking Water Permitting Program (DWPP). Both programs oversee the 2618 public water systems in the state of Georgia, including the 315 public water systems in the Flint River Basin.

3.2 Surface Water Quantity

3.2.1 Surface Water Supply Sources

Surface water supplies in the Flint basin include water in rivers, ponds, and reservoirs, including two major impoundments on the Flint mainstem (see Section 2.1.4). Total annual flow in the Flint is estimated at 2,060,000 million gallons per year. Reservoirs provide a storage capacity within the basin of 1,470 million gallons (4,500 acre feet).

3.2.2 Surface Water Supply Demands and Uses

Municipal and Industrial Demands

Municipal and Industrial (M&I) water demands include publicly supplied and privately supplied residential, commercial, governmental, institutional, industrial, manufacturing, and other demands such as distribution system water losses. Total demand for M&I water for the Flint River Basin is expected to increase from 164 million gallons per day (MGD) in 1995 to 172 MGD in 2000 and to 181 MGD in 2005 (Davis et al., 1996) with passive conservation programs in place (see Table 3-1). These passive conservation measures include increases in water use efficiency resulting from recently implemented plumbing codes, the natural replacement of water fixtures, and known increases in water and wastewater prices since 1990.

Existing permits for municipal and industrial (non-agricultural) surface water withdrawals in the Flint River Basin are shown in Table 3-2. About 60 percent of the 2005 Flint basin demand is expected to come from surface water. The residential sector accounted for 44 percent of the 1990 water demand in the Flint basin. By 2050, nearly half (47 percent) of the basins M&I demand for water is expected to be for the residential sector. The manufacturing sector demand for water in the Flint basin is projected to increase from 30 percent in 1990 to 33 percent in 2010 and then drop to 25 percent of the subbasins demand in 2050.

Sixty percent (109 MGD) of the 2005 Flint basin demand is projected to be supplied by surface water withdrawals and 40 percent (72 MGD) by ground water withdrawals. Ground water pumpage is expected to intercept some water that would have surfaced in the streams, and this amount can be viewed as ground water demand that is effectively supplied by surface water. In the Flint, the ground water to surface water relationship is complicated; however, the 72 MGD ground water demand is expected to ultimately reduce Flint river flow by 22 MGD.

Much of the M&I demand is not consumed, but is instead returned back to the river as treated wastewater. In 2005 approximately 39 percent of the demand quantity is projected to be returned to the Flint River Basin (Table 3-1).

While there has generally been adequate water to meet the needs of most users, there have been periods of low water flows and drought dating back to the 1920's in the Flint River Basin. With increased growth and development, the droughts of 1981, 1986, and 1988 created greater competition among users for limited water resources than had been experienced before. The defining hydrologic conditions of the 1980's droughts were that the preceding winters and springs were dry to the point that ground water and major headwaters storage reservoirs did not recover from the preceding fall dry periods. With flows and reservoirs low at the beginning of the summer, the ability to meet the various project purposes was more dependent on water stored in conservation storage zones of the various reservoirs.

Table 3-1. Projected Municipal and Industrial Demands Including Percent Returned

	Demand (MGD)	% Returned to Flint River
1990	158	35
1995	164	37
2000	172	38
2005	181	39
2010	189	40
2015	194	41
2020	196	40
2025	196	40
2030	195	40
2050	206	38

Table 3-2. Permits for Surface Water Withdrawals in the Flint River Basin

Facility	Source	24 Hour Max (Mgd)	Monthly Avg. (Mgd)	County
Clayton County Water Auth - Flint	Flint River	40.00	40.00	Clayton
Clayton County Water Auth - Shoal	J.W. Smith Res./Shoal Cr.	12.00	12.00	Clayton
Newnan Water Supply & Light Comm	White Oak Creek	7.00	7.00	Coweta
Newnan Water Supply & Light Comm	Raw Water Reservoirs	14.00	14.00	Coweta
Newnan Water Supply & Light Comm	Line Creek	12.00	12.00	Coweta
Newnan Water Supply & Light Comm	Sandy/Browns Creek	8.00	8.00	Coweta
Senoia, City of	Hutchins Lake	0.30	0.30	Coweta
Georgia Power Co - Mitchell	Flint River	232.00	232.00	Dougherty
Board of Commissioners of Fayette Co.	Whitewater Creek	2.00	2.00	Fayette
Fayette County	Line Cr (Mcintosh Site)	2.00	2.00	Fayette
Fayette County Water System	Lake Peachtree	0.55	0.50	Fayette
Fayette County Water System - Flat	Flat Creek Reservoir	4.50	4.00	Fayette
Fayetteville, City of - Ginger Cake	Ginger Cake Creek	0.15	0.15	Fayette
Martin Marietta Aggregates	Pit Sump	1.80	0.09	Lee
Weyerhauser Company	Flint River	14.50	12.50	Macon
Greenville, City of	Toen Creek	0.16	0.15	Meriwether
Manchester, City of	Pigeon Creek	1.00	0.75	Meriwether
Roosevelt Warm Springs Rehab	Cascade Creek	0.14	0.14	Meriwether
Woodbury, City of	Cain Cr Res on Pond Cr	0.75	0.50	Meriwether
Zebulon, City of	Elkins Creek	0.40	0.30	Pike
Griffin, City of	Flint River	13.20	12.00	Spalding
Georgia Game and Fish	Gum Creek	0.00	0.00	Talbot
Manchester, City of	Rush Creek Reservoir	2.00	1.44	Talbot
Southern Mills, Inc.	Thundering Springs Lake	0.65	0.50	Upson
Thomaston Mills, Inc.	Potato Creek	4.40	3.40	Upson
Thomaston, City of	Raw Water Cr Res	4.30	4.30	Upson
Westek, Inc.	Potato Creek	1.44	0.40	Upson
Crisp County Power Comm - Hydro	Lake Blackshear			Worth
Crisp County Power Comm - Steam	Lake Blackshear	15.00	15.00	Worth

Note: Permits are not required for withdrawals of less than 100,000 gallons per day on a monthly average.

Agricultural Water Demand

Current Agricultural Water Demands

The demands on water resources for agricultural activities includes irrigation for crops, nursery, and turf, drinking water for livestock and poultry, and aquacultural activities.

In 1992, 655,000 acres (50 percent) of the 1.3 million acres used to harvest a commodity were irrigated. Almost all of the acres under irrigation in 1992 were for crops and orchards. Agricultural withdrawal permits are too numerous to list in this document.

Approximately 70 percent of the water used for crop and orchard commodities in 1992 came from ground sources. Much of this is attributed to the widespread irrigation taking place in the lower Flint. It is estimated that only 18 percent of the water used for irrigation in the lower Flint is surface water, the rest coming from ground water. However, groundwater withdrawals in the Flint basin affect the surface water supply. One study has estimated that, in the lower Flint, every ten gallons of ground water withdrawn may ultimately diminish the surface water supply by about three gallons.

The most important variable in the demand for supplemental agricultural water is rainfall. The Chattahoochee and Flint basins received an estimated 60 inches of rain in 1992; the 30-year average for the study area is 51 inches. This additional 9 inches of rainfall in 1992 certainly reduced irrigation needs for that year. However, the magnitude of these reductions is difficult to quantify reliably for the entire basin. In 1987, growers and producers withdrew 460 MGD when rainfall for the basins was only 43 inches, about 8 inches below the 30 year average. In 1987 rainfall was 17 inches less than that in 1992, and irrigation was approximately 233 MGD more in 1987 than in 1992.

For comparison purposes, collective water use of all growers and producers in the Flint River Basin totaled 82,900 million gallons (227 MGD) in 1992. Of the 227 MGD, 94 percent went to crop and orchard irrigation; livestock and poultry consumed 2 percent, aquaculture used 1 percent, and nursery and turf accounted for the remaining 3 percent.

Future Agricultural Water Demands

It is anticipated that the number of total agricultural acres in the Flint River Basin will decline through the year 2000 due to a short term drop in peanut acreage. The number of total agricultural acres is expected to drop from 1.3 million in 1992 to 1.2 million in 2000, and the number of irrigated acres from 655,000 to 636,000. There is considerable uncertainty, however, in the projected growth of agricultural land, and irrigated land in particular. Year 2050 estimates of irrigated land range from about 780,000 to more than 1.5 million acres in the Flint River Basin. The projection of irrigation water demand varies accordingly under normal rainfall conditions.

Future demand for agricultural water in the Flint basin is driven by projected increases in crop and orchard irrigation. The 94 percent allocation of water to crop/orchard commodities in 1992 is expected to rise to 95 percent of the projected 124,000 MG (340 MGD) by 2000. Research has demonstrated that producers are not currently applying sufficient quantities of water to achieve optimum yields. Part of the reason is economics, part is technology, and part is education. As more producers become aware of the relationship of water application to plant yield and profits, they are expected to begin applying more water. Therefore, projections regarding future water demands were made assuming producers would gradually increase the amount of irrigation water applied until recommended levels are reached.

Table 3-3 shows the projected increases in total water demand. Total agricultural water demand (ground water and surface water) is expected to increase from 82,900 million gallons in 1992 to 146,000 million gallons in 2010. Much of this increase will begin after the year 2000 as peanut acreage stabilizes and producers begin to irrigate an increasing percentage of their crops. The increase in water demand between 1992 and 1995 is largely attributed to the less than "typical" water application by producers in 1992, a high rainfall year. In drought

Table 3-3. Agricultural Water Demand Including Crops/Orchards, Turf, Nursery, Livestock/Poultry, and Aquaculture (MG per year, including crops/orchards, turf, nursery, livestock/poultry, and aquaculture demand, from NRCS, 1996, Based on Medium Demand Projections without Water Conservation)

Year	Upper Flint	Middle Flint	Lower Flint	Total
1992	3,337	17,722	61,874	82,933
1995	6,099	24,840	80,595	111,534
2000	7,057	26,186	86,671	119,914
2010	9,638	32,905	103,530	146,073
2020	10,672	35,830	109,027	155,529
2050	14,730	47,825	134,239	196,794

conditions, the agricultural demand would be higher, possibly 1.5 to 2 times the amount under normal rainfall.

Even though the demand for agricultural water exists throughout the year, the months of May through August account for 81 percent of annual demand. These months reflect the heart of the growing season for crop and orchard commodities. This means that the 146,000-million gallon demand for the year 2010 would result in a withdrawal of 118,300 million gallons between May and August. Instead of 400 MGD average annual demand, the June demand would be 59,480 million gallons or 1,980 MGD.

Power Generation Water Demand

Four power-generating plants located along the mainstem Flint River use the water resources of the basin (Figure 2-11), including two hydropower facilities and two fossil fuel generating (Couch et al., 1996). The two hydroelectric plants located along the mainstem of the Flint River impound run-of-the-river reservoirs which do not appreciably influence the flow of the Flint River, and are therefore essentially nonconsumptive. The total hydroelectric generation capacity is 699,720 kilowatts in the ACF River basin (Fanning et al., 1991).

Water used for thermoelectric-power generation is considered an offstream use of water, and generally is moderately consumptive to non-consumptive. Thermoelectric power is generated at two fossil-fuel plants located in the Flint River Basin, in Crisp County and Mitchell County.

Navigation Water Demand

Navigation in the Flint River Basin does not pose a significant use of the water resources. The U.S. Army Corps of Engineers maintains a navigation channel from the mouth of the Apalachicola River to Bainbridge, Georgia, which is in the southern portion of the basin.

Recreation Water Demand

The demand for outdoor recreation continues to increase as Georgia's population increases. As a result, the Flint River, its reservoirs, and its tributaries are heavily used for recreational activities such as boating, fishing, hunting, water sports, and sight-seeing. The majority of the recreational activities conducted in the Flint River Basin are tubing, rafting, sight-seeing, and fishing. Many local businesses and services (i.e., bait and tackle shops, restaurants, guide services, and hotels) rely on the economically significant impacts associated with the freshwater bass tournaments and other warm water fish species.

South of the metropolitan Atlanta area, the Flint River is a significant attraction for fishermen and other recreational river users. The Flint River shoal bass is a prized sport fish that attracts considerable fishing pressure. Other important recreational sport fish species include largemouth bass, catfish, and various species of sunfish.

Lake Blackshear is a popular recreation area. Lake levels are managed primarily to support recreational uses, including sportfishing. The GADNR operates the Georgia Veterans State Park, which has approximately 5 miles of shoreline along the lake, and provides various recreational facilities.

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 Flint 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 for support of viable communities of fish and other aquatic organisms. From a water quantity perspective, aquatic habitat is adversely affected by unnatural extreme variations in lake levels and river flow. One significant issue which is receiving increasing attention from EPD is that of the minimum stream flow rate which must be maintained below a reservoir. This is not a major issue in the Flint basin, where the two major dams create run-of-the-river impoundments that do not significantly alter flow.

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 gallons per day (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 nonagricultural 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 3-2 lists the permits in effect for the Flint River Basin.

Applicants are required to submit details relating to the source of withdrawals, demand projections, water conservation measures, low flow protection measures (for nongrandfathered 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.

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 gallons per day; however, users of less 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.

Applicants for these permits who could establish that their use existed prior to July 1, 1988, and submitted their applications 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 toward 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

Sometimes the issue is not the lack of water, but too much water. Floods, as well as droughts, can be very damaging natural hazards. Almost all of Georgia is susceptible to the threat of floods. The Georgia Emergency Management Agency (GEMA) ranks floods as the number one natural hazard in Georgia. Over the past nineteen years, 57 Georgians have lost their lives due to flooding. The Flood of 1994 (Tropical Storm Alberto) is considered the worst flooding event in Georgia since 1841, which is the beginning of the State's recorded flood history. Much of the flooding in 1994 resulted from the overflowing of the Flint River and the Ocmulgee River and, to a much lesser extent, the Chattahoochee River.

In July 1994, rainfall from Tropical Storm Alberto caused severe flooding in the Flint River Basin. These floods affected hundreds of thousands of people, damaging or destroying highways, water-supply systems, wastewater treatment plants, crops, and homes. Damage from such a severe flood cannot be averted completely, but with sound hydrologic information, reliable estimates of river stages and of discharges can be made. Using these data, emergency management personnel can provide ample warning of impending danger to communities.

Development within the floodplains of these rivers is also a concern, especially when a community has no means of regulating the development. Development within floodplain areas can increase flood levels, thereby increasing the number of people and the amount of property at risk. Although 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. It is a continuous process of making decisions about whether floodplains are to be used for development and how they are to be developed. It encompasses the choices made by owners of floodplain homes and businesses, developers, and officials at all levels of government.

3.3 *Ground Water Quantity*

3.3.1 Ground Water Sources

Ground water provides a significant source of both drinking water and a source for irrigation for agricultural purposes throughout the Flint River Basin. Within the Coastal Plain Province, aquifer yields are high and groundwater withdrawals are an important part of the total water budget. The majority of public supply withdrawals in the Coastal Plain Province come from groundwater sources. The Floridan aquifer system supplied most of the ground water used in the basin in 1990, followed by the Claiborne, Clayton, crystalline-rock, and Providence aquifers.

As part of the Apalachicola-Chattahoochee-Flint and Alabama-Coosa-Tallapoosa (ACF/ACT) Comprehensive Basin Study, scientists at USGS completed studies of groundwater resources in each of eight geographic subareas of the ACF/ACT basins. The Flint River Basin is coincident with subareas 2 through 4 of this study.

Groundwater Subarea 2 includes the upper Flint River Basin from the headwaters to the Fall Line, and is within the Piedmont physiographic province (Chapman and Peck, 1995). This province is underlain by crystalline-rock aquifers (metamorphic and igneous rocks) having little or no primary permeability. Ground-water exploration in the Piedmont province of Georgia has had the reputation of being "difficult and unpredictable". The yield of bedrock wells depends on the characteristics of the water-bearing zones penetrated by the open borehole. Well yields greater than 100 gal/min (0.144 MGD) are considered to be high-yielding. Yields of 200 to 300 gal/min (0.288 to 0.432 MGD) are not uncommon when wells are properly sited. Chapman and Peck conclude that groundwater resources in Subarea 2 are underutilized. Today, as historically, the rural population relies on ground water as their principal source of water supply, whereas most populated areas, such as the metropolitan-Atlanta area, rely on surface water resources for supply. Ground water could serve as a supplemental resource during many peak demand periods and under drought conditions. Ground water also contributes to surface flow within Subarea 2. The estimated mean annual ground-water discharge contribution to the Flint River near Thomaston, Georgia is estimated to be about 690 cubic feet per second.

Groundwater Subarea 3 includes the part of the Flint River Basin between the Fall Line and Lake Blackshear, and is within the Coastal Plain physiographic province (Southern Coastal Plain and Georgia Sand Hills land-resource areas) (Mayer, 1995). The aquifer system in Subarea 3 is comprised of sedimentary rock sequences that dip and thicken to the south. The outcrop area of the sedimentary rocks functions as the recharge area of the aquifers, receiving precipitation that infiltrates down to the saturated zone. Most of the water that enters the aquifers as recharge is eventually discharged to nearby streams or rivers. Under mean conditions, 1,812 cfs is discharged from the groundwater flow system to the Flint River. In contrast, during the severe drought of 1986, 525 cfs was discharged to the Flint River. Total 1990 groundwater withdrawals in the Flint River Basin portion of Subarea 3 equaled about 3 percent of the mean annual ground-water discharge, and about 10 ½ percent of the 1986 drought discharge.

Groundwater Subarea 4 includes the lower Flint River Basin from Lake Blackshear to Lake Seminole (Torak and McDowell, 1994), and is also within the Southern Coastal Plain province. This area is underlain by Coastal Plain sediments consisting of alternative units of sand, clay, sandstone, dolomite and limestone that gradually thicken and dip gently to the southeast. The primary water-bearing system is the Upper Floridan aquifer. This aquifer has a high capacity to store and transmit water, attributable to the fractured nature of the constituent Ocala limestone and associated dissolution of limestone by ground water

3.3.2 Ground Water Supply Demands and Uses

Municipal and Industrial Water Uses

Sixty percent (109 MGD) of the Flint River M & I basin demand in 2005 is projected to be supplied by surface water withdrawals and 40 percent (72 MGD) by groundwater withdrawals. Ground water pumpage is expected to intercept some water that would have surfaced in the streams, and this amount can be viewed as groundwater demand that is effectively supplied by surface water. The ground water to surface water relationship is complicated; however, the 72 MGD groundwater demand is expected to ultimately reduce Flint River flow by about 22 MGD. Refer to section 3.2.2 for a detailed discussion of municipal and industrial water demand.

Agricultural Water Demand

Information from the Georgia Geological Survey suggests that 70 percent of the water used for crop and orchard commodities in 1992 came from ground sources. Much of this is attributed to the widespread irrigation taking place in the lower Flint basin. It is estimated that 82 percent of the water used for irrigation in the lower Flint basin is ground water. Of the other agricultural sectors inventoried, nurseries appear to be the only one to obtain water primarily from ground sources. Agricultural water sources in the Flint basin are not expected to change appreciably. Groundwater withdrawals in the Flint basin affect the surface water supply. In the lower Flint basin, every ten gallons of ground water withdrawn ultimately diminishes the surface water supply by about three gallons. Refer to section 3.2.2 for a detailed discussion of current and projected agricultural water demand.

3.3.3 Ground Water Supply Permitting

The Georgia Groundwater Use Act of 1972 requires permits from EPD for all non-agricultural users of more than 100,000 GPD of ground water. 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 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. Groundwater 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 M & I ground water permits is provided in Table 3-4.

The 1988 Amendments to the Groundwater Use Act established 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 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 submitted their 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 toward protection of grandfathered users and the integrity of the resource. Generally, agricultural users are not required to submit any water use reports.

Table 3-4. Active Municipal and Industrial Ground Water Withdrawal Permits in the Flint River Basin

County	Permit #	Type	Permit User	Monthly Permitted Flow (MGD)	Yearly Permitted Flow (MGD)	Aquifer
Baker	004-0001	M	Newton, City of	0.250	0.250	Claiborne
Calhoun	019-0003	M	Arlington, City of	0.350	0.300	Floridan
Calhoun	019-0002	M	Edison, City of	0.300	0.200	Clayton
Calhoun	019-0001	M	Leary, City of	0.300	0.300	Claiborne, Tallahatta
Calhoun	019-0004	M	Morgan, City of	0.300	0.250	Clayton
Crawford	039-0001	M	Roberta, City of	0.240	0.180	Cretaceous Sand
Crisp	040-0001	M	Cordele, City of	4.100	3.000	Floridan, Tallahatta, Wilcox
Crisp	040-0002	I	Masonite Corporation	0.225	0.207	Floridan
Decatur	043-0002	I	Amoco Fabrics & Fibers Co - Bainbridge Mills	0.900	0.750	Floridan
Decatur	043-0003	M	Bainbridge, City of	3.000	2.400	Floridan
Decatur	043-0004	I	Decator County Industrial Airpark	0.650	0.550	Floridan
Decatur	043-0001	I	Southern Concrete Construction Company	0.285	0.235	Floridan
Dooly	046-0002	M	Vienna, City of	2.609	2.153	Cretaceous Sand, Claiborne
Dougherty	047-0002	M	Albany, City of - Water, Gas & Light Com	31.500	20.000	Clayton, PR, Tallahatta, Floridan
Dougherty	047-0001	I	Cooper Tire Company	0.720	0.720	Floridan
Dougherty	047-0011	I	Doublegate Country Club	0.720	0.720	Floridan
Dougherty	047-0012	I	Georgia Power Company - Plant Mitchell	0.250	0.250	Floridan
Dougherty	047-0008	I	Marine Corps Logistics Base	2.000	1.500	Tallahatta, Wilcox, Clayton, UK
Dougherty	047-0003	I	Merck & Company, Inc	10.440	8.550	Floridan
Dougherty	047-0007	I	Miller Brewing Company	3.000	3.000	Clayton, Tallahatta
Dougherty	047-0005	I	Procter & Gamble Paper Products Co	8.500	8.500	Floridan
Dougherty	047-0004	I	Southern Concrete Construction Company	0.250	0.160	Floridan
Dougherty	047-0013	I	Viking Distillery, Inc	0.100	0.100	Clayton
Dougherty	047-0010	I	Young Pecan Company - Nut Tree Division	0.180	0.100	Floridan

County	Permit #	Type	Permit User	Monthly Permitted Flow (MGD)	Yearly Permitted Flow (MGD)	Aquifer
Fayette	056-0001	M	Fayette County Water System	0.875	0.825	Crystalline Rock
Fayette	056-0002	M	Fayetteville, City of	0.937	0.937	Crystalline Rock
Lee	088-0001	M	Leesburg, City of	0.320	0.300	Tallahatta, Wilcox, Paleocene
Macon	094-0004	I	C-E Minerals - Plant #5 Mulcoa	0.100	0.100	Midway, Providence
Macon	094-0003	M	Marshallville,City of	0.155	0.120	Cretaceous Sand
Macon	094-0001	M	Montezuma, City of	1.250	0.810	Cretaceous Sand
Macon	094-0006	M	Oglethorpe, City of	0.370	0.330	Cretaceous Sand
Macon	094-0002	I	Southern Frozen Foods,Inc	2.000	1.000	Cretaceous Sand
Macon	094-0005	I	Weyerhaeuser Company	1.836	1.836	Providence Sand, Cusseta Sand
Marion	096-0001	M	Buena Vista, City of	2.000	1.750	Cretaceous Sand
Merriwether	099-0002	M	Greenville, City of	0.400	0.300	Crystalline Rock
Miller	100-0001	M	Colquitt, City of	0.420	0.300	Floridan
Mitchell	101-0002	M	Camilla, City of	3.500	3.000	Floridan
Randolph	120-0001	M	Cuthbert, City of	0.800	0.600	Clayton
Randolph	120-0003	I	Georgia Feed Products, Inc	0.200	0.200	Clayton
Randolph	120-0002	M	Shellman, City of	0.180	0.150	Claiborne
Schley	123-0001	M	Ellaville, City of	0.350	0.275	Cretaceous Sand
Seminole	125-0002	I	Columbia Yeast, Inc	1.200	1.200	Floridan
Seminole	125-0001	M	Donaldsonville, City of	1.000	0.800	Floridan
Stewart	128-0001	M	Richland, City of	0.100	0.100	Cretaceous Sand
Sumter	129-0001	M	Americus, City of	4.200	3.750	Cretaceous Sand
Sumter	129-0002	M	Plains, City of	0.220	0.195	Claiborne (Tallahatta)
Talbot	130-0001	M	Talbotton, City of	0.100	0.100	Crystalline Rock
Taylor	133-0003	M	Butler, City of	0.750	0.550	Cretaceous Sand
Taylor	133-0002	M	Reynolds, City of	0.450	0.255	Cretaceous Sand
Terrell	135-0001	M	Dawson, City of	3.000	2.000	Clayton
Upson	145-0001	M	Sunset Village Water System	0.106	0.106	Crystalline Rock

References

Chapman, M.J. and M.F. Peck. 1995. Ground-water Resources of the Upper Chattahoochee River Basin, Georgia — Subarea 2 of the Apalachicola-Chattahoochee-Flint and Alabama-Coosa-Tallapoosa River Basins. U.S. Geological Survey, Atlanta, GA.

Couch, C.A., E.H. Hopkins, and P.S. Hardy. 1996. Influences of Environmental Settings on Aquatic Ecosystems in the Apalachicola-Chattahoochee-Flint River Basin. Water-Resources Investigations Report 95-4278. U.S. Geological Survey, Atlanta, GA.

Davis, W.Y., M.T. Beezhold, E.M. Opitz, and B. Dziegielewski. 1996. ACT-ACF Comprehensive Study: Municipal and Industrial Water Use Forecasts. Planning and Management Consultants, Ltd., Carbondale, IL.

Fanning, J.L., G.A. Doonan, V.P. Trent, and R.D. McFarlane. 1991. Power generation and Related Water Use in Georgia. Georgia Geological Survey Information Circular 87.

Mayer, G.C. 1995. Ground-water Resources of the Upper Chattahoochee River Basin, Georgia — Subarea 3 of the Apalachicola-Chattahoochee-Flint and Alabama-Coosa-Tallapoosa River Basins. U.S. Geological Survey, Atlanta, GA.

NRCS. 1996. ACT/ACF River Basins Comprehensive Study, Agricultural Water Demand, Appendix B, Basinwide Management Shared Vision Data. Natural Resources Conservation Service, U.S. Department of Agriculture.

Torak, L.J. and R.J. McDowell. 1994. Ground-water Resources of the Upper Chattahoochee River Basin, Georgia — Subarea 1 of the Apalachicola-Chattahoochee-Flint and Alabama-Coosa-Tallapoosa River Basins. U.S. Geological Survey, Atlanta, GA.

USDA. 1995. ACT/ACF River Basins Comprehensive Study: Agricultural Water Demand. USDA Natural Resources Conservation Service, Water Resources Planning Staff.

Section 4
Environmental Stressors

This section describes the important environmental stressors which impair or threaten water quality in the Flint River Basin. 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. Section 4.1 discusses environmental stressors by source type. Section 4.2 then provides a summary of stressor loads by type of stressor.

4.1 *Sources and Types of Stressors*

Environmental stressors are first catalogued by type of source in this section. This is the traditional programmatic approach, and provides a match to regulatory lines of authority for permitting and management.

4.1.1 Point Sources

Point sources constitute permitted 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 discharge at relatively stable rates, and permitted stormwater discharges, which tend to discharge at highly irregular, intermittent rates, depending on precipitation. Non-discharging (land application) waste disposal facilities, which prevent discharge of wastewater effluent to surface waters, are also discussed in this section.

4.1.1.1 NPDES Permitted Wastewater Dischargers

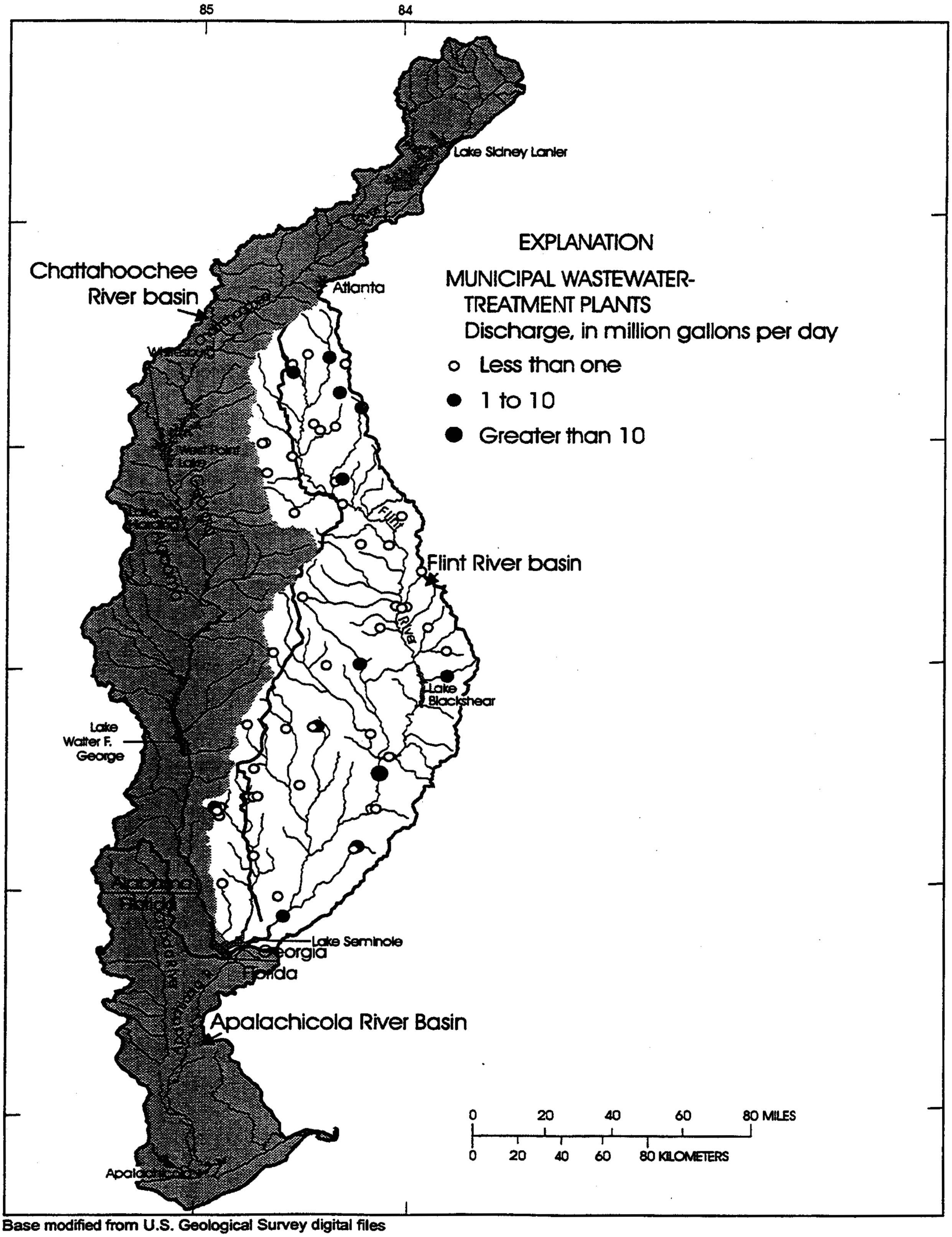
Table 4-1 displays the municipal wastewater treatment plants with permitted discharges in the Flint River Basin. The geographic distribution of dischargers is shown in Figure 4-1. In addition, there are discharges from a variety of smaller wastewater treatment plants, including both public facilities (schools, marinas, etc.) and private facilities (package plants associated with non-sewered developments and mobile home parks). These minor discharges may have the potential to cause localized stream impacts, but are relatively insignificant from a basin perspective.

The EPD NPDES permit program provides a basis for regulating municipal and industrial waste discharges, monitoring compliance with limitations, and appropriate enforcement action for violations. For point source discharges, the permit, among other things, establishes specific effluent limitations and specifies compliance schedules that must be met by the discharger. Effluent limitations are designed to achieve relevant numeric and narrative water quality standards in the receiving water, and are re-evaluated periodically (at least every 5 years).

Municipal wastewater treatment plants are among the most significant point sources regulated under the NPDES program in the Flint River Basin, accounting for the vast majority of the total point source effluent flow. 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,

Table 4-1. Major Municipal Wastewater Treatment Facilities in The Flint River Basin

NPDES Permit #	Facility Name	City/Authority	County	Receiving Stream	Permitted Monthly Average Flow(MGD)
HUC 03130005					
GA0035777	Peachtree City Line Creek WPCP	Peachtree City	Fayette	Line Creek-Whitewater Creek	2.000
GA0035807	Fayetteville-Whitewater Creek WPCP	Fayetteville	Fayette	Whitewater Creek-Line Creek	3.750
GA0046655	Peachtree City Rockaway WPCP	Peachtree City	Fayette	Line Crk Trib. to Whitewater Crk	2.000
GA0030791	Griffin Potato Creek WPCP	Griffin	Spalding	Potato Creek trib /Flint River	2.000
GA0047040	Griffin Shoal Creek	Griffin	Spalding	Shoal Creek trib to Flint	1.500
GA0020079	Thomaston-Bell Creek WPCP	Thomaston	Upson	Bell Creek	1.500
GA0030121	Thomaston (Town Branch WPCP)	Thomaston	Upson	Potato Creek Trib to Flint	2.000
HUC 03130006					
GA0024503	Cordele WPCP	Cordele	Crisp	Gum Creek	5.000
GA0020486	Montezuma WPCP #2	Montezuma	Macon	Spring Crk/downstream of Drayton Rd	1.950
HUC 03130007					
GA0047767	Americus Mill Crk, WPCP	Americus	Sumter	Mill Crk at Muckalee Crk.	4.400
HUC 03130008					
GA0024678	Bainbridge WPCP	Bainbridge	Decatur	Flint River	2.500
GA0033511	Decatur Co-Ind. Airpark WPCP	Bainbridge	Decatur	Flint River	1.000
GA0020991	Albany	Albany	Dougherty	Flint River	20.000
GA0020362	Camilla WPCP	Camilla	Mitchell	Big Slough Crk Trib/Flint River	3.000
HUC 03130009					
GA0021326	Dawson WPCP	Dawson	Terrell	Brantley Creek	2.500
HUC 03130010					
GA0025585	Blakely WPCP	Blakely	Early	Dry Creek Trib	1.315



Base modified from U.S. Geological Survey digital files

Figure 4-1. Location of Municipal Wastewater Treatment Plants in the Flint River Basin

Georgia has invested over $180,000,000 in construction and upgrade of municipal water pollution control plants in the Flint River Basin, as summarized in Appendix C. These upgrades have resulted in significant reductions in pollutant loading and consequent improvements in water quality below wastewater treatment plant outfalls. The most widely used measure of municipal pollution is the extent to which the organic content of treated wastewater depletes oxygen in the receiving water and reduces the oxygen available to fish and aquatic life. In 1994, it was estimated that approximately 93% of oxygen demanding wastes produced by municipalities was removed by municipal water pollution control plants. As of the 1994-95 water quality assessment, only 10 segments (52 miles) of river/streams in the Flint basin were identified in which municipal discharges contributed to not fully supporting designated uses, all of which are being addressed through the NPDES permitting process. A current issue in Albany is combined sewer overflows (CSOs) which have historically discharged diluted, untreated municipal wastewater during wet weather. Georgia is currently in the process of bringing all CSOs into compliance with federal and State water quality standards, as described in Section 4.1.1.2.

Most urban wastewater treatment plants also receive industrial process and non-process wastewater, which may contain a variety of conventional and toxic pollutants. 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 that 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 and federal wastewater discharges are also significant point sources regulated under the NPDES program. There are a total of 109 permitted municipal, state, federal, private, and industrial wastewater and process water discharges in the Flint River Basin, as summarized in Table 4-2. The complete permit list is summarized in Appendix D.

Only a small number of the industrial dischargers discharge significant amounts of flow. Since the nature of industrial discharges varies widely compared to discharges from municipal plants, effluent flow is not generally a good measure of the significance of an industrial

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

HUC	Major Municipal	Small Public and Private Facilities	Industrial and Federal Facilities	Total
03130005	7	24	12	43
03130006	2	7	5	14
03130007	1	7	2	10
03130008	4	4	11	19
03130009	1	8	0	9
03130010	1	4	0	5

discharge. Industrial discharges can consist of organic heavy oxygen-demanding waste loads from facilities such as pulp and paper mills, large quantities of non-contact cooling water and very little else 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 materials, 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. As of the 1994-95 water quality assessment, six (6) segments (47 miles) of river/streams were identified in which industrial discharges contributed to not supporting designated uses, all of which are being addressed through the NPDES permitting process. Table 4-3 lists the four major industrial and federal wastewater treatment plants with discharges into the Flint River Basin in Georgia. There are also 50 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 Flint River Basin are shown in Figures 4-2 through 4-7.

4.1.1.2 Combined Sewer Overflows (CSO)

Combined sewers are sewers that carry both stormwater runoff and sanitary sewage in the same pipe. Most of these combined sewers were built at the turn of the century and are found in most large cities. At that time both sewage and stormwater 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 system expanded. Often new combined sewers were laid in order to move the untreated wastewater discharge to the outskirts of the town.

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 stormwater 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 stormwater and sanitary waste. Uncontrolled CSOs thus discharge diluted raw sewage, and can introduce elevated concentrations of bacteria, BOD, and solids into a receiving water body. In many cases, CSOs discharge into relatively small creeks, where the effects can be devastating. CSOs are considered point sources of pollution and are subject to the requirements of the Clean

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

NPDES Permit #	Facility Name	County	Receiving Stream
HUC 03130005			
GA0000213	Thomaston Mills Inc	Upson	Fourth Br
HUC 03130006			
GA0049336	Weyerhauser	Macon	Flint River
HUC 03130008			
GA0001465	Georgia Power Plant Mitchell	Dougherty	Flint River
GA0001619	Merck Manufacturing Division	Dougherty	Flint River

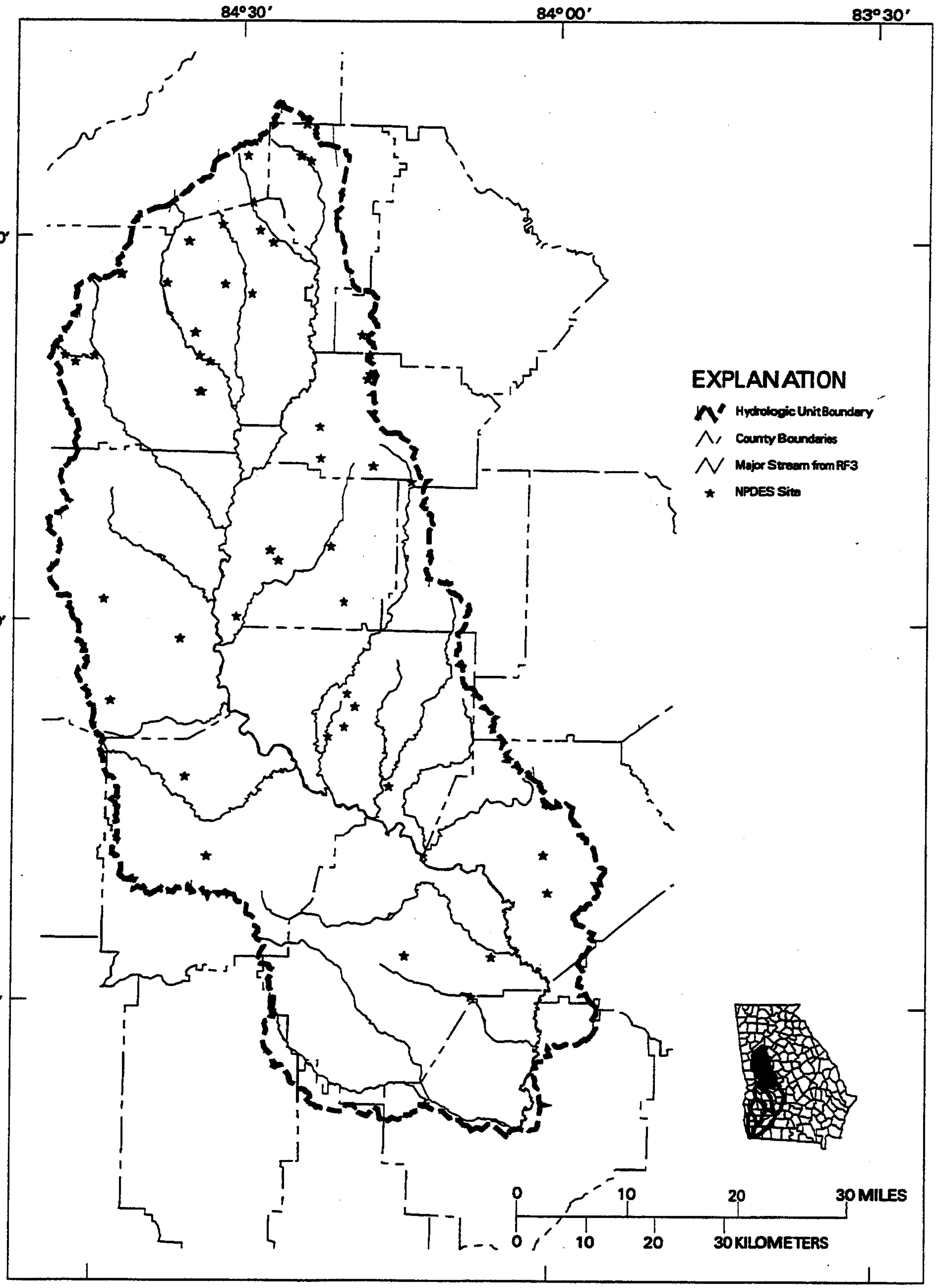


Figure 4-2. NPDES Sites Permitted by EPD, Upper Flint River Basin, HUC 03130005

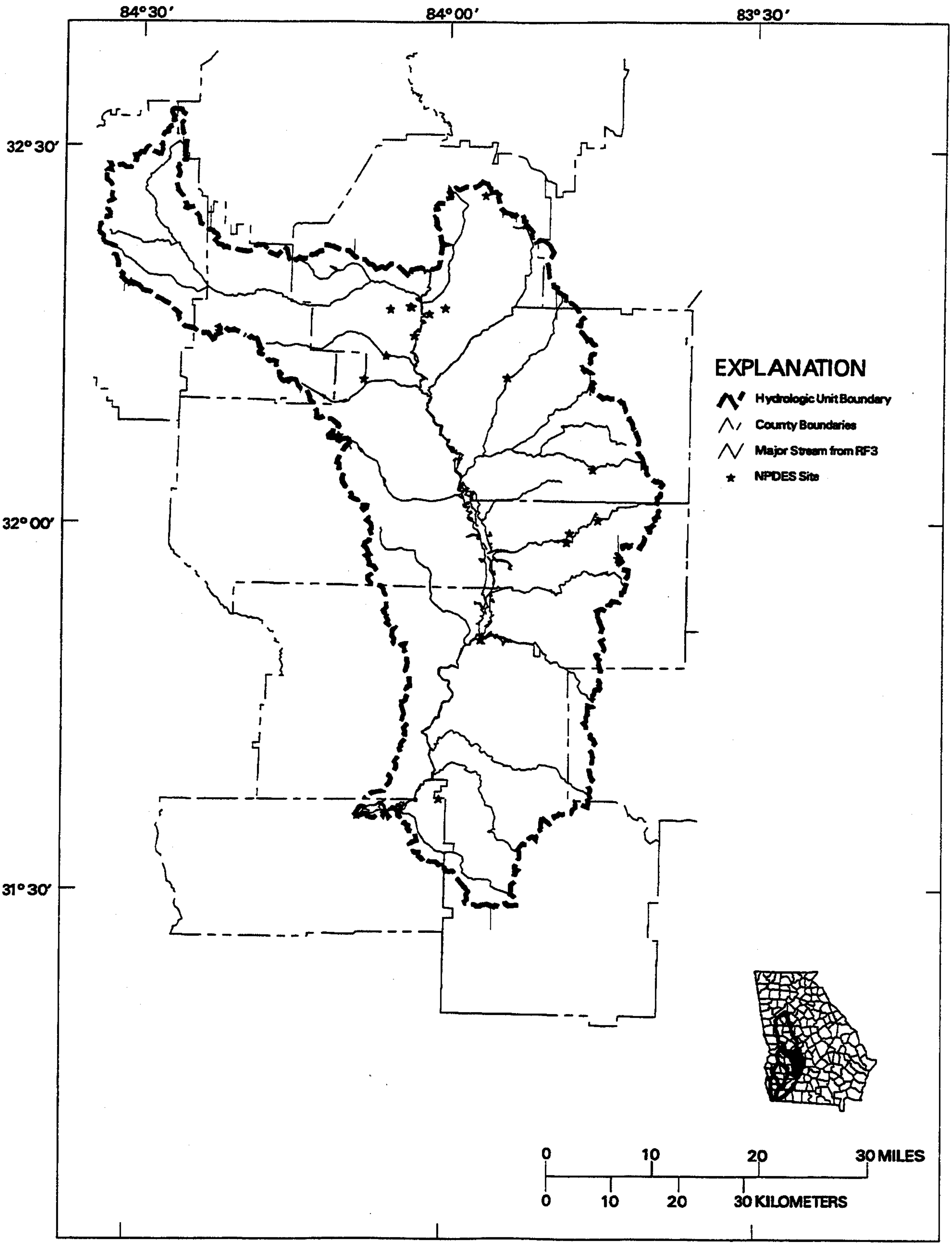


Figure 4-3. NPDES Sites Permitted by EPD, Middle Flint River Basin, HUC 03130006

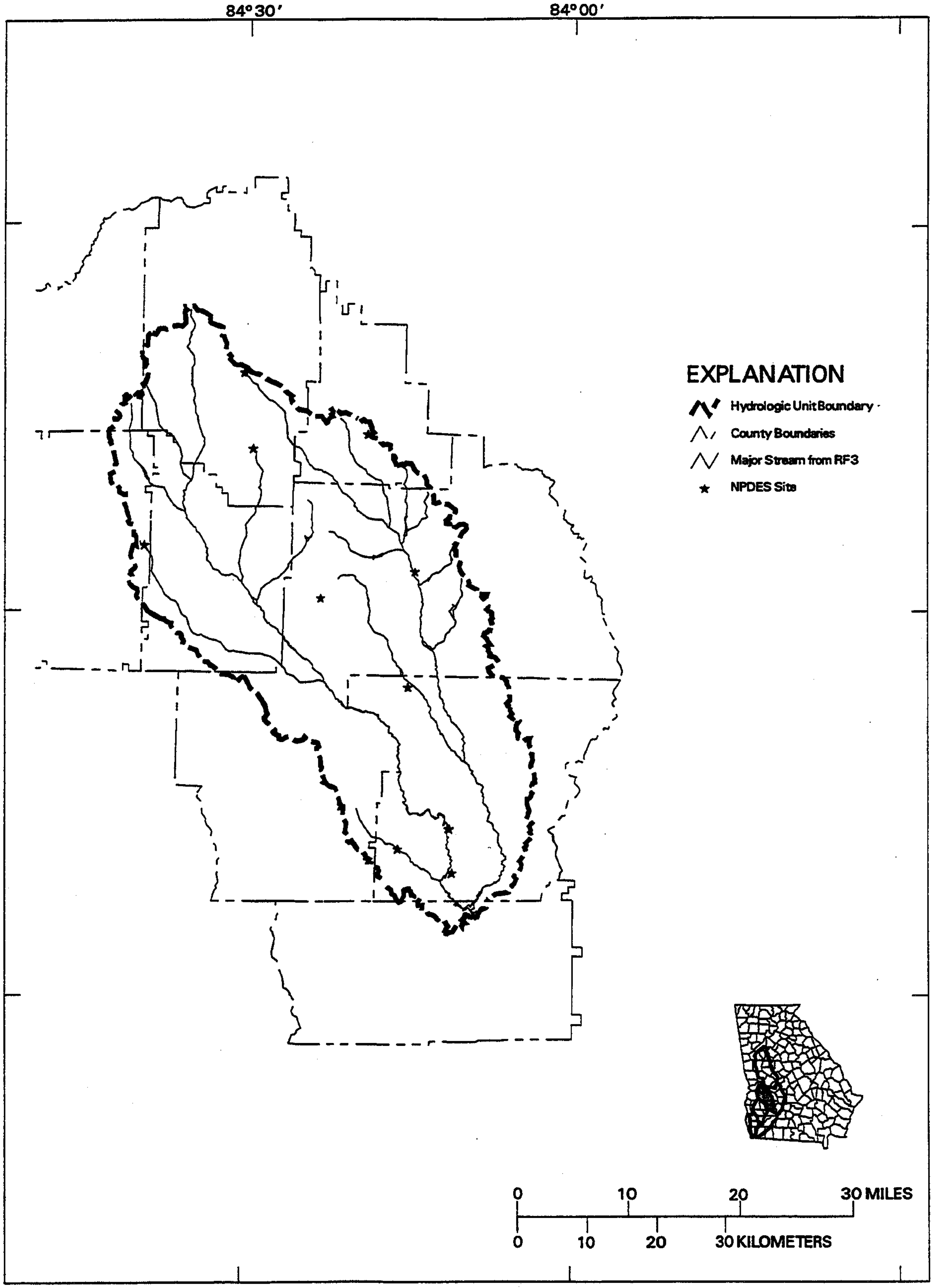


Figure 4-4. NPDES Sites Permitted by EPD, Kinchafoonee-Muckalee Creeks Basins, HUC 03130007

