APPENDIX A

River Basin Profiles

The River Basin Profiles (RBPs) provide information about watershed conditions and features within each of the Metropolitan North Georgia Water Planning District's (the District) Hydrologic Unit Code (HUC)-8 watersheds. Each profile contains information regarding physical and natural features, land use, impaired water bodies, management issues, and strategies to address those issues. Jurisdictions may use the RBPs as a starting point for local watershed planning. For example, Action Item WATERSHED-8 requires local governments carry out Watershed Improvement Projects and many jurisdictions develop watershed improvement plans to guide implementation. Additionally, jurisdictions can use the information in the RBPs as a foundation for Nine-Element Watershed Plans, which are required for a Section 319(h) Implementation Grant.

In addition to being a source of information for localized planning, RBPs also provide a high-level perspective of each basin. This high-level perspective further reinforces the interconnectedness of the various water sectors (supply, waste, storm, etc.) and brings in additional elements such as land use. The RBPs do not get into specific details on each sub-watershed, allowing for a high-level integration to guide local planning and management. Local sub-watershed planning is typically handled at the local level, with District support as needed.

Each RBP contains the following information:

- Physical and Natural Features (geography, hydrology, and protected species)
- Land Use and Impaired Water Bodies Characteristics (water supply, land cover/land use, effective impervious areas, and impaired waters). Impaired water bodies described in each RBP reference the Final Georgia 2020 303(d)/305(b) List of Impaired Waters.
- Management Issues and Recommendations (priority areas, issues and strategies, and indicators of success)

Overview of District Watersheds

The District is located on the eastern subcontinental divide and is composed of three distinct river systems, six river basins and nine separate 8-digit HUC-8 Basins as outlined in Table A-1 and illustrated in Figure A-1. Unlike most other major metropolitan areas in the United States that drain to a large (from a volume perspective) water body such as an ocean, lake or river, the region primarily drains to smaller headwater tributaries with limited or no groundwater capacity, making water resource management more challenging. These major river systems and their outlets include the following:

- **Apalachicola, Chattahoochee, and Flint (ACF):** Almost half, 48 percent, of the District drains to the ACF, which ultimately flows to the Gulf of Mexico at Apalachicola Bay in Florida.
- **Alabama, Coosa, Tallapoosa (ACT):** Twenty-eight percent of the District is part of the ACT, which drains to the Gulf of Mexico at Mobile Bay in Alabama.

- **Altamaha River:** The remaining 24 percent of the District is part of the Altamaha River system, including the Upper Ocmulgee and Upper Oconee River Basins, which drain to the Atlantic Ocean in Georgia.

The District is within six major river basins: the Chattahoochee, Coosa, Flint, Ocmulgee, Oconee, and Tallapoosa River Basins. Each river basin within the District is described in this appendix by breaking them out into their corresponding HUC-8 as defined by the U.S. Geological Survey (USGS) and U.S. Department of Agriculture (USDA) – National Resource Conservation Service (NRCS) Watershed Boundary Dataset (WBD). The WBD provides a uniquely identified and uniform method of subdividing large drainage areas for progressively smaller areas, such as HUC 8, 10 and 12 (USGS, 2015). This approach provides consistency with other water resource studies to further characterize their unique watershed characteristics and challenges. RBPs for each of the nine river basins identified in Table A-1 are included as Attachments 1 through 9 of this appendix. HUC-12 watersheds are listed by number and description in Attachment 10.

Table A-1. Metro Water District Basins and Terminology

Major River Basin	HUC-8 River Basin	HUC-8 #	% of District	% of HUC-8
Apalachicola, Chattahoochee, and Flint (ACF)				
Chattahoochee	Upper Chattahoochee River	3130001	18	57
	Middle Chattahoochee River (to Lake Harding)	3130002	19	30
Flint	Upper Flint River	3130005	11	21
Alabama, Coosa, Tallapoosa (ACT)				
Coosa	Etowah River	3150104	24	64
	Coosawattee River	3150102	2	12
	Oostanaula River	3150103	1	6
Tallapoosa	Upper Tallapoosa River	3150108	1	3
Altamaha River				
Oconee	Upper Oconee River	3070101	4	7
Ocmulgee	Upper Ocmulgee River	3070103	20	33

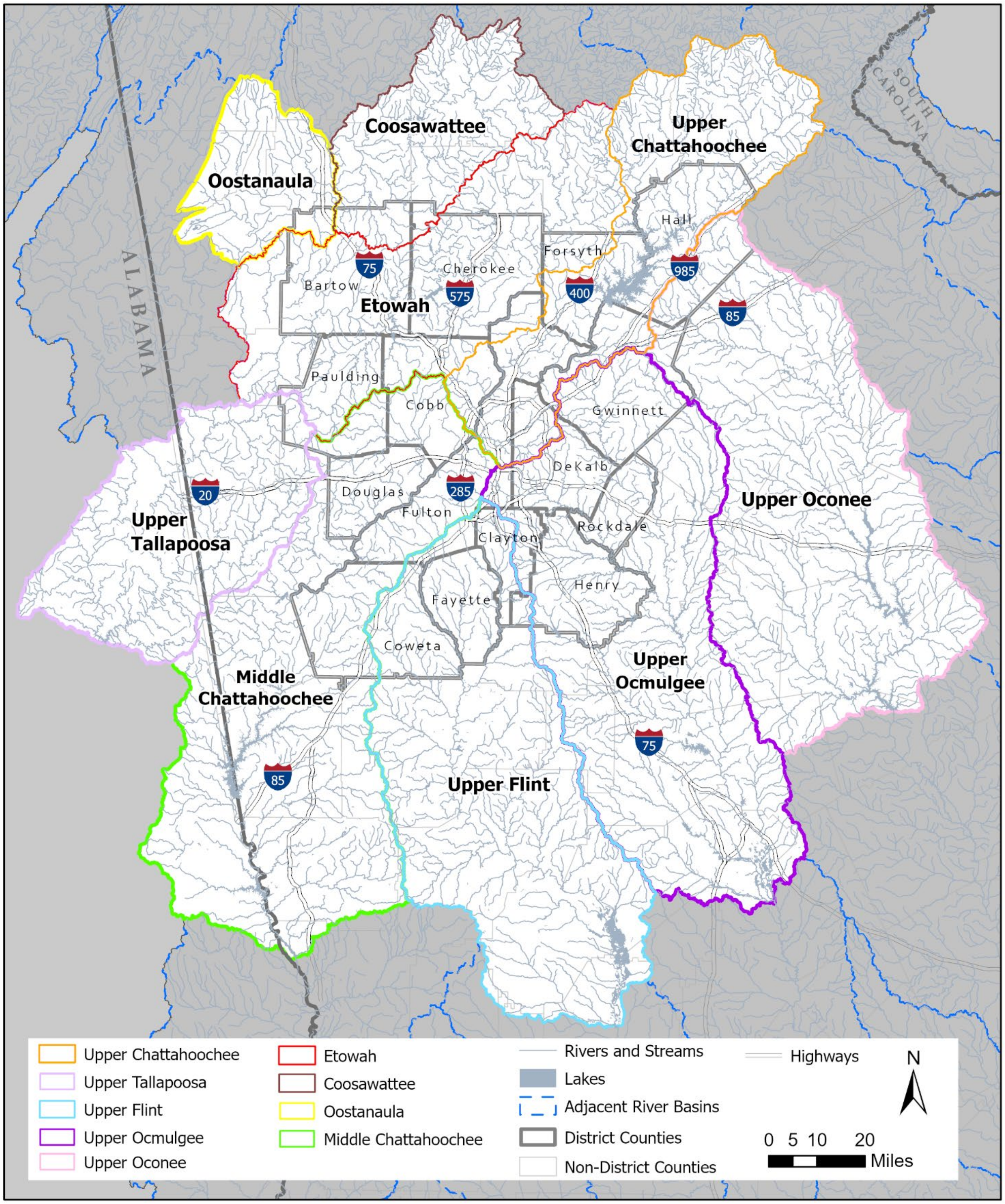

Figure A-1. District Major River Basins

A profile for each HUC-8 Basin is included in Attachments 1 through 9 of this appendix. Table A-2 lists the attachment number for each; the HUC-8 Basin; and the abbreviations used for table, figure, and page numbering.

Table A-2. HUC-8 Basin Profile Guide

Attachment No.	HUC-8 Basin	Abbreviation
1	Upper Chattahoochee River	UC
2	Middle Chattahoochee River	MC
3	Upper Ocmulgee River	UO
4	Upper Flint River	UF
5	Etowah River	ER
6	Coosawattee River	CO
7	Oostanaula River	OO
8	Oconee River	OC
9	Upper Tallapoosa River	UT

Land Use

Each RBP contains land use information based on the 2019 USGS National Land Cover Database data, the most recent year for which data is available. This information is intended to give a perspective on current trends.

Watershed Planning Elements

The U.S. Environmental Protection Agency (EPA) delineated nine minimum elements to address in watershed plans that could ultimately be used to seek incremental Clean Water Act Section 319 and other funds intended to address water quality impairments (EPA, 2004). Grant applicants are expected to develop their own detailed, watershed-specific plans typically at the HUC-12 or smaller level.

The RBPs, included as Attachments 1 through 9, were developed to provide a starting point for District communities by providing details consistent with EPA's nine minimum elements. Table A-3 lists the nine elements and describes how the Water Resource Management Plan supports these local efforts by meeting these nine elements considered critical for achieving water quality improvements.

Each element is annotated with additional references so that a grant applicant can use the RBP as a foundational watershed management plan on which to add more specific details from watershed protection plans, monitoring data and evaluations, comprehensive planning documents, or other sources.

Table A-3. EPA 9 Minimum Elements of a Watershed Plan

Element	Element Description	References to RBPs and Additional Guidance
a.	Identification of causes of impairment and pollutant sources (or groups of similar sources) that need to be controlled to achieve needed load reductions.	The RBPs summarize causes of impairment and pollutant sources. They may be used as a basis to develop site-specific information for each local jurisdiction or permittee based on the current watershed guidance from the Georgia Environmental Protection Division (Georgia EPD).
b.	An estimate of the load reductions expected from implementation actions.	See models and tools at http://water.epa.gov/type/watersheds/datait/watershedcentral/tool.cfm and http://water.epa.gov/infrastructure/greeninfrastructure/gi_performance.cfm. For structural measures, if designed, constructed and maintained in accordance with the Georgia Stormwater Management Manual (GSMM), best management practices (BMPs) are expected to provide the design removal efficiencies listed in Table 4.1.3-1 of the GSMM. Use the Stormwater Quality Site Development Review Tool that accompanies the GSMM, Spreadsheet Tool for Estimating Pollutant Loads (STEPL), PLOAD geographical information system (GIS)-based model or other tools to estimate the load reductions that would result from the implementation of various structural measures (Atlanta Regional Commission [ARC], 2001; TetraTech, 2015; CH2M HILL Engineers, Inc. [CH2M], 2001). For nonstructural measures that may reduce the amount of stormwater runoff or potential pollutant sources before they occur, load reductions can be estimated based on land use types, soil characteristics and stream channel stability for a specific drainage area or watershed. These watershed characteristics would be evaluated with information about the frequency and amount of the nonstructural activity, such as street sweeping or public education efforts. There are several techniques developed by states, Municipal Separate Stormwater System (MS4) programs and watershed protection groups around the country that provide methodology or references for nonstructural load reductions; however, EPA recognizes the many variables and performance uncertainty particularly associated with nonstructural measures. The emphasis has been on including nonstructural measures as an integral part of ensuring the success of a watershed management program. See Chapter 9, Set Goals and Identify Load Reductions, of the *Handbook for Developing Watershed Plans to Restore and Protect Our Waters* for more information (EPA, 2008).
c.	A description of the nonpoint source implementation actions to achieve load reductions in element b, and a description of the critical areas for implementation of those actions.	Critical areas for implementation are identified in the RBPs under Management Issues and Recommended Strategies. Additional site-specific information and analysis for each local jurisdiction or permittee may be needed to quantify reductions. See also EPA Recovery Potential Screening tools that are used by Georgia EPD's 319 grant program to prioritize areas (http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/recovery/index.cfm) See Chapter 9, Set Goals and Identify Load Reductions, of the *Handbook for Developing Watershed Plans to Restore and Protect Our Waters* for more information on identifying implementation actions for critical areas (EPA, 2008).
d.	Estimate of the amounts of technical and financial assistance needed and authority for implementation.	The Nine-Element Plan should outline the schedule and costs expected for implementation. The Plan should also address the authority for implementation and Federal and State Regulations.

Table A-3. EPA 9 Minimum Elements of a Watershed Plan

Element	Element Description	References to RBPs and Additional Guidance
e.	Public information and education component to enhance public's understanding of the plan and to encourage their early and continued participation in implementation.	Public information and education is described in this Plan.
f.	Schedule for implementing the nonpoint source management measures identified in this plan that is reasonably expeditious.	Specific implementation schedules should be developed based on individual needs, costs, budgets and available resources. The schedule should include parties responsible for implementation. See Chapter 12, Design Implementation Program and Assemble Watershed Plan, of the *Handbook for Developing Watershed Plans to Restore and Protect Our Waters* for more information on developing implementation schedules.
g.	A description of interim measurable milestones for tracking implementation.	As with element f., interim milestones would be established by each community within their schedule based on available resources and goals. Review descriptions of implementation actions in Section 5.
h.	A set of criteria to determine whether loading reductions are being achieved over time and substantial progress is being made toward attaining water quality standards.	This Plan includes watershed-specific Action Items that address criteria for establishing load reductions. This Plan also includes a description of the District's trackable milestones.
i.	A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under element h.	This Plan includes long-term monitoring requirements.

ATTACHMENT 1

Upper Chattahoochee River Basin Profile

The District represents 57 percent of the overall Upper Chattahoochee River Hydrologic Unit Code (HUC)-8 Basin, while that portion of this HUC-8 within the District represents 18 percent of the total District area. This area supplies drinking water and serves as the primary receiving water for treated wastewater effluent for over 3.5 million people in the District (Atlanta Regional Commission [ARC], 2010). Lake Sidney Lanier, managed by the U.S. Army Corps of Engineers (Corps), and the Chattahoochee River National Recreation Area, managed by the National Park Service, are major recreational destinations within the region and Southeast U.S.

Physical and Natural Features

Geography

The Upper Chattahoochee River Basin has its headwaters in the Blue Ridge Mountains northeast of the District, flowing southwest to the confluence of the Chattahoochee River with Peachtree Creek. Approximately 43 percent, or 680 square miles, of this HUC-8 Basin is located upstream of the District before it occupies a relatively narrow corridor through the center of the District, averaging about 40 miles wide, starting in the northeast corner and extending to the southwest corner (UC-1). The Chattahoochee River is entirely within the Piedmont province, which consists of a series of rolling hills and occasional isolated mountains. The Upper Chattahoochee River Basin includes portions of the Gainesville Ridge, Central Highlands, and the Winder Slope physiographic districts (District and CH2M HILL Engineers, Inc., 2002).

Portions of 29 cities and seven counties are within the District portion of the Upper Chattahoochee River Basin, including Cherokee, Cobb, DeKalb, Forsyth, Fulton, Gwinnett and Hall. All of northern Fulton County is now incorporated within the Upper Chattahoochee River Basin, which also includes just over one-third, 35 percent, of the City of Atlanta as well as the newly incorporated City of Brookhaven in DeKalb County and the City of Peachtree Corners in Gwinnett County. The Upper Chattahoochee Basin covers 1,823 square miles and, when combined with the Middle Chattahoochee River - Lake Harding HUC-8, described in the next subsection, is the largest river basin within the District. As new cities have been created, additional levels of coordination should be implemented to ensure proper watershed management across each basin.

Hydrology and Soils

The Chattahoochee River joins the Flint River in southern Georgia to form the Apalachicola River, which flows to the Gulf of Mexico. The main tributaries feeding the Upper Chattahoochee River Basin through the District include the Chestatee River, Wahoo Creek, Suwanee Creek, Big Creek, Sope Creek, Rottenwood Creek, and Peachtree Creek. In contrast to the mainstem Chattahoochee River, all of the natural tributaries remain free-flowing within this basin. Groundwater availability is limited due to geologic conditions, which restrict the potential yield for water supply.

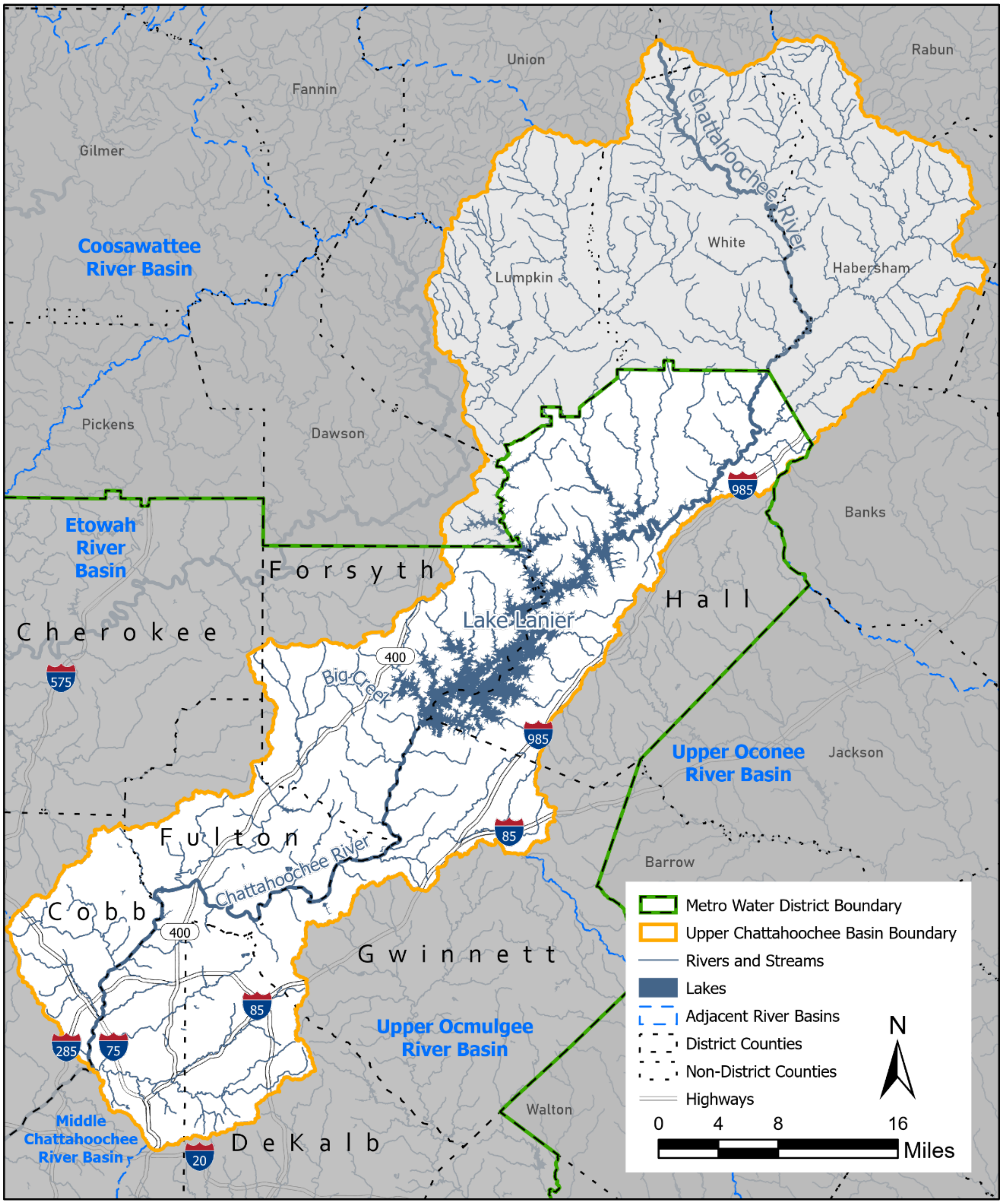

Figure UC-1. Upper Chattahoochee Basin Within the District

The flow of the Chattahoochee River through the District is regulated primarily by Buford Dam, a federal impoundment forming Lake Lanier, which is operated by the Corps. Lake Lanier has a drainage area of 1,040 square miles and extends from Buford Dam about 44 miles up the Chattahoochee River and about 19 miles up the Chestatee River. Constructed in the 1950s, Lake Lanier is a multipurpose reservoir that provides flood protection, power production, water supply, navigation, recreation and fish and wildlife management. It is the largest reservoir in the District (as well as Georgia) and provides the majority of the District's water supply, either through direct withdrawals or downstream releases. Morgan Falls Dam, a second smaller downstream dam operated by Georgia Power, is a run-of-the-river project that provides minor regulation of the river. West Point Lake, also a Corps reservoir, is the second major reservoir on the Chattahoochee River system, located just south of the District. Average monthly flows in the Chattahoochee River at Atlanta range from a low of 425.5 cubic feet per second (cfs) to a high of 8,959 cfs, with a mean flow of 2,470 cfs based on 65 years of records (U.S. Geological Survey [USGS], 2020). Rainfall ranges from an average of 68 inches per year in the northeastern part of the basin to 49 inches in the southwestern part.

The District lies almost completely within the Piedmont and the Blue Ridge (Ridge and Valley) geologic provinces. The aquifers in these provinces overlie crystalline rocks that crop out in the northern portion of the basin and extend to the fall line. The rock is overlain with deposits of weathered, unconsolidated rock debris (regolith) that make up the available aquifer spaces. These deposits are thickest in valleys, but generally provide insufficient yield for uses other than very low density residential and thus surface water is the primary source of potable water for the District. The Georgia Geologic Survey Hydrologic Atlas 18 database identifies approximately 28 areas, representing about 4 percent of the District, that are likely to contain unconfined aquifers, and 79 areas, representing about 12 percent of the District, that are likely to contain thick soils considered to be an indicator of significant groundwater recharge areas. The recharge areas were mapped based on outcrop area, lithology, soil type and thickness, slope, density of lithologic contacts, geologic structure, the presence of karst and potentiometric surfaces. There are approximately 131 square miles—14 percent of the basin area within the District—of potential recharge areas within the Upper Chattahoochee River Basin, as listed in Table UC-1.

Table UC-1. Groundwater Recharge Areas within the Upper Chattahoochee River Basin

Recharge Area Type	County	Square Miles of Recharge Area Type within County
Probable Areas of Thick Soil	Cobb	31
	DeKalb	13
	Forsyth	38
	Fulton	35
	Gwinnett	11
	Hall	3
Total Recharge Areas		131

An assessment of the availability of groundwater resources in select prioritized aquifers of Georgia was completed as part of Georgia's Comprehensive State-wide Water Management Plan (Georgia Environmental Protection Division [EPD], 2010). None of the Chattahoochee River Basin within the District was selected as a priority aquifer for assessment; however, a water budget approach was used to provide a planning-level assessment of groundwater resource sustainability in the Chattahoochee River-Chickamauga Creek and Soque River Basins, which cover 315 square miles upstream of the District in portions of Habersham, Towns, Union and White Counties. The assessment found that there are small amounts of additional groundwater available from the Paleozoic rock aquifer in the northwestern Georgia study basin and from the crystalline-rock aquifer in the Piedmont and Blue Ridge.

There are four soil associations that describe the soil types in the Upper Chattahoochee River Subbasin: Cecil-Madison-Pacolet, Madison-Davidson-Pacolet, Riverview-Chewacla-Cartecay, and the “urban” soils that start in north Fulton County (Table UC-2). The Cecil-Madison-Pacolet and Madison-Davidson-Pacolet associations were the most abundant, with the former types associated with moderate rolling hills and the latter with steeper terrain. These soils are well drained and highly weathered, having a red to yellowish-red subsoil (Brock, 1977: Jordan et al., 1973; Murphy, 1979; Thomas and Tate, 1973; USDA, 1976; Thomas, 1982; Wells, 1961; Robertson et al., 1960; USDA, 1958; Tate, 1967; Thomas and Tate, 1964). The Riverview-Chewacla-Cartecay association was found along the banks of some of the major rivers, particularly the lower half of the Chattahoochee River. These soils are variable and less well drained than soils on higher elevations (Thomas and Tate, 1973; USDA, 1976; Thomas, 1982; Thomas, 1982 and USDA, 1958).

Table UC-2. Major Soil Associations within the Upper Chattahoochee River Basin

Soil Association	Significance to Watershed Management
Cecil-Madison-Pacolet	**Characteristics:** Associated with moderate rolling hills, well drained, highly weathered. **Significance to Watershed Management:** Sloping surfaces may be more susceptible to increased erosion due to stormwater runoff from impervious surfaces; well-drained soils may be more permeable, which increases infiltration capacity in areas without impervious cover, also may improve feasibility of infiltration practices.
Madison-Davidson-Pacolet	**Characteristics:** Associated with steep terrain, well drained, highly weathered. **Significance to Watershed Management:** Steep terrain may be more susceptible to increased erosion due to stormwater runoff from impervious surfaces; well-drained soils may be more feasible for infiltration practices.
Riverview-Chewacla-Cartecay	**Characteristics:** Found along the banks of some of the major rivers; less well drained. **Significance to Watershed Management:** Located near water bodies, this soil type is characterized by flat terrain less susceptible to erosion due to stormwater runoff velocities from impervious surfaces; poor-drained soils are less feasible for infiltration.
Urban Soils	**Characteristics:** Highly disturbed and compacted soils. **Significance to Watershed Management:** Compacted soils; poor-drained, soils are less feasible for infiltration, restricted water drainage.
Areas of Bedrock	Infiltration practices may be limited in areas of contiguous bedrock.

Protected Species

Protected species include all species listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service, and those listed as endangered, threatened, rare, or unusual by the State of Georgia. The USFWS also may designate critical habitat for a federally listed species, which provides protection for the habitat as well as the species itself. The current listings of these endangered species, including their status, range, and habitat, can be accessed via the USFWS’s automated Information, Planning and Conservation System (IPaC, http://ecos.fws.gov/ipac/).

The District is home to a number of species that are considered threatened or endangered. Protecting watershed health is more than protecting water quality; it also includes protection of biological resources. Within the District, there are a number of protected animal species that spend all or part of their life cycle in rivers and streams or depend on streams for a significant portion of their life history. In addition, there are protected plants that are either aquatic or semi-aquatic and grow within or along the margins of rivers and streams. Table UC-3 lists the 21 protected species potentially found within the counties of the Upper Chattahoochee River Basin of the District.

Table UC-3. Aquatic and Semi-aquatic Protected Species in the Upper Chattahoochee River Basin

Fauna Type	Common Name	Status*	Cherokee	Cobb	DeKalb	Forsyth	Fulton	Gwinnett	Hall
Bird	Bald eagle	T	X			X	X		X
Fish	Altamaha shiner	T			X			X	X
	Amber darter	<u>E</u>	X						
	Bluestripe shiner	R		X			X		X
	Cherokee darter	<u>T</u>	X	X		X	X		
	Coosa Chub	E	X			X			
	Etowah darter	<u>E</u>	X			X			
	Frecklebelly madtom	<u>E</u>	X			X			
	Freckled darter	E	X						
	Highscale shiner	R		X			X		
	Lined chub	R	X	X					
	Rock darter	R	X			X			
Invertebrate	Alabama spike	E	X						
	Chattahoochee crayfish	T		X	X	X	X	X	X
	Delicate spike	E		X			X		
	Etowah crayfish	T	X			X			
	Finelined pocketbook	<u>T</u>	X						
	Gulf moccasinshell	<u>E</u>		X			X		
	Shineyrayed pocketbook	<u>E</u>					X		
Mammal	Gray bat	<u>E</u>	X						
	Northern long-eared bat	<u>T</u>	X						X

* Status that is not underlined is listed in Georgia. <u>Underlined status</u> is federally listed.

