In This Section

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

Section 4

Water Quality: Environmental Stressors

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

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

4.1 Sources and Types of Environmental Stressors

This section describes the major potential sources of environmental stressors within the Coosa River basin. These sources include point source discharges, nonpoint source contributions from land-use activities, and temperature and flow modifications. The sources are discussed by type, which provides a match to regulatory lines of authority for permitting and management.

4.1.1 Point Sources and Non-discharging Waste Disposal Facilities

Point sources are defined as the 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 be discharged at relatively stable rates, and permitted storm water discharges, which tend to be discharged at highly irregular, intermittent rates, depending on precipitation. Nondischarging waste disposal facilities, including land application systems and landfills, which are not intended to discharge wastewater effluent to surface waters, are also discussed in this section.

NPDES Permitted Wastewater Discharges

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

Table 4-1 displays the major municipal wastewater treatment plants with permitted discharges of 1 million gallons per day (MGD) or greater in the Coosa River basin. (Tennessee reports no upstream NPDES permits for discharges to surface water within the Coosa River basin.) The geographic distribution of dischargers is shown in Figure 4-1. In addition, there are discharges from a variety of smaller wastewater treatment plants, including both public facilities (small public water pollution control plants, schools, marinas, etc.) and private facilities (package plants associated with nonsewered developments and mobile home parks) with less than a 1-MGD flow. These minor discharges might have the potential to cause localized stream impacts, but they are relatively insignificant from a basin perspective. Approximately 130 MGD of treated wastewater is currently discharged from water pollution control plants in Georgia into the Coosa River or tributaries by permitted point source discharges, including municipal and industrial sources, but excluding non-contact cooling water from power generation. Almost 78 percent of the Georgia discharges occur in the Etowah River drainage (HUC 03150104) or in the Rome area (HUC 03150105). While the river provides a means to assimilate these treated wastewaters, the discharges are sources of a variety of environmental stressors which must be regulated and controlled to prevent degradation of the receiving water.

Municipal Wastewater Discharges

Municipal wastewater treatment plants are among the most significant point sources regulated under the NPDES program in the Coosa River basin, accounting for about 78 percent of the total point source effluent flow (exclusive of cooling water). These plants collect, treat, and release large volumes of treated wastewater. Pollutants associated with treated wastewater include pathogens, nutrients, oxygen-demanding waste, metals, and chlorine residuals. Over the past several decades, Georgia has invested more than $170 million in construction and upgrade of municipal water pollution control plants in the Coosa River basin. A summary of these investments is provided in Appendix C. These upgrades have resulted in significant reductions in pollutant loading and consequent improvements in downstream water quality. As of the 1996-1997 water quality assessment, only three segments (38 miles) of river/streams were identified in which municipal discharges contributed to not fully supporting designated uses, all of which are being addressed through the NPDES permitting process.

Most urban wastewater treatment plants also receive industrial process and non-process wastewater, which can contain a variety of conventional and toxic pollutants. Approximately 80 percent of the flow to the Trion WPCP is attributed to process water from a textile mill. The control of industrial pollutants in municipal wastewater is addressed through pretreatment programs. The major publicly owned wastewater treatment plants in this basin have developed and implemented approved local industrial pretreatment programs. Through these programs, the wastewater treatment plants are required to establish effluent limitations for their significant industrial dischargers (those which discharge in excess of 25,000 gallons per day of process wastewater or are

Table 4-1. Major Municipal Wastewater Treatment Plant Discharges with Permitted Monthly Average Flows Greater than 1MGD in the Coosa River Basin

NPDES Permit #	Facility Name	Authority	County	Receiving Stream	Permitted Monthly Average Flow (MGD)	Approved Expansions (MGD)
HUC 03150101 (Conasauga River Basin)						
GA0032492	Chatsworth WPCP	Chatsworth	Murray	Holly Creek, trib. Conasauga River	3.0	
HUC 03150102 (Coosawatee River Basin)						
GA0021369	Ellijay WPCP	Ellijay	Gilmer	Coosawattee River	2.5	
HUC 03150103 (Oostanaula River Basin)						
GA0030333	Calhoun WPCP	Calhoun	Gordon	Oostanaula River	12.00	16.0
HUC 03150104 (Etowah River Basin)						
GA0024091	Cartersville WPCP	Cartersville	Bartow	Etowah River	12.1	15.0
GA0025674	Canton WPCP	Canton	Cherokee	Etowah River	1.89	
GA0046451	Cherokee Co. Rose Creek WPCP	Cherokee Co.	Cherokee	Etowah River Arm of Lake Allatoona	4.0	
GA0024988	Noonday Water Reclamation Fac.	Cobb Co.	Cobb	Noonday Crk. trib. Lake Allatoona	12.0	
GA0046761	Northwest Water Reclamation Fac.	Cobb Co.	Cobb	Etowah River Arm of Lake Allatoona	4.0	
GA0026026	Dallas West WPCP	Dallas	Paulding	Weaver Creek trib.	0.9	
GA0026042	Rockmart WPCP	Rockmart	Polk	Euharlee Creek	3.0	
HUC 03150105 (Coosa River below Rome and Chattooga River Basin)						
GA0024074	Cedartown WPCP	Cedartown	Polk	Cedar Creek	3.5	
GA0024112	Rome WPCP	Rome	Floyd	Coosa River	18.0	
GA0024341	Rome Coosa WPCP	Rome	Floyd	Coosa River	2.0	
GA0025607	Trion WPCP	Trion	Chattooga	Chattooga River	5.0	
GA0025704	Summerville WPCP	Summerville	Chattooga	Chattooga River	2.0	
GA0025712	LaFayette WPCP	LaFayette	Walker	Chattooga Creek	3.5	5.0

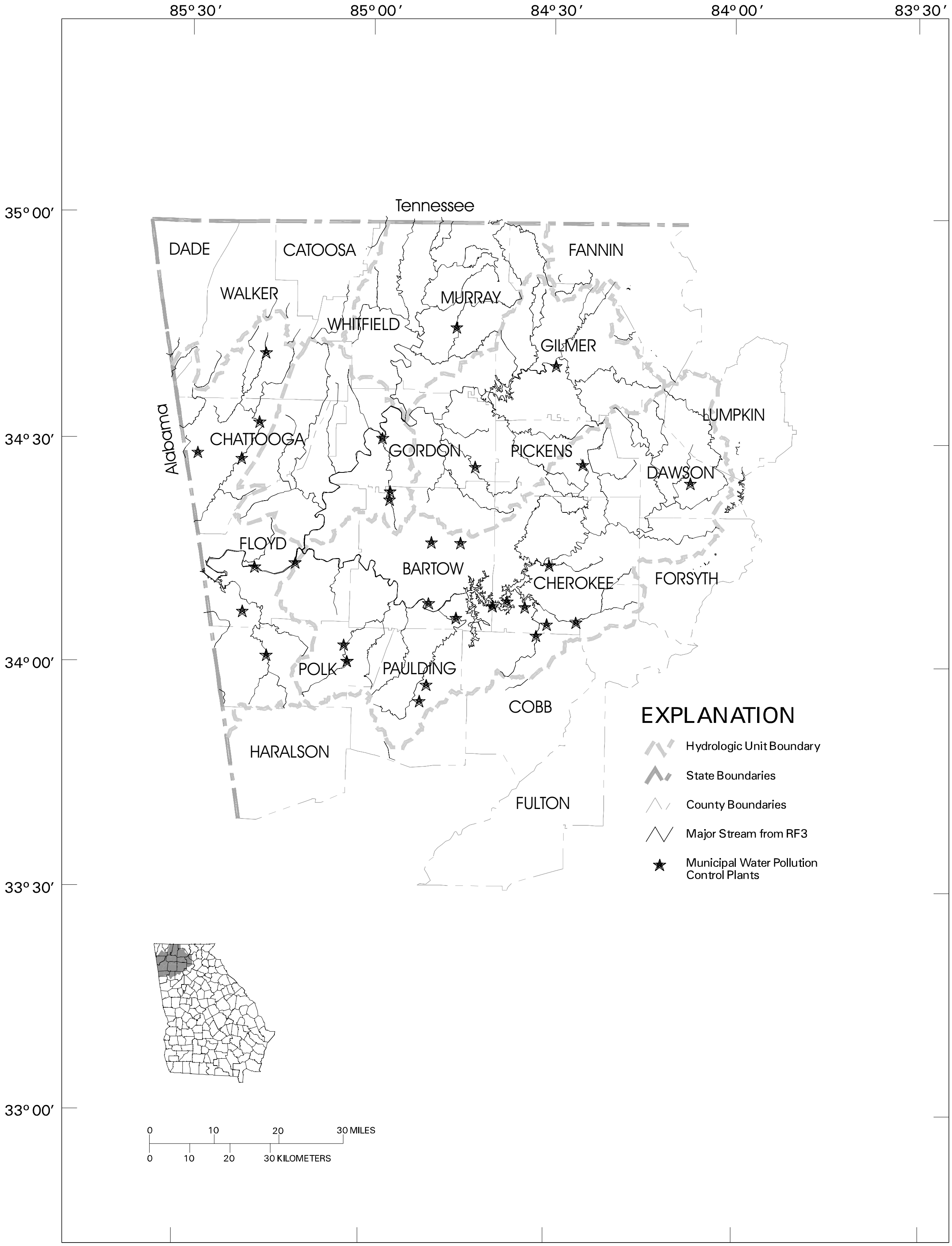

Figure 4-l. Location of Municipal Wastewater-Treatment Plants in the Coosa River Basin

regulated by a Federal Categorical Standard) and to monitor the industrial user's compliance with those limits. The treatment plants are able to control the discharge of organics and metals into their sewerage system through the controls placed on their industrial users.

Industrial Wastewater Discharges

Industrial and federal wastewater discharges are also significant point sources regulated under the NPDES program. There are a total of 103 permitted municipal, state, federal, private, and industrial wastewater and process water discharges in the Coosa River basin, as summarized in Table 4-2. The complete permit list is summarized in Appendix D.

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

HUC	Major Municipal Facilities	Major Industrial and Federal Facilities	Minor Public Facilities	Minor Private and Industrial Facilities	*Total*
03150101	1	0	2	17	*20*
03150102	1	0	0	1	*2*
03150103	1	2	1	6	*10*
03150104	7	1	9	39	*56*
03150105	6	4	1	4	*15*
TOTAL	*16*	*7*	*13*	*67*	*103*

The flow rates for industrial dischargers in the Coosa basin are relatively low. However, the nature of industrial discharges varies widely compared to discharges from municipal plants. 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 from facilities such as power plants, pit pumpout and surface runoff from mining and quarrying operations, 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. Georgia's 1996-1997 water quality assessment report identified 3 segments (5 miles) of river/streams in the Georgia portion of the basin where permitted industrial discharges contributed to a failure to support designated uses. These segments are being addressed through the NPDES permitting process. Table 4-3 lists the major industrial and federal wastewater treatment plants with discharges into the Coosa River basin in Georgia.

There are also 67 minor industrial and private discharges which may have the potential to cause localized stream impacts, but these are relatively insignificant from a basin perspective. The locations of permitted point source discharges of treated wastewater in the Coosa River basin are shown in Figures 4-2 through 4-6.

Combined Sewer Overflows

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

Table 4-3. Major Industrial NPDES Facilities in the Coosa River Basin

NPDES Permit #	Facility Name	Description	Flow and Load	Receiving Stream
HUC 03150103: Oostanaula River Basin				
GA0000329	Goodyear Tire Co., Gordon Co.	Wastewater from rubber and rubber products manufacture	Average 0.16 MGD BOD-5: 46 lb/day TSS: 45 lb/day Ammonia: 21 lb/day	Oothkalooga River
GA0024155	GE Co., Rome, Floyd Co.	Treated storm water runoff	Average 0.8 MGD PCBs: 0.013 lb/day	Horse Creek, Little Dry Creek
HUC 03150104: Etowah River Basin				
GA0001449	Georgia Power, Plant Bowen, Bartow Co.	Wastewater from power generation by coal and oil	Average 17.5 MGD BOD-5: 4,378.5 lb/day TSS: 4,378.5 lb/day Arsenic: 0.22 lb/day Copper 6.13 lb/day Selenium 0.267 lb/day	Euharlee Creek, Etowah River
HUC 03150105: Coosa River Basin below Rome and Chattooga River Basin				
GA0001708	Georgia Specialty Chemicals, Polk Co.	Wastewater from manufacture of organic chemicals	Average 2.3 MGD BOD-5: 135 lb/day TSS: 141 lb/day Ammonia: 66 lb/day	Cedar Creek, Big Spring Creek
GA0001104	Inland Container Corp., Floyd Co.	Wastewater from manufacture of pulp and paper.	Average 26.0 MGD BOD-5: 13,400 lb/day TSS: 32,000 lb/day	Smith Cabin Creek
GA0001457	Georgia Power, Plant Hammond, Floyd Co.	Cooling water from steam electric power generation	Average 580 MGD No significant pollutant loads.	Coosa River
GA0024104	Mohawk Carpets, Chattooga Co.	Wastewater from manufacture of carpets.	Average 3.0 MGD BOD-5: 400 lb/day TSS: 2,350 lb/day Chromium: 8.5 lb/day	Chattooga River

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

CSOs are considered a point source of pollution and are subject to the requirements of the Clean Water Act. Although CSOs are not required to meet secondary treatment effluent limits, sufficient controls are required to protect water quality standards for the designated use of the receiving stream. In the 1990 session of the Georgia Legislature, a CSO law was passed requiring all Georgia cities to eliminate or treat CSOs. There are two cities in the Coosa River basin that formerly had CSOs: the City of Rome and the City of Cedartown. Both cities have recently completed removal of their CSOs, as described below.