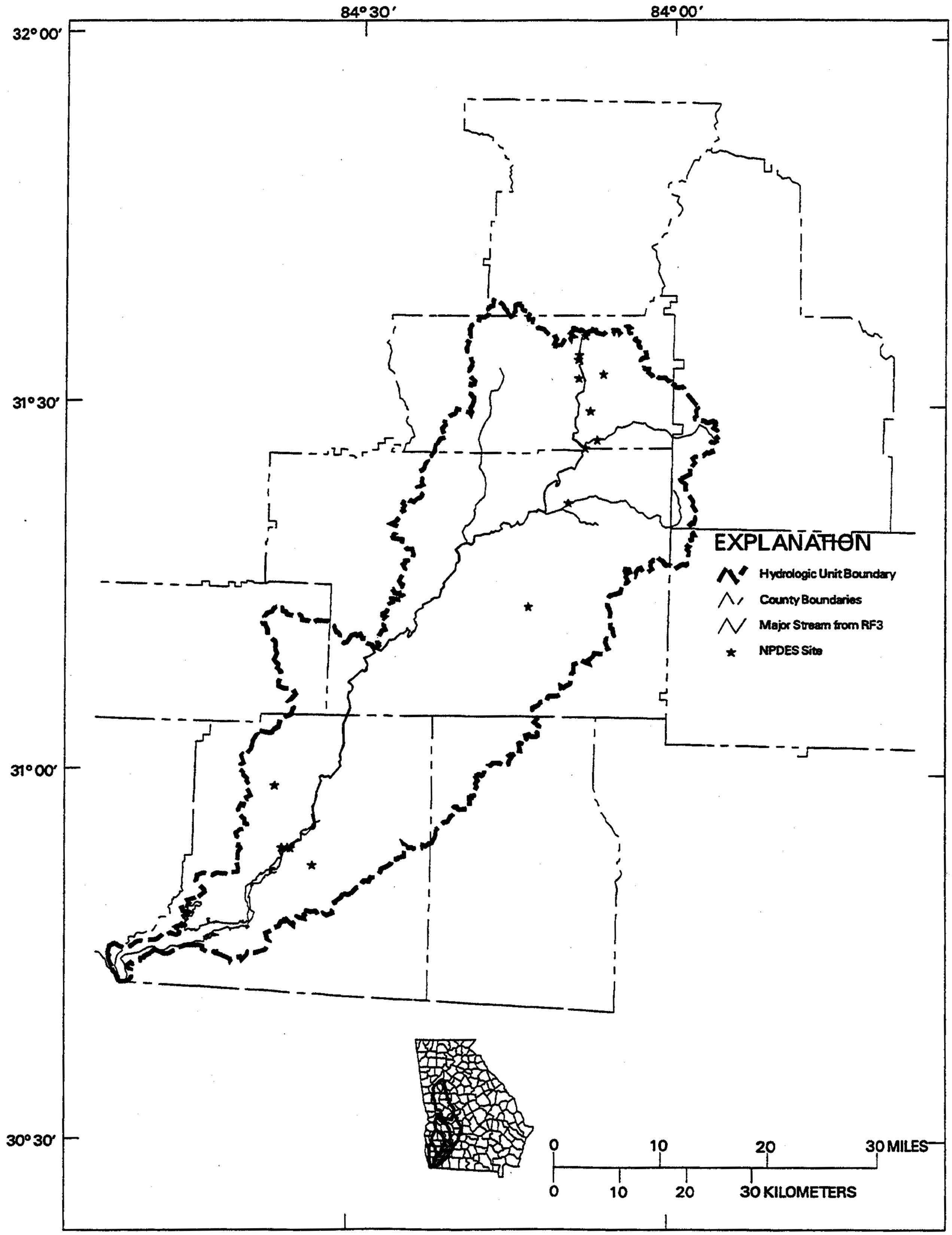


Figure 4-5. NPDES Sites Permitted by EPD, Lower Flint River Basin, HUC 03130008

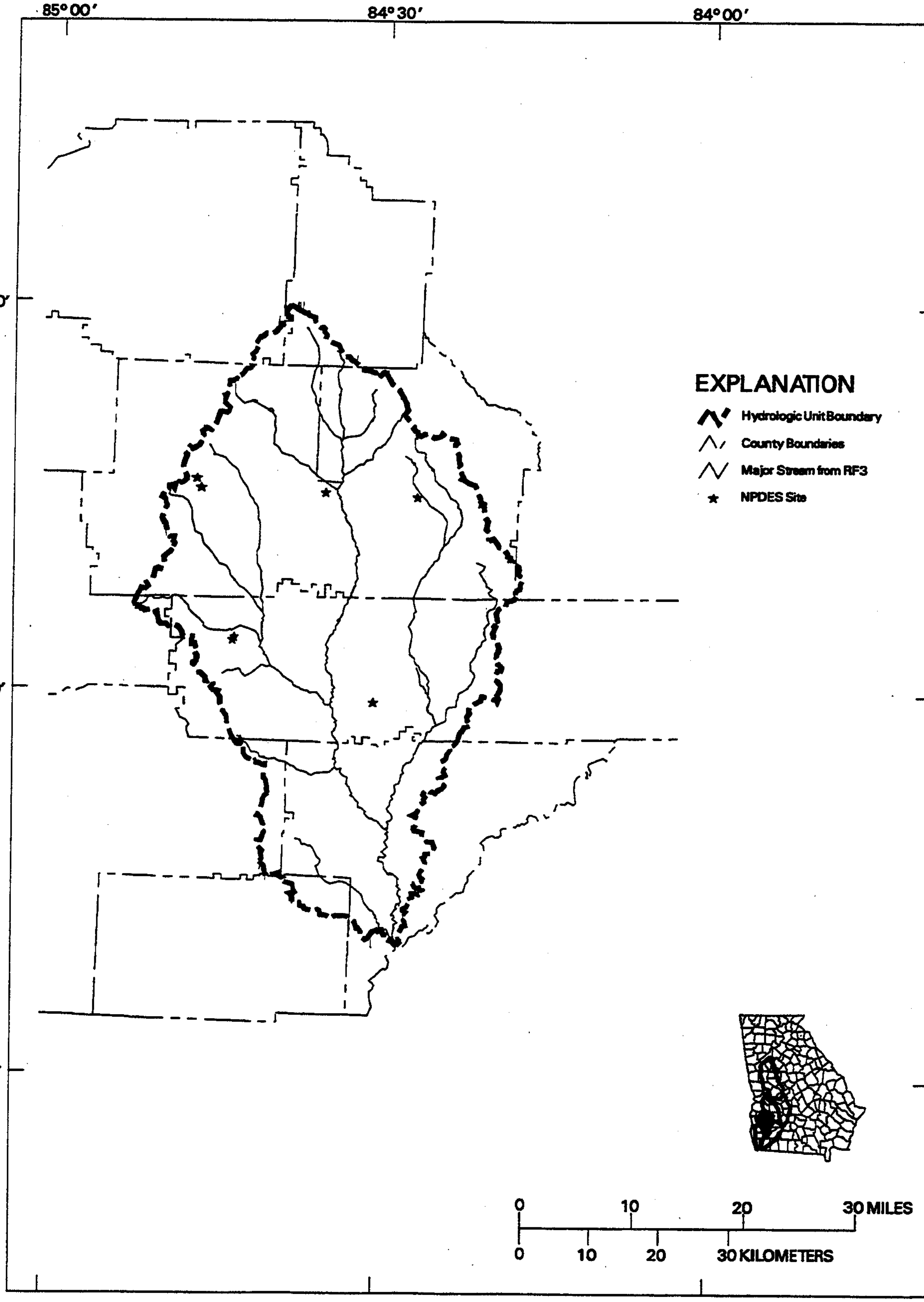


Figure 4-6. NPDES Sites Permitted by EPD, Ichawaynochaway Creeks Basins, HUC 03130009

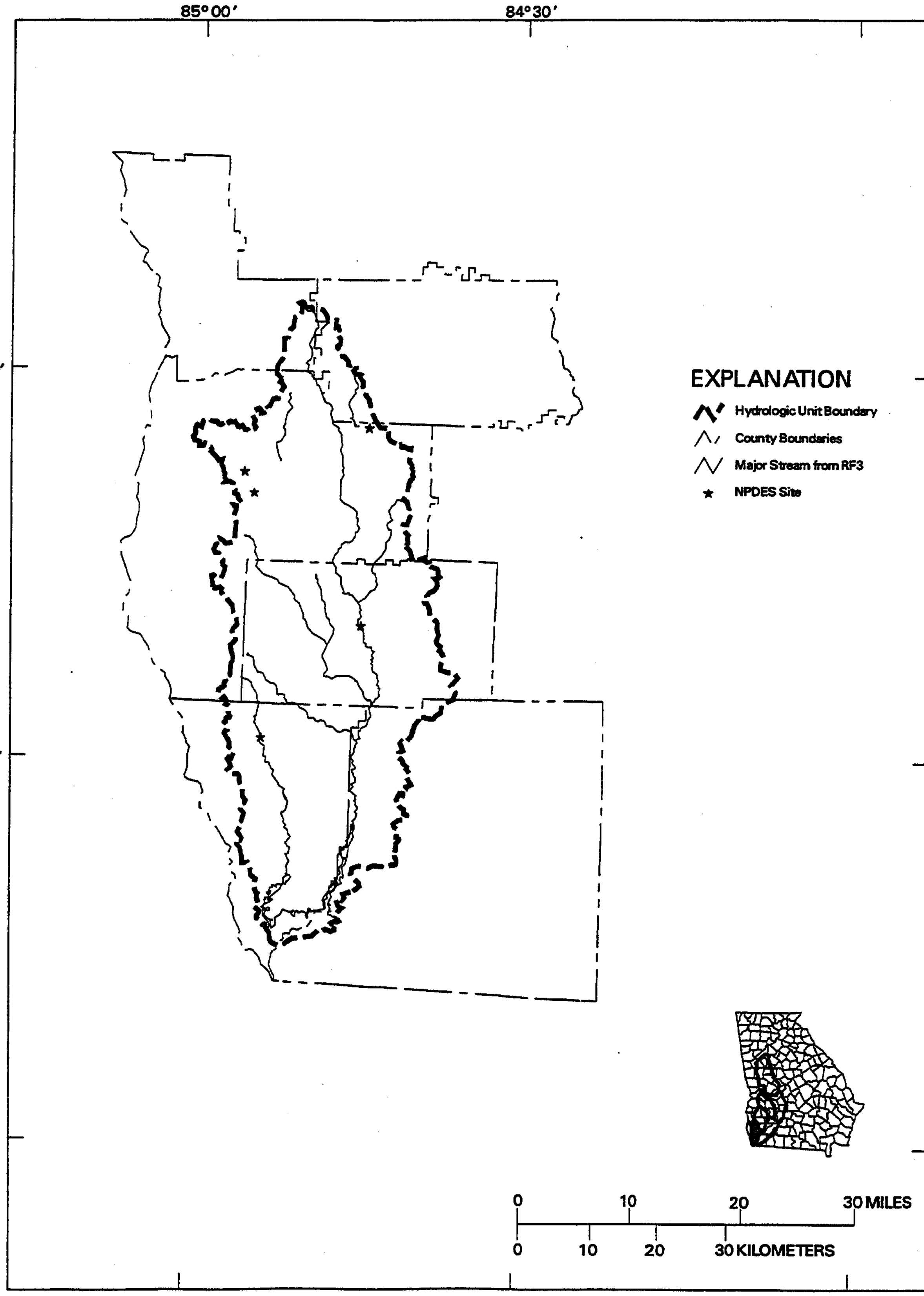


Figure 4-7. NPDES Sites Permitted by EPD, Spring Creek Basin, HUC 03130010

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 the 1990 session of the Georgia Legislature, a CSO law was passed requiring all Georgia cities with CSOs to eliminate or treat CSOs. Albany is the only city in the Flint River Basin that has combined sewer systems. Following the 1990 legislation, the City of Albany conducted a study to locate and determine the impact of CSOs on the Flint River.

Although CSO controls are well underway in the Flint River Basin, there is very limited data on the overall effectiveness of the controls and resulting improvement to water quality. The next basin planning cycle should provide more information on the effects of CSO mitigation on water quality of the Flint River Basin. Table 4-4 lists twelve active CSOs that were identified in the City of Albany.

The City's plan calls for controlling more than 75% of the CSO discharge during approximately 95% of the storms by transport and treatment at the City's wastewater treatment facility. The total costs of the interceptors, separation, diversion, storage and treatment facility expansion is over $40 million.

Much of the work involved in the plan has been completed. However, due to the 1994 flood some work has been delayed. The complete control plan should be in operation, including the expansion of the treatment facility, in late 1998.

4.1.1.3 NPDES Permitted Stormwater Discharges

Urban stormwater has been identified as a major source of stressors such as oxygen demanding waste (BOD) and fecal coliforms in the Upper Flint River Basin, due to metropolitan Atlanta. Stormwater may flow directly to streams as a diffuse, non-point source 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. Nonpoint stormwater is discussed in Section 4.1.2.2.

Pollutants typically found in urban stormwater 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. All of these pollutants, and many others, influence the quality of stormwater runoff. There are also many problems related to the quantity of urban runoff, which contributes to flooding and erosion in the immediate drainage area and downstream.

Table 4-4. Albany CSOs in the Flint River Basin

8th Avenue	Highland Avenue
3rd Avenue	Whitney Avenue
3rd Avenue West	Lift Station # 27
Booker Avenue	East Side/N. Broadway Avenue
West Broad Avenue	East Side/S. CSX Railroad
Oglethorpe Bridge	Mercer Avenue

In accordance with Federal "Phase I" stormwater regulations, the State of 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. Only one of these permits falls within the Flint basin, as shown in Table 4-5.

Industrial sites often have their own stormwater conveyance systems. Volume and quality of stormwater discharges associated with industrial activity is dependent upon a number of different factors, such as the industrial activities occurring at the facility, the nature of precipitation, and the degree of surface imperviousness. These discharges are of intermittent duration with short-term pollutants 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 stormwater 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 stormwater discharges for 10 of 11 federally regulated industrial subcategories. The 11th subcategory, construction activities, will be covered under a separate general permit. 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 stormwater pollution prevention plan; and, in some cases, the monitoring of stormwater discharges from the facility. As with the municipal stormwater permits, implementation of site-specific best management practices is the preferred method for controlling stormwater runoff.

4.1.1.4 Non-Discharging Waste Disposal Facilities

Land Application Systems (LAS)

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

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

Table 4-5. Permitted Municipal Separate Storm Sewer System, Flint River Basin

Permit #	GAS000130	**Contact**	Mary Lee, Mayor
Permittee	Riverdale	**Address**	6690 Church Street
County	Clayton	**City**	Riverdale
Type	Large/Clayton Coapp	**ZIP**	30274
Issued	06/15/94		
Expires	06/14/99		
HUC	03130005		

A total of 128 (municipal) and 35 (industrial) permits for land application systems were in effect in Georgia in 1995. Municipal and other wastewater land application systems within the Flint basin are listed in Table 4-6. The locations of all LAS's within the basin are shown in Figures 4-8 through 4-13.

Landfills

Permitted landfills are required to contain and treat any leachate or contaminated run-off 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 not currently practiced at any landfills in Georgia. Groundwater contaminated by landfill leachate from older, unlined landfills represents a potential threat to waters of the State. Groundwater and surface water monitoring and corrective action requirements are in place for all landfills operated after 1988 to identify

Table 4-6. Major Wastewater Land Application Systems in the Flint Basin

Facility Name	Facility Number	County	Design Flow (MGD)
HUC 03130005			
Clayton Co. Shoal Creek	GAU 020236	Clayton	1.10
Fayette Co (CR Edu.Complx)	GAU 030898	Fayette	0.15
Hampton Industrial Park	GAU 020125	Henry	0.10
Henry Co. Bear Creek	GAU 020095	Henry	0.25
Manchester	GAU 020081	Meriwether	0.81
Southern Mills, Inc.	GAU 010311	Coweta	0.07
Southern Mills, Inc.	GAU 010578	Upson	0.50
Upson Co. - C.I.	GAU 020136	Upson	0.008
Woodbury	GAU 020079	Meriwether	0.32
HUC 03130006			
Southern Dairy	GAU 010410	Macon	0.233
Southern Dairy	GAU 010409	Macon	0.415
Tyson Foods	GAU 010457	Macon	0.048
Vienna	GAU 020244	Dooly	0.75
Vienna	GAU 020167	Dooly	0.99
HUC 03130007			
GDC - Lee C.I.	GAU 020284	Lee	0.07
Oak Hill Farms	GAU 010455	Lee	0.236
HUC 03130008			
Camilla	GAU 020088	Mitchell	3.10
Mitchell Co.-Autry C. I.	GAU 030740	Mitchell	0.145
United States Dairy Co.	GAU 010558	Mitchell	0.318
HUC 03130009			
Georgia Feed Products, Inc.	GAU 010509	Randolph	0.345
Morgan - Calhoun C. I.	GAU 020076	Calhoun	0.15
HUC 03130010			
None			

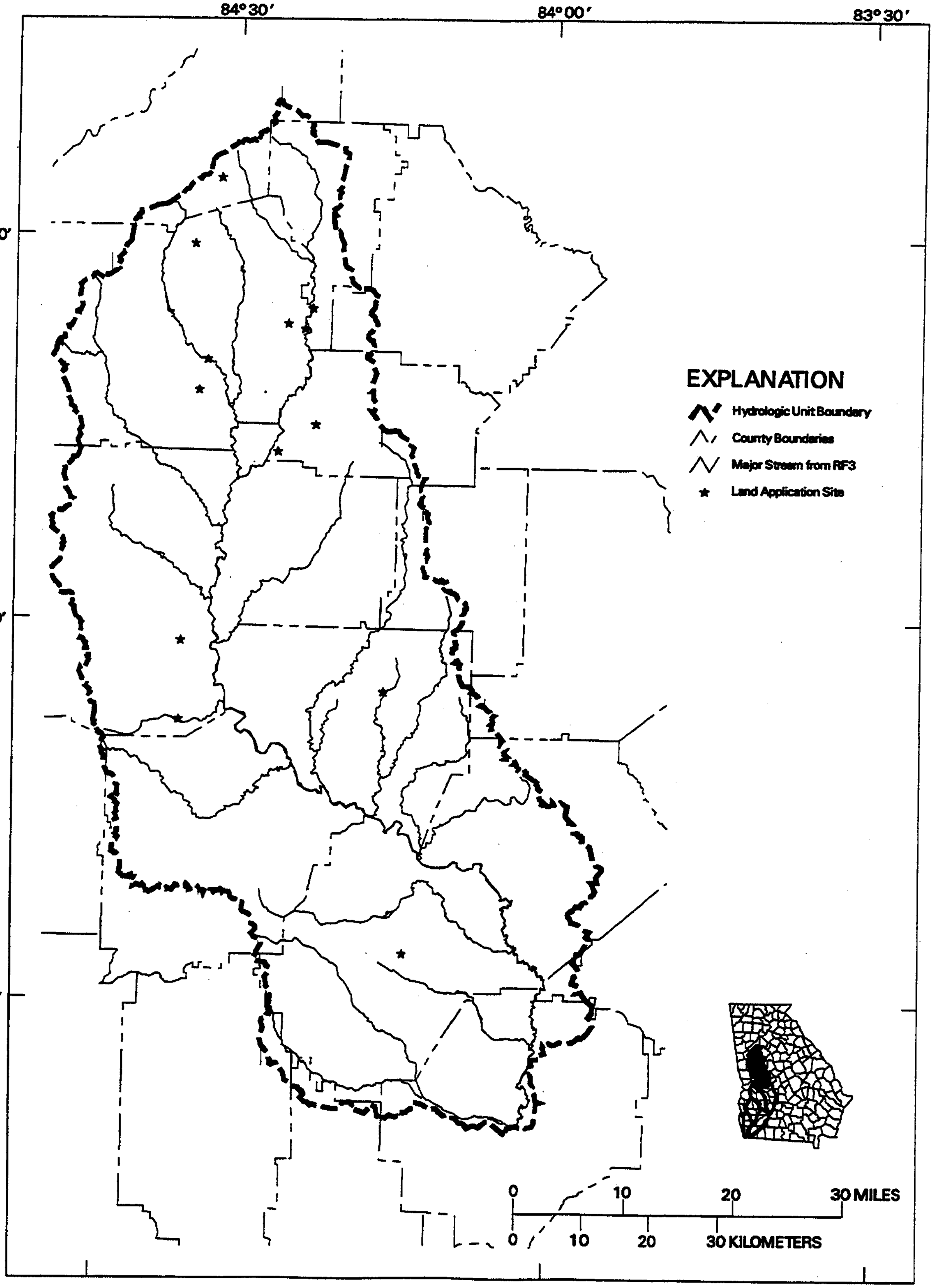


Figure 4-8. Land Application Sites, Middle Flint River Basin, HUC 03130005

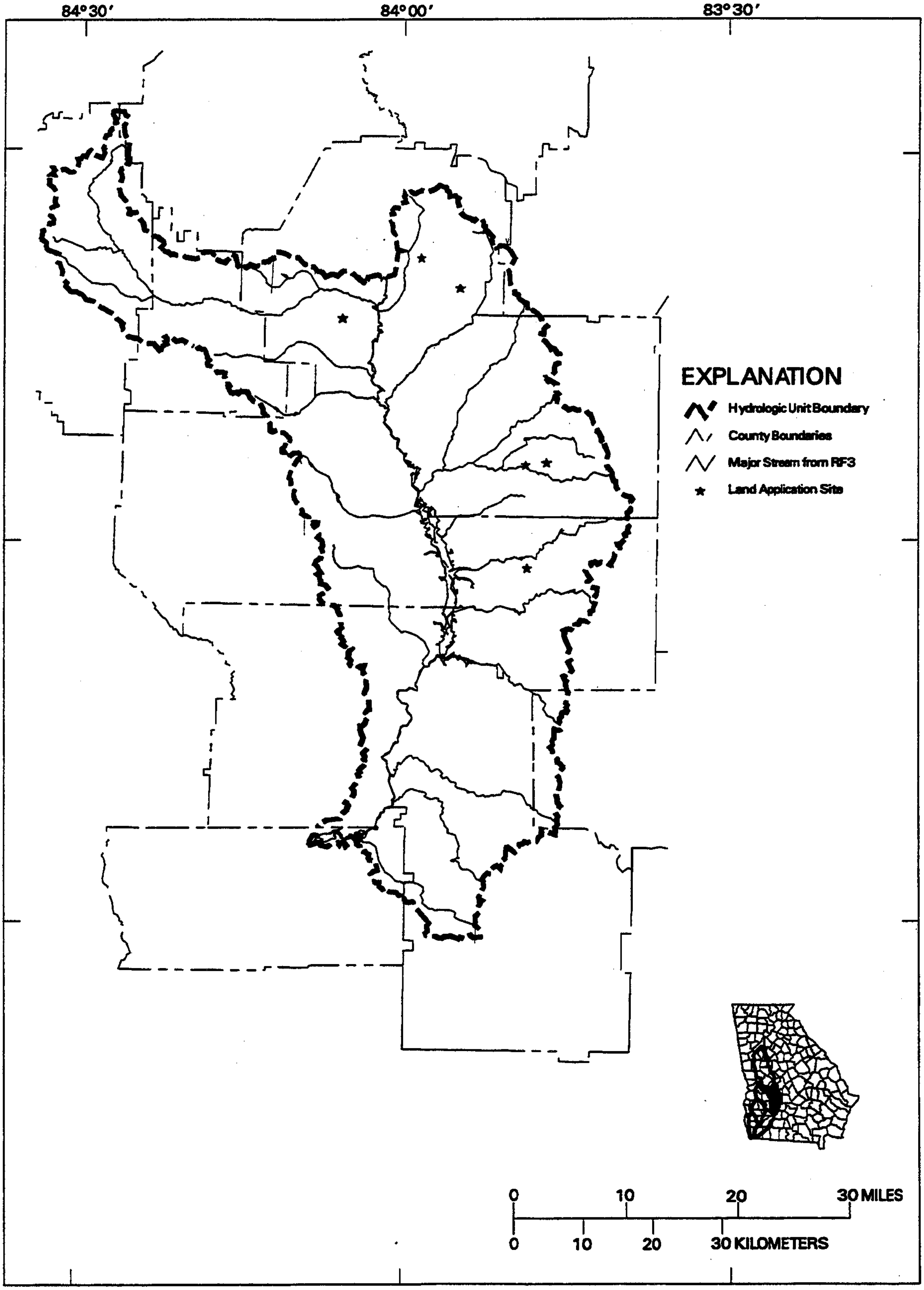


Figure 4-9. Land Application Sites, Middle Flint River Basin, HUC 03130006

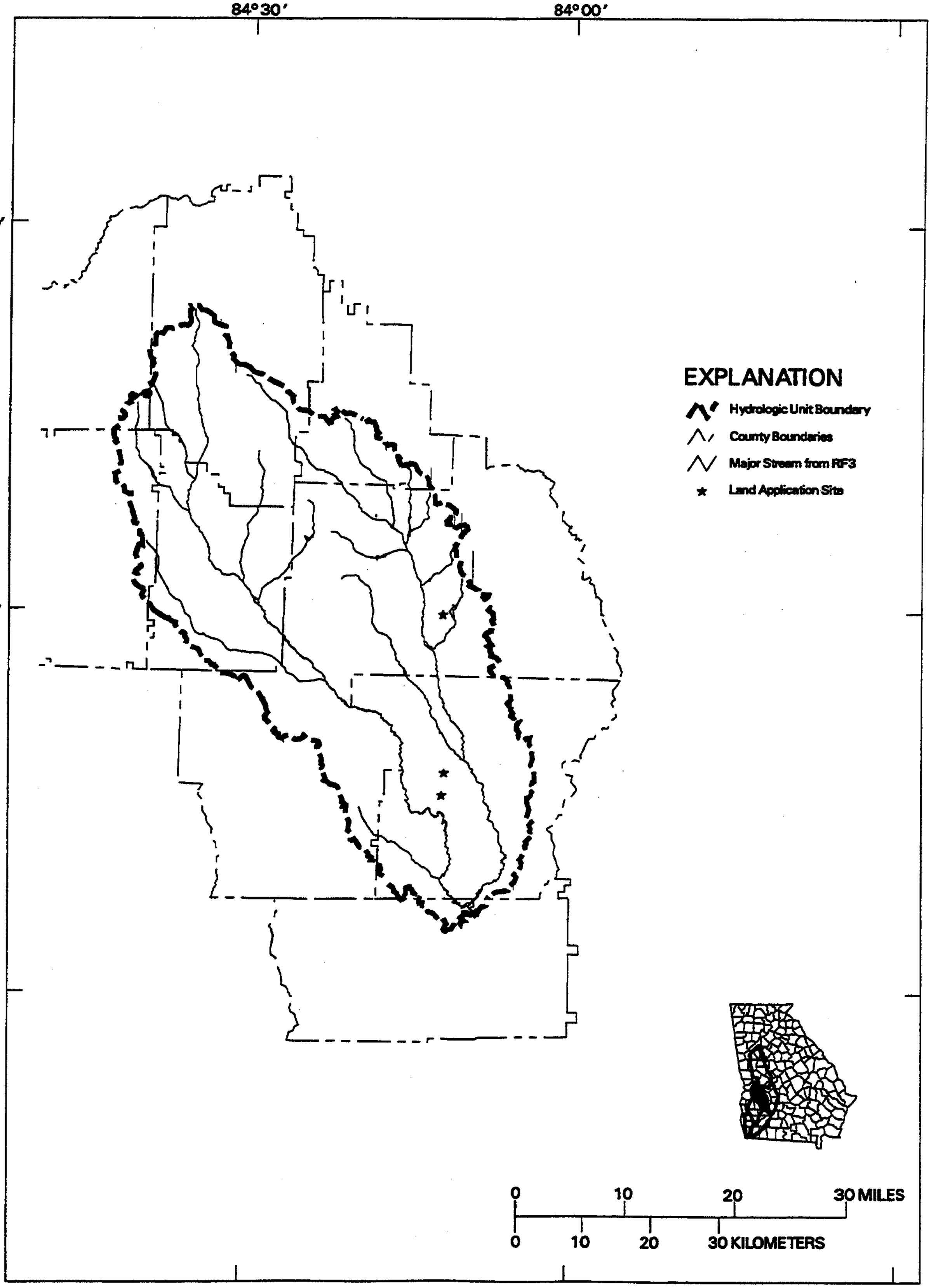


Figure 4-10. Land Application Sites, Kinchafoonee-Muckalee Creeks Basin, HUC 03130007

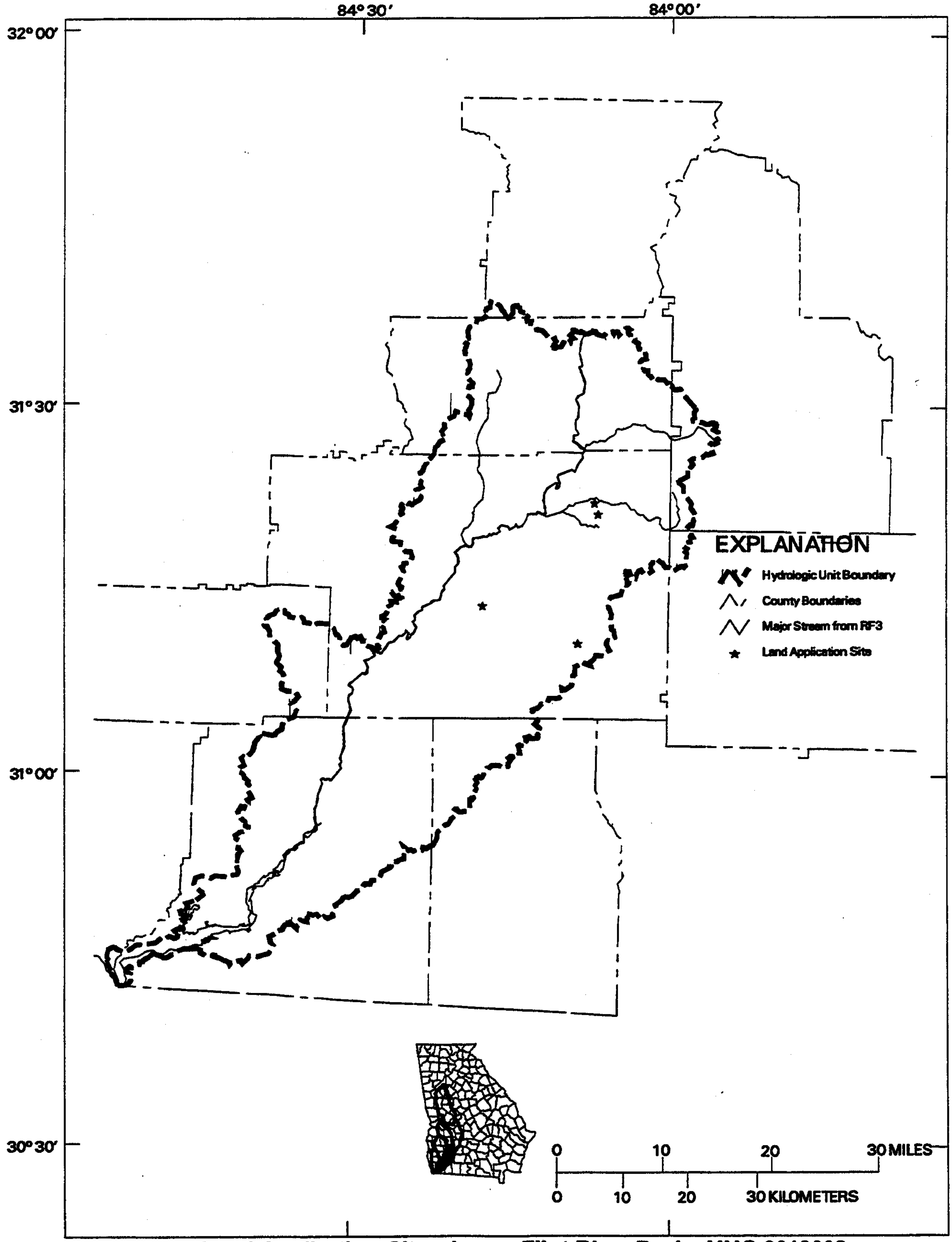


Figure 4-11. Land Application Sites, Lower Flint River Basin, HUC 0313008

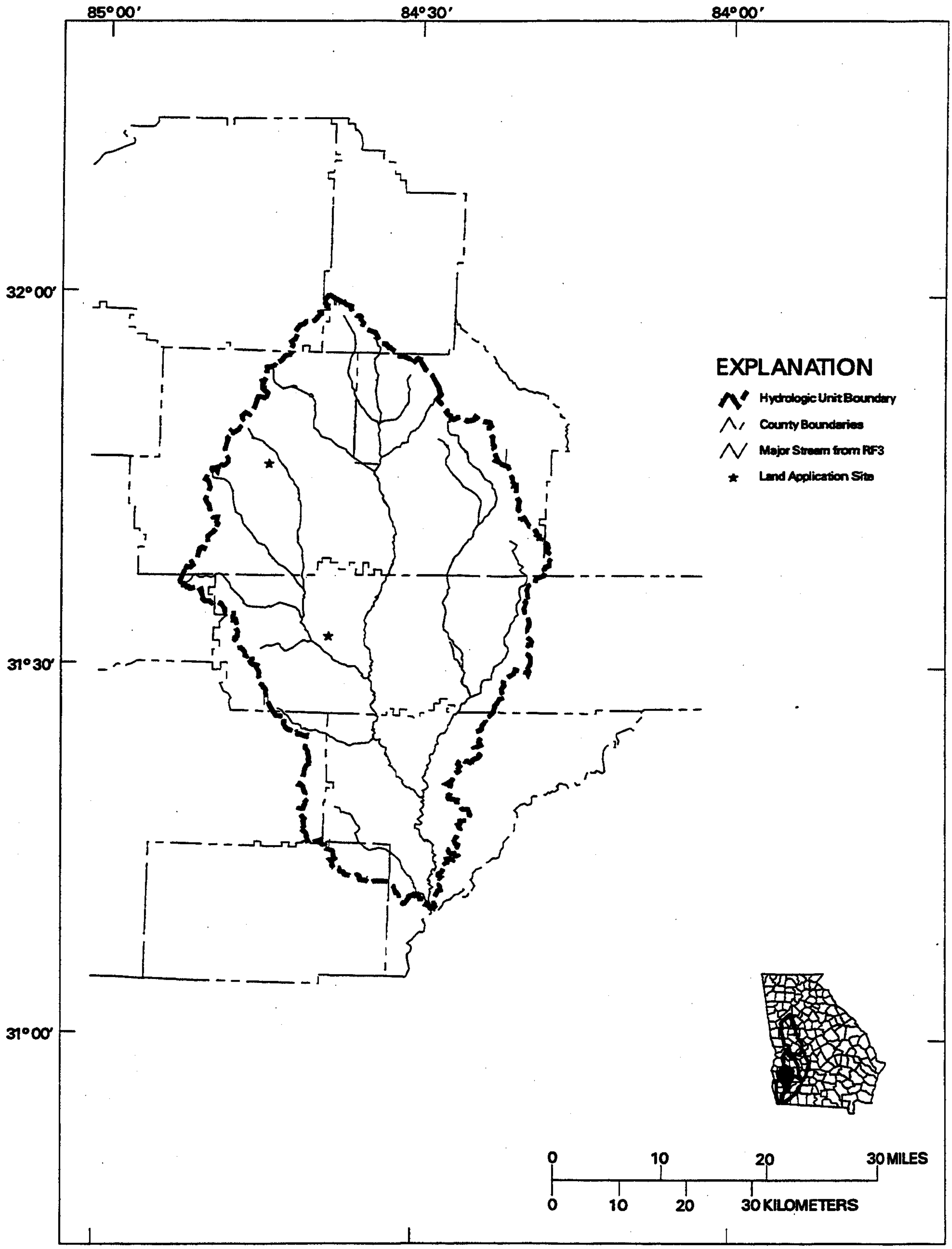


Figure 4-12. Land Application Sites, Ichawaynochaway Creek Basin, HUC 03130009

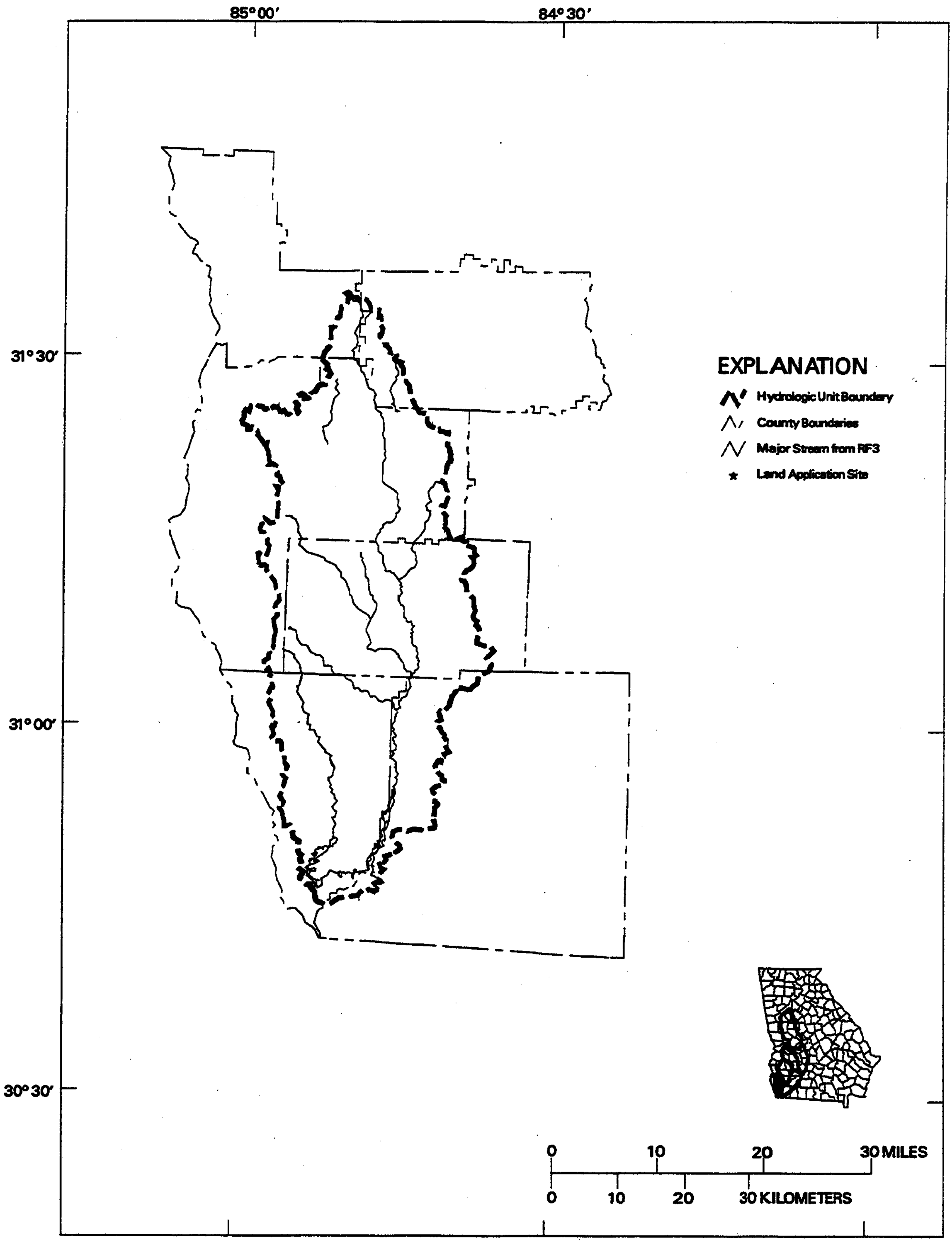


Figure 4-13. Land Application Sites, Spring Creek Basin, HUC 03130010

and remediate potential threats. 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 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 4-14 through 4-19.

4.1.2 Nonpoint Sources

The pollution impact on Georgia's streams has shifted over the last two decades. Streams are no longer dominated by untreated or partially treated wastewater discharges which result in little or no oxygen and little or no aquatic life. The wastewater is now treated, oxygen levels have returned, and strong 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, and consist of mud, litter, bacteria, pesticides, fertilizers, metals, oils, grease, and a variety of other pollutants which are washed from rural and urban lands by stormwater.

Nonpoint pollutant loading comprises a wide variety of sources not subject to point source control via NPDES permits. The most significant nonpoint sources are those associated with precipitation, washoff, and erosion, which may move pollutants from the land surface to water bodies. Both rural and urban land uses can contribute significant amounts of nonpoint pollution.

Historically in Georgia, as well as elsewhere in the nation, the major source of water quality degradation has been pollutant loading from point sources. However, as the dominant point source problems have been brought under control, increasing emphasis has been placed on the control of nonpoint source pollution. A review of 1994-95 water quality assessment results for the Flint River Basin indicate that urban runoff and nonpoint sources contribute significantly to nonsupport of water uses.

4.1.2.1 Nonpoint Sources from Agriculture

Agricultural operations can contribute stressors to water bodies in a variety of ways. Tillage and other soil disturbing activities may 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.

Agricultural influences on aquatic ecosystems differ with the type of agricultural activity. Confined feeding for poultry and livestock production dominate in the Piedmont Province, and row-crop agriculture dominates in the Coastal Plain. Potential effects on aquatic ecosystems in the Piedmont Province primarily are nutrient enrichment from manure disposal and riparian degradation and stream-bank erosion caused by livestock trampling and grazing. Aquatic ecosystems in areas of row-crop agriculture are at risk of receiving inputs of pesticides and chemical fertilizers.