R = Rare
E = Endangered
T = Threatened

Trout Streams

Trout streams are classified in accordance with the primary and secondary designations and criteria defined in Section 15 of Georgia's Water Use Classifications and Water Quality Standards (391-3-6-.03). Streams designated as Primary Trout Streams are waters supporting a self-sustaining population of rainbow, brown or brook trout. Streams designated as Secondary Trout Streams are those with no evidence of natural trout reproduction but are capable of supporting trout throughout the year. The Chattahoochee River upstream from Interstate 285 West Bridge is the only water designated as a secondary trout stream within the District of the Upper Chattahoochee River Basin.

Land Use and Surface Water Quality

Drinking Water Supply

The Upper Chattahoochee River Basin is the primary drinking water supply source for the District, providing water to all or parts of eight District counties, including the four most populous: Cobb, DeKalb, Fulton, and Gwinnett. Withdrawals from this basin account for 72 percent of the District's total public water supplies. Recognizing the linkage between watershed management and water quality for water supply, the Georgia Department of Natural Resources (GADNR) Rule 391-3-16-.01 includes environmental planning criteria (or Part V criteria) to protect natural resources, such as wetlands, stream buffers, water supply watershed areas, groundwater recharge areas, protected rivers, and protected mountains. Table UC-4 lists the water supply sources and Figure UC-2 shows those waters that are designated to meet State drinking water criteria within the Upper Chattahoochee River Basin.

Table UC-4. Upper Chattahoochee River Basin Drinking Water Supply Sources

Water Supply Source	Owner/Operator Utilizing Source
Chattahoochee River	Cobb County-Marietta Water Authority DeKalb County Department of Watershed Management City of Atlanta Department of Watershed Management Atlanta - Fulton County Water Resources Commission
Lake Lanier	Cumming Utilities Forsyth County Water and Sewer Department Gwinnett County Department of Water Resources City of Buford City of Gainesville Department of Water Resources
Big Creek	City of Roswell Water Utility Department

Source water assessments were performed for all drinking water supplies within the Upper Chattahoochee River Basin as required by the U.S. Environmental Protection Agency (EPA). The source water assessments determined the potential for pollution based on individual source and nonpoint source pollution within drinking water supply watersheds and assigned a susceptibility ranking to each drinking water source. The susceptibility rankings throughout the basin were low for Lake Lanier, medium-high for the Chattahoochee River, and High for Big Creek. These susceptibility rankings indicate the urban and suburban nature of most of the watersheds within the Upper Chattahoochee River Basin.

Small Water Supply Watershed

A small water supply watershed is a watershed that has less than 100 square miles of land within the drainage basin upstream of a water supply reservoir. In this context, a water supply reservoir is a governmentally owned impoundment of water for the primary purpose of providing water to one or more governmentally owned public drinking water systems, which excludes the multipurpose reservoirs owned by the USACE.

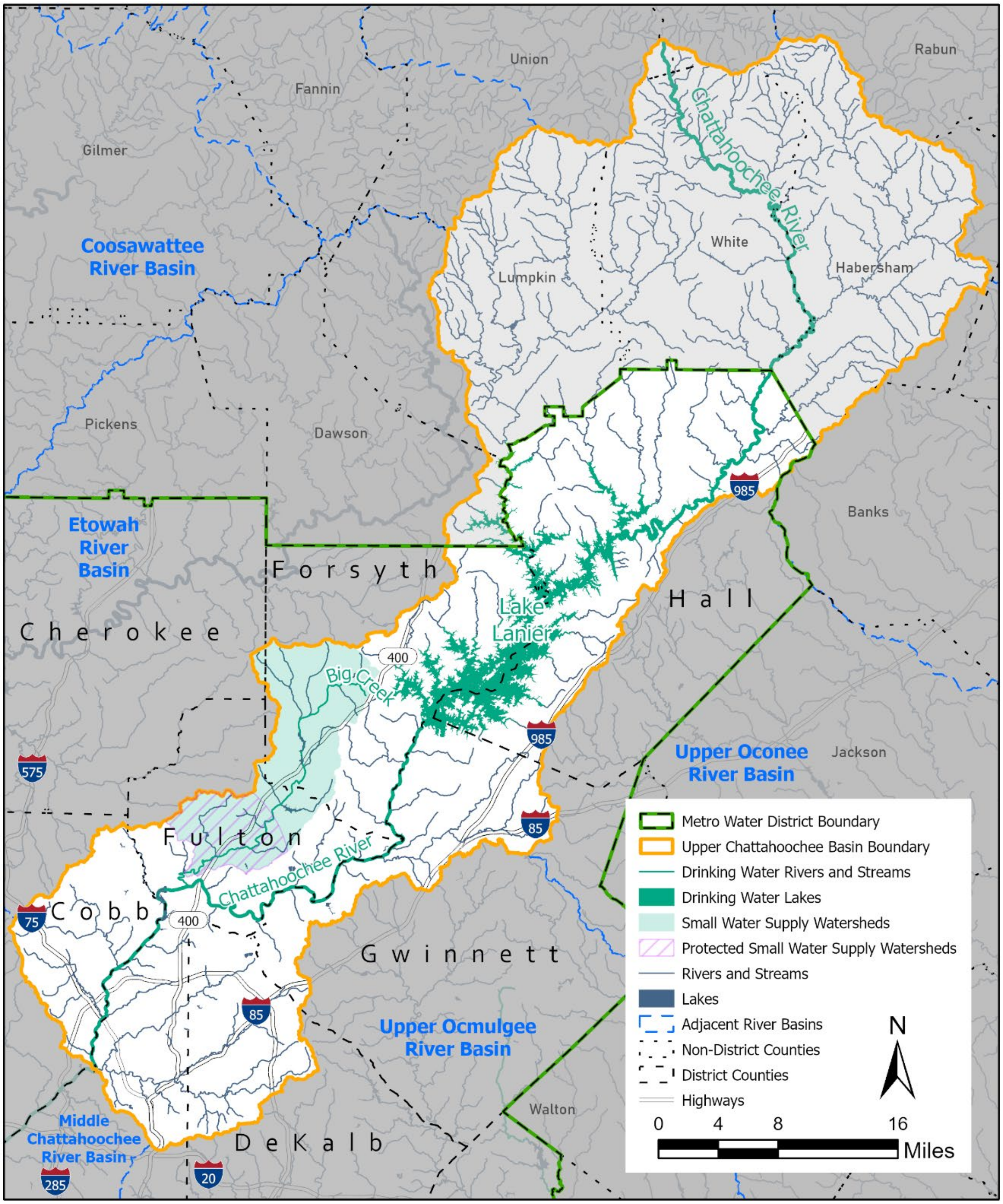

Figure UC-2. Upper Chattahoochee Basin Drinking Water

GADNR Rule 391-3-16-.01(7) requires 100-foot undisturbed buffers and 150-foot impervious surface setbacks for streams in small water supply watersheds within 7 miles upstream of water supply intakes and within 7 miles upstream of water supply reservoirs, excluding federal reservoirs. That portion of a small water supply watershed that includes the corridors of streams within a 7-mile radius upstream of a governmentally owned public drinking water supply intake or a non-federal water supply reservoir is called the protected small water supply watershed.

To facilitate implementation of GADNR Rule 391-3-16-.01(7) and Action Item Integrated-7, all areas of small water supply watersheds that are subject to protection through additional buffers and setbacks have been mapped for all local governments within the District. The Upper Chattahoochee River Basin has 31 square miles of protected small water supply watersheds in Fulton County as shown in Figure UC-2. Additional information and guidance can be found on the District Technical Assistance webpage in a memorandum titled, "District TAP Memo – Integrated-7 Additional Buffers in Small Water Supply Watersheds."

Land Cover/Land Use

The southern extent of the Upper Chattahoochee River Basin, downstream of Lake Lanier, transitions from a predominantly suburban character in Forsyth, Gwinnett, and North Fulton to the more densely developed employment areas of Perimeter Center and Cobb Galleria. In addition to including stretches of all of the major transportation corridors, auto and rail, in the region, portions of Peachtree Creek drain some of the most densely developed areas in the District, encompassing downtown and midtown Atlanta, Buckhead and Decatur. Overall, 54 percent of the Upper Chattahoochee River Basin within the District is developed, 30 percent is forested area, and 16 percent of the area falls within the remaining land cover classes (Table UC-5, Figure UC-3).

Table UC-5. Upper Chattahoochee River Basin Land Cover / Land Use within the District

Land Cover/Land Use	Area (Square Miles)	2019 Existing (%)
Barren Land (Rock/Sand/Clay)	2.38	0.26
Cultivated Crops	0.30	0.03
Deciduous Forest	183.61	20.23
Developed, High Intensity	50.70	5.59
Developed, Low Intensity	156.14	17.20
Developed, Medium Intensity	104.27	11.49
Developed, Open Space	181.39	19.98
Emergent Herbaceous Wetlands	0.43	0.05
Evergreen Forest	45.87	5.05
Grassland/Herbaceous	8.83	0.97
Mixed Forest	46.42	5.11
Open Water	60.74	6.69
Pasture/Hay	55.91	6.16
Shrub/Scrub	3.78	0.42
Woody Wetlands	7.04	0.78
Undeveloped	***415.31***	***45.75***
Developed	***492.50***	***54.25***
Total	**907.81**	**100**

Notes:

Developed = High Intensity, Low Intensity, Medium Intensity, and Open Space.
Undeveloped = land cover classes not described as Developed.

Data Source:

Aggregated Land Cover categories from USGS National Land Cover Database 2019.

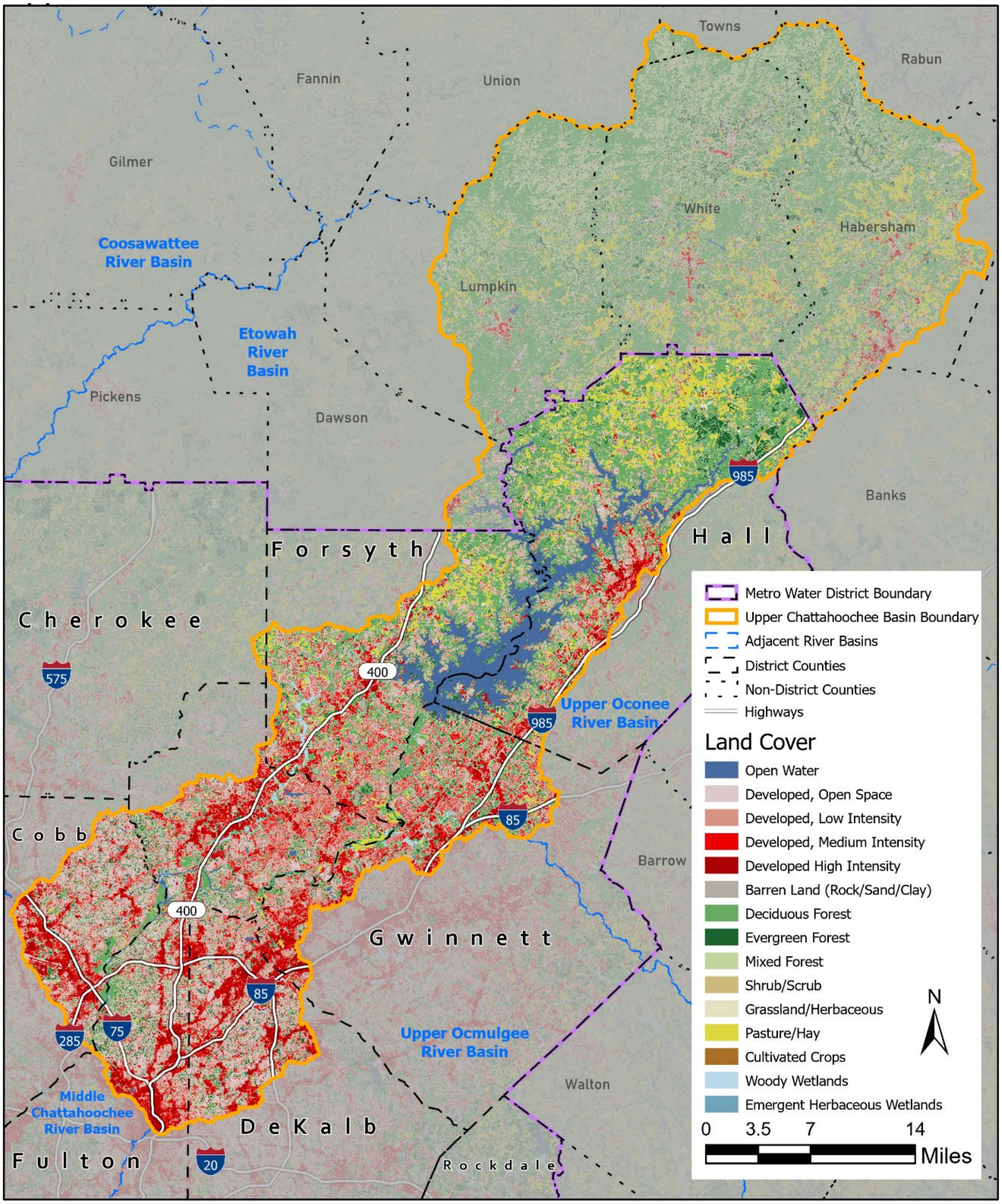

Figure UC-3. Upper Chattahoochee Land Cover

Source: 2019 USGS National Land Cover Database

Effective Impervious Areas

The level of watershed imperviousness has long been linked to impacts on changes in hydrologic regimes that lead to increased intensity and frequency of peak stormwater flows, which affect stream stability, water quality, and aquatic habitat and biotic community integrity. In general, the most sensitive aquatic organisms are affected at impervious levels greater than 10 percent. Between 11 and 25 percent of most stream communities become impacted, and over 25 percent of streams are generally no longer able to support viable biotic communities (Schueler, 2001).

Impervious surfaces (such as roofs, streets, parking lots) have a significantly different hydrologic response from pervious surfaces (lawns, forests); therefore, it is important to clearly define terms and assumptions related to the calculation of pervious and impervious areas for the purposes of watershed management. “Total impervious area” quantifies all of the land surfaces impervious to rainfall for the particular land cover category while “effective impervious area” (EIA) refers to the directly connected impervious area used for water quality and stormwater conveyance modeling. For the 2003 District-wide Plan, EIA values were initially defined based on previous studies, including the local watershed assessments, and then further refined based on calibration using available water quality data. For the 2022 District-wide Plan, the EIA of the HUC-12 subwatersheds within the District was calculated using a mathematical model developed by Sutherland for EPA based on land cover data from the 2019 USGS National Land Cover Database.

Of the 41 HUC-12s within the District portion of Upper Chattahoochee River Basin, 23 had an EIA greater than 10 percent, primarily those HUCs that either straddle a major transportation corridor such as Georgia 400 or Interstate 85 or the HUCs located within the more densely urbanized area of Interstate 285. Upstream of Buford Dam, the Lake Lanier drainage area had two HUC-12s greater than 10 percent EIA, including Flat Creek in Gainesville and the Bald Ridge Creek subwatershed just to the east of the City of Cumming. The effects of the region’s transportation corridors are also apparent as most of the subwatersheds encompassing Interstate 85, Interstate 75, and Interstate 285 have EIAs greater than 20 percent (Figure UC-4).

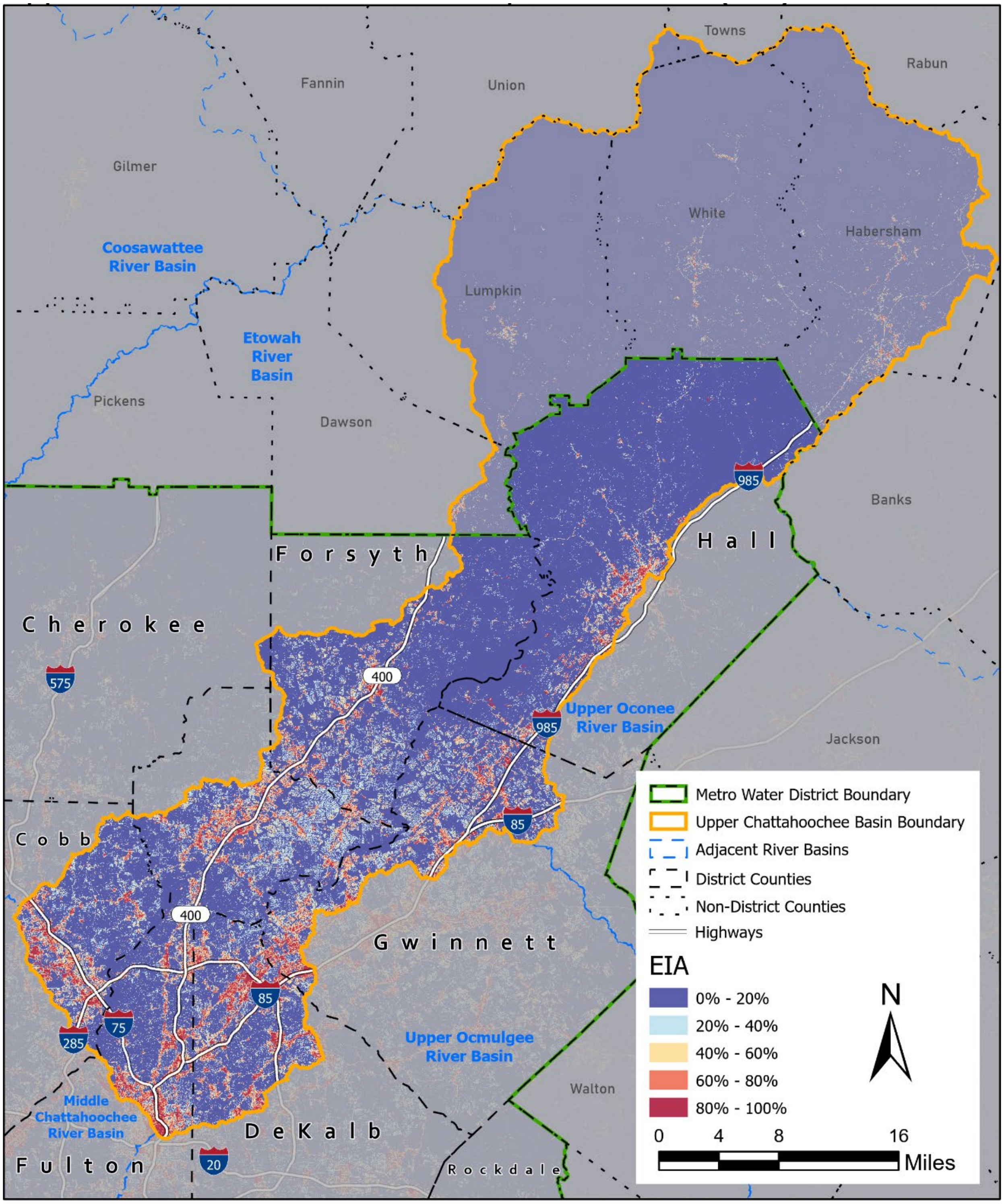

Figure UC-4. Upper Chattahoochee Effective Impervious Area

Wastewater Management

Permitted Wastewater Facility Service Areas

There are 19 municipal wastewater treatment facilities in the Upper Chattahoochee River Basin with a permitted capacity of 202.7 Maximum Monthly Flow – Million Gallons per Day (MMF-MGD). Additionally, the Upper Chattahoochee River Basin has 29 non-municipal wastewater treatment facilities with a permitted capacity of 20.9 MMF-MGD.

Combined-sewer Overflow Areas

Combined-sewer overflow (CSO) areas within the Upper Chattahoochee River Basin are limited to two small drainage areas within the Peachtree Creek (HUC-12 # 031300011204) subwatershed in the City of Atlanta. Major infrastructure improvement projects related to potential CSO overflows from the Tanyard Creek and Clear Creek areas during storm events as well as sanitary sewer overflows (SSOs) from the wastewater conveyance systems are ongoing and continue to reduce the bacteria contributions from these sources.

Impaired Water Bodies

The Georgia EPD establishes water quality standards for the state's surface waters. Section 303(d) of the federal Clean Water Act requires that all states list water bodies that do not meet water quality standards. The Georgia EPD publishes a biennial list of streams that do not meet State water quality standards, referred to as the 303(d)/305(b) list. If a water body does not support its designated use (drinking, recreation, fishing, wild/scenic rivers, or coastal fishing) because conditions violate water quality standards, it is considered an "impaired" stream or water body.

The Georgia EPD determines whether a water body is supporting its designated uses by collecting water quality data and comparing it against State water quality criteria. Georgia EPD describes their listing methodology and "preferred minimum dataset" at http://epd.georgia.gov/georgia-305b303d-list-documents. This methodology is important to understand the sample size, extent, and timeframe of the dataset that was used to list a water body. Feedback can be given to Georgia EPD if additional data or information are known that may affect future sampling or listing evaluations.

The District portion of the Upper Chattahoochee River Basin contains 1,721 stream miles, 385 of which were assessed for impairments. A total of 327 stream miles, 19 percent of total streams or 85 percent of assessed streams, did not meet State water quality standards based on the 2020 303(d) list. The streams listed as "not supporting" are summarized in Table UC-6 by parameter and graphically shown in Figure UC-5. Several streams are listed for violations of more than one parameter; therefore, the summation of impaired miles by parameter will not equal the miles of not supporting stream.

Streams in the Upper Chattahoochee River Basin that do not meet water quality standards for fecal coliform bacteria as a result of nonpoint source pollution account for 15 percent or 67 percent of total and assessed streams, respectively. Fecal coliform is used for water quality purposes as a Fecal Indicator Bacteria (FIB). FIBs are used to provide an approximation of the potential risk a water body poses to human health. These bacteria enter the stream from both human and non-human sources, including SSOs, leaking sewer lines, failing septic systems and pet/wildlife waste. Fecal coliform typically is found in both developed and undeveloped watersheds, and monitoring programs in Georgia have found levels that exceed State standards in urban, agricultural, and forested areas (Georgia EPD, 2011). While fecal coliform is ubiquitous in streams across the country (Georgia EPD, 2011), concentrations of bacteria can increase as a result of the higher density of potential pollutant sources and decreased stormwater filtration and stormwater treatment from population growth and development. Biota listings typically indicate high sediment loads in streams, which decrease habitat quality for benthic macroinvertebrates and fish. Sediment sources include runoff from construction sites as well as from streambank erosion due to accelerated streamflow velocities from impervious cover associated with urbanization.

Table UC-6. Upper Chattahoochee River Basin Summary of Impaired Streams

Criterion Violated	Miles of Stream	% of 2020 Assessed Streams	% of Total Stream Mileage
Fecal coliform bacteria	256	67	15
Biota (fish community)	153	40	9
E. coli	47	12	3
Biota (macroinvertebrate community)	38	10	2
Fish consumption guidance (PCBs)	12	3	1
Tetrachloroethylene	7	2	< 1
Copper	3	< 1	< 1
Lead	3	< 1	< 1
Zinc	3	< 1	< 1
Alpha-BHC and beta-BHC	1	< 1	< 1
Total impaired stream mileage*	327	85	19
Total mileage assessed for possible impairment	385		
Total stream mileage in the basin	1,721		

* Several streams are listed for violations of multiple parameters within the same stream segment; therefore, the total of impaired miles by parameter will not equal the total stream mileage of impaired streams.

BHC = benzene hexachloride
PCB = polychlorinated biphenyl

Woodall Creek, a 3-mile-long tributary to Peachtree Creek in Atlanta, is listed for fecal coliform, copper, zinc, lead, and tetrachloroethylene (PCE) violations while a 1-mile-long tributary to Woodall Creek is also listed for copper, zinc, and alpha-BHC and beta-BHC, byproducts of the production of the insecticide lindane (γ-hexachlorocyclohexane [HCH]). PCE is the predominant chemical solvent used in dry cleaning.

Tributary #2 to Sope Creek in Cobb County is also listed for PCEs.

The Chattahoochee River from Morgan Falls Dam to West Point Lake, downstream of the District, is listed for Fish Consumption Guidance as a result of legacy PCB levels.

Lake Lanier has a designated use of Recreation and Drinking Water with corresponding chlorophyll a and total nitrogen criteria. Sixteen percent of Lake Lanier at Browns Bridge Road (SR 369) is listed as not supporting its designated uses of Recreation and Drinking Water due to not meeting State water quality standards for chlorophyll a. An additional 13 percent of the lake (at Lanier Bridge Road) is pending assessment. A total of 68 percent of Lake Lanier is listed as supporting its designated use. Georgia EPD conducted modeling to establish Total Maximum Daily Loads (TMDLs) to address these exceedances and Georgia EPD found the growing season average chlorophyll a criteria at Browns Bridge and Flowery Branch needed to be revised based on modeling an all forested watershed. Georgia EPD has reevaluated and revised the chlorophyll a criteria at these locations (Georgia EPD, 2013).

TMDLs and TMDL Implementation Plans have been developed to help jurisdictions address impaired streams and lakes and specific parameters of concern. More information on specific TMDLs in the Upper Chattahoochee River Basin can be found on the Georgia EPD website https://epd.georgia.gov/total-maximum-daily-loadings.