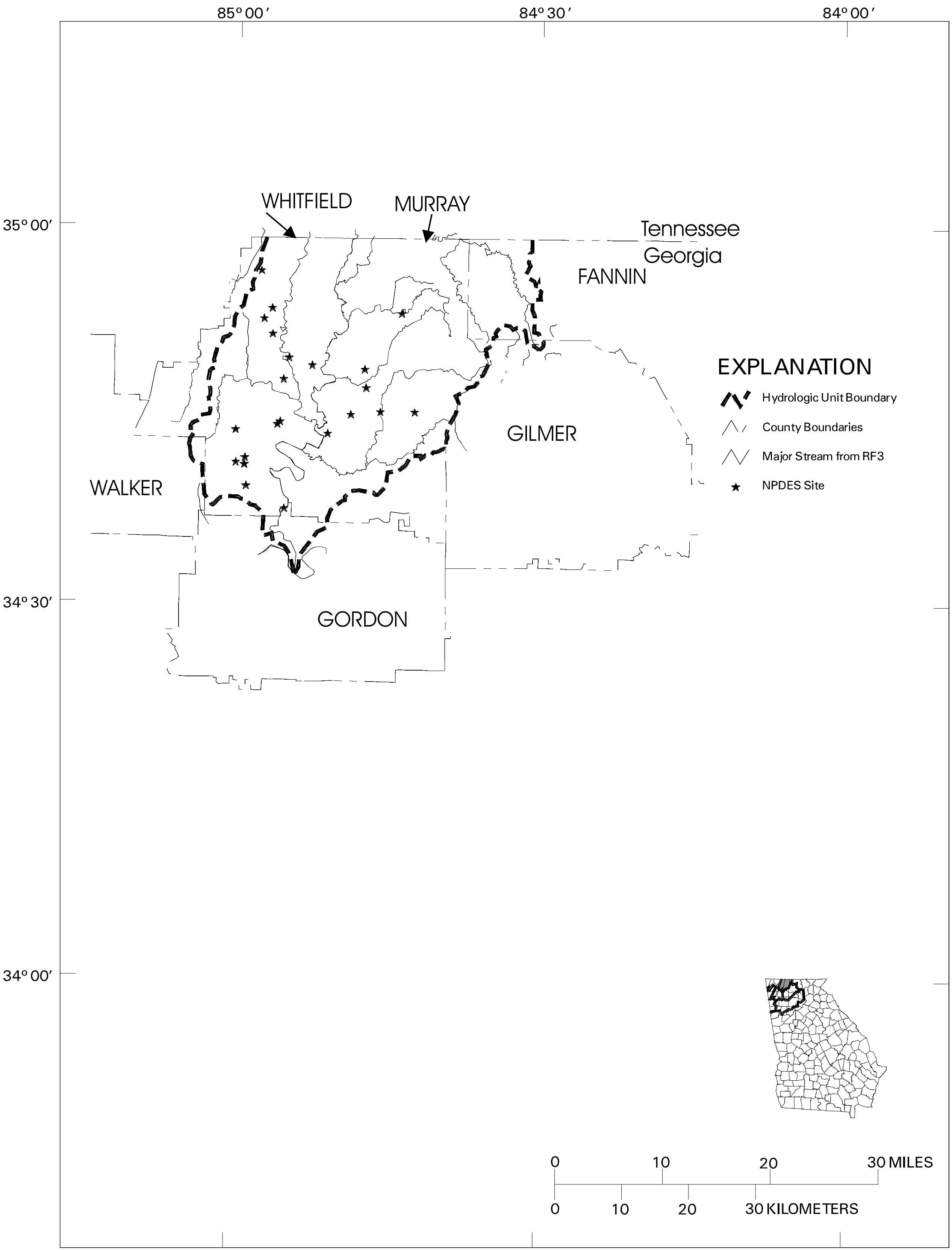

Figure 4-2. NPDES Sites Permitted by GAEPD, Coosa River Basin, HUC 03150101

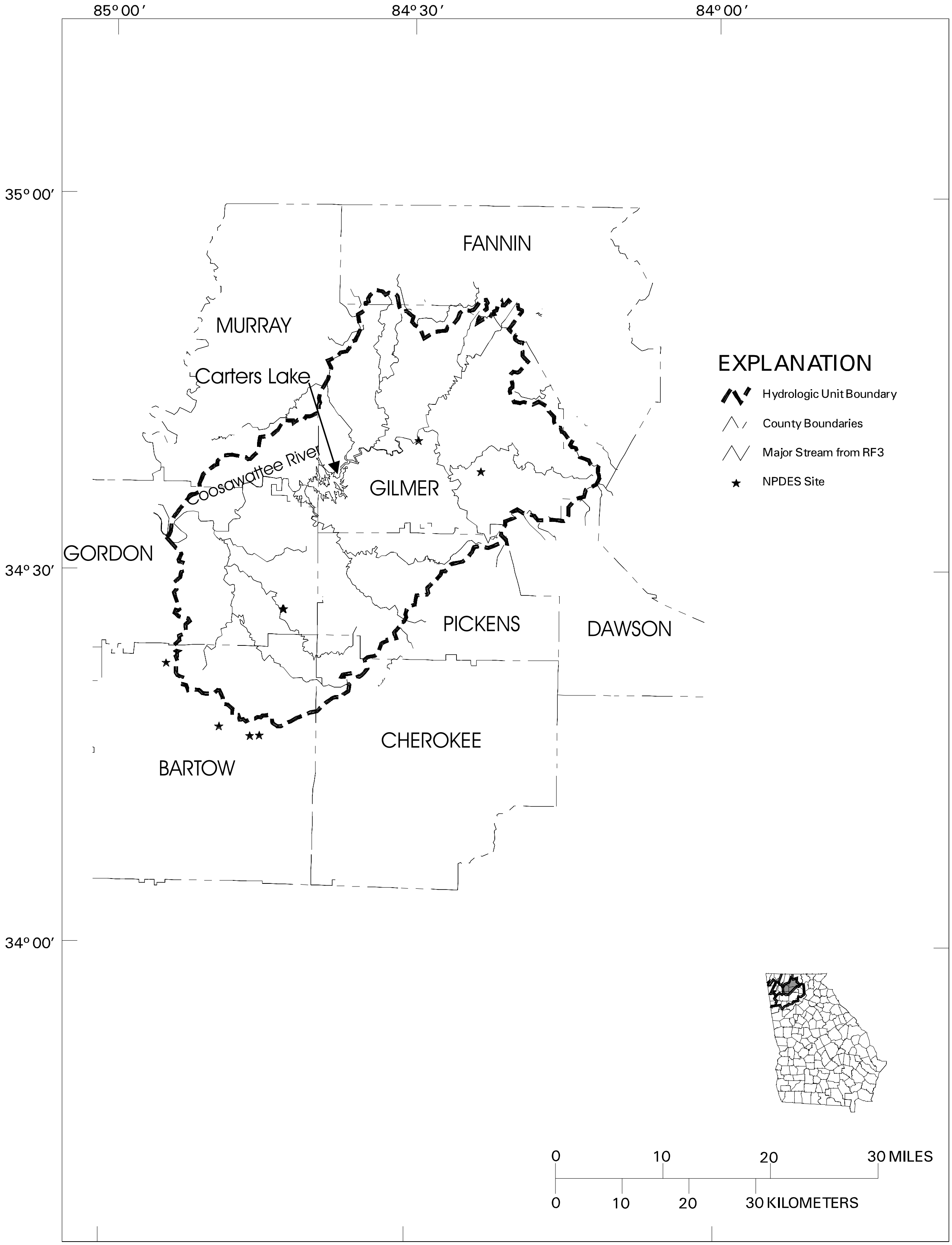

Figure 4-3. NPDES Sites Permitted by GAEPD, Coosa River Basin, HUC 03150102

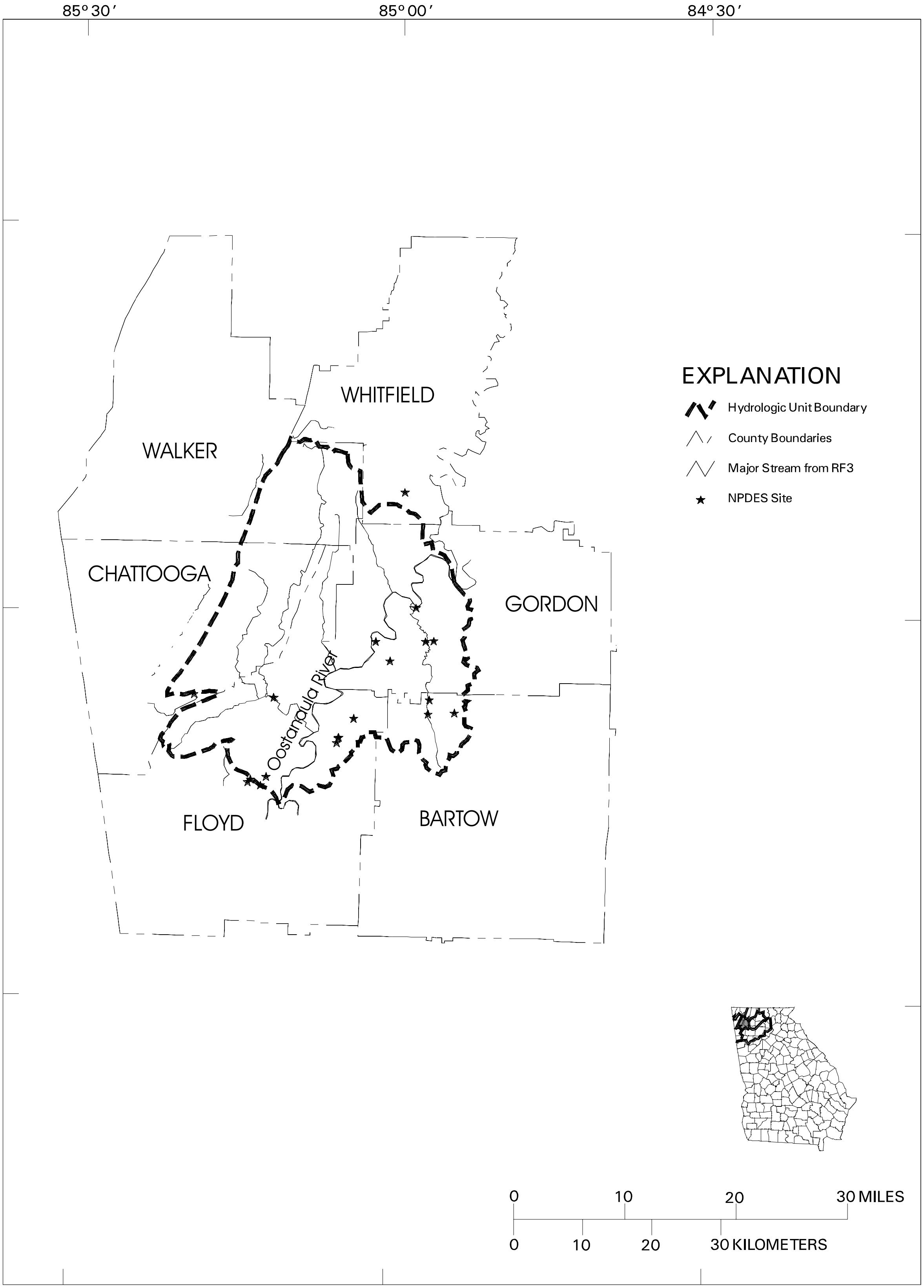

Figure 4-4. NPDES Sites Permitted by GAEPD, Coosa River Basin, HUC 03150103

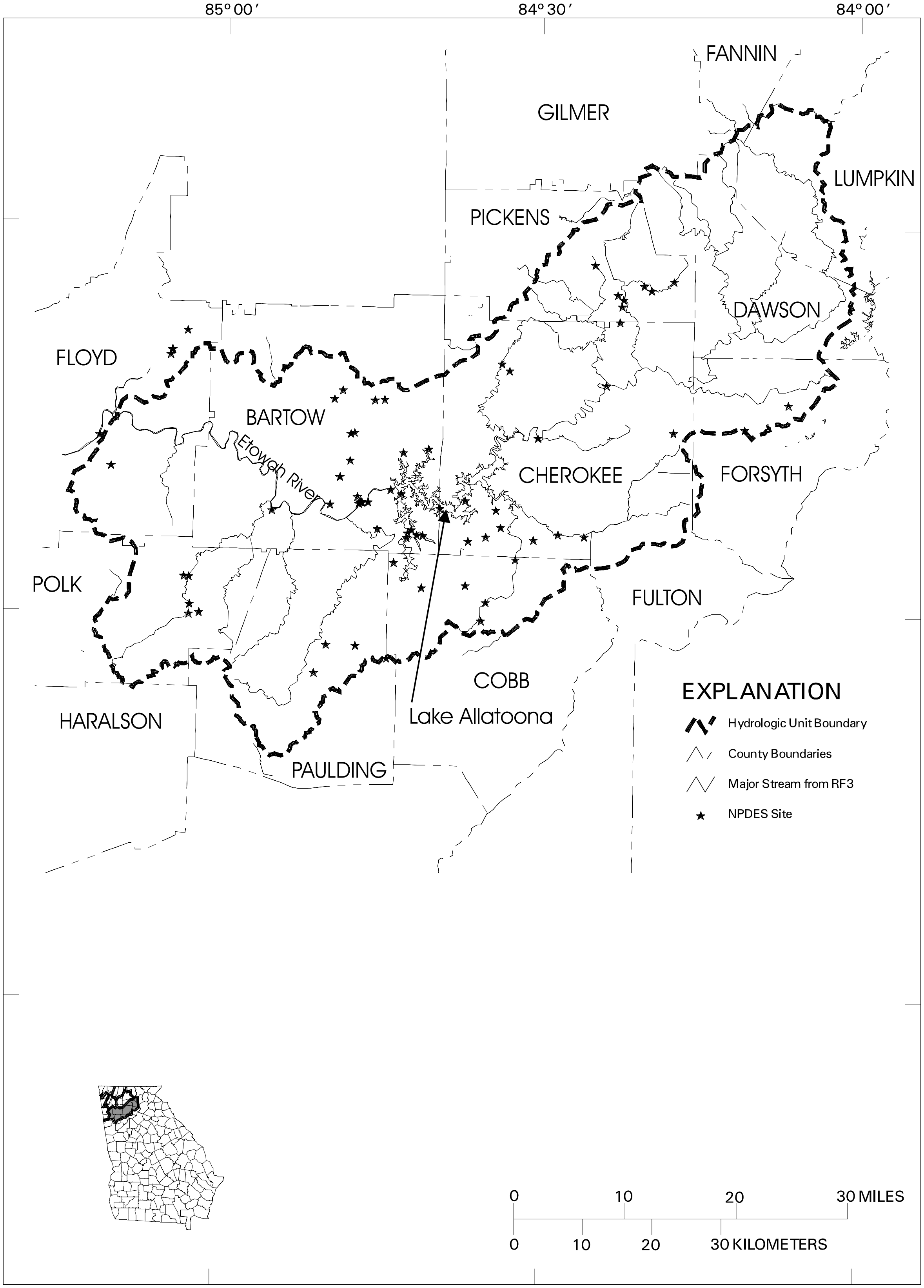

Figure 4-5. NPDES Sites Permitted by GAEPD, Coosa River Basin, HUC 03150104

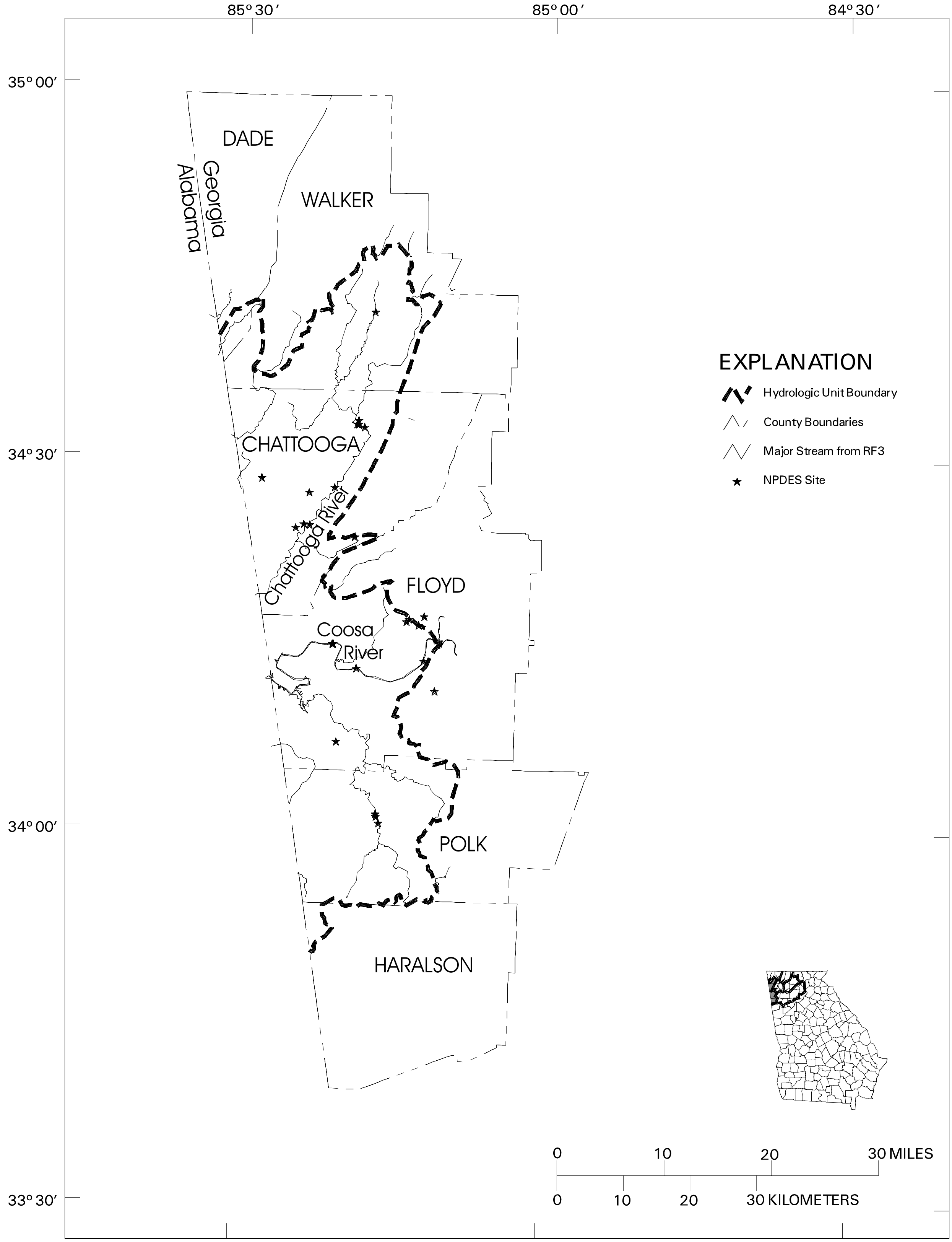

Figure 4-6. NPDES Sites Permitted by GAEPD, Coosa River Basin, HUC 03150105

Cedartown CSOs

The City of Cedartown began studying their CSOs in the late 1980s. Following the 1990 legislative action, the City of Cedartown developed a CSO control plan to eliminate overflow points within the sewage collection system into Cedar Creek. The CSO control plan identified four CSO overflow points. CSOs No. 1, 2 and 3 were located south of West Girard Avenue and north of Optimist Field adjacent to the Cedar Creek. CSO No. 4 was located near West Ave. And Cedar Creek. The CSO control plan proposed to physically eliminate the overflows by plugging the overflow pipes. On November 2, 1992 the City of Cedartown eliminated all four CSO overflows. On February 10, 1995 the CSO NPDES Permit No. GA0036846 for the City of Cedartown CSOs was rescinded by EPD.

Rome CSOs

The City of Rome began studying their CSOs in the early 1990s. Following the 1990 legislative action, the City of Rome developed a CSO control plan that involved the elimination of overflow points within the sewage collection system into the Etowah River and the Oostanaula River. The City identified six CSOs:

CSO No. 1 - 6th Avenue at Glenn Miller Boulevard adjacent to the Etowah River

CSO No. 2 - 2nd Avenue adjacent to the Etowah River

CSO No. 3 - 4th Street adjacent to the Etowah River

CSO No. 4 - 2nd Street at Southeastern Mills adjacent to the Etowah River

CSO No. 5 - 2nd Avenue adjacent to the Oostanaula River

CSO No. 6 - 6th Avenue at West 2nd Street adjacent to the Oostanaula River

After evaluating several CSO control options, the City of Rome chose to separate the storm and sanitary flows and then to transport the sanitary flow to a wastewater treatment facility.

On August 29, 1996 the City of Rome completed the CSO separation of all six CSOs. The City spent $2.5 million on these modifications and agreed to a negotiated settlement of $26,500 in accordance with the Consent Order No. EPD-WQ-3212. On September 20, 1996, the NPDES Permit No. GA0036862, Administrative Order No. EPD-WQ-1871 and Consent Order EPD-WQ-3212 was rescinded by EPD.

NPDES Permitted Storm Water Discharges

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

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

Municipal Storm Water Discharges

In accordance with Federal "Phase I" storm water regulations, the state of Georgia has issued individual areawide NPDES municipal separate storm sewer system (MS4) permits to 58 cities and counties in municipal areas with populations greater than 100,000 persons. Permits in the Coosa basin are shown in Table 4-4.

Industrial Storm Water Discharges

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

EPD has issued one general permit regulating storm water discharges for 10 of 11 federally regulated industrial subcategories. The 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 storm water pollution prevention plan; and, in some cases, the monitoring of storm water discharges from the facility. As with the municipal storm water permits, implementation of site-specific best management practices is the preferred method for controlling storm water runoff. As of March 1998, 369 NOIs had been filed for the Coosa basin. The distribution of NOIs by HUC is as follows:

HUC 03150101 (Conasauga River Basin)	116
HUC 03150102 (Coosawattee River Basin)	16
HUC 03150103 (Oostanaula River Basin)	43
HUC 03150104 (Etowah River Basin)	150
HUC 03150105 (Mainstem Coosa below Rome and Chattooga River Basin)	44

Nondischarging Waste Disposal Facilities

Land Application Systems (LASs)

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

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

Table 4-4. Permitted Municipal Separate Storm Sewer Systems, Coosa River Basin

Permittee	Permit #	Contact	Address	City	ZIP	County	Type	Issued	Expires	HUC
Acworth	GAS000101	Ms. Frana Brown, City Clerk	4375 Senator R. B. Russell Square	Acworth	30101	Cobb	Large/Independent	19940615	19990614	03150104 (Etowah)
Alpharetta	GAS000102	Mr. Jarvis Middleton, Public Works Dept.	82 Haynes Bridge Rd.	Alpharetta	30201	Fulton	Large/Independent	19940615	19990614	03150104 (Etowah)
Cobb County	GAS000108	Henry Mingledorff, Cobb County Water System	680 South Cobb Dr., Building 3	Marietta	30060	Cobb	Large/Independent	19940615	19990614	03150104 (Etowah)
Fulton County	GAS000117	Earl Burrell, Public Works Dept.	141 Pryor St., SW, Suite 6001	Atlanta	30303	Fulton	Large/Independent	19940615	19990614	03150104 (Etowah)
Kennesaw	GAS000121	Martin Poole, Public Works Dept.	3080 Moon Station Rd.	Kennesaw	30144	Cobb	Large/Independent	19940615	19990614	03150104 (Etowah)
Marietta	GAS000125	Russell Moorehead, Public Works Dept.	205 Lawrence St.	Marietta	30060	Cobb	Large/Independent	19940615	19990614	03150104 (Etowah)
Roswell	GAS000131	Scott Forward, Engineering Division	38 Hill St., Suite C-50	Roswell	30075	Fulton	Large/Independent	19940615	19990614	03150104 (Etowah)

A total of 128 municipal and 35 industrial permits for land application systems were in effect in Georgia in 1998. Municipal and other major wastewater land application systems (permitted flow greater than 0.01 MGD) within the Coosa Basin are listed in Table 4-5. The locations of all LASs within the basin are shown in Figures 4-7 through 4-11. The only LAS with a flow greater than 1 MGD is Dalton Utilities LAS, which is permitted to land apply up to 40.0 MGD of treated wastewater effluent to its 3,600 acres of spray fields. More than 85 percent of the influent wastewater is industrial process wastewater. Dalton Utilities wastewater treatment processes include preliminary treatment, biological treatment (activated sludge), and secondary clarification. Dalton Utilities also administers and implements a local pretreatment program.

Table 4-5. Wastewater Land Application Systems in the Coosa River Basin

Operator	Location	Permit No.	Permitted Flow (MGD)
HUC 03150101 (Conasauga River Basin)			
Dalton Utilities	Whitfield Co.	GA02-056	40.0
HUC 03150104 (Etowah River Basin)			
DNR Red Top Mountain	Bartow Co.	GA02-237	0.022
Etowah Water and Sewer	Dawson Co.	GA02-232	0.180
Dawsonville LAS	Dawson Co.	GA02-179	0.120
DNR Amicalola Falls LAS	Dawson Co.	GA02-045	0.022
Chestatee Development LAS	Dawson Co.	GA02-192	0.075
Fulton Co. Little River LAS	Cherokee Co.	GA02-170	0.200
Cherokee Little River/Fitz.	Cherokee Co.	GA02-278	0.170
Lake Arrowhead Utility Co.	Cherokee Co.	GA03-819	0.300
Chapel Knoll	Paulding Co.	GA03-944	0.010

Landfills

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

EPD's Land Protection Branch is responsible for permitting and compliance of municipal and industrial Subtitle D landfills. The location of permitted landfills within the basin is shown in Figures 4-12 through 4-16 and Table 4-6.