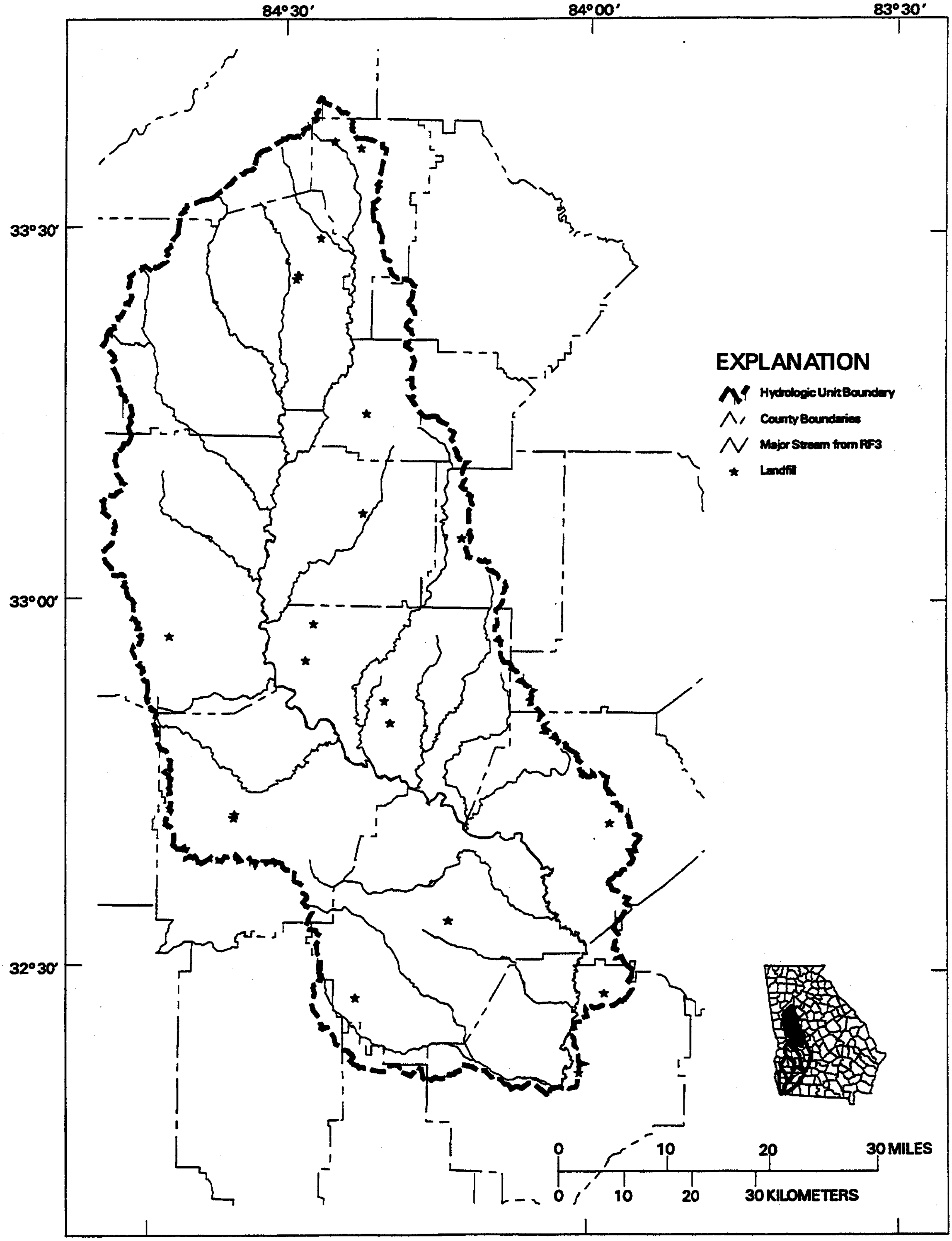


Figure 4-14. Landfills, Upper Flint River Basin, HUC 0313005

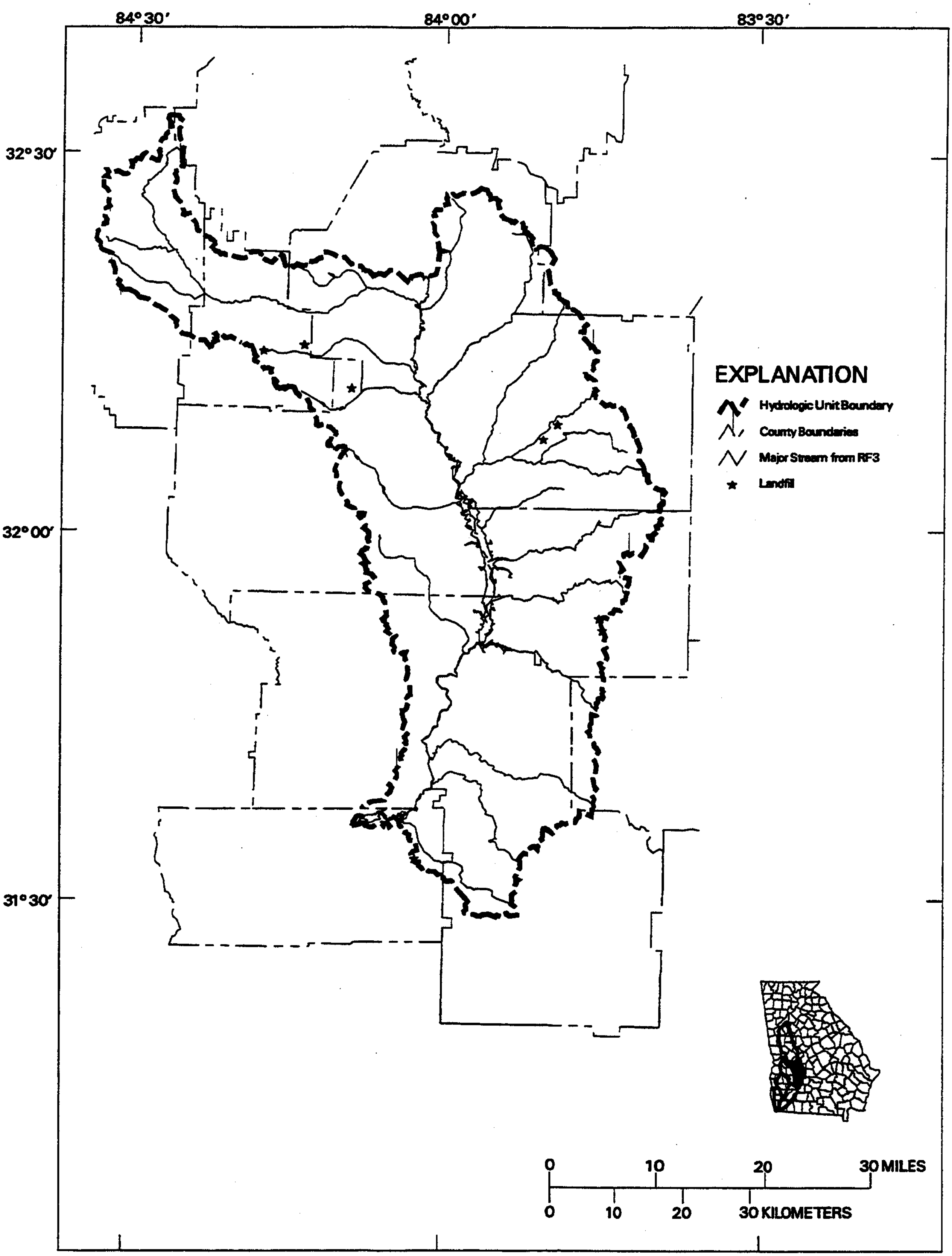


Figure 4-15. Landfills, Middle Flint River Basin, HUC 03130006

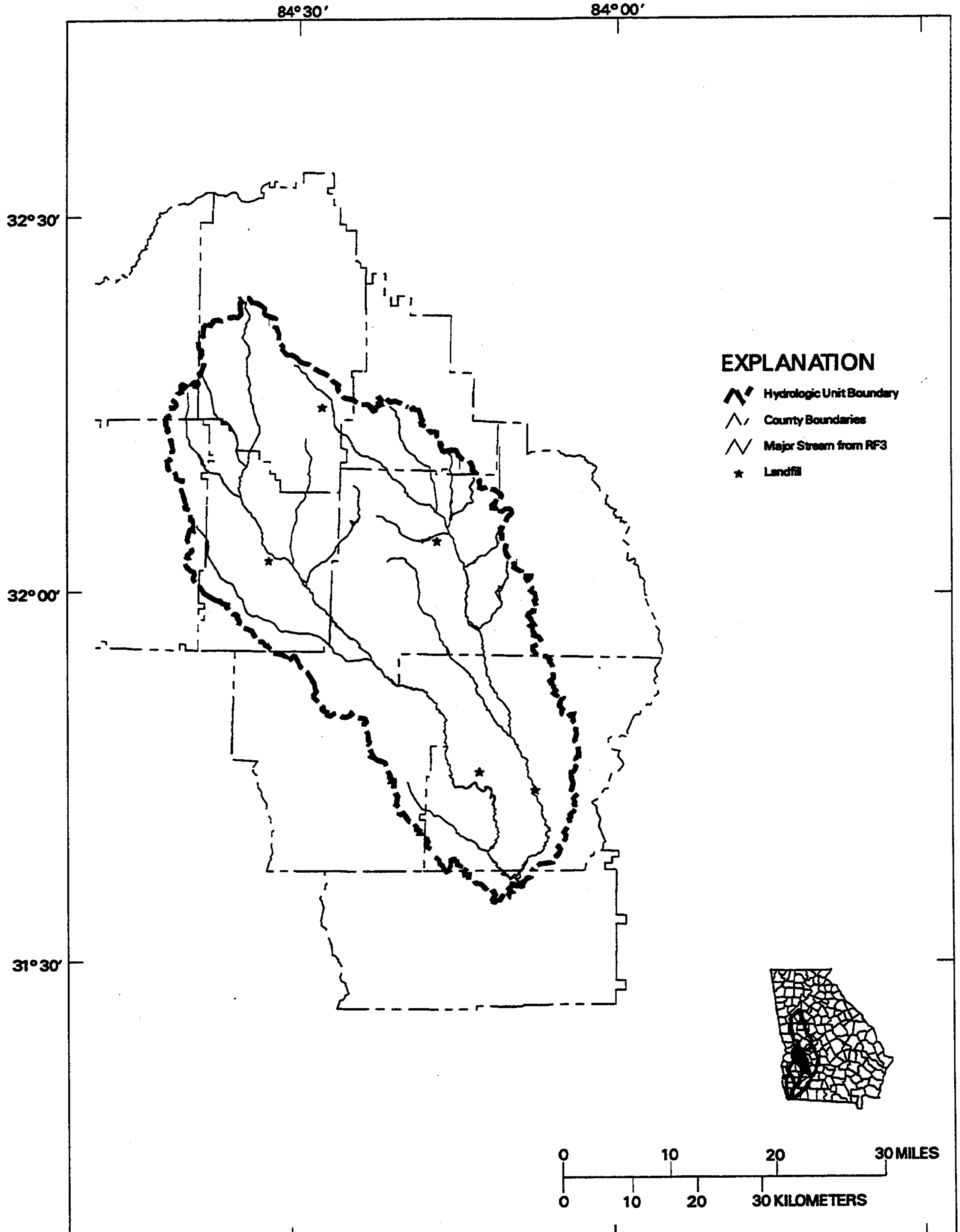


Figure 4-16. Landfills, Kinchafoonee-Muckalee Creeks Basin, HUC 03130007

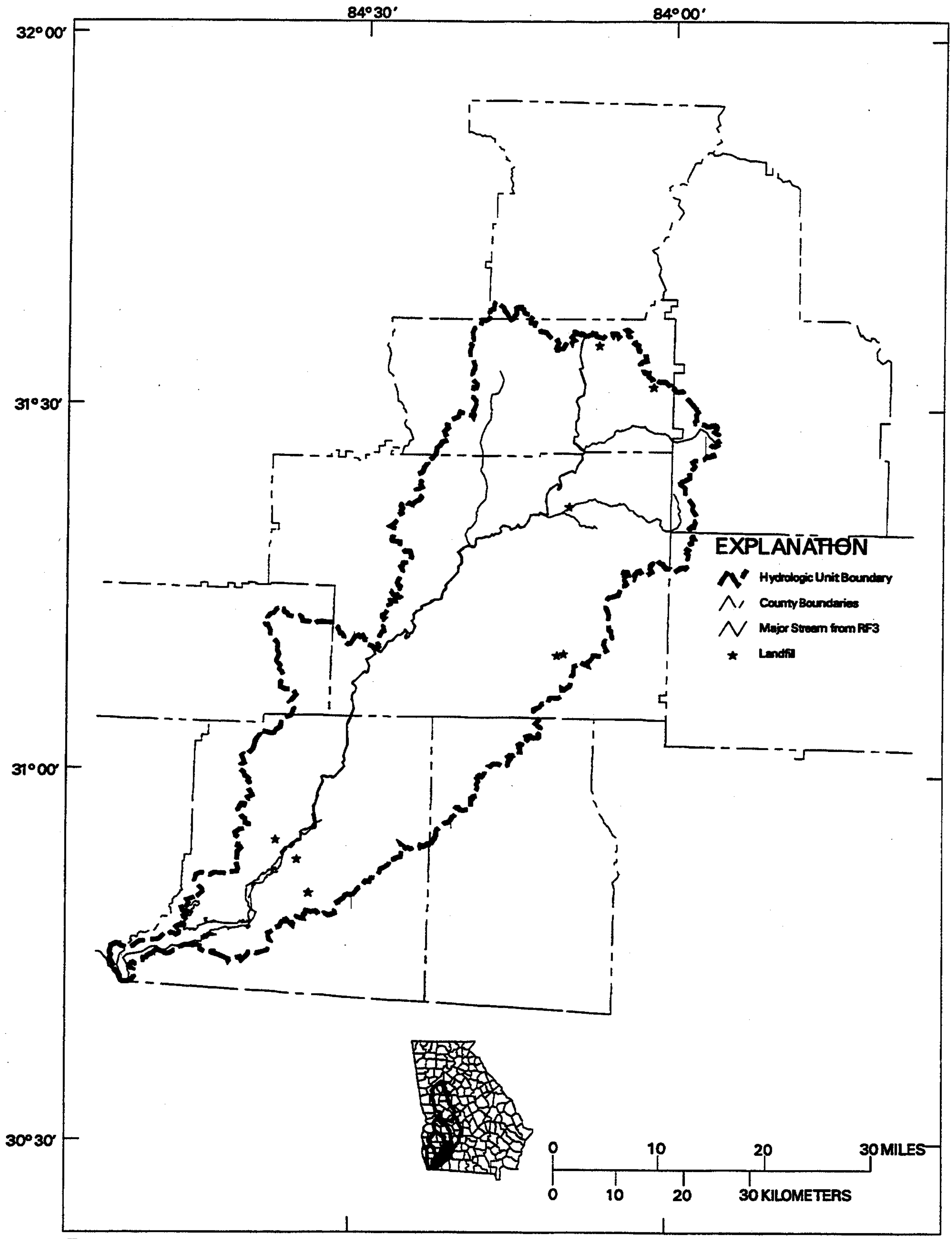


Figure 2-17. Landfills, Lower Flint River Basin, HUC 03130008

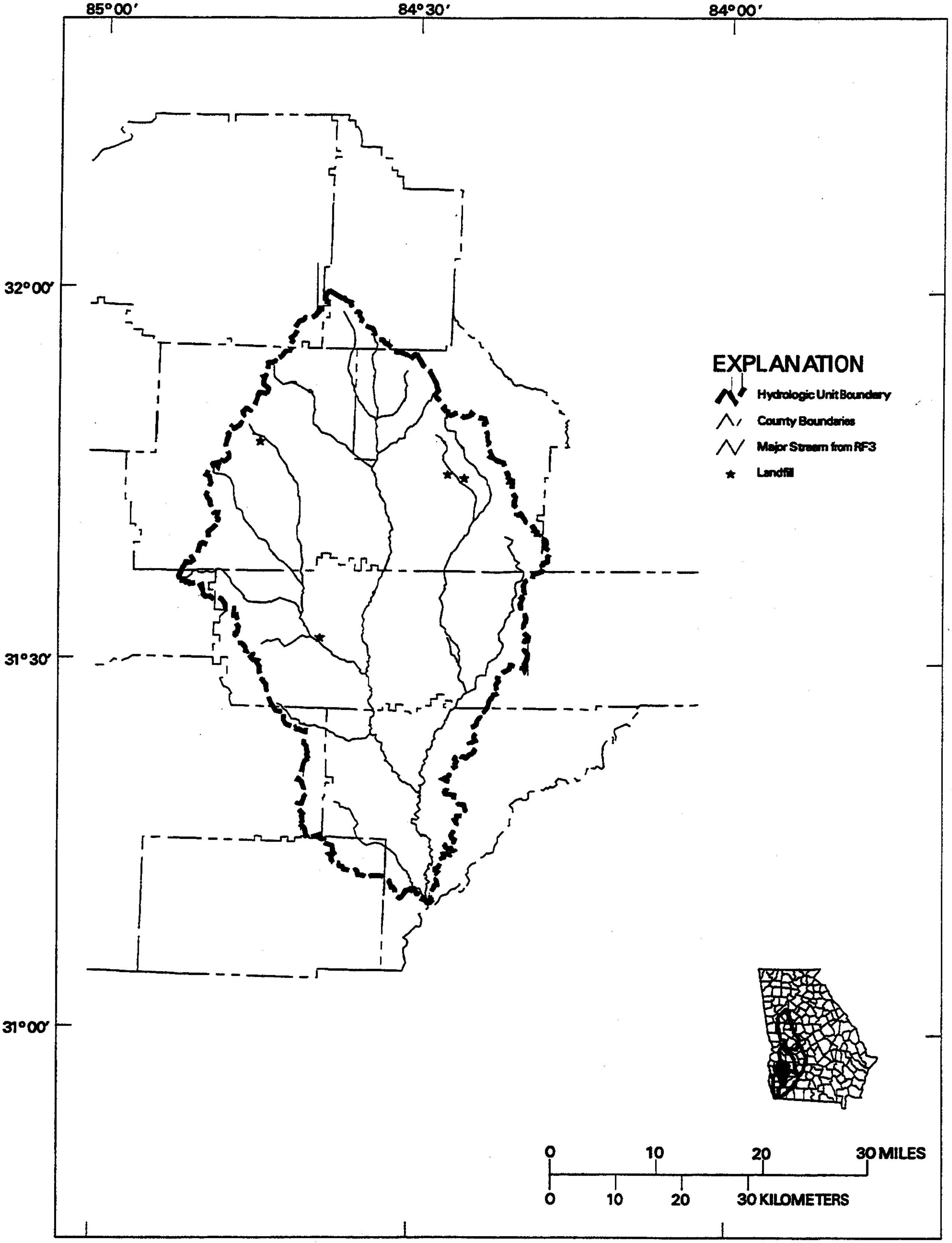


Figure 4-18. Landfills, Ichawaynochaway Creek Basin, HUC 03130009

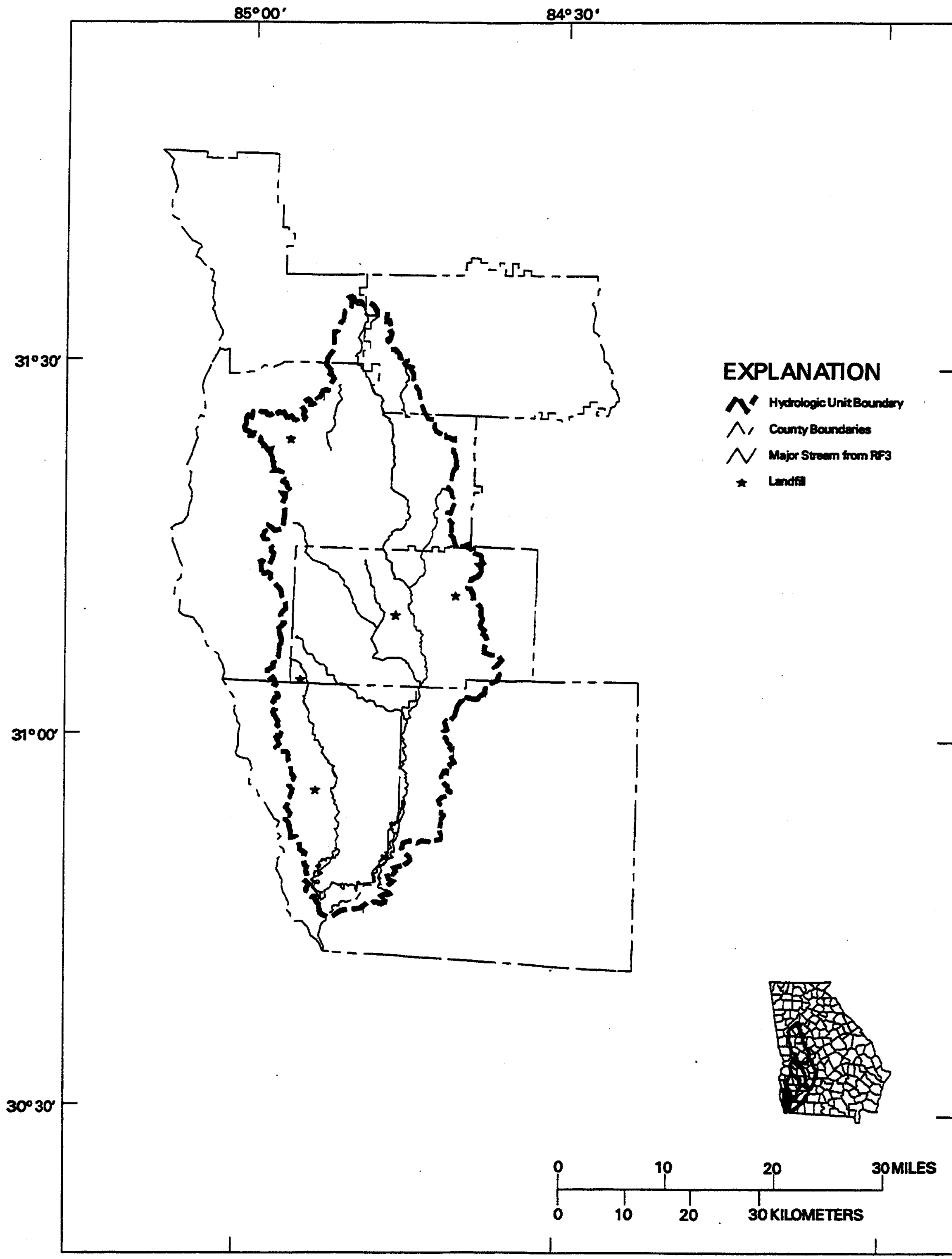


Figure 4-19. Landfills, Spring Creek Basin, HUC 03130010

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 may also include crop debris and animal wastes. Excess sediment loads can damage aquatic habitat by smothering and shading food organisms, altering natural substrate, and destroying spawning areas. Runoff with elevated sediment concentrations can also scour aquatic habitat causing significant impacts to the biological community. Excess sediment may also increase water treatment costs, interfere with recreational uses of water bodies, create navigation problems, and increase flooding damage. Second, a high percentage of nutrients lost from agricultural lands, particularly phosphorus, is transported sorbed to sediment. Many organic chemicals used as pesticides or herbicides are also transported predominantly sorbed to sediment.

Agriculture can also be a significant source of nutrients, which can lead to excess or nuisance growth of aquatic plants and depletion of dissolved oxygen in surface waters, or may cause contamination of ground water. The nutrients of most concern from agricultural land uses are nitrogen (N) and phosphorus (P), which may derive 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, while 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 its mobility, the major route of nitrate loss is to streams by interflow or to groundwater in deep seepage.

Phosphorus transport is a complex process involving 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 the phosphorus in solution.

In 1993, the Soil Conservation Service (SCS, now NRCS) completed a study to identify hydrologic units in Georgia with high potential for nonpoint source (NPS) pollution problems resulting from agricultural land uses (SCS, 1993). This study concluded that there is not a major statewide agricultural pollution problem in Georgia. However, the assessment shows that some watersheds have sufficient agricultural loadings to potentially impair their designated uses, based on estimates of transported sediments, nutrients, and animal waste from agricultural lands.

In the SCS study, estimates of potential agricultural NPS loads were based on county units. An erosion index was developed for each county that included soil erodibility, slope, and slope length. Each county was assigned to one of seven Major Land Resource Areas on which a joint Agricultural Research Service (ARS) and EPA study (USDA Utilization Research Report No. 6 and EPA-600/2-79-059) gave estimates of annual runoff, pounds per acre of dissolved nitrogen and phosphorus from applied animal waste, and a method of converting pound per acre to parts per million (ppm) concentration in runoff from agricultural lands.

Data on agricultural lands, land use, and animal units were developed for each county and reviewed and modified by the local agricultural Field Advisory Committee. Erosion and sediment yield data bases were calculated and compiled for agricultural lands based on county erosion indexes and cover factors. Nutrient needs were also developed by county and watershed. Potential nutrient loads were based on a worst case scenario where nutrients needed for agricultural lands are provided entirely from commercial fertilizer and animal waste is not managed for its nutrient value. Erosion and sediment yields were developed based on county cropland and grassland data. Estimates include sheet, rill, and ephemeral gully erosion, factored by a delivery ratio to the streams.

Estimates of sediment, nitrogen and phosphorus loads from agricultural lands were calculated by SCS (1993) on a county basis, then converted to average concentrations per event. Reporting on a concentration basis helps account for the fact that county boundaries generally do not coincide with watershed boundaries. Estimates for agricultural loading for those counties with significant land area within the Flint River Basin are summarized in Table 4-7.

Based on these analyses, SCS (1993) and the Georgia Soil and Water Conservation Commission (GSWCC) also identified specific watersheds within the Flint River Basin which have potential water quality problems associated with agricultural runoff. The identification was updated by the GSWCC for inclusion in Georgia's 1995 305(b) report and is shown in Table 4-8. The list represented the best effort by the Federal and State agricultural agencies to identify potential water problem areas, but was not based on documented water quality problems. Mileages presented are based on taking a flat percentage of stream miles within the hydrologic unit and represent an estimate only.

In July and August of 1996, EPD conducted additional biological assessment of the waters listed in Table 4-8 to determine which of these waters should be added to Georgia's Section 303(d) list of water quality limited segments. Those waters designated with a "3" under 303(d) Priority Ranking were added to the § 303(d) list in December 1996. Those designated with a "0" were determined not to be water quality limited segments based on the July-August 1996 sampling.

Animal waste

Besides 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 groundwater through runoff, seepage, or percolation and surface water as return flow. The organic materials place an oxygen demand on the receiving waters during their decomposition adversely impacting fisheries; and cause other problems with taste, odor, and color. The possible presence of pathogens including fecal bacteria that impact human health is of particular concern when waters are contaminated by waste from mammals.. In addition to bacteria, cattle waste may be an important source of the infectious oocysts of the protozoan parasite *Cryptosporidium parvum*.

Pesticides

Pesticides applied in agricultural production may be insoluble or soluble and include herbicides, insecticides, miticides and fungicides. Their primary transport mode is direct surface runoff, either in dissolved form or attached to sediment particles. Some pesticides may cause acute and chronic toxicity problems in the water or throughout the entire food chain. Others are suspected human carcinogens, although the use of these pesticides has generally been discouraged in recent years.

Table 4-7. Estimated Loads from Agricultural Lands by County (SCS, 1993)

County	Acres with nutrient application	Sediment (tons)	Sediment (ppm)	Nitrogen (tons)	Nitrogen (ppm)	Phosphorus (tons)	Phosphorus (ppm)
Hydrologic Unit 03130005, Upper Flint River Basin							
Clayton	6,279	2,580	14.5	9	0.05	4	0.020
Coweta	39,214	39,641	34.3	114	0.10	45	0.040
Crawford	32,246	14,480	33.8	57	0.15	20	0.053
Lamar	43,907	32,016	24.7	116	0.09	42	0.034
Meriwether	60,489	45,424	25.1	133	0.08	53	0.031
Pike	35,616	38,090	31.1	131	0.13	50	0.049
Spalding	19,818	24,366	42.0	74	0.13	28	0.050
Talbot	28,085	13,551	16.6	42	0.05	17	0.021
Taylor	62,645	39,649	45.5	116	0.16	43	0.059
Upson	37,718	12,767	11.4	75	0.07	27	0.025
Hydrologic Unit 03130006, Middle Flint River Basin							
Crisp	0	144,216	56.0	374	0.16	148	0.061
Dooly	112,931	154,242	47.4	420	0.15	158	0.058
Macon	93,230	88,717	65.2	200	0.09	44	0.020
Schley	22,072	29,172	39.6	83	0.16	31	0.059
Worth	140,433	147,585	39.2	413	0.12	156	0.046
Hydrologic Unit 03130007, Kinchafoonee-Muckalee Creek Basin							
Lee	72,356	59,749	25.1	202	0.12	67	0.039
Marion	25,465	12,902	10.6	256	0.85	99	0.330
Sumter	131,559	159,067	40.6	447	0.14	168	0.053
Webster	30,055	33,070	34.5	88	0.12	34	0.047
Hydrologic Unit 03130008, Lower Flint River Basin							
Decatur	111,836	118,568	30.2	334	0.11	128	0.040
Dougherty	51,248	29,843	19.8	90	0.07	34	0.027
Mitchell	149,965	148,860	32.8	441	0.12	162	0.045
Hydrologic Unit 03130009, Ichawaynochaway Creek Basin							
Baker	77,762	44,280	21.7	130	0.07	49	0.026
Calhoun	0	83,365	44.2	225	0.13	88	0.052
Randolph	67,758	120,441	60.3	317	0.19	124	0.075
Terrell	71,265	84,052	28.8	216	0.13	85	0.049
Hydrologic Unit 03130010, Spring Creek Basin							
Early	123,292	146,088	32.6	391	0.13	153	0.051
Miller	94,148	58,928	22.0	180	0.08	66	0.029
Seminole	74,143	51,918	24.1	148	0.08	56	0.031

Note: Mass estimates are based on whole county. Concentration estimates are average event runoff concentration from agricultural lands.

Table 4-8. List of Watersheds Potentially Impacted by Agricultural Nonpoint Source Pollution in The Flint River Basin

HUC	Watershed Name - County	River Miles	§ 303(d) Priority
3130005	Patsiliga Creek - Taylor	16	0
3130005	Potato Creek - Lamar and Upson	26	0
3130005	Red Oak Creek - Meriwether	19	3
3130005	White Water Creek - Macon and Taylor	21	3
3130006	Camp and Lime Creek - Schley, Sumter and Macon	23	3[1]
3130006	Hogcrawl and Spring Creek - Dooly and Macon	26	3[2]
3130006	Chokee Creek - Sumter and Lee	8	0
3130006	Swift Creek - Crisp and Worth	15	0
3130007	Lower Kinchafoonee Creek - Terrell and Lee	11	3
3130007	Muckalee Creek - Schley and Sumter	35	0
3130008	Big Creek - Grady and Decatur	16	0
3130008	Cooleewahee Creek - Baker and Dougherty	5	3
3130008	River Bend-Baconton - Mitchell	2	3[3]
3130008	Big Slough - Grady and Mitchell	7	3[3]
3130009	Lower Pachitla Creek - Baker, Calhoun and Early	13	0
3130009	Chickasawhatchee Creek - Terrell	23	3
3130009	Pachitla Creek - Randolph and Calhoun	20	3
3130009	Ichawaynochaway Creek - Randolph and Terrell	24	0
3130009	Lower Chickasawhatchee Creek - Baker and Calhoun	12	0
3130010	Fishpond Drain - Seminole	2	3[3]
3130010	Spring Creek - Calhoun, Clay, Early and Miller	13	0
3130010	Aycocks Creek - Early and Miller	18	0

[1] Only Camp Creek in Schley County was placed on 303(d) list.

[2] Only Spring Creek in Macon County was placed on 303(d) list.

[3] These segments were dry during the July-August 1996 sampling, so EPD was unable to collect data to support the omission of these segments from the 303(d) list.

Use of agricultural pesticides/herbicides within the basin is described in Stell *et al.* (1995). For the Flint and Chattahoochee basins combined, data compiled from the Georgia Herbicide Use Survey Summary (Monks and Brown, 1991) indicate that bentazon, paraquat, 2,4-DB, methanearsonates (MSMA/DSMA), alachlor, and pendimethalin were used to treat the largest number of acres (from 307,000 to 205,000 acres); and alachlor, MSMA/DSMA, fluometuron, atrazine, metolachlor, and bentazon were applied in the greatest quantities (from 506,000 to 185,000 pounds of active ingredient. Since 1990, the use of alachlor in Georgia has decreased dramatically (about 98 percent) in response to market conditions, as peanut wholesalers will no longer buy peanuts treated with alachlor. Metolachlor, rather than alachlor, is now being applied to peanuts.

Non-herbicide pesticide use is difficult to estimate. According to Stell *et al.*, pesticides other than herbicides are currently used only when necessary to control some type of infestation (nematodes, fungi, insects), and chlorothalonil, aldicarb, chlorpyrifos, methomyl, thiodicarb, carbaryl, acephate, fonofos, methyl parathion, terbufos, disulfoton, phorate, triphenyltin hydroxide (TPTH), and synthetic pyrethroids/pyrethrins are commonly used. Application periods of the principal agricultural pesticides span the calendar year in the basin; however, agricultural pesticides are applied most intensively and on a broader range of crop types from March 1 to September 30 in any given year.

It should be noted that past uses of persistent agricultural pesticides which are now banned may continue to impact water quality within the basin, particularly through residual concentrations present in bottom sediments. The survey of pesticide concentration data by Stell *et al.* found that nearly 56 percent of the analyses in water and sediment having concentrations at or above minimum reporting levels were for two groups: DDT and metabolites, and chlordane and related compounds (heptachlor, heptachlor epoxide), while dieldrin was also frequently detected. All these pesticides are now banned by USEPA for use in the United States, but may persist in the environment for long periods of time.

Prime Farmland Conversion

Between 1982 and 1992 four million acres of Georgia prime farmland were lost to urban and suburban development. Nonpoint source pollution delivery coefficients tend to be higher for urban/suburban land uses in comparison to prime farmland, which by definition is relatively flat with soils that are highly permeable.

4.1.2.2 Nonpoint Sources from Urban, Industrial, and Residential Lands

Water quality in urban waterbodies is the result of both point source discharges and the impact of diverse land activities in the drainage basin (i.e., nonpoint sources). One of the most important sources of environmental stressors in the Flint basin, and particularly in the developed and rapidly growing areas around Atlanta and Albany, is diffuse runoff from urban, industrial, and residential land uses (jointly referred to as "urban runoff"). Nonpoint source contamination can lead to impairment in streams draining extensive commercial and industrial areas, where stormwater runoff, unauthorized discharges, and accidental spills may contribute to pollutant loading. 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 only occurs intermittently, in response to precipitation events.

The characteristics of nonpoint urban runoff are generally similar to those of NPDES permitted stormwater discharges (Section 4.1.1.2). Separate stormwater systems, however, are typically found in developed areas with high imperviousness and, frequently, sanitary sewer systems. Nonpoint urban runoff includes drainage from some builtup areas with similar characteristics, but also includes less highly developed areas with greater amounts of pervious surfaces. Nonpoint urban runoff is likely to include a larger percentage of drainage from areas including lawns, gardens, and septic tanks, all of which may be sources of nutrient load.

At present, little site-specific data are available to quantify loading in nonpoint urban runoff in the Flint River Basin, although estimates of loading rates by land use types have been widely applied in other areas. Peters and Kandell (1997) present a water quality index for streams in the Atlanta region, based primarily on nutrients and nutrient-related parameters because data for metals, organics, biological conditions, and suspended sediment were generally unavailable. They report that the annual average index of water quality conditions generally improved at most long-term monitoring sites between 1986 and 1995. However, conditions markedly worsened between 1994 and 1995 at several sites where major development was ongoing.

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. Stell *et al.* (1995) provide a summary of usage in the Atlanta Metropolitan Statistical 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.

Stell *et al.* estimated that there are about 190 mi^2 of lawns in the Atlanta MSA part of the Chattahoochee and Flint basins, of which home owners apply pesticides to about 120 mi^2 and the lawn care industry applies pesticides to about 23 mi^2, with the remainder of lawns untreated. Other types of urban/suburban land receiving pesticide treatment include golf courses, roadsides, local government land, parks, industrial land, and schools.

Urban and residential stormwater 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 exact number of leaking under ground storage tanks (LUSTs) within the Flint River Basin is unknown. EPD's Land Protection Branch is responsible for ensuring that proper action is taken to identify and remediate LUSTs. Petroleum hydrocarbons and lead are typically the pollutants associated with LUSTs.

4.1.2.3 Nonpoint Sources from Forestry

Undisturbed forest land is generally associated with low rates of stressor loading compared to other land uses, and conversion of forest to urban/residential land uses is often associated with water quality degradation. Silvicultural operations can also serve as sources of stressors, particularly excess sediment loads to streams, when proper management practices are not followed. Potential effects of silvicultural management activities on aquatic ecosystems are primarily alterations in physical habitat, such as increased temperature due to the loss of shade from riparian vegetation, and increased sedimentation.

Many existing woods roads are being used and new roads are being built to access timber. From a water quality standpoint, 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. Estimates in Georgia are that there are approximately 3,000 annual harvesting operations conducted in the state so the potential impact to water quality from erosion and sedimentation is great if Best Management Practices (BMPs) are not adhered to.

Silviculture is also a potential source of pesticides/herbicides. According to Stell *et al.*, 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 glyphosphate (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. Dicambia, 2,4-D, 2,3-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 1970s.

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.

Control of insects and diseases is not widely practiced 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.

4.1.2.4 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.

Frick *et al.* (1996) report estimates of nitrogen loading from atmospheric deposition to the Flint River Basin as of 1990. Over the whole Flint basin they estimated an annual input of approximately 10,000 tons of nitrogen via atmospheric deposition, distributed as follows:

Hydrologic unit code	Subbasin Name	Atmospheric Deposition (tons of N per year)
03130005	Upper Flint	3,100
03130006	Middle Flint	1,800
03130007	Kinchafoonee-Muckalee	1,300
03130008	Lower Flint	1,500
03130009	Ichawaynochaway	1,300
03130010	Spring	910

Data are not available nationally to estimate phosphorus input from atmospheric deposition; however, this component is expected to be of minor significance (Frick *et al.*, 1996).

Atmospheric deposition may also be a source of certain mobile toxic pollutants. In particular, mercury found in fish in the upper Flint basin is thought to derive in part from atmospheric deposition. Atmospheric deposition also contributes small background loads of PCBs and other organic chemicals.

4.1.3 Flow And Temperature Modification

Aquatic ecosystems of the Flint River Basin are also influenced by hydrologic alterations resulting from hydropower operations and the maintenance of navigation channels. In contrast to the Chattahoochee River, which is highly regulated by the operation of 13 dams, the Flint River posesses only two dams. Both the Warwick and Flint River Dams, which are run-of-the-river and contain very little storage capacity, are located on the lower Flint River. The upper Flint River is one of only 42 unregulated river reaches of at least 125 mi. in length remaining in the contiguous United States.

Because there are very large seasonal withdrawals of groundwater (2000 MGD or more) for irrigation in the lower Flint River Basin, and because the Flint is very dependent on groundwater recharge, especially during the dry season, agricultural withdrawals can have a significant effect on the river flow rates. The USGS has studied the relationship of groundwater pumping and streamflow recharge in the area of the Flint basin and has determined that, under long term steady state conditions of large withdrawals during a drought, there may be a cumulative reduction of up to 30% in river recharge rates. Such a reduction could have a significant effect on flows and temperatures in the Flint during late summer.

4.1.4 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 effects.

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

Another important form of physical habitat disruption is loss of riparian tree cover. Under natural conditions, smaller streams in Georgia are shaded by a tree canopy. If this canopy is removed the resulting direct sunlight can result in increased water temperatures with adverse effects on native aquatic life. Habitat disturbance through construction of small impoundments can also raise water temperatures.

4.2 Stressor Summary

Section 4.1 described the major sources of loads of pollutants (and other types of stressors) to the Flint basin. What happens in the river, however, is often the result of the combined impact of many different types of loading, including point and nonpoint sources. For instance, excess loads of nutrients may represent the net effect 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 over-abundance 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 which is 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 Flint 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 fresh water. The bulk of the nitrogen in fresh water systems is found in one of three ionic forms: ammonium (NH_4^+), nitrite (NO_2^-), and 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 discharges, with corresponding increase in the nitrate fraction.

The major sources of nutrient loading in the Flint basin are agricultural runoff, urban runoff and stormwater, and wastewater treatment facilities. Concentrations found within rivers and lakes of the Flint 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 (Section 4.1.2.1); however, nonpoint loads from urban/residential sources in the basin have not yet been quantified. The net load arising from all sources may, however, be examined from instream monitoring. Long term trends in nutrients within the Flint River Basin for 1972–90 are summarized by Frick *et al.* (1996). An even more informative picture is obtained by examining results from EPD long-term trend monitoring stations from 1968 to present.

Trends in loading of total phosphorus can be seen by examining results at four stations: Flint River at Ackert Road near Inman (just south of Atlanta), Flint River at Georgia Highways 26 and 49 near Oglethorpe (between Atlanta and Lake Blackshear), Flint River at the Plant Mitchell intake (just south of Albany), and Flint River at the State Docks (at the Flint River inflow to Lake Seminole).

In the 1970s, loading of phosphorus to the upper Flint River just south of Atlanta was mainly due to discharge from three secondary wastewater treatment plants, along with several package plants and oxidation ponds. Figure 4-20 shows individual trend-monitoring measurements since 1971 as points. Superimposed on these points is a moving-average line, representing long-term trends. The median (50th percentile) phosphorus concentration observed at this station is 0.27, and the maximum observed was 1.58 mg/l (in 1980). As of 1979, two of the treatment plants (located in Clayton County) were upgraded to provide pretreatment for a land application system, which continues to be in operation. In 1984, the City of Atlanta completed construction of pump and pipeline that diverted wastewater from the third treatment plant (the Atlanta Flint River Plant [6 MGD]) to the Chattahoochee River, due to its higher waste assimilation capacity. The result of these changes can be observed as a sharp decline in total phosphorus concentrations between 1981 and 1984. However, during the 80's, expanding urbanization resulted in increasing phosphorus concentrations in the upper Flint. In 1990, State legislation was passed limiting the amount of phosphorus in various household and commercial detergents. Since this time, instream phosphorus concentrations have been steadily dropping in the upper Flint River. In 1995, the median phosphorus concentration at the Ackert Road station was 0.07 mg/l.

Table 4-9 summarizes the statistics for the four stations discussed in this section. The last column of this table displays the percent of observations that exceeded 0.1 mg/l; this column is useful for comparative purposes, and does not indicate violations of a water quality standard. The three stations below Inman (Figures 4-21 through 4-23) have similar median concentrations, though the station near Albany has a slightly higher median than the other two, indicating the influence of wastewater treatment plant discharges from the City of Albany. The fact that concentrations of phosphorus above Albany and at the inflow to Lake Seminole (far below Albany) remain somewhat elevated despite the lack of significant point sources may be an indication of the influence of nonpoint loading of phosphorus, mainly from the many agricultural operations in the middle and lower Flint basin.

All three trend monitoring stations below Inman showed a simultaneous increase in phosphorus concentrations beginning in 1988, and dropping off again from 1990 to 1992. This may be related to record low flows in the Flint River in 1988 and 1990 (see Figure 2-10), resulting in less dilution of phosphorus loads. Between 1972 and 1990, the stations at Albany and Lake Seminole showed no significant change in total phosphorus concentrations, while the Oglethorpe station showed a statistically significant increase (Frick *et al.*, 1996). As there is no significant wastewater discharge in the vicinity of Oglethorpe, this increase must be attributable to increases in nonpoint loading, probably from agricultural operations in the area.

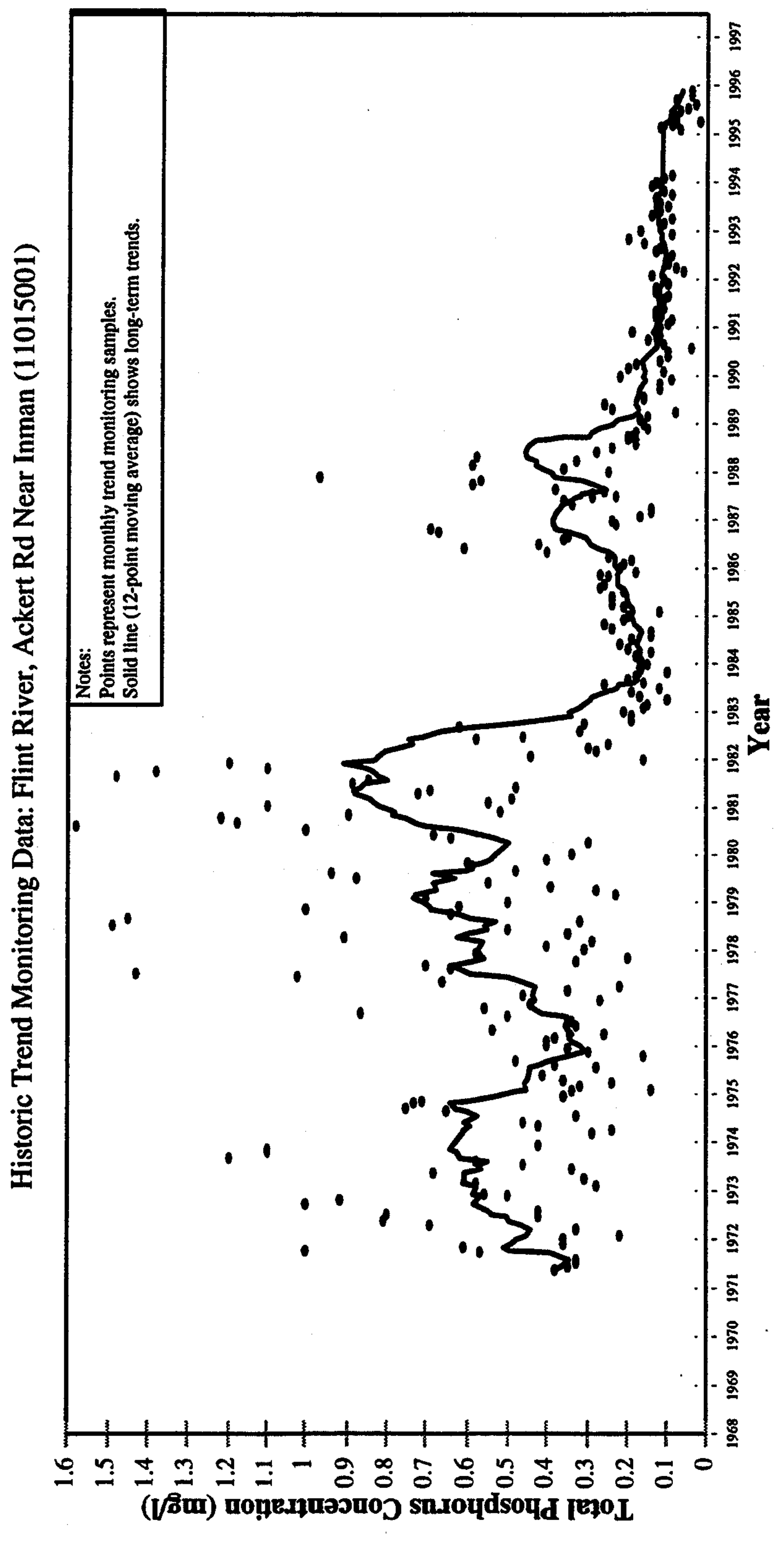


Figure 4-20. Total Phosphorus Concentrations, Flint River Near Inman, 1968-1997

Table 4-9. Summary of Phosphorus Concentration Data in Flint River Mainstem, 1968-1997

Station	Phosphorus Concentrations (mg/l)			Percent Above 0.1
	Max (Year)	Median	1995-96 Median	
Ackert Road near Inman	1.58 (1980)	0.27	0.07	89.1
Georgia Highways 26 and 49 near Oglethorpe	0.47 (1977)	0.06	0.03	15.1
Plant Mitchell Intake south of Albany	0.54 (1989)	0.08	0.05	26.5
State Docks at Lake Seminole Inflow	0.31 (1989)	0.06	0.03	15.4

4.2.2 Oxygen Depletion

Oxygen is required to support aquatic life, and Georgia quality standards specify minimum and daily average dissolved oxygen concentration standards for all waters. Problems with oxygen depletion in the rivers and streams of the Flint basin are, for the most part, 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.

In the 1994-95 Georgia water quality assessment (EPD, 1996), several portions of the Flint River and its tributaries were not supporting designated uses due to violations of dissolved oxygen. The majority of the problems lie in the metropolitan areas of the basin where there is more influence from urban runoff.