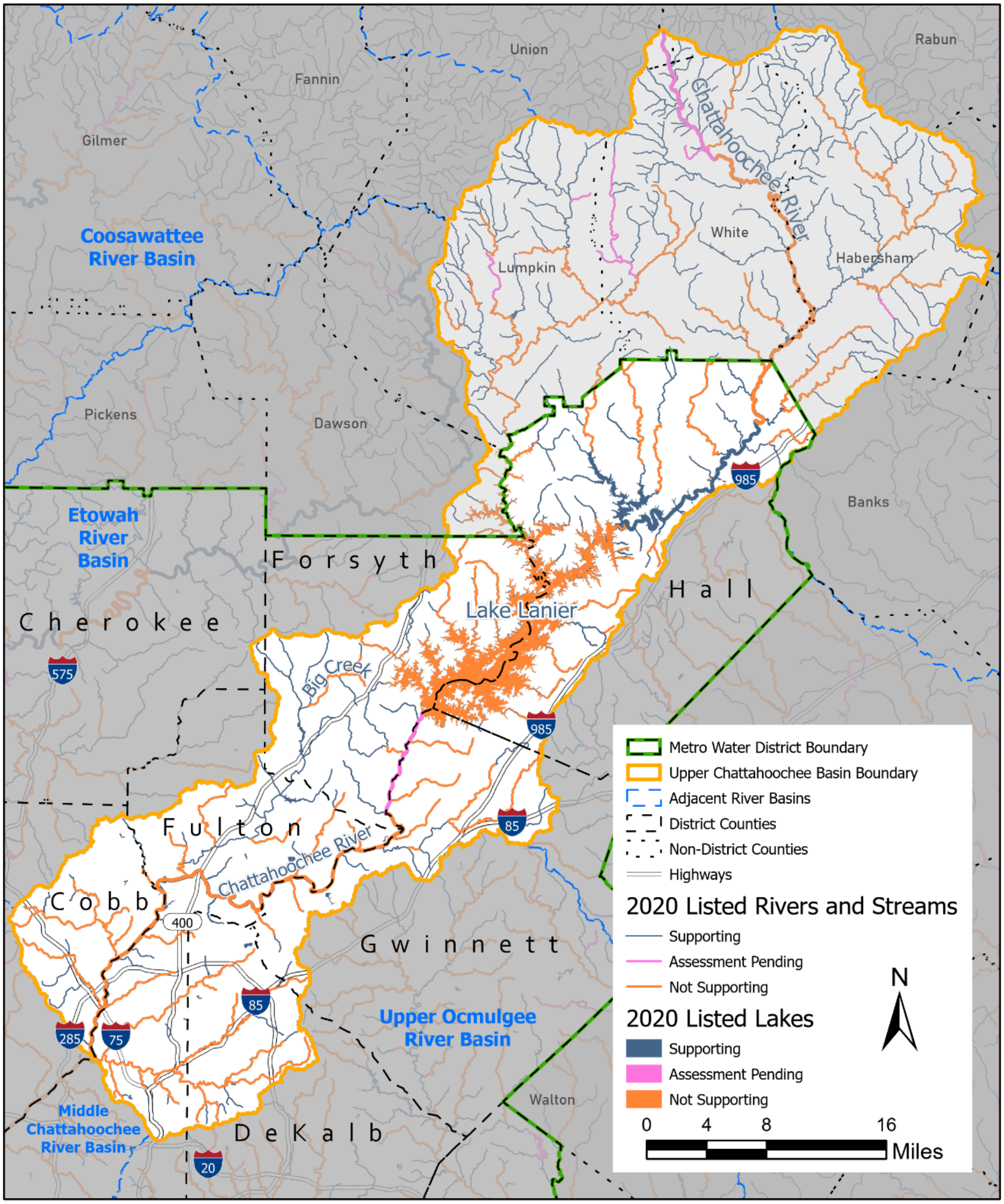

Figure UC-5. Upper Chattahoochee Basin 305(b)/303(d) Listed Waters

Management Issues and Recommendations

Basin-level Summary

Land development affects the physical, chemical, and biological conditions of the District's watersheds, waterways, and water resources. Based on the Stormwater Forecast analysis, development patterns in the District over the past century have resulted in substantial changes to watershed characteristics. Developed area is projected to increase from over 314,850 acres in the current (2019) condition to over 401,800 acres in 2040, a 28 percent increase. If current land use policy and recent development patterns continue, future estimates of land use are expected to intensify, with the weighted average curve number (CN) value potentially reaching approximately 84 and total imperviousness potentially reaching nearly 45 percent by 2040, based on the future developed area.

Precipitation rates are also expected to increase based on the future precipitation study results for the District. By 2040, the Basin-wide weighted average 85th percentile annual rainfall; 1-year, 24-hour rainfall; and 25-year, 24-hour rainfall events are estimated to potentially increase by 14 percent, 11 percent, and 16 percent, respectively. These changes to watershed characteristics and rainfall intensity will have a direct impact on the total potential runoff management volume generated from development that may require additional management from structural control measures.

Runoff for the three post-construction volumes (Water Quality Volume [WQv], Channel Protection Volume [CPv] and Overbank Flood Protection Volume [OFPv]) were calculated for 1,232 individual subcatchments in the basin. In 2019, a total of 517 million cubic feet of runoff was estimated in the basin for the WQv, 1,188 million cubic feet for the CPv, and 6,891 million cubic feet for the OFPv, based on over 314,850 acres of development. See additional information in the following summary table (Table UC-7) and a figure of the 2019 WQv for the basin (Figure UC-6).

Table UC-7. Upper Chattahoochee River Basin Watershed Characteristics and Total Potential Runoff Management Volumes

	Predevelopment	2019	2030	2040
Subcatchments (count)	1,231	1,231	1,231	1,231
Total area (acres)	580,776	580,776	580,776	580,776
Developed area (acres)	314,850	314,850	375,187	401,835
Total imperviousness (percent)	1.0	36.4	42.2	44.9
CN	62	82	83	84
Slope (percent)	9.8	9.8	9.8	9.8
85th percentile annual rainfall (inches)	1.20	1.20	1.32	1.37
1-year, 24-hour rainfall (inches)	3.34	3.34	3.58	3.70
25-year, 24-hour rainfall (inches)	5.99	5.99	6.61	6.94
WQv (cubic feet)	80.92 M	517.32 M	772.21 M	907.85 M
CPv (cubic feet)	349.34 M	1,187.86 M	1,665.97 M	1,910.11 M
OFPv (cubic feet)	-	6,890.77 M	10,232.41 M	12,014.55 M

Note:

M = million

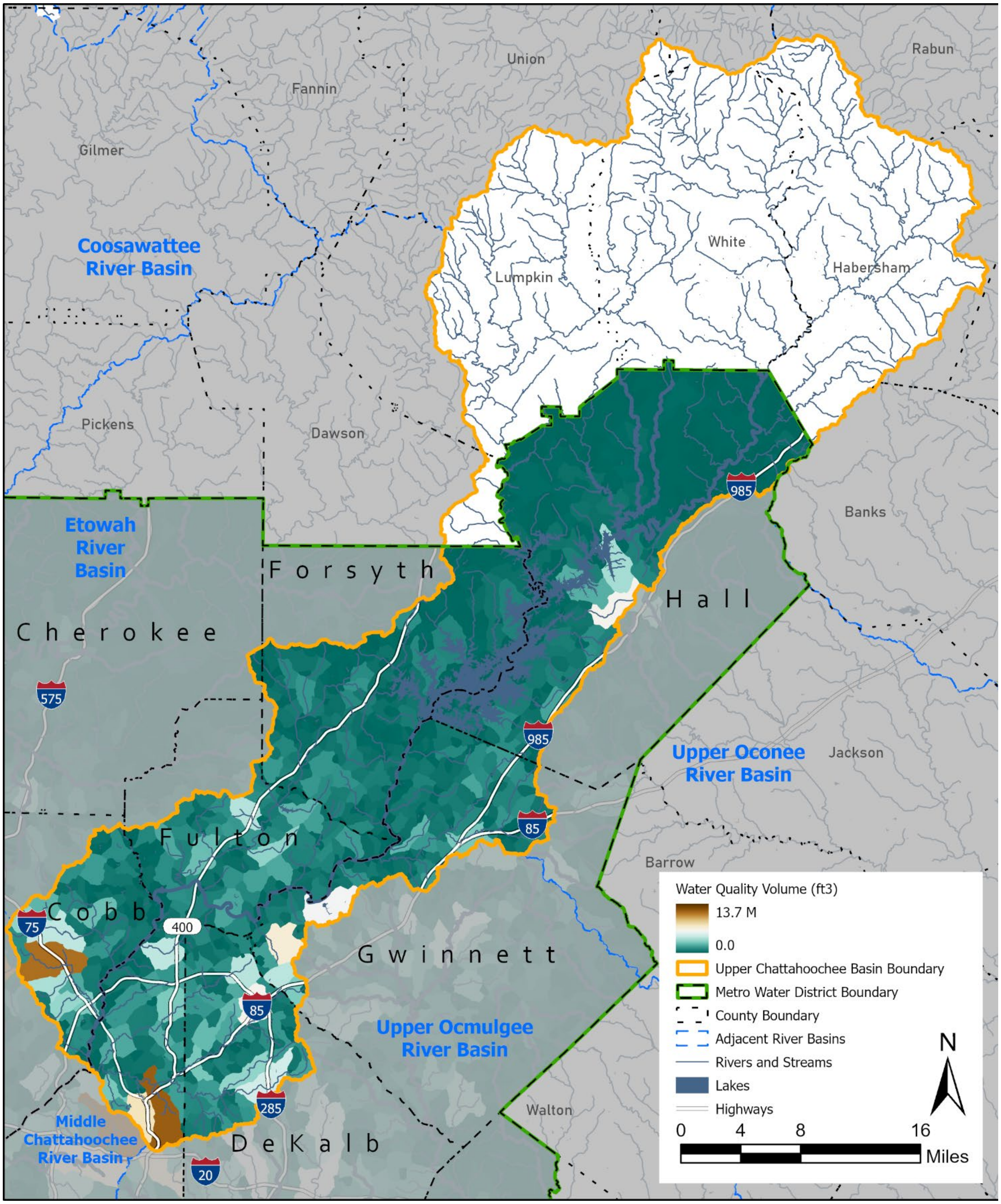

Figure UC-6. Estimated Water Quality Runoff Volume per Subcatchment – 2019

Management Issues and Recommended Strategies

Table UC-8 outlines management issues and strategies for the Upper Chattahoochee River Basin within the District. The recommended strategies presented in Table UC-8 are based on data presented within this River Basin Profile. These strategies are provided to further describe the potential causes and potential solutions to the watershed issues. They provide a foundation for guidance but are not presented here as mandatory requirements.

Table UC-8. Upper Chattahoochee River Basin Management Issues and Recommended Strategies

Management Issue	Description	Recommended Strategies
Source water quality	Source water watershed protection of Lake Lanier, Chattahoochee River, and small water supply watersheds.	• Implement source water protection measures in all subwatersheds draining to Lake Lanier. • Implement source water protection measures in all subwatersheds. • Continue collaborative efforts in small drinking water supply watersheds, such as Big Creek, to protect the viability of these supplies.
Nutrient loading	TMDL nutrient concentrations in Lake Lanier Portions of Lake Lanier have not met the chlorophyll a standards. Urban nutrient loading reductions will potentially be needed to restore Lake Lanier to its designated use. Agricultural nutrient loading reductions will potentially be needed to restore Lake Lanier to its designated use (Georgia EPD, 2013).	• Implement post-construction stormwater controls and infiltration practices to reduce NPS pollutants associated with multiple land uses, particularly suburban/urban and agricultural. • Educate the public on NPS pollution reduction and proper fertilizer application and the impacts of excess nutrients on the lake and local economy. • Coordinate with Georgia EPD NPS Program to develop nutrient management plans and strategies to reduce nutrient loading from animal feeding operations in concentrated production regions. • Participate in efforts to educate agricultural stakeholders about the importance of implementing the *Best Management Practices for Georgia Agriculture Manual* for animal production facilities (poultry) and grazing operations. • Coordinate with Georgia Department of Agriculture Livestock/ Poultry Section on inspections, complaint investigations, nutrient management plan reviews, permit administrative support and enforcement assistance (Georgia EPD, 2014). • Coordinate with counties upstream of Lake Lanier (Dawson, Habersham, and White Counties) in nutrient management efforts.
Increases in impervious cover (new development)	Increases in impervious cover can lead to a change in the hydrologic regime of a watershed by causing more intense, high-velocity stormwater flows and increased erosion and sedimentation.	• Nonpoint source pollution management • Adopt and enforce the post-construction stormwater control ordinance and use of Georgia Stormwater Management Manual design standards. • Watershed improvement projects, such as stream restoration and bank stabilization, are recommended in areas to reduce instream sediment load contributions.
Inadequate stormwater controls on existing impervious cover	Much of the development in the basin occurred prior to current Georgia Stormwater Management Manual design standards. Limited resources and cost of maintaining and repairing stormwater infrastructure Varying local strategies of funding stormwater management	• Implement an asset management program to identify and prioritize maintenance and capital improvement projects to maximize benefit. • Consider updating stormwater controls during redevelopment. • Identify opportunities for watershed improvement projects to retrofit or install updated stormwater controls, green infrastructure, stormwater treatment or other controls. • Consider dedicated funding sources, such as stormwater utilities, and seek out opportunities for grants, loans, and partnerships.

Table UC-8. Upper Chattahoochee River Basin Management Issues and Recommended Strategies

Management Issue	Description	Recommended Strategies
Aquatic resources	The Chattahoochee River upstream from I-285 West Bridge is a designated secondary trout stream.	• Balance nonpoint source temperature inputs from its tributaries with cold water releases from Buford Dam to meet secondary trout stream criteria.
Biota TMDLs	40% of assessed instream fish communities and 10% of the benthic macroinvertebrate communities are impaired. Biota impairment in this basin is the result of high sediment loads, primarily associated with existing development with inadequate stormwater controls, which is a concern for drinking water source supplies, biota, and recreation.	• Enforce post-construction stormwater ordinance on new development and seek opportunities to retrofit stormwater controls to maximize water quality and channel protection. • Recommend watershed improvement projects, such as stream restoration and streambank stabilization, in areas with failing stream banks to reduce instream sediment load contributions.
Bacteria TMDLs	67% of assessed stream segments in the Chattahoochee River Basin (within the District) are listed for fecal coliform.	• Identify bacteria sources through inspections, monitoring, source tracing and stream walks. • Educate public on pollution prevention, proper septic system maintenance and reporting a potential illicit discharge. • Address fecal coliform bacteria contributions from SSOs. • Address bacteria loads from agricultural sources as they are identified. • Perform regular maintenance to ensure proper functioning of decentralized systems (such as septic tanks). • Ongoing infrastructure improvement projects related to reduction of potential CSO overflows.
Lake management	Lake Lanier is the largest lake within this basin, but there are other public and privately-held and managed lakes that play a significant role in meeting designated uses and downstream hydrologic regimes and water quality.	• Develop a central inventory of lakes, ownership, and management practices to facilitate pollutant source identification both up and downstream of the lake. • Coordinate available water quality data and management activities for inventoried lakes. • Implement shoreline protection and upstream sediment management to prevent excessive nutrients and sedimentation within the lake. • Facilitate proper maintenance and management, particularly of small lakes by providing resources, links, or other materials to assist with periodic activities such as inspections, water quality sampling or dredging. • Conduct public education and involvement activities to promote watershed stewardship to protect lake quality.

Note:

NPS = nonpoint source pollution

Identify Indicators and Monitoring to Measure Implementation Success

A critical component of any watershed management program is the ability to assess progress and determine if management strategies are effectively addressing issues. This Plan includes implementation actions related to watershed monitoring and conducting condition assessments to evaluate implementation success. These implementation actions include long-term ambient trend monitoring (Action Item WATERSHED-10), as well as resource-specific implementation actions for Watershed Improvement (Action Item WATERSHED-8). Communities may choose to conduct project-specific monitoring associated with a watershed improvement project, such as biological or geomorphological monitoring to evaluate success.

As included in EPA (2008), a monitoring program should "…track progress in meeting load reduction goals and attaining water quality standards and other goals. Measurable progress is critical to ensuring continued support of watershed projects, and progress is best demonstrated with the use of monitoring data that accurately reflect water quality conditions relevant to the identified problems. Monitoring programs should include baseline (before), project-specific (during), and post-project (after) monitoring."

Some potential indicators to measure implementation success for the Upper Chattahoochee River Basin are listed as follows, but this list is not exhaustive:

- Select representative monitoring stations within the watershed to monitor for pollutants of concern and other water quality or biological parameters.
- Use USGS stream gage data or collect data to establish stream stage-discharge relationships and calculate or model water quality pollutant loads and potential reductions.
- Calculate or model improvements to hydrologic and hydraulic conditions based on structural project implementation.
- Estimate stream/lake bank stability and habitat improvement based on annual stream cross section surveys and bank erosion monitoring.
- Conduct stream/lake walks or structure inspections to inventory structure condition and performance, streambank stability and riparian condition over time.
- Conduct project monitoring to establish pre-, during-, and post-project conditions, as well as upstream/downstream monitoring during the same time period to reduce the effects of environmental variability.
- To determine if water quality degradation is being prevented, conduct GIS analysis to identify high-activity areas of a watershed using aerial overlays, work orders, facility inspection, erosion and sedimentation control, or new construction inspection data. Identify if monitoring data and GIS data follow similar patterns.
- Track number, location, size, or features (that is, drainage area treated or linear feet of restored stream) of watershed improvement, green infrastructure, or other nonpoint source reduction projects.
- Compare percentage of TMDL stream/lake segments over time.
- Track implementation actions by jurisdiction within the basin, and their measured effectiveness.
- Track enforcement actions by category and location.
- Track stream/lake buffer variances and local permits issued.

- Conduct public surveys for pollution prevention awareness or education effectiveness, particularly pre- and post-data associated with an education event.
- Compare existing water quality modeled loads against future water quality modeled loads.

ATTACHMENT 2

Middle Chattahoochee River Basin Profile

The District represents 30 percent of the overall Middle Chattahoochee River Hydrologic Unit Code (HUC)-8 Basin while that portion of this HUC-8 within the District represents 19 percent of the total District area. The Middle Chattahoochee River Basin serves as the primary receiving water for treated wastewater effluent for over 3.5 million people in the District (Atlanta Regional Commission [ARC], 2010).

Physical and Natural Features

Geography

The Middle Chattahoochee River Basin, HUC-8 #3130002, starts just south of Peachtree Creek in Atlanta and flows southwest, past West Point Lake, to downstream of Lake Harding near Columbus on the Georgia-Alabama state line. Figure MC-1 illustrates the six counties within the District portion of this river basin (Cobb, Clayton, Coweta, Douglas, Fulton and Paulding) and 18 cities including portions of Atlanta, Marietta, East Point, Fairburn and all of Chattahoochee Hills and Douglasville. The Middle Chattahoochee River Basin within the District covers 915 square miles, which represents 19 percent of the overall District area and 30 percent of the Middle Chattahoochee HUC-8 River Basin area itself.

The Chattahoochee River is entirely within the Piedmont province, which consists of a series of rolling hills and occasional isolated mountains; however, there are six physiographic districts, making the topography and hydrology highly variable. The Middle Chattahoochee River Basin includes portions of the Gainesville Ridge, Greenville Slope, and Winder Slope physiographic districts (District and CH2M HILL Engineers, Inc., 2002).

Hydrology and Soils

The Chattahoochee River flows to the Gulf of Mexico after joining with the Flint River to form the Apalachicola River in southern Georgia. West Point Lake is the second major reservoir on the Chattahoochee River system, located just south of the District. Authorized in 1962, the United States Army Corps of Engineers (Corps) operates West Point for its authorized purposes of flood control, hydroelectric power, navigation, fish and wildlife development and general recreation (Corps, 2015).

The Chattahoochee River within the District portion of the Middle Chattahoochee River Basin and the majority of its tributaries remain unimpounded. The main tributaries feeding the Middle Chattahoochee River Basin through the District include Proctor Creek, Sweetwater Creek, Anneewakee Creek, Camp Creek, Utoy Creek, Mountain Creek, Cedar Creek, Sandy Creek, and New River. Annual average rainfall ranges from 50 to 54 inches per year in the Middle Chattahoochee River Basin, with rainfall generally being lower to the southeast (National Oceanic and Atmospheric Administration, 2015). Measurements recorded at the U.S. Geological Survey's (USGS) Chattahoochee River near Fairburn station (USGS Station 02337170) indicate annual flows ranging from a low of 1,042 cubic feet per second (cfs) to a high of 11,230 cfs, with a mean flow of 3,450.6 cfs based on 57 years of record (USGS, 2020). The Dog River Reservoir, Cedar Creek Reservoir and J.T. Haynes Reservoir provide additional storage capacity.

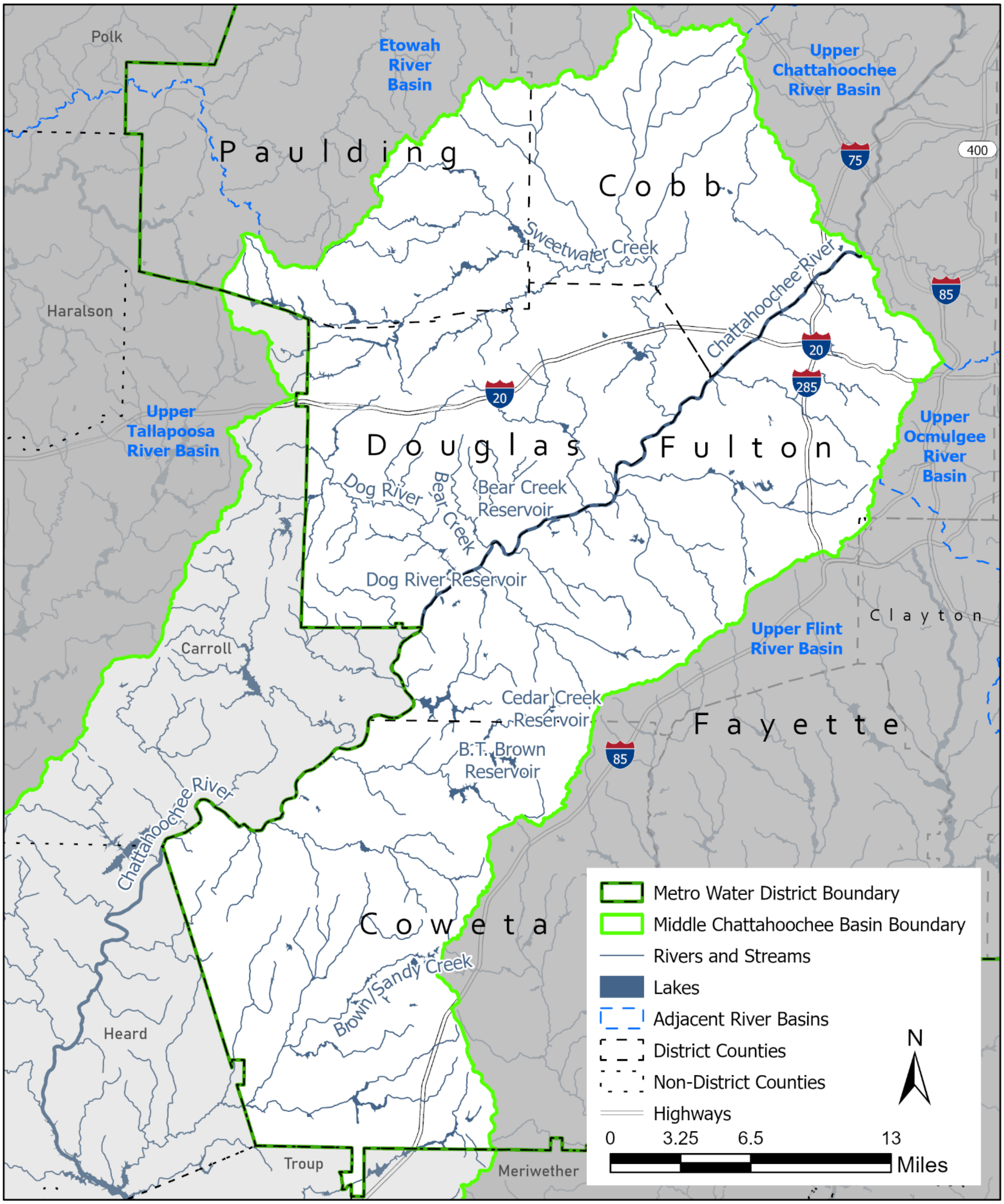

Figure MC-1. Middle Chattahoochee Basin Within the District

Surface waters in the Middle Chattahoochee River Basin are designated to have water quality that supports fishing, drinking water or recreation, with the majority designated for fishing.

An assessment of the availability of groundwater resources in select prioritized aquifers of Georgia was completed as part of Georgia's Comprehensive State-wide Water Management Plan (Georgia Environmental Protection Division [Georgia EPD], 2010). Groundwater availability is limited due to geologic conditions that restrict the potential yield for water supply; therefore, none of the Middle Chattahoochee River Basin within the District was selected as a priority aquifer for assessment.

The District lies almost completely within the Piedmont and the Blue Ridge (Ridge and Valley) geologic provinces. The aquifers in these provinces are in crystalline rocks that crop out in the northern portion of the basin and extend to the fall line. The rock is overlain with deposits of weathered, unconsolidated rock debris (regolith) that make up the available aquifer spaces. These deposits are thickest in valleys, but generally provide insufficient yield for uses other than very low density residential and thus surface water is the primary source of potable water for the District. The Georgia Geologic Survey Hydrologic Atlas 18 database identifies approximately 28 areas, representing about 4 percent of the District, that are likely to contain unconfined aquifers, and 79 areas, representing about 12 percent of the District, that are likely to contain thick soils considered to be an indicator of significant groundwater recharge areas. The recharge areas were mapped based on outcrop area, lithology, soil type and thickness, slope, density of lithologic contacts, geologic structure, the presence of karst and potentiometric surfaces. There are approximately 131 square miles—14 percent of the basin area within the District—of potential recharge areas within the Middle Chattahoochee River Basin (Table MC-1).

Table MC-1. Groundwater Recharge Areas within the Middle Chattahoochee River Basin

Recharge Area Type	County	Square Miles of Recharge Area Type within County
Probable Areas of Thick Soil	Clayton	< 1
	Cobb	9
	Coweta	56
	Douglas	25
	Fulton	31
	Paulding	10
Total Recharge Areas		132

There are four soil associations that describe the soil types in the Middle Chattahoochee River Basin: Cecil-Madison-Pacolet, Madison-Davidson-Pacolet, Riverview-Chewacla-Cartecay and the “urban” soils that start in north Fulton County (Table MC-2). The Cecil-Madison-Pacolet and Madison-Davidson-Pacolet associations are the most abundant, with the former types associated with moderate rolling hills and the latter with steeper terrain. These soils are well-drained and highly weathered, having a red to yellowish-red subsoil (Brock, 1977; Jordan et al., 1973; Murphy, 1979; Thomas and Tate, 1973; U.S. Department of Agriculture [USDA], 1976; Thomas, 1982; Wells, 1961; Robertson et al., 1960; USDA, 1958; Tate, 1967; Thomas and Tate, 1964). The Riverview-Chewacla-Cartecay association was found along the banks of some of the major rivers, particularly the lower half of the Chattahoochee River. These soils are variable and less well-drained than soils on higher elevations (Thomas and Tate, 1973; USDA, 1976; Thomas, 1982; Thomas, 1982; and USDA, 1958).

Table MC-2. Major Soil Associations within the Middle Chattahoochee River Basin

Soil Association	Significance to Watershed Management
Cecil-Madison-Pacolet	**Characteristics:** Associated with moderate rolling hills, well-drained, highly weathered. **Significance to Watershed Management:** Sloping surfaces may be more susceptible to increased erosion due to stormwater runoff velocities from impervious surfaces; well-drained soils may be more permeable, which increases infiltration capacity in areas without impervious cover, also may improve feasibility for infiltration practices.
Madison-Davidson-Pacolet	**Characteristics:** Associated with steep terrain, well-drained, highly weathered. Significance to Watershed Management: Steep terrain may be more susceptible to increased erosion due to stormwater runoff velocities from impervious surfaces; well-drained soils may be more feasible for infiltration practices.
Riverview-Chewacla-Cartecay	**Characteristics:** Found along the banks of some of the major rivers; variable and less well-drained. **Significance to Watershed Management:** Located near water bodies, this soil type is characterized by flat terrain that is less susceptible to erosion due to stormwater runoff velocities from impervious surfaces; poorly drained soils are less feasible for infiltration.
Urban Soils	**Characteristics:** Highly disturbed and compacted soils created as a result of human activity, vertical and spatial variability. **Significance to Watershed Management:** Compacted soils; poorly drained soils are less feasible for infiltration, restricted water drainage.

Protected Species

Protected species include all species listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service, and those listed as endangered, threatened, rare, or unusual by the State of Georgia. The USFWS also may designate critical habitat for a federally listed species, which provides protection for the habitat as well as the species itself. The current listings of these endangered species, including their status, range, and habitat, can be accessed via the USFWS's automated Information, Planning and Conservation System (IPaC, http://ecos.fws.gov/ipac/).