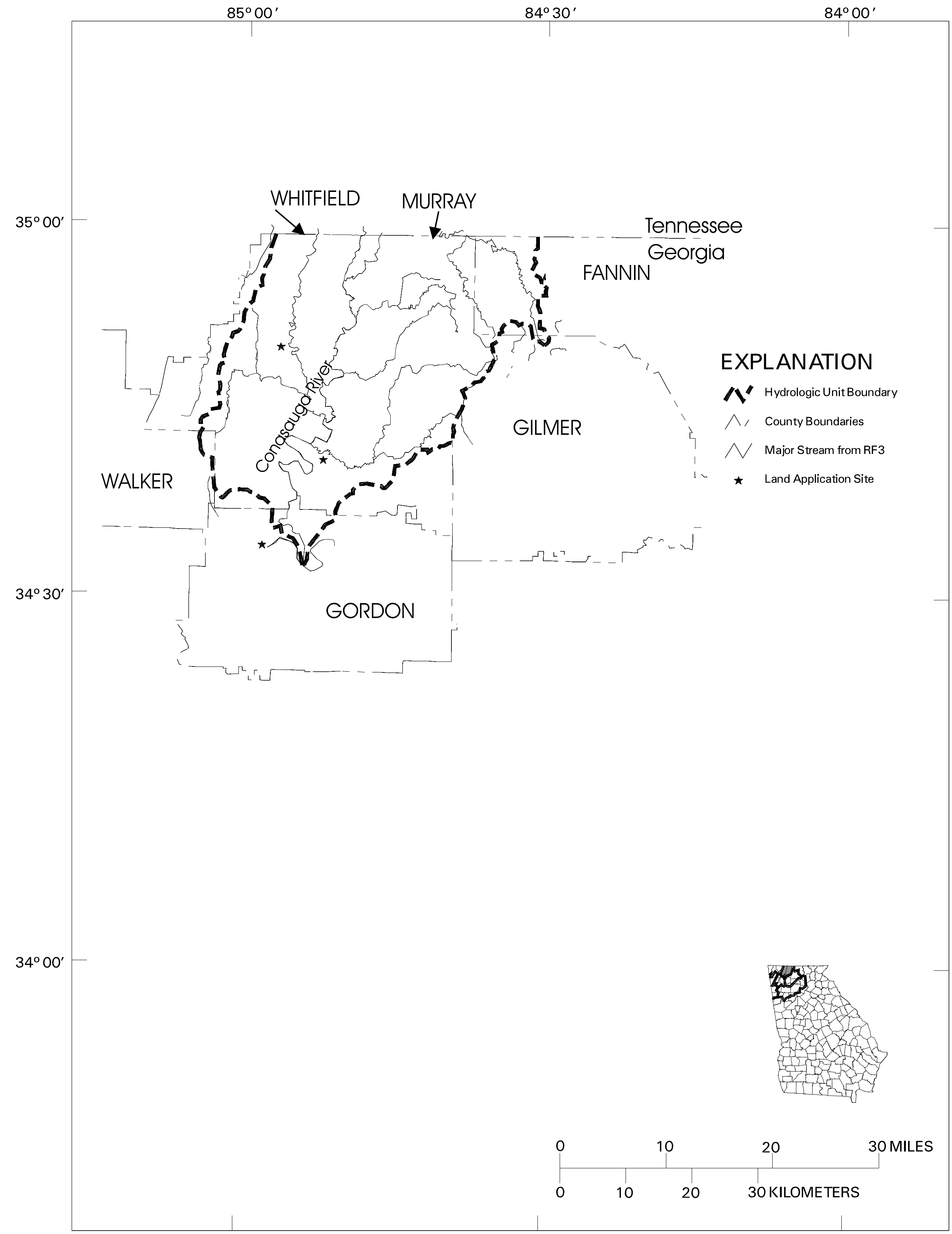

Figure 4-7. Land Application Systems, Coosa River Basin, HUC 03150101

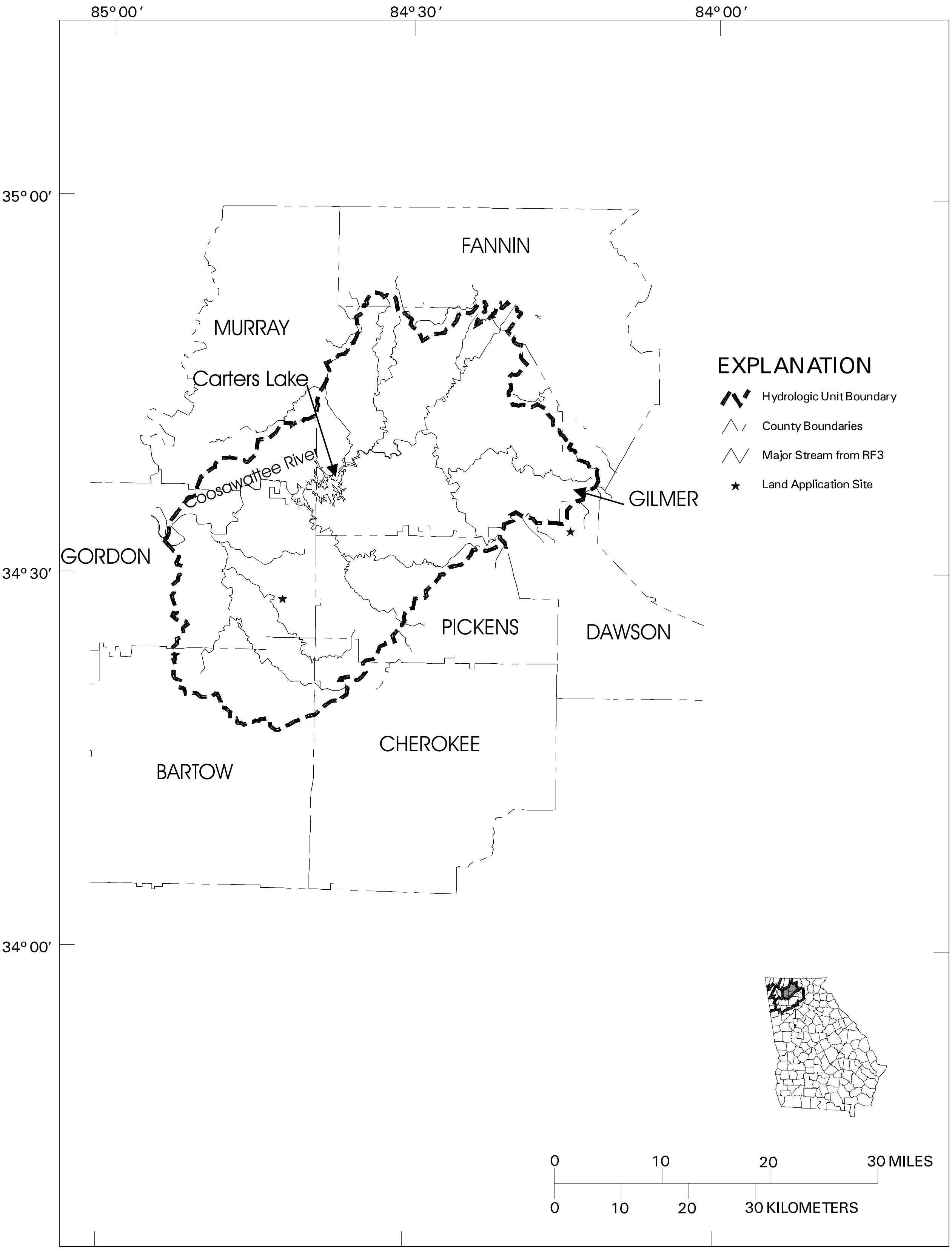

Figure 4-8. Land Application Systems, Coosa River Basin, HUC 03150102

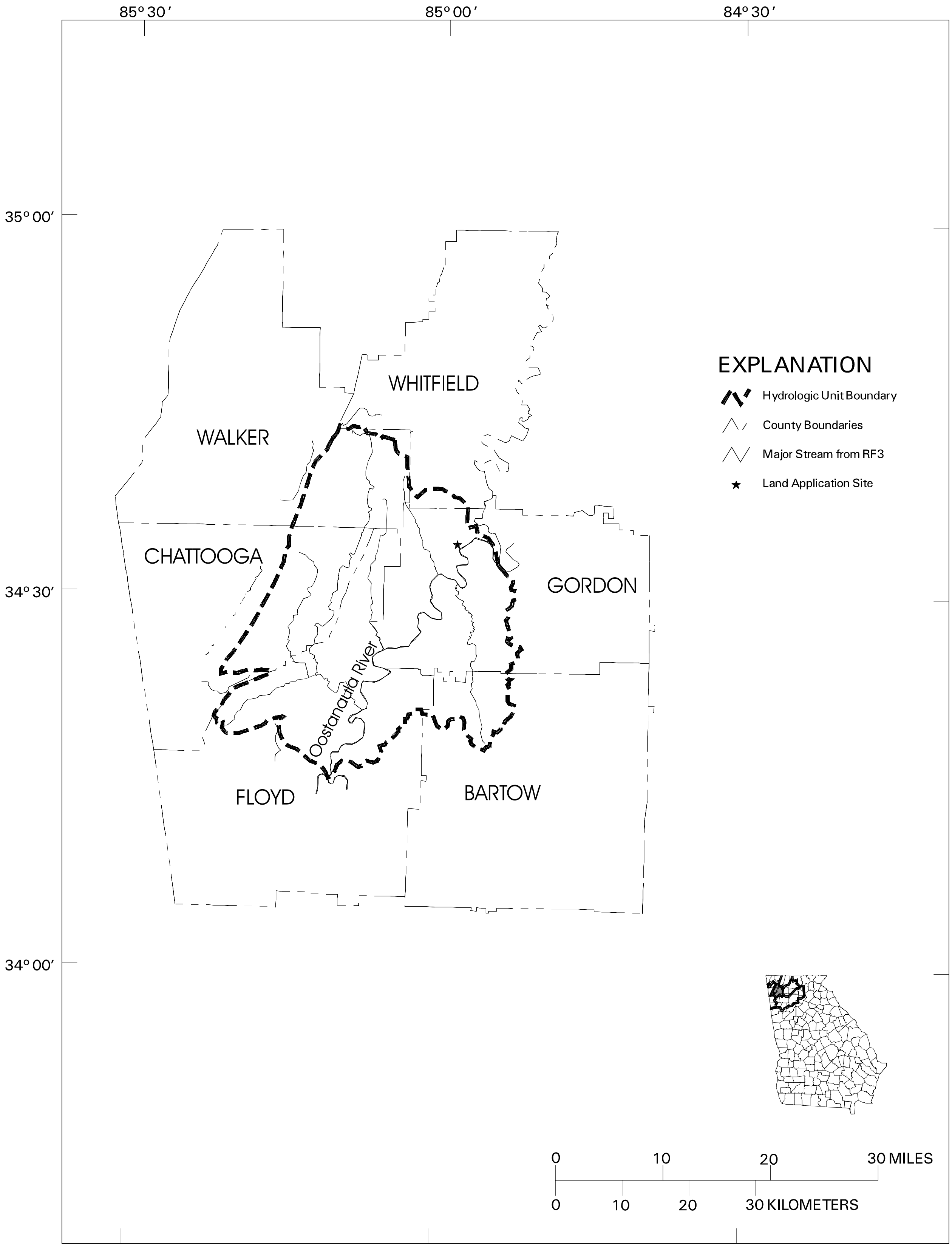

Figure 4-9. Land Application Systems, Coosa River Basin, HUC 03150103

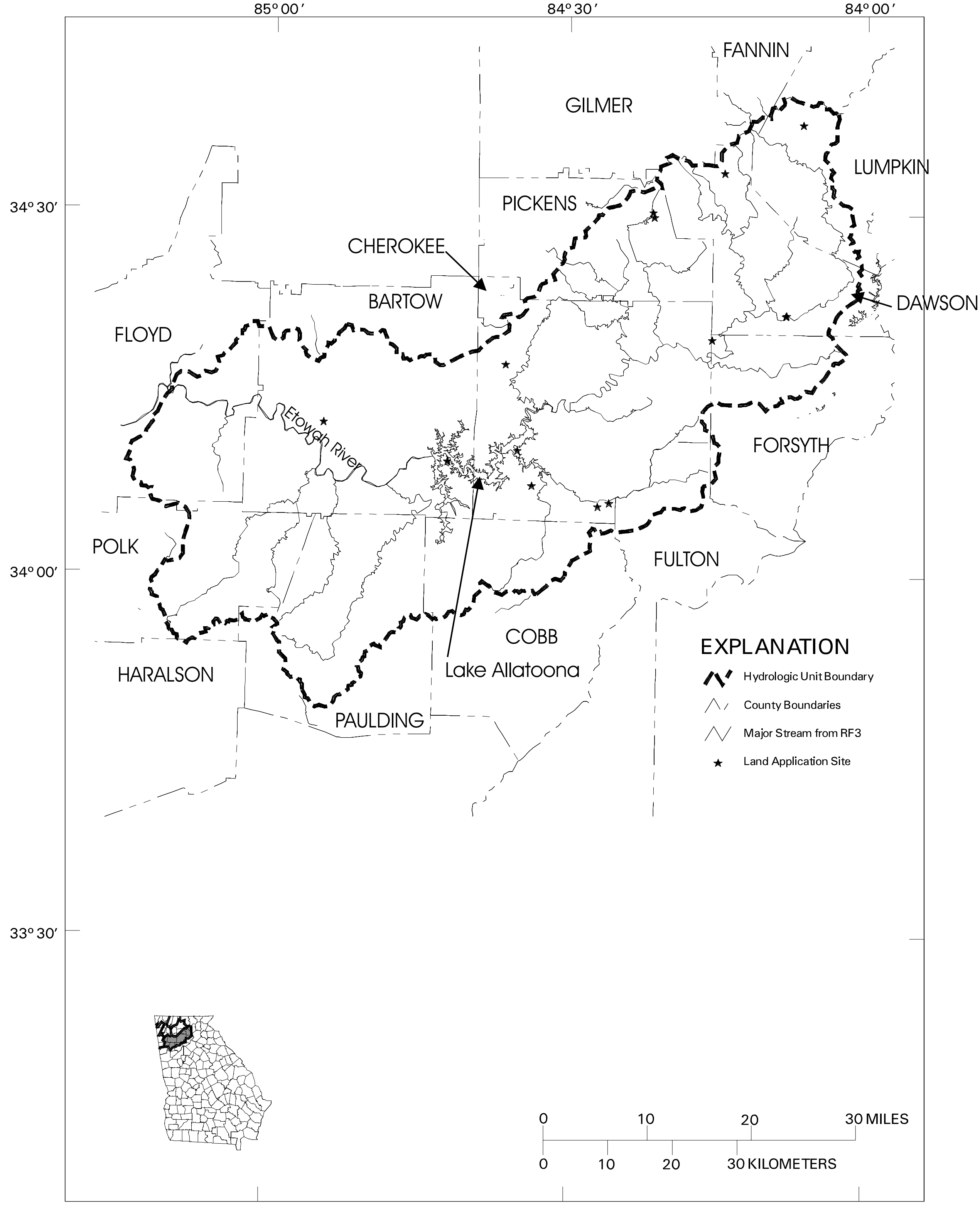

Figure 4-10. Land Application Systems, Coosa River Basin, HUC 03150104

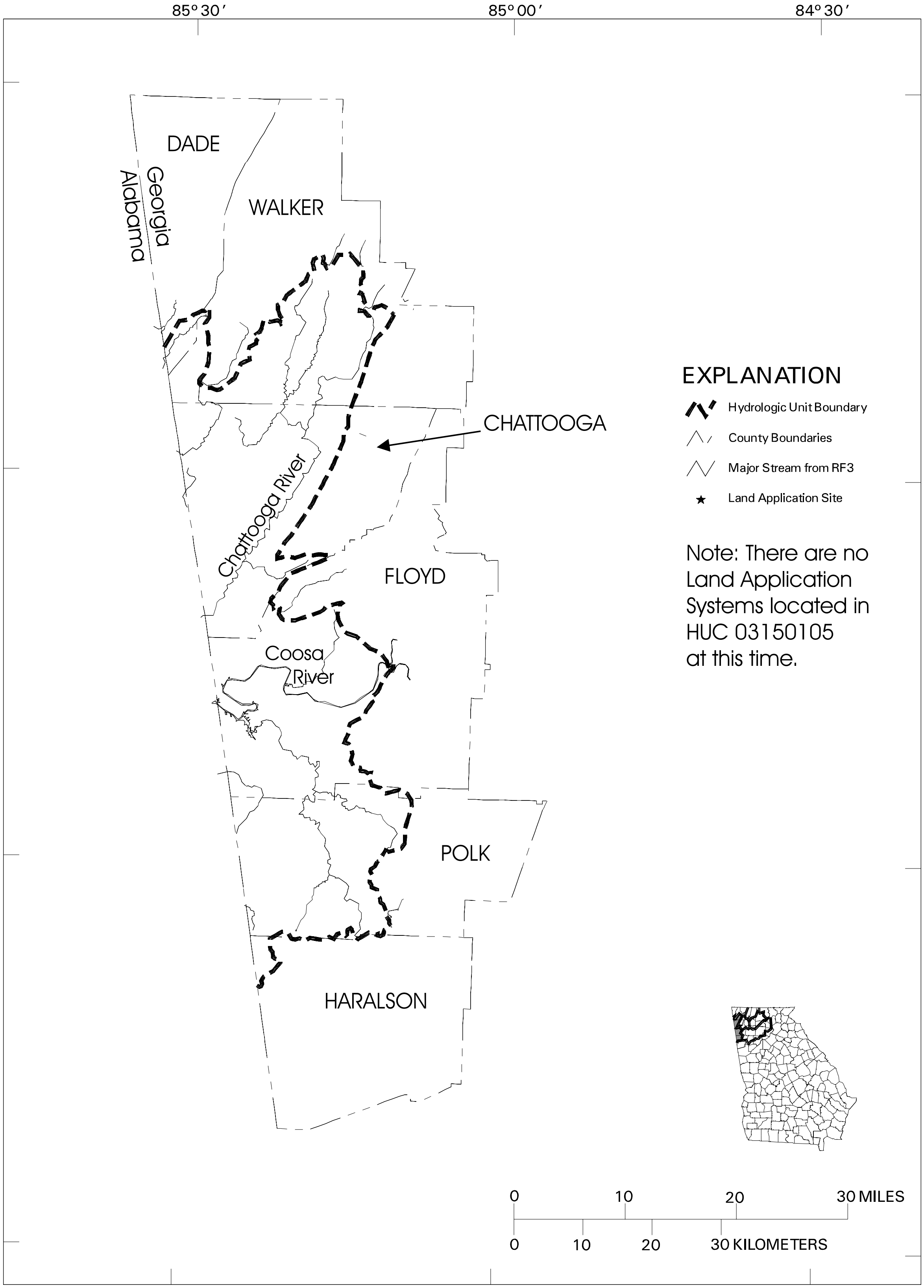

Figure 4-11. Land Application System, Coosa River Basin, HUC 03150105

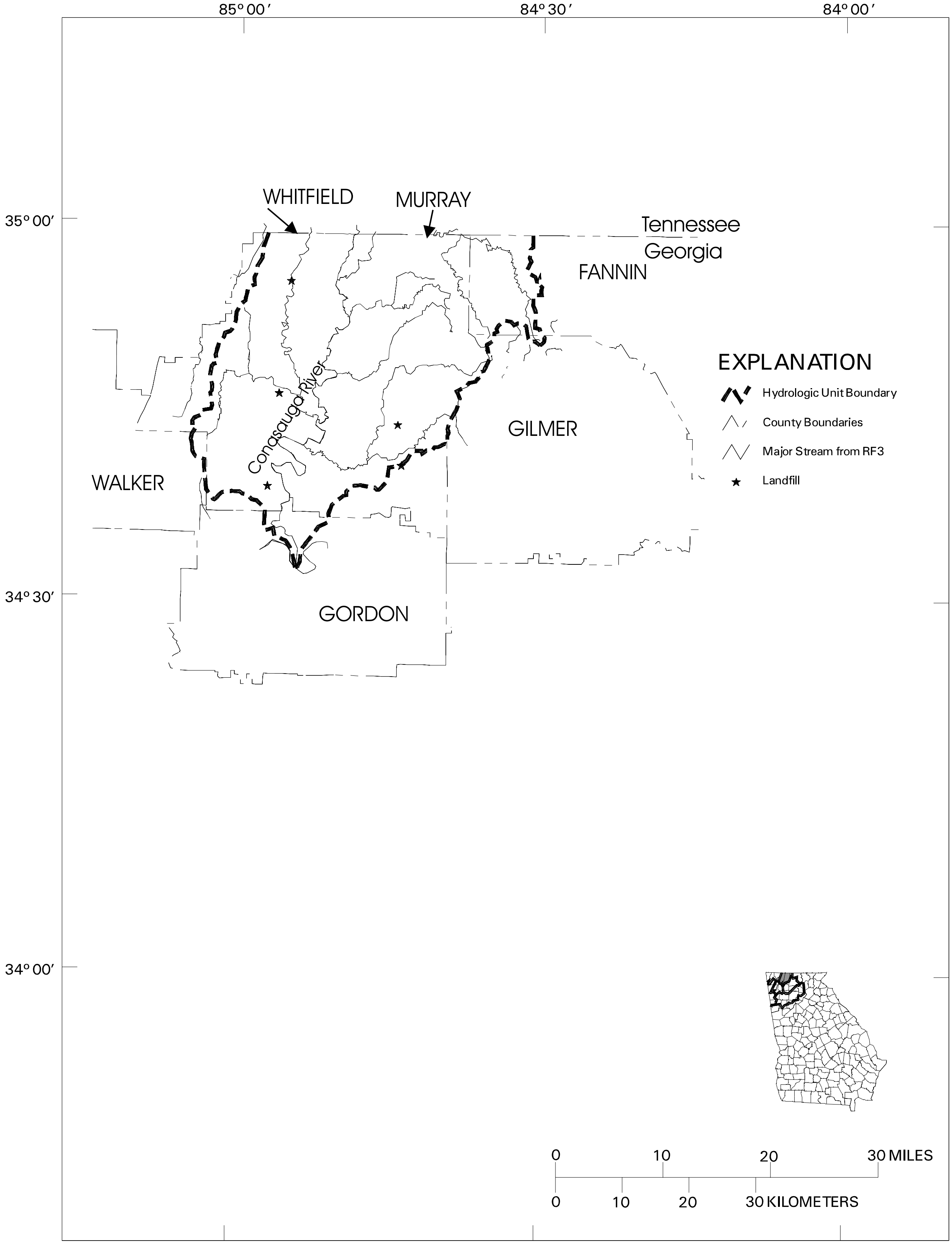

Figure 4-12. Landfills, Coosa River Basin, HUC 03150101

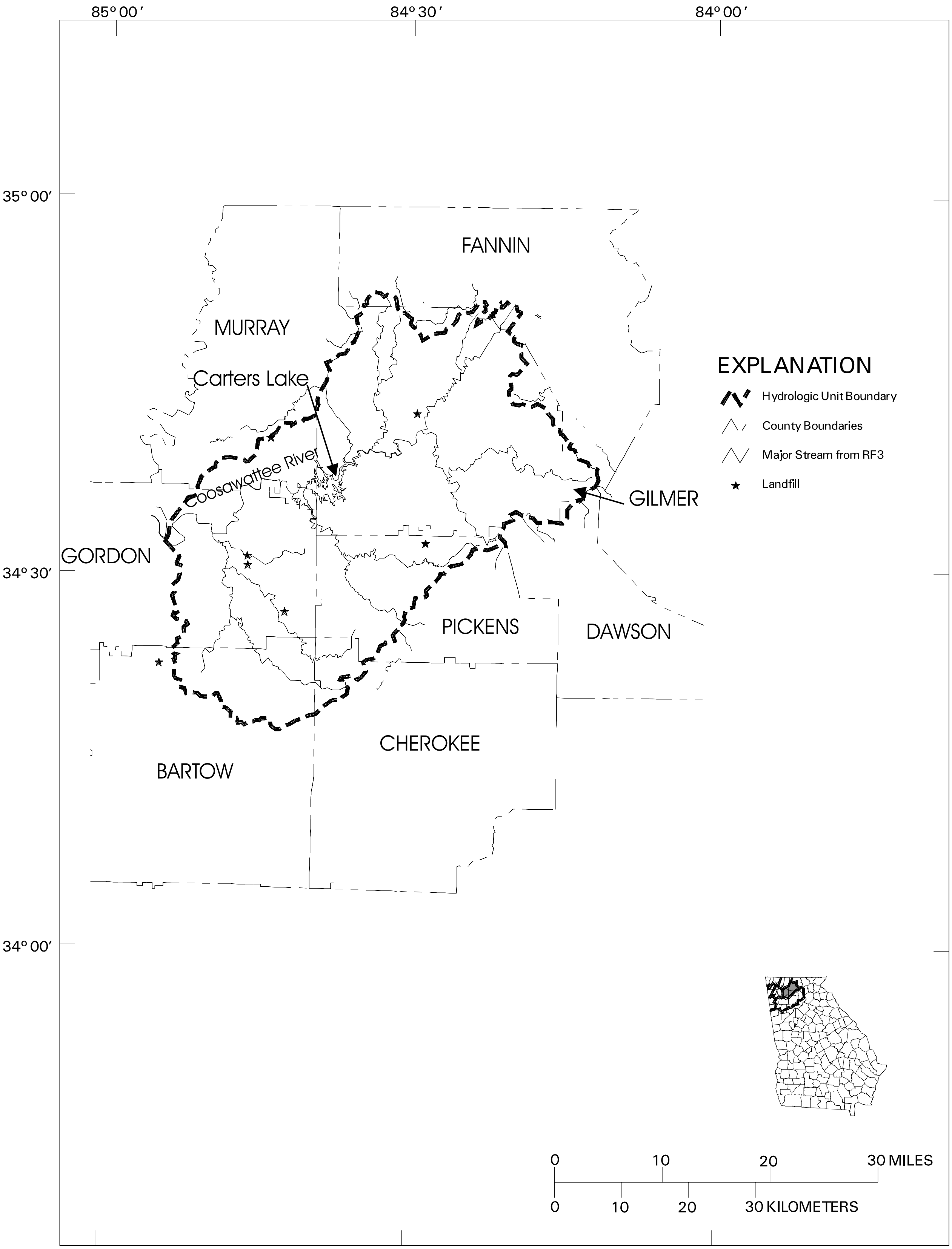

Figure 4-13. Landfills, Coosa River Basin, HUC 03150102

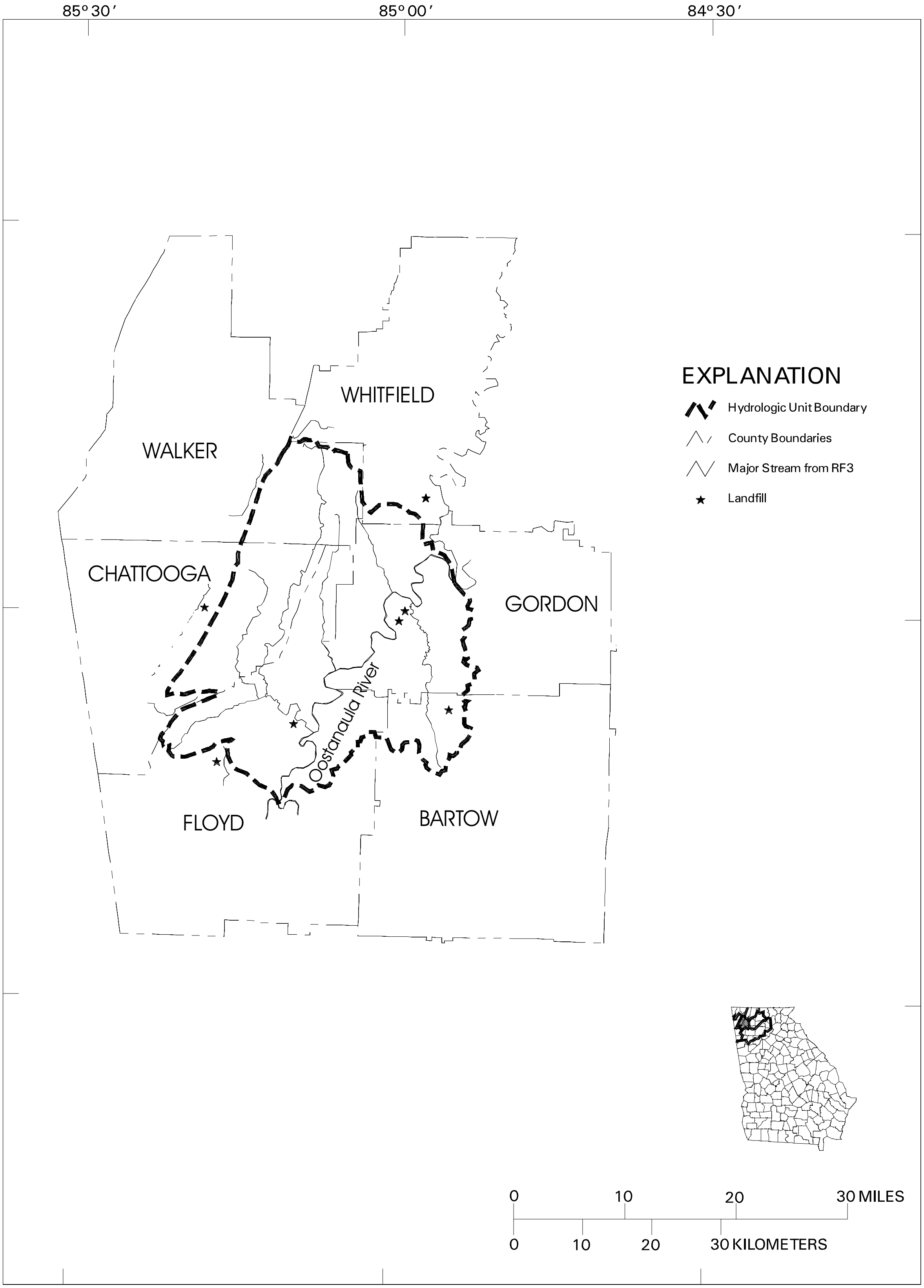

Figure 4-14. Landfills, Coosa River Basin, HUC 03150103

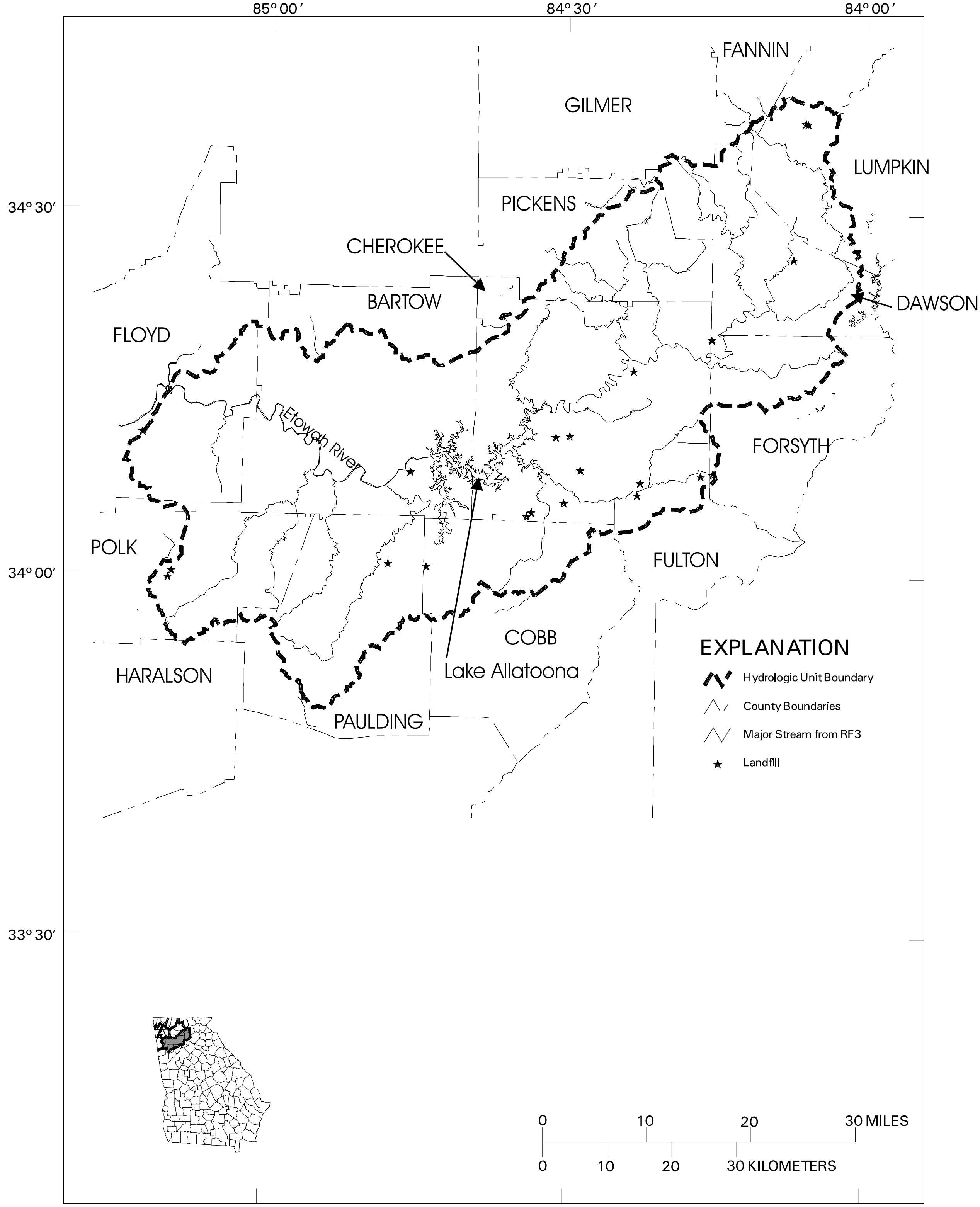

Figure 4-15. Landfills, Coosa River Basin, HUC 03150104

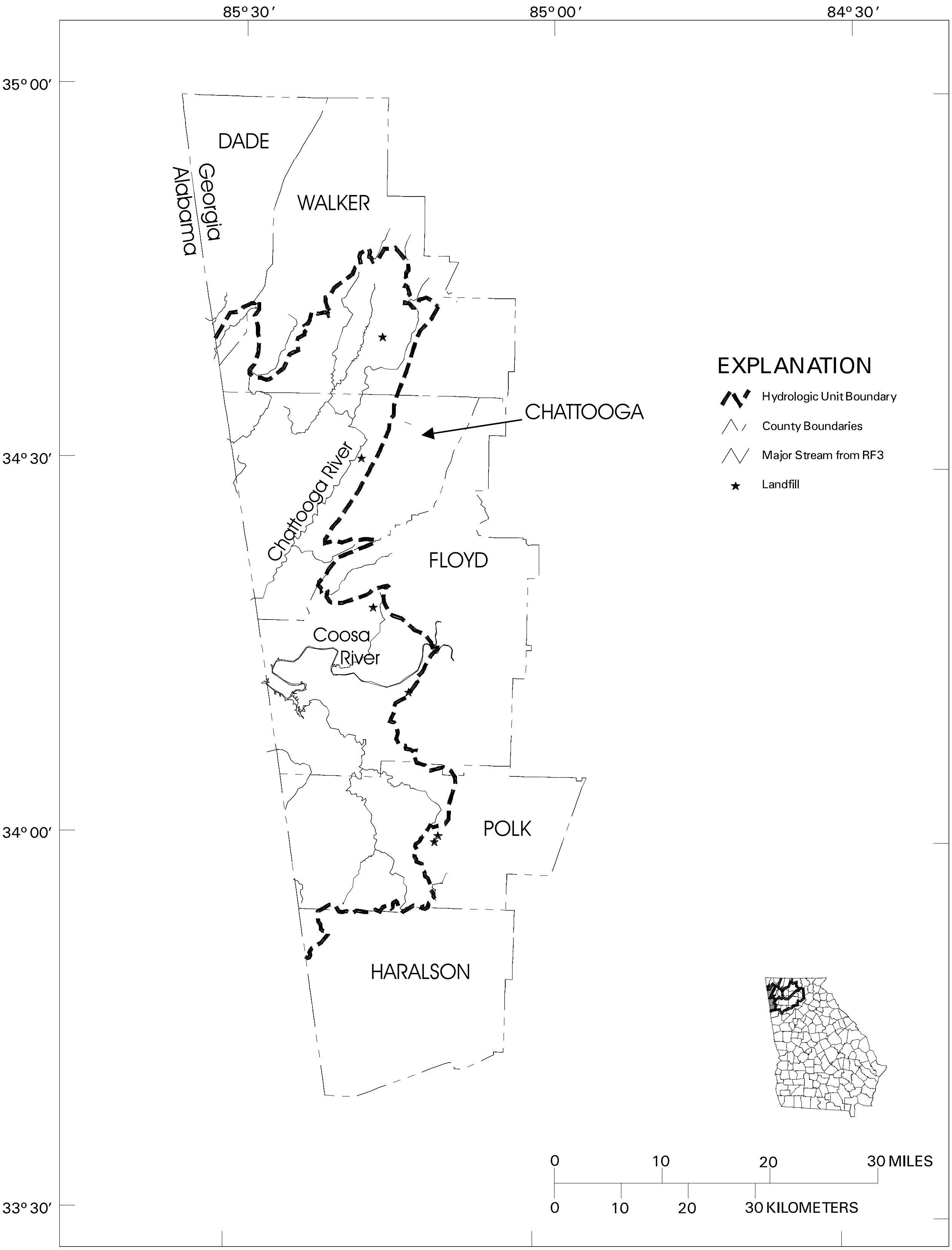

Figure 4-16. Landfills, Coosa River Basin, HUC 03150105

Table 4-6. Permitted Landfills in the Coosa River Basin

PERMIT_NO	NAME	COUNTY	TYPE
HUC 03150101 (Conasauga River Basin)			
105-004D(SL)	US 411 Dennis Mill Rd.	Murray	Sanitary Landfill
155-043D(L)	Dalton - McGaughey Ch/Coahulla	Whitfield	Landfill
155-044D(SL)	Dalton - Old Dixie Hwy PH5	Whitfield	Sanitary Landfill
155-047D(SL)	Whitfield Co. - Old Dixie Hwy.	Whitfield	Sanitary Landfill
155-034D(L)	Dalton - Waugh St. PH1	Whitfield	Landfill
155-037D(L)	Dalton - Waugh St. PH2	Whitfield	Landfill
155-021D(SL)	Dalton - Old Dixie Hwy PH2	Whitfield	Sanitary Landfill
155-027D(SL)	Dalton - Old Dixie Hwy PH4	Whitfield	Sanitary Landfill
HUC 03150102 (Coosawattee River Basin)			
061-010D(SL)	SR 52N / TV Tower PH1-5	Gilmer	Sanitary Landfill
064-009D(SL)	US 411	Gordon	Sanitary Landfill
064-010D(SL)	Lick Creek Road	Gordon	Sanitary Landfill
064-016D(SL)	Redbone Ridges Rd.	Gordon	Sanitary Landfill
105-012D(L)	US 411 Westside	Murray	Landfill
105-011D(SL)	US 411 Westside	Murray	Sanitary Landfill
112-005D(SL)	Jones Mtn Rd. PH2	Pickens	Sanitary Landfill
112-007D(SL)	Jones Mtn Rd. Westside	Pickens	Sanitary Landfill
112-006D(SL)	Jones Mtn Rd. PH3	Pickens	Sanitary Landfill
HUC 03150103 (Oostanaula River Basin)			
008-012D(SL)	SR 140 Adairsville	Bartow	Sanitary Landfill
057-011D(L)	Jones Mill Rd.	Floyd	Landfill
064-003D(L)	SR 156	Gordon	Landfill
064-011D(SL)	Harris Rd. PH2	Gordon	Sanitary Landfill
064-014D(L)	Calhoun - Harris Rd. PH4	Gordon	Landfill
HUC 03150104 (Etowah River Basin)			
008-008D(SL)	SR 394 Emerson PH1	Bartow	Sanitary Landfill
008-016D(SL)	SR 294 Emerson MSWL	Bartow	Sanitary Landfill
028-040D(L)	SWIMS - SR 92 (Dixie) PH4	Cherokee	Landfill
028-041D(SL)	Blalock Rd. PH6	Cherokee	Sanitary Landfill
028-039D(SL)	Pine Bluff Landfill Inc.	Cherokee	Sanitary Landfill
028-034D(L)	SWIMS - SR 92 (Dixie) PH3	Cherokee	Landfill
028-032D(L)	Kuykendall - Earney Rd.	Cherokee	Landfill
028-030D(L)	SWIMS - SR 92 (Dixie) PH1&2	Cherokee	Landfill
028-015D(SL)	Blalock Rd. PH3	Cherokee	Sanitary Landfill
028-017D(SL)	Blalock Rd. PH4	Cherokee	Sanitary Landfill
028-014D(SL)	Ridge Rd. PH2	Cherokee	Sanitary Landfill
028-013D(L)	Kendrick - Arnold Mill Rd. PH1	Cherokee	Landfill
028-007D(L)	Univeter Rd.	Cherokee	Landfill