Dissolved oxygen data from the four EPD trend monitoring stations used in section 4.2.1 are summarized in Figures 4-24 through 4-27, and in Table 4-10. The last column of this table displays the percent of observations that fell below 5.0 mg/l; this column is useful for comparative purposes, and does not indicate the number of violations of water quality standards (which have changed over the period of record of this station). The Inman station (Figure 4-24) has shown a marked improvement in dissolved oxygen as a result of wastewater treatment plant upgrades and diversions (as discussed in 4.2.1). While 13.6% of observations fell below the standard, no such violations have been recorded since 1987. Near Oglethorpe, average dissolved oxygen levels have remained approximately unchanged since 1968. This area has never been strongly impacted by wastewater treatment plants or by urban nonpoint source pollution, which are the typical sources of oxygen-demanding waste. As a result, there are no recorded violations of the standard at the Oglethorpe station. The Plant Mitchell station is influenced by treated wastewater discharge in Albany, but the median oxygen level is not much lower than at Oglethorpe (7.9 mg/l vs. 8.4 mg/l) and oxygen levels have not often dipped below the standard; the last violation was in 1981. There appears to be a moderate improvement in dissolved oxygen levels over the course of this record. The Lake Seminole station also has shown very few violations of the dissolved oxygen standard (none since 1975).

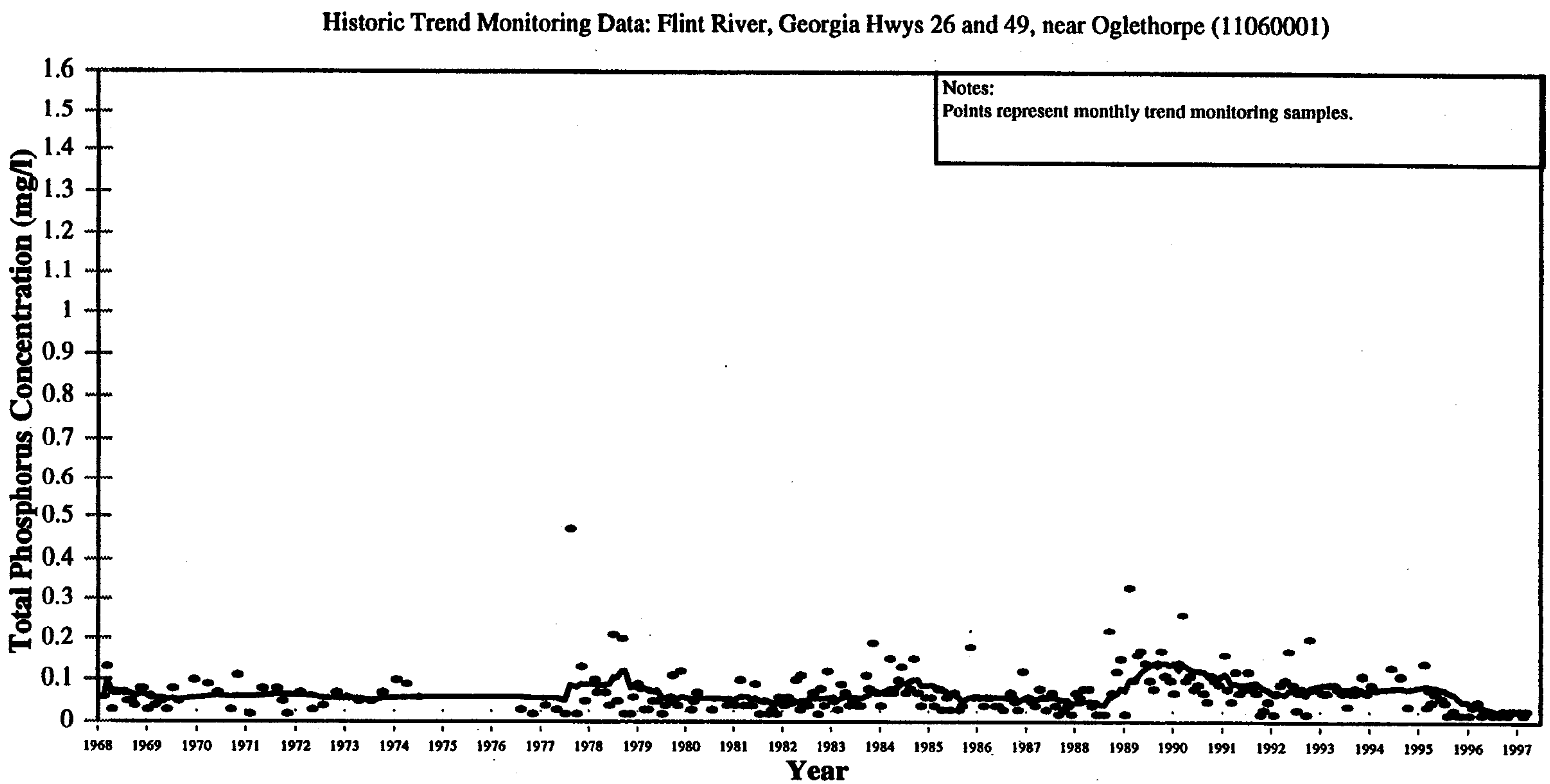


Figure 4-21. Total Phosphorus Concentrations, Flint River Near Oglethorpe, 1968-1997

Historic Trend Monitoring Data: Flint River, Plant Mitchell Intake, South of Albany (11100001)

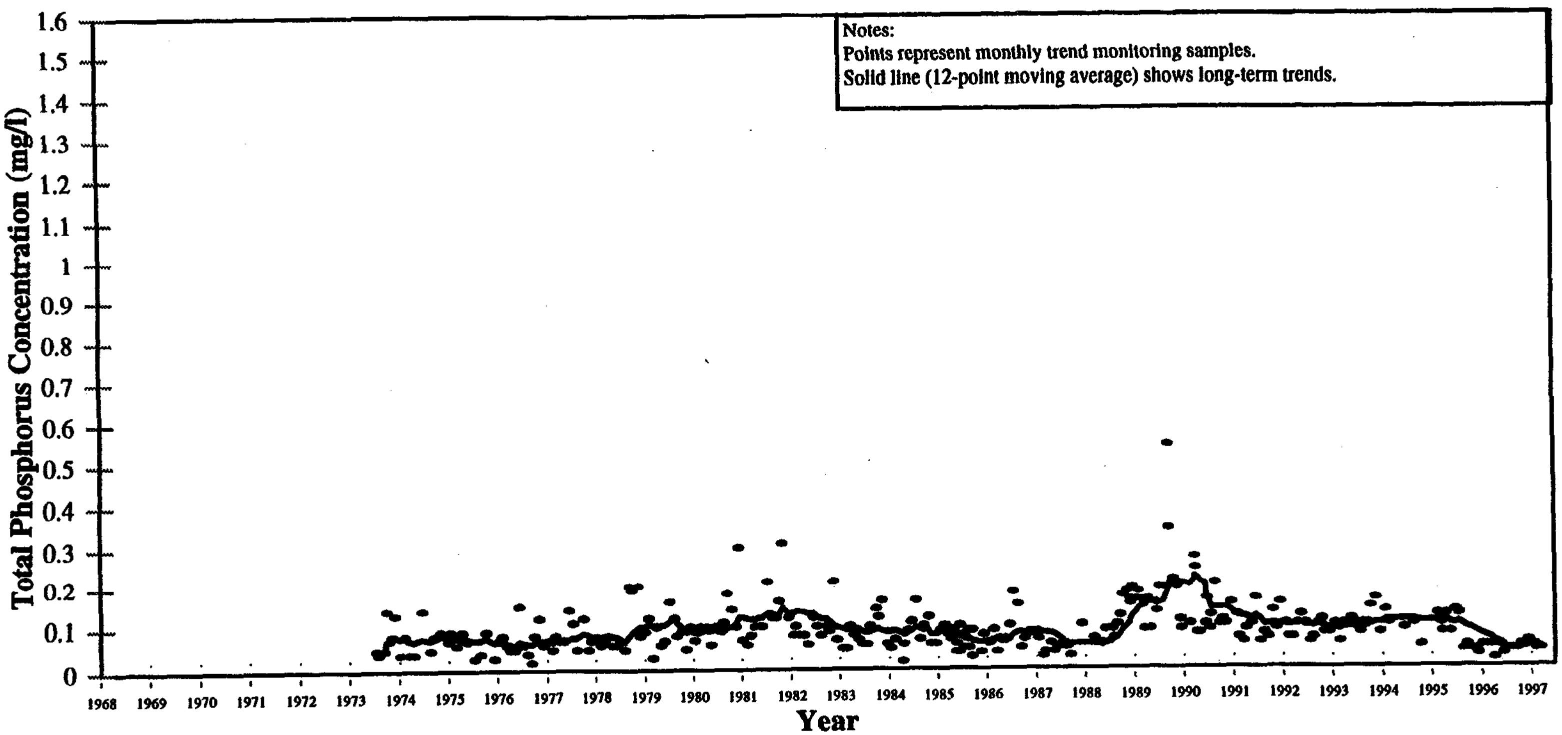


Figure 4-22. Total Phosphorus Concentrations, Flint River, South of Albany, 1968-1997

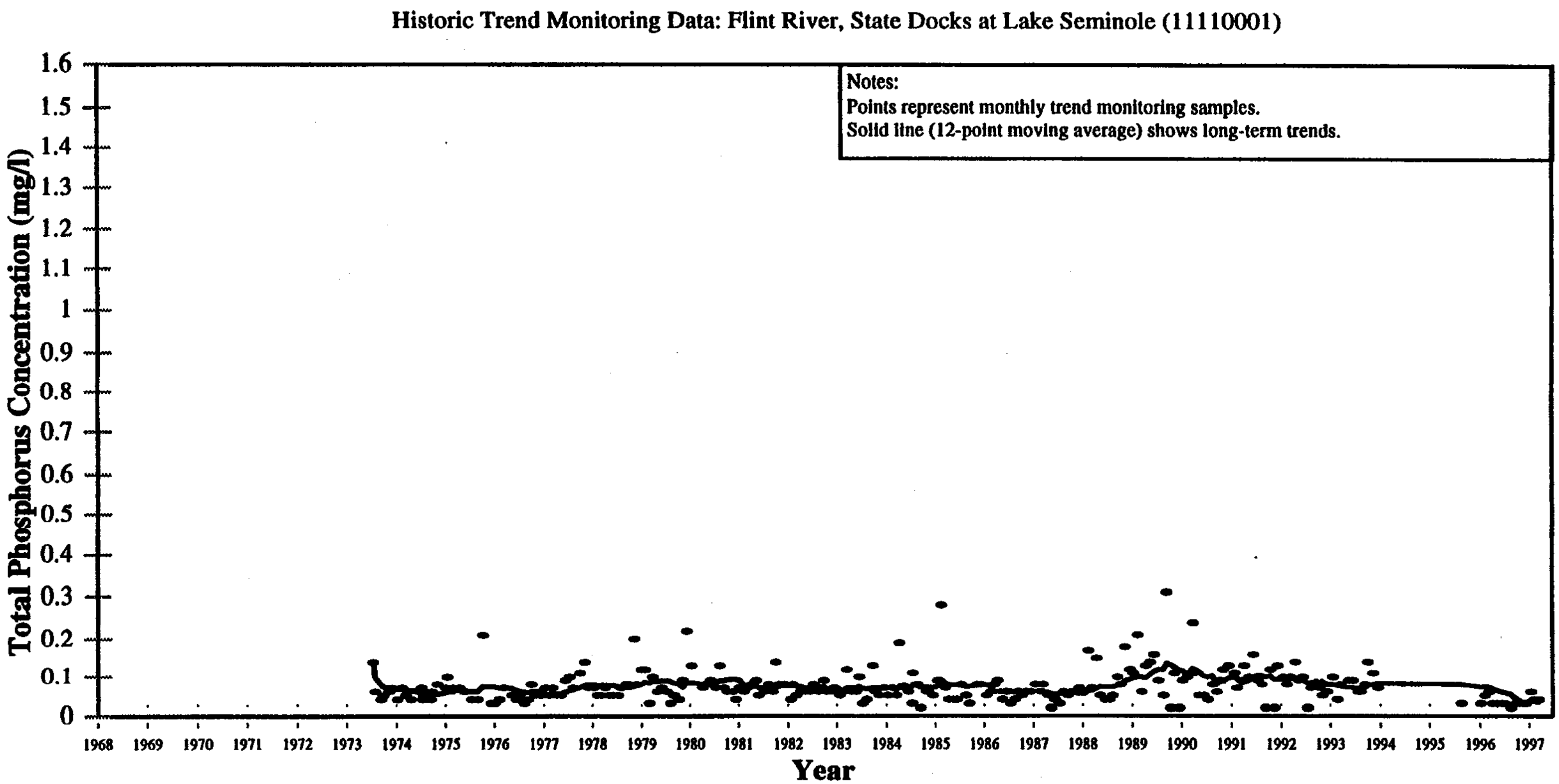


Figure 4-23. Total Phosphorus Concentrations, Flint River, State Docks at Lake Seminole, 1968-1997

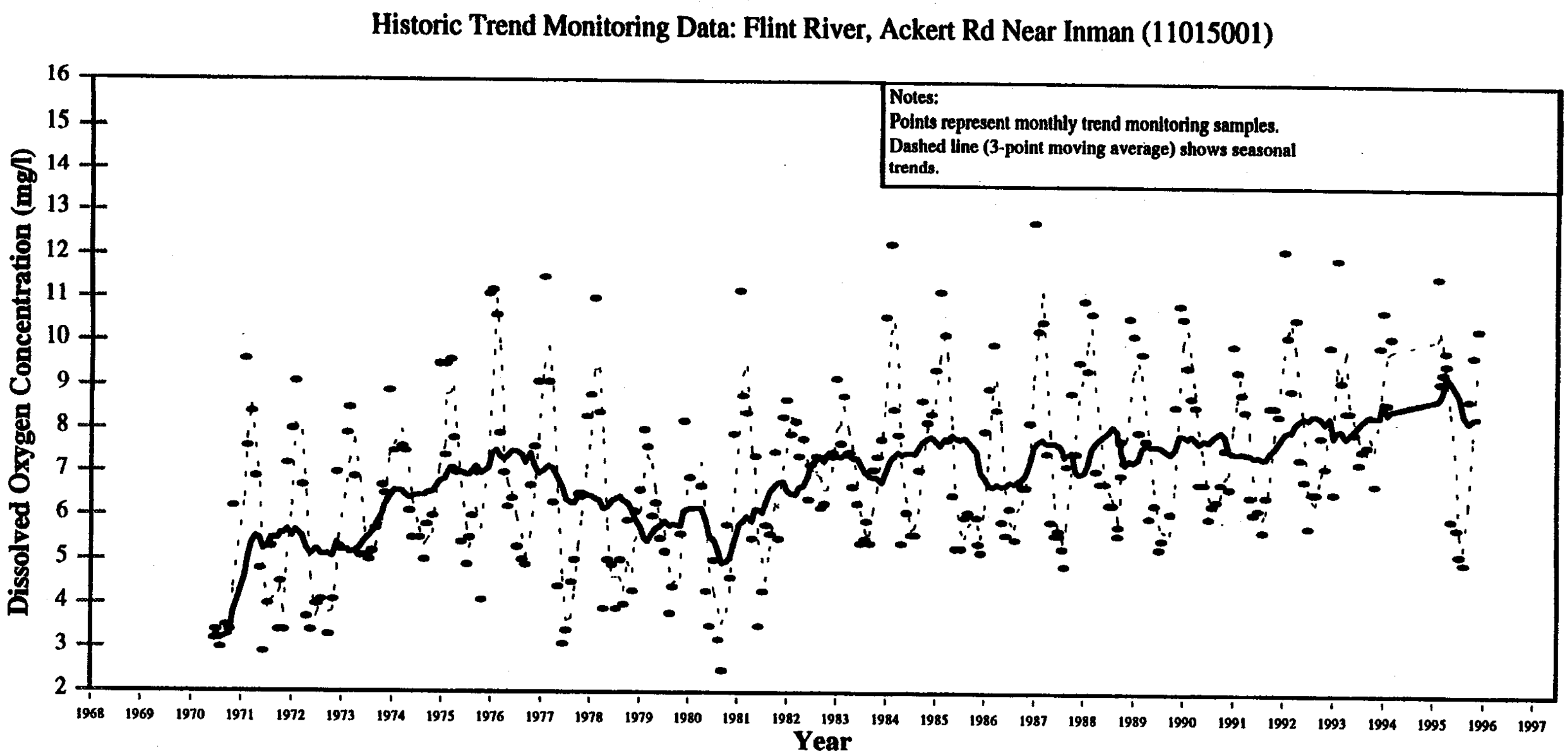


Figure 4-24. Dissolved Oxygen Concentrations, Flint River Near Inman, 1968-1997

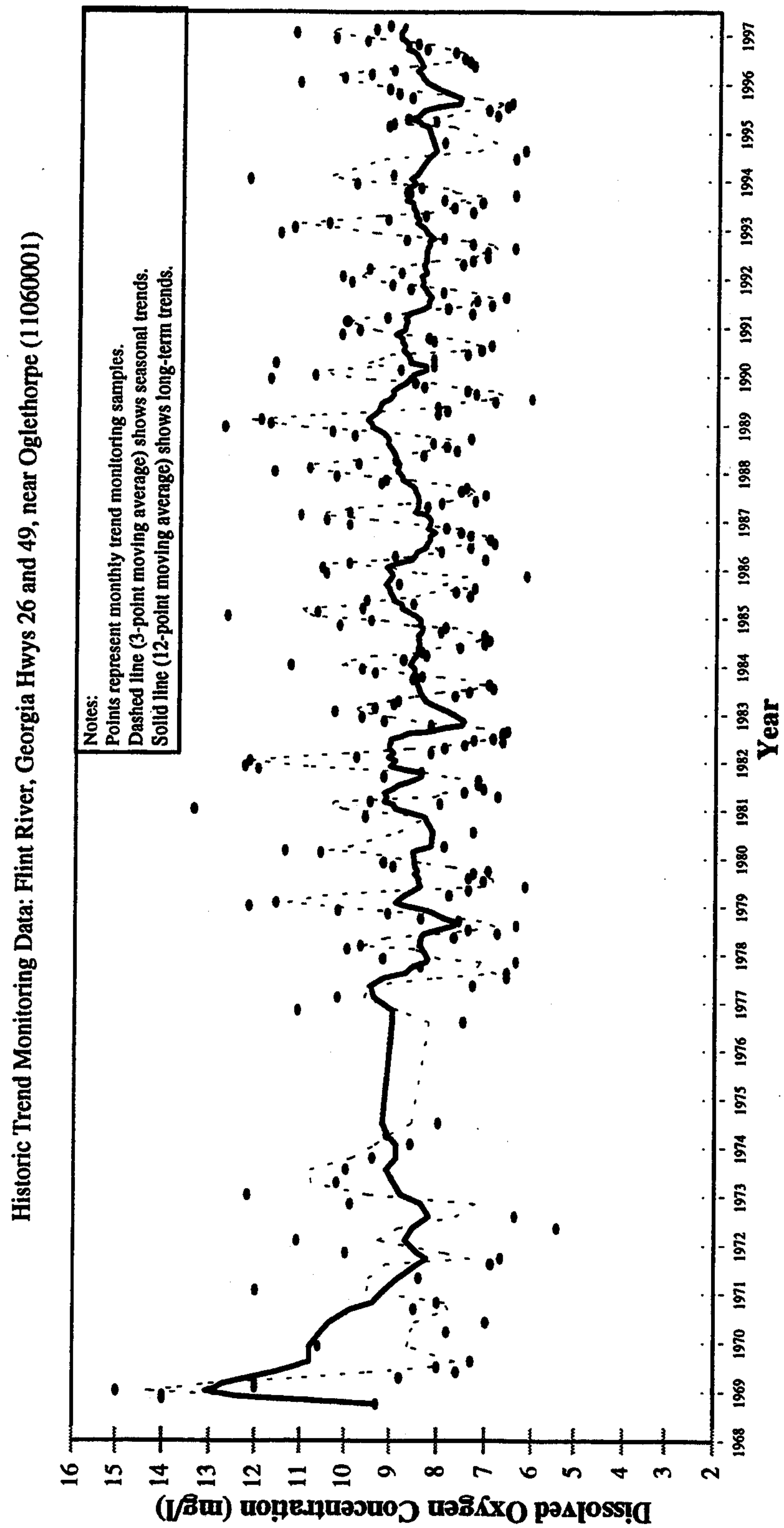


Figure 4-25. Dissolved Oxygen Concentrations, Flint River, Near Oglethorpe, 1968-1997

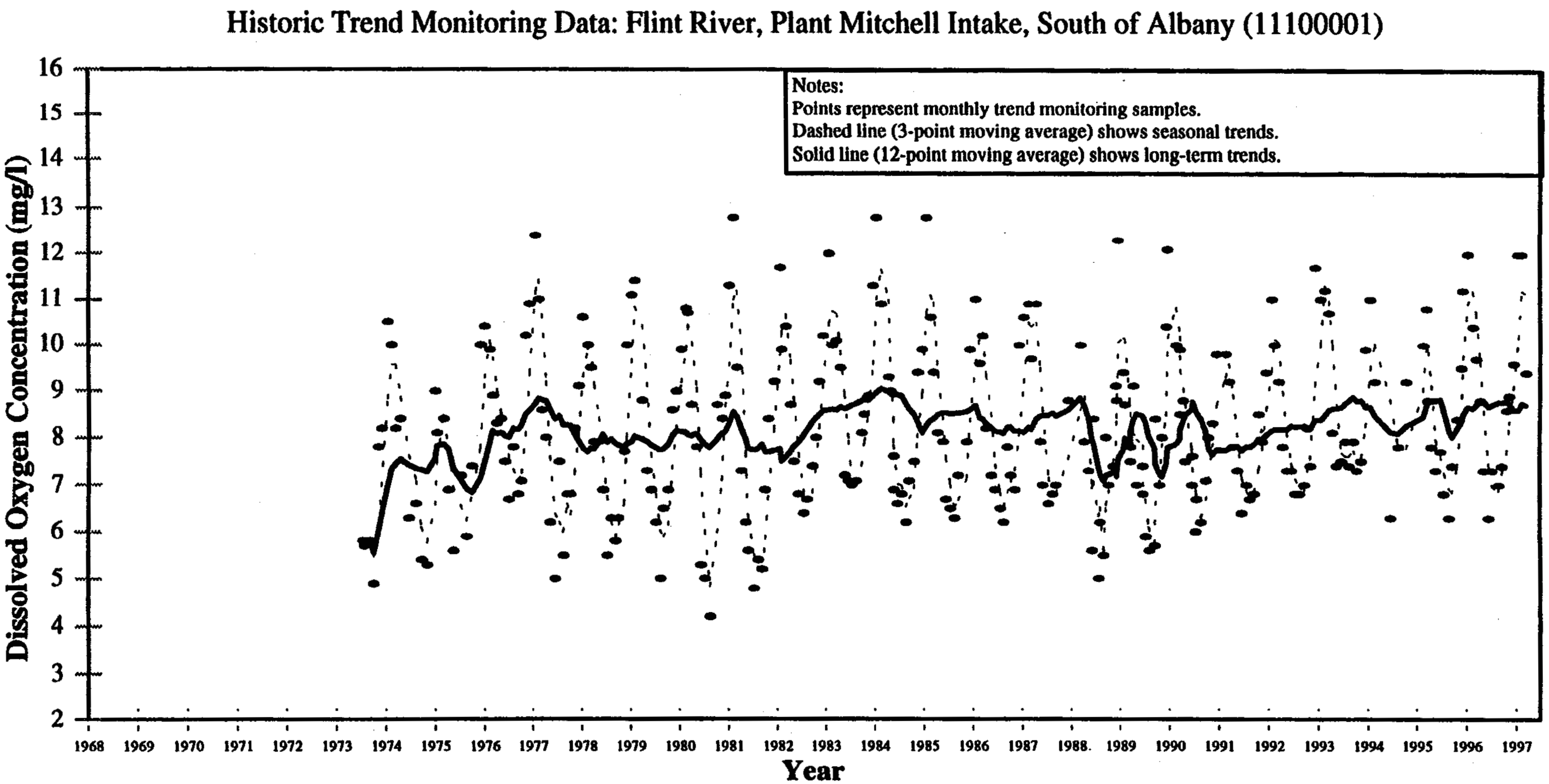


Figure 4-26. Dissolved Oxygen Concentrations, Flint River, South of Albany, 1968-1997

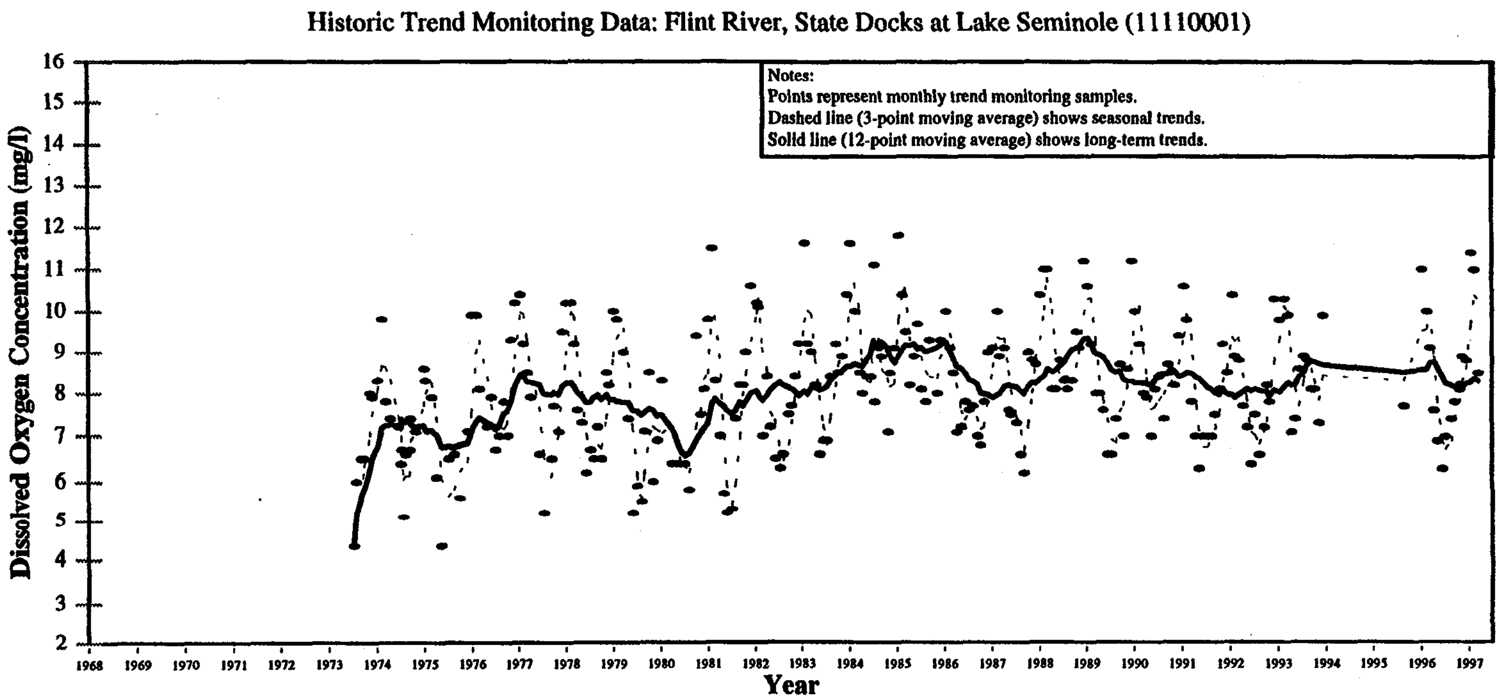


Figure 4-27. Dissolved Oxygen Concentrations, Flint River, State Docks at Lake Seminole, 1968-1997

Table 4-10. Summary of Dissolved Oxygen Concentration Data in Flint River Mainstem, 1968-1997

Station	Dissolved Oxygen Concentrations (mg/l)			Percent Below 5.0
	Min (Year)	Median	1995-96 Median	
Ackert Road near Inman	2.5 (1980)	6.8	9.3	13.6
Georgia Highways 26 and 49 near Oglethorpe	5.4 (1972)	8.4	8.7	0
Plant Mitchell Intake south of Albany	4.2 (1980)	7.9	8.5	1.1
State Docks at Lake Seminole Inflow	4.3 (1975)	8.1	7.8	0.8

4.2.3 Metals

All of these stations show the seasonal dependence of dissolved oxygen levels (dashed line in the figures), which are typically lower during the summer months.

Violations of water quality standards for metals (i.e., lead, copper, and zinc) were the second most commonly listed causes of non-support of designated uses in the Flint River Basin in the 1994-95 water quality assessment (23 segments). In most cases, these metals are attributed to nonpoint source urban runoff. Point sources of metals in the Flint basin have generally been brought into compliance through permits, leaving the more difficult nonpoint sources as the primary cause of impairment.

Data and analysis on metals in many streams of the Flint basin is rather sparse. There is also some concern as to the accuracy of the older data. While urban runoff appears to be the primary source of metal loading throughout Georgia, loading rates have not been quantified and will require additional analysis.

Within the Coastal Plain Province of the Flint River Basin, mercury is a metal of concern. Mercury is a naturally occurring metal that recycles between land, water, and air. As mercury cycles through the environment, it is absorbed and ingested by plants and animals. Most of the mercury absorbed will be returned to the environment but some will remain in the plant and animal tissues, where it has led to fish consumption guidelines in the Flint basin. In Spalding and Fayette Counties, there is a fish consumption guideline for largemouth bass due to mercury. In Merriwether and Pike Counties, fish consumption guidelines exist for shoal bass due to mercury.

It is not known where the mercury in fish tissue originated. Mercury may be present in fish because of the mercury content of soils in the southeast, from municipal and industrial sources, or from fossil fuel use. It is also possible that mercury contamination is related to global atmospheric transport.

4.2.4 Fecal Coliform Bacteria

Violations of the standard for fecal coliform bacteria were the most commonly listed cause of non-support of designated uses in the 1994-95 water quality assessment (35 stream and one lake segments in the Flint River Basin). 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 function of wastewater treatment plants is to reduce this risk through disinfection. Observed violations of the fecal coliform standard below wastewater treatment plants on the Flint River have generally been rapidly corrected in recent years. Combined sewer overflows, which may discharge diluted untreated wastewater directly to streams during wet weather, have been a source of intermittent fecal coliform contamination in the Albany area, but are now being addressed through control strategies, as discussed in Sections 4.1.1.2 and 7.0.

Fecal coliform data from the four EPD trend monitoring stations used in section 4.2.1 are summarized in Figures 4-28 through 4-31, and in Table 4-11. The last column of this table displays the percent of observations that fell above 400 per 100 ml; this column is useful for comparative purposes, and does not indicate the number of violations of water quality standards (which have changed over the period of record of this station). Note that the left-hand axis of the figures uses a logarithmic scale. Fecal coliform are measured as the number of cells per 100 milliliters of water. The Inman trend monitoring station (Figure 4-28) shows the effects of wastewater treatment plant effluent and runoff from the urbanized area south of Atlanta. In the early 70s, fecal coliform counts greater than 10,000 per 100 ml were not uncommon. Treatment plant upgrades and diversions (as discussed in 4.2.1) have caused observed fecal coliform counts to drop somewhat, though counts greater than 1,000 are still common on an intermittent basis in response to runoff events. This demonstrates the importance of nonpoint sources in contributing to fecal coliform levels. Fecal coliform levels near Oglethorpe (Figure 4-29) are markedly lower than at Inman, since this area is not strongly impacted by point sources or by urban runoff. The maximum observed count here is 43,000, as compared to a maximum of 11 million at the Inman station. Fecal coliform counts at the Oglethorpe station appear to be staying in about the same range for the last 15 to 20 years. The Plant Mitchell intake (Figure 4-30) is just below Albany, and the median fecal coliform count (930 per 100 ml) is evidence of the impact of point and nonpoint sources. Occasional counts greater than 100,000 are evidence of Albany's intermittent combined sewer overflows (CSOs), which discharge diluted untreated wastewater into the Flint River. Completion of controls and disinfection for Albany CSOs will reduce fecal coliform concentration peaks in this stretch of the river. The 1995-96 median count was 330, which may be an indication of a general downward trend in fecal coliform levels. The station at the top of Lake Seminole (Figure 4-31) shows lower fecal coliform counts than those below Albany, and also appears to be experiencing a downward trend.

As point sources have been brought under control, nonpoint sources have become increasingly important as potential sources of fecal coliform bacteria. In the Flint River Basin, fecal coliform concentrations have been documented in excess of water quality criteria in 35 segments (covering 356 river miles). Point source inputs were thought to be responsible in 5 of these segments (less than 70 river miles). Nonpoint sources may include:

- Agricultural nonpoint sources of fecal contamination mainly include animal operations and/or animal wastes that may enter stream systems through stormwater runoff.

- Urban nonpoint sources of fecal contamination, human and animal, are also loaded to rivers and streams through runoff. The majority of fecal coliform violations in the Flint basin are directly attributed to urban runoff.

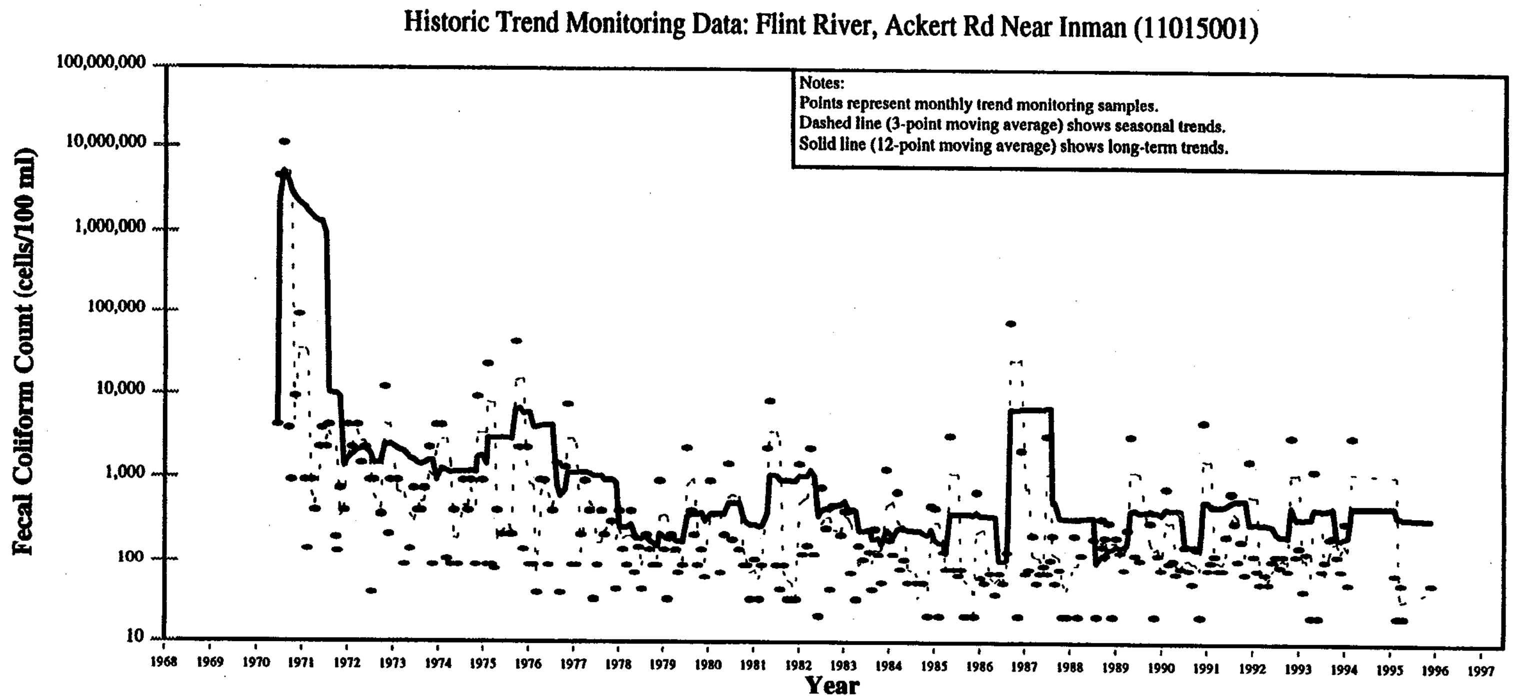


Figure 4-28. Fecal Coliform Bacteria Concentrations, Flint River near Inman, 1968-1997

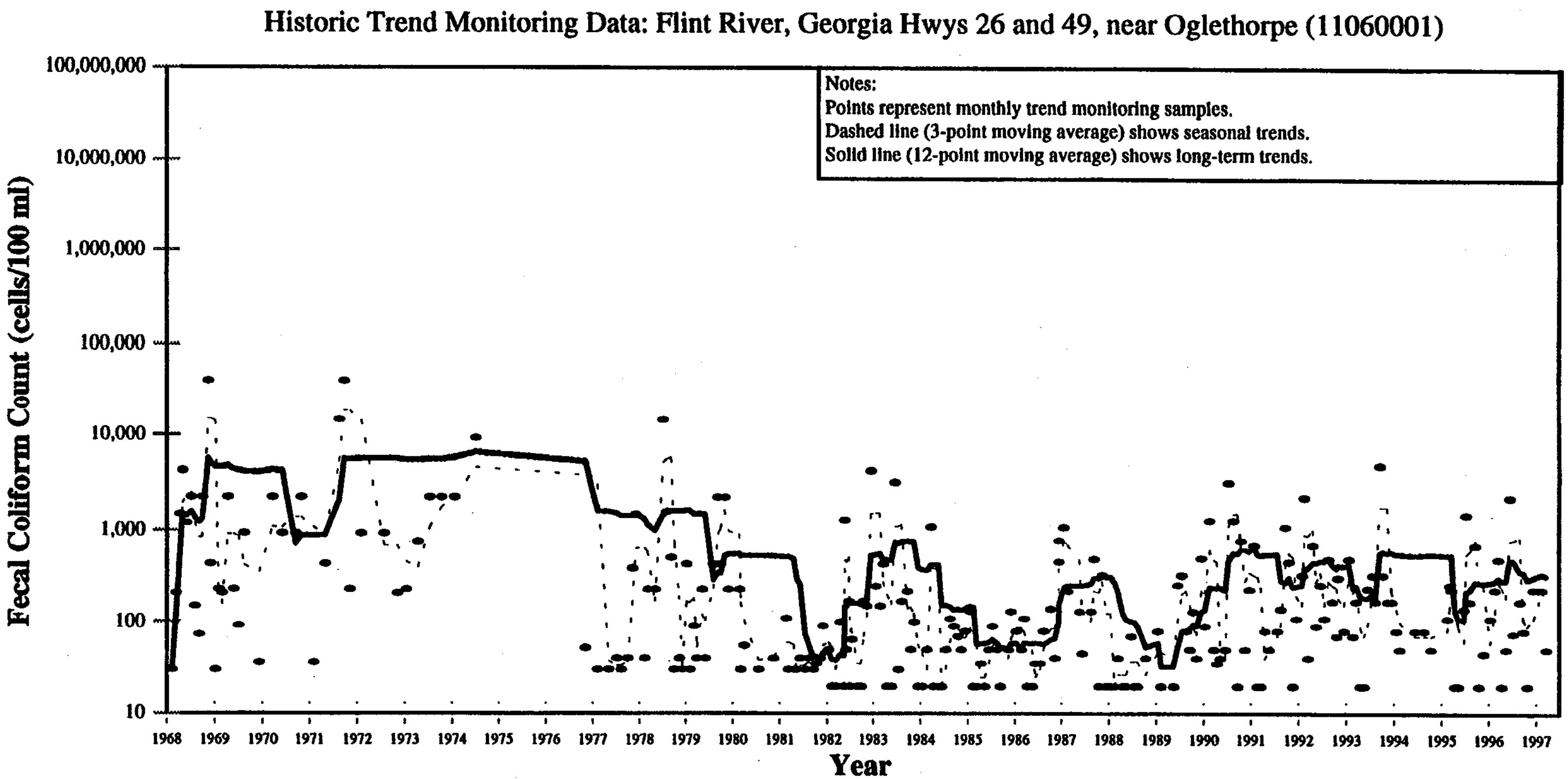


Figure 4-29. Fecal Coliform Bacteria Concentrations, Flint River near Oglethorpe, 1968-1997

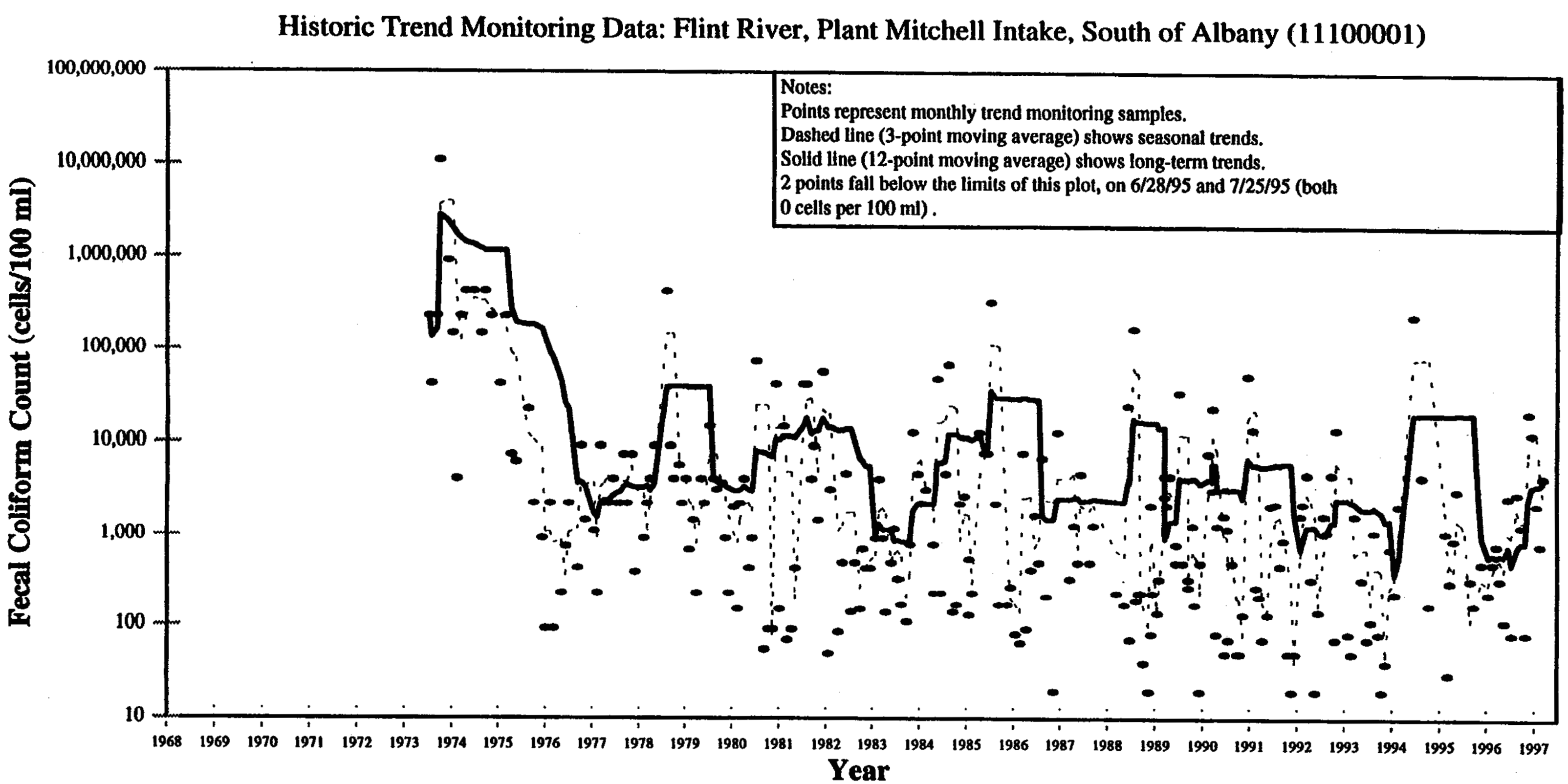


Figure 4-30. Fecal Coliform Bacteria Concentrations, Flint River, South of Albany, 1968-1997

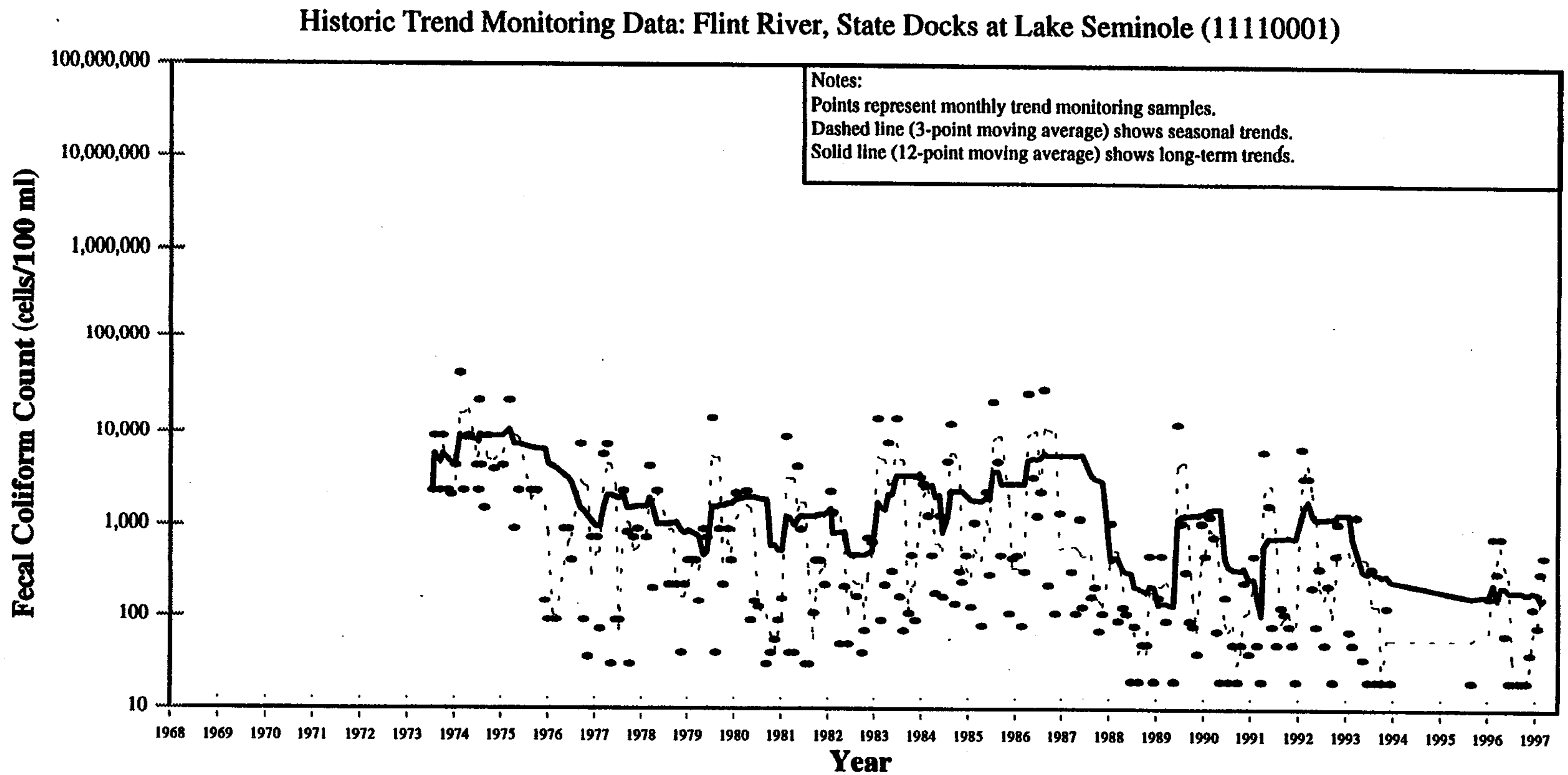


Figure 4-31. Fecal Coliform Bacteria Concentrations, Flint River, State Docks at Lake Seminole, 1968-1997

Table 4-11. Summary of Fecal Coliform Count Data in Flint River Mainstem, 1968-1997

Station	Fecal Coliform Count (MPN/ml)			Percent Above 400
	Max (Year)	Median	1995-96 Median	
Ackert Road near Inman	11,000,000 (1970)	140	<35	30.8
Georgia Highways 26 and 49 near Oglethorpe	43,000 (1971)	90	125	23.4
Plant Mitchell Intake south of Albany	11,000,000 (1973)	930	330	64.2
State Docks at Lake Seminole Inflow	43,000 (1974)	250	40	45.1

- Urban and rural input from failed or ponding septic systems may also contribute to fecal contamination in the Flint River Basin.