The District is home to a number of species that are considered threatened or endangered. Protecting watershed health is more than protecting water quality; it also includes protection of biological resources. Within the District, there are many protected animal species that spend all or part of their life cycle in rivers and streams or depend on streams for a significant portion of their life history. In addition, there are protected plants that are either aquatic or semi-aquatic and grow within or along the margins of rivers and streams. Table MC-3 lists the 25 protected species potentially found within the counties of the Middle Chattahoochee River Basin of the District.

Table MC-3. Aquatic and Semi-Aquatic Protected Species in the Middle Chattahoochee River Basin Counties

Fauna Type	Common Name	Status*	Cobb	Coweta	Douglas	Fulton	Paulding
Bird	Bald eagle	T			X	X	X
Fish	Bluestripe shiner	R		X	X	X	X
	Cherokee darter	<u>T</u>		X			X
	Etowah darter	<u>E</u>					
	Highscale shiner	R	X	X	X	X	X
	Lined chub	R		X			
	Lipstick darter	E					
	Muscadine darter	R					
	Tallapoosa darter	R					
Invertebrate	Chattahoochee crayfish	T		X	X	X	X
	Delicate spike	E		X	X		X
	Etowah crayfish	T					
	Finelined pocketbook	<u>T</u>					
	Gulf moccasinshell	<u>E</u>		X	X		X
	Inflated spike	T			X		
	Oval pigtoe	<u>E</u>			X		
	Piedmont blue burrower	E			X		
	Purple bankclimber	<u>T</u>			X		
	Rayed creekshell	T			X		
	Shineyrayed pocketbook	<u>E</u>		X	X		X
	Southern elktoe	E			X		
	Tallapoosa crayfish	R					
Mammal	Northern long-eared bat	<u>T</u>				X	
Reptile	Alligator snapping turtle	<u>T</u>	X		X		
	Barbour's map turtle	T			X		

* Status that is not underlined is listed in Georgia. <u>Underlined status</u> is federally listed.

R = Rare
E = Endangered
T = Threatened

Trout Streams

Trout streams are classified in accordance with the primary and secondary designations and criteria defined in Section 15 of Georgia's Water Use Classifications and Water Quality Standards (391-3-6-.03); there are no waters designated as primary or secondary trout streams in the Middle Chattahoochee River Basin.

Land Use and Surface Water Quality

Drinking Water Supply

The Middle Chattahoochee River Basin is the primary drinking water supply source for the District, providing water to all or parts of eight District counties including two of the most populous, Cobb and Fulton. Withdrawals from this basin account for 72 percent of the District's total public water supplies. Recognizing the linkage between watershed management and water quality for water supply, the Georgia Department of Natural Resources (GADNR) Rule 391-3-16-.01 includes environmental planning criteria (or Part V criteria) to protect natural resources such as wetlands, stream buffers, water supply watershed areas, groundwater recharge areas, protected rivers, and protected mountains. The Act is further described in Section 3. Table MC-4 lists the water supply sources and Figure MC-2 shows those waters that are designated to meet State drinking water criteria within the Middle Chattahoochee River Basin.

Source water assessments were performed for all drinking water supplies within the Middle Chattahoochee River Basin as required by the U.S. Environmental Protection Agency (EPA). The source water assessments determined the potential for pollution based on individual source and nonpoint source pollution within drinking water supply watersheds and assigned a susceptibility ranking to each drinking water source. The susceptibility rankings throughout the basin were low for B.T. Brown Reservoir, Cedar Creek Reservoir and Dog River Reservoir, low-medium for Bear Creek Reservoir and Brown/Sandy Creek, and medium for Sweetwater Creek. These susceptibility rankings indicate the urban and suburban nature of most of the watersheds within the Middle Chattahoochee River Basin.

Table MC-4. Middle Chattahoochee River Basin Drinking Water Supply Sources

Water Supply Source	Owner/Operator Utilizing Source
Chattahoochee River	Middle Chattahoochee Regional Water Authority
Sweetwater Creek	City of East Point Water and Sewer Authority
Dog River Reservoir (Dog River)	Douglasville Douglas County Water and Sewer Authority
Bear Creek Reservoir (Bear Creek)	Douglasville Douglas County Water and Sewer Authority
Cedar Creek Reservoir	City of Palmetto Water Department
B.T. Brown Reservoir	Coweta County Water and Sewerage Authority
Brown/Sandy Creek	Newnan Utilities

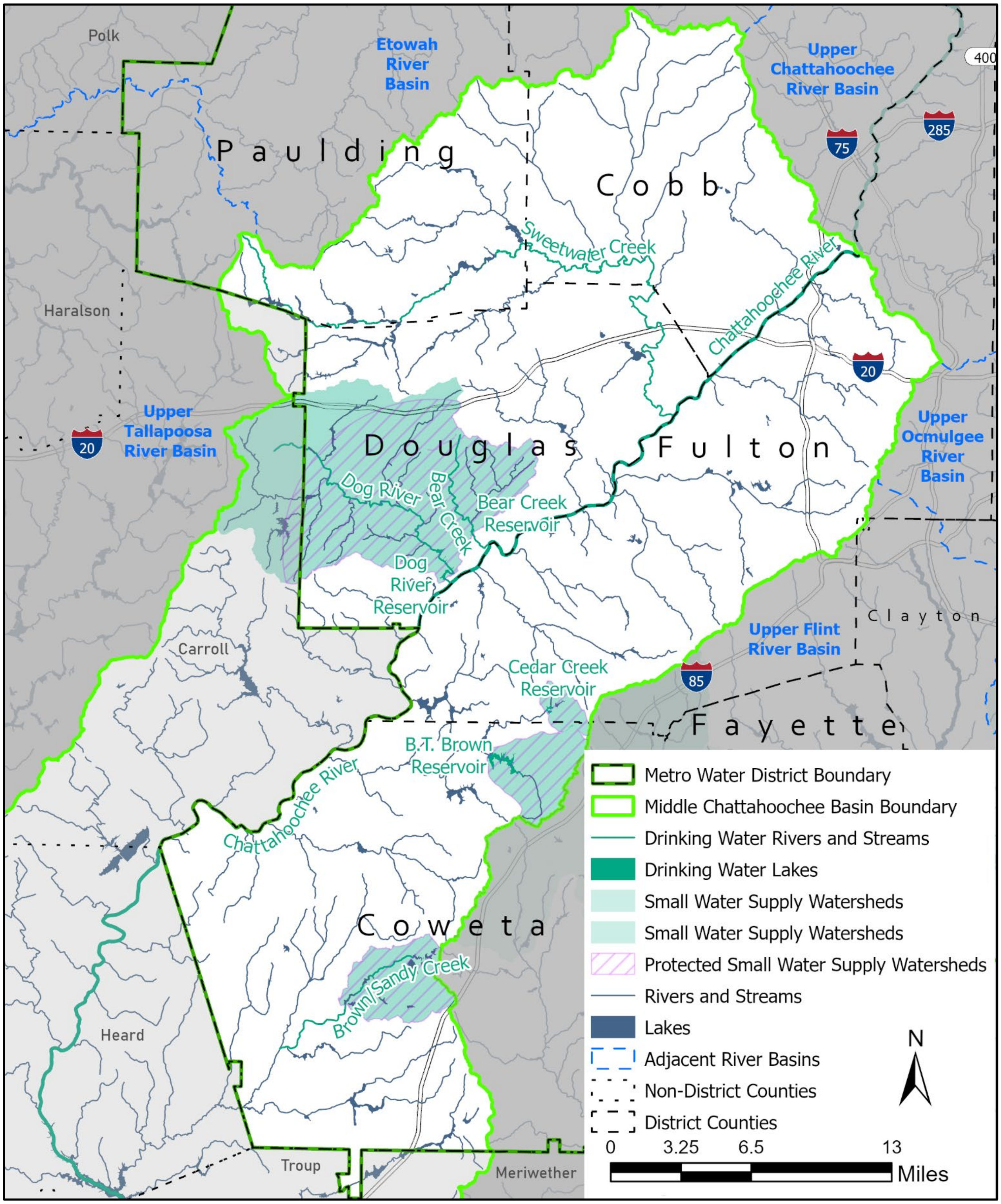

Figure MC-2. Middle Chattahoochee Basin Drinking Water

Small Water Supply Watershed

A small water supply watershed is a watershed that has less than 100 square miles of land within the drainage basin upstream of a water supply reservoir. In this context, a water supply reservoir is a governmentally owned impoundment of water for the primary purpose of providing water to one or more governmentally owned public drinking water systems, which excludes the multipurpose reservoirs owned by the Corps.

GADNR Rule 391-3-16-.01(7) requires 100-foot undisturbed buffers and 150-foot impervious surface setbacks for streams in small water supply watersheds within seven miles upstream of water supply intakes and within seven miles upstream of water supply reservoirs, excluding federal reservoirs. That portion of a small water supply watershed that includes the corridors of streams within a 7-mile radius upstream of a governmentally owned public drinking water supply intake or a non-federal water supply reservoir is called the protected small water supply watershed.

To facilitate implementation of GADNR Rule 391-3-16-.01(7) and Action Item INTEGRATED-7, all areas of small water supply watersheds that are subject to protection through additional buffers and setbacks have been mapped for all local governments within the District. The Middle Chattahoochee River Basin has 93 square miles of protected small water supply watersheds in Coweta, Douglas and Fulton Counties as shown in Figure MC-2. Additional information and guidance can be found on the District Technical Assistance webpage in a memorandum titled, “District TAP Memo – Integrated-7 Additional Buffers in Small Water Supply Watersheds.”

Land Cover/Land Use

Land cover/land use characteristics in the Middle Chattahoochee River Basin generally transition from the densely urbanized areas of the City of Atlanta in Fulton County, and Marietta and Smyrna in Cobb County. The legacy of Atlanta’s role as a transportation hub is readily apparent with major rail yards in Proctor Creek (Atlanta) and Sweetwater Creek (Austell), as well as the Interstate 20, Interstate 285 and Interstate 85 and Fulton Industrial Boulevard corridors and their associated commercial and industrial uses. With the limited exception of the developed lands around Union City, Fairburn and Newnan, land cover downstream of Anneewakee Creek in Douglas County and Camp Creek in Fulton County, tends to transition to a more forested or agricultural character. Overall, 34 percent of the Middle Chattahoochee River Basin within the District is developed, 49 percent of the area is forested, and 17 percent of the area falls within the remaining land cover classes (Table MC-5 and Figure MC-3).

Table MC-5. Middle Chattahoochee River Basin Land Cover / Land Use within the District

Land Cover/Land Use	Area (Square Miles)	2019 Existing (%)
Barren Land (Rock/Sand/Clay)	1.82	0.20
Cultivated Crops	0.03	0.00
Deciduous Forest	232.20	25.36
Developed, High Intensity	26.69	2.92
Developed, Low Intensity	111.90	12.22
Developed, Medium Intensity	51.52	5.63
Developed, Open Space	125.99	13.76
Emergent Herbaceous Wetlands	0.70	0.08
Evergreen Forest	166.51	18.19
Grassland/Herbaceous	15.76	1.72
Mixed Forest	47.30	5.17
Open Water	12.45	1.36
Pasture/Hay	81.16	8.86
Shrub/Scrub	14.00	1.53
Woody Wetlands	27.54	3.01
Undeveloped	***599.47***	***65.47***
Developed	***316.11***	***34.53***
Total	**915.58**	**100**

Notes:

Developed = High Intensity, Low Intensity, Medium Intensity, and Open Space.
Undeveloped = land cover classes not described as Developed.

Data Source:
Aggregated Land Cover categories from USGS National Land Cover Database (NLCD), 2019.

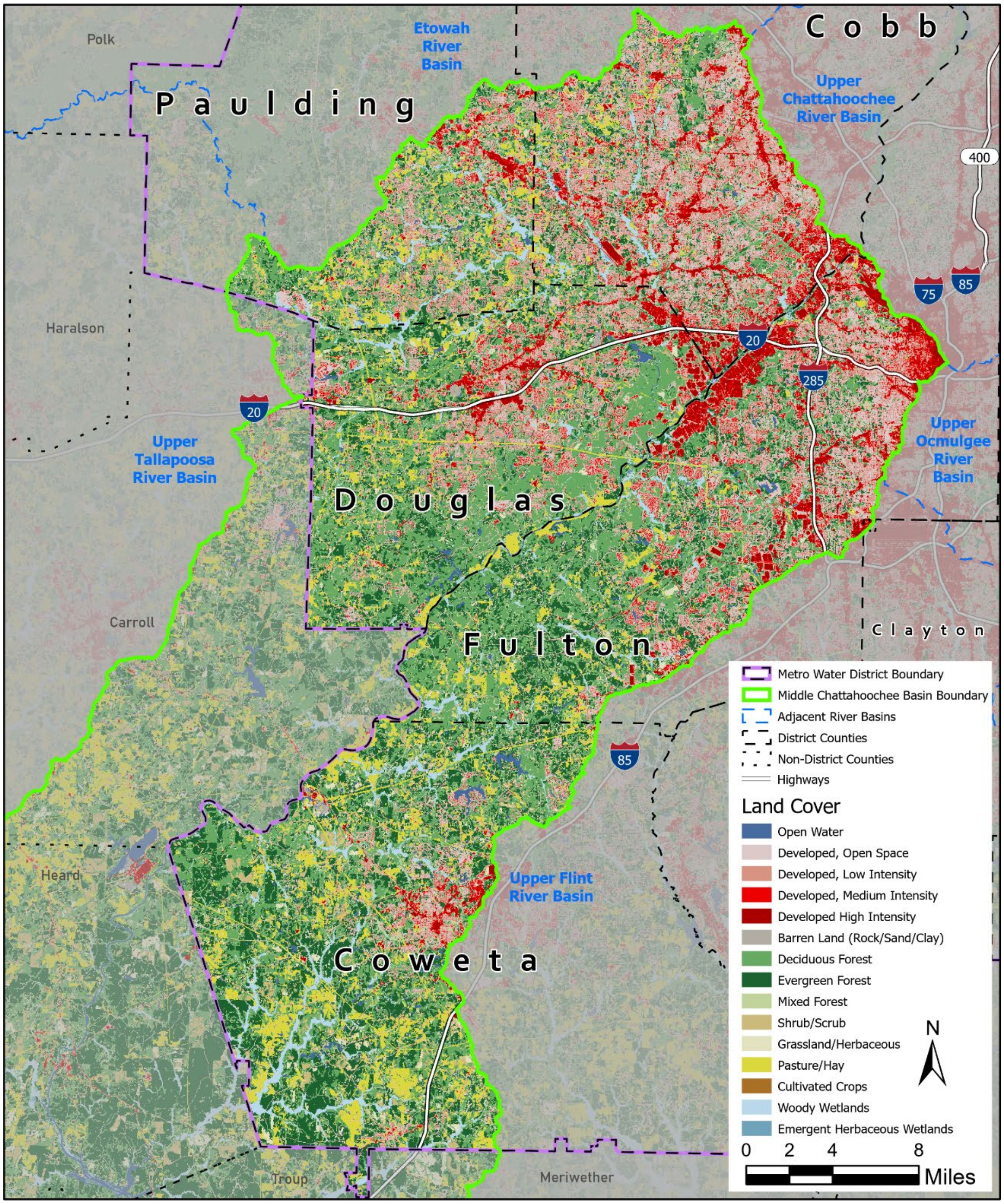

Figure MC-3. Middle Chattahoochee Land Cover

Source: 2019 NLCD

Over the course of the planning horizon, the basin is expected to have steady growth based on population projections. Much of this growth is anticipated to occur in the northeastern portion of the basin in south Fulton and Coweta Counties, while infill development and redevelopment resulting in increased density is expected to continue in Cobb, Douglas and Fulton Counties based on current land-use data.

Effective Impervious Areas

The level of watershed imperviousness has long been linked to impacts on changes in hydrologic regimes that lead to increased intensity and frequency of peak stormwater flows, which affect stream stability, water quality and aquatic habitat and biotic community integrity. In general, the most sensitive aquatic organisms are affected at impervious levels greater than 10 percent. Between 11 and 25 percent of most stream communities become impacted, and over 25 percent of streams are generally no longer able to support viable biotic communities (Schueler, 2001).

Impervious surfaces (such as roofs, streets, parking lots) have a significantly different hydrologic response from pervious surfaces (lawns, forests); therefore, it is important to clearly define terms and assumptions related to the calculation of pervious and impervious areas for the purposes of watershed management. “Total impervious area” quantifies all of the land surfaces impervious to rainfall for the particular land cover category while “effective impervious area” (EIA) refers to the directly connected impervious area used for water quality and stormwater conveyance modeling. For the 2003 District-wide Plan, EIA values were initially defined based on previous studies, including the local watershed assessments, and then further refined based on calibration using available water quality data. For the 2022 District-wide Plan, the EIA of the HUC-12 subwatersheds within the District was calculated using a mathematical model developed by Sutherland for EPA based on land cover data from the 2019 USGS National Land Cover Database.

Of the 34 HUC-12s within the District portion of Middle Chattahoochee River Basin, 13 had an EIA of greater than 10 percent and are primarily those HUC Basins that either straddle a major transportation corridor or are located within the more densely urbanized area located within Interstate 285. The only HUC-12 watersheds with an EIA greater than 20 percent are the Proctor Creek watershed, which drains the western side of downtown Atlanta, the Oiley Creek and Nickajack Creek watersheds in Cobb County, the Wilson Creek watershed which contains the portion of the mainstem of the Chattahoochee River and straddles the Fulton-Cobb-Douglas lines and includes Fulton County Airport - Brown Field, Six Flags over Georgia as well as the western Interstate 20/Interstate 285 interchange, and the Utoy Creek watershed, which is just south of the Fulton County Airport and encompasses portions of Interstate 285 (Figure MC-4).

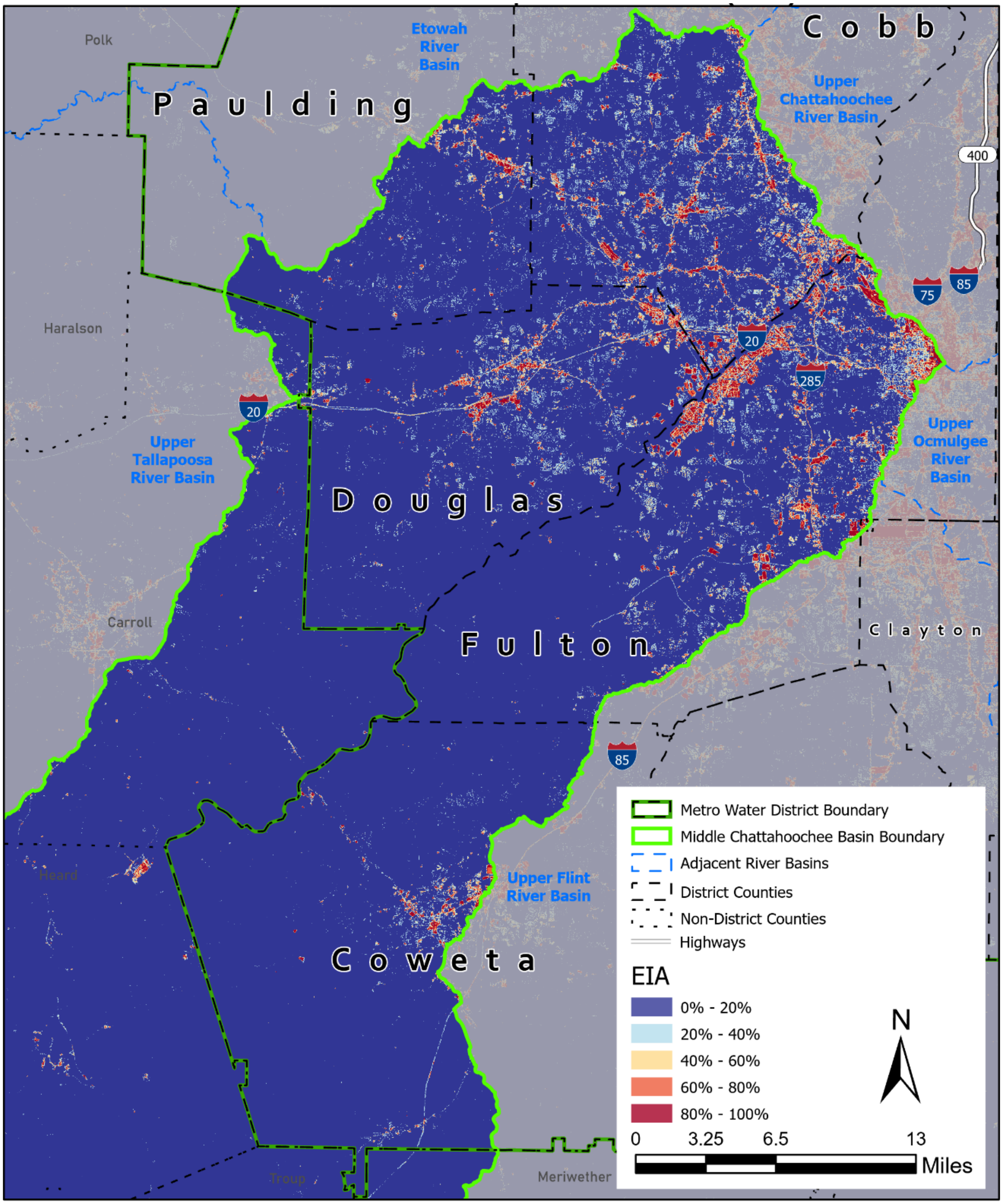

Figure MC-4. Middle ChattahoocheeEffective Impervious Area

Wastewater Management

Permitted Wastewater Facility Service Areas

There are 18 municipal wastewater treatment facilities in the Middle Chattahoochee River Basin with a permitted capacity of 269.6 Maximum Monthly Flow – Million Gallons per Day (MMF-MGD). Additionally, the Middle Chattahoochee River Basin has eight non-municipal wastewater treatment facilities with a permitted capacity of 1.2 MMF-MGD.

Combined-sewer Overflow Areas

Combined-sewer overflow (CSO) areas within the Middle Chattahoochee River Basin are limited to two small drainage areas within the Proctor Creek (HUC-12 # 031300020101) subwatershed in the City of Atlanta. Major infrastructure improvement projects related to potential CSOs from the Greensferry and Proctor Creek areas during storm events as well as sanitary sewer overflows from the wastewater conveyance systems are ongoing and continue to reduce the bacteria contributions from these sources.

Impaired Water Bodies

The Georgia EPD establishes water quality standards for the state's surface waters. Section 303(d) of the federal Clean Water Act requires that all states list water bodies that do not meet water quality standards. The Georgia EPD publishes a biennial list of streams that do not meet State water quality standards, referred to as the 303(d)/305(b) list. If a water body does not support its designated use (drinking, recreation, fishing, wild/scenic rivers, or coastal fishing) because conditions violate water quality standards, it is considered an "impaired" stream or water body.

The Georgia EPD determines whether a water body is supporting its designated uses by collecting water quality data and comparing it against the State water quality criteria. Georgia EPD describes their listing methodology and "preferred minimum dataset" at http://epd.georgia.gov/georgia-305b303d-list-documents. This methodology is important to understand the sample size, extent and timeframe of the dataset that was used to list a water body. Feedback can be given to Georgia EPD if additional data or information are known that may affect future sampling or listing evaluations.

The District portion of the Middle Chattahoochee River Basin contains 1,894 stream miles, 384 of which were assessed for impairments. A total of 234 miles, 12 percent of total streams or 61 percent of assessed streams, did not meet State water quality standards based on the 2020 303(d) list. The streams listed as "not supporting" are summarized in Table MC-6 by parameter and graphically shown in Figure MC-5. Several streams are listed for violations of more than one parameter; therefore, the sum of impaired miles by parameter will not equal the miles of not supporting stream.

Streams in the Middle Chattahoochee River Basin that do not meet water quality standards for fecal coliform bacteria as a result of nonpoint source pollution account for 10 percent or 47 percent of total and assessed streams, respectively. Fecal coliform is used for water quality purposes as a Fecal Indicator Bacteria (FIB). FIBs are used to provide an approximation of the potential risk a water body poses to human health. These bacteria enter the stream from both human and non-human sources, including sanitary sewer overflows, leaking sewer lines, failing septic systems, and pet/wildlife waste. Fecal coliform typically is found in both developed and undeveloped watersheds, and monitoring programs in Georgia have found levels that exceed State standards in urban, agricultural, and forested areas (Georgia EPD, 2011). While fecal coliform is ubiquitous in streams across the country (Georgia EPD, 2011), concentrations of bacteria can increase as a result of the higher density of potential pollutant sources and decreased stormwater filtration and stormwater treatment from population growth and development.

Table MC-6. Middle Chattahoochee River Basin Summary of Impaired Streams

Criterion Violated	Miles of Stream	% of 2020 Assessed Streams	% of Total Stream Mileage
Fecal coliform bacteria	180	47	10
Biota (fish community)	75	19	4
Fish consumption guidance (polychlorinated biphenyls)	43	11	2
Biota (macroinvertebrate community)	11	3	< 1
Algae	8	2	< 1
Dissolved oxygen	7	2	< 1
Zinc	5	1	< 1
E. coli	< 1	< 1	< 1
Total impaired stream mileage*	234	61	12
Total mileage assessed for possible impairment	384		
Total stream mileage in basin	1,894		

* Several streams are listed for violations of multiple parameters within the same stream segment; therefore, the total of impaired miles by parameter will not equal the total stream mileage of impaired streams.

Biota listings typically indicate high sediment loads in streams, which decrease habitat quality for benthic macroinvertebrates and fish. Sediment sources include runoff from construction sites as well as from streambank erosion caused by accelerated streamflow velocities from impervious cover associated with urbanization.

The Chattahoochee River from Morgan Falls Dam to West Point Lake, downstream of the District, is listed for Fish Consumption Guidance as a result of legacy polychlorinated biphenyl levels. Utoy Creek is listed for zinc impairment with the cited source as urban runoff. Total maximum daily loads (TMDLs) and TMDL Implementation Plans have been developed to help jurisdictions address impaired streams and specific parameters of concern. More information on specific TMDLs in the Middle Chattahoochee River Basin can be found on the Georgia EPD website https://epd.georgia.gov/total-maximum-daily-loadings.