PERMIT_NO	NAME	COUNTY	TYPE
028-012D(SL)	Brown - SR 92W	Cherokee	Sanitary Landfill
033-038D(SL)	Cheatham Rd. PH2	Cobb	Sanitary Landfill
042-002D(SL)	Shoal Hole Rd	Dawson	Sanitary Landfill
058-010D(SL)	Hightower Rd. PH4	Forsyth	Sanitary Landfill
058-009D(SL)	Hightower Rd. PH3	Forsyth	Sanitary Landfill
058-005D(L)	Anglin - Francis Rd.	Forsyth	Landfill
058-006D(SL)	Hightower Rd. PH1	Forsyth	Sanitary Landfill
060-072D(L)	Chadwick Road Landfill	Fulton	Landfill
060-059D(L)	Honea - C&R Landfill (Francis	Fulton	Landfill
093-005D(SL)	US Army - Camp Merrill No. 6	Lumpkin	Sanitary Landfill
093-004D(SL)	Camp Merrill - US Army	Lumpkin	Sanitary Landfill
110-005D(SL)	Gulledge Rd. N. Tract 1	Paulding	Sanitary Landfill
115-005D(SL)	US 278 Cedartown PH2	Polk	Sanitary Landfill
115-008D(SL)	Grady Rd.	Polk	Sanitary Landfill
HUC 03150105 (Coosa below Rome and Chattooga River Basin)			
027-006D(SL)	Penn Bridge Rd. PH1	Chattooga	Sanitary Landfill
057-013D(SL)	Walker Mtn Rd. PH1 2 &3	Floyd	Sanitary Landfill
057-020D(MSWL)	Walker Mtn. Rd. Site 2	Floyd	Municipal Solid Waste
057-009D(SL)	Berry Hill Rd.	Floyd	Sanitary Landfill
146-013D(L)	LaFayette - Coffman Springs Rd	Walker	Landfill

4.1.2 Nonpoint Sources

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

Nonpoint pollutant loading comprises a wide variety of sources not subject to point source control through NPDES permits. The most significant nonpoint sources are those associated with precipitation, washoff, and erosion, which can move pollutants from the land surface to water bodies. Both rural and urban land uses can contribute significant amounts of nonpoint pollution. A review of the 1996-1997 water quality assessment results for the Coosa basin indicates that urban runoff and rural nonpoint sources contribute significantly to lack of full support for designated uses. The major categories of stressors for nonpoint sources are discussed below.

Nonpoint Sources from Agriculture

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

Sediment and Nutrients

Sediment is the most common pollutant resulting from agricultural operations. It consists mainly of mineral fragments resulting from the erosion of soils, but it can 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 on the biological community. Excess sediment can also increase water treatment costs, interfere with recreational uses of water bodies, create navigation problems, and increase flooding damage. In addition, a high percentage of nutrients lost from agricultural lands, particularly phosphorus, is transported attached to sediment. Many organic chemicals used as pesticides or herbicides are also transported predominantly attached to sediment.

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

Phosphorus transport is a complex process that involves different components of phosphorus. Soil and sediment contain a pool of adsorbed phosphorus which tends to be in equilibrium with the phosphorus in solution (phosphate) as water flows over the soil surface. The concentrations established in solution are determined by soil properties and fertility status. Adsorbed phosphorus attached to soil particles suspended in runoff also equilibrates with 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 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 (Table 4-7).