4.2.5 Synthetic Organic Chemicals

Synthetic organic chemicals (SOCs) include pesticides, herbicides, and other man-made toxic chemicals. SOCs may be loaded 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, insecticides, etc.;
- Nonpoint runoff from agricultural and silvicultural land with pesticide and herbicide applications;
- Nonpoint runoff from urban areas, which may load a variety of SOCs, including horticultural chemicals, termiticides, etc.;
- Illegal disposal and dumping of wastes.

To date, synthetic organic chemicals have not been detected in surface waters of the Flint River Basin in problem concentrations. Agricultural sources were potentially important in the past, particularly from cotton production in the Coastal Plain, but risk of excess loading has apparently declined with the switch to less persistent pesticides. Recent research by USGS (Stell *et al.*, 1995; Hippe *et al.*, 1994) suggests that pesticide/herbicide loading in urban runoff may be of greater concern than agricultural loading, particularly in streams of the metropolitan Atlanta and Albany areas.

Certain SOCs, discharged to the watershed in past decades, continue to be of concern today. These compounds, which are highly bioaccumulative, apparently continue to enter the food chain through contaminated sediments. Urban runoff and stormwater may also play a role in continued loading of these chemicals. PCBs and chlordane, which have been banned, cause fish consumption guidelines in many areas in Georgia. The Flint River, however, contains no fish consumption guidelines for either PCBs or chlordane.

4.2.6 Stream Flow and Flooding

One of the main issues concerning stream flow in the Flint River Basin is directly related to groundwater withdrawals and input. Many groundwater springs exist in the lower half of the basin and greatly contribute to stream flow, especially during long periods of dry weather. As ground water pumping is increased for crop irrigation, the base flow contribution to the stream flow will decrease.

Flooding is another major concern facing the Flint River Basin, as demonstrated during Tropical Storm Alberto, July 3-7, 1994. This storm dropped as much as 28 inches of rain onto parts of southwestern and central Georgia, causing severe flooding on the Flint River and several of its tributaries. This storm generated over 7 inches of runoff (700 billion gallons) in the Flint River Basin upstream of Newton. The flooding associated with Tropical Storm Alberto caused severe damage to both the Flint River and Warwick dams.

4.2.7 Sediment

Erosion and discharge of sediment can have a number of adverse impacts on water quality. First, sediment may carry sorbed 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. It can interfere with the photosynthetic process by reducing light penetration. Deposits may also fill reservoirs and hinder navigation. Important sources of sediment load include: construction; unpaved rural roads; streambank erosion associated with peak flows from increased impervious area and hydropower operations; dredging; agriculture; and forestry.

Sediment loading is of concern throughout the Flint basin, but is of greatest concern in developing areas of metropolitan Atlanta and in lower half of the basin where agriculture is predominant.

4.2.8 Habitat Degradation and Loss

Chemical and organic pollution are commonly perceived as the greatest threats to aquatic ecosystems, and are of primary concern to human health and water quality monitoring programs. However, a recent international study determined that habitat loss and degradation, as well as overharvesting are significant factors contributing to species population declines and extinctions. For example, both the alligator snapping turtle and Barbour's map turtle are endangered as a consequence of overharvesting. Many of the basin's fish and mussel species are threatened primarily as a result of habitat loss due to reservoir construction and sedimentation. A 1993 survey by the U.S. Fish and Wildlife Service found severely declining populations of all unionid mussel species in the Flint River (Couch *et al.*, 1996).

In many parts of the Flint basin, support for native aquatic life is 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 Flint is loss of riparian tree cover, which can lead to increased water temperatures.

References

Couch, C. A. 1997. Environmental distribution of mercury related to land use and physicochemical setting in watersheds of the Apalachicola-Chattahoochee-Flint River Basin. pp. 45-52, *Proceedings of the 1997 Georgia Water Resources Conference,* March 20-22, 1997, The University of Georgia, Athens, GA.

Couch, C.A., E.H. Hopkins, and P.S. Hardy. 1996. Influences of Environmental Settings on Aquatic Ecosystems in the Apalachicola-Chattahoochee-Flint River Basin. Water-Resources Investigations Report 95-4278. U.S. Geological Survey, Atlanta, GA.

Delaplane, K.S., *ed.* 1991. 1991 Georgia Pest Control Handbook. Special Bulletin 28, Cooperative Extension Service, The University of Georgia College of Agriculture, Athens, GA.

EPD. 1996. Water Quality in Georgia, 1994-1995. Georgia Department of Natural Resources, Environmental Protection Division, Atlanta, GA.

Frick, E.A., G.R. Buell, and E.H. Hopkins. 1996. Nutrient Sources and Analysis of Nutrient Water-Quality Data, Apalachicola–Chattahoochee–Flint River Basin, Georgia, Alabama, and Florida, 1972–90. Water-Resources Investigations Report 96-4101. National Water-Quality Assessment Program, Atlanta, GA.

Hippe, D.J., D.J. Wangsness, E.A. Frick and J.W. Garrett. 1994. Water Quality of the Apalachicola-Chattahoochee-Flint and Ocmulgee River Basins Related to Flooding from Tropical Storm Alberto; Pesticides in Urban and Agricultural Watersheds; and Nitrate and Pesticides in Ground Water, Georgia, Alabama, and Florida. Water-Resources Investigations Report 94-4183. U.S. Geological Survey, Atlanta, GA.

Monks, C.D. and S.M. Brown. 1991. Georgia Herbicide Use Survey Summary. University of Georgia Cooperative Extension Service, Tifton, GA

SCS. 1993. Georgia Watershed Agricultural Nonpoint Source Pollution Assessment, Cooperative River Basin Study. Prepared by U.S. Department of Agriculture, Forest Service, Conservation Service. Soil Conservation Service, Atlanta, GA.

Stell, S.M., E.H. Hopkins, G.R. Buell and D.J. Hippe. 1995. Use and Occurrence of Pesticides in the Apalachicola-Chattahoochee-Flint River Basin, Georgia, Alabama, and Florida, 1960-91. Open-File Report 95-739. U.S. Geological Survey, Atlanta, GA.

Section 5

Assessment

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

5.1 Assessment of Water Quantity

Water quantity issues in the Flint basin are being addressed comprehensively as part of the ACT/ACF study. In that process an Interstate Compact is to be established for the purpose of administering a water allocation formula which will partition the flow of the Chattahoochee and Flint Rivers among Alabama, Florida, and Georgia. The following sections provide a summary of preliminary findings from this study.

5.1.1 Municipal and Industrial Water Uses

As noted in section 3.2, municipal and industrial (M&I) demands in the Flint River basin are expected to increase by 10 percent through 2005 and by another 14 percent by 2050. Approximately 40 percent of the supply will come from ground water sources, though that withdrawal may also reduce surface water stream flows by as much as 1 mgd for every 3 mgd pumped out of the aquifer. Approximately 40 percent of the withdrawal quantity is returned to the surface streams. M&I demands should be met easily for the foreseeable future and at the established quality standards.

Overall the surface water quality is good for use as drinking water. However, surface water quality problems due to non-point source pollution such as timber harvesting, agricultural and urban storm water runoff are concerns to municipalities which withdraw surface water from the Flint River and tributaries. The contaminant of most concern is higher turbidity due to erosion and sediment runoff. Water higher in turbidity can clog filters, interrupt the proper treatment of raw water, and increase the cost of the water to the consumers because more chemicals are needed to settle out the sediment. Fortunately almost all surface water plants in the state of Georgia have either reservoirs that allow for ample storage and time to settle out runoff sediments or have intakes located in tributaries with lower runoff sediments. All public water systems in the state of Georgia that use surface water meet the federal Surface Water Treatment Rules for filtration and treatment.

Overall ground water quality is very good for use as drinking water from wells. Since most wells used in public water systems are constructed by licensed well drillers and draw from deeper confined aquifers, the number of contaminated wells is small. However, in the Flint basin some public water system wells have been contaminated by local pollution sources such as leaky underground storage tanks, malfunctioning septic tank systems, spills, and possible agricultural activities. One significant contaminant of concern in the lower half of the Flint basin is nitrate. Although a couple of public water system wells have exceeded the MCL for nitrate, individual domestic wells which are usually shallow have raised concern. The responsibility of regulating domestic wells is the local county health depart but the DWP has provided special testing and technical assistance when needed. Those public water system wells that exceed the Maximum Contaminant Level (MCL) for a contaminant are either removed from service or added treatment. Also a few wells in the basin have been found to be under the direct influence of surface water. These wells are monitored and have additional treatment. The DWP plans to conduct additional testing for ground water under the influence of surface water in public water system wells located the lower Flint basin since the geology of the area is predisposed to karst.

5.1.2 Agriculture

Agricultural water demand is very great in the Flint River basin (primarily in the lower basin south of Cordele). It has been estimated that over 80% of water demand for irrigation in the Flint basin comes from groundwater sources. Total agricultural water demand is expected to increase from 83,000 million gallons (MG) in 1995 to about 154,000 MG in 2010 and perhaps to 220,000 MG in 2050.However, because the demand for irrigation is concentrated in the months of May through August, and because demand is much greater during a drought, the withdrawal rate could be 2,000 million gallons per day (MGD) in 2010 and 3,000 MGD in 2050. At these rates of withdrawal, coming as they do in the summer when stream flows often diminish as a result of inconsistent rainfall, there is a real potential for short-term effects on aquifer levels and, in part because of reduced recharge rates, on significantly lower stream flows. This possibility has significant implications for the ability of farmers in southwest Georgia to provide sufficient water to produce a quality crop in a severe drought under a high agricultural growth scenario.

5.1.3 Recreation

Water-based recreation in the Flint basin is primarily dependent on sufficient water flow in the streams to support low density boating and fishing activities. It is unlikely that there will be any significant effect on these activities due to unavailability of water, with the possible exception of short term stream flows during droughts when agricultural irrigation is very high.

5.1.4 Hydropower

There is no significant hydropower production in the Flint basin. Both the Warwick Dam and the Flint River Dam, the two dams of the Flint River basin, are operated for hydropower but have very little storage capacity and impound run-of-the-river reservoirs.

5.1.5 Navigation

The Flint River is navigable only to Bainbridge, a few miles above Lake Seminole. As with the Chattahoochee, navigation is primarily dependent on channel depths in the Apalachicola River. The ACT/ACF Study will likewise have a significant effect on future navigation predictability.

5.1.6 Waste Assimilation Capacity

There are presently no known segments of surface waters in the Flint River basin in which there is a critical need for sufficient flow to meet water quality standards. At this time there does not appear to be such a need in the foreseeable future. To protect aquatic wildlife, it has been recommended that a minimum instream flow of 30 percent of average annual discharge be maintained (Evans and England, 1995).

5.2 Assessment of Water Quality

The 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 sub-basin 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. The standards were upgraded in 1989 to eliminate use classifications for Agriculture, Industrial, Navigation and Urban Stream uses. Table 5-1 provides a summary of water use classifications and basic water quality criteria for each use currently designated.

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

Table 5-1. 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-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 Coastal Fishing[3]	1,000 (Nov-April) 200 (May-October)	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 2°F 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 water body 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...

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 complete list of the toxic substance standards that apply to all waters in Georgia.

Georgia is also developing site-specific standards for major lakes where control of nutrient loading is required to prevent problems associated with eutrophication. Thus far, the Board of Natural Resources has adopted site-specific standards for three lakes: West Point Lake, Lake Walter F. George and Lake Jackson. Standards were adopted for chlorophyll *a*, pH, total nitrogen, phosphorus, fecal coliform bacteria, dissolved oxygen, and temperature. Site-specific standards may be proposed for lakes in the Flint basin as needed.

5.2.2 Surface Water Quality Monitoring

EPD 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 establish 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 wateruses, and establish TMDLs. Trend monitoring, intensive surveys, lake, estuary, biological, and toxic substance monitoring, fish tissue testing, and facility compliance sampling are the major monitoring tools used by EPD.

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.

In addition to work done by cooperative agreements, EPD associates collect water and sediment samples for toxic substance analyses. EPD associates also collect macroinvertebrate samples to characterize the biological community at selected locations as a part of the trend monitoring effort. The trend monitoring network in place in the Flint in 1994 is shown in Figure 5-1.

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.

Figure 5-2 shows the redirected trend monitoring network for 1995. The focus for trend monitoring was in the Chattahoochee and Flint River basins. Statewide trend monitoring was continued at the 37 core station locations statewide, in the Savannah Harbor, and at all continuous monitoring locations. The remainder of the trend monitoring resources were devoted to the Chattahoochee and Flint River basins. In addition to chemical sampling, new work on macro-invertebrate sampling was done as a part of the Chattahoochee/Flint river basin monitoring work. As a result, more sampling was conducted along the mainstem and in the smaller tributaries of the two river basins. Increasing the resolution of the water quality monitoring will improve the opportunity to identify impaired waters as well as the causes of impairment.

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 have been conducted on samples from selected trend monitoring stations since 1973. 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, ten to twenty sites per year were sampled as part of this project. During the 1994-1995 period, this effort was reduced significantly due to use of limited laboratory resources for different types of analysis. Future work will be conducted as a part of the River Basin Management Planning process.

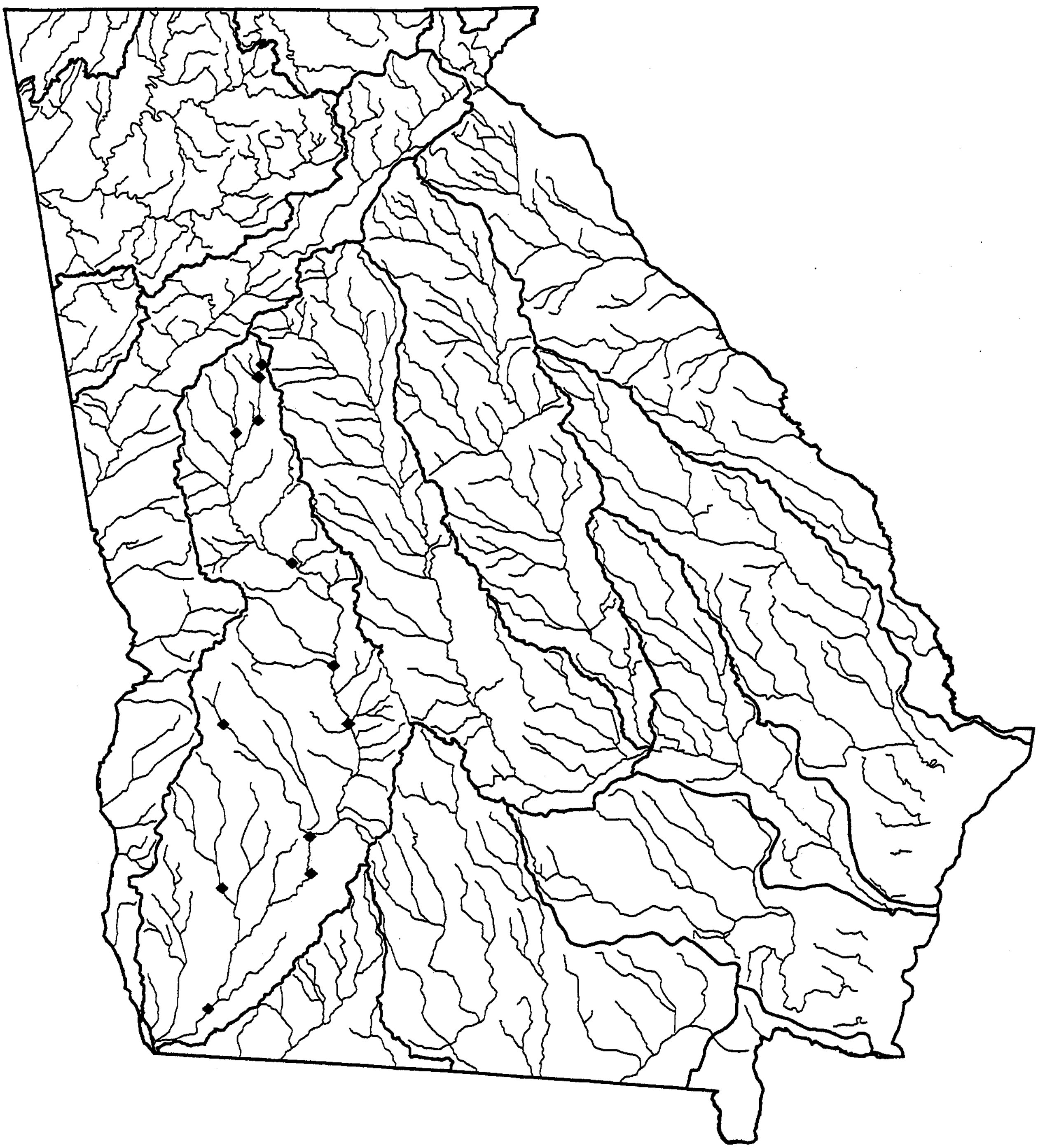


Figure 5-1. Flint River Basin Trend Monitoring Station Network, 1994

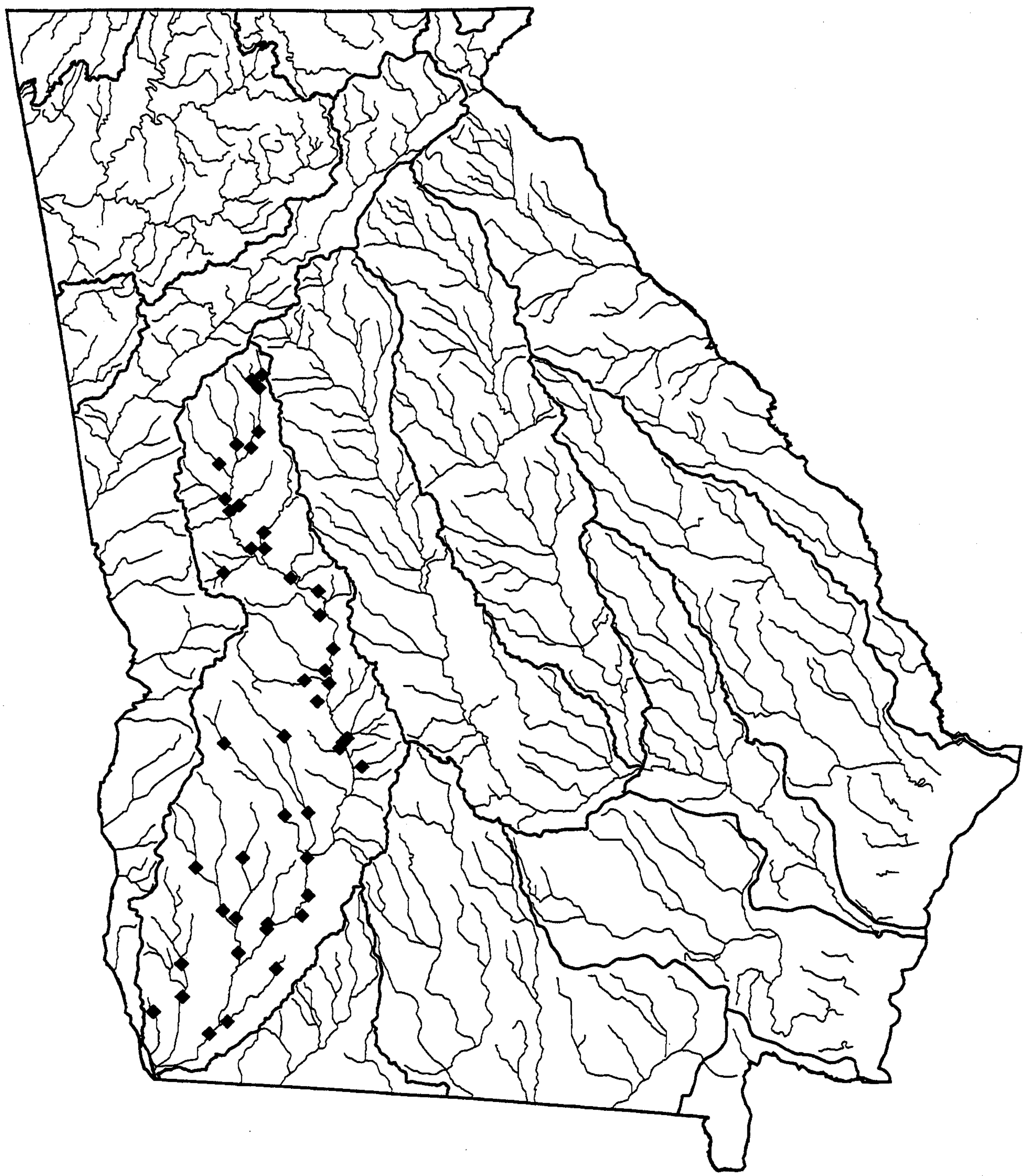


Figure 5-2. Flint River Basin Trend Monitoring Station Network, 1995

Intensive Surveys. Intensive surveys complement long term fixed station monitoring as these studies involve intensive monitoring of 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 model. Models are used for wasteload allocations and/or TMDLs and as tools for use in making regulatory decisions. Impact studies are conducted where 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 1960's, 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 included fourteen lakes in Georgia. 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. Georgia's water quality monitoring network has collected long term data from sites in four major lakes including Lake Lanier, West Point Lake, Lake Harding, and West Point Lake (none of which are in the Flint basin).

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, and specific conductance, Secchi disk transparency, and chemical analyses for chlorophyll *a*, total phosphorus, nitrogen compounds, and turbidity. The three measures of Carlson's Trophic State Index were combined into a single trophic state index (TTSI) and used with other field data and observations to assess the trophic condition of each lake.

Monitoring efforts have continued since the 1980-1981 Lake Classification Survey with a focus on major lakes (those with a surface area greater than 500 acres), and have continued to use the TTSI as a tool to mark trophic state trends. The major lakes in the Flint basin are listed in Table 5-3 and are ranked according to the TTSI for the period 1984-1993. Greater study emphasis has been placed on those lakes with consistently higher rankings. The major lakes monitoring project was suspended in 1994 due to a lack of field and laboratory resources resulting from the focus on the Chattahoochee River Modeling Project work (discussed in the Chattahoochee River Basin Management Plan). The work on major lakes in the future will be a part of the RBMP process.

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 five year rotating schedule to track any trends in fish contaminant levels. The DNR has also made

Table 5-3. Major Lakes in The Flint Basin Ranked by Sum of Trophic State Index Values, 1980-1993

1984	1985	1986	1987	1988
Blackshear 177 Worth 167 range for state: 120-205	Blackshear 181 Worth 167 range for state: 116-188	Worth 164 Blackshear 162 range for state: 114-177	Worth 167 Blackshearh <167 range for state:<108-184	Blackshear 177 Worth 164 range for state: 111-178
1989	**1990**	**1991**	**1992**	**1993**
Blackshear 209 Worth 170 range for state: 123-209	Blackshear 178 Worth 163 range for state: 118-182	Blackshear 193 Worth 176 range for state: 121-193	Blackshear 176 Worth 157 range for state: 131-194	Blackshear 185 Worth 172 range for state: 122-195

Note: Higher values represent more eutrophic conditions.

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 metals, organic chemicals and pesticides listed in Table 5-4. Of the 43 constituents tested, only PCBs, chlordane, and mercury have been found in fish at concentrations which create a fish consumption problem.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.

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, and an evaluation of the permittee sampling and flow monitoring requirements.

Table 5-4. 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

In excess of 350 sampling inspections were conducted by EPD staff statewide in 1994-1995. 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 1995 this work was focused in the Chattahoochee and Flint River basins in support of the River Basin Management Planning process.

Aquatic Toxicity Testing. In 1982 EPD incorporated aquatic toxicity testing in 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. Today, toxicity testing is addressed in all municipal and industrial NPDES permits. EPD began conducting aquatic toxicity tests on effluents and surface waters in 1985. In 1988, EPD constructed laboratory facilities to support chronic and acute testing capabilities. All toxicity testing is conducted in accordance with appropriate USEPA methods. Over the 1994-1995 period, EPD conducted 106 chronic tests and 19 acute tests on effluents or surface waters. In 1995, priority was given to testing of facility effluents in the Flint and Chattahoochee River basins in accordance with the River Basin Management Planning approach. Test results are used to manage and control the discharge of toxic substances in toxic amounts to the waters of the State. Toxicity testing by EPD will be phased out in July, 1997.

5.2.3 Data Analysis

Assessment of Use Support. Water quality data is assessed to determine if standards are met and if the waterbody supports its classified use. If monitoring data shows that standards are not achieved, depending on the frequency standards are not met, the waterbody is said to be not supporting or partially supporting the designated use.

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 exceedence of a water quality standard in 11%-25% of the samples collected or
- a fish consumption guideline was in place for the waterbody.

The partially supporting list also includes stream reaches based on predicted concentrations of metals at low streamflow (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 exceedence of a water quality standard in greater than 25% of the samples collected,
- a fish consumption ban was in place for the waterbody, or
- acute or chronic toxicity tests documented or predicted toxicity at low streamflow (7Q10) due to a municipal or industrial discharge to the waterbody.

Additional specific detail is provided in the following paragraphs on 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 thirty day period) of 200 MPN/100 ml for all waters in Georgia during the recreational season of May- October. This is the year-round standard for waters with the water use classification of recreation. Although the standard is based on a geometric mean, most of the data for Georgia and other states is based on once per month sampling as resources are not available to conduct sampling and analysis four times per month. Thus, for the purposes of this report USEPA recommends the use of a review criterion of 400 MPN/100 ml to evaluate once per month sample results.

This density, 400 MPN/100 ml, was used to evaluate data for the months from May through October for all waters. For waters with the water use classification of recreation, this guidance criterion was used to evaluate data for the entire year. For waters classified as drinking water, fishing, or coastal fishing, the maximum Georgia standard for fecal coliform bacteria is 4000 MPN/100 ml (November-April). This standard was used to evaluate data collected during November through April for these waters. Waters were deemed not supporting uses when 25% 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% of the samples were in excess of the review criteria.

Metals. In general, data on metals from any one given site are not frequent. As the data are infrequent, using the general evaluation technique of 25% exceedence to indicate nonsupport and 11%-25% exceedence to indicate partial support was not meaningful. Streams were placed in the non-supporting category if multiple exceedences of state criteria occurred and the data were based on more than four samples per year. With less frequent sampling, streams with exceedences were placed on the partially supporting list. In addition, an asterisk is placed beside metals data in those cases where there is a minimal database. This is in accordance with USEPA guidance which suggests any single exceedence of a metals criteria be listed.

Toxicity Testing/Toxic Substances. Data from EPD toxicity testing of water pollution control plant effluents were used to demonstrate or predict toxicity in the receiving waterbody. Based on the effluent toxicity, receiving waters were evaluated as not supporting when one or more tests gave a clear indication of instream toxicity and as partially supporting when based on predicted instream toxicity. Effluent data for toxic substances were used to designate either partial support or non-support based on whether instream corroborating data were available. When instream data were available, the stream was determined to be not supporting. When instream data were not available, the stream is 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% of the time, the waters were evaluated as not supporting the designated use. Between 11% and 25% non-compliance resulted in a partially supporting evaluation.

Fish/Shellfish Consumption Guidelines. A waterbody was included in the not supporting category when an advisory was for no consumption of fish, a commercial fishing ban, or a shellfishing ban was in effect. Waterbodies were 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 utilized were fish. Studies of fish populations by the DNR Wildlife Resources Division used the Index of Biotic Integrity (IBI) to identify impacted 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.

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 Flint River basin. Most of these results were previously provided in the report "Water Quality in Georgia, 1994-1995" (Georgia DNR, 1996). Results are grouped by the three major sections in the basin. A geographic summary of assessment results is provided by HUC in Figures 5-3 through 5-8.

5.2.4.1 Upper Flint River Basin (HUC 03130005)

Stream Water Quality

Data from the mainstem stations indicate that water quality conditions are being affected by both point and nonpoint source pollution.

Water Quality Sampling. Violations in the dissolved oxygen water standard due to urban runoff were noted at three sites between the headwaters at Hartsfield International Airport and Flat Shoals. Violations in the dissolved oxygen standard were also measured in Flat Creek near Peachtree City, Camp Creek in Fulton County, and Beaver Creek in Crawford County, due mainly to nonpoint sources. Violations of the dissolved oxygen water standard due to municipal wastewater discharge were measured in Cabin Creek near Griffin. A violation of the pH standard in Avera Creek in Crawford County was attributed to nonpoint sources.

Two stations on the mainstem between Hartsfield International Airport and Flat Shoals had violations of the lead standard as a result of urban runoff. Three monitored tributaries draining the metropolitan Atlanta area of the subbasin had violations of standards for lead, and one of these had additional standard violations for copper and zinc. Twelve monitored tributaries had violations of the standard for fecal coliforms due to nonpoint sources in the metropolitan Atlanta area and the cities of Thomaston and Griffin. An additional tributary near Greenville had violations of the fecal coliform standard due to a municipal discharge that has since been eliminated.

Note: Water use support maps which illustrate Appendix E will be supplied in the final copy of the plan. (Figures 5-3 through 5-8).

Benthic Invertebrate Sampling. Benthic macroinvertebrates were collected from a single location on the mainstem of the Flint River in 1995. Water quality based on benthic macroinvertebrate data was Very Good.

Fish Tissue Sampling. Fish tissue sampling in this region prompted fish consumption guidelines to be issued for two species of fish (largemouth bass and shoal bass) based on mercury contamination. The guideline restricted consumption of the fish to one meal per week.

Fisheries

Many of the headwater tributaries are impacted by various forms of urban runoff, but continue to support struggling populations of various fish species. The longest free-flowing stream section in Georgia exists from the headwaters of the Flint River and continues to the Lake Blackshear dam. This section of the Flint River is thought to have considerable potential for supporting the natural reproduction of the highly recreational striped bass sport fishery.

5.2.4.2 Middle Flint River Basin (HUC 03130006 and HUC 03130007)

Stream Water Quality

Data from the mainstem stations indicate that water quality conditions are being affected by both point and nonpoint source pollution.

Water Quality Sampling. Violations in the dissolved oxygen water standard due to nonpoint sources were measured in Gulley Creek, upstream from Lake Blackshear. Nine monitored tributaries in the Lake Blackshear area had violations of standards for lead, copper, and zinc. Six monitored tributaries had violations of the fecal coliform standard.

Data from one station on Kinchafoonee Creek near Dawson and from one station on Muckalee Creek upstream from the city of Americus had violations of the fecal coliform standard due to nonpoint sources.

Benthic Macroinvertebrates. Benthic macroinvertebrates were collected at seven locations in subbasin 03130006 during the basin assessment in 1995. Water quality based on benthic macroinvertebrate data ranged from Very Good to Poor. Instream habitat destruction with few EPT taxa (*Ephemeroptera, Plecoptera, Tricoptera*: i.e., mayflies, stoneflies and caddisflies) were the causes of the Poor rating given to the Red Oak Creek site. In addition, there was some evidence of old stream alteration impacts at the Red Oak Creek location. Big Lazar Creek received a Poor biological condition rating due in part to instream habitat destruction. Nonpoint runoff may be contributing to much of the impact found at both sites.

Benthic macroinvertebrates were collected from two locations on Potato Creek, above and below the city of Thomaston. The benthos data collected from the upstream location yielded a Good biological condition rating, but the downstream Pobiddy Road location was rated as Poor. This result suggests a moderate impact on the biota due in part to a combination of point source and nonpoint source impacts, most likely from the city of Thomaston.

Benthic macroinvertebrates were collected from a single location in subbasin 03130007 in 1995, in Muckaloochee Creek, a major tributary of Muckalee Creek. The data collected yield a Very Good biological condition rating.

Fish Tissue Sampling. This area of the Flint River basin has not been tested because fish collections in Lake Blackshear indicate that there are no problems in this section of the River.

Similary, both the Kinchafoonee and Muckalee Creeks and their tributaries have not been tested because fish collections from Lake Worth indicate that there are no problems upstream of the lake impoundment.

Lake Water Quality: Lake Blackshear

Water Quality Sampling. In addition to early studies, water quality monitoring of Lake Blackshear by EPD was conducted as part of the Georgia Lake Classification Survey (1980-1981) and major lake monitoring studies conducted from 1984 to 1993. Lake Blackshear was one of the 14 Georgia lakes sampled in 1973 as part of the USEPA National Eutrophication Survey; it was rated as eutrophic. Of Georgia lakes larger than 1000 acres, Blackshear ranks high in the amount of nutrient loading it receives due to the large amount of agricultural land use, particularly in row-crops, present in the Middle Flint and surrounding watersheds providing inflow to the lake. Nuisance conditions caused by aquatic macrophyte growth (giant cutgrass, *Zizaniopsis miliacea*) and large mats of the blue-green algae *Lyngbya* have been historical problems that have necessitated ongoing control programs such as herbicide applications and biological control methods, including the introduction of more desirable, competitive aquatic vegetation.

Results of metals analysis documented concentrations of copper, nickel, lead, and zinc in some water samples collected in the lake; these results, in addition to fecal coliform densities, led to Lake Blackshear's being listed as not supporting designated use in the Georgia 1994-1995 305(b) Report. The Gum Creek watershed is one of the most highly developed of the watersheds having input to Lake Blackshear. The elevated metals and fecal coliform was attributed to various nonpoint and urban sources. Future sampling and analysis of metals should follow recent methodology developed for trace level concentrations (USEPA Clean Sampling and Analysis).

In February 1991, EPD applied for funding under the Clean Lakes Grant Program to conduct a Phase I Diagnostic/Feasibility Study. Grant funding was obtained by EPD, and a contract cooperative agreement with the Lake Blackshear Watershed Association (LBWA) was approved in September 1991. The Association provided the matching funds required for the grant. The primary investigators in this study are Georgia Southwestern College and Clemson University. When the study is completed, EPD will use the findings in developing specific lake water quality standards for Lake Blackshear.

During the period of July 3-7, 1994, the passage of Tropical Storm Alberto resulted in as much as 28 inches of rainfall over parts of southwestern and central Georgia, causing record flooding on the Flint River and several of its tributaries. The earthen dike at the Lake Blackshear Warwick Dam was breached and suffered extensive damage from the record flood levels that ensued. With the receding of flood waters, Lake Blackshear was dewatered. In August 1994, Georgia Southwestern College and the Lake Blackshear Watershed Association organized a meeting of involved organizations to discuss investigative and corrective opportunities presented with the lake dewatering event. Repair of the earthern dike was achieved with reservoir refilling begun in 1995.

Fish Tissue Sampling. Tissue sampling of largemouth bass and spotted sucker have yielded no fish consumption restrictions for Lake Blackshear.

Lake Water Quality: Lake Worth

Water Quality Sampling. Monitoring of Lake Worth was conducted as part of the Georgia Lake Classification Survey in 1980-1981 and as part of major lake monitoring conducted from 1984 through 1993 by EPD. The Total Trophic State Index (TTSI) for Lake Worth over the 1980-1981 and 1984-1993 period has ranged from 142 to 177. The Georgia 1994-1995 305(b) Report includes the Lower Kinchafoonee Creek and Muckalee Creek (Schley and Sumter Counties) as watersheds potentially impacted by agricultural nonpoint source inputs.

Lake Worth contains a substantial littoral zone (and shallow mud flat areas), and because of this and the run-of-river operation that maintains a stable water level, conditions favor the growth of submerged and emergent aquatic vegetation. Many aquatic macrophytes are represented, but Georgia Power cites Giant Cutgrass, *Zizaniopsis miliacea*, as causing current nuisance conditions. The Georgia Power Company has continued to participate as a cooperator with the Georgia Wildlife Resources Division in an aquatic macrophyte control program involving annual herbicide applications (since about 1983). It has also funded research since 1991 to study the blue-green alga *Lyngbya*, which periodically forms nuisance floating mats in areas of Lake Worth (KMF).

During the period of July 3-7, 1994, the passage of Tropical Storm Alberto resulted in as much as 28 inches of rainfall over parts of southwestern and central Georgia, causing record flooding on the Flint River and several of its tributaries. Following the failure of the earthen dike at the upstream Lake Blackshear Warwick Dam, increased flow also washed out the earthen dike located between the Muckafoonee Diversion Dam and the Flint River Dam, including the substation. With the receding of flood waters, both impoundments were drained. The dike was rebuilt and both impoundments refilled.

Fish Tissue Sampling. Fish tissue sampling yielded no consumption restrictions for largemouth bass or spotted sucker.

Fisheries

Both the Crisp County Power Commission dam which impounds Lake Blackshear and the Georgia Power Company dam which impounds Lake Worth were badly damaged due to flooding caused by Tropical Storm Alberto in 1994. As a result, the lakes were drained for long periods of time to allow for rebuilding of the dams and the majority of the existing fisheries contained in the two reservoirs was lost. Today, the fish population of the two reservoirs is much like that of a new impoundment.

5.2.4.3 Lower Flint River Basin (HUC 03130008, HUC 03130009 and HUC 03130010)

Stream Water Quality

Water Quality Sampling. The fecal coliform standard was exceeded due to urban runoff in samples collected from Chickasawhatchee Creek in Dougherty County. In HUC 03130010, Aycocks Creek in Miller County and Spring Creek downstream from the cities of Arlington and Colquitt had violations of the fecal coliform standard due to nonpoint sources. Dry Creek downstream from the city of Blakely had violations of the fecal coliform standard due to urban runoff and a municipal discharge. Baptist Branch downstream from the city of Blakely had a violation of the lead standard due to a municipal discharge.

Benthic Macroinvertebrates. Benthic macroinvertebrates were collected at two locations within the 03130008 subbasin in 1995. Samples from Cooleewahee Creek yielded a biological rating of Good while the sample from the Flint River yield a biological rating of Very Good.

Benthic macroinvertebrates were collected from one location in subbasin 03130009 during the summer of 1995. Few EPT taxa were collected at this location. Previous reconnaissance surveys suggest a significant fluctuation in the benthic community throughout the seasons. Samples from Chickasawhatchee Creek yielded a biological rating of Good.

Benthic macroinvertebrates were collected at a Spring Creek location in subbasin 03130010 in 1995. Samples in Spring Creek yielded a biological rating of Very Good.

Fish Tissue Sampling. Fish tissue sampling in Dougherty, Baker, and Mitchell counties yielded no restrictions for largemouth bass, suckers, flathead catfish, and spotted suckers.

Groundwater Quality

Water Quality Sampling. In the southwest portion of the City of Albany, near the Albany Airport, a survey of nitrates in 221 shallow wells has indicated an elevated nitrate level in the groundwater. Sixty percent of the wells tested had nitrate levels greater than 4 ppm, denoting a broad area of concern of about 11.5 square miles. Within this area, in a subarea of about 1 square mile, the concentration of nitrates in the groundwater exceeded the drinking water MCL of 10 ppm.

Fisheries

Below Albany, from Lake Worth dam to Lake Seminole, is the only stream section in the State of Georgia where striped bass are known to reproduce successfully. These striped bass rely heavily on the cool groundwater springs which feed into the Flint River. Thus, groundwater withdrawal for agriculture and other purposes poses a potential threat to the survival of this important native game fish.

References

EPD. 1996. Water Quality in Georgia, 1994-1995. Georgia Department of Natural Resources, Atlanta, Georgia.

Evans, J.W. and R.H. England. 1995. A recommended Method to Protect Instream Flows in Georgia. Georgia Department of Natural Resources, Wildlife Resources Division, Social Circle, Georgia.

Section 6

Concerns and Priority Issues

The assessments in Section 5 present a number of water quality and quantity concerns within the Flint River Basin. This section combines the assessment information to identify priority issues for which management strategies are needed. For many waters, ongoing control strategies are expected to result in attainment of designated uses. In some cases, however, the development of additional management strategies may be required or implemented in order to achieve water quality goals.

Long-term priorities for addressing water quality concerns have not yet been finalized; however, short-term water quality action priorities for EPD are summarized in Section 6.2. Priorities for addressing water quantity issues within the Flint River Basin will be identified as part of the ACT/ACF study, and are summarized in Section 6.3.

6.1 *Identified Water Quality Planning and Management Concerns*

Section 5 identified both site-specific and generalized sources of water quality stressors, based on data from water quality, fish tissue, and macroinvertebrate sampling. Some of the concerns were isolated to individual stream segments, while other stressors were evident throughout the basin. The criterion listed most frequently in the 1994-1995 Water Quality Assessment as a contributor to non-supporting or partially-supporting status in the basin is fecal coliform bacteria (35 segments covering 365 miles) followed by metals (22 segments covering 165 miles). Urban runoff was listed most frequently as the source of fecal coliform and metals.

Summarized below are the priority water quality concerns that were identified for each subbasin as they affect the primary uses. These uses include fishing, recreation, drinking water quality, fish consumption, and water supply (flow). Each concern summarizes the linkage between stressor sources and water quality impairment or threat. In some cases, the source of the stressor is unknown.

The following discussion is broken out by the three major sections in the basin—upper Flint, middle Flint, and lower Flint. Lake Blackshear and Lake Worth are treated under the middle Flint. Table 6-1 summarizes the stressors and associated sources for each section of the basin, while Table 6-2 summarizes the use impacts for each section and lists the stressors affecting the uses.

Problem Statements

Upper Flint (HUC 03130005)

This is the most urban subbasin in the Flint River Basin. The population in the upper Flint almost equals half of the remaining population in the entire Flint River Basin. Stressors are due primarily to urban nonpoint source inputs from southern Metropolitan Atlanta and Hartsfield International Airport. This subbasin reported the greatest number of violations to water quality standards criteria for fecal coliform, dissolved oxygen, metals, biota, toxicity, and pH.

Table 6-1. Summary of Concerns in the Flint River Basin

Stressor	Sources of Stressor		
	Upper Flint (03130005)	**Middle Flint (03130006, 03130007)**	**Lower Flint (03130008, 03130009, 03130010)**
Fecal Coliform Bacteria	urban runoff, agricultural nonpoint sources, point source discharges	urban runoff, nonpoint sources,	urban runoff, CSOs, agricultural nonpoint sources, point source discharges
Metals	urban runoff, point source discharges	urban runoff, nonpoint sources	nonpoint sources
Dissolved Oxygen	urban runoff, point source discharges	nonpoint sources	
Erosion/ Sedimentation	urban runoff, increased development, rural roads, agricultural nonpoint sources and forestry practices	agricultural nonpoint sources, rural roads, forestry practices	agricultural nonpoint sources, rural roads, forestry practices
Nutrients		agricultural nonpoint sources, point source discharges	agricultural nonpoint sources
Water Supply/Flow	water withdrawals for Atlanta area	groundwater depletion	groundwater depletion, low instream flows
Flooding	habitat modification, urbanization	habitat modification, urbanization	habitat modification, urbanization

Low dissolved oxygen concentrations are due to a combination of point source discharges from wastewater treatment plants and urban runoff. This was the only subbasin in the Flint River Basin to have a fish consumption guideline which was for mercury in largemouth bass and channel catfish.

Stressors, Associated Use Impacts and Possible Sources of Stressors

A. Metals: The water use classification of fishing was not fully supported in 6 stream segments due to exceedances of water quality standards for metals (lead, zinc, and copper). One station had zinc violations, two stations between Hartsfield International Airport and Flat Shoals had lead violations due to urban runoff, three monitored tributaries draining the metropolitan Atlanta area of the subbasin had violations of standards for lead, and one of these had additional standard violations for copper and zinc.

B. Fish Consumption Guidelines: The water use classification of fishing was not fully supported in the Flint River mainstem (in Spalding/Fayette counties and Meriwether/Pike/Upson counties) based on fish consumption guidelines due to mercury. The guidelines are for largemouth bass and shoal bass, respectively.

C. Fecal Coliform Bacteria: The water use classification of fishing was not fully supported in 16 segments due to exceedances of the water quality standard for fecal coliform bacteria. Twelve

Table 6-2. Summary of Sources of Use Impairments in the Flint River Basin

Water Use Impacted	Stressors		
	Upper Flint (03130005)	**Middle Flint (03130006, 03130007)**	**Lower Flint (03130008, 03130009, 03130010)**
Fishing (Support for Aquatic Life)	metals, fecal coliform, sedimentation, low dissolved oxygen, flooding	metals, fecal coliform, nutrients, low dissolved oxygen, sedimentation, water supply, flooding	metals, fecal coliform, sedimentation, groundwater withdrawals, flooding
Fishing (Fish Consumption)	metals		
Recreation	fecal coliform	fecal coliform, nutrients	fecal coliform
Drinking Water	fecal coliform		nutrients, groundwater withdrawals
Water Supply/Flow	flooding	groundwater withdrawals, flooding	groundwater withdrawals, flooding

monitored tributaries had violations of the standard for fecal coliform bacteria in urban areas (Atlanta, Griffin, Thomaston). These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, and rural nonpoint sources. An additional tributary near Greenville had violations of the fecal coliform standards due to a municipal discharge that has since been eliminated.