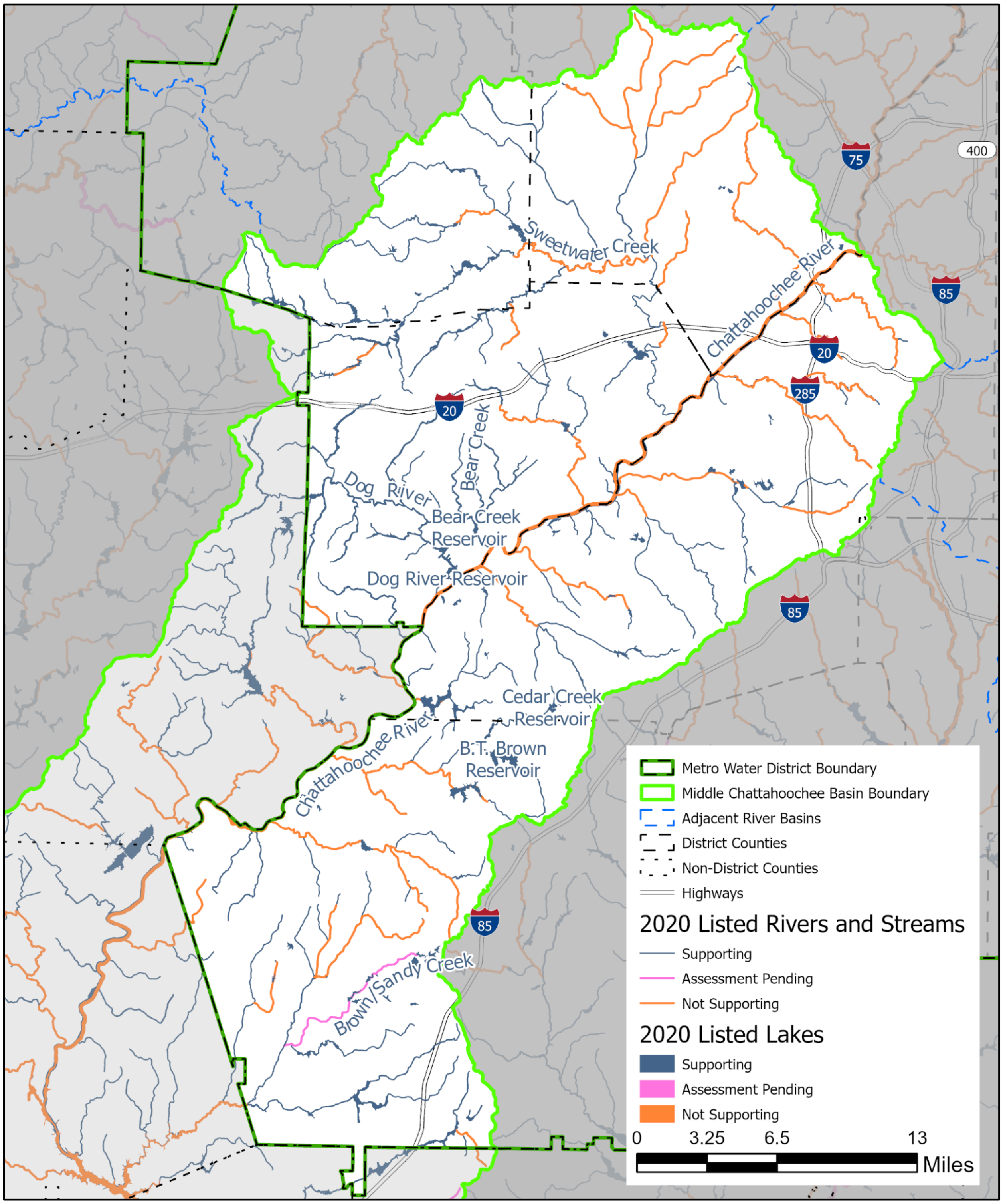

Figure MC-5. Middle Chattahoochee Basin 305(b)/303(d) Listed Waters

Management Issues and Recommendations

Basin-level Summary

Land development affects the physical, chemical and biological conditions of the District's watersheds, waterways and water resources. Based on the Stormwater Forecast analysis, development patterns in the District over the past century have resulted in substantial changes to watershed characteristics. Developed area is projected to increase from 201,377 acres in the current (2019) condition to 310,888 acres in 2040, a 54 percent increase. If current land use policy and recent development patterns continue, future estimates of land use are expected to intensify, with the weighted average curve number (CN) value potentially reaching approximately 84 and total imperviousness potentially reaching nearly 47 percent by 2040, based on the future developed area.

Precipitation rates are also expected to increase based on the future precipitation study results for the District. By 2040, the basin-wide weighted average 85th percentile annual rainfall; 1-year, 24-hour rainfall; and 25-year, 24-hour rainfall events are estimated to potentially increase by 14 percent, 11 percent, and 16 percent, respectively. These changes to watershed characteristics and rainfall intensity will have a direct impact on the total potential runoff management volume generated from development that may require additional management from structural control measures.

Runoff for the three post-construction volumes (Water Quality Volume [WQv], Channel Protection Volume [CPv], and Overbank Flood Protection Volume [OFPv]) were calculated for 1,091 individual subcatchments in the basin. In 2019, a total of 301 million cubic feet of runoff was estimated in the basin for the WQv, 750 million cubic feet for the CPv, and 4,543 million cubic feet for the OFPv, based on 201,377 acres of development. Additional information is provided in the following summary table (Table MC-7) and figure of the 2019 WQv for the basin (Figure MC-6).

Table MC-7. Middle Chattahoochee River Basin Watershed Characteristics and Total Potential Runoff Management Volumes

	Predevelopment	2019	2030	2040
Subcatchments (count)	1,091	1,091	1,091	1,091
Total area (acres)	585,881	585,881	585,881	585,881
Developed area (acres)	201,377	201,377	269,424	310,888
Total imperviousness (percent)	1.0	32.6	41.6	46.9
CN	61	81	83	84
Slope (percent)	8.1	8.1	8.1	8.1
85th percentile annual rainfall (inches)	1.20	1.20	1.32	1.37
1-year, 24-hour rainfall (inches)	3.39	3.39	3.64	3.77
25-year, 24-hour rainfall (inches)	6.26	6.26	6.92	7.26
WQv (cubic feet)	51.75 M	300.91 M	547.26 M	730.55 M
CPv (cubic feet)	223.76 M	749.63 M	1,216.02 M	1,518.70 M
OFPv (cubic feet)	-	4,543.16 M	7,822.30 M	9,991.13 M

Note:

M = million

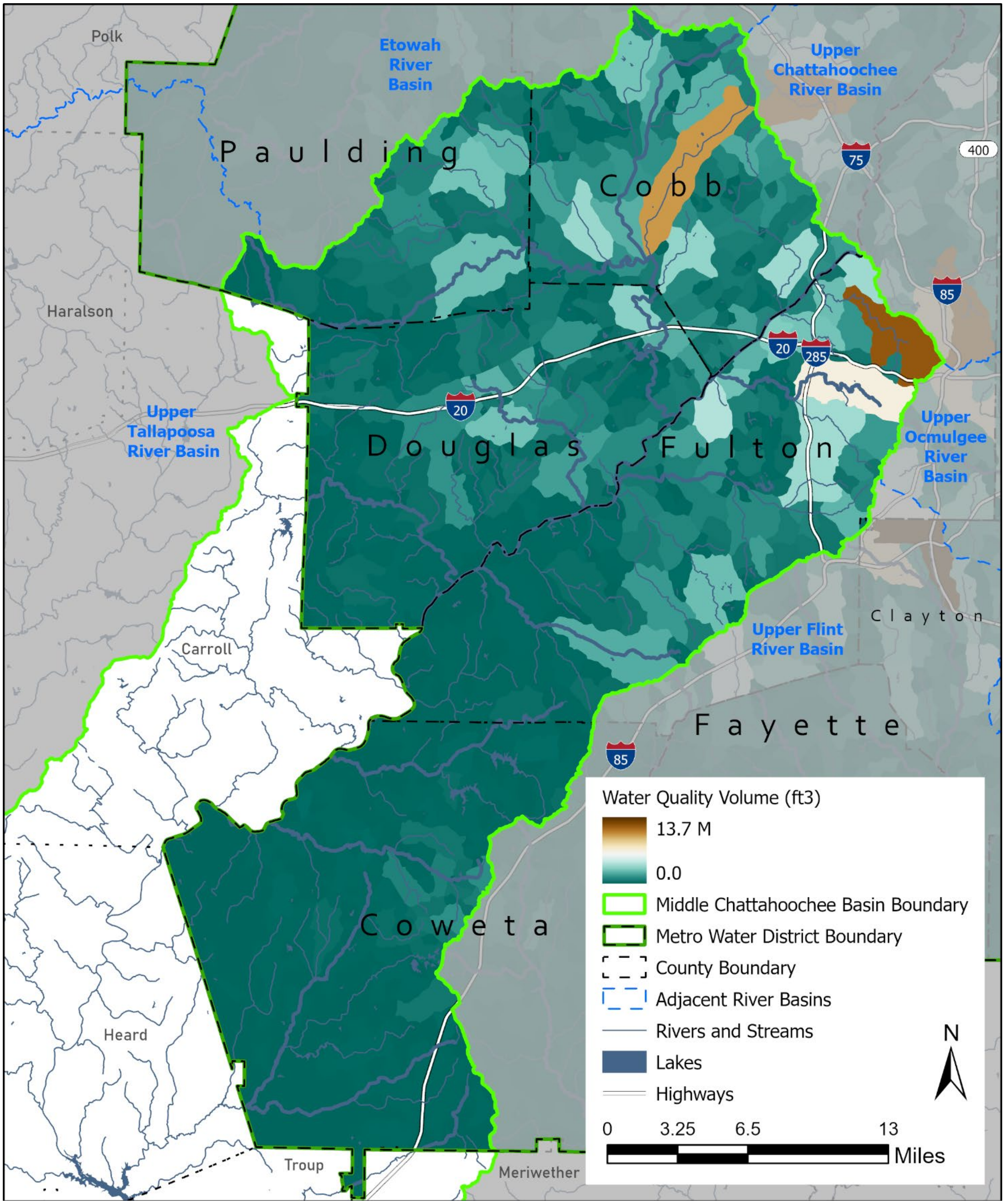

Figure MC-6. Estimated Water Quality Runoff Volume per Subcatchment – 2019

Management Issues and Recommended Strategies

Table MC-8 outlines management issues and strategies for the Middle Chattahoochee River Basin within the District. The recommended strategies presented in Table MC-8 are based on data presented within this River Basin Profile. These strategies are provided to further describe the commonality of causes and potential solutions to the watershed issues. They provide a foundation for guidance but are not presented here as mandatory requirements.

Table MC-8. Middle Chattahoochee River Basin Management Issues and Recommended Strategies

Management Issue	Description	Recommended Strategies
Source water quality	Source water watershed protection of Chattahoochee River, and small water supply watersheds.	• Implement source water protection measures in all subwatersheds upstream of Peachtree Creek. • Continue collaborative efforts in small drinking water supply watersheds, such as Sweetwater Creek, Dog River, and Cedar Creek, to protect the viability of these supplies.
Increases in impervious cover (new development)	Increases in impervious cover can lead to a change in the hydrologic regime of a watershed by causing more intense, high-velocity stormwater flows and increased erosion and sedimentation.	• Manage nonpoint source pollution. • Adopt and enforce the post-construction stormwater control ordinance and use of Georgia Stormwater Management Manual design standards. • Watershed improvement projects, such as stream restoration and streambank stabilization, are recommended in areas with failing streambanks to reduce instream sediment load contributions.
Inadequate stormwater controls on existing impervious cover	Much of the development in the basin occurred prior to current Georgia Stormwater Management Manual design standards. Limited resources and cost of maintaining and repairing stormwater infrastructure. Varying local strategies of funding stormwater management.	• Implement an asset management program to identify and prioritize maintenance and capital improvement projects to maximize benefit. • Consider updating stormwater controls during redevelopment. • Identify opportunities for watershed improvement projects to retrofit or install updated stormwater controls, green infrastructure, stormwater treatment, or other controls. • Consider dedicated funding sources, such as stormwater utilities, and seek out opportunities for grants, loans, and partnerships.
Biota TMDLs	19% of assessed instream fish communities and 3% of the benthic macroinvertebrate communities are impaired. Biota impairment in this basin is the result of high sediment loads, primarily associated with existing development with inadequate stormwater controls, which is a concern for drinking water source supplies, biota, and recreation.	• Enforce post-construction stormwater ordinance on new development and seek opportunities to retrofit stormwater controls to maximize water quality and channel protection. • Recommend watershed improvement projects, such as stream restoration and streambank stabilization, in areas with failing streambanks to reduce instream sediment load contributions.

Table MC-8. Middle Chattahoochee River Basin Management Issues and Recommended Strategies

Management Issue	Description	Recommended Strategies
Bacteria TMDLs	47% of assessed stream segments in the Middle Chattahoochee River Basin (within the District) are listed for fecal coliform.	• Identify bacteria sources through inspections, monitoring, source tracing and stream walks. • Educate public on pollution prevention, proper septic system maintenance, and reporting a potential illicit discharge. • Address fecal coliform bacteria contributions from sanitary sewer overflows. • Perform regular maintenance to ensure proper functioning of decentralized systems (such as septic tanks).
Lake management	Lake Lanier is the largest lake within this basin, but there are other public and privately held and managed lakes that play a significant role in meeting designated uses and downstream hydrologic regimes and water quality. Lakes within this HUC-8 include Dog River Reservoir as well as lakes downstream of the District.	• Develop a central inventory of lakes, ownership and management practices to facilitate pollutant source identification both up and downstream of the lake. • Coordinate available water quality data and management activities for inventoried lakes. • Implement shoreline protection and upstream sediment management to prevent excessive nutrients and sedimentation within the lake. • Facilitate proper maintenance and management, particularly of small lakes by providing resources, links, or other materials to assist with periodic activities such as inspections, water quality sampling or dredging. • Conduct public education and involvement activities to promote watershed stewardship to protect lake quality.

Identify Indicators and Monitoring to Measure Implementation Success

A critical component of any watershed management program is the ability to assess progress and determine if management strategies are effectively addressing issues. As discussed in Section 5, the Plan includes implementation actions related to watershed monitoring and conducting condition assessments to evaluate implementation success. These implementation actions include long-term ambient trend monitoring (Action Item WATERSHED-10), as well as resource-specific implementation actions for Watershed Improvement (Action Item WATERSHED-8). Communities may choose to conduct project-specific monitoring associated with a watershed improvement project, such as biological or geomorphological monitoring, to evaluate success.

As included in EPA (2008), a monitoring program should "…track progress in meeting load reduction goals and attaining water quality standards and other goals. Measurable progress is critical to ensuring continued support of watershed projects, and progress is best demonstrated with the use of monitoring data that accurately reflect water quality conditions relevant to the identified problems. Monitoring programs should include baseline (before), project-specific (during) and post-project (after) monitoring."

Some potential indicators to measure implementation success for the Middle Chattahoochee River Basin are listed below, but this list is not exhaustive:

- Select representative monitoring stations within the watershed to monitor for pollutants of concern and other water quality or biological parameters.
- Use USGS stream gage data or collect data to establish stream stage-discharge relationships and calculate or model water quality pollutant loads and potential reductions.

- Calculate or model improvements to hydrologic and hydraulic conditions based on structural project implementation.
- Estimate streambank stability and habitat improvement based on annual stream cross section surveys and bank erosion monitoring.
- Conduct stream walks or structure inspections to inventory structure condition and performance, streambank stability and riparian condition over time.
- Conduct project monitoring to establish pre-, during-, and post-project conditions, as well as upstream/downstream monitoring during the same time period to reduce the effects of environmental variability.
- Conduct GIS analysis to identify high-activity areas of a watershed using aerial overlays, work orders, facility inspection, erosion and sedimentation control or new construction inspection data to determine if water quality degradation is being prevented. Identify if monitoring data and GIS data follow similar patterns.
- Track number, location, size, or features (that is, drainage area treated or linear feet of restored stream) of watershed improvement, green infrastructure, or other nonpoint source reduction projects.
- Compare percentage of TMDL stream segments over time.
- Track implementation actions by jurisdiction within the basin, and their measured effectiveness.
- Track enforcement actions by category and location.
- Track stream buffer variances and local permits issued.
- Conduct public surveys for pollution prevention awareness or education effectiveness, particularly pre- and post-data associated with an education event.
- Compare existing water quality modeled loads against future water quality modeled loads.

ATTACHMENT 3

Upper Ocmulgee River Basin Profile

The Upper Ocmulgee River Basin encompasses 982 square miles along the southeastern edge of the District, representing 20 percent of its total area and 33 percent of the overall Upper Ocmulgee River Hydrologic Unit Code (HUC)-8 Basin. It includes portions of 30 cities and the following six counties: Clayton, DeKalb, Fulton, Gwinnett, Henry, and Rockdale. Several of the larger cities located within the Upper Ocmulgee River Basin portion of the District include Atlanta, Conyers, Lawrenceville, Snellville, Stockbridge, and McDonough. Approximately 100 miles of Interstate 85, Interstate 75, Interstate 285, and Interstate 20 traverse the basin. It supplies drinking water to Rockdale, Henry, and Clayton Counties in the District area (ARC, 2010).

Physical and Natural Features

Geography

The Ocmulgee streams and tributaries are classified as drinking or fishing, with the majority designated for fishing. The Upper Ocmulgee River Basin is entirely within the Piedmont province, which consists of a series of rolling hills and occasional isolated mountains. The Upper Ocmulgee River Basin includes portions of the Gainesville Ridge, Washington Slope and Winder Slope physiographic districts (Figure UO-1) (District, 2002).

Hydrology and Soils

The headwaters of the Upper Ocmulgee River Basin originate in Clayton, DeKalb, Fulton, and Gwinnett Counties and drain to the southeast through portions of Henry and Rockdale Counties. The Alcovy River, South River, Towaliga River, and Yellow River are the main tributaries draining to this portion of the District. This river basin includes one 8-digit HUC, ten 10-digit HUCs, and forty 12-digit HUCs. While there are multiple smaller reservoirs, such as Big Haynes Creek, Blalock Lake, Lake Jodeco, and Stone Mountain Lake in this basin, there are no major impoundments. However, Lake Jackson, a 4,570-acre Georgia Power-managed project, is located just outside of and downstream of the District. As such, it is influenced by the land cover and watershed conditions found within the Upper Ocmulgee River Basin. Jackson Lake is not supporting its designated use of recreation due to fish consumption guidelines for legacy polychlorinated biphenyl (PCB) contamination, which is attributed to urban runoff and nonpoint source pollution.

Two U.S. Geological Survey (USGS) flow stations were selected to characterize the hydrology in the Upper Ocmulgee River Basin. Stream discharges for the Alcovy River and its tributaries were characterized via USGS Station 02208450, Alcovy River above Covington, for a 50-year period of record. Annual flows at this station ranged from a low of 5.91 cubic feet per second (cfs) to a high of 1,069 cfs, with a mean of 237.5 cfs (USGS, 2020). The South River at Klondike Road, near Lithonia, USGS Station 02204070, showed an annual flow ranging from a low of 68 cfs to a high of 1,133 cfs for a 39-year period of record, with a mean flow of 314.6 cfs (USGS, 2020).

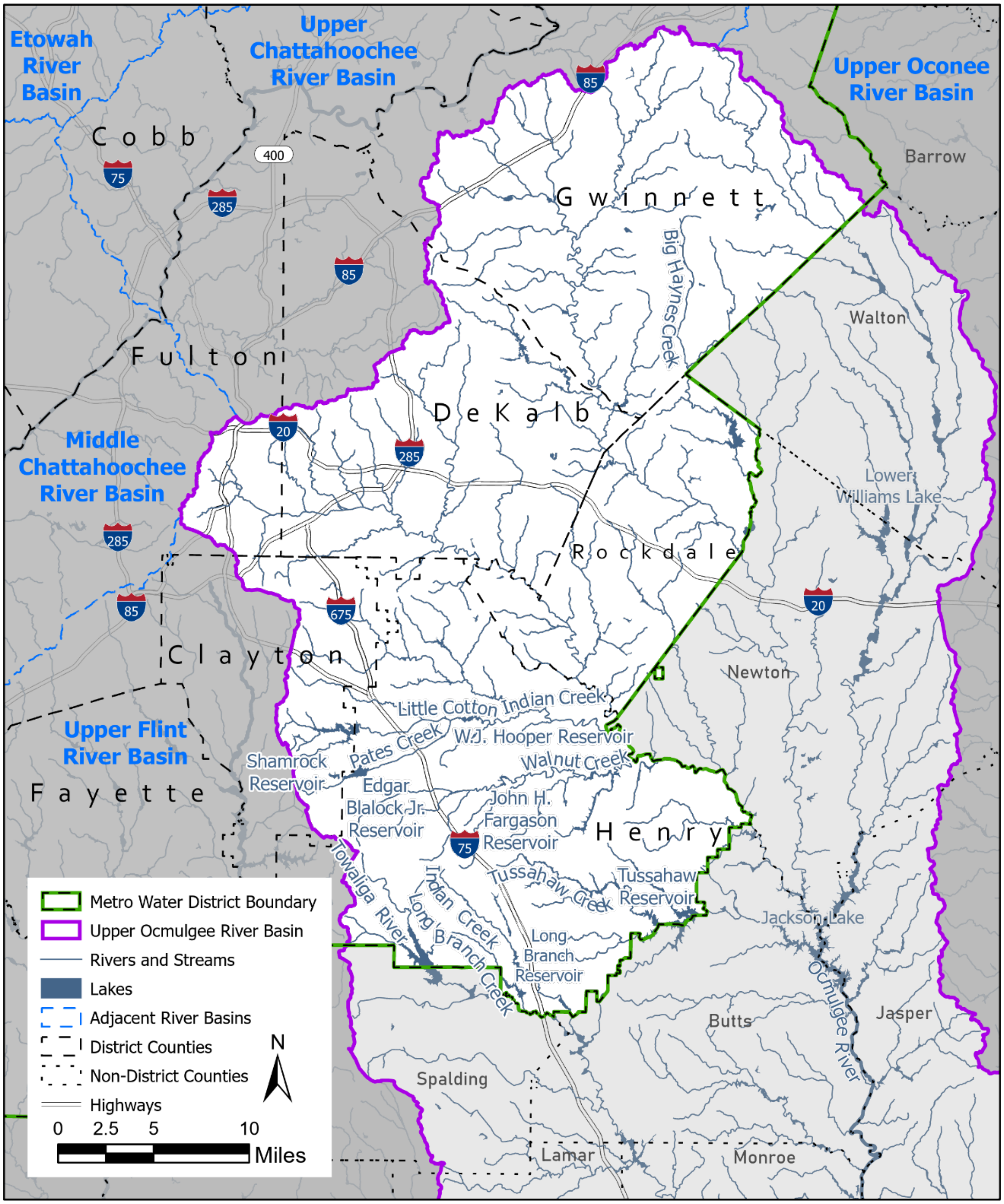

Figure UO-1. Upper Ocmulgee Basin Within the District

An assessment of the availability of groundwater resources in select prioritized aquifers of Georgia was completed as part of Georgia's Comprehensive State-wide Water Management Plan (Georgia Environmental Protection Division [Georgia EPD], 2010). None of the Ocmulgee River Basin within the District was selected as a priority aquifer for assessment.

The Upper Ocmulgee River Basin within the District lies completely within the Piedmont geologic provinces. The aquifers in these provinces are in crystalline rocks that crop out in the northern portion of the basin and extend to the fall line. The rock is overlain with deposits of weathered, unconsolidated rock debris (regolith) that make up the available aquifer spaces. These deposits are thickest in valleys, but generally provide insufficient yield for uses other than very low density residential and thus surface water is the primary source of potable water for the District. The Georgia Geologic Survey Hydrologic Atlas 18 database identifies approximately 28 areas, representing about four percent of the District, that are likely to contain unconfined aquifers, and 79 areas, representing about 12 percent of the District, that are likely to contain thick soils considered to be an indicator of significant groundwater recharge areas. There are approximately 162 square miles—17 percent of the basin area within the District—of potential recharge areas within the Upper Ocmulgee River Basin (Table UO-1).

Table UO-1. Groundwater Recharge Areas within the Upper Ocmulgee River Basin

Recharge Area Type	County	Square Miles of Recharge Area Type within County
Probable Areas of Thick Soil	Clayton	1
	DeKalb	13
	Gwinnett	65
	Henry	60
	Rockdale	23
Total Recharge Areas		162

There are five soil associations that describe the soil types in the Upper Ocmulgee River Basin: Ashlar-Pacolet-Cecil, Ashlar-Wedowee-Appling, Cecil-Madison-Pacolet, Madison-Davidson-Pacolet, and the “urban” soils that start in DeKalb, South Fulton, and Clayton Counties (Table UO-2). The Cecil-Madison-Pacolet and Madison-Davidson-Pacolet associations were the most abundant, with the former types associated with moderate rolling hills and the latter with steeper terrain. These soils are well-drained and highly weathered, having a red to yellowish-red subsoil (Brock, 1977; Jordan et al., 1973; Murphy, 1979; Thomas and Tate, 1973; U.S. Department of Agriculture [USDA], 1976; Thomas, 1982; Wells, 1961; Robertson et al., 1960; USDA, 1958; Tate, 1967; Thomas and Tate, 1964). The Ashlar-Pacolet-Cecil and Ashlar-Wedowee-Appling association was found primarily in South Gwinnett, DeKalb and Rockdale Counties and are characterized as soils that are deep to very deep with moderate to rapid permeability (Thomas and Tate, 1973; USDA, 1976; Thomas, 1982; Thomas, 1982; USDA, 1958).

Table UO-2. Major Soil Associations within the Upper Ocmulgee River Basin

Soil Association	Significance to Watershed Management
Ashlar-Pacolet-Cecil	**Characteristics:** Moderately deep and excessively drained. **Significance to Watershed Management:** Runoff is slow to rapid with moderately rapid permeability.
Ashlar-Wedowee-Appling	**Characteristics:** Consists of very deep, well-drained soils; these soils are on narrow ridges and on side slopes of uplands. **Significance to Watershed Management:** Runoff is medium to rapid and internal drainage is medium; permeability is moderate.

Table UO-2. Major Soil Associations within the Upper Ocmulgee River Basin

Soil Association	Significance to Watershed Management
Cecil-Madison-Pacolet	**Characteristics:** Associated with moderate rolling hills, well-drained, highly weathered. **Significance to Watershed Management:** Sloping surfaces may be more susceptible to increased erosion due to stormwater runoff velocities from impervious surfaces; well-drained soils may be more permeable, which increases infiltration capacity in areas without impervious cover, also may improve feasibility for infiltration practices.
Madison-Davidson-Pacolet	**Characteristics:** Associated with steep terrain, well-drained, highly weathered. **Significance to Watershed Management:** Steep terrain may be more susceptible to increased erosion due to stormwater runoff velocities from impervious surfaces; well-drained soils may be more feasible for infiltration practices.
Urban soils	**Characteristics:** Highly disturbed and compacted soils. **Significance to Watershed Management:** Construction activities, compaction and surface sealing dramatically change soil properties and can sometimes result in a reduced ability to perform the critical functions or activities of natural soil (Scheyer, 2005). Water movement in urban soils can be influenced by infiltration into the soil surface (especially from rainfall), percolation within the soil drain lines from septic systems (important in the soil below the drain line and above a restrictive layer) and the permeability within the soil from the surface to a restrictive layer.

Protected Species

Protected species include all species listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service, and those listed as endangered, threatened, rare or unusual by the State of Georgia. The USFWS also may designate critical habitat for a federally listed species, which provides protection for the habitat as well as the species itself. The current listings of these endangered species, including their status, range, and habitat, can be accessed via the USFWS's automated Information, Planning and Conservation System (IPaC, http://ecos.fws.gov/ipac/).

The District is home to a number of species that are considered threatened or endangered. Protecting watershed health is more than protecting water quality; it also includes protection of biological resources. Within the District, there are a number of protected animal species that spend all or part of their life cycle in rivers and streams or depend on streams for a significant portion of their life history. In addition, there are protected plants that grow within or along the margins of rivers and streams. Table UO-3 lists the 10 protected species that are either aquatic or semi-aquatic and potentially found within the counties of the Upper Ocmulgee River Basin.