In July and August 1996, the USEPA conducted biological assessments on Georgia watersheds that had sufficient agricultural loading to potentially impair designated stream use to determine which of those waters should be added to Georgia's Section 303(d) list of streams with water quality-limited segments. Those waters identified by EPA as potentially impaired by agricultural nonpoint source loading and added to the 303(d) TMDL list in December 1996 are shown in Table 4-8.

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

County	Percent of Area in Basin	Acres with nutrient application	Sediment (tons)	Sediment (ppm)	Nitrogen (tons)	Nitrogen (ppm)	Phosphorus (tons)	Phosphorus (ppm)
Bartow	100	104,812	128,849	41.8	442	0.15	152	0.051
Chattooga	100	37,841	54,053	48.0	156	0.15	62	0.058
Cherokee	100	30,811	49,473	30.3	403	0.25	106	0.065
Cobb	33	8,154	8,838	38.8	25	0.11	10	0.044
Dawson	91	13,373	11,948	30.6	78	0.21	23	0.061
Fannin	2	19,330	22,052	21.3	80	0.08	33	0.032
Floyd	100	58,438	61,159	34.7	227	0.14	83	0.050
Forsyth	31	36,057	27,381	26.6	330	0.33	69	0.067
Fulton	9	15,476	12,513	28.6	33	0.07	13	0.029
Gilmer	94	21,780	30,930	26.7	348	0.30	72	0.063
Gordon	100	67,068	125,184	63.9	670	0.35	193	0.101
Lumpkin	34	17,675	17,876	35.6	340	0.68	41	0.081
Murray	100	20,780	30,383	49.5	135	0.23	42	0.072
Paulding	60	42,409	9,882	8.2	58	0.05	20	0.017
Pickens	100	16,698	21,003	23.7	234	0.26	49	0.056
Polk	100	38,016	47,654	42.6	180	0.17	67	0.063
Walker	49	62,702	53,691	29.1	197	0.11	74	0.042
Whitfield	80	30,229	67,842	78.7	247	0.29	86	0.101

Note: Mass estimates are based on county-wide averages weighted by percent of area in the basin. Concentration estimates are average event runoff concentration from agricultural lands.

Table 4-8. Waters Identified as Potentially Impacted by Agricultural Nonpoint Source Loading and Added to the Georgia 303(d) List

Waterbody	County	Pollutant(s) of Concern
Dykes and Hall Creeks	Bartow and Floyd	Habitat/Sediment
Euharlee Creek	Polk and Bartow	Biota
Canton Creek	Cherokee	Biota, Habitat
Long Swamp Creek	Pickens and Cherokee	Biota, Habitat
Coal Mt. Area	Dawson and Forsyth	Biota, Habitat
Oothklooga Creek	Gordon and Bartow	Biota, Habitat/Sediment
Lower Coosawattee River	Gordon, Gilmer, and Murray	Habitat
Pinelog Creek	Bartow and Gordon	Sediment
Sallacoa Creek	Pickens and Gordon	Biota, Habitat

Animal waste

In addition to contributing to nutrient loads, animal waste may also contribute high loads of oxygen-demanding chemicals and bacterial and microbial pathogens. The waste may reach surface waters through direct runoff as solids or in their soluble form. Soluble forms may reach ground water through runoff, seepage, or percolation and reach surface water as return flow. As the organic materials decompose, they place an oxygen demand on the receiving waters which may adversely affect fisheries and cause other problems with taste, odor, and color. When waters are contaminated by waste from mammals the possible presence of pathogens including fecal bacteria that impact human health is of particular concern. In addition to bacteria, cattle waste might be an important source of the infectious oocysts of the protozoan parasite *Cryptosporidium parvum*.