D. Dissolved Oxygen: The water use classification of fishing was not fully supported in 7 stream segments due to dissolved oxygen concentrations below water quality standards. Oxygen demand in urban runoff from metropolitan Atlanta and treated wastewater discharges from the Griffin-Cabin Creek WPCP contributed to reduced dissolved oxygen levels. Dissolved oxygen violations were also found in Flat Creek, Camp Creek and Beaver Creek, due to nonpoint sources.

E. Erosion/Sedimentation: The water use classifications of fishing and drinking water are potentially threatened in many segments, by erosion and loading of sediment, which can alter stream morphology, impact habitat, reduce water clarity, and clog drinking water systems. There are 15 stream segments listed in this subbasin as partially supporting designated uses due to poor fish communities. Sediment may be a factor influencing fish communities in these areas. Potential sources include urban runoff and development (particularly construction), unpaved rural roads, forestry practices, and agriculture.

F. Water Supply/Flows: Water supply to meet municipal water supply needs is threatened due to growth pressures in the subbasin.

G. Flooding: Flooding in the Flint River Basin threatens people and property located within the floodplain, as demonstrated during the massive floods of 1994. Flooding may also breach dams, and can contaminate drinking water wells located within the floodplain.

Middle Flint (HUC 03130006 and HUC 03130007), including Lakes Blackshear and Worth

This section of the Flint River Basin supports both suburban and rural land uses. The largest point source discharge in the Flint River Basin is located here. HUC 03130006 had the second largest number of violations in the basin for fecal coliform, dissolved oxygen, and metals. These are most likely attributed to both point source discharges and nonpoint source impacts from urban and rural sources.

Lake Blackshear and Lake Worth are located in the middle Flint so the surrounding watersheds can have a significant impact on loadings to the lakes. Both lakes support strong fisheries and provide a significant recreational resource in the basin. Both of the dams from these lakes were heavily damaged from the tropical storm Alberto in 1994. The dams have since been rebuilt and the reservoirs have been restocked. The lake water quality is directly affected by the upstream flows coming into the lakes. Therefore, sources of impairment in the lakes most likely result from activities upstream from the lakes.

Stressors, Associated Use Impacts and Possible Sources of Stressors

A. Metals: The water use classification of fishing was not fully supported in 13 stream segments due to exceedances of water quality standards for metals (lead, zinc, and copper) from nonpoint sources. The water use classification of recreation was not supported in a portion of Lake Blackshear due to metals (lead, nickel, zinc, and copper) from urban runoff and other nonpoint sources. A portion of the City of Cordele lies in the Gum Creek watershed, which drains to Lake Blackshear.

B. Fecal Coliform Bacteria: The water use classification of fishing was not fully supported in 9 segments due to exceedances of the water quality standard for fecal coliform bacteria due to nonpoint sources. There is a large dairy operation in this subbasin which may contribute to the presence of fecal coliform bacteria. Land applications of sludge may also be a source of fecal coliform bacteria due to the karst topography in the region. The water use classification of recreation was not supported in a portion of Lake Blackshear due to elevated fecal coliform bacteria from urban and nonpoint sources. A portion of the City of Cordele lies in the Gum Creek watershed, which drains to Lake Blackshear.

C. Dissolved Oxygen: The fishing water use classification was not fully supported in one stream due to dissolved oxygen concentrations less than the water quality standard due to nonpoint sources.

D. Erosion/Sedimentation: The water use classifications of fishing and recreation 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.

E. Water Supply/Flow: Water supply for drinking water and agricultural uses is potentially impaired in the middle Flint due to the depletion of groundwater supplies. Large quantities of groundwater are withdrawn from the Floridan Aquifer for irrigation during dry periods of the growing season to support agricultural production in the middle Flint basin. The Floridan

Aquifer is interconnected with the Flint River; therefore, as these agricultural withdrawals increase, the flow of the Flint River during dry periods gets progressively smaller, possibly leading to deleterious instream flow conditions. In addition, since no new municipal, industrial, or agricultural withdrawals of groundwater can be made from the Clayton Aquifer, a deeper aquifer in the Dougherty Plain which is not connected with surface streams, future expansions of irrigation pumping are likely to come from the Floridan, thereby possibly exacerbating the surface water effects.

F. Flooding: Flooding in the Flint River Basin threatens people and property located within the floodplain, as demonstrated during the massive floods of 1994. Flooding may also breach dams, and can contaminate drinking water wells located within the floodplain.

G. Nutrients and Eutrophication: The water use classifications of fishing and recreation are potentially threatened in Lakes Blackshear and Worth due to inputs of nutrients which may cause excess algal growth in the lakes. A source of nutrients may be agricultural runoff, since a primary land use surrounding Lake Blackshear is agricultural production of row-crops. Other sources may include municipal and industrial water pollution control plants discharging in the watershed.

H. Nuisance Weeds: The water use classifications of fishing and recreation are potentially threatened in Lakes Blackshear and Worth due to the presence of nuisance aquatic plant species.

Lower Flint (HUC 03130008, HUC 03130009, and HUC 03130010)

The lower Flint River Basin is primarily defined by agricultural operations. These agricultural operations have an impact on water supply due to the use of groundwater for irrigation, as well as potentially contributing sources of nonpoint source pollutants such as sediments, nutrients, and fecal coliform. Subbasins 03130008 and 03130009 had violations for fecal coliform. The Cities of Albany, Newton, and Bainbridge, are all located in HUC 03130008. These are the principal urban areas in the lower Flint that contribute point and nonpoint source pollution.

Stressors, Associated Use Impacts and Possible Sources of Stressors

A. Metals: The water use classification of fishing was not fully supported in 3 stream segments due to exceedances of water quality standards for metals (lead and zinc) as a result of urban runoff from the City of Albany.

B. Fecal Coliform Bacteria: The water use classification of fishing was not fully supported in 10 stream segments due to exceedances of the water quality standard for fecal coliform bacteria. These violations may be attributed to CSOs in the City of Albany and other sources of urban runoff.

C. Nitrates in Groundwater: Drinking water use is potentially threatened in the lower Flint due to the presence of nitrates in groundwater supplies in some of the Coastal Plain aquifers. In the southwest portion of the City of Albany, near the Albany Airport, a survey of nitrates in 221 shallow wells has indicated an elevated nitrate level in the groundwater. Nitrates can come from nonpoint sources such as natural and artificial fertilizer, feedlots, and animal enclosures.

Septic tanks and land application of treated wastewater and sludge are other potential sources of nitrate.

D. Erosion/Sedimentation: The water use classifications of fishing and recreation are potentially threatened in many 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, 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.

E. Water Supply/Flow: The water supply, drinking water use, and fisheries are potentially impaired in the lower Flint due to groundwater demand. Very large quantities of groundwater are withdrawn from the Floridan Aquifer for irrigation during dry periods of the growing season to support agricultural production in the upper Flint basin. The Floridan Aquifer is interconnected with the Flint River; therefore, as these agricultural withdrawals increase, the flow of the Flint River during dry periods gets progressively smaller, possibly leading to deleterious instream flow conditions. Also, the striped bass fisheries south of Albany are dependent on groundwater springs to provide cool water refuges during the summer months. In addition, since no new municipal, industrial, or agricultural withdrawals of groundwater can be made from the Clayton Aquifer, a deeper aquifer in the Dougherty Plain which is not connected with surface streams, future expansions of irrigation pumping are likely to come from the Floridan, thereby possibly exacerbating the surface water effects.

F. Flooding: Flooding in the Flint River Basin threatens people and property located within the floodplain, as demonstrated during the massive floods of 1994. Flooding may also breach dams, and can contaminate drinking water wells located within the floodplain.

6.2 Short-term Water Quality Action Priorities for EPD

Section 6.1 identifies water quality concerns for which management and planning will be required. Because of limited resources, and in some cases, limitations to technical knowledge, varying degrees of effort can be expended to address these concerns 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. This section provides a rationale for assigning relative priorities to addressing the various concerns.

The current priorities for action identified by EPD are discussed below (EPD, 1996). 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 addition, the priorities were presented to the public in stakeholder meetings in Griffin and Albany. These priorities may change based on stakeholder input throughout the basin in the next basin-planning cycle.

Priorities for addressing water segments that do not fully support designated uses are summarized in Table 6-3. In the discussion below, 305(b) waters are waters for which water quality data have been assessed and the waters categorized — as supporting, partially supporting, or not supporting of uses — during the state's biennial water quality assessment, mandated by section 305(b) of the Clean Water Act. 303(d) waters are a subset of 305(b) waters

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

Priority	Type
1	Active 305(b) waters where ongoing pollution control strategies are expected to result in achieving support of designated uses; Active special projects.
2	Segments with dissolved oxygen violations or with multiple data points showing violation of standards for toxic metals.
3	Waters for which government partners are available, including low DO problems associated with dam releases and potential impact from agricultural nonpoint sources
4	Waters for which urban runoff and generalized nonpoint sources have resulted in violations of standards for metals or fecal coliform bacteria.

for which no action has been initiated by EPD which will result in water quality improvement and attainment of water quality standards.

Priority One Actions

For many water bodies in the Flint River Basin, ongoing control strategies are expected to result in attainment of designated uses in the water body. The majority of EPD resources will be directed to ensuring that the ongoing pollution control strategies are implemented as planned and water quality improvements are achieved. These waters (see Appendix E) are the highestpriority waters because these segments will continue to require resources to complete actions and ensure that water quality standards are achieved. These stream segments have been assigned priority one.

Priority Two Actions

Second priority was allocated to stream segments with multiple data points which showed metals or other toxic substance concentrations in excess of water quality standards and to segments in which dissolved oxygen concentration was an issue.

Priority Three Actions

Third priority was assigned to segments where governmental partners may be available to aid in the process of implementing water quality improvements such as the Corps of Engineers in segments where dissolved oxygen is low below a dam or the Georgia Soil and Water Conservation Commission (designated lead agency for agriculture) in segments potentially impacted by nonpoint sources from agricultural practices.

Priority Four Actions

Fourth priority was assigned to active 303(d) segments where urban runoff and general nonpoint sources caused metal or fecal coliform bacteria standards violations. Within the current round of basin planning these sources of stressors will be addressed primarily through general strategies of encouraging best management practices for controls of the stressors.

A couple of scientific issues help forge the rationale for priorities. First, the vast majority of waters on the active 303(d) list are a result of exceedance of the criteria for metals, fecal coliform bacteria, or poor fish communities due to urban runoff or nonpoint sources. At the present time the viability of the standards for metals and the efficacy of the fecal coliform bacteria standard are in question in the scientific community, as described in Section 4.2. Also, in many cases, the metals database was minimal with as little as one data point showing a concentration in excess of stream standards placing a stream reach or area of a lake on the partial support lists.

6.3 Priorities for Water Quantity Concerns

With regard to the priority to be placed on meeting competing demands for future water use, the Environmental Protection Division (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 among the states of Alabama, Florida, and Georgia. 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) cannot be met under conditions of water shortage, efforts will be made to optimize the mix of economic and environmental values.

While these "guiding principles" were specifically developed to give expression to Georgia's water needs priorities in those areas of Georgia within the study area of the Alabama-Coosa-Tallapoosa/Apalachiocola-Chattahoochee-Flint (ACT/ACF) Comprehensive Study, it is likely that they characterize water needs priorities throughout the state. Thus, Georgia places highest value on the use of water for its citizens to use in drinking and water for agricultural needs. Also, with respect to surface waters, extremely important are the needs for sufficient instream flows to maintain acceptable quality in the State's rivers and streams to address aquatic habitant and species needs.

In managing Georgia's surface waters, EPD's approach is to meet as many of the identified water needs to the highest extent practicable, while minimizing adverse impacts associated with meeting those needs. Of foremost importance in meeting those needs is maximizing use of already developed water resources along with aggressive water conservation. As existing developed sources are maximized and water conservation efforts approach diminishing returns, inter-jurisdictional regional cooperation to identify and develop water sources takes on heightened importance.

The Interstate Compact which has been drafted by the states and Federal government for the ACF basin does not give the Commission power to determine how Georgia must allocate its share of available water among competing uses; that decision, and the mechanism to implement that allocation, is left to the Environmental Protection Division. Of course, the larger Georgia's share of the available water resource in these basins, the less often any single demand will not be met.

6.4 Priorities for Additional Data Collection

In the 1996-97 time frame monitoring efforts are focused on work to support the Chattahoochee River Modeling Project and modeling projects for West Point and Allatoona Lakes as well as on listed priority waters in the Coosa/Oconee/Tallapoosa (1996) and Savannah/Ogeechee (1997) river basins in accordance with EPD basin planning schedule. Intensive monitoring will return to the Flint basin in support of the next iteration of the basin planning cycle in 2000. Prior to this time, EPD and partners will develop a strategic monitoring plan for the Flint, documented through a written monitoring plan. 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.

References

EPD. 1996. *Water Quality in Georgia, 1994-1995*. Georgia Department of Natural Resources, Environmental Protection Division, Atlanta, Georgia.

Section 7

Implementation Strategies

The Statement of Mission for Georgia's River Basin Management Planning (see Figure 1-1) 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 to meet all applicable local, state, and federal laws, rules, and regulations, and provide for water quality, habitat, and recreation. In the Flint 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 general and basin wide implementation strategies of most relevance to the Flint River Basin management plan. Targeted strategies for specific priority concerns within each sub-basin, as identified in Section 6, are then presented in Section 7.2.

7.1 General/basin Wide Management Strategies

7.1.1 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 water body. 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 in stream 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 in stream water uses and the level of water quality necessary to protect the existing use shall be maintained and protected.

Water Supply Watershed Protection Strategy

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:

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

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

2. 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.

As population continues to increase within the Flint River Basin, it will become ever more important to protect the water quality of already developed raw water sources. It is therefore necessary and appropriate to prepare and implement water supply watershed protection plans for each water supply watershed of 100 square miles or less within the Flint River Basin. Over the next five years, EPD will intensify its watershed protection planning efforts with the Department of Community Affairs, Regional Development Centers, and local governments to assist with development and implementation of these plans. EPD will also seek to utilize its current permitting authority to ensure development of these plans.

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 water bodies where water quality standards are not met following the application of technology based controls, and to establish TMDLs for the listed stream segments. The U.S. Environmental Protection Agency (EPA) 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 1996. Georgia submitted a draft 303(d) list to the USEPA in February 1996. The EPA reviewed the Georgia submittal and provided comments to in March, 1996. Georgia submitted a final 303(d) listing to the EPA on April 1, 1996. The EPA approved the Georgia 303(d) list on May 2, 1996.

Georgia's 1996 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, 1995-1996.* 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 Flint River Basin. An explanation of the codes is given below. An "X" in the 303(d) column indicates the segment is on 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 without additional control strategies. These segments are not part of the Georgia 303(d) list.

X Waters with active 303(d) status. 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.

NA Waters assessed as supporting designated uses.

Georgia will address a number of the listed waters in the 1997-1998 time period, however, the majority of work on segments in the Flint River will be addressed in the second round of basin planning. The second round of basin planning for the Flint River will begin in 1999 and the river will be the focus of monitoring in the year 2000. Significant efforts will be made to assess the condition of the listed 303(d) waters at that time and results of the assessments will dictate the areas where TMDLs will be developed.

7.1.2 Management of Permitted Point Sources

The strategies in this section strive to minimize adverse effects from municipal, industrial, and concentrated stormwater discharges. Permitted discharges of wastewater and effluents 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 in stream 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) toxics 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.

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 Flint River Basin. The funding for these projects has come from state and federal construction grants and the citizens of local municipalities.

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 federal 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 in stream concentration of 0.011 mg/l, the permitted flow of the facility, 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 effluent 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 will be required to meet ammonia limits for toxicity if those limits are more stringent than in stream dissolved oxygen based limits. Existing facilities will not be required to meet ammonia limits based on calculated toxicity unless actual toxicity has been identified through toxicity tests.

Metals / Priority Pollutants

Major municipal and industrial facilities are required to submit periodic priority pollutant scans to EPD as part of their permit monitoring requirements or upon submittal of a permit application for permit reissuance. The priority pollutant data is assessed in accordance with the Georgia Rules and Regulations for Water Quality Control. The results of the assessment 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

Georgia does not have statewide numeric effluent or in stream standards for phosphorus, and there are currently no site-specific major lake water quality standards in place within the Flint basin. Should site-specific standards be developed for Lake Blackshear or Worth, then point sources upstream of the lake would be required to control phosphorus loading such that in-lake uses are met. This has already occurred in the Chattahoochee River basin upstream of West Point Lake, where site-specific standards have been enacted.

Stormwater Permitting

The 1987 Amendments to the federal Clean Water Act require permits to be issued for certain types of stormwater discharges, with primary focus on stormwater runoff from industrial operations and large urban areas. The USEPA promulgated Stormwater Regulations on November 16, 1990. EPD subsequently received delegation from the USEPA in January 1991 to issue General Permits and regulate stormwater in Georgia. EPD has developed and implemented a stormwater 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 stormwater from the MS4s which they own or operate, and incorporate detailed stormwater management programs. These programs may include such measures as structural and non-structural controls, best management practices, inspections, enforcement and public education efforts. Stormwater management ordinances, erosion and sediment control ordinances, development regulations and other local regulations provide the necessary legal authority to implement the stormwater 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 stormwater management program.

EPD has determined that the metropolitan Atlanta area is a large municipal system as defined in the regulations. Clayton, Cobb, DeKalb, Fulton, and Gwinnett Counties and all interlying incorporated cities are required to comply with the application submittal target dates for a large municipal area. Forty-five stormwater permits were issued to the Atlanta area municipalities on June 15, 1994. There are no medium size municipal systems (population 100,000 to 250,000) within the Flint basin.

The stormwater permits for large and medium municipal systems require annual reports to be submitted starting one year after the permit issuance. During 1995, the Georgia stormwater permitting program included EPD review of the first Annual Reports from each of the 45 Atlanta area municipalities. Among other things, the Annual Report includes a detailed description of the municipality's implementation of its Stormwater Management Plan.

The Atlanta Regional Commission (ARC) provides a variety of services related to stormwater management to the area cities and counties surrounding Atlanta. The ARC coordinated and facilitated the application process for the 45 NPDES municipal separate storm sewer system (MS4) permits which were issued by EPD to the Atlanta-area municipalities in 1994. The ARC provided (and continues to provide) a variety of services to area cities and counties, including rainfall analysis, land use characterization, mapping services and stormwater management program guidance. In addition, the ARC organized and coordinated the stormwater discharge characterization sampling and modeling efforts for the permit applications, and currently facilitates area stormwater management through its activities with the Atlanta Region Stormwater Management Task Force, coordination of the Atlanta Regional Stormwater Sampling Program and publication of guidance documents. (Note: The ARC should be contacted directly regarding its involvement with land use planning, water quality monitoring, development of a water quality index and other work relevant to the basin planning process.)

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

Currently there are 288 facilities in the Flint River Basin that have submitted NOIs for coverage under the general permit for stormwater discharges associated with industrial activities. As with the municipal systems, implementation of Phase II of Federal stormwater permitting is expected to result in a greater number of facilities becoming regulated to control stormwater runoff. However, the specific types of industrial, commercial and retail activities which will be addressed under Phase II have yet to be determined.

7.1.3 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

The Georgia Environmental Protection Division (EPD) is currently revising and updating the Georgia Nonpoint Source Management Program. The Georgia Nonpoint Source Management Program will provide an overview of the State's nonpoint source water quality management activities as well as a summary of what the State intends to accomplish in the next five federal fiscal years (FFY 1998 - FFY 2002). As outlined in the Clean Water Act, the State is only eligible to receive financial assistance under Section 319(h) for program implementation if the Georgia Nonpoint Source Management Program has been approved by the United States Environmental Protection Agency (USEPA).

EPD has contracted with the University of Georgia - Institute of Community Affairs and Development to assist in revising and updating the Georgia Nonpoint Source Management Program. A final draft of the Georgia Nonpoint Source Management Program will be submitted to the USEPA for review and approval in September, 1997.

During the initial phase, UGA - ICAD faculty will develop a composite inventory of nonpoint source pollution management activities at EPD and selected cooperating agencies. This inventory will be developed through a review of available documentation and series of site visits and interviews. An objective of this project is to compile information on both current nonpoint source pollution management activities and goals and activities anticipated over the next five years, FFY 1998 - FFY 2002, (including statewide and watershed-specific programs).

Once approved, the Georgia Nonpoint Source Management Program will address the following nonpoint source categories:

- Agriculture
  - Non-irrigated crop production
  - Irrigated crop production
  - Specialty crop production (e.g., truck farming and orchards)
  - Pasture land
  - Range land
  - Feedlots - all types
  - Aquaculture
  - Animal holding/management areas
- Silviculture
  - Harvesting, reforestation, residue management
  - Forest management
  - Road construction/maintenance
- Construction
  - Highway/road/bridge
  - Land development
  - Urban Runoff
  - Storm sewers (source control)
  - Combined sewers (source control)
  - Surface runoff
- Resource Extraction/ Exploration/Development
  - Surface mining
  - Subsurface mining
  - Placer mining
  - Dredge mining
  - Petroleum activities
- Mill tailings
  - Mine tailings
- Land Disposal (Runoff/Leachate from Permitted Areas)
  - Sludge
  - Wastewater
  - Landfills
  - On-site wastewater systems (septic tanks,etc.)
  - Hazardous waste
- Hydrologic/Habitat Modification
  - Channelization
  - Dredging
  - Dam construction
  - Flow regulation/modification

Bridge construction
Removal of riparian vegetation
Streambank modification/
destabilization

Other

Atmospheric deposition
Waste storage/storage tank leaks
Highway maintenance and runoff
Spills
In-place contaminants
Natural

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.

Georgia Soil and Water Conservation Commission (GSWCC). Created in 1937 by an Act of the Georgia Legislature, the GSWCC has been designated as the administering or lead agency for agricultural nonpoint source 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 oversight for the Georgia Erosion and Sedimentation Act. There are 6 regional offices and 40 local districts in the states. The initial contact for the GSWCC is: Georgia Soil and Water Conservation Commission, Graham Liles, Executive Director, P.O. Box 8024, Athens, Georgia 30603, (706) 542-3065.

Soil and Water Conservation Districts (SWCDs). Georgia's SWCDs were also formed by Act of the Georgia General Assembly in 1937. Georgia's SWCD's receive no annual appropriations and are not regulatory or enforcement agencies. 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).

Currently, there are forty active SWCD's in Georgia, eight of which are in the Flint River Basin. At the county level, each SWCD receives technical assistance, via an existing Memorandum of Agreement, from the United States Department of Agriculture's Natural Resources Conservation Service to work with landowners on implementing agricultural BMPs. Through these partnerships, applying a voluntary approach to conservation, 15 million acres have received conservation treatment in Georgia. The initial contact for the GSWCC and the SWCDs is: Georgia Soil and Water Conservation Commission, Graham Liles, Executive Director, P.O. Box 8024, Athens, Georgia 30603, (706) 542-3065.

U. S. Department of Agriculture's Natural Resources Conservation Service (NRCS). The NRCS (formerly known as the Soil Conservation Service [SCS]) cooperates with federal, state, and local units of government to provide technical assistance to landowners, cooperators, producers, and special interest groups. Standards and specifications regarding conservation practices, animal waste management systems, grazing activities, plant materials, and other practices are developed and revised by a varied staff. The initial contact for the NRCS is United States Department of Agriculture, Natural Resources Conservation Service, Earl Cosby, State Conservationist, 355 Hancock Avenue, Athens, Georgia, (706) 546-2272.

University of Georgia's College of Agricultural and Environmental Sciences (CAES). The CAES includes various departments, the Cooperative Extension Service, and Experiment Stations. Services provided include classroom instruction in agriculture-related topics; basic and applied research; consultative assistance; and information on nonpoint-related impacts on water quality; water quality monitoring; pest control; and analyses of nutrients, pesticides, herbicides, and other constituents in forage, water, and animal waste. Nutrient management plans for farms are often developed by CAES. The initial contact for the CAES is Dr. Gale Buchanan, College of Agriculture, University of Georgia, Athens, Georgia, 30602, (706)542-2151.

Farm Services Agency (FSA). The FSA, formerly known as the Consolidated Farm Services Agency (CFSA) and the Agricultural Stabilization and Conservation Service (ASCS), administers conservation cost-sharing and incentive programs for practices that improve environmental quality on farms. A variety of water quality improvement practices are cost-shared, with rates generally between 50 and 70 percent of the total cost of the installation. A large portion of funds allocated are targeted for high-priority watersheds with water quality problems. The initial contact for the FSA is Mr. Bobby Duncan, Acting State Director, Farm Services Agency, 355 East Hancock Avenue, Athens, Georgia 30601, (706)546-2266.

Georgia Department of Agriculture (GDA). The GDA administers a variety of insect and plant and animal disease control programs. The Department also enforces myriad Georgia laws that include inspections of agricultural products and the registration and use of pesticides. The GDA also provides guidance in location of animal waste facilities and disposal of dead animals. The initial contact for the GDA is The Honorable Tommy Irvin, Commissioner, 204 Agriculture Building, Capitol Square, Atlanta, GA 30334, (404) 656-3600.

Agricultural Research Service (ARS). As part of the U. S. Department of Agriculture (USDA), the ARS is involved in a wide variety of agricultural research projects and monitoring programs. Research on grazing land systems and irrigation methods relevant to watershed-scale monitoring projects and nutrient movement in surface water and groundwater are examples of work performed by the ARS. The initial contact for the ARS is Dr. Jean Steiner, Director, 1430 Experiment Station Road, Watkinsville, GA 30677, (706)-769-8962.

Resource Conservation and Development (RC&D) Councils. RC&D councils are groups of local citizens that are involved in a program to encourage economic development, as well as the wise conservation of natural and human resources. The RC&D Councils are locally organized within geographic regions served by the USDA. The 1962 Food and Agriculture Act established the RC&D Council program with USDA employees called coordinators assigned to help the RC&D Councils. Currently, there are 10 RC&D Councils in Georgia. Initial contact for RC&D Councils is The Honorable Jeanette Jamieson, President, Georgia RC&D Council, P.O. Box 852, Toccoa, GA 30577 (706) 886-6889.

The federal and state agencies work closely with the Georgia agricultural commodity commissions and organizations such as the Farm Bureau Federation, AgriBusiness Council, Cattleman's Association, Milk Producers, Pork Producers Association, Poultry Federation, and other producer groups and agriculture support industries to control, prevent, and/or abate nonpoint source pollution.

The agricultural community has been participating with EPD in project activities designed to demonstrate agricultural best management practices (BMPs) through Section 319 of the Federal Clean Water Act. These demonstration projects act as a forerunner to Federal agricultural programs charged with getting conservation measures or BMPs installed within designated priority areas. The Cooperative Extension Service also works with landowners, through their Sustainable Agriculture & Farm-A-Syst Programs, to promote conservation measures, BMPs, and other appropriate cultural practices designed to foster agricultural production using environmentally sound techniques.

Georgia's Soil and Water Conservation Districts, with assistance from the Natural Resources Conservation Service and the Farm Services Agency, work with landowners on the implementation of conservation measures and BMPs. The 1996 Farm Bill has enhanced and diversified the delivery of conservation programs in Georgia. It is anticipated that the Farm Bill delivery process will provide opportunities for all types of agricultural production to qualify for cost-share incentives to voluntarily implement BMPs, which will include, but not be limited to, conservation cropping sequence; conservation tillage practices; contour farming; grassed waterways; and terracing. A NRCS State Technical Committee, comprised of natural resource professionals with diverse technical expertise and representing a number of State and Federal agencies, is now being utilized to identify priority resource concerns and geographic areas across the State. Conservation Programs available to address priority resource concerns include, but are not limited to: the existing 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), a voluntary program designed to protect, restore, and enhance wetlands with cost-share incentives; and the Wildlife Habitat Incentives Program [WHIP], which will help landowners develop and improve habitats for upland wildlife, wetland wildlife, endangered species, fisheries, and other wildlife. Other programs include the Forestry Incentives Program (FIP), the Farmland Protection Program, and the newly created Environmental Quality Incentives Program (EQIP), which encompasses the old Agricultural Conservation Program and Water Quality Incentives Program, and is discussed further below. Collectively all of these programs will continue to have a significant and positive impact on Georgia's natural resources.

Environmental Quality Incentives Program

The 1996 Farm Bill created a new flagship conservation program, the Environmental Quality Incentives Program (EQIP), which will provide the lion's share of funding for technical, educational, and financial assistance for the implementation of agricultural best management practices. The NRCS has leadership for EQIP and works with the Farm Service Agency (FSA) to set policies, priorities, and guidelines. These two agencies take recommendations from local work groups and the State Technical Committee (discussed in the previous paragraph) when addressing actual, and potential, resource impairments associated with agricultural land uses.

EQIP provides incentive payments and cost-sharing for conservation practices through 5 - 10 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, filterstrips, 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. During the 1997 Federal fiscal year (FFY 97), Georgia has 19 priority areas, 9 of which are located in the Flint River Basin.

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, pasture land, forest land, and other farm lands.

Shown in Table 7-1 is the estimated Financial Assistance (FA), Educational Assistance (EA), and Technical Assistance (TA) that will be available to producers during the 1997 FFY in the Flint River Basin. Local NRCS and FSA offices will have 3 - 5 years for obligating this year's allocation to eligible producers.

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 (BMP) 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 twelve (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.

In 1992, the GFC conducted a statewide BMP implementation survey by evaluating 342 sites. The most significant problems identified were with rate of implementation of BMPs on forest roads, skid trails, and stream crossings. Within the Flint River Basin, the GFC evaluated 64 sites (21 Piedmont, 36 Upper Coastal Plain and 7 Lower Coastal Plain). Forty eight of the sites were on private land, fifteen on forest industry lands and one public owned lands.

Approximately 73.7 miles of forest roads were evaluated on 59 sites of which 62.5 miles (85%) were in compliance with BMPs. Sixty six percent of the sites maintained road grades in accordance with BMPs and water control structures (broad based dips, water bars, turnouts, etc.) were used on 26 percent of the sites. At critical areas such as stream crossings, roads were stabilized only on 15 percent of the sites with stream crossings.

Table 7-1. Flint River Basin - Prioritized and General Appropriations under EQIP

	Priority Consv Appropriations	Resource Concerns			Total
		Water Quality	Soil Erosion	Wildlife Habitats	
3130005					
Financial Assistance	$83,653	$6,998	$1,000	$2,292	$93,943
Educational Assistance	433	30	45	27	535
Technical Assistance	16,731	1,399	200	458	18,788
Total	100,817	8,427	1,245	2,777	113,266
3130006					
Financial Assistance	582,825	-	-	-	582,825
Educational Assistance	2,975	-	-	-	2,975
Technical Assistance	116,565	-	-	-	116,565
Total	702,365	-	-	-	702,365
3130007					
Financial Assistance	207,440	6,998	1,000	2,293	217,731
Educational Assistance	1,071	31	46	28	1,176
Technical Assistance	41,488	1,399	200	459	43,546
Total	249,999	8,428	1,246	2,780	262,453
3130008					
Financial Assistance	316,793	6,999	1,000	2,293	327,085
Educational Assistance	1,624	31	45	28	1,728
Technical Assistance	63,359	1,399	200	459	65,417
Total	381,776	8,429	1,245	2,780	394,230
3130009					
Financial Assistance	130,491	-	-	-	130,491
Educational Assistance	673	-	-	-	673
Technical Assistance	26,098	-	-	-	26,098
Total	157,262	-	-	-	157,262
3130010					
Financial Assistance	114,545	-	-	-	114,545
Educational Assistance	593	-	-	-	593
Technical Assistance	22,909	-	-	-	22,909
Total	138,047	-	-	-	138,047
Grand Total					
Financial Assistance	1,435,747	20,995	14,999	6,878	1,478,619
Educational Assistance	7,369	92	136	82	7,679
Technical Assistance	287,150	4,199	3,000	1,376	295,725

Approximately 9,888 harvested acres were evaluated on 64 sites of which 8,915 acres (90%) were in compliance with the BMPs. On 29 sites that needed water bars installed in skid trails, only 1 site (3%) actually installed them. Log decks in critical areas were retired and stabilized on 27 percent of the sites. Logging debris had been left in stream channels on 32 percent of the sites with streams. Random skidder crossings occurred on 56 percent of the sites with streams and temporary stream crossings consisting of debris and dirt were removed on 17 percent of the sites.

Approximately 1,550 site prepared acres were evaluated on three sites of which 1,523 acres (98%) were in compliance with BMPs. No major problems were noted. No regenerated acres were evaluated in the basin.

Since this survey, a massive BMP educational program was initiated and conducted. The GFC in cooperation with the Georgia Forestry Association (GFA) and the University of Georgia has and is in the process of conducting professional forester, timber buyer and logger educational training. Member companies of the American Forest and Paper Association, as part of their Sustainable Forest Initiative, have funded an educational program called the Master Timber Harvesters Workshop with a goal of educating the 2,500 loggers in the state. The three day workshop which started in December 1995 focuses on forest ecology, silviculture, wildlife management, soils, hydrology, BMPs, harvest planning, insurance, OSHA regulations and business management. Already over 500 professional foresters and nearly 1,000 loggers have been trained. Because of this educational thrust, the GFA has a goal of 100 percent BMP compliance by the year 2000. The GFC will be conducting BMP surveys in 1997 and 1999 to monitor this progress.

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.

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 was convened in 1988 to assist the Georgia Department of Natural Resources in developing a cooperative approach to prevention, control and abatement of nonpoint source impacts on urban streams. The Task Force's report emphasized the importance of cooperative partnerships and building working relationships between the units of government responsible for land and water quality management. Educational, management, and support strategies were recommended to help move toward an integrated structure which could provide continued evolution of intergovernmental and private sector roles and promote development of urban stream management activities over time.

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 nonpoint sources of pollution. 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."

Since publication of *We All Live Downstream*, urban nonpoint source management in Georgia has continued to evolve. Consistent with the multiple sources of urban nonpoint sources of pollution, the management systems has multiple focuses. Some programs focus on specific sources of urban nonpoint sources of pollution, targeting implementation of structural and/or management BMPs on individual sites or system wide. Other programs treat corridors along water bodies as a management unit to prevent or control the impacts of runoff on urban streams.

Additional programs focus on comprehensive watershed management. This approach, which considers the impacts of all the land draining into a water body and incorporates integrated management techniques, is particularly critical to protecting or enhancing the quality of urban streams. The quality of urban water bodies cannot be effectively managed without controlling the adverse impacts of activities in their watersheds.

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. The agency is also expanding its role in facilitation and support of local management efforts. Development of this aspect of urban nonpoint source management will continue through the activities planned for the next five years.

EPD has a primary role in management of urban nonpoint sources of pollution, and is responsible for administering and enforcing a variety of permit programs, including permitting of stormwater 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 nonpoint sources of pollution in general, regulatory requirements, and cooperative or non-regulatory approaches. Units within EPD which have responsibilities related to urban nonpoint sources of pollution the Surface Water Permitting Unit, housed in the Water Resources Management Branch, the Nonpoint Source Program, housed in the Water Protection Branch, and the Georgia Geologic Survey.

For urban nonpoint sources of pollution, activities of the Nonpoint Source Management Program interact strongly with point source controls for combined sewers and storm sewers, both of which discharge urban nonpoint sources of pollution through point conveyances. Current activities for urban surface runoff control include the following:

- Implement local 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 the general public, business and industry, local and regional governments, and school system
- Implement the Georgia Adopt-A-Stream Program, as described below in Section 7.1.6.
- Identify and evaluate resources to support urban watershed planning and management.
- EPD has provided both financial and technical support to and encouraged the development of local government water quality management programs. Projects have

included an assessment of nonpoint source impacts on groundwater in Albany; support of local stream watch programs in Fulton County; support of a pilot program to set up water-watch programs for neighborhood planning units in the City of Atlanta; and an annual Adopt-A-Stream Conference.

7.1.4 Floodplain Management

Floodplain Management Strategies

The following strategies are to support and strengthen efforts to reduce the risk and impact of flooding.

- Improve the level of awareness, information, and education regarding floodplain management.
- Increase the number of communities participating in the National Flood Insurance Program (NFIP).
- Enhance the effectiveness of floodplain management on the state and local levels.
- Promote the institutionalization of natural hazard mitigation on the state and local levels.

Floodplain management in the State of Georgia is administered through federal regulations and locally adopted ordinances. The federal statutes are found in Title 44 of the Code of Federal Regulations Parts 59-79. As a condition of participation in the NFIP, local political jurisdictions voluntarily adopt Flood Damage Prevention Ordinances, which are based on federal regulations, to enforce and administer floodplain development. Subsequently, the Federal government makes flood insurance available to all residents of the participating community.

Georgia's Floodplain Management Office, located within EPD, serves as liaison between the Federal Emergency Management Agency (FEMA) and local governments participating in the NFIP. Through training workshops, quarterly newsletters, and technical assistance, 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.

RiverCare 2000 Program

Georgia also has strategies to protect and manage riparian floodplain areas. Of particular relevance is RiverCare 2000, a conservation program which Governor Miller established in September of 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. To date, RiverCare 2000 has obtained $15.6 million in acquisition funds, and has begun negotiations to acquire suitable riparian lands via voluntary sales. 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 green way; and
- Restoration Sites, which are tracts of land which the state will identify, acquire, and manage to reduce nonpoint-source water pollution.

7.1.5 Wetlands Management

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. We still suffer from the lack of accurate assessments for current and historic wetland acreages. 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. In the settlement of violations, restorations occurred on 16.8 acres in 1994, and 17.8 acres in 1995.

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. Through December, 1995, 100,000 acres had been acquired by purchase, gift, or long term lease under this program. Additional wetlands acquisition occurs as part of the River Care 2000 initiative, discussed above.

Education And Public Outreach

WRD has one full-time person involved in aquatic education, providing training for educators in wetland values and acting as a resource person for developing and coordinating teaching materials. The Aquatic Education Program consists of three key components: Youth Education, Adult Education, and Kids Fishing. Youth Education involves training educators to use Aquatic Project Wild (APW), which consists of instructional workshops and supplementary conservation curriculum materials for teachers of K-12 grade children. About 1,000 educators are trained annually to use APW in the classroom. Adult Education consists primarily of producing educational materials such as the annual Freshwater and Saltwater Sport Fishing Regulations, Reservoir and Southeast Rivers Fishing Predictions, Small Georgia Lakes Open to Public Fishing, Introduction to Trout Fishing, news releases, brochures, radio Public Service Announcements, videos, and staff presentations to sportsmen and civic organizations, as well as large events. The purpose of Kids Fishing Events (KFEs) is to introduce youth and their families to the joys of recreational fishing. In 1994, KFEs were conducted in over 90 counties with over 15,000 children fishing in these events.

The aquatic education program touches tens of thousands of youths and adults each year, bringing these people closer to the environment, and teaching them conservation principles that are important to sustaining healthy fish populations, such as clean lakes and streams, and maintaining functional wetlands.

State Protected Species in Wetlands

With assistance from the US-F&WS, Section 6 Federal Aid Program, and USDA-FS Stewardship Program, WRD has developed and published a descriptive handbook of Georgia's 103 protected plant species that include endangered, threatened, unusual, and rare plant species found in the state. Forty percent of the protected species are dependent on wetland or aquatic habitats in the vast majority of known occurrences. The "Protected Plants of Georgia" book includes illustrations, descriptions, threats to species or their habitats, range in adjoining states, historical notes, and recommendations for management of protected species habitats.

The protected plant book has been distributed to all DNR personnel and wildlife biologists involved in the management of state properties. The protected plant book is being distributed to Georgia Forestry Commission (200), USDA-Natural Resource Conservation Service (300), Forest Service, US F&WS, Corps of Engineers, US EPA, major utility companies, forest products corporations, consulting biologists, educators, and private citizens. The book will call the public's attention to the need to protect wetlands on private property as well as public property in the state.

7.1.6 Stakeholder Involvement / Stewardship Strategies

Stakeholder involvement and stewardship are essential to address one of the major challenges identified by the Community Stream Management Task Force in *We All Live Downstream*: nonpoint sources of pollution are diffuse and varied, therefore prevention, control and abatement of nonpoint source impacts will require action by a wide range of audiences. 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. Consequently, community and citizen educational strategies were emphasized in the Task Force's recommendations.

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. The first component of the state's education and citizen monitoring program is development of Georgia Adopt-A-Stream, designed to promote citizen monitoring and water body protection. The second prong of the state's effort is general education. A report outlining a plan for nonpoint source education in Georgia was completed in 1994. Titled *Georgia Urban Water body Education Plan and Program*, the plan laid out nonpoint education strategies for seven target audiences: general public, environmental interest organizations, civic associations, educators, business associations, local government officials, and state government officials. Given limited resources and the scope of effort required to target each of these audiences concurrently, EPD decided to initially target nonpoint source education efforts toward educators and students in grades K-12. When programs for that audience have been fully implemented, the focus of nonpoint source education in the state will be re-evaluated and additional target audience(s) identified to encourage active involvement in controlling nonpoint source pollution.

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. Currently, more than 5,000 volunteers participate in individual and community sponsored Adopt-A-Stream Programs. Volunteers conduct clean-ups, stabilize stream banks, monitor streams using biological and chemical methods, and evaluate habitats and watersheds. 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 Georgia's water resources from nonpoint source pollution. The Program offers training and support in the following activities – watershed surveys, visual surveys, biological monitoring, chemical testing and clean ups.

In 1989 the DNR appointed a Community Stream Management Task Force (CSMTF) to seek a cooperative intergovernmental approach to integrate land and water quality management to correct, abate, and prevent stream contamination. A final report containing the task force's findings and recommendations was released during the second quarter of 1991. EPD utilized the task force's recommendations regarding the development of resources and initiating programs for local and regional governments including participation by the general public. EPD developed and presented a local government stream management and assessment work-shop. A task force was assembled and a report prepared to guide the development of a Adopt-A-Stream Program for Georgia. EPD has made numerous presentations to encourage the formation of local Adopt-A-Stream organizations, assembled and distributed a package of materials for interested groups, provided technical assistance, and provided grant support to programs operated by local governments. In 1993, EPD hired full-time coordinators for the statewide Adopt-A-Stream and Nonpoint Source Education Programs.

The Georgia Adopt-A-Stream Program addresses nonpoint source pollution from agriculture, silviculture, construction and urban runoff. The focus of the Adopt-A-Stream Programs in middle and southern Georgia is often agricultural NPS pollution (especially, where land use is largely agricultural crop production). Examples of agricultural NPS pollution are presented in workshops, videos and manuals (e.g., excess fertilizer and animal waste). In north Georgia, the focus is generally silvicultural NPS pollution (especially, in areas adjacent to the Chattahoochee and Oconee National Forests). Adopt-A-Stream Programs in urban areas address construction and urban runoff NPS pollution. Workshops and training sessions emphasize the connection between land use, stormwater runoff and water resources. Erosion and sedimentation control at construction sites is always a major concern with volunteers. Therefore, Georgia's Erosion and Sedimentation Act is explained and the issuing authority for land disturbing activity permits is identified.

Volunteers are offered three (3) levels of involvement. Each level involves an education and action component on a local stream. Volunteers commit for a minimum of one (1) year on a half-mile stream segment. Level I consists of setting up a project (i.e., identifying a stream segment, identifying partners, registering with the Georgia Adopt-A-Stream Program), evaluating land use and stream conditions during a "watershed walk", conducting quarterly visual evaluations and clean-ups, and one public outreach activity. Volunteers create a "Who to Call for Questions or Problems" list so that if something unusual is noted, immediate professional attention can be obtained. Level II builds on Level I by adding either biological monitoring, chemical monitoring or a habitat improvement project. Level III includes two or more Level II activities.

Approximately 500 volunteers participate in the various workshops each year. An "Introduction to Adopt-A-Stream Program" and "Watershed Walk" videos have been produced, duplicated and distributed on loan. The Georgia Adopt-A-Stream Program Manuals have been printed and distributed to approximately 1,000 volunteers. In addition, a bi-monthly newsletter is published and distributed to over 1,000 volunteers. The Annual Georgia Adopt-A-Stream Conference and Awards Ceremony is held each Fall. The Georgia Adopt-A-Stream Program assists EPD in organizing the Annual Georgia River Clean-Up Week each Fall, with over 1000 volunteers cleaning up river segments in over 50 locations. In addition, the Georgia Adopt-A-Stream Program conducts numerous presentations around the State.

The Georgia Adopt-A-Stream Program is a statewide program with two (2) staff positions in EPD and five (5) Regional Training Centers. The Regional Training Centers are a network of college-based training centers located in Albany, Columbus, Dahlonega, Milledgeville and Savannah. This network of training centers allows the Georgia Adopt-A-Stream Program to be accessible to all areas of the state.

Several organizations have already established Adopt-A-Stream Programs in the Flint River Basin, including Clayton County. Appendix F provides a list of Georgia Adopt-A-Stream volunteer groups in the Flint River Basin.

With the program's outreach activities, nonpoint source pollution and preventive measures are described. As with any public outreach program, the prevention, control and/or abatement of nonpoint source pollution must be measured indirectly. As outlined, the active participation of volunteers and local and regional governments in the Georgia Adopt-A-Stream Program indirectly point towards significant pollution prevention.

Nonpoint Source Education: Project WET

As described above, EPD is currently targeting initial nonpoint education activities toward educators and students in grades K-12. To reach this target audience, EPD has focused on implementing Project WET, a water resources education curriculum which focuses on nonpoint pollution. Covering impacts on groundwater and on surface water, the curriculum addresses the following nonpoint sources: agriculture, forestry, urban, and construction. It is recognized nationally and internationally and is readily adaptable to fit the state's Quality Core Curriculum requirements. To date, nonpoint source concerns have not received significant emphasis in water resources education efforts in Georgia. Implementation of Project WET will address this gap, providing educators and students in grades K-12 with an understanding of the problems caused by nonpoint source pollution and of the tools that can be used to prevent, control or abate nonpoint source impacts. EPD began implementing Project WET in December 1996. Initial facilitator training sessions were conducted in January and February 1997.

Resources for teachers which are currently available include a curriculum module on groundwater flow, the Enviroscape teaching module, and the River of Words Teacher's Guide. Resources which are under development include an Educator Newsletter, a Web page for students, the Georgia River Resource Guide, the Georgia Liquid History Well, Georgia River Trunks (a traveling puppet show) and Hydora (a NPS education performance character). In addition to these resources, an awards program is planned to outstanding efforts on behalf of Project WET and nonpoint source education in Georgia. EPD will be the lead agency of Project WET for a minimum of three years. Initially, implementation will target selected population centers with existing environmental education activities to help leverage the limited resources of EPD's NPS Education Program. It is expect that full implementation of Project WET will take three years. EPD will serve as the lead agency for period with the following acting as cooperating agencies: Georgia Environmental Education Alliance, State PTA, National Park Service, Southface Energy Institute, and Zoo Atlanta. After three years, it is expected that a cooperating agency will assume responsibility for on-going Project WET activities. At that time, the focus of the state's NPS education activities will be re-evaluated and, depending on the focus of education efforts undertaken by other entities, another of the audiences identified in the 1994 education plan may be targeted.