Table UO-3. Aquatic and Semi-Aquatic Protected Species in the District

Fauna Type	Common Name	Status*	Clayton	DeKalb	Fulton	Gwinnett	Henry	Rockdale
Bird	Bald eagle	T			X		X	X
Fish	Altamaha shiner	T		X		X	X	X
	Bluestripe shiner	R			X			
	Cherokee darter	T			X			
	Highscale shiner	R	X		X			
Invertebrate	Chattahoochee crayfish	T		X	X	X		
	Delicate spike	E			X			
	Gulf moccasinshell	E			X			
	Shineyrayed pocketbook	E			X			

Table UO-3. Aquatic and Semi-Aquatic Protected Species in the District

Fauna Type	Common Name	Status*	Clayton	DeKalb	Fulton	Gwinnett	Henry	Rockdale
Reptile	Alligator snapping turtle	<u>T</u>	X					

* Status that is not underlined is listed in Georgia. <u>Underlined status</u> is federally listed.

R = Rare
E = Endangered
T = Threatened

Trout Streams

Trout streams are classified in accordance with the primary and secondary designations and criteria defined in Section 15 of Georgia's Water Use Classifications and Water Quality Standards (391-3-6-.03). There are no primary trout streams or secondary trout streams located within the District portion of the Upper Ocmulgee River Basin.

Land Use and Surface Water Quality

Drinking Water Supply

The Upper Ocmulgee River Basin is the primary drinking water supply source for some of the District, providing water to all or parts of three District counties: Clayton, Henry, and Rockdale Counties. Recognizing the linkage between watershed management and water quality for water supply, the Georgia Department of Natural Resources (GADNR) Rule 391-3-16-.01 includes environmental planning criteria (or Part V criteria) to protect natural resources, such as wetlands, stream buffers, water supply watershed areas, groundwater recharge areas, protected rivers, and protected mountains. Table UO-4 lists the water supply sources while Figure UO-2 shows the drinking water supply watersheds and those waters that are designated to meet State drinking water criteria within the Upper Ocmulgee River Basin. Most of Big Haynes Creek in Gwinnett and Rockdale Counties and a segment of the Yellow River in Rockdale County are expected to meet drinking water quality criteria, as are the following seven segments in Henry County: Big Cotton Indian Creek, Brown Branch, Little Cotton Indian Creek, Indian Creek, Pates Creek, Towaliga River, and Tussahaw Creek (Georgia EPD, 2015).

Table UO-4. Upper Ocmulgee River Basin Drinking Water Supply Sources

Water Supply Source	Owner/Operator Using Source
W.J. Hooper Reservoir (Little Cotton Indian Creek)	Clayton County Water Authority
Edgar Blalock Jr. Reservoir (Pates Creek)	Clayton County Water Authority
Shamrock Reservoir	Clayton County Water Authority
John H. Fargason Reservoir (Walnut Creek)	City of McDonough Water Department
Towaliga River	Henry County Water Authority
Indian Creek	Henry County Water Authority
Long Branch Reservoir (Long Branch Creek)	Henry County Water Authority
Tussahaw Reservoir (Tussahaw Creek)	Henry County Water Authority
Randy Poynter Reservoir (Big Haynes Creek)	Rockdale County Department of Water Resources

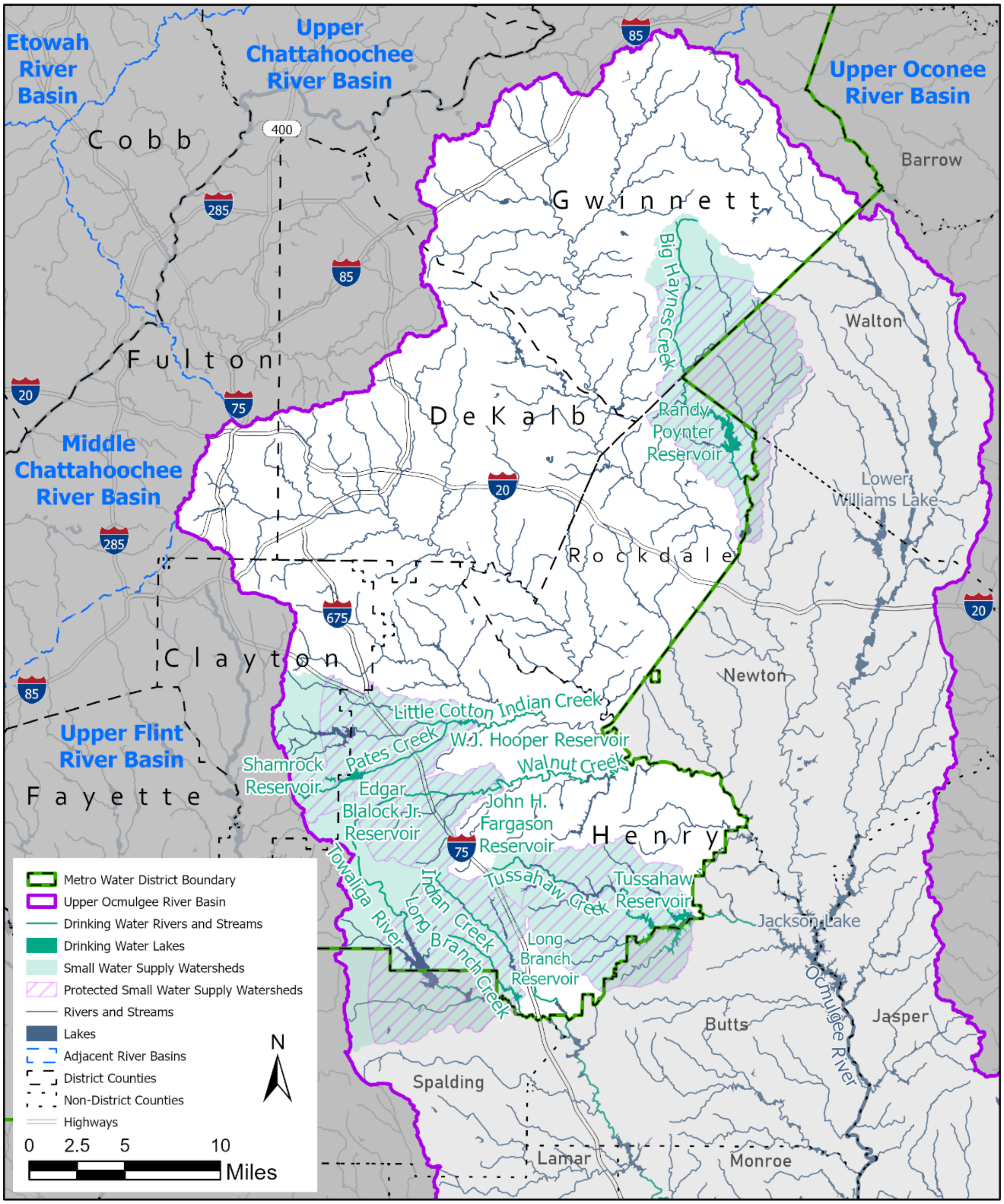

Figure UO-2. Upper Ocmulgee Basin Drinking Water

In addition, surface waters downstream of the District serve as important water supply sources, including Lake Jackson. This further stresses the need for protection of surface water quality within the 15-County region as well as the need for coordination with communities upstream and downstream.

Source water assessments were performed for all drinking water supplies within the Upper Ocmulgee River Basin as required by the U.S. Environmental Protection Agency (EPA). The source water assessments determined the potential for pollution based on individual source and nonpoint source pollution within drinking water supply watersheds and assigned a susceptibility ranking to each drinking water source. The susceptibility rankings throughout the basin were low for Big Haynes Creek, Long Branch Creek, Pates Creek, Towaliga River, and Tussahaw Creek. Walnut Creek was assigned a susceptibility ranking of low-medium, while Little Cotton Indian Creek was assigned a susceptibility ranking of medium-high. These susceptibility rankings indicate the urban and suburban nature of most of the watersheds within the Upper Ocmulgee River Basin and the number of potential pollutant sources within each source water watershed.

Small Water Supply Watershed

A small water supply watershed is a watershed that has less than 100 square miles of land within the drainage basin upstream of a water supply reservoir. In this context, a water supply reservoir is a governmentally owned impoundment of water for the primary purpose of providing water to one or more governmentally owned public drinking water systems, which excludes the multipurpose reservoirs owned by the United States Army Corps of Engineers.

GADNR Rule 391-3-16-.01(7) requires 100-foot undisturbed buffers and 150-foot impervious surface setbacks for streams in small water supply watersheds within 7 miles upstream of water supply intakes and within 7 miles upstream of water supply reservoirs, excluding federal reservoirs. That portion of a small water supply watershed that includes the corridors of streams within a 7-mile radius upstream of a governmentally owned public drinking water supply intake or a non-federal water supply reservoir is called the protected small water supply watershed.

To facilitate implementation of GADNR Rule 391-3-16-.01(7) and Action Item INTEGRATED-7, all areas of small water supply watersheds that are subject to protection through additional buffers and setbacks have been mapped for all local governments within the District. The Upper Ocmulgee River Basin has 183 square miles of protected small water supply watersheds in Clayton, Gwinnett, Henry, Newton, and Rockdale counties as shown in Figure UO-2. Additional information and guidance can be found on the District Technical Assistance webpage in a memorandum titled, “District TAP Memo – Integrated-7 Additional Buffers in Small Water Supply Watersheds.”

Land Cover/Land Use

The northern extent of the Upper Ocmulgee River Basin in Gwinnett and DeKalb Counties is predominantly suburban in character with more densely developed urban areas in the headwaters of the South River in the cities of Atlanta and Decatur. It is also traversed by stretches of five major interstates (85, 20, 285, 675, and 75) as well as Georgia 316 and the Stone Mountain Freeway and the resulting development associated with these corridors. Overall, 51 percent of the Upper Ocmulgee River Basin within the District is developed, 34 percent is forested, and 15 percent of the area falls within the remaining land cover classes (Table UO-5, Figure UO-3).

Table UO-5. Upper Ocmulgee River Basin Land Cover / Land Use within the District

Land Cover/Land Use	Area (Square Miles)	2019 Existing (%)
Barren Land (Rock/Sand/Clay)	5.00	0.51
Cultivated Crops	0.64	0.07
Deciduous Forest	153.30	15.57
Developed, High Intensity	44.48	4.52
Developed, Low Intensity	184.89	18.78
Developed, Medium Intensity	94.47	9.60
Developed, Open Space	182.93	18.58
Emergent Herbaceous Wetlands	0.64	0.07
Evergreen Forest	139.00	14.12
Grassland/Herbaceous	14.32	1.46
Mixed Forest	37.50	3.81
Open Water	14.49	1.47
Pasture/Hay	80.32	8.16
Shrub/Scrub	6.94	0.71
Woody Wetlands	25.36	2.58
Undeveloped	***477.53***	***48.51***
Developed	***506.77***	***51.49***
Total	**984.30**	**100**

Notes:

Developed = High Intensity, Low Intensity, Medium Intensity and Open Space.
Undeveloped = land cover classes not described as Developed.

Data Source:

Aggregated Land Cover categories from USGS National Land Cover Database (NLCD), 2019.

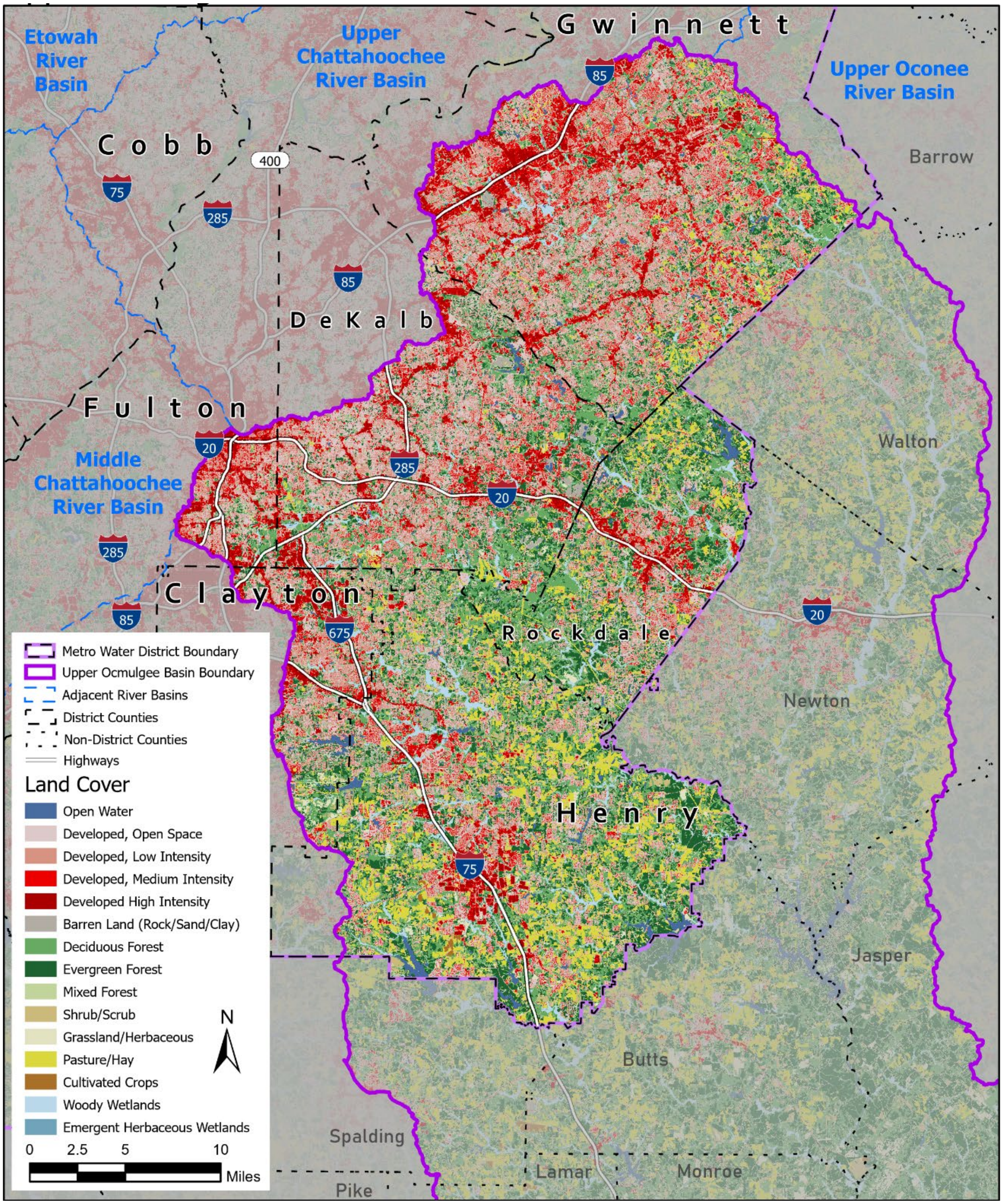

Figure UO-3. Upper Ocmulgee Land Cover

Source: 2019 NLCD

Effective Impervious Areas

The level of watershed imperviousness has long been linked to impacts on changes in hydrologic regimes that lead to increased intensity and frequency of peak stormwater flows, which affect stream stability, water quality and aquatic habitat and biotic community integrity. In general, the most sensitive aquatic organisms are affected at impervious levels greater than 10 percent. Between 11 and 25 percent of most stream communities become impacted, and over 25 percent of streams are generally no longer able to support viable biotic communities (Schueler, 2001).

Impervious surfaces (such as roofs, streets, and parking lots) have a significantly different hydrologic response from pervious surfaces (lawns, forests); therefore, it is important to clearly define terms and assumptions related to the calculation of pervious and impervious areas for the purposes of watershed management. "Total impervious area" quantifies all of the land surfaces impervious to rainfall for the particular land cover category while "effective impervious area" (EIA) refers to the directly connected impervious area used for water quality and stormwater conveyance modeling. For the 2003 District-wide Plan, EIA values were initially defined based on previous studies, including the local watershed assessments, and then further refined based on calibration using available water quality data. For the 2022 District-wide Plan, the EIA of the HUC-12 subwatersheds within the District was calculated using a mathematical model developed by Sutherland for EPA based on land cover data from the 2019 USGS National Land Cover Database.

Of the 40 HUC-12s within the District portion of Upper Ocmulgee River Basin, 28 had an EIA greater than 10 percent, primarily those HUCs that either straddle a major transportation corridor such as Interstate 20, Interstate 75, Interstate 85, Interstate 675, or the HUCs located within the more densely urbanized area within Interstate 285 (Figure UO-4). There were 14 HUC-12s with an EIA greater than 20 percent, including the headwaters of the South River in Fulton and Clayton Counties, Beaver Ruin and Sweetwater Creeks in Gwinnett County, and napping Shoals Creek and Dried Indian Creek in Rockdale County near Conyers.

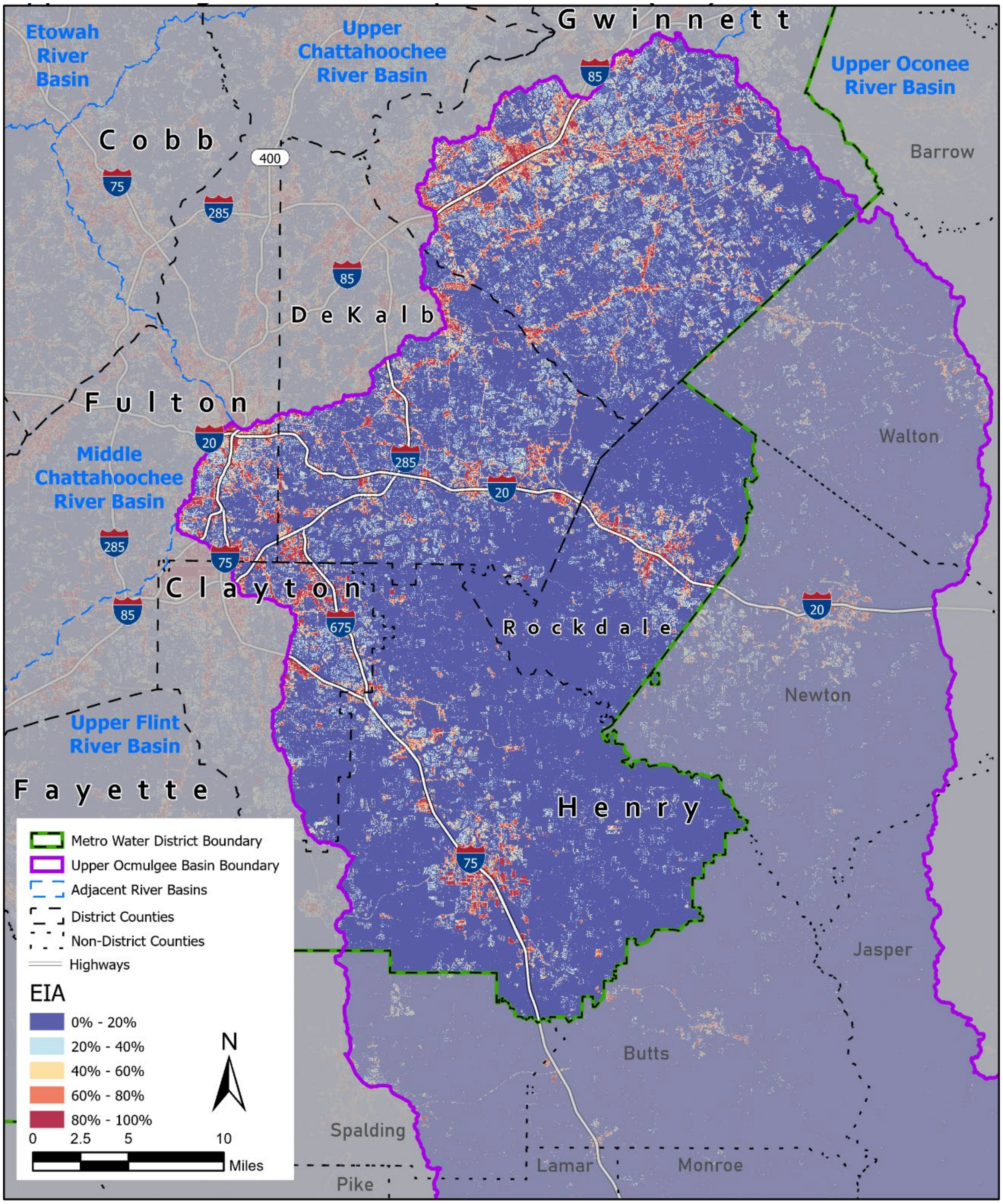

Figure UO-4. Upper Ocmulgee Effective Impervious Area

Wastewater Management

Permitted Wastewater Facility Service Areas

There are 16 municipal wastewater treatment facilities in the Upper Ocmulgee River Basin with a permitted capacity of 129 Maximum Monthly Flow – Million Gallons per Day (MMF-MGD). Additionally, the Upper Ocmulgee River Basin has 11 non-municipal wastewater treatment facilities with a permitted capacity of 0.5 MMF-MGD.

Combined-sewer Overflow Areas

Combined-sewer overflow (CSO) areas within the Upper Ocmulgee River Basin are limited to one small drainage area within the South River (HUC-12 # 30701030101) in the City of Atlanta. Major infrastructure improvement projects related to potential CSOs from the East Area CSO facilities during storm events as well as sanitary sewer overflows from the wastewater conveyance systems are ongoing and continue to reduce the bacteria contributions from these sources.

Impaired Water Bodies

Georgia EPD establishes water quality standards for the state's surface waters. Section 303(d) of the federal Clean Water Act requires that all states list water bodies that do not meet water quality standards. The Georgia EPD publishes a biennial list of streams that do not meet State water quality standards, referred to as the 303(d)/305(b) list. If a water body does not support its designated use (drinking, recreation, fishing, wild/scenic rivers, or coastal fishing) because conditions violate water quality standards, it is considered an "impaired" stream or water body.

Georgia EPD determines whether a water body is supporting its designated uses by collecting water quality data and comparing it against State water quality criteria. Georgia EPD describes their listing methodology and "preferred minimum dataset" at http://epd.georgia.gov/georgia-305b303d-list-documents. This methodology is important to understand the sample size, extent and timeframe of the dataset that was used to list a water body. Feedback can be given to Georgia EPD if additional data or information are known that may affect future sampling or listing evaluations.

The District portion of the Upper Ocmulgee River Basin contains 2,047 stream miles, 439 of which were assessed for impairments. A total of 348 stream miles, 17 percent of total streams or 79 percent of assessed streams, did not meet State water quality standards based on the 2020 303(d) list. The streams listed as not supporting are summarized in Table UO-6 and graphically shown on Figure UO-5. Several streams are listed for violations of more than one parameter; therefore, the summation of impaired miles by parameter will not equal the miles of not supporting stream.

Table UO-6. Upper Ocmulgee River Basin Summary of Impaired Streams

Criterion Violated	Miles of Stream	% of 2020 Assessed Streams	% of Total Stream Mileage
Fecal coliform bacteria	307	70	15
Biota (fish community)	83	19	4
Fish consumption guidance (PCBs)	46	11	2
Biota (macroinvertebrate community)	45	10	2
Copper	11	3	< 1
pH	8	2	< 1
Zinc	3	< 1	< 1
Cadmium	3	< 1	< 1
Total impaired stream mileage*	348	79	17
Total mileage assessed for possible	439		
Total stream mileage in basin	2,047		

* Several streams are listed for violations of multiple parameters within the same stream segment; therefore, the total of impaired miles by parameter will not equal the total stream mileage of impaired streams.

Streams in the Upper Ocmulgee River Basin that do not meet water quality standards for fecal coliform bacteria as a result of nonpoint source pollution account for 15 percent or 70 percent of total and assessed streams, respectively. Fecal coliform is used for water quality purposes as a Fecal Indicator Bacteria (FIB). FIBs are used to provide an approximation of the potential risk a water body poses to human health. These bacteria enter the stream from both anthropogenic and non-anthropogenic sources, including sanitary sewer overflows, leaking sewer lines, failing septic systems and pet/ wildlife waste. Fecal coliform typically is found in both developed and undeveloped watersheds, and monitoring programs in Georgia have found levels that exceed state standards in urban, agricultural, and forested areas (Georgia EPD, 2011). While fecal coliform is ubiquitous in streams across the country (Georgia EPD, 2011), concentrations of bacteria can increase as a result of the higher density of potential pollutant sources and decreased stormwater filtration and stormwater treatment from population growth and development. Biota listings typically indicate high sediment loads in streams, which decrease habitat quality for benthic macroinvertebrates and fish. Sediment sources include runoff from construction sites as well as from streambank erosion due to accelerated streamflow velocities from impervious cover associated with urbanization.

The South River from Atlanta to Snapping Shoals Creek, downstream of the District, is listed for Fish Consumption Guidance as a result of legacy PCB levels. The Ocmulgee River from Tobesofkee Creek to Echeconnee Creek downstream of the District is also listed for Fish Consumption Guidance as a result of legacy PCB levels. Stone Mountain Creek from its headwaters to Stone Mountain Lake is listed for fecal coliform. This 4-mile section is designated as a fishing stream and was added to the 2012 list.

Total maximum daily loads (TMDLs) and TMDL Implementation Plans have been developed to help jurisdictions address impaired streams and specific parameters of concern. More information on specific TMDLs in the Upper Ocmulgee River Basin can be found on the Georgia EPD website https://epd.georgia.gov/total-maximum-daily-loadings.