Pesticides

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

The major agricultural pesticides/herbicides used within the basin include 2,4-D, AAtrex/Atrazine, Weedmaster, Trifluralin/Trefland/Trilin, Blazer/Basagran, Gramoxone, Hoelon, Lexone/Sencor, Classic, Dual, and Lasso (alachor) (compiled from the Georgia Herbicide Use Survey Summary [Monks and Brown, 1991]). Since 1990, the use of alachlor in Georgia has decreased dramatically since peanut wholesalers no longer buy peanuts treated with alachlor.

Nonherbicide pesticide use is difficult to estimate. According to Stell et al. (1995), pesticides other than herbicides are currently used only when necessary to control some type of infestation (nematodes, fungi, insects). Other common nonherbicide pesticides include chlorothalonil, aldicarb, chlorpyrifos, methomyl, thiodicarb, carbaryl, acephate, fonofos, methyl parathion, terbufos, disulfoton, phorate, triphenyltin hydroxide (TPTH), and synthetic pyrethroids/pyrethrins. 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 that are now banned might continue to affect water quality within the basin, particularly through residual concentrations present in bottom sediments. A survey of pesticide concentration data by Stell et al. (1995) found that two groups of compounds had concentrations at or above minimum reporting levels in 56 percent of the water and sediment analyses in the Apalachicola-Chattahoochee-Flint basin. The first group included DDT and metabolites, and the second group included chlordane and related compounds (heptachlor, heptachlor epoxide), while dieldrin was also frequently detected. All of these pesticides are now banned by USEPA for use in the United States, but they might persist in the environment for long periods of time.

Nonpoint Sources from Urban, Industrial, and Residential Lands

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

The major difference is that urban runoff occurs only intermittently, in response to precipitation events.

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

There is little site-specific data available to quantify loading in nonpoint urban runoff in the Coosa 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. 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.

Pesticides and Herbicides from Urban and Residential Lands

Urban and suburban land uses are also a potential source of pesticides and herbicides through application to lawns and turf, roadsides, and gardens and beds. 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.

Other Urban/Residential Sources

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

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

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

Nonpoint Sources from Forestry

Forest is the dominant land cover in the Coosa basin, accounting for 70 percent of the land area in 1991. Undisturbed forest land generally presents very low stressor loadings compared to other land uses, while the conversion of forest to urban/residential land uses is often associated with water quality degradation. For the period from 1982 through 1989, the area classified as commercial forest land within the Coosa basin decreased by approximately 106,986 acres.

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

Statewide BMP Implementation Survey

In 1992 the Georgia Forestry Commission (GFC) conducted a statewide BMP implementation survey to determine to what extent forestry BMPs were being implemented. Within the entire Coosa basin, the GFC evaluated 25 sites. Thirteen sites totaling 600 acres were located on private lands and 12 sites totaling 1,818 acres were located on forest industry land. Overall compliance with BMPs on both private and public lands was 95 percent.

The majority of the main haul roads on the 25 sites were in compliance with BMPs. Problems were noted where roads did not follow the contour, and where water diversions to slow surface water flow and divert the flow out of the road were needed but were not installed. Main haul roads crossed streams on almost half of the sites and culverts were sized correctly for the watershed. Almost half of the crossings were located at too steep of grades and were not stabilized correctly. By ownership, road compliance for private lands and forest industry was 66 percent and 89 percent, respectively.

The majority of the 2,418 harvested acres evaluated on the 25 sites were in compliance with BMPs. Problems were noted where water bars were not installed in skid trails with sites on sloping terrain. Only 22 percent of the log decks were stabilized. Equipment was improperly serviced on 12 percent of the sites. Harvesting within the 80-ft Streamside Management Zones (SMZs) only occurred on 17 sites and resulted in 18 percent of the zones rutted or damaged and excess logging debris left in the streams on 53 percent of the sites. Log decks were usually properly located outside of the recommended zone. Temporary stream crossings occurred on a few sites and were properly removed after the harvest on half of the sites. By ownership, harvesting compliance for private lands and forest industry was 96 percent for both.

The majority of the 417 site-prepared acres evaluated on the five sites were in compliance with BMPs. One site (50 acres) occurred on private land and 4 sites (367 acres) occurred on industry land. The main problem with noncompliance involved heavy mechanical clearing on slopes greater than 20 percent on one site and presuppression firebreaks located inside SMZs on 4 of the sites. By ownership, site preparation compliance for private lands and forest industry was 74 percent and 89 percent, respectively.

One tract was evaluated for regeneration involving 50 acres of which all 50 were in compliance with BMPs. The tract was hand planted and occurred on private land.

Pesticides and Herbicides from Silviculture

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

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

Chemical 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. There is one commercial forest tree nursery within the basin and is located in Murray County.

Atmospheric Deposition

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

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

4.1.3 Flow and Temperature Modification

Many species of aquatic life are adapted to specific flow and temperature regimes. In addition, both flow and temperature affect the dissolved oxygen balance in water, and changes in flow regime can have important impacts on physical habitat. Temperature is particularly critical for the cold-water trout fishery. Georgia is located at the extreme southern edge of trout habitat, and therefore many trout waters approach maximum tolerable temperatures during the hottest summer months, even under natural conditions. Trout need cold water to survive and reproduce well, so any practices that cause stream warming can have adverse effects.

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

Flow Modification

Low flows in streams during drought periods form an important constraint on aquatic habitat. Expected minimum flows vary with geology. One index of low flow conditions is the low flow of seven days' duration which recurs, on average, once every two years (7Q2 flow). The 7Q2 flow in tributaries in the Coosa basin draining terrains underlain by igneous and metamorphic rocks range from about 0.4 to 0.8 cubic foot per second per square mile of drainage area. The 7Q2 flows for tributaries draining carbonate rocks is about 0.2 to 0.4 cubic foot per second per square mile, while the 7Q2 for tributaries that drain sandstone and shale may be as low as 0.005 to 0.02 cubic foot per second per square mile (Robinson et al., 1996). Reductions in these low flows as a result of man's activities can seriously stress aquatic organisms.

Natural flows in the Georgia portion of the Coosa basin have been altered by the construction of two major dams in Georgia and by Lake Weiss in Alabama. The lower Etowah river has been fully regulated since the completion of Allatoona Dam in 1949 by the U.S. Army Corps of Engineers. Carters Dam, also a Corps of Engineers impoundment, has regulated flows on the Coosawattee River since 1972. Lake Weiss backs water up the Coosa River to the vicinity of Rome, Georgia. The Mayo navigational lock and dam at Rome, although no longer functional, causes limited constriction of natural river flow just below the confluence of the Oostanaula and Etowah rivers.

Flows from Allatoona Dam are primarily driven by hydropower generation schedules for supply of electricity during peak demand times. When not generating, no minimum flow is provided. Thompson/Wyman Dam, a small privately-operated run-of-the-river hydropower dam about three miles downstream, provides limited re-regulation of flows from Allatoona and thereby lessens the impact of the pulse of high water associated with peak power generation.

The cycle of dam releases follows a weekly schedule with five weekdays of short periods of power generation followed by two weekend days of reduced generation. During a typical week, power is generated for several hours each weekday and less frequently on weekends. Superimposed on these daily and weekly cycles is an annual pattern caused by operations for flood control. During the fall, the reservoir pool in Allatoona is lowered to provide flood storage for winter and spring rainfall runoff. During very high inflows, water may pass over the concrete spillway at Allatoona Dam.

Flows from Carters Dam are also driven by hydropower generation schedules for supply of electricity during peak demand times, but Carters is a pumped storage facility with a lower storage pool that not only allows water to be pumped back into Carters Lake during low electricity demand periods, but also allows for re-regulating the river flow. Water is released from the re-regulation pool at a relatively constant rate that depends on net daily flow from Carters Dam, thus the river downstream has a relatively natural flow regime (except for extreme high flows). Carters Dam also provides for flood control by lowering the normal pool elevation in anticipation of increased winter and spring rainfall.

Temperature

The Coosa Basin has many miles of trout waters that are threatened by the impact of small impoundments which can result in increased summer temperatures. Most of the trout streams in the basin are secondary trout streams (they are cold enough to support trout populations, but no natural reproduction occurs) and actual trout fisheries are limited by the supply of trout for stocking. Even small impoundments, if not specifically designed to prevent stream warming, may impact temperatures for several miles downstream.

Another threat to suitable temperature regime in the trout streams of the Coosa River basin is the removal of riparian tree cover, which allows increased warming of water by sunlight. 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. Timber harvest within riparian buffers can thus lead to temperature stress if proper management practices are not followed. Increases in impervious surface area coverage (particularly paved areas) in the watershed also contribute to stream warming.

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. Trout waters are particularly sensitive to sedimentation as trout need clean substrate to survive and reproduce well. Thus, any land use practices that cause excess sediment input can have significant impacts. Because of rapid development in the mountainous areas, the quality of trout streams is often compromised by sedimentation from land disturbing activities.

Physical habitat disturbance is also evident in many urban streams. Increased impervious cover in urban areas results in higher peak flows and lower drought flows. Higher peak flows increase bank erosion and lower low flows reduce the instream habitat available to aquatic life during drought periods. In addition, construction and other land-disturbing activities produce excessive sediment loads, resulting in choking of the natural substrate and alteration of the physical form of streams with mounds of sand and silt.

4.2 Summary of Stressors Affecting Water Quality

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

4.2.1 Nutrients

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

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

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

Nutrient Loads

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

Point source loads can be quantified from permit and effluent monitoring data, but nonpoint loads are difficult to quantify. Rough estimates of average nutrient loading rates from agriculture are available; however, nonpoint loads from urban/residential sources in the basin have not yet been quantified. The net load arising from all sources may, however, be examined from instream monitoring. Long term trends in nutrients within the Coosa River basin can be obtained by examining results from EPD long-term trend monitoring stations.

Trends in loading of total phosphorus can be seen by examining the monitoring summary shown in Table 4-9. Total phosphorus concentrations have remained relatively low on average in the Coosawattee and Etowah River stations. The highest average concentrations have been seen in the Conasauga River, in the Chattooga, and in the Coosa at the Alabama State Line.

Table 4-9. Trend Monitoring Summary for Total Phosphorus (mg/L) in the Coosa River Basin

Station	Years	Average	Maximum	Minimum
Conasauga nr. Resaca, 14040001	1973-1996	0.66	7.2	0.02
Coosawattee at Hwy 225, 14130001	1974-1996	0.05	0.53	0.02
Oostanaula at Rome intake, 14250001	1973-1998	0.24	1.1	0.02
Etowah at Hwy. 5, 14300001	1968-1996	0.06	0.59	0.02
Etowah at Rome, 14350001	1968-1996	0.08	1.1	0.02
Coosa at Alabama Line, 14450001	1973-1998	0.17	0.6	0.02
Chattooga near Chattoogaville, 14560001	1973-1998	0.28	0.92	0.04

Figure 4-17 shows trends in phosphorus concentrations in the Coosa River at the Alabama line. Declines in concentration in the mid-1970s appear to reflect upgrades to the Rome WPCP. Concentrations increased throughout the 1980s. A strong decline in average concentration after 1989 reflects further WPCP upgrades and legislation restricting the use of phosphate detergents.

Figure 4-18 shows phosphorus concentration trends in the upper Etowah River. This station is above Lake Allatoona, and nutrient loads and associated eutrophication of Lake

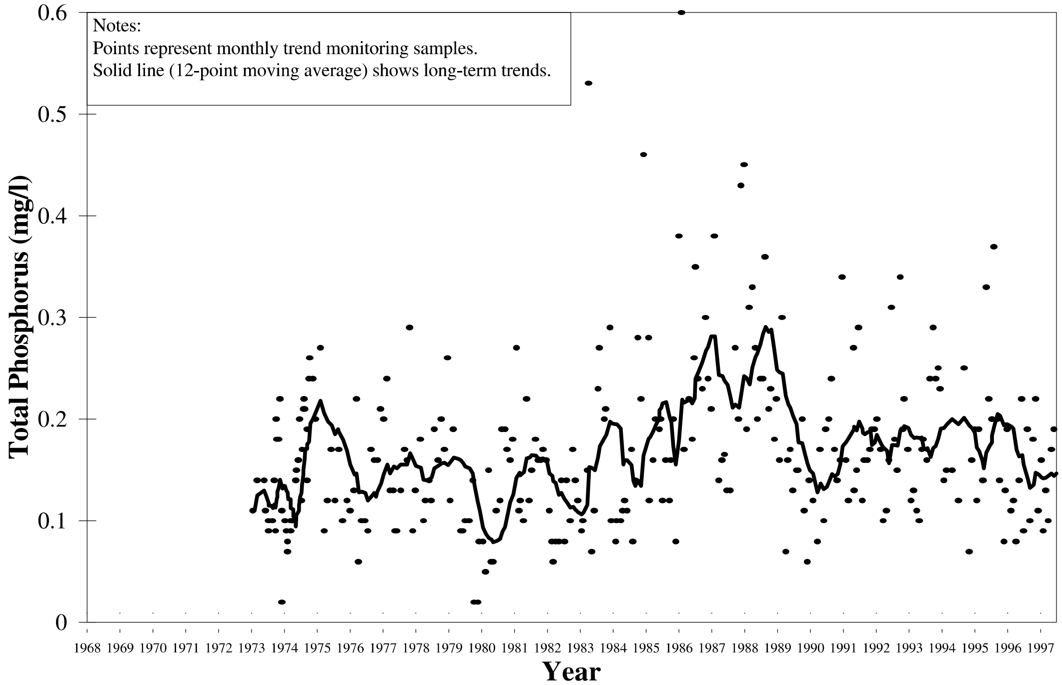

Figure 4-17. Phosphorus Concentrations, Coosa River at Alabama State Line (Trend Monitoring Station 14450001)

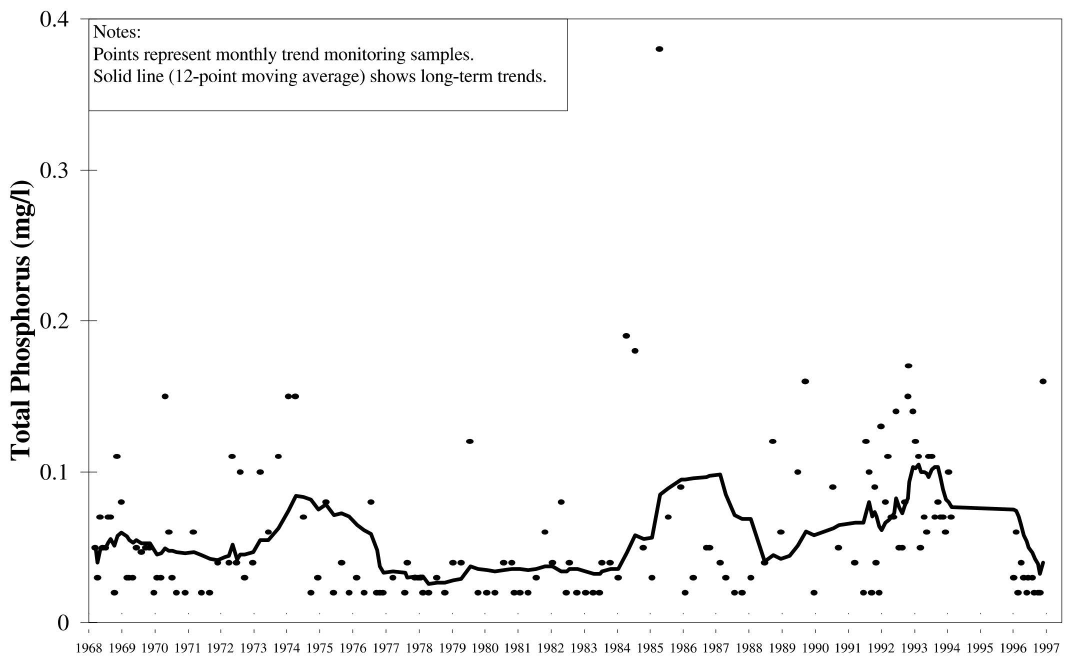

Figure 4-18. Phosphorus Concentrations, Etowah River at Georgia Highway 5 (Trend Monitoring Station 14300001)

Allatoona remain a concern in the basin. Concentrations at this station have generally increased into the 1990s, although the most recent 1996 observations showed lower levels.