7.1.7 Groundwater 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 groundwater contamination and the need for groundwater 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 sludges,
- municipal and industrial discharges to rivers and streams,
- storage/concentration/burial of radioactive wastes, and
- 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. EPD also administers 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 groundwater 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.

7.2 Targeted Management Strategies

This section describes specific management strategies that are targeted toward the concerns and priority issues for the Flint River Basin described in Section 6. Strategies are presented by geographic area. For each of the identified concerns, the management strategy statement 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, and evaluate data, locally-led efforts in the subbasins will be required to help to restore and maintain the water quality throughout the Flint River Basin.

For many issues, similar strategies, with minor variations, are appropriate for several different geographic areas. In addition, similar targeted strategies may be used to address a variety of priority concerns if these concerns are linked to the same source of stress. For example, successfully controlling urban runoff can reduce loadings of metals, fecal coliform bacteria, and sediments entering a water body.

7.2.1 Upper Flint Basin (HUC 03130005)

The upper Flint basin is the most populated subbasin in the Flint River system, containing Hartsfield International Airport and supporting increased suburban development from southern metropolitan Atlanta. While seventy-one percent of the streams sampled supported their designated uses, twenty-nine percent either partially or did not support the designated use. The concerns identified may indicate an actual exceedance of water quality standards or indicate the need for further monitoring to ensure that the water quality/quantity is not threatened in the future.

The concerns identified for portions of this subbasin include metals concentrations, concentrations of PCBs, chlordane, or mercury in fish tissue, elevated fecal coliform bacteria concentrations, low dissolved oxygen concentrations, sedimentation, and water supply/flow needs.

Issue A. Metals

Problem Statement: The water use classification of fishing was not fully supported in 6 stream segments due to exceedances of water quality standards for metals (lead, zinc, and copper). One station had zinc violations, two stations between Hartsfield International Airport and Flat Shoals had lead violations due to urban runoff, three monitored tributaries draining the metropolitan Atlanta area of the subbasin had violations of standards for lead, and one of these had additional standard violations for copper and zinc.

General Goals: Meet water quality standards to support designated water uses.

Ongoing Efforts: Urban runoff is being addressed in the EPD Stormwater Management Strategy for metropolitan Atlanta. An areawide stormwater permit was issued on 6/15/94. This strategy will encourage a number of protective measures, as described in Section 7.1.

The Atlanta Regional Commission (ARC) is coordinating stormwater management for local governments in the Atlanta metro area. ARC has established the Regional Stormwater Management Task Force as a forum for cooperative management of stormwater in the metro area, and coordinates stormwater monitoring required for annual reports to EPD.

Identified Gaps and Needs: The EPD is concerned with the accuracy of many of the stream assessments showing criteria violations for metals, as, in many cases, the metals database was minimal with as little as one data point showing a concentration in excess of stream standards. Further, there are quality assurance concerns with much of the earlier metals data, as it is now evident that clean and ultra clean techniques for sample collection and laboratory testing are necessary to produce quality assured data. Thus, the first step to address this issue will be to collect additional samples using clean techniques to determine if water quality standards are actually being exceeded.

It is also unclear how occasional standards violations translate into actual risk to aquatic life. Georgia standards for metals may need to be reevaluated in light of recent EPA guidance on use of the dissolved fraction of total metal concentrations to calculate risk to aquatic life. Additional biological monitoring may be appropriate to measure impacts along with concentrations of metals. Restoration goals for urban streams are not clearly defined. Consideration should be given to the interaction of metals and habitat degradation: mitigation of metals may have little beneficial impact unless habitat issues are also addressed. It is probable, however, that streams with highly urbanized watersheds cannot be restored to pristine "natural" conditions.

Strategies: Addressing urban runoff will be a complex task, requiring a strong local component. Management of urban runoff is needed to address a variety of water quality problems, including metals, fecal coliform bacteria, nutrients, and habitat degradation.

Key Participants and Roles:

- *EPD*: monitor and assess use support in listed waters; administer stormwater regulations; encourage local efforts to address nonpoint sources of pollution.

- *ARC:* coordinate stormwater management for the Atlanta metro area.
- *Local governments*: stormwater management strategies, where the issuing authority erosion and sedimentation control enforcement, zoning and land use planning, local watershed initiatives, and monitoring programs.
- *Citizen groups*: Adopt-A-Stream program and work with local governments on watershed initiatives.

Specific Management Objectives: Encourage local watershed planning and management to ensure that designated water uses are supported.

Management Option Evaluation: Integrated management options will be proposed and evaluated primarily at the local level using forums such as the Regional Stormwater Task Force.

Action Plan:

- EPD will complete a review of existing metals data in this area by September 1999, in accordance with the statewide RBMP management cycle.
- EPD will propose a plan for resampling of streams identified as not supporting or partially supporting designated uses and complete sampling by December 2000, in accordance with the statewide RBMP management cycle.
- EPD will continue to administer the stormwater regulations and will encourage local planning to address stormwater management.
- Local governments under the Phase I stormwater program will submit annual reports and apply for renewal of existing permits in FY 1999. EPD will review these applications during FY 1999.
- EPD will continue to develop Rapid Bioassessment Protocol capabilities designed to assess impairment of aquatic life.
- EPD will encourage involvement of citizen groups through the Adopt-A-Stream program to address restoration of urban streams.
- The basin team will re-evaluate stream status and management strategies during the next basin cycle, scheduled for 2001.

Methods for Tracking Performance: Progress in management of urban stormwater will be tracked through annual reporting required by municipal stormwater permits.

Issue B. Fish Consumption Guidelines

Problem Statement: The water use classification of fishing was not fully supported in the Flint River mainstem (in Spalding/Fayette counties and Meriwether/Pike/Upson counties) based on fish consumption guidelines due to mercury. The guidelines are for largemouth bass and shoal bass, respectively.

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

Ongoing Efforts: DNR has monitored fish within this segment of the Flint River and issued fish consumption guidelines. There are no known point source discharges of mercury into the Flint River Basin.

Identified Gaps and Needs: The source of mercury is believed to originate from atmospheric sources.

Strategies: Because the source of mercury is not originating from any known point sources, the strategy is to keep the fishing public notified of risks associated with fish consumption.

Key Participants and Roles:

- *EPD and WRD*: sample the fish tissue and issue the fish consumption guidelines as appropriate.

Specific Management Objectives: 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 reach will be considered in 2000 in accordance with the river basin monitoring cycle.

Issue C. Fecal Coliform Bacteria

Problem Statement: The water use classification of fishing was not fully supported in 16 segments due to exceedances of the water quality standard for fecal coliform bacteria. Twelve monitored tributaries had violations of the standard for fecal coliform bacteria in urban areas (Atlanta, Griffin, Thomaston). These may be attributed to a combination of urban runoff, septic systems, sanitary sewer overflows, and rural nonpoint sources. An additional tributary near Greenville had violations of the fecal coliform standards due to a municipal discharge that has since been eliminated.

General Goals: Meet water quality standards to support designated water uses.

Ongoing Efforts: The principal source of exceedances of water quality standards for fecal coliform bacteria in the upper Flint is urban nonpoint source runoff. Septic tanks and sanitary sewer overflows may also contribute to the problem. The major point source discharges in this area were eliminated in the 1980's with the implementation of the Three Rivers Water Quality Management Program. In addition, EPD issued a Consent Order to the City of Greenville requiring the City to eliminate an unpermitted raw sewage discharge form the City's sewage system. Greenville has eliminated the discharge.

In general, urban runoff is being addressed in the EPD Stormwater Management Strategy for metropolitan Atlanta. An areawide stormwater permit was issued on 6/15/94. This will encourage a number of protective measures, as described in Section 7.1.

The Atlanta Regional Commission (ARC) is coordinating stormwater management for local governments in the Atlanta metro area. ARC has established the Regional Stormwater Management Task Force as a forum for cooperative management of stormwater in the metro area, and coordinates stormwater monitoring required for annual reports to EPD. The ARC also expects to develop a water quality management plan for the Atlanta metropolitan region. The plan's purpose is to provide a means for coordinating regional water quality issues and needs with local governments, state and federal agencies, and the public.

Finally, ARC addresses urban best management practices (BMPs) through the development review process established by the Georgia Planning Act. As the designated regional planning agency in metro Atlanta, ARC reviews and comments on developments that may have significant regional impacts. In this review process, ARC estimates annual stormwater pollutant loads generated from proposed project sites and provides interim guidelines for BMPs for developers and jurisdictions to follow if these projects are approved. It is expected that, when the regional plan is complete, projections from that plan will be used to refine loading estimates and guidelines regarding BMPs. The review process provides an opportunity to promote awareness of BMPs for stormwater control, educate elected officials on the need for vigorous erosion and sedimentation controls and stormwater management programs, and to encourage improved water quality monitoring in the region.

Identified Gaps and Needs: Sources of fecal coliform bacteria in many stream segments are not clearly defined. In some cases, coliform 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. In addition, 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 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.

Strategies: Separate strategies are needed to address nonpoint fecal coliform loading in rural and developed areas.

Urban Areas:

Addressing urban runoff will be a complex task, requiring a strong local component. 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 re-evaluation scheduled for October 2001-September 2002, in accordance with the statewide RBMP management cycle.

Key Participants and Roles:

- *EPD*: monitor and assess use support in listed stream segments; administer CSO control efforts, administer stormwater regulations; regulate point sources under the NPDES program; and encourage local government efforts to address nonpoint source pollution.
- *ARC*: coordinate stormwater management to the Atlanta metro area.

- *Local governments*: operate and maintain sewer systems and wastewater treatment plants, stormwater programs, zoning and land use planning, local watershed initiatives, and monitoring programs.
- *Chattahoochee-Flint RDC:* coordinate regional stormwater planning.
- *Municipalities*: work with the local health departments to identify locations of septic systems and educate owners about the proper care and maintenance of septic systems.
- *Citizen groups*: Adopt-A-Stream programs and work with local governments on watershed initiatives.

Specific Management Objectives: Encourage local government watershed planning and management to ensure that designated water uses are supported.

Management Option Evaluation: Integrated management options will be proposed and evaluated primarily at the local level using forums such as the Regional Stormwater Task Force.

Action Plan:

- EPD will continue to ensure that all permitted point sources remain in compliance with permitted effluent limitations for fecal coliform bacteria. EPD will also request a comprehensive watershed assessment, looking at both point and nonpoint sources, from localities applying for new or expanded NPDES point source discharge permits. The intent is to direct localities' attention to current and future nonpoint source issues in their watershed 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 stormwater regulations and will encourage local planning to address stormwater management.
- ARC will develop a draft water quality management plan for the Atlanta metro area in FY 1999.
- Local governments under the Phase I stormwater program will submit annual reports and apply for renewal of existing permits in FY 1999. EPD will review these applications during FY 1999.
- 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 jurisdictions.
- EPD will encourage citizen involvement through Adopt-A-Stream groups to address restoration of urban streams.
- EPD will complete reassessment of fecal coliform bacteria monitoring protocols and will propose a plan for resampling of streams identified as not supporting or partially supporting designated uses and complete sampling by December, 2000, in accordance with the statewide RBMP management cycle.

Methods for Tracking Performance: EPD tracks point source discharges through inspections and evaluations of self-monitoring data. Progress in management of urban stormwater will be tracked through annual reporting required by municipal stormwater permits. An evaluation of the status of listed waterbodies will be made coincident with the next iteration of the RBMP management cycle for the Flint River Basin in 2001.

Rural Areas:

Key Participants and Roles:

- *EPD:* monitor and assess use support in listed streams, encourage local planning efforts, regulate point sources under the NPDES program.
- *GSWCC* and local SWCDs and RC&D councils with assistance form NRCS: promote implementation of agricultural management practices.
- *County and municipal governments*: septic system regulations, land use planning guidelines.
- *Citizen groups:* Adopt-A-Stream programs and work with local governments on watershed initiatives.

Specific Management Objectives: Encourage local watershed planning and management sufficient to ensure that designated water uses are supported.

Management Option Evaluation: Evaluation will be on a site-by-site basis. For agricultural BMP support, existing prioritization methods of the agricultural agencies will be used.

Action Plan:

- EPD will continue to ensure that permitted point sources remain in compliance with fecal coliform bacteria limits.
- GSWCC and local agricultural agencies will continue to support adoption of BMPs for animal waste handling. Methods for prioritization and implementation of cost-share incentives under the 1996 Farm Bill are still being worked out, but it is expected that incentives will be targeted to areas of apparent water quality impact, including rural streams which may sustain excessive fecal coliform loads from animal operations.
- DHR is in the process of developing new regulations for septic systems. DHR will work to educate local governments and citizen groups about the need for adequate regulation and maintenance of septic systems to protect water quality.

Method for Tracking Performance: Agricultural agencies will track rates of BMP implementation for animal operations. An evaluation of the status of listed waterbodies will be made coincident with the next iteration of the RBMP management cycle for the Flint River Basin in 2001.

Issue D. Dissolved Oxygen

Problem Statement: The water use classification of fishing was not fully supported in 7 stream segments due to dissolved oxygen concentrations below water quality standards. Oxygen demand in urban runoff from metropolitan Atlanta and treated wastewater discharges from the Griffin-Cabin Creek WPCP contributed to reduced dissolved oxygen levels. Dissolved oxygen violations were also found in Flat Creek, Camp Creek and Beaver Creek, due to nonpoint sources.

General Goals: Meet water quality standards to support designated uses.

Ongoing Efforts: EPD will conduct a model calibration study of Cabin Creek to determine DO concentrations for the Griffin-Cabin Creek WPCP discharge.

In general, urban runoff is being addressed in the EPD Stormwater Management Strategy for metropolitan Atlanta. An areawide stormwater permit was issued on 6/15/94. This will encourage a number of protective measures, as described in Section 7.1.

The Atlanta Regional Commission (ARC) is coordinating stormwater management for local governments in the Atlanta metro area. ARC has established the Regional Stormwater Management Task Force as a forum for cooperative management of stormwater in the metro area, and coordinates stormwater monitoring required for annual reports to EPD. The ARC also expects to develop a water quality management plan for the Atlanta metropolitan region. The plan's purpose is to provide a means for coordinating regional water quality issues and needs with local governments, state and federal agencies, and the public.

Finally, ARC addresses urban best management practices (BMPs) through the development review process established by the Georgia Planning Act. As the designated regional planning agency in metro Atlanta, ARC reviews and comments on developments that may have significant regional impacts. In this review process, ARC estimates annual stormwater pollutant loads generated from proposed project sites and provides interim guidelines for BMPs for developers and jurisdictions to follow if these projects are approved. It is expected that, when the regional plan is complete, projections from that plan will be used to refine loading estimates and guidelines regarding BMPs. The review process provides an opportunity to promote awareness of BMPs for stormwater control, educate elected officials on the need for vigorous erosion and sedimentation controls and stormwater management programs, and to encourage improved water quality monitoring in the region.

Identified Gaps and Needs: The types of nonpoint source inputs causing the low dissolved oxygen readings at Flat Creek, Camp Creek and Beaver Creek, need to be identified to determine control strategies for these areas.

Strategies: Addressing urban runoff will be a complex task, requiring a strong local component. Management of urban runoff is needed to address a variety of water quality problems, including metals, low dissolved oxygen concentrations, fecal coliform bacteria, nutrients, and habitat degradation.

Key Participants and Roles:

- *EPD:* monitor and assess use support in listed waters; regulate point sources under the NPDES program; administer stormwater regulations; encourage local efforts to address nonpoint sources of pollution.
- *ARC:* coordinate stormwater management for the Atlanta metro area.

- *Local governments*: stormwater management strategies, where the issuing authority erosion and sedimentation control enforcement, zoning and land use planning, local watershed initiatives, and monitoring programs.
- *Citizen groups*: Adopt-A-Stream programs and work with local governments on watershed initiatives.

Specific Management Objectives: Encourage local government watershed planning and management to ensure that designated water uses are supported.

Management Option Evaluation: Integrated management options will be proposed and evaluated primarily at the local level using forums such as the Regional Stormwater Task Force.

Action Plan:

- EPD will continue to ensure that all permitted point sources remain in compliance with permitted effluent limitations for dissolved oxygen. EPD will also request a comprehensive watershed assessment, looking at both point and nonpoint sources, from localities applying for new or expanded NPDES point source discharge permits. The intent is to direct localities' attention to current and future nonpoint source issues in their watershed 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 stormwater regulations and will encourage local planning to address stormwater management.
- Local governments under the Phase I stormwater program will submit annual reports and apply for renewal of existing permits in FY 1999. EPD will review these applications during FY 1999.
- EPD will encourage involvement of citizen groups through the Adopt-A-Stream program to address restoration of urban streams.
- EPD will propose a plan for resampling of streams identified as not supporting or partially supporting designated uses and complete sampling by December 2000, in accordance with the statewide RBMP management cycle.
- The basin team will re-evaluate stream status and management strategies during the next basin cycle, scheduled for 2001.

Methods for Tracking Performance: Progress in management of urban stormwater will be tracked through annual reporting required by municipal stormwater permits. A reevaluation of the status of listed waterbodies will be made coincident with the next iteration of the RBMP management cycle for the Flint River Basin in 2001.

Issue E. Erosion and Sedimentation

Problem Statement: The water use classifications of fishing and drinking water are potentially threatened in many segments, by erosion and loading of sediment, which can alter stream morphology, impact habitat, reduce water clarity, and clog drinking water systems. There are 15 stream segments listed in this subbasin as partially supporting designated uses due to poor fish communities. Sediment may be a factor influencing fish communities in these areas. Potential sources include urban runoff and development (particularly construction), unpaved rural roads, forestry practices, and agriculture.

General Goals: Control erosion and sedimentation from land disturbing activities in order to meet water quality standards for turbidity.

Ongoing Efforts: GSWCC has recently updated, and has made available for distribution, the *Manual for Erosion and Sedimentation Control in Georgia,* which will be distributed to personnel working on erosion and sedimentation issues throughout the state.

GFC conducted a compliance survey for forestry BMPs on 3,517 acres in this subbasin and determined that eighty-two percent of the activities were in compliance: roads 79%; harvesting 81%; and site preparation 99%.

The Urban Resources Partnership addresses urban natural resource and environmental issues in the Atlanta metropolitan area. Several stream restoration projects are underway as part of this grant program.

Identified Gaps and Needs: Habitat degradation due to erosion and sedimentation is thought to be a primary contributor to biological impairment in metropolitan Atlanta streams, but requires further study. Adverse impacts of excess sediment loading include degradation of habitat and reduction in species diversity. These types of impacts are best addressed through biological monitoring. Stream segments currently listed as partially supporting were based on fish IBI (Index of Biotic Integrity) studies conducted by the WRD in this area of the state. EPD is also developing increased capability for biomonitoring using Rapid Bioassessment Protocols (RBPs) for benthic macroinvertebrates. The EPD protocols include habitat assessment. These tools provide methods for detecting and quantifying impairment of aquatic life resulting from habitat-modifying stressors such as sediment, as well as impacts from other stressors.

Unpaved rural roads are thought to be a significant contributor to sedimentation but the amount is unclear. Further monitoring may be needed to quantify the impact of rural roads as a source of sedimentation into streams.

A key need for developing strategies to address erosion, sedimentation, and habitat issues in urban streams is definition of appropriate management goals. It is likely that streams with highly urbanized watersheds cannot be returned to "natural" conditions. An appropriate restoration goal needs to be established in consultation between EPD and other stakeholders.

Strategies: Understanding 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:

- *EPD and WRD*: monitor and assess use support in listed waters; encourage water quality improvement efforts; and continue the development of biomonitoring methods.
- *ARC:* encourage the use of urban best management practices and coordinate the stormwater strategy.

- *Local governments:* enforce erosion controls for construction practices and implement land use planning.
- *GSSWC:* encourage the implementation of BMPs to control erosion of agricultural lands.
- *GFC:* encourage the implementation of forestry BMPs to control erosion.
- *Citizen groups*: Adopt-A-Stream programs and work with local governments on watershed initiatives.

Specific Management Objectives: Control erosion and sedimentation from land disturbing activities in order to meet water quality standards for turbidity.

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

Action Plan:

- EPD and WRD will continue to develop RBP capabilities designed to assess aquatic life impairment.
- EPD will propose a plan for the next basin cycle sampling of streams listed due to poor fish communities and conduct appropriate sampling by December 2000, in accordance with the statewide RBMP management cycle.
- EPD will encourage citizen involvement through Adopt-A-Stream groups to address restoration of urban streams.
- ARC will develop a draft regional water quality plan for the Atlanta metro area by FFY 1999.
- ARC will provide base loading estimates and BMP guidelines on projections in the regional water quality plan (ongoing after FFY 1999).
- The basin team will re-evaluate listed stream status and management strategies during the next basin cycle, scheduled for 2001.
- Local governments which are the issuing authority will enforce erosion controls for construction practices.
- GSSWC will encourage the implementation of BMPs to control erosion of agricultural lands.
- GFC will target landowner and user groups for BMP education to ensure compliance with forestry BMP guidelines.

Method for Tracking Performance: GSWCC and GFC will track BMP implementation. Local governments with the issuing authority will track erosion and sediment control programs. A reevaluation of the status of listed waterbodies will be made coincident with the next iteration of the RBMP management cycle for the Flint River Basin in 2001.

Issue F. Water Supply/Flows

Problem Statement: Water supply to meet municipal water supply needs is threatened due to growth pressures in the subbasin.

General Goals: Maintain instream flows to support drinking water uses.

Ongoing Efforts: Water quantity needs and allocations throughout the entire basin are being addressed as part of the mulit-agency Alabama-Coosa-Tallapoosa/Apalachicola-Chattahoochee-Flint (ACT/ACF) study.

Strategies: Water conservation strategies should be implemented to extend water supplies.

Issue G. Flooding

Problem Statement: Flooding in the Flint River Basin threatens people and property located within the floodplain, as demonstrated during the massive floods of 1994. Flooding may also breach dams, and can contaminate drinking water wells located within the floodplain.

General Goals: Increase awareness and knowledge of floodplain management. Assist communities participating in the National Flood Insurance Program (NFIP) to maintain compliance with NFIP regulations.

Ongoing Efforts: The EPD will continue to provide workshops, and technical assistance and data to participating communities and other parties involved in floodplain determinations. In addition, floodplain management information and updates on available technical resources will continue to be disseminated via quarterly newsletters and the Internet.

Identified Gaps and Needs: Recently produced Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs) of communities in the Flint River Basin lack specific Base Flood Elevation (BFE) data within the Special Flood Hazard Areas. The absence of BFE data requires communities to use arbitrary above natural ground lowest floor elevation requirements for new construction (less than 50 lots and/or 5 acres) and substantial improvements of existing structures.

Strategies: Develop "action partnerships" with agencies and organizations such as Regional Development Centers (RDCs), Georgia Municipal Association and Association County Commissioners of Georgia to maintain compliance and increase the number of NFIP communities within the basin. Agencies such as the Natural Resources Conservation Service and U.S. Army Corps of Engineers are potential resources for technical data and information.

7.2.2 Middle Flint Basin (HUC 03130006 and 03130007)

The concerns identified for portions of this subbasin include metals concentrations, elevated fecal coliform bacteria concentrations, low dissolved oxygen concentrations, sedimentation, and water supply/flow needs.

Issue A. Metals

Problem Statement: The water use classification of fishing was not fully supported in 13 stream segments due to exceedances of water quality standards for metals (lead, zinc, and copper) from nonpoint sources. The water use classification of recreation was not supported in a portion of Lake Blackshear due to metals (lead, nickel, zinc, and copper) from urban runoff and other nonpoint sources. A portion of the City of Cordele lies in the Gum Creek watershed, which drains to Lake Blackshear.

General Goals: Meet water quality standards to support designated water uses.

Ongoing Efforts: EPD is conducting a Clean Lakes Phase I Diagnostic/Feasibility Study of Lake Blackshear.

Identified Gaps and Needs: The EPD is concerned with the accuracy of many of the stream assessments showing criteria violations for metals, as, in many cases, the metals database was minimal with as little as one data point showing a concentration in excess of stream standards. Further, there are quality assurance concerns with much of the earlier metals data, as it is now evident that clean and ultra clean techniques for sample collection and laboratory testing are necessary to produce quality assured data. Thus, an initial effort to address this issue will be to collect additional samples using clean techniques to determine if water quality standards are actually being exceeded.

It is also unclear how occasional standards violations translate into actual risk to aquatic life. Georgia standards for metals may need to be reevaluated in light of recent EPA guidance on use of the dissolved fraction of total metal concentrations to calculate risk to aquatic life. Biological monitoring may be appropriate to measure impacts along with concentrations of metals. Restoration goals for urban streams are not clearly defined. Consideration should be given to the interaction of metals and habitat degradation: mitigation of metals may have little beneficial impact unless habitat issues are also addressed. It is probable, however, that streams with highly urbanized watersheds cannot be restored to pristine "natural" conditions.

Strategies: Addressing urban runoff will be a complex task, requiring a strong local component. Management of urban runoff is needed to address a variety of water quality problems, including metals, fecal coliform bacteria, nutrients, and habitat degradation.

Key Participants and Roles:

- *EPD:* monitor and assess use support in listed waters and encourage local efforts to address nonpoint sources of pollution.
- *Local governments*: stormwater management strategies, where the issuing authority erosion and sedimentation control enforcement, zoning and land use planning, local watershed initiatives, and monitoring programs.
- *Citizen groups*: Adopt-A-Stream programs and work with local governments on watershed initiatives.

Specific Management Objectives: Encourage local watershed planning and management to ensure that designated water uses are supported.

Management Option Evaluation: Integrated management options will be proposed and evaluated primarily at the local level.

Action Plan:

- EPD will complete a review of existing metals data in listed waters by September 1999, in accordance with the statewide RBMP management cycle.
- EPD will propose a plan for resampling of streams identified as not supporting or partially supporting designated uses and complete sampling by December 2000, in accordance with the statewide RBMP management cycle.
- EPD will continue to develop Rapid Bioassessment Protocol capabilities designed to assess impairment of aquatic life.
- EPD will encourage involvement of citizen groups through the Adopt-A-Stream program to address restoration of urban streams.
- The basin team will re-evaluate listed stream status and management strategies during the next basin cycle, scheduled for 2001.

Methods for Tracking Performance: EPD tracks point source discharges through inspections and evaluations of self-monitoring data. An evaluation of the status of listed waterbodies will be made coincident with the next iteration of the RBMP management cycle for the Flint River Basin in 2001.

Issue B. Fecal Coliform Bacteria

Problem Statement: The water use classification of fishing was not fully supported in 9 segments due to exceedances of the water quality standard for fecal coliform bacteria due to nonpoint sources. There is a large dairy operation in this subbasin which may contribute to the presence of fecal coliform bacteria. Land applications of sludge may also be a source of fecal coliform bacteria due to the karst topography in the region. The water use classification of recreation was not supported in a portion of Lake Blackshear due to elevated fecal coliform bacteria from urban and nonpoint sources. A portion of the City of Cordele lies in the Gum Creek watershed, which drains to Lake Blackshear.

General Goals: Meet water quality standards to support designated water uses.

Ongoing Efforts: The EPD is conducting a Clean Lakes Phase I Diagnostic/Feasibility Study.

Identified Gaps and Needs: Sources of fecal coliform bacteria in many stream segments are not clearly defined. In some cases, coliform 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 sources. Sanitary sewer leaks and overflows may be a source of fecal coliform bacteria. In addition, previous sampling has not been 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 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.

Strategies: Separate strategies are needed to address nonpoint fecal coliform loading for urban and agricultural sources.

Urban Areas:

Addressing urban runoff will be a complex task, requiring a strong local component. 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 re-evaluation scheduled for October 2001-September 2002, in accordance with the statewide RBMP management cycle.

Key Participants and Roles:

- *EPD*: monitor and assess use support in listed stream segments and encourage local efforts to address nonpoint source pollution.
- *Local governments*: operate and maintain sewer systems and wastewater treatment plants, stormwater programs, monitor land application systems, zoning and land use planning, local watershed initiatives, and monitoring programs.
- *Citizen groups*: Adopt-A-Stream programs and work with local governments on watershed initiatives.

Specific Management Objective: Encourage local watershed planning and management sufficient to ensure that designated water uses are supported.

Management Option Evaluation: Integrated management options will be proposed and evaluated primarily at the local level.

Action Plan:

- EPD will continue to ensure that all permitted point sources remain in compliance with permitted effluent limitations for fecal coliform bacteria. EPD will also request a comprehensive watershed assessment, looking at both point and nonpoint sources, from localities applying for new or expanded NPDES point source discharge permits. The intent is to direct localities' attention to current and future nonpoint source issues in their watershed 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 encourage local planning to address stormwater management.
- 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 jurisdictions.
- EPD will encourage citizen involvement through Adopt-A-Stream groups to address restoration of urban streams.
- EPD will complete reassessment of fecal coliform bacteria monitoring protocols and will propose a plan for resampling of streams identified as not supporting or partially

supporting designated uses and complete sampling by December, 2000, in accordance with the statewide RBMP management cycle.

Methods for Tracking Performance: EPD tracks point source discharges through inspections and evaluations of self-monitoring data. An evaluation of the status of listed waterbodies will be made coincident with the next iteration of the RBMP management cycle for the Flint River Basin in 2001.

Rural Areas

Key Participants and Roles:

- *EPD*: monitor and assess use support in listed streams, encourage local planning efforts, and regulate point sources under the NPDES program.
- *GSWCC* and local SWCDs and RC&D councils with assistance form NRCS: promote implementation of agricultural management practices.
- *County and municipal governments*: septic system regulation, land use planning guidelines.
- *Citizen groups*: Adopt-A-Stream programs and work with local governments on watershed initiatives.

Specific Management Objectives : Encourage local watershed planning and management to ensure that designated water uses are supported.

Management Option Evaluation: Evaluation will be on a site-by-site basis. For agricultural BMP support, existing prioritization methods of the agricultural agencies will be used.

Action Plan:

- EPD will continue to ensure that permitted point sources remain in compliance with fecal coliform bacteria limits.
- GSWCC and local agricultural agencies will continue to support adoption of BMPs for animal waste handling. Methods for prioritization and implementation of cost-share incentives under the 1996 Farm Bill are still being worked out, but it is expected that incentives will be targeted to areas of apparent water quality impact, including rural streams which may sustain excessive fecal coliform loads from animal operations.
- DHR is in the process of developing new regulations for septic systems. DHR will work to educate local governments and citizen groups about the need for adequate regulation and maintenance of septic systems to protect water quality.

Method for Tracking Performance: Agricultural agencies will track rates of BMP implementation for animal operations. An evaluation of the status of listed waterbodies will be made coincident with the next iteration of the RBMP management cycle for the Flint River Basin in 2001.

Issue C. Dissolved Oxygen

Problem Statement: The fishing water use classification was not fully supported in one stream due to dissolved oxygen concentrations less than the water quality standard due to nonpoint sources.

General Goals: Meet water quality standards to support designated water uses.

Identified Gaps and Needs: The sources of oxygen-demanding wastes need to be identified before control strategies can be developed.

Strategies: Ensure that permit limits are being met for municipal and industrial discharges and implement additional nonpoint source controls to reduce the amount of oxygen-demanding waste entering the listed waterbody.

Issue D. Erosion and Sedimentation

Problem Statement: The water use classifications of fishing and recreation 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.

General Goals: Control erosion and sedimentation from land disturbing activities in order to meet water quality standards for turbidity.

Ongoing Efforts: GSWCC has recently updated, and has made available for distribution, the *Manual for Erosion and Sedimentation Control in Georgia,* which will be distributed to personnel working on erosion and sedimentation issues throughout the state.

GFC conducted a BMP compliance survey in 1992 on 10 sites (976 acres) in HUC 03130006 and documented 90% compliance: roads, 82%; harvesting, 90%. Survey on 5 sites (765 acres) in HUC 03130007 rated 95% compliance: roads, 72%; harvesting, 96%; and site preparation, 95%.

Identified Gaps and Needs: Adverse impacts of excess sediment loading include degradation of habitat and reduction in species diversity. These types of impacts are best addressed through biological monitoring. EPD is developing increased capability for biomonitoring using Rapid Bioassessment Protocols (RBPs) for benthic macroinvertebrates. The EPD protocols include habitat assessment. The WRD is working with the IBI (Integrated Biotic Index) to assess fish communities. These tools will provde methods to detect and quantify impairment of aquatic life resulting from habitat-modifying stressors such as sediment, as well as impacts from other stressors.

Rural roads are thought to be a significant contributor to sedimentation but the amount is unclear. Further monitoring may be needed to quantify the impact of rural roads as a source of sedimentation into streams.

A key need for developing strategies to address erosion, sedimentation, and habitat issues in urban streams is definition of appropriate management goals. It is likely that streams with highly urbanized watersheds cannot be returned to "natural" conditions. An appropriate restoration goal needs to be established in consultation between EPD and other stakeholders.

Strategies: Understanding 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:

- *EPD:* encourage local government water quality improvement efforts; and continue the development of biomonitoring methods.
- *Local governments:* where the issuing authority enforce erosion controls for construction practices and land use planning.
- *GSSWC:* encourage the implementation of BMPs to control erosion of agricultural lands.
- *GFC:* encourage the implementation of forestry BMPs to control erosion.
- *Citizen groups:* Adopt-A-Stream programs and work with local governments on watershed initiatives.

Specific Management Objectives: Control erosion and sedimentation from land disturbing activities in order to meet water qualilty standards for turbidity.

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

Action Plan:

- EPD will encourage citizen involvement through Adopt-A-Stream groups to address restoration of urban streams.
- Local governments with the issuing authority will enforce erosion controls for construction practices.
- GSSWC will encourage the implementation of BMPs to control erosion of agricultural lands.
- GFC will target landowner and user groups for BMP education to encourage compliance with forestry BMP guidelines.
- EPD and WRD will continue to develop biological monitoring capabilities designed to assess aquatic life.

Method for Tracking Performance: GSWCC and GFC will track BMP implementation.

Issue E. Water Supply/Flow

Problem Statement: Water supply for drinking water and agricultural uses is potentially impaired in the middle Flint due to the depletion of groundwater supplies. Large quantities of groundwater are withdrawn from the Floridan Aquifer for irrigation during dry periods of the growing season to support agricultural production in the middle Flint basin. The Floridan Aquifer is interconnected with the Flint River; therefore, as these agricultural withdrawals increase, the flow of the Flint River during dry periods gets progressively smaller, possibly leading to deleterious instream flow conditions. In addition, since no new municipal, industrial, or agricultural withdrawals of groundwater can be made from the Clayton Aquifer, a deeper aquifer in the Dougherty Plain which is not connected with surface streams, future expansions of irrigation pumping are likely to come from the Floridan, thereby possibly exacerbating the surface water effects.

General Goals: Meet the growing irrigation needs of Georgia's agricultural economy in the middle Flint River Basin, while protecting Flint River instream flow conditions.

Ongoing Efforts: Water quantity needs, including those of agriculture, are being addressed throughout the Flint basin as part of the ACT/ACF Study. A water allocation formula must now be developed which covers the Flint basin and meets Georgia's water needs in the region while addressing the issue of downstream and instream water quantity and quality concerns.

Identified Gaps and Needs: Agricultural water users in Georgia are not required to provide data on their annual or seasonal water use (under permits issued by the Georgia Environmental Protection Division). Development of a workable water management strategy for southwest Georgia must eventually address the collection and evaluation of actual agricultural water uses.

Strategies: After the adoption of a water allocation formula which covers the Flint River Basin, EPD must work with stakeholders from the region to develop a water management plan that, when implemented, meets the agricultural irrigation (and other) needs of the region, while not violating provisions of the allocation formula.

Issue F. Flooding

Problem Statement: Flooding in the Flint River Basin threatens people and property located within the floodplain, as demonstrated during the massive floods of 1994. Flooding may also breach dams, and can contaminate drinking water wells located within the floodplain.

General Goals: Increase awareness and knowledge of floodplain management. Assist communities participating in the National Flood Insurance Program (NFIP) to maintain compliance with NFIP regulations.

Ongoing Efforts: The EPD will continue to provide workshops, and technical assistance and data to participating communities and other parties involved in floodplain determinations. In addition, floodplain management information and updates on available technical resources will continue to be disseminated via quarterly newsletters and the Internet.

Identified Gaps and Needs: Recently produced Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs) of communities in the Flint River Basin lack specific Base Flood Elevation (BFE) data within the Special Flood Hazard Areas. The absence of BFE data requires communities to use arbitrary above natural ground lowest floor elevation requirements for new construction (less than 50 lots and/or 5 acres) and substantial improvements of existing structures.

Strategies: Develop "action partnerships" with agencies and organizations such as Regional Development Centers (RDCs), Georgia Municipal Association and Association County Commissioners of Georgia to maintain compliance and increase the number of NFIP communities within the basin. Agencies such as the Natural Resources Conservation Service and U.S. Army Corps of Engineers are potential resources for technical data and information.

Issue G. Nutrients

Problem Statement: The water use classifications of fishing and recreation are potentially threatened in Lakes Blackshear and Worth due to inputs of nutrients which may cause excess algal growth in the lakes. A source of nutrients may be agricultural runoff, since a primary land use surrounding Lake Blackshear is agricultural production of row-crops. Other sources may include municipal and industrial water pollution control plants discharging in the watershed.

General Goals: Meet water quality standards to support designated water uses.

Ongoing Efforts: EPD is conducting a Clean Lakes Phase I Diagnostic/Feasibility Study the results of which will be used to develop specific lake water quality standards for Lake Blackshear.

Identified Gaps and Needs: The Clean Lake Study will provide information on nutrient concentrations and sources.

Strategies: Additional point and nonpoint source controls such as agricultural best management practices may be implemented in the watersheds surrounding Lakes Blackshear and Worth to minimize nutrient inputs into the lakes and comply with future water quality standards.

Issue H. Nuisance Weeds

Problem Statement: The water use classifications of fishing and recreation are potentially threatened in Lakes Blackshear and Worth due to the presence of nuisance aquatic plant species.

General Goals: Monitor and manage the populations of nuisance aquatic plants.

Ongoing Efforts: The Georgia Power Company and Crisp County Power Commission participate as a cooperator with the Georgia Wildlife Resources Division in a nuisance aquatic plant control program. Ongoing control programs include herbicide applications and biological control methods, including the introduction of more desirable, competitive aquatic vegetation.

Identified Gaps and Needs: Work should be done periodically by the power companies to inventory aquatic weed populations in the lake.

Strategies: Georgia Power, Crisp County Power Commission, and WRD should continue the control program for aquatic weeds.

7.2.3 Lower Flint Basin (HUC 03130008, 03130009, and 03130010)

The concerns identified for portions of this subbasin include metals concentrations, elevated fecal coliform bacteria concentrations, nutrients, sedimentation, and water supply/flow needs.

Issue A. Metals

Problem Statement: The water use classification of fishing was not fully supported in 3 stream segments due to exceedances of water quality standards for metals (lead and zinc) as a result of urban runoff from the City of Albany.

General Goals: Meet water quality standards to support designated water uses.

Ongoing Efforts: None identified.

Identified Gaps and Needs: The EPD is concerned with the accuracy of many of the stream assessments showing criteria violations for metals, as, in many cases, the metals database was minimal with as little as one data point showing a concentration in excess of stream standards. Further, there are quality assurance concerns with much of the earlier metals data, as it is now evident that clean and ultra clean techniques for sample collection and laboratory testing are necessary to produce quality assured data. Thus, an initial effort to address this issue will be to collect additional samples using clean techniques to determine if water quality standards are actually being exceeded.

It is also unclear how occasional standards violations translate into actual risk to aquatic life. Georgia standards for metals may need to be reevaluated in light of recent EPA guidance on use of the dissolved fraction of total metal concentrations to calculate risk to aquatic life. Additional biological monitoring may be appropriate to measure impacts along with concentrations of metals. Restoration goals for urban streams are not clearly defined. Consideration should be given to the interaction of metals and habitat degradation: mitigation of metals may have little beneficial impact unless habitat issues are also addressed. It is probable, however, that streams with highly urbanized watersheds cannot be restored to pristine "natural" conditions

Strategies: Addressing urban runoff will be a complex task, requiring a strong local component. Management of urban runoff is needed to address a variety of water quality problems, including metals, fecal coliform bacteria, nutrients, and habitat degradation.

Key Participants and Roles:

- *EPD:* monitor and assess use support in listed waters and encourage local efforts to address nonpoint sources of pollution.
- *Local governments*: stormwater management strategies, where the issuing authority erosion and sedimentation control enforcement, zoning and land use planning, and local watershed initiatives, and monitoring programs.
- *Citizen groups*: Adopt-A-Stream programs and work with local governments on watershed initiatives.

Specific Management Objectives: Encourage local government watershed planning and management to ensure that designated water uses are supported.

Management Option Evaluation: Integrated management options will be proposed and evaluated primarily at the local level.

Action Plan:

- EPD will complete a review of existing metals data for listed waters by September 1999, in accordance with the statewide RBMP management cycle.
- EPD will propose a plan for resampling of streams identified as not supporting or partially supporting designated uses and complete sampling by December 2000, in accordance with the statewide RBMP management cycle.
- EPD will continue to develop Rapid Bioassessment Protocol capabilities designed to assess impairment of aquatic life.

- EPD will encourage involvement of citizen groups through the Adopt-A-Stream program to address restoration of urban streams.
- The basin team will re-evaluate stream status and management strategies during the next basin cycle, scheduled for 2001.

Methods for Tracking Performance: EPD tracks point source discharges through inspections and evaluations of self-monitoring data. An evaluation of the status of listed waterbodies will be made coincident with the next iteration of the RBMP management cycle for the Flint River Basin in 2001.

Issue B. Fecal Coliform Bacteria

Problem Statement: The water use classification of fishing was not fully supported in 10 stream segments due to exceedances of the water quality standard for fecal coliform bacteria. These violations may be attributed to CSOs in the City of Albany and other sources of urban runoff.

General Goals: Meet water quality standards to support designated water uses.

Ongoing Efforts: The City of Albany has developed a CSO strategy that is expected to be fully operational in 1998.

Identified Gaps and Needs: Sources of fecal coliforms in many stream segments are not clearly defined. In some cases, coliforms 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 sources. Sanitary sewer leaks and overflows may be a source of fecal coliforms. In addition, 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 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.

Strategies: Separate strategies are needed to address nonpoint fecal coliform loading for urban and agricultural sources.

Urban Areas:

- Addressing urban runoff will be a complex task, requiring a strong local component. 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 re-evaluation scheduled for October 2001-September 2002, in accordance with the statewide RBMP management cycle.

Key Participants and Roles:

- *EPD*: monitor and assess use support in listed stream segments; administer CSO control efforts; and encourage local efforts to address nonpoint source pollution.

- *Local governments*: operate and maintain sewer systems and wastewater treatment plants, monitor land application systems, stormwater programs, zoning and land use planning, local watershed initiatives, and monitoring programs.
- *Citizen groups*: Adopt-A-Stream programs and work with local governments on watershed initiatives.

Specific Management Objectives: Encourage local watershed planning and management to ensure that designated water uses are supported.

Management Option Evaluation: Integrated management options will be proposed and evaluated primarily at the local level.

Action Plan:

- EPD will continue to ensure that permitted point sources remain in compliance with permitted effluent limitations for fecal coliform bacteria. EPD will also request a comprehensive watershed assessment, looking at both point and nonpoint sources, from localities applying for new or expanded NPDES point source discharge permits. The intent is to direct localities' attention to current and future nonpoint source issues in their watershed 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 encourage local planning to address stormwater management.
- 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 jurisdictions.
- EPD will encourage citizen involvement through Adopt-A-Stream groups to address restoration of urban streams.
- EPD will complete reassessment of fecal coliform bacteria monitoring protocols and will propose a plan for resampling of streams identified as not supporting or partially supporting designated uses and complete sampling by December, 2000, in accordance with the statewide RBMP management cycle.

Methods for Tracking Performance: EPD tracks point source discharges through inspections and evaluations of self-monitoring data. An evaluation of the status of listed waterbodies will be made coincident with the next iteration of the RBMP management cycle for the Flint River Basin in 2001.

Rural Areas:

Key Participants and Roles:

- *EPD:* monitor and assess use support in listed streams, ecourage local planning efforts, regulate point sources under the NPDES program.

- *GSWCC* and local SWCDs and RC&D councils with assistance form NRCS: promote implementation of agricultural management practices.
- *County and municipal governments:* septic system regulations and land use planning guidelines.
- *Citizen groups*: Adopt-A-Stream programs and work with local governments on watershed initiatives.

Specific Management Objectives: Encourage local watershed planning and management to ensure that designated water uses are supported.

Management Option Evaluation: Evaluation will be on a site-by-site basis. For agricultural BMP support, existing prioritization methods of the agricultural agencies will be used.

Action Plan:

- EPD will continue to ensure that permitted point sources remain in compliance with fecal coliform bacteria limits.
- GSWCC and local agricultural agencies will continue to support adoption of BMPs for animal waste handling. Methods for prioritization and implementation of cost-share incentives under the 1996 Farm Bill are still being worked out, but it is expected that incentives will be targeted to areas of apparent water quality impact, including rural streams which may sustain excessive fecal coliform loads from animal operations.
- DHR is in the process of developing new regulations for septic systems. DHR will work to educate local governments and citizen groups about the need for adequate regulation and maintenance of septic systems to protect water quality.

Method for Tracking Performance: Agricultural agencies will track rates of BMP implementation for animal operations. An evaluation of the status of listed waterbodies will be made coincident with the next iteration of the RBMP management cycle for the Flint River Basin in 2001.

Issue C. Nitrates in Groundwater

Problem Statement: Drinking water use is potentially threatened in the lower Flint due to the presence of nitrates in groundwater supplies in some of the Coastal Plain aquifers. In the southwest portion of the City of Albany, near the Albany Airport, a survey of nitrates in 221 shallow wells has indicated an elevated nitrate level in the groundwater. Nitrates can come from nonpoint sources such as natural and artificial fertilizer, feedlots, and animal enclosures. Septic tanks and land application of treated wastewater and sludge are other potential sources of nitrate.

General Goals: Meet applicable water quality standards, ensure water quality protective of aquatic life and human health for drinking water.

Ongoing Efforts: EPD monitors ambient groundwater quality through the Georgia Groundwater Monitoring Network. Approximately 133 wells are sampled annually. EPD has been working with the Department of Agriculture to sample a network of special monitoring wells located downgradient from concentrations of agricultural fields to monitor for pesticides in groundwater.

Since the source(s) of the groundwater contamination near the Albany Airport have not yet been determined, the Georgia Environmental Protection Division, Daugherty County Health Department and the Georgia Department of Agricultural initiated a site assessment in May, 1997.

Identified Gaps and Needs: None identified.

Strategies: Additional nonpoint source control strategies should be implemented to reduce fertilizer application in the lower Flint.

Issue D. Erosion/Sedimentation

Problem Statement: The water use classifications of fishing and recreation are potentially threatened in many 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, 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.

General Goals: Control erosion and sedimentation from land disturbing activities in order to meet water quality standards for turbidity.

Ongoing Efforts: GSWCC has recently updated, and has made available for distribution, the *Manual for Erosion and Sedimentation Control in Georgia,* which will be distributed to personnel working on erosion and sedimentation issues throughout the state.

GCF conducted a BMP compliance survey in 1992 on 23 sites (4,475 acres) and documented 97% compliance: roads, 95%; and harvesting, 97%.

Identified Gaps and Needs: Adverse impacts of excess sediment loading include degradation of habitat and reduction in species diversity. These types of impacts are best addressed through biological monitoring. EPD is developing increased capability for biomonitoring using Rapid Bioassessment Protocols (RBPs) for benthic macroinvertebrates. The EPD protocols include habitat assessment. The WRD is working with the IBI (Integrated Biotic Index) to assess fish communities. These tools will provde methods to detect and quantify impairment of aquatic life resulting from habitat-modifying stressors such as sediment, as well as impacts from other stressors.

Rural roads are thought to be a significant contributor to sedimentation but the amount is unclear. Further monitoring may be needed to quantify the impact of rural roads as a source of sedimentation into streams.

A key need for developing strategies to address erosion, sedimentation, and habitat issues in urban streams is definition of appropriate management goals. It is likely that streams with highly urbanized watersheds cannot be returned to "natural" conditions. An appropriate restoration goal needs to be established in consultation between EPD and other stakeholders.

Strategies: Understanding 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:

- *EPD:* encourage local government water quality improvement efforts; and continue the development of biomonitoring methods.
- *Local governments:* where the issuing authority will enforce erosion controls for construction practices and land use planning.
- *GSSWC:* encourage the implementation of BMPs to control erosion of agricultural lands.
- *GFC:* encourage the implementation of forestry BMPs to control erosion.
- *Citizen groups*: Adopt-A-Stream programs and work with local governments on watershed initiatives.

Specific Management Objectives: Control erosion and sedimentation from land disturbing activities in order to meet water qualilty standards for turbidity.

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

Action Plan:

- EPD will encourage citizen involvement through Adopt-A-Stream groups to address restoration of urban streams.
- Local governments with the issuing authority will enforce erosion controls for construction practices.
- GSSWC will encourage the implementation of BMPs to control erosion of agricultural lands.
- GFC will target landowner and user groups for BMP education to encourage compliance with forestry BMP guidelines.
- EPD and WRD will continue to develop biological monitoring capabilities designed to assess aquatic life.

Method for Tracking Performance: GSWCC and GFC will track BMP implementation.

Issue E. Water Supply/Flow

Problem Statement: The water supply, drinking water use, and fisheries are potentially impaired in the lower Flint due to groundwater demand. Very large quantities of groundwater are withdrawn from the Floridan Aquifer for irrigation during dry periods of the growing season to support agricultural production in the upper Flint basin. The Floridan Aquifer is interconnected with the Flint River; therefore, as these agricultural withdrawals increase, the flow of the Flint River during dry periods gets progressively smaller, possibly leading to deleterious instream flow conditions. Also, the striped bass fisheries south of Albany are dependent on groundwater springs to provide cool water refuges during the summer months. In addition, since no new municipal, industrial, or agricultural withdrawals of groundwater can be made from the Clayton Aquifer, a deeper aquifer in the Dougherty Plain which is not connected with surface streams, future expansions of irrigation pumping are likely to come from the Floridan, thereby possibly exacerbating the surface water effects.

General Goals: Meet the growing irrigation needs of Georgia's agricultural economy in the upper Flint basin, while protecting Flint River instream flow conditions.

Ongoing Efforts: Water quantity needs, including those of agriculture, are being addressed throughout the Flint basin as part of the ACT/ACF Study. A water allocation formula must now be developed which covers the Flint basin and meets Georgia's water needs in the region while addressing the issue of downstream and instream water quantity and quality concerns.

Identified Gaps and Needs: Agricultural water users in Georgia are not required to provide data on their annual or seasonal water use (under permits issued by the Georgia Environmental Protection Division). Development of a workable water management strategy for southwest Georgia must eventually address the collection and evaluation of actual agricultural water uses.

Strategies: After the adoption of a water allocation formula which covers the Flint River Basin, EPD must work with stakeholders from the region to develop a water management plan that, when implemented, meets the agricultural irrigation (and other) needs of the region, while not violating provisions of the allocation formula.

Flooding

Problem Statement: Flooding in the Flint River Basin threatens people and property located within the floodplain, as demonstrated during the massive floods of 1994. Flooding may also breach dams, and can contaminate drinking water wells located within the floodplain.

General Goals: Increase awareness and knowledge of floodplain management. Assist communities participating in the National Flood Insurance Program (NFIP) to maintain compliance with NFIP regulations.

Ongoing Efforts: The EPD will continue to provide workshops, and technical assistance and data to participating communities and other parties involved in floodplain determinations. In addition, floodplain management information and updates on available technical resources will continue to be disseminated via quarterly newsletters and the Internet.

Identified Gaps and Needs: Recently produced Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs) of communities in the Flint River Basin lack specific Base Flood Elevation (BFE) data within the Special Flood Hazard Areas. The absence of BFE data requires communities to use arbitrary above natural ground lowest floor elevation requirements for new construction (less than 50 lots and/or 5 acres) and substantial improvements of existing structures.

Strategies: Develop "action partnerships" with agencies and organizations such as Regional Development Centers (RDCs), Georgia Municipal Association and Association County Commissioners of Georgia to maintain compliance and increase the number of NFIP communities within the basin. Agencies such as the Natural Resources Conservation Service and U.S. Army Corps of Engineers are potential resources for technical data and information.

References

Woolsley, T. 1997. Hazard mitigation activities involving dams, *in* Proceedings of the 1997 Georgia Water Resources Conference, held March 20-22, 1997, at The University of Georgia, Kathryn J. Hatcher, Editor, Institute of Ecology, The University of Georgia, Athens, Georgia.

Section 8

Future Issues and Challenges

8.1 The Need for Continuing and Adaptive Management

Basin Management is Never-Ending

This plan constitutes another step in management of the water resources in the Flint River Basin, but not the final step. It is important for all to understand that there will never be a final step. Management is ongoing and dynamic because changes in resource use and condition 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.

We've Done Well....But There is More to Do

For the past few decades, management efforts have resulted in substantial improvements in water quality, and reduction in pollutant loading for many waters (see examples in Section 4). Much of these improvements stem from increased wastewater treatment at municipalities and industries, and from implementation of best management practices by landowners that help reduce soil and contamination runoff. Indeed, many of the waterbodies in the basin are fully supporting their designated uses. The assessments summarized in this plan show, however, that not all waters are at the level of quality deemed necessary to support designated uses. There are existing waters still in need of restoration and attention beyond existing management efforts.

Today's Issues Require Actions by Many Different Stakeholders

The current and proposed strategies summarized in this plan do not "solve" all existing problems. Many of the unsolved problems will require actions by stakeholders other than those that have been involved in planning to date. For example, resolution of fecal coliform bacteria problems will typically require local government (e.g., eliminating leaking and overflowing sanitary sewers) and private landowner actions (e.g., correcting failed septic systems; using best management practices in animal operations and land application of waste residuals). Other issues will require significant additional time and effort before they are addressed sufficiently (e.g., restoration of riparian zones and aquatic habitat). Some of these issues may require trial management efforts and adapting those efforts over time based on observations of what works well, particularly where there is no 100 percent effective solution evident at the time of strategy development. Future management should focus on the priorities among these continuing needs, as determined by communities and partners in management.

Additionally, continued growth in population is expected in the Flint basin, especially in the upper reaches of the basin around the Atlanta metropolitan area (see Section 2). This growth will place additional demands on water resources, and require corresponding responses in management. More people means more water use (drinking water, industrial consumption, irrigation), more stormwater runoff (from impervious surfaces of new houses, roads, industries, businesses, and parking lots), and more contamination (sediment; nutrients; organic material; pesticides, herbicides, and other toxics). Therefore it is essential that stakeholders continue to work together to plan and implement the most cost-effective ways of restoring and protecting water resources.

Basin Management Must Blend Regulatory and Voluntary Approaches

Although the regulatory authorities of agencies such as EPD are very important to 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. Ultimate success in protecting natural resources for the people of Georgia, however, is dependent on those very same people. Long-term protection means that the people, governments, and businesses must learn collectively what is needed for protection and adapt their lifestyles and operations accordingly. Our 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 resources of Georgia.

8.2 Working to Strengthen Planning and Implementation Capabilities

We Need to Understand 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 Flint 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 of 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
- Issuing permits for point source discharges of treated wastewater, municipal stormwater discharges as required, and land application systems
- Issuing water supply permits
- Enforcing compliance with permit conditions

There are many areas, however, where organizations or entities other than EPD are responsible. For example,

- Septic tank permitting (County Health Department) and maintenance (individual landowners)
- Land development and zoning ordinances (counties, municipalities)
- Sanitary sewer and stormwater ordinances (counties, municipalities)
- Water supply source water protection ordinances (counties, municipalities)
- Flood plain management (FEMA, counties, municipalities)
- Implementation and enforcement of forestry best management practices (landowners and Georgia Forestry Commission)
- 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 serve to illustrate how responsibilities are spread across many stakeholders in each basin. Additionally, there are other agencies and organizations that assist planning and implementation in many of these areas, i.e., regional development centers; federal, state, and local technical assistance programs; citizens groups; and business associations. As stakeholders become more familiar with one another's responsibilities and capabilities, they will more frequently be aware of appropriate partners to work with in addressing their issues of concern.

Let's Use 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 that support two-way communication. For example, Basin Technical Planning Team meetings provide opportunities for partners to share information on their responsibilities and capabilities with one another. Similarly, River Basin Advisory Committee meetings and Stakeholder meetings provide opportunities for citizens, businesses, government agencies, associations, etc. to share information and learn from one another. Although often requiring considerable time, these interactions are critical to the future of management in the basin because they build working relationships and trust that are essential to carrying out effective, integrated actions.

We Can Also Continue 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 within 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

Basin Planning Can Support More Consistent Implementation of Protection Measures

In addressing the impacts from anticipated population growth and increased land development in the basin, future management will need to build off increased understanding of roles and use improved forums for coordination to develop more specific action plans. Historically, mitigating impacts from newly developed areas has been approached mostly on a case-by-case basis. Unfortunately, this 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 level.

One way that Georgia EPD will address this issue is by only approving permits for 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 until the permit application process, however, local governments can work together and with EPD to work out some of these issues in advance. There is incentive 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 Regional Development Centers (RDCs) to work out consistent methods for watershed assessments of developing areas and for improving implementation of protection measures as development occurs. EPD, DCA and other partners can help build these planning bridges by facilitating discussion at RBMP meetings and supporting local initiatives aimed at this issue.

We need to Work Closely with the ACF Interstate Commission

Another future challenge is securing sufficient allocation of water from the ACF Interstate Commission to maintain needed water supplies for municipal, agricultural, and other purposes in the face of increasing growth and land development pressure. During the remainder of 1997 and 1998, the States of Alabama, Florida, and Georgia, together with the Corps of Engineers, will complete the ACT/ACF data base and modeling effort to analyze alternative options for management of water quantity. The Interstate Commission will be responsible for developing a water allocation formula by the end of 1998. The affected states and their citizens will need to work together to critique, improve, approve and implement the allocations.

8.4 Entering the Next Iteration of the Basin Cycle

Build on the Foundation of Previous, Ongoing, and Planned Efforts

As discussed above and in Section 7.2, there is more work to do to adequately restore and protect all of Georgia's water resources. Following a brief period for focusing on implementation of this plan, the Flint River Basin will enter into its second iteration of the basin management cycle (scheduled for April, 1999). The next cycle will provide opportunity to review issues that were not fully addressed during the first cycle and to reassess for identification of 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.

This Basin Plan Provides Historical Reference for the Next Basin Plan

Partners will not have to start from scratch during the next iteration. The information in this document provides an historical account of what is known and planned to date. Stakeholders in the Flint 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.

Appendix A

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.

Appendix B

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)Ether	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	†
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 ‡
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

** 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.

(f) The dissolved oxygen criteria as specified in individual water use classifications.

Appendix C

Point Source Control Efforts in the Flint River Basin

HUC 03130005

1936 City of Griffin Ison Branch WTF.
1958 City of Manchester trickling filter system.
1958 City of Butler oxidation pond, $227,000.
1958 City of Hampton trickling filter system.
1959 Moose Lodge #1503, Griffin, 0.0055 MGD subsurface sand filter.
1960 Georgia Baptist wastewater pond 0.006 MGD.
1964 Griffin Beaverbrook School WTF 0.009 MGD $20,000.
1965 Woodland Housing Authority, 0.0006 MGD package treatment plant.
1966 City of Griffin Shoal Creek 0.6 MGD trickling filter system.
1970 Zebulon 0.286 MGD pond system.
1972 Marnelle Mobile Home Estates 0.06 MGD pond.
1973 Thomaston Mills, Inc. WTF, $893,411.
1974 City of Hampton 0.5 MGD activated sludge system.
1975 Molena Nursing Home oxidation pond, $22,000.
1976 Autumn's Gate MHP 0.03 MGD package plant.
1976 City of Griffin Potato Creek trickling filter system, $2,500,000. This facility replaced the City's Ison Branch WTF.
1979 Fayetteville Whitewater Creek WPCP, 1.25 MGD activated sludge, $3,000.000.
1983 Griffin Beaverbrook School WTF chlorination system added, $7,000.
1983 Thomaston Mills WTF upgrade.
1983 Greenville Kennel Creek WTF, 0.24 MGD, $500,000.
1985 City of Butler pond upgraded, $705,000..
1986 City of Griffin Shoal Creek relocated, upgraded and expanded to 1.5 MGD, $2,500,000.
1987 City of Manchester 0.812 MGD land application system, $1,975,000.
1988 City of Griffin Potato Creek WPCP upgraded and expanded to 2.0 MGD, $2,500,000.
1991 Thomaston Mills upgraded and discharge combined with City of Thoamston's.
1992 Southern Mills Plant Ray land application system $3,051,404.
1992 Fayetteville Whitewater Creek WPCP upgraded and expanded 3.75 MGD sequenching batch reactors, $5,000,000.
1992 Woodland Housing Authority WPCP replaced, $187,500.
1993 Autumn's Gate MHP expanded to 0.04 MGD and updated.

1996 Hampton upgrade $20,000.

1996 Griffin Beaverbrook School WTF replaced $80,000.

1997 City of Griffin Shoal Creek 2.25 MGD land application system, $5,900,000.

HUC 03130006

1930's Albany Naval Air Station 0.6 MGD trickling filter WPCP.

1955 Cordele 1.5 MGD trickling filter WPCP, $414,105.

1963 Oaks Nursing Home pond.

1973 City of Oglethorpe WTF 0.13 MGD.

1978 Miller Brewing Company, 6.1 MGD, $17,000,000.

1980 Weyerhaeuser WTF $5,679,000.

1981 Cordele WPCP upgraded and expanded to 5.0 MGD, $5,500,000.

1981 Weyerhaeuser upgrades $225,000.

1983 Tyson Foods in Buena Vista added sequential batch reactors, $1,000,000.

1984 Weyerhaeuser upgrades $150,000.

1986 Weyerhaeuser upgrades $120,000.

1988 Weyerhaeuser upgrades $320,000.

1989 Weyerhaeuser upgrades $260,000.

1989 Tyson Foods in Buena Vista added disolved air floatation unit, $150,000.

1991 City of Oglethorpe WTF upgraded and expanded to 0.45 MGD $815,000.

1992 Tyson Foods in Buena Vista upgraded, $390,000.

1993 Tyson Foods in Buena Vista upgraded, $950,000.

1994 City of Vienna Tyson WTF, 0.99 MGD land application system with sequenching batch reactors, $3,337,090.

1994 City of Vienna oxidation pond replaced with 0.74 MGD land application system, $854,288.

1995 Tyson Foods in Buena Vista added second dissolved air floatation unit, $200,000.

HUC 03130007

1976 Andersonville WPCP, 0.034 MGD, $37,000.

HUC 03130008

1956 Decatur County WPCP

1960 Palmer's Motel 0.015 MGD pond.

1972 City of Camilla, 1.5 MGD activated sludge system, $1,100,000.

1972 Merck & Co. WTF $3,200,000.

1975 City of Bainbridge, 2.5 MGD activated sludge system, $3,000,000.

1979 City of Bainbridge WPCP added standby power generator.

1988 Decatur County, 1.00 MGD sequencing batch reactor, $4,500,000.

1993 Merck & Co. WTF upgrade $500,000.

1995 Camilla's Cagle WTF, 2.0 MGD land application system, $7,300,000.

1996 Merck & Co.WTF upgrades $6,000,000.

1997 Merck & Co.WTF upgrades $13,000,000.

1997 Decatur County WPCP upgraded, $350,000.

HUC 03130009

1975 City of Dawson, 1.2 MGD activated sludge system, $2,500,000.

1982 City of Shellman, 0.15 MGD activated sludge system, $459,542.

1991 City of Dawson upgraded to 2.5 MGD, $2,564,572.

HUC 03130010

1951 City of Blakely trickling filter WPCP, $200,000.

1960 City of Blakely Oxidation Pond A, 0.120 MGD, $100,000.

1970 City of Blakely Oxidation Pond B, 0.120 MGD, $125,000.

1974 Donalsonville, 0.4 MGD activated sludge, $505,070.

1986 City of Blakely WPCP converted to activated sludge system and expanded to 1.315 MGD, $1,300,000.

1995 City of Blakely Pond B upgraded, $20,000.

1996 City of Blakely added stormwater diversion ponds, $1,000,000.

Appendix D

Permitted Discharges in the Flint River Basin

Facility Name	NPDES #	Permitted Flow	Major	Receiving Stream
HUC 03130005				
Atl Sand and Supply	GA0001384			Beaver Cr
Autumn's Gate MHP	GA0034606	0.040		Turkey Cr
Beaverbrook Elem School	GA0034380	0.010		Heads Cr Trib
Blue Circle Inc Clayton	GA0046108			Sullivan Creek
Butler Pond	GA0021083	0.500		Town Branch Trib
Concord North #2	GA0025461	0.030		Birch Cr
Concord South #1	GA0025470	0.100		Elkins Cr
Coweta Co Shenandoah	GA0034614	0.890		White Oak Cr
Davidson Minerals Prop Fayett	GA0046060			Trickum Crk
Fayetteville Whitewater	GA0035807	3.750	Y	Whitewater Cr-Line Cr
Fernwood Park	GA0023078	0.011		Morning Cr
Florida Rock Ind Flat Creek	GA0024872			Flat Cr
Florida Rock Ind Flint River	GA0027073			Flint Rv
Florida Rock Ind Fayette	GA0031844			Line Cr
GA Baptist Children's Home	GA0022314			Five Mile Cr
Greenville Kennel Cr	GA0047813	0.250		Kennel Creek Trib
Griffin Potato Cr WPCP	GA0030791	2.000	Y	Potato Cr
Griffin Shoal Cr	GA0047040	1.500	Y	Shoal Cr Trib to Flint
Hampton WPCP	GA0020320	0.500		Bear Creek
Jackson Rd Elem School	GA0020869	0.013		Unnamed Trib to Cabin Creek
Marnelle Mobile Home Estates	GA0030198	0.060		Pelham Cr
Marshallville WPCP	GA0047431	0.120		Spring Hill Cr
Martin Marietta Junction Cty	GA0046507			Unnamed Tri to S. Fork Upatoi Crk
Molena Care Home Inc	GA0024031	0.120		Elkins Cr
Moose Lodge #1503-Griffin	GA0034592	0.006		Potato Cr-Flint Rv
North Fayette Elem School	GA0035670	0.035		Morning Cr
Oaks Nursing Home	GA0031691			Flint Rv
Peachtree City Rockaway	GA0046655	2.000	Y	Line Crk Trib. To Whitewater
Peachtree City Flat Cr	GA0020371	0.900		Flat Cr Trib to Line Cr
Peachtree City Line Cr	GA0035777	2.000	Y	Line Cr-Whitewater Cr
Reynolds Pond	GA0020729	0.160		Patsiliga Cr
Roberta WPCP	GA0020834	0.440		Culpepper Cr Trib
Shadydale MHP	GA0023388	0.075		Tar Cr
Shaw Industries Inc	GA0001171			Turkey Cr

Facility Name	NPDES #	Permitted Flow	Major	Receiving Stream
Southern Mills Coweta	GA0046361			Dead Oak Crk
Southern Natural Gas Upson	GA0037567			Unnamed Trib of Swift Creek
Specialty Brands Inc	GA0000876			Cane Cr
Talbotton WPCP	GA0047805	0.100		Edwards Creek Trib
Taylor Co Bd of Comm	GA0000302	0.120		Horse Crk in Flint River
Thomaston Town Branch	GA0030121	2.000	Y	Potato Cr
Thomaston Mills Inc	GA0000213		Y	Fourth Br
Thomaston Bell Cr	GA0020079	2.000	Y	Potato Cr
Timber Creek MHP	GA0023531	0.018		Heads Cr
Vulcan Mat Red Oak Quarry	GA0000752			Kimberly Cr
Vulcan Mat Turner	GA0036749			Unnamed Trib to Shoal Creek
Warm Springs WPCP	GA0001601	0.400		Warm Springs Br
Westek Inc	GA0000621			Drake Br/Miller Br/Potato Cr
Woodland Housing Auth	GA0020761			Lazar Cr
Zebulon WPCP	GA0049476	0.286		Town Branch Trib
HUC 03130006				
Andersonville WPCP	GA0033669	0.034		Sweetwater Cr to Flint Rv
Byromville Pond	GA0025623	0.104		Turkey Cr
Cordele WPCP	GA0024503	5.000	Y	Gum Cr
Crisp Co Power Commission	GA0025399			Lake Blackshear
Crispaire Corp	GA0037184			Gum Creek
Cytec Ind	GA0023728			Camp Crk
Dot Rest Area #13/Vienna	GA0023671	0.020		Pennahatchee Cr
Drexel Chemical Company	GA0047686			Deep Creek
Ideal	GA0048011	0.080		Cedar Cr to Flint Rv
Master's Inn	GA0048933	0.025		Gum Cr
Montezuma WPCP #2	GA0020486	1.950	Y	Spring Cr
Montezuma WPCP #1	GA0021288	0.840		Spring Creek
Oglethorpe	GA0036919	0.450		Flint River
Proctor & Gamble Paper Product	GA0049981			Flint River
Tyson Foods Inc	GA0046574			Unnamed Trib to Mill Crk
Weyerhauser	GA0049336		Y	Flint Rv
Worthy Manor Sd	GA0026891	0.070		Rocky Br
HUC 03130007				
Americus Mill Cr	GA0047767	4.400	Y	Mill Cr

Facility Name	NPDES #	Permitted Flow	Major	Receiving Stream
Buena Vista WPCP	GA0023710	0.500		Oochee Cr
Doe South GA Tech & Voc	GA0048267	0.075		Tributary to Satterfield
Ellaville Pond	GA0050105	0.200		Unnamed Trib
Lee High Acres	GA0026603	0.250		Kinchafoonee Cr
Leesburg Pond	GA0026638	0.450		Kinchafoonee Cr
Martin Marietta Leesburg	GA0048968			Fowltown Cr
Plains WPCP	GA0020931	0.120		Passell Crk Trib/Kinchafoonee
Richland Pond	GA0021539	0.180		Bear Creek Trib
Smithville Pond	GA0047422	0.120		Muckaloochee Cr
Tri Co High School	GA0024899	0.035		Lanahassee Cr
Tyson Foods Inc	GA0000817			Muckalee Cr
HUC 03130008				
Albany Naval Air	GA0020265	0.600		Georgia Power Lake, Flint
Albany Joshua Road #1	GA0020991	20.000	Y	Flint Rv
Baconton WPCP	GA0031780	0.050		Raccoon Creek Trib
Bainbridge WPCP	GA0024678	2.500	Y	Flint Rv
Camilla WPCP	GA0020362	3.000	Y	Big Slough Cr
Decatur Co Ind Airpark	GA0033511	1.000	Y	Flint Rv
Englehard Specialty Chemicals	GA0046744			Swamp Crk
Ergon Inc	GA0037486			Flint River
Georgia Power Mitchell	GA0001465		Y	Flint Rv
Georgia Power Flint River	GA0001546			Flint Rv
Holland's Folly Albany	GA0022675	0.045		Dry Cr
Merck Manufacturing Division	GA0001619		Y	Flint Rv
Miller Brewing co	GA0049093			Flint Rv
Palmer's Motel Bainbridge	GA0034746			Lake Douglas Trib
Vigoro Industries Inc	GA0000531			Decatur Co Drainage Ditch
HUC 03130009				
Cuthbert Pond	GA0050083	0.410		Town Br-Flint Rv
Dawson WPCP	GA0021326	2.500	Y	Brantley Cr
Edison Pond	GA0020494	0.154		Bay Br
Edison	GA0037427	0.250		Bay Branch of Pachitla Cr
Leary WPCP	GA0026212	0.100		Keel Cr
Randolph-Clay High School	GA0035874	0.030		Hog Creek Trib
Shellman WPCP	GA0032361	0.150		Ichawaynotchaway Cr Tri.

Facility Name	NPDES #	Permitted Flow	Major	Receiving Stream
HUC 03130010				
Arlington Pond #1	GA0026204	0.100		Perry Cr Trib
Arlington Pond #2	GA0050075	0.060		Boggy Cr Trib
Blakely Pond A	GA0031976	0.120		Breastworks Br to Dry Cr
Blakely WPCP	GA0025585	1.315	Y	Baptist Branch Trib
Blakely Pond A	GA0031968	0.120		Blue Creek Trib to Dry Cr
Colquitt WPCP	GA0047252	0.400		Spring Cr
Donalsonville WPCP	GA0026123	0.400		Fish Pond Drain

Appendix E

Support of Designated Uses for Rivers and Streams in the Flint River Basin, 1994-95

NAME	LOCATION	USE CLASSIFICATION	STATUS	CRITERION VIOLATED	EVALUATED CAUSES	ACTIONS TO ALLEVIATE	MILES	303(D)	PRIORITY
HUC 03130005									
Andrews Creek	Upson County	Fishing	S	None	None	None	2	NA	0
Auchumpkee Creek	Upson County	Fishing	S	None	None	None	23	NA	0
Avera Creek	Crawford County	Fishing	PS	Bio,pH	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	4	X	2
Bailey Creek	Crawford County	Fishing	S	None	None	None	4	NA	0
Basin Creek	Upson County	Fishing	PS	Bio	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	6	X	4
Bear Creek	Hampton	Fishing	S	None	None	None	2	NA	0
Beaver Creek	Crawford County	Fishing	PS	Bio,DO	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	11	X	2
Beaver Creek	Merriwether County	Fishing	S	None	None	None	6	NA	0
Bell Creek	Thomaston	Fishing	PS	FC,Bio	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy for the basin.	4	X	4
Birch Creek	Pike County	Fishing	S	None	None	None	11	NA	0
Britten Creek	Merriwether County	Fishing	S	None	None	None	5	NA	0
Cabin Creek	Spalding County	Fishing	PS	DO	M	Griffin Cabin Creek WPCP in compliance with permit limits. Model predicts dissolved oxygen violations at low flows. Model calibration study planned.	4	x	2
Camp Creek	Clayton County	Fishing	NS	FC,DO	UR	Urban runoff is being addressed in the EPD Stormwater Management Strategy for metropolitan Atlanta. An areawide stormwater permit was issued on 6/15/94.	9	2	1
Cane Creek	Merriwether County	Fishing	S	None	None	None	9	NA	0
Cater Creek	College Park	Fishing	S	None	None	None	1	NA	0
Chandlers Creek	Coweta County	Fishing	S	None	None	None	5	NA	0
Cold Springs Branch	Merriwether County	Fishing	S	None	None	None	4	NA	0
Culpepper Creek	Crawford County	Fishing	S	None	None	None	4	NA	0
Dead Oak Creek	Upstream Line Creek	Fishing	S	None	None	None	2	NA	0
Dominy Branch	Near Cobb/Upstream Lime Creek	Fishing	S	None	None	None	3	NA	0
Double Branch	Coweta County	Fishing	S	None	None	None	3	NA	0
Drake Branch	Upson County	Fishing	S	None	None	None	2	NA	0
Dye Branch	Thomaston	Fishing	S	None	None	None	2	NA	0
East Swift Creek	Upson County	Fishing	S	None	None	None	5	NA	0
Elkins Creek	Molena	Fishing	PS	FC	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	11	X	4
Elkins Creek	Upson, Pike & Spalding Counties	Fishing	S	None	None	None	26	NA	0
Five Mile Creek	Pike County	Fishing	PS	Bio	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	4	X	4
Five Mile Creek	Upson County	Fishing	S	None	None	None	3	NA	0

NAME	LOCATION	USE CLASSIFICATION	STATUS	CRITERION VIOLATED	EVALUATED CAUSES	ACTIONS TO ALLEVIATE	MILES	303(D)	PRIORITY
Flat Creek	Peachtree City	Fishing	PS	DO	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	4	X	2
Flat Creek	Spalding County	Fishing	S	None	None	None	11	NA	0
Flint River	Flat Shoals to Potato Creek	Fishing	S	None	None	None	37	NA	0
Flint River	Hartsfield Airport to Hwy 138	Fishing	NS	FC,Pb*,DO	UR	Urban runoff is being addressed in the EPD Stormwater Management Strategy for metropolitan Atlanta. An areawide stormwater permit was issued on 6/15/94.	8	2	1
Flint River	Horse Creek to Spring Creek	Fishing	PS	Zn	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	16	X	2
Flint River	Hwy 138 to N. Hampton Road	Fishing	NS	FC,DO	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy for the basin.	8	X	2
Flint River	N. Hampton Road to Road S1058	Fishing	PS	FC	UR	Urban runoff is being addressed in the EPD Stormwater Management Strategy for metropolitan Atlanta. An areawide stormwater permit was issued on 6/15/94.	5	2	4
Flint River	Potato Creek to Horse Creek	Fishing	S	None	None	None	55	NA	0
Flint River	Road S1058 to Flat Shoals	Drinking Water/Fishing	NS	FC,DO,Pb*	UR	Urban runoff is being addressed in the EPD Stormwater Management Strategy for metropolitan Atlanta. An areawide stormwater permit was issued on 6/15/94.	32	2	2
Flint River	Upstream Hartsfield Airport	Fishing	NS	FC,Cu*,Pb*	UR	Urban runoff is being addressed in the EPD Stormwater Management Strategy for metropolitan Atlanta. An areawide stormwater permit was issued on 6/15/94.	1	2	1
Ginger Cake Creek	Fayette County	Fishing	S	None	None	None	6	NA	0
Grace Branch	Crawford County	Fishing	PS	Bio	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	2	X	4
Grape Creek	Griffin	Fishing	S	None	None	None	2	NA	0
Grape Creek	Lamar County	Fishing	S	None	None	None	3	NA	0
Haddock Creek	Fayette County	Fishing	S	None	None	None	4	NA	0
Heads Creek	Downstream Griffin Reservoir	Fishing	PS	Bio	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	2	X	4
Horse Creek	Crawford County	Fishing	S	None	None	None	6	NA	0
Horseley Creek	Upson County	Fishing	S	None	None	None	2	NA	0
Hurricane Branch	Merriwether County	Fishing	S	None	None	None	3	NA	0
Hurricane Creek	Upson County	Fishing	S	None	None	None	3	NA	0
Ison Branch	Griffin	Fishing	S	None	None	None	3	NA	0
Jerry Reeves Creek	Upson County	Fishing	S	None	None	None	4	NA	0
Keg Creek	Hutchins Lake to Line Creek	Fishing	S	None	None	None	3	NA	0
Kendall Creek	Merriwether County	Fishing	S	None	None	None	3	NA	0
Lee Creek	Crawford County - Downstream Lake Henry	Fishing	PS	Bio	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	1	X	4
Lewis Creek	Pike County	Fishing	PS	Bio	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	2	X	4

NAME	LOCATION	USE CLASSIFICATION	STATUS	CRITERION VIOLATED	EVALUATED CAUSES	ACTIONS TO ALLEVIATE	MILES	303(D)	PRIORITY
Line Creek	Fayette/Coweta Counties Upstream Wynns Pond	Fishing	S	None	None	None	7	NA	0
Line Creek	Flat Creek to Flint River	Fishing	S	None	None	None	15	NA	0
Line Creek	Line Creek WPCP to Flat Creek	Fishing	PS	Tox	M	EPD will address toxicity through the NPDES permitting process.	2	2	1
Line Creek	Wynns Pond to Line Creek WPCP	Fishing	S	None	None	None	4	NA	0
Little Potato Creek	Downstream Barnesville	Fishing	S	None	None	None	8	NA	0
Little Redoak Creek (aka Sandy Creek)	Merriwether County	Fishing	S	None	None	None	6	NA	0
Little Turkey Creek	Upson County	Fishing	S	None	None	None	2	NA	0
Little White Oak Creek	Coweta County/Upstream White Oak Creek	Fishing	S	None	None	None	6	NA	0
Little White Oak Creek	Coweta/Meriwether Counties - Downstream Long Branch	Fishing	S	None	None	None	8	NA	0
Long Branch	Upson County	Fishing	S	None	None	None	3	NA	0
Marby Creek	Upson County	Fishing	S	None	None	None	4	NA	0
Matthews Creek	Crawford County	Fishing	S	None	None	None	5	NA	0
Mill Creek	Merriwether County	Fishing	S	None	None	None	6	NA	0
Mock Woodall Creek	Upson County	Fishing	PS	Bio	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	2	X	4
Mountain Creek	Pike County	Fishing	S	None	None	None	6	NA	0
Mud Creek	Downstream Hapeville	Fishing	NS	FC,Cu,Pb,Zn	UR,I1	Urban runoff is being addressed in the EPD Stormwater Management Strategy for metropolitan Atlanta. An areawide stormwater permit was issued on 6/15/94. Ford plant discharge under study.	5	2,X	1
Murphy Creek	Fayette County	Fishing	S	None	None	None	4	NA	0
North Branch	Crawford County	Fishing	PS	Bio	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	4	X	4
Pappys Creek	Meriwether County	Fishing	S	None	None	None	6	NA	0
Patsiga Creek	Reynolds	Fishing	S	None	None	None	6	NA	0
Pigeon Creek	Meriwether County	Fishing	S	None	None	None	8	NA	0
Potato Creek	Spalding/Lamar Counties	Fishing	PS	Bio,Tox	NP,UR,M	EPD will address through a watershed protection strategy for the basin. Griffin Potato Creek WPCP toxicity will be handled through the NPDES permitting process..	22	X,2	4,1
Potato Creek	Thomaston	Fishing	PS	FC	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy for the basin and will evaluate for repermitting within the next 12 months.	11	X	4
Powder Creek	Pike County	Fishing	S	None	None	None	5	NA	0
Red Oak Creek	Imlac	Fishing	S	None	None	None	8	NA	0

NAME	LOCATION	USE CLASSIFICATION	STATUS	CRITERION VIOLATED	EVALUATED CAUSES	ACTIONS TO ALLEVIATE	MILES	303(D)	PRIORITY
Redoak Creek	Merriwether County	Fishing	S	None	None	None	10	NA	0
Rocky Ford Branch	Merriwether County	Fishing	S	None	None	None	2	NA	0
Rose Creek	Upson County-Willis Road to Potato Creek	Fishing	S	None	None	None	6	NA	0
Shoal Creek	Fayette County	Fishing	S	None	None	None	5	NA	0
Shoal Creek	Griffin	Fishing	S	None	None	None	5	NA	0
Spring Creek	Upson County	Fishing	S	None	None	None	3	NA	0
Starling Branch	Upson County	Fishing	S	None	None	None	2	NA	0
Sullivan Creek	Clayton County	Fishing	PS	FC	UR	Urban runoff is being addressed in the EPD Stormwater Management Strategy for metropolitan Atlanta. An areawide stormwater permit was issued on 6/15/94.	5	2	1
Sullivan Creek	Upson County	Fishing	S	None	None	None	4	NA	0
Swift Creek	Upson County	Fishing	S	None	None	None	19	NA	0
Tanyard Branch	Greenville	Fishing	NS	FC	M	City issued Order on 9/14/95 to eliminate discharge.	1	2	1
Ten Mile Creek	Upson County-Symrna Road to Potato Creek	Fishing	S	None	None	None	8	NA	0
Tobler Creek	Upson County	Fishing	S	None	None	None	23	NA	0
Town Branch	Butler	Fishing	PS	Tox	M	Butler under Consent Order to eliminate toxicity.	1	2	1
Town Branch	Thomaston	Fishing	PS	Tox,Bio	M,UR	EPD will address toxicity at Thomaston WPCP through the NPDES permitting process. EPD will address nonpoint source (urban runoff) through a watershed protection strategy for the basin and will evaluate for repermitting within the next 12 months.	4	2,X	1,4
Tributary to Flint River	College Park	Fishing	NS	FC,Pb*	UR	Urban runoff is being addressed in the EPD Stormwater Management Strategy for metropolitan Atlanta. An areawide stormwater permit was issued on 6/15/94.	1	2	1
Tributary to Nash Creek	Fayetteville	Fishing	PS	FC	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy for the basin.	1	X	4
Turkey Creek	Upson County	Fishing	PS	Bio	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	3	X	4
Ulcohatchee Creek	Crawford County	Fishing	S	None	None	None	16	NA	0
Walnut Creek	Merriwether County	Fishing	S	None	None	None	4	NA	0
White Oak Creek	Alvaton	Fishing	NS	FC	NP	EPD will address nonpoint source through a watershed protection strategy for the basin.	9	X	4
White Oak Creek	I-85 to Sullivan Creek	Fishing	S	None	None	None	6	NA	0
White Oak Creek	Newnan - I-85 to Chandlers Creek	Fishing	NS	FC	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	6	X	4
Whitewater Creek	Fayette Counties Upstream Lees Lake	Fishing	PS	Bio	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy for the basin.	3	X	4
Whitewater Creek	Fayette County Downstream Lake Bennett	Fishing	S	None	None	None	8	NA	0

NAME	LOCATION	USE CLASSIFICATION	STATUS	CRITERION VIOLATED	EVALUATED CAUSES	ACTIONS TO ALLEVIATE	MILES	303(D)	PRIORITY
Whitewater Creek	Oglethorpe	Fishing	S	None	None	None	2	NA	0
Whitewater Creek	Starr's Millpond to Line Creek	Fishing	S	None	None	None	5	NA	0
Wildcat Creek	Spalding County	Fishing	S	None	None	None	2	NA	0
Willingham Spring Creek	Upson County	Fishing	PS	Bio	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	3	X	4
Winky Branch	Merriwether County	Fishing	S	None	None	None	4	NA	0
Wolf Creek	Merriwether County	Fishing	S	None	None	None	5	NA	0
Wolf Creek	Upson County	Fishing	S	None	None	None	5	NA	0
Womble Creek	Upson County	Fishing	S	None	None	None	6	NA	0
Woolsey Creek	Fayette County	Fishing	S	None	None	None	6	NA	0
HUC 03130006									
Beaver Creek	Upstream Spring Hill Creek (SW Marshallville)	Fishing	NS	FC	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	4	X	4
Buck Creek	Oglethorpe	Fishing	PS	FC	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	16	X	4
Camp Creek	Oglethorpe	Fishing	NS	Cu,Zn,FC	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	4	X	2
Cannon Branch	Lake Blackshear	Fishing	PS	pH	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	1	X	4
Cedar Creek	Crisp County	Fishing	PS	Zn*	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	3	X	4
Flint River	Spring Creek to Hwy 27	Fishing	NS	FC,Pb*,Cu*	UR	Urban runoff is being addressed in the EPD Stormwater Management Strategy for metropolitan Atlanta. An areawide stormwater permit was issued on 6/15/94.	20	2	1
Gulley Creek	Upstream Lake Blackshear	Fishing	NS	DO,Pb,Zn	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	4	X	2
Gum Creek	Downstream Cordele	Fishing	PS	Zn*,FC	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy for the basin.	6	X	4
Hog Crawl Creek	NW Cordele	Fishing	PS	Pb*	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	8	X	4
Lime Creek	Lake Blackshear	Fishing	NS	Zn,FC	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	5	X	2
Limestone Creek	Lake Blackshear	Fishing	PS	Zn*,Cu*	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	3	X	4
Pecan Creek	Lake Blackshear	Fishing	S	None	None	None	1	NA	0
Spring Creek	Lake Blackshear	Fishing	PS	Zn*,Pb*	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	2	X	4
Spring Creek	Montezuma	Fishing	PS	Tox	M	Montezuma WPCP toxicity will be handled through the NPDES permitting process and will evaluate for repermitting within the next 12 months.	2	2	1
Sweetwater Creek	Downstream Andersonville	Fishing	NS	pH,Pb,Zn	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	5	X	2

NAME	LOCATION	USE CLASSIFICATION	STATUS	CRITERION VIOLATED	EVALUATED CAUSES	ACTIONS TO ALLEVIATE	MILES	303(D)	PRIORITY
Swift Creek	Lake Blackshear	Fishing	PS	Zn*,Pb*	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	7	X	4
Turkey Creek	Downstream Pennahatchee Creek, NW Cordele	Fishing	NS	FC	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	4	X	4
Turkey Creek	Newnan to Reese Lake	Fishing	NS	FC,Pb*	UR	Urban runoff is being addressed in the EPD Stormwater Management Strategy for metropolitan Atlanta. An areawide stormwater permit was issued on 6/15/94.	4	2	1
Valihalla Branch	Lake Blackshear	Fishing	PS	Cu*	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	1	X	4
HUC 03130007									
Kinchafoonee Creek	Webster County	Fishing	S	None	None	None	23	NA	0
Mackaloochee Creek	Smithville - Downstream Hwy 118	Fishing	S	None	None	None	5	NA	0
Muckalee Creek	Americus	Fishing	S	None	None	None	2	NA	0
Muckalee Creek	Leesburg	Fishing	S	None	None	None	20	NA	0
Muckalee Creek	Upstream Americus	Fishing	PS	FC	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	5	X	4
HUC 03130008									
Big Cypress Creek	Near Newton/Upstream Ichawaynochaway	Fishing	S	None	None	None	6	NA	0
Big Drain Creek	Boykin/Upstream Spring Creek	Fishing	S	None	None	None	2	NA	0
Big Slough	Bainbridge	Fishing	S	None	None	None	5	NA	0
Big Slough	Near Pelham	Fishing	NS	DO,FC	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy for the basin.	4	X	2
Cooleewahee Creek	Newton	Fishing	S	None	None	None	16	NA	0
Flint River	Big Slough to 1 mi. downstream State docks	Fishing	PS	Pb*,Zn*	NP,UR	EPD will address through a watershed protection strategy for the basin.	5	X	4
Flint River	Lake Worth Dam to Racoon Creek	Fishing	PS	FC,Pb,Zn	CSO,UR	Albany to complete CSO treatment facilities by 12/31/96. Albany WPCP in compliance with NPDES permit limits. EPD will address nonpoint source (urban runoff) through a watershed protection strategy for the basin.	23	2,X	1,2
Flint River	Racoon Creek to Ichawaynochaway Creek	Fishing	PS	FC	CSO,UR	Albany to complete CSO treatment facilities by 12/31/96. EPD will address nonpoint source (urban runoff) through a watershed protection strategy for the basin.	28	2,X	1,4
Kiokee Creek	Mud Creek to Hwy 62	Fishing	S	None	None	None	3	NA	0
HUC 03130009									
Brantley Creek	Dawson	Fishing	NS	Tox	M	EPD will address toxicity through the NPDES permitting process and will evaluate for repermitting within the next 12 months.	2	2	1
Chickasawhatchee Creek	Dougherty County	Fishing	PS	FC	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy for the basin.	12	X	4

NAME	LOCATION	USE CLASSIFICATION	STATUS	CRITERION VIOLATED	EVALUATED CAUSES	ACTIONS TO ALLEVIATE	MILES	303(D)	PRIORITY
Chickasawhatchee Creek	Elmodel	Fishing	S	None	None	None	10	NA	0
Ichawaynochaway Creek	Baker County	Fishing	S	None	None	None	35	NA	0
Kinchafoone Creek	Dawson	Fishing	NS	FC	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy for the basin.	29	X	4
Lazar Creek	Talbotton	Fishing	NS	FC	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	6	X	4
Pachitla Creek	Edison	Fishing	S	None	None	None	3	NA	0
HUC 03130010									
Aycocks Creek	Miller County	Fishing	PS	FC	NP	EPD will address nonpoint sources through a watershed protection strategy for the basin.	15	X	4
Baptist Branch	Downstream Blakely	Fishing	PS	Pb,Tox	M	Blakely completed Individual Control Strategy to comply with metals limit in 1994 and toxicity to be addressed through NPDES permitting program and will evaluate for repermitting within the next 12 months.	2	2	1
Cypress Creek	Colquitt/Upstream Aycocks Creek	Fishing	S	None	None	None	4	NA	0
Dry Creek	Downstream Blakely	Fishing	PS	FC	M,UR	City completed facility upgrade in 1994. EPD will address nonpoint source (urban runoff) through a watershed protection strategy for the basin.	12	1,X	4
Fish Pond Drain	Donalsonville	Fishing	NS	FC	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy for the basin.	7	X	4
Spring Creek	Downstream Arlington & Colquitt	Fishing	PS	FC	UR	EPD will address nonpoint source (urban runoff) through a watershed protection strategy for the basin.	35	X	4

Codes

Status Codes

S	=	Supporting Designated Uses
PS	=	Partially Supporting Designated Uses
NS	=	Not Supporting Designated Uses

Criterion Violated Codes

Bio	=	Biota Impacted
Cu	=	Copper
DO	=	Dissolved Oxygen
FC	=	Fecal Coliform Bacteria
Pb	=	Lead
Tox	=	Toxicity Indicated
Zn	=	Zinc

Potential Cause Codes

CSO	=	Combined Sewer Overflow
I1	=	Industrial Facility
M	=	Municipal Facility
NP	=	Nonpoint Sources/Unknown Sources
UR	=	Urban Runoff/Urban Effects