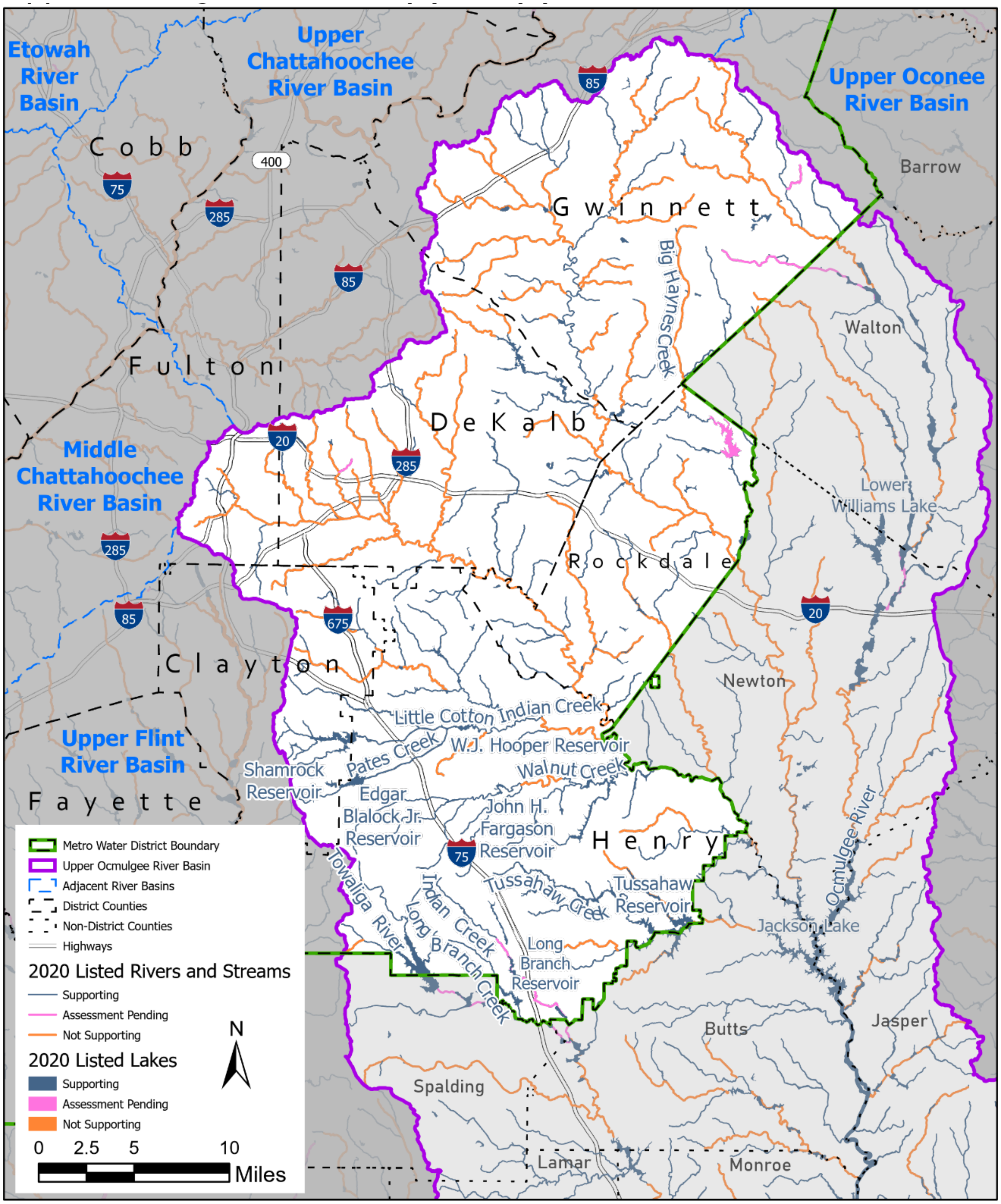

Figure UO-5. Upper Ocmulgee Basin 305(b)/303(d) Listed Waters

Management Issues and Recommendations

Basin-level Summary

Land development affects the physical, chemical, and biological conditions of the District's watersheds, waterways, and water resources. Based on the Stormwater Forecast analysis, development patterns in the District over the past century have resulted in substantial changes to watershed characteristics. Developed area is projected to increase from 323,350 acres in the current (2019) condition to 459,435 acres in 2040, a 42 percent increase. If current land use policy and recent development patterns continue, future estimates of land use are expected to intensify, with the weighted average curve number (CN) value potentially reaching approximately 83 and total imperviousness potentially reaching nearly 46 percent by 2040, based on the future developed area.

Precipitation rates are also expected to increase based on the future precipitation study results for the District. By 2040, the Basin-wide weighted average 85th percentile annual rainfall; 1-year, 24-hour rainfall; and 25-year, 24-hour rainfall events are estimated to potentially increase by 14 percent, 11 percent, and 16 percent, respectively. These changes to watershed characteristics and rainfall intensity will have a direct impact on the total potential runoff management volume generated from development that may require additional management from structural control measures.

Runoff for the three post-construction volumes (Water Quality Volume [WQv], Channel Protection Volume [CPv], and Overbank Flood Protection Volume [OFPv]) were calculated for 1,221 individual subcatchments in the basin. In 2019, a total of 510 million cubic feet of runoff was estimated in the basin for the WQv), 1,066.4 million cubic feet for the CPv, and 7,031.9 million cubic feet for the OFPv, based on 323,350 acres of development. Additional information is provided in the following summary table (Table UO-7) and figure of the 2019 WQv for the Basin (Figure UO-6).

Table UO-7. Upper Ocmulgee River Basin Watershed Characteristics and Total Potential Runoff Management Volumes

	Predevelopment	2019	2030	2040
Subcatchments (count)	1,221	1,221	1,221	1,221
Total area (acres)	628,498	628,498	628,498	628,498
Developed area (acres)	323,350	323,350	412,771	459,435
Total imperviousness (percent)	1.0	34.7	42.2	45.9
CN	58	80	82	83
Slope (percent)	7.1	7.1	7.1	7.1
85th percentile annual rainfall (inches)	1.20	1.20	1.32	1.37
1-year, 24-hour rainfall (inches)	3.29	3.29	3.53	3.65
25-year, 24-hour rainfall (inches)	6.06	6.06	6.70	7.03
WQv (cubic feet)	83.10 M	510.07 M	850.69 M	1,058.36 M
CPv (cubic feet)	239.73 M	1,066.40 M	1,680.62 M	2,031.11 M
OFPv (cubic feet)	-	7,031.91 M	11,503.61 M	14,122.56 M

Note:

M = million

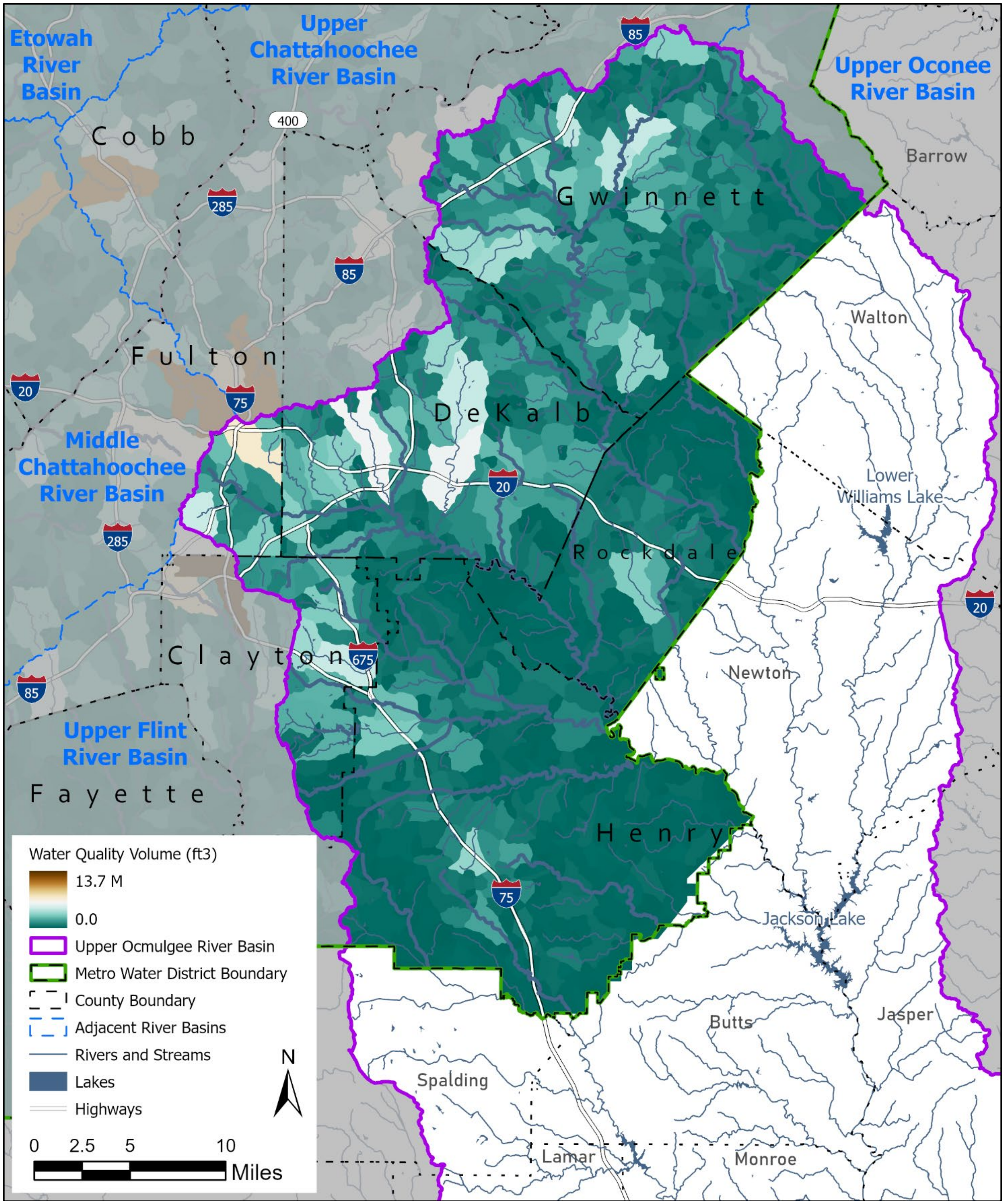

Figure UO-6. Estimated Water Quality Runoff Volume per Subcatchment – 2019

Management Issues and Recommended Strategies

Table UO-8 outlines management issues and strategies for the Upper Ocmulgee River Basin within the District. The recommended strategies presented in Table UO-8 are based on data presented within this River Basin Profile. These strategies are provided to further describe the commonality of causes and potential solutions to the watershed issues. They provide a foundation for guidance but are not presented here as mandatory requirements.

Table UO-8. Upper Ocmulgee River Basin Management Issues and Recommended Strategies

Management Issue	Description	Recommended Strategies
Source water quality	Source water watershed protection of small water supply watersheds.	• Implement source water protection measures in all water supply subwatersheds. • Continue collaborative efforts in small drinking water supply watersheds.
Increases in impervious cover (new development)	Increases in impervious cover can lead to a change in the hydrologic regime of a watershed by causing more intense, high-velocity stormwater flows and increased erosion and sedimentation.	• Manage nonpoint source pollution. • Adopt and enforce the post-construction stormwater control ordinance and use of Georgia Stormwater Management Manual design standards. • Watershed improvement projects, such as stream restoration and streambank stabilization, are recommended in areas with failing streambanks to reduce instream sediment load contributions. • Green infrastructure/Low impact development.
Inadequate stormwater controls on existing impervious cover	Much of the development in the basin occurred prior to current Georgia Stormwater Management Manual design standards. Limited resources and cost of maintaining and repairing stormwater infrastructure. Varying local strategies of funding stormwater management.	• Implement an asset management program to identify and prioritize maintenance and capital improvement projects to maximize benefit. • Consider updating stormwater controls during redevelopment. • Identify opportunities for watershed improvement projects to retrofit or install updated stormwater controls, green infrastructure, stormwater treatment, or other controls. • Consider dedicated funding sources such as stormwater utilities and seek out opportunities for grants, loans, and partnerships.
Biota TMDLs	19% of the streams assessed had impaired fish communities and 10% of the benthic macroinvertebrate communities are impaired. Biota impairment in this basin are the result of high sediment loads, primarily associated with existing land uses, which is a concern for drinking water source supplies, biota, and recreation.	• Enforce post-construction stormwater ordinance on new development and seek opportunities to retrofit stormwater controls to maximize water quality and channel protection. • Watershed improvement projects, such as stream restoration and streambank stabilization are recommended in areas with failing streambanks to reduce instream sediment load contributions. • Participate in efforts to educate agricultural stakeholders about the importance of implementing conservation practices to protect surface water quality for animal production facilities (poultry) and grazing operations as found in the Best Management Practices for Georgia Agriculture manual.

Table UO-8. Upper Ocmulgee River Basin Management Issues and Recommended Strategies

Management Issue	Description	Recommended Strategies
Bacteria TMDLs	70% of assessed stream segments in the Upper Ocmulgee River Basin (within the District) are listed for fecal coliform.	• Identify bacteria sources through inspections, monitoring, source tracing, and stream walks. • Educate public on pollution prevention, proper septic system maintenance, reporting a potential illicit discharge. • Address fecal coliform bacteria contributions from sanitary sewer overflows. • Regular maintenance to ensure proper functioning of decentralized systems (such as septic tanks). • Coordinate with Georgia Department of Agriculture Livestock/Poultry Section on inspections, complaint investigations, nutrient management plan reviews, and permit administrative support.
Lake management	Within this basin, there are many public reservoirs and lakes (Table UO-4) as well as other privately-held and managed lakes that play a significant role in meeting designated uses and downstream hydrologic regimes and water quality.	• Develop a central inventory of lakes, ownership and management practices to facilitate pollutant source identification both up and downstream of the lake. • Coordinate available water quality data and management activities for inventoried lakes. • Implement shoreline protection and upstream sediment management to prevent excessive nutrients and sedimentation within the lake. • Facilitate proper maintenance and management, particularly of small lakes by providing resources, links, or other materials to assist with periodic activities such as inspections, water quality sampling or dredging. • Conduct public education and involvement activities to promote watershed stewardship to protect lake quality.
South River	Urbanizing land uses, aging infrastructure, and nonpoint source pollution are responsible for water quality impairments. These lead to a loss of recreational opportunities and poor water quality.	• Work with local jurisdictions and other stakeholders to develop a framework for coordination and projects to address issues • Focus on nonpoint sources and what can be done to mitigate those impacts.

Identify Indicators and Monitoring to Measure Implementation Success

A critical component of any watershed management program is the ability to assess progress and determine if management strategies are effectively addressing issues. The Plan includes implementation actions related to watershed monitoring and conducting condition assessments to evaluate implementation success. These implementation actions include long-term ambient trend monitoring (Watershed-10), as well as resource-specific implementation actions for Watershed Improvement (Watershed-8). Communities may choose to conduct project-specific monitoring associated with a watershed improvement project, such as biological or geomorphological monitoring to evaluate success.

As included in EPA (2008), a monitoring program should "…track progress in meeting load reduction goals and attaining water quality standards and other goals. Measurable progress is critical to ensuring continued support of watershed projects, and progress is best demonstrated with the use of monitoring data that accurately reflect water quality conditions relevant to the identified problems. Monitoring programs should include baseline (before), project-specific (during) and post-project (after) monitoring."

Some potential indicators to measure implementation success for the Upper Ocmulgee River Basin are listed as follows, but this list is not exhaustive:

- Select representative monitoring stations within the watershed to monitor for pollutants of concern and other water quality or biological parameters.
- Use USGS stream gage data or collect data to establish stream stage-discharge relationships and calculate or model water quality pollutant loads and potential reductions.
- Calculate or model improvements to hydrologic and hydraulic conditions based on structural project implementation.
- Estimate streambank stability and habitat improvement based on annual stream cross section surveys and bank erosion monitoring.
- Conduct stream walks or structure inspections to inventory structure condition and performance, streambank stability and riparian condition over time.
- Conduct project monitoring to establish pre-, during-, and post-project conditions, as well as upstream/downstream monitoring during the same time period to reduce the effects of environmental variability.
- To determine if water quality degradation is being prevented, conduct GIS analysis to identify high-activity areas of a watershed using aerial overlays, work orders, facility inspection, erosion and sedimentation control or new construction inspection data. Identify if monitoring data and GIS data follow similar patterns.
- Track number, location, size, or features (that is, drainage area treated or linear feet of restored stream) of watershed improvement, green infrastructure, or other nonpoint source reduction projects.
- Compare percentage of TMDL stream segments over time.
- Track implementation actions by jurisdiction within the basin, and their measured effectiveness.
- Track enforcement actions by category and location.
- Track stream buffer variances and local permits issued.
- Conduct public surveys for pollution prevention awareness or education effectiveness, particularly pre- and post-data associated with an education event.
- Compare existing water quality modeled loads against future water quality modeled loads.

ATTACHMENT 4

Upper Flint River Basin Profile

The Upper Flint River Basin is located in the southern section of the District and encompasses about 556 square miles of the District, or 11 percent of its total area. This also represents 21 percent of the overall Upper Flint River Hydrologic Unit Code (HUC)-8 Basin, which extends downstream to Macon County in southern Georgia. Portions of 25 cities and five counties are within the District portion of the Upper Flint River Basin including Fulton, Clayton, Fayette, Coweta, and Henry Counties (Figure UF-1). Larger cities include College Park, Fairburn, Fayetteville, Newnan, Peachtree City, Riverdale, Tyrone, and Union City.

Physical and Natural Features

Geography

The Upper Flint River Basin lies entirely within the Piedmont province and includes only the Greenville Slope district. It is characterized by rolling topography that decreases gradually in elevation from about 1,000 feet in the northeast to 600 feet in the southwest. Those flowing to the southwest occupy shallow, open valleys with broad, rounded divides while those flowing to the southeast occupy narrower, deeper valleys with narrow, rounded divides (Clark and Zisa, 1976). The Flint River is entirely within the Piedmont province, which consists of a series of rolling hills and occasional isolated mountains. The Upper Flint River Basin includes portions of the Gainesville Ridge, Greenville Slope, Washington Slope and Winder Slope physiographic districts (District, 2002).

Hydrology and Soils

The Upper Flint River Basin originates in Atlanta and drains to all of Fayette County and portions of Clayton, Coweta, Douglas, and Henry Counties. It eventually drains to the Gulf of Mexico at Apalachicola Bay in Florida. It is comprised of one 8-digit HUC, three 10-digit HUCs and nineteen 12-digit HUCs, and its main tributaries are Line, Morning, White Oak and Whitewater Creeks. Stream discharges for the Flint River and its tributaries are recorded by the U.S. Geological Survey (USGS) Station 02344500, the Flint River near Griffin. Annual flows range from a low of 6.01 cubic feet per second (cfs) to a high of 2,644 cfs, with a mean of 335.5 cfs (USGS, 2020). The existing reservoirs in the Upper Flint River Basin are primarily smaller impoundments on tributaries to the Flint River that were developed for drinking water supply.

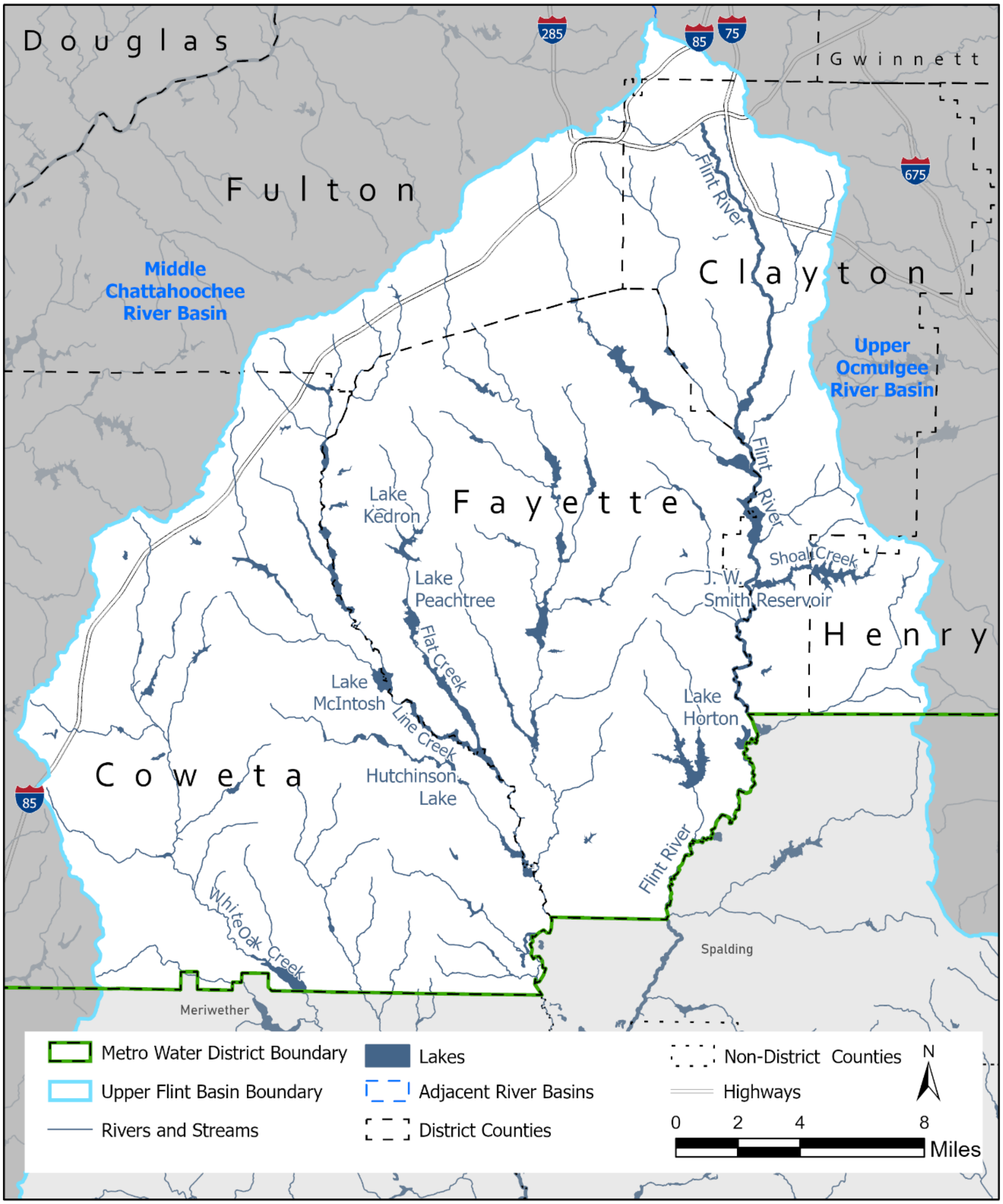

Figure UF-1. Upper Flint Basin Within the District

An assessment of the availability of groundwater resources in select prioritized aquifers of Georgia was completed as part of Georgia's Comprehensive State-wide Water Management Plan (Georgia Environmental Protection Division [Georgia Environmental Protection Division [Georgia EPD], 2010). While none of the Upper Flint River Basin within the District was selected as a priority aquifer for assessment, the Cretaceous Aquifer in Georgia's Coastal Plain includes the southern tip of the Upper Flint River HUC-8 watershed below the fall line. The aquifers in the Piedmont province are in crystalline rocks that crop out in the northern portion of the basin and extend to the fall line. The rock is overlain with deposits of weathered, unconsolidated rock debris (regolith) that make up the available aquifer spaces. These deposits are thickest in valleys, but generally provide insufficient yield for uses other than very low density residential, and thus surface water is the primary source of potable water for the District.

The Georgia Geologic Survey Hydrologic Atlas 18 database identifies approximately 28 areas, representing about 4 percent of the District, that are likely to contain unconfined aquifers and 79 areas, representing about 12 percent of the District, that are likely to contain thick soils considered to be an indicator of significant groundwater recharge areas. There are approximately 77 square miles—or 14 percent of the basin area within the District—of potential recharge areas within the Upper Flint River Basin (see Table UF-1).

Table UF-1. Groundwater Recharge Areas within the Upper Flint River Basin

Recharge Area Type	County	Square Miles of Recharge Area Type within County
Probable Areas of Thick Soil	Clayton	3
	Coweta	20
	Fayette	45
	Fulton	10
Total Recharge Area		77

There are three soil associations that describe the soil types in the Upper Flint River Basin: Ashlar-Pacolet-Cecil, Cecil-Madison-Pacolet, and the “urban” soils that start in south Fulton County (Table UF-2). The Ashlar-Pacolet-Cecil association was found along the banks of some of the major rivers, particularly Peachtree City and Fayetteville. These soils are variable and less well-drained than soils on higher elevations (Thomas and Tate, 1973; USDA, 1976; Thomas, 1982; USDA, 1958). The Cecil-Madison-Pacolet associations were the most abundant associated with moderate rolling hills. These soils are well-drained and highly weathered, having a red to yellowish-red subsoil (Brock, 1977; Jordan et al., 1973; Murphy, 1979; Thomas and Tate, 1973; USDA, 1976; Thomas, 1982; Wells, 1961; Robertson et al., 1960; USDA, 1958; Tate, 1967; Thomas and Tate, 1964).

Table UF-2. Major Soil Associations within the Upper Flint River Basin

Soil Association	Significance to Watershed Management
Ashlar-Pacolet-Cecil	**Characteristics:** Moderately deep and excessively drained. **Significance to Watershed Management:** Runoff is slow to rapid with moderately rapid permeability.
Cecil-Madison-Pacolet	**Characteristics:** Associated with moderate rolling hills, well-drained, highly weathered. **Significance to Watershed Management:** Sloping surfaces may be more susceptible to increased erosion due to stormwater runoff velocities from impervious surfaces; well-drained soils may be more permeable, which increases infiltration capacity in areas without impervious cover, also may improve feasibility for infiltration practices.
Urban soils	**Characteristics:** Highly disturbed and compacted soils. **Significance to Watershed Management:** Compacted soils; poorly drained soils are less feasible for infiltration, restricted water drainage.

Protected Species

Protected species include all species listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service, and those listed as endangered, threatened, rare or unusual by the State of Georgia. The USFWS also may designate critical habitat for a federally listed species, which provides protection for the habitat as well as the species itself. The current listings of these endangered species, including their status, range, and habitat, can be accessed via the USFWS's automated Information, Planning and Conservation System (IPaC, http://ecos.fws.gov/ipac/).

The District is home to a number of protected animal species that spend all or part of their life cycle in rivers and streams or depend on streams for a significant portion of their life history. In addition, there are protected plants that are either aquatic or semi-aquatic and grow within or along the margins of rivers and streams. Table UF-3 lists the 17 protected aquatic or semi-aquatic species potentially found within the counties of the Upper Flint River Basin of the District.

Table UF-3. Aquatic and Semi-Aquatic Protected Species in the Upper Flint River Basin

Fauna Type	Common Name	Status*	Clayton	Coweta	Fayette	Fulton	Henry
Bird	Bald eagle	T		X		X	X
Fish	Altamaha shiner	T					X
	Bluestripe shiner	R		X		X	
	Cherokee darter	T				X	
	Highscale shiner	R	X	X	X	X	
Invertebrate	Chattahoochee crayfish	T		X		X	
	Delicate spike	E		X	X	X	
	Gulf moccasinshell	E		X	X	X	
	Inflated spike	T		X			
	Oval pigtoe	E		X	X		
	Piedmont blue burrower	E		X	X		
	Purple bankclimber	T		X			
	Rayed creekshell	T		X	X		
	Shineyrayed pocketbook	E		X	X	X	
	Southern elktoe	E		X			
Reptile	Alligator Snapping turtle	T	X	X	X		
	Barbour's map turtle	T		X			

* Status that is not underlined is listed in Georgia. Underlined status is federally listed.

R = Rare
E = Endangered
T = Threatened

Trout Streams

Trout streams are classified in accordance with the primary and secondary designations and criteria defined in Section 15 of Georgia's Water Use Classifications and Water Quality Standards (391-3-6-.03). There are no primary trout streams or secondary trout streams located within the District of the Upper Flint River Basin.

Land Use and Surface Water Quality

Drinking Water Supply

There are nine individual water supply sources operated by four separate entities (Table UF-4). Figure UF-2 illustrates the corresponding water supply watersheds as well as those waters that are designated to meet State drinking water criteria within the Upper Flint River Basin. Recognizing the linkage between watershed management and water quality for water supply, the Georgia Department of Natural Resources (GADNR) Rule 391-3-16-.01 includes environmental planning criteria (or Part V criteria) to protect natural resources such as wetlands, stream buffers, water supply watershed areas, groundwater recharge areas, protected rivers, and protected mountains.

Table UF-4. Upper Flint River Basin Drinking Water Supply Sources

Water Supply Source	Owner/Operator Using Source
Flint River	Clayton County Water Authority Fayette County Water System
J.W. Smith Reservoir (Shoal Creek)	Clayton County Water Authority
Lake Kedron (Flat Creek)	Fayette County Water System
Lake Peachtree (Flat Creek)	Fayette County Water System
Lake Horton	Fayette County Water System
Lake McIntosh (Line Creek)	Fayette County Water System
Line Creek	Newnan Utilities
White Oak Creek	Newnan Utilities
Hutchinson Lake (Keg Creek)	City of Senoia Water System

Source water assessments were performed for all drinking water supplies within the Upper Flint River Basin as required by the U.S. Environmental Protection Agency (EPA). The source water assessments determined the potential for pollution based on individual source and nonpoint source pollution within drinking water supply watersheds and assigned a susceptibility ranking to each drinking water source. The susceptibility rankings throughout the basin were low for Hutchinson Lake and Lake Horton, low-medium for Line Creek, medium-high for Flat Creek and White Oak Creek, and high for Flint River. All other source waters were assigned a susceptibility ranking of medium. These susceptibility rankings indicate the urban and suburban nature of most of the watersheds within the Upper Flint River Basin.

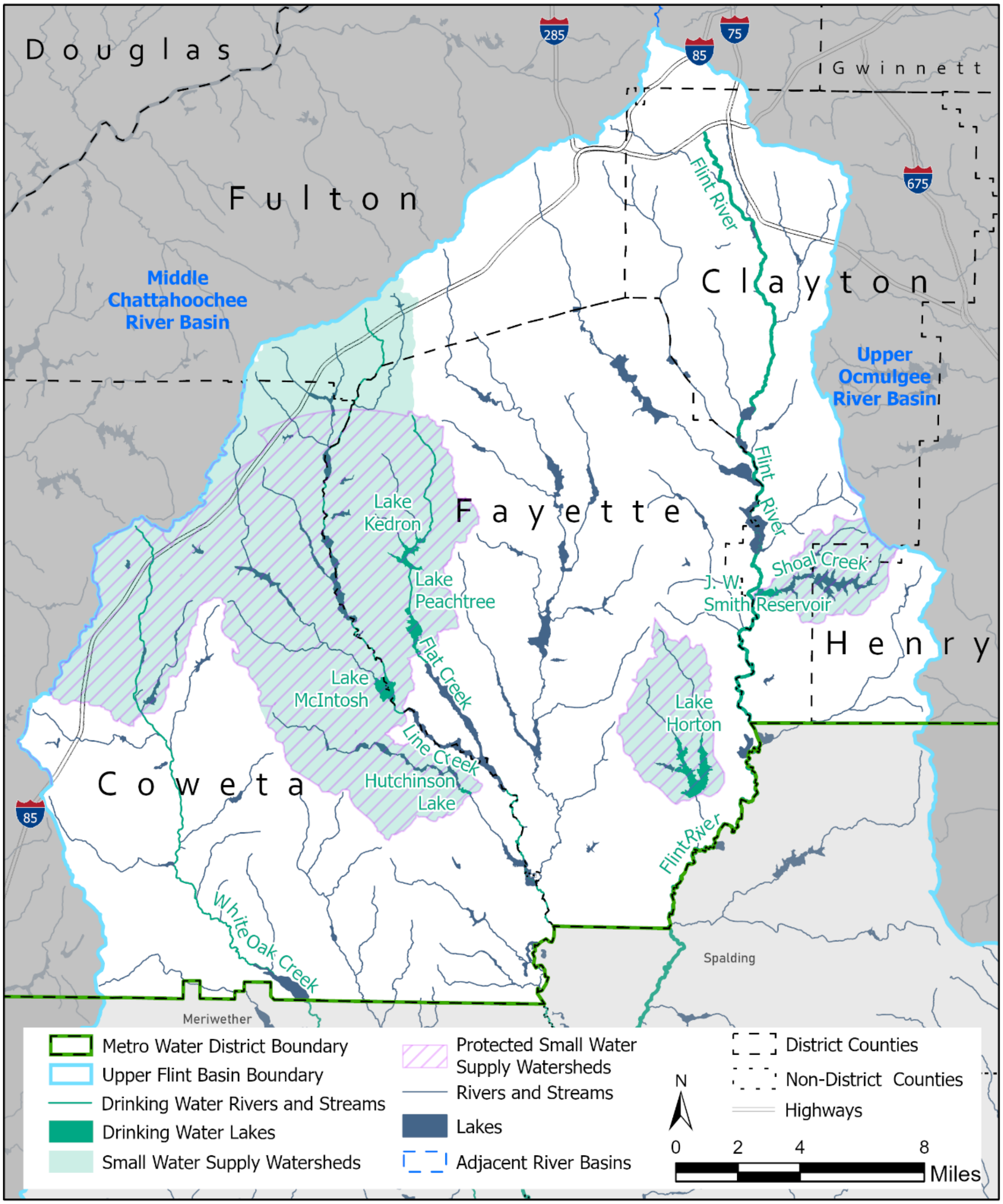

Figure UF-2. Upper Flint Basin Drinking Water

Small Water Supply Watershed

A small water supply watershed is a watershed that has less than 100 square miles of land within the drainage basin upstream of a water supply reservoir. In this context, a water supply reservoir is a governmentally owned impoundment of water for the primary purpose of providing water to one or more governmentally owned public drinking water systems, which excludes the multipurpose reservoirs owned by the United States Army Corps of Engineers.

GADNR Rule 391-3-16-.01(7) requires 100-foot undisturbed buffers and 150-foot impervious surface setbacks for streams in small water supply watersheds within 7 miles upstream of water supply intakes and within 7 miles upstream of water supply reservoirs, excluding federal reservoirs. That portion of a small water supply watershed that includes the corridors of streams within a 7-mile radius upstream of a governmentally owned public drinking water supply intake or a non-federal water supply reservoir is called the protected small water supply watershed.

To facilitate implementation of GADNR Rule 391-3-16-.01(7) and Action Item Integrated-7, all areas of small water supply watersheds that are subject to protection through additional buffers and setbacks have been mapped for all local governments within the District. The Upper Flint River Basin has 124 square miles of protected small water supply watersheds in Clayton, Coweta, Fayette, and Henry Counties as shown in Figure ER-2. Additional information and guidance can be found on the District Technical Assistance webpage in a memorandum titled, “District TAP Memo – Integrated-7 Additional Buffers in Small Water Supply Watersheds.”

Land Cover/Land Use

The northern extent of the Upper Flint River Basin is traversed by over 46 miles of major transportation corridors such as Interstates 85, 75 and 285, as well as Hartsfield Atlanta International Airport and its supporting businesses (Figure UF-3). The Flint River, Camp Creek and Morning Creek watersheds in southeastern Fulton County and northwestern Clayton County are also located in developed areas of medium intensity and high intensity. With the exception of some limited pockets of denser development around Fayetteville, Newnan and Peachtree City, the southern two-thirds of the Upper Flint River Basin are dominated by undeveloped lands. Overall, 35 percent of the Upper Flint River Basin within the District is developed, 40 percent is forested area and 25 percent of the area falls within the remaining land cover classes (Table UF-5, Figure UF-3).

Table UF-5. Upper Flint River Basin Land Cover / Land Use within the District

Land Cover/Land Use	Area (Square Miles)	2019 Existing (%)
Barren Land (Rock/Sand/Clay)	1.81	0.32
Cultivated Crops	0.13	0.02
Deciduous Forest	96.89	17.41
Developed High Intensity	21.88	3.93
Developed, Low Intensity	68.15	12.24
Developed, Medium Intensity	34.21	6.15
Developed, Open Space	71.46	12.84
Emergent Herbaceous Wetlands	0.81	0.15
Evergreen Forest	100.77	18.11
Grassland/Herbaceous	11.60	2.08
Mixed Forest	23.69	4.26
Open Water	10.40	1.87
Pasture/Hay	71.01	12.76
Shrub/Scrub	5.67	1.02
Woody Wetlands	38.07	6.84
Undeveloped	***360.85***	***64.84***
Developed	***195.69***	***35.16***
Total	**556.54**	**100**

Notes:

Developed = High Intensity, Low Intensity, Medium Intensity, and Open Space.
Undeveloped = land cover classes not described as Developed.

Data Source:

Aggregated Land Cover categories from USGS National Land Cover Database (NLCD), 2019.

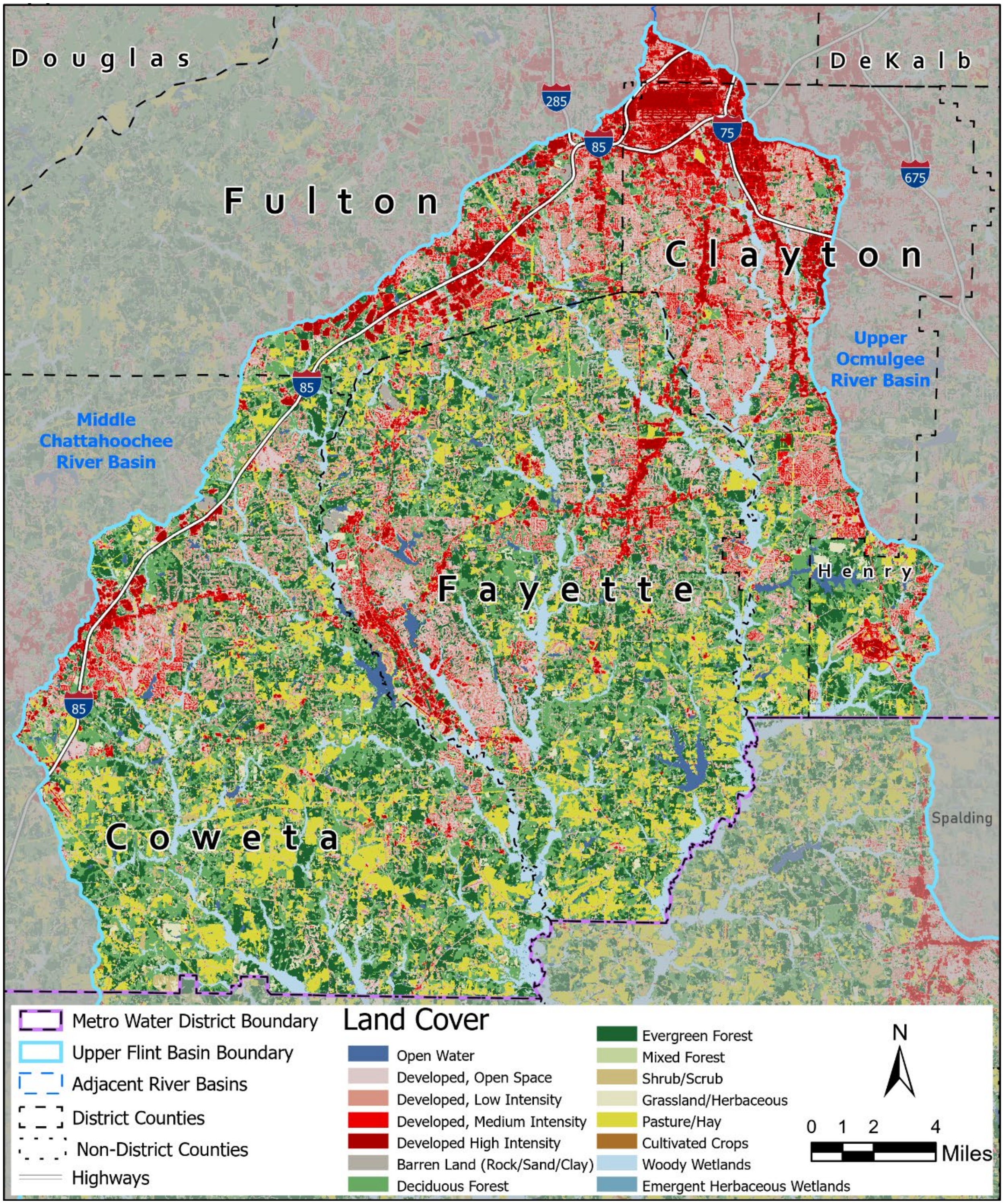

Figure UF-3. Upper Flint Land Cover

Source: 2019 NLCD

Effective Impervious Areas

The level of watershed imperviousness has long been linked to impacts on changes in hydrologic regimes that lead to increased intensity and frequency of peak stormwater flows, which affect stream stability, water quality and aquatic habitat and biotic community integrity. In general, the most sensitive aquatic organisms are affected at impervious levels greater than 10 percent. Between 11 and 25 percent of most stream communities become impacted, and over 25 percent of streams are generally no longer able to support viable biotic communities (Schueler, 2001).

Impervious surfaces (such as roofs, streets, parking lots) have a significantly different hydrologic response from pervious surfaces (lawns, forests); therefore, it is important to clearly define terms and assumptions related to the calculation of pervious and impervious areas for the purposes of watershed management. “Total impervious area” quantifies all of the land surfaces impervious to rainfall for the particular land cover category while “effective impervious area” (EIA) refers to the directly connected impervious area used for water quality and stormwater conveyance modeling. For the 2003 District-wide Plan, EIA values were initially defined based on previous studies, including the local watershed assessments, and then further refined based on calibration using available water quality data. For the 2022 District-wide Plan, the EIA of the HUC-12 subwatersheds within the District was calculated using a mathematical model developed by Sutherland for EPA based on land cover data from the 2019 USGS National Land Cover Database.

Of the 19 HUC-12s within the District portion of Upper Flint River Basin, eight had an EIA greater than 10 percent, primarily those HUCs that included the Hartsfield Atlanta International Airport and surrounding area or that straddle a major transportation corridor such as Interstates 85 or 285 or the HUC is located within the more densely urbanized area of local cities like Newnan and Peachtree City. There are three HUC-12s with an EIA greater than 20 percent, including the Headwaters Flint River watershed which encompasses the Hartsfield-Jackson International Airport, the Morning Creek watershed, which contains portions of the Interstate 85 corridor, and the Headwaters White Oak Creek watershed, which contains portions of the City of Newnan as well as the Interstate 85 corridor (Figure UF-4).

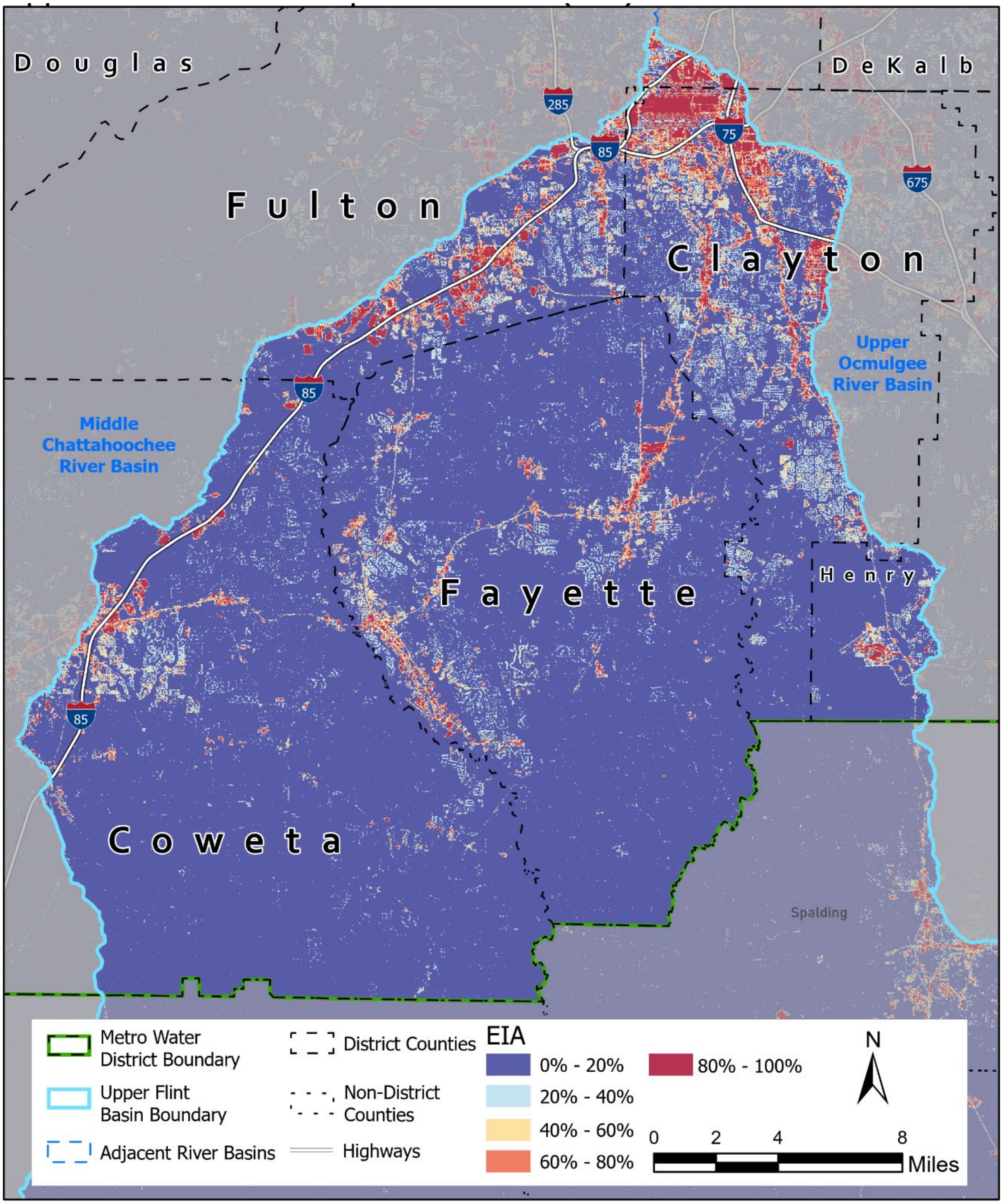

Figure UF-4. Upper Flint Effective Impervious Area

Wastewater Management

Permitted Wastewater Facility Service Areas

There are 10 municipal wastewater treatment facilities in the Upper Flint River Basin with a permitted capacity of 27 maximum monthly flow – million gallons per day (MMF-MGD). Additionally, the Upper Flint River Basin has 10 non-municipal wastewater treatment facilities with a permitted capacity of 1.5 MMF-MGD.

Combined-sewer Overflow Areas

There are no combined-sewer overflow areas in the Upper Flint River Basin.

Impaired Water Bodies

The Georgia EPD establishes water quality standards for the state's surface waters. Section 303(d) of the federal Clean Water Act requires that all states list water bodies that do not meet water quality standards. The Georgia EPD publishes a biennial list of streams that do not meet State water quality standards, referred to as the 303(d)/305(b) list. If a water body does not support its designated use (drinking, recreation, fishing, wild/scenic rivers, or coastal fishing) because conditions violate water quality standards, it is considered an "impaired" stream or water body.

Georgia EPD determines whether a waterbody is supporting its designated uses by collecting water quality data and comparing it against State water quality criteria. Georgia EPD describes their listing methodology and "preferred minimum dataset" at http://epd.georgia.gov/georgia-305b303d-list-documents. This methodology is important to understand the sample size, extent and timeframe of the dataset that was used to list a waterbody. Feedback can be given to Georgia EPD if additional data or information are known that may affect future sampling or listing evaluations.

The District portion of the Upper Flint River Basin contains 1,173 stream miles, 218 of which were assessed for impairments. A total of 121 stream miles, 10 percent of total streams or 56 percent of assessed streams, did not meet State water quality standards based on the 2020 303(d) list. The streams listed as not supporting are summarized in Table UF-6 by parameter and graphically shown in Figure UF-5. Several streams are listed for violations of more than one parameter; therefore, the summation of impaired miles by parameter will not equal the total miles of not supporting streams.

Table UF-6. Upper Flint River Basin Summary of Impaired Streams

Criterion Violated	Miles of Stream	% of 2020 Assessed Streams	% of Total Stream Mileage
Fecal coliform bacteria	100	46	9
Biota (fish community)	27	12	2
Biota (macroinvertebrate community)	7	3	< 1
Copper	7	3	< 1
Total impaired stream mileage*	121	56	10
Total mileage assessed for possible impairment	218		
Total stream mileage in basin	1,173		

* Several streams are listed for violations of multiple parameters within the same stream segment; therefore, the total of impaired miles by parameter will not equal the total stream mileage of impaired streams.

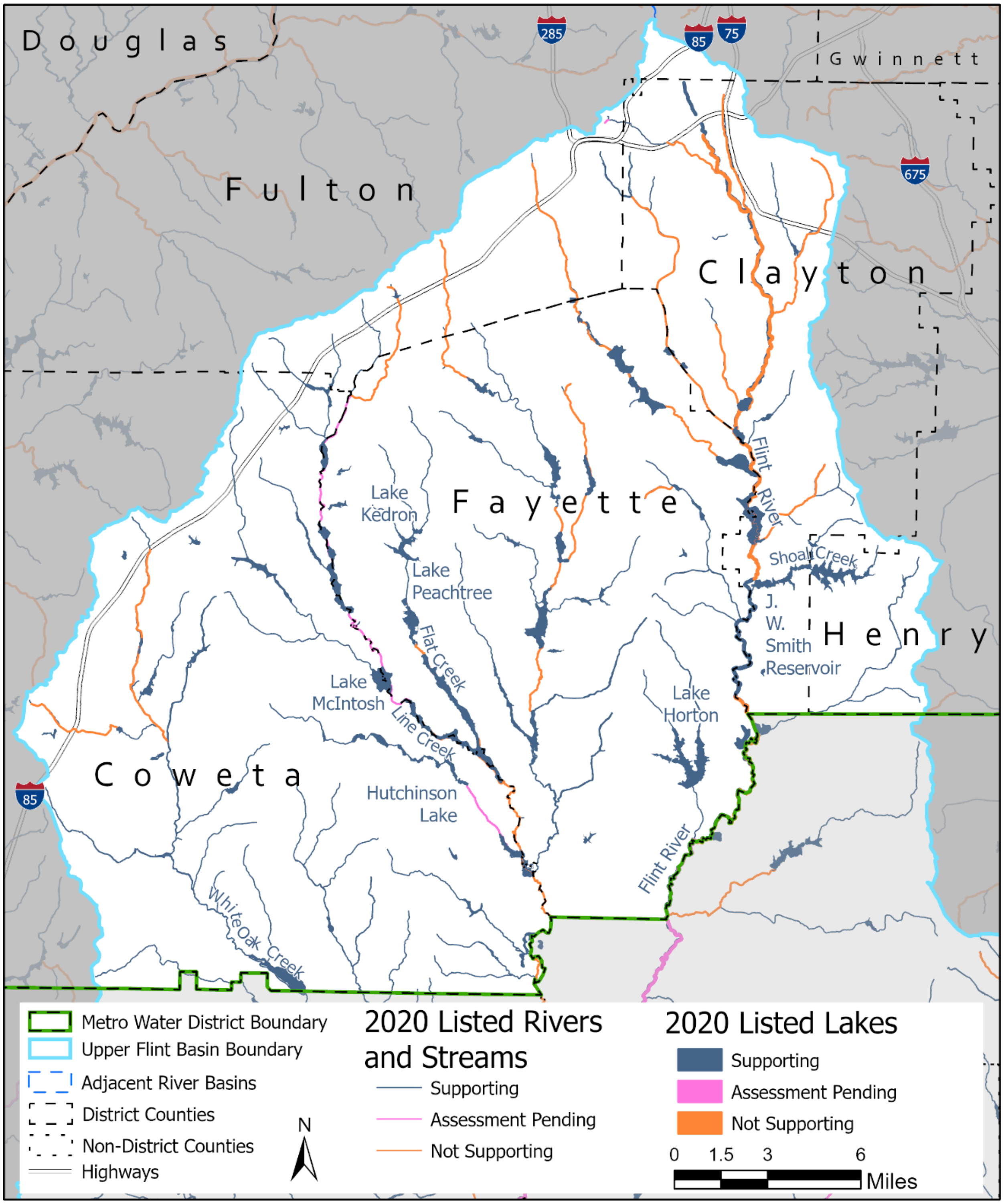

Figure UF-5. Upper Flint Basin 305(b)/303(d) Listed Waters

Streams in the Upper Flint River Basin that do not meet water quality standards for fecal coliform bacteria as a result of nonpoint source pollution account for nine percent or 46 percent of total and assessed streams, respectively. Fecal coliform is used for water quality purposes as a Fecal Indicator Bacteria (FIB). FIBs are used to provide an approximation of the potential risk a water body poses to human health. These bacteria enter the stream from both anthropogenic and non-anthropogenic sources, including sanitary sewer overflows, leaking sewer lines, failing septic systems and pet/wildlife waste. Fecal coliform typically is found in both developed and undeveloped watersheds, and monitoring programs in Georgia have found levels that exceed state standards in urban, agricultural, and forested areas (Georgia EPD, 2011). While fecal coliform is ubiquitous in streams across the country (Georgia EPD, 2011), concentrations of bacteria can increase as a result of the higher density of potential pollutant sources and decreased stormwater filtration and stormwater treatment from population growth and development. Biota listings typically indicate high sediment loads in streams, which decreases habitat quality for benthic macroinvertebrates and fish. Sediment sources include runoff from construction sites as well as from streambank erosion due to accelerated streamflow velocities from impervious cover associated with urbanization.

Total maximum daily loads (TMDLs) and TMDL Implementation Plans have been developed to help jurisdictions address impaired streams and specific parameters of concern. More information on specific TMDLs in the Upper Flint River Basin can be found on the Georgia EPD website https://epd.georgia.gov/total-maximum-daily-loadings.

Management Issues and Recommendations

Basin-level Summary

Land development affects the physical, chemical, and biological conditions of the District's watersheds, waterways, and water resources. Based on the Stormwater Forecast analysis, development patterns in the District over the past century have resulted in substantial changes to watershed characteristics. Developed area is projected to increase from over 124,506 acres in the current (2019) condition to over 198,888 acres in 2040, a 60 percent increase. If current land use policy and recent development patterns continue, future estimates of land use are expected to intensify, with the weighted average curve number (CN) value potentially reaching approximately 84 and total imperviousness potentially reaching over 52 percent by 2040, based on the future developed area.

Precipitation rates are also expected to increase based on the future precipitation study results for the District. By 2040, the basin-wide weighted average 85th percentile annual rainfall; 1-year, 24-hour rainfall; and 25-year, 24-hour rainfall events are estimated to potentially increase by 14 percent, 11 percent, and 11 percent, respectively. These changes to watershed characteristics and rainfall intensity will have a direct impact on the total potential runoff management volume generated from development that may require additional management from structural control measures.

Runoff for the three post-construction volumes (Water Quality Volume [WQv], Channel Protection Volume [CPv] and Overbank Flood Protection Volume [OFPv]) were calculated for 1,026 individual subcatchments in the basin. In 2019, a total of 201 million cubic feet of runoff was estimated in the basin for the WQv, 440 million cubic feet for the CPv, and 2,826 million cubic feet for the OFPv, based on over 124,506 acres of development. Additional information is provided in the following summary table (Table UF-7) and figure of the 2019 WQv for the basin (Figure UF-6).

Table UF-7. Upper Flint River Basin Watershed Characteristics at and Total Potential Runoff Management Volumes

	Predevelopment	**2019**	**2030**	**2040**
Subcatchments (count)	1,026	1,026	1,026	1,026
Total area (acres)	355,938	355,938	355,938	355,938
Developed area (acres)	124,506	124,506	168,632	198,888
Total imperviousness (percent)	1.0	35.7	45.6	52.3
CN	59	80	83	84
Slope (percent)	5.6	5.6	5.6	5.6
85th percentile annual rainfall (inches)	1.20	1.20	1.32	1.37
1-year, 24-hour rainfall (inches)	3.35	3.35	3.60	3.72
25-year, 24-hour rainfall (inches)	6.34	6.34	7.02	7.37
WQv (cubic feet)	32.00 M	201.31 M	372.12 M	515.51 M
CPv (cubic feet)	108.81 M	439.97 M	735.59 M	947.01 M
OFPv (cubic feet)	-	2,825.80 M	4,942.02 M	6,475.62 M

Note:

M = million