4.2.2 Oxygen Depletion

Oxygen is required to support aquatic life, and Georgia water quality standards specify minimum and daily average dissolved oxygen concentration standards for all waters. Problems with oxygen depletion in rivers and streams of the Coosa basin are associated with oxygen-demanding wastes from point and nonpoint sources and hydropower operations which release oxygen-depleted bottom water from reservoirs. 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.

Within the Coosa basin, most dissolved oxygen measurements have remained above the minimum concentration of 4.0 mg/L specified in water quality standards (see Table 4-10). Low concentrations in the Chattooga River were observed in the first year of monitoring in 1973, but since have remained above 4.0 mg/L. More significant dissolved oxygen problems were historically present in the Conasauga River downstream of Dalton. Figure 4-19 shows the long-term trends in dissolved oxygen concentrations in the Conasauga at Resaca. In the early years there were frequent observations of concentrations less than 4.0 mg/L; however, there has been a general upward trend in concentrations, and no concentrations below 4.0 mg/L have been observed in trend monitoring since 1987.

Table 4-10. Trend Monitoring Summary for Dissolved Oxygen (mg/L) in the Coosa River Basin

Station	Years	Average	Maximum	Minimum
Conasauga nr. Resaca, 14040001	1973-1996	7.5	13.6	0.1
Coosawattee at Hwy 225, 14130001	1974-1996	9.1	13.8	5.3
Oostanaula at Rome intake, 14250001	1973-1998	8.2	12.5	4.0
Etowah at Hwy. 5, 14300001	1968-1996	9.2	14.0	5.6
Etowah at Rome, 14350001	1968-1996	8.9	14.0	5.0
Coosa at Alabama Line, 14450001	1973-1998	7.8	12.7	3.8
Chattooga near Chattoogaville, 14560001	1973-1998	8.2	13.5	2.5

4.2.3 Metals

Violations of water quality standards for metals (e.g., lead, copper, zinc) were the second most commonly listed causes of non-support of designated uses in the 1996-97 water quality assessment of the Coosa basin, after fecal coliform bacteria. In most cases, these metals are attributed to nonpoint urban runoff and storm water. Point sources also contribute metals loads; however, major point sources of metals in the Coosa basin (wastewater treatment plants and certain industrial discharges) have been brought into compliance with permit limits, leaving the more-difficult-to-control nonpoint sources as the primary cause of impairment.

It should be noted that sample data on metals in many streams is rather sparse, and there are concerns with quality of some of the older data. While urban runoff appears to be the primary source of loading of these stressors, loading rates have not been quantified and will require additional study.

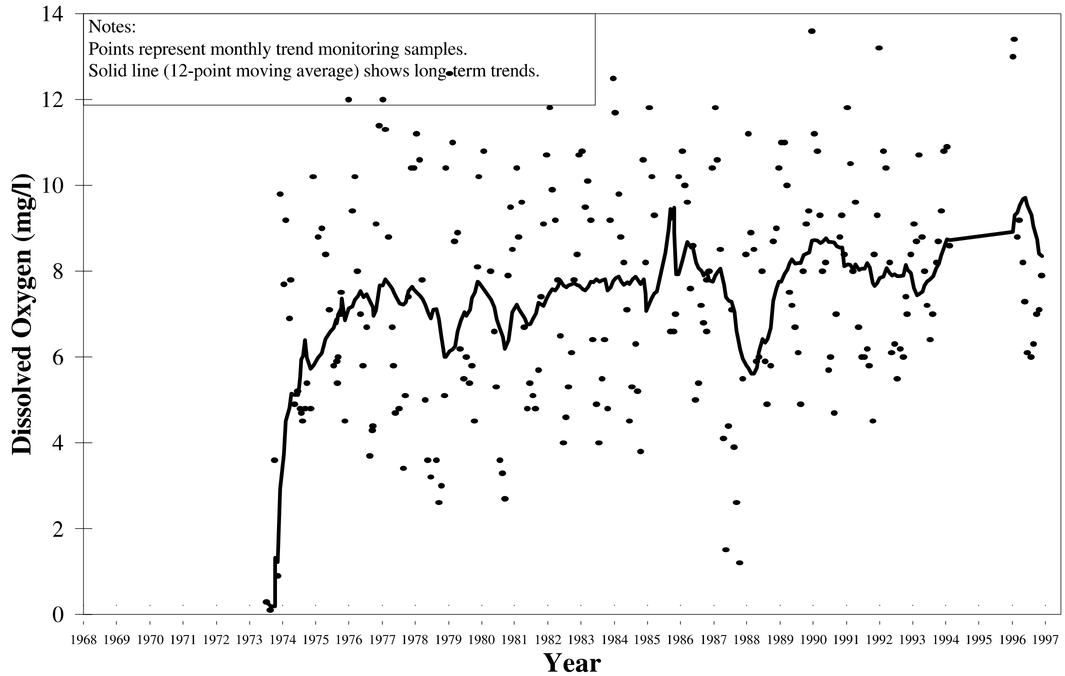

Figure 4-19. Dissolved Oxygen Concentrations in the Conasauga River near Resaca, Georgia (Trend Monitoring Station 14040001)

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 1996-97 water quality assessment. Fecal coliform bacteria are monitored as an indicator of fecal contamination and the possible presence of human bacterial and protozoan pathogens in water. Fecal coliform bacteria may arise from many of the different point and nonpoint sources discussed in Section 4.1. Human waste is of greatest concern as a potential source of bacteria and other pathogens. One primary function of wastewater treatment plants is to reduce this risk through disinfection. Observed violations of the fecal coliform standard below several wastewater treatment plants on the Coosa River have generally been rapidly corrected in recent years. Combined sewer overflows, which may discharge dilute untreated sewage directly to streams during wet weather, have been a source of intermittent fecal coliform contamination in the Rome and Cedartown areas, but are now being addressed through control strategies, as discussed in Section 4.1.1.2.

Table 4-11 summarizes long term trend monitoring data for fecal coliform bacteria in the Coosa River basin. State water quality standards for the fishing classification specify a 30-day geometric mean of 200 MPN/100 ml for May through October, and 1,000 MPN/100 ml for November through April. Occasional high concentrations are expected during wet weather events, and are allowed for in the standard. The median or 50th percentile value is a useful summary of fecal coliform concentrations which is less sensitive to occasional high values than the average.

Table 4-11. Trend Monitoring Summary for Fecal Coliform Bacteria (MPN/100 ml) in the Coosa River Basin

Station	Years	Geometric Mean	Average	Maximum	Median
Conasauga nr. Resaca 14040001	1973-1996	671	4706	43000	750
Coosawattee at Hwy 225 14130001	1974-1996	234	773	23000	210
Oostanaula at Rome intake 14250001	1973-1998	538	1937	43000	330
Etowah at Hwy. 5 14300001	1968-1996	402	2577	33000	330
Etowah at Rome 14350001	1968-1996	629	10653	930000	330
Coosa at Alabama Line 14450001	1973-1998	339	3729	290000	210
Chattooga near Chattoogaville 14560001	1973-1998	380	2074	43000	230

Monthly trend-monitoring sampling is not sufficient to establish 30-day geometric means for comparison to the standard. The long-term averages and medians shown in Table 4-11 are generally inflated by data from earlier years prior to WPCP upgrades. For instance, monitoring in the Etowah River at Rome (Figure 4-20) shows a steady declining trend in fecal coliform concentrations from the late 1960s to the present (note the use of a logarithmic scale). Monitoring at this station from 1990 to 1996 shows that the median winter concentration was 168 and the median summer concentration 340 MPN/100 ml, indicating the need for continued improvements.

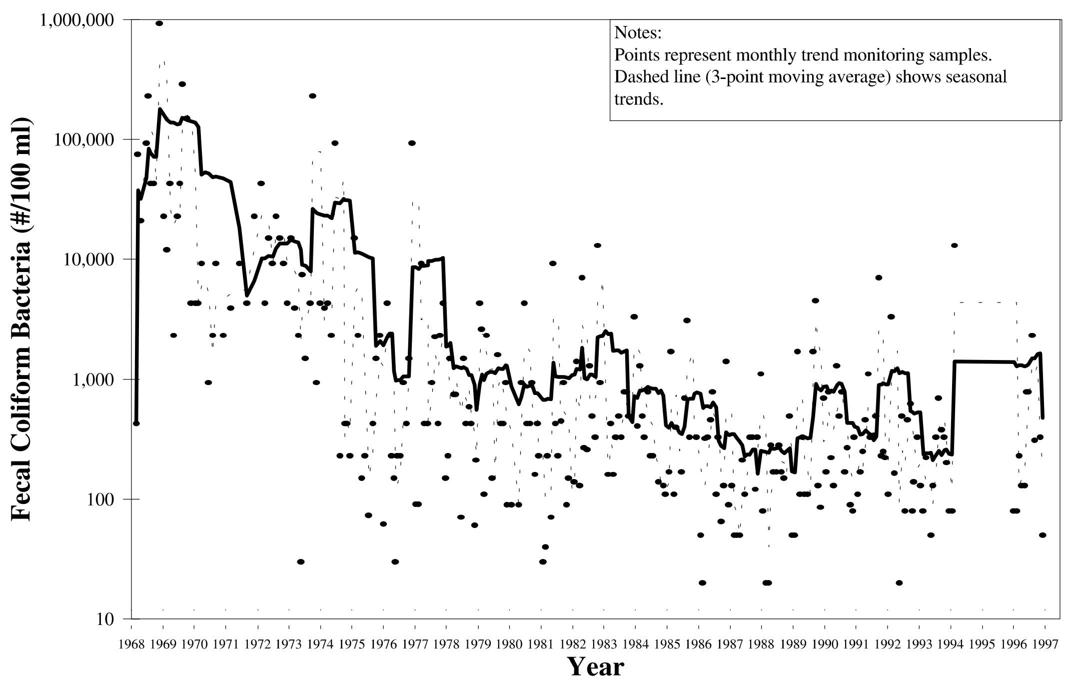

Figure 4-20. Fecal Coliform Bacteria Concentrations (MPN/100 ml), Etowah River near Rome (Trend Monitoring Station 14350001)

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

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

4.2.5 Synthetic Organic Chemicals

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

- Industrial point source discharges;
- Wastewater treatment plant point source discharges, which often include industrial effluent as well as SOCs from household disposal of products such as cleaning agents, 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 the surface waters of the Coosa River basin in problem concentrations, except for chlordane in the Chattooga River. It should be noted, however, that the majority of monitoring has been targeted to waters located below point sources where potential problems were suspected. Agricultural sources were potentially important in the past, particularly from cotton production in the Coastal Plain, but the risk has apparently greatly declined with a switch to less persistent pesticides. Recent research by USGS (Stell *et al*., 1995; Hippe *et al*., 1994) suggests pesticide/herbicide loading in urban runoff and storm water may be of greater concern than agricultural loading, particularly in streams of the metropolitan Atlanta area.

Certain SOCs, discharged to the watershed in past decades, continue to be of concern today. In particular, PCBs (now banned) have resulted in fish consumption guidelines in the lower Oostanaula, lower Etowah, and Coosa River mainstem below the GE Rome plant. These compounds, which are highly bioaccumulative, apparently enter the food chain from residuals in contaminated river sediments.

4.2.6 Stressors from Flow and Temperature Modification

Stress from flow modification is primarily associated with the peaking hydropower operation of Allatoona Dam on the Etowah River, and to some extent, increased storm flow in smaller streams in developing areas as the percentage of impervious surfaces increases. During drought periods, the flow of the Conasauga River below the city of Dalton has been severely depleted due to municipal/industrial withdrawals, and the potential exists for such flow depletion below other withdrawals in the basin. The hydropeaking operation of Allatoona Dam results in pulsing of flow and seasonal depletion of dissolved oxygen during summer and fall. Oxygen levels are largely restored to normal as the river flows over the crest of Thompson-Wyman Dam, a low-head dam about three miles downstream from Allatoona.

The Etowah River below Lake Allatoona is artificially cooled by releases of water from deep in the lake. Although not cold enough to support a trout fishery, the cool water is beneficial to striped bass which reproduce naturally within the Coosa Basin.

Stress from temperature modifications is primarily a problem in small streams in designated trout watersheds. Small impoundments on such streams permanently alter water temperature regimes unless specific provisions are made to prevent such changes.

4.2.7 Sediment

Erosion and discharge of sediment can have a number of adverse impacts on water quality. First, sediment may carry attached nutrients, pesticides and metals into streams. Second, sediment is itself a stressor. Excess sediment loads can alter habitat, destroy spawning substrate, and choke aquatic life, while high turbidity also impairs recreational and drinking water uses. Sediment loading is of concern throughout the basin, but is of greatest concern in the developing metropolitan areas and major transportation corridors. The rural areas are of lesser concern with the exception of rural unpaved road systems, areas where cultivated cropland exceeds 20 percent of the total land cover, and areas where foresters are not following appropriate management practices.

4.2.8 Habitat Degradation and Loss

In many parts of the Coosa 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.

Water temperature increases due to the impacts of small impoundments also threaten trout habitat throughout the basin. As development increases in the basin, and as demand for water grows, the integrity of aquatic habitat is threatened by reduced flows, particularly during the late summer and fall when stream flows are normally low.

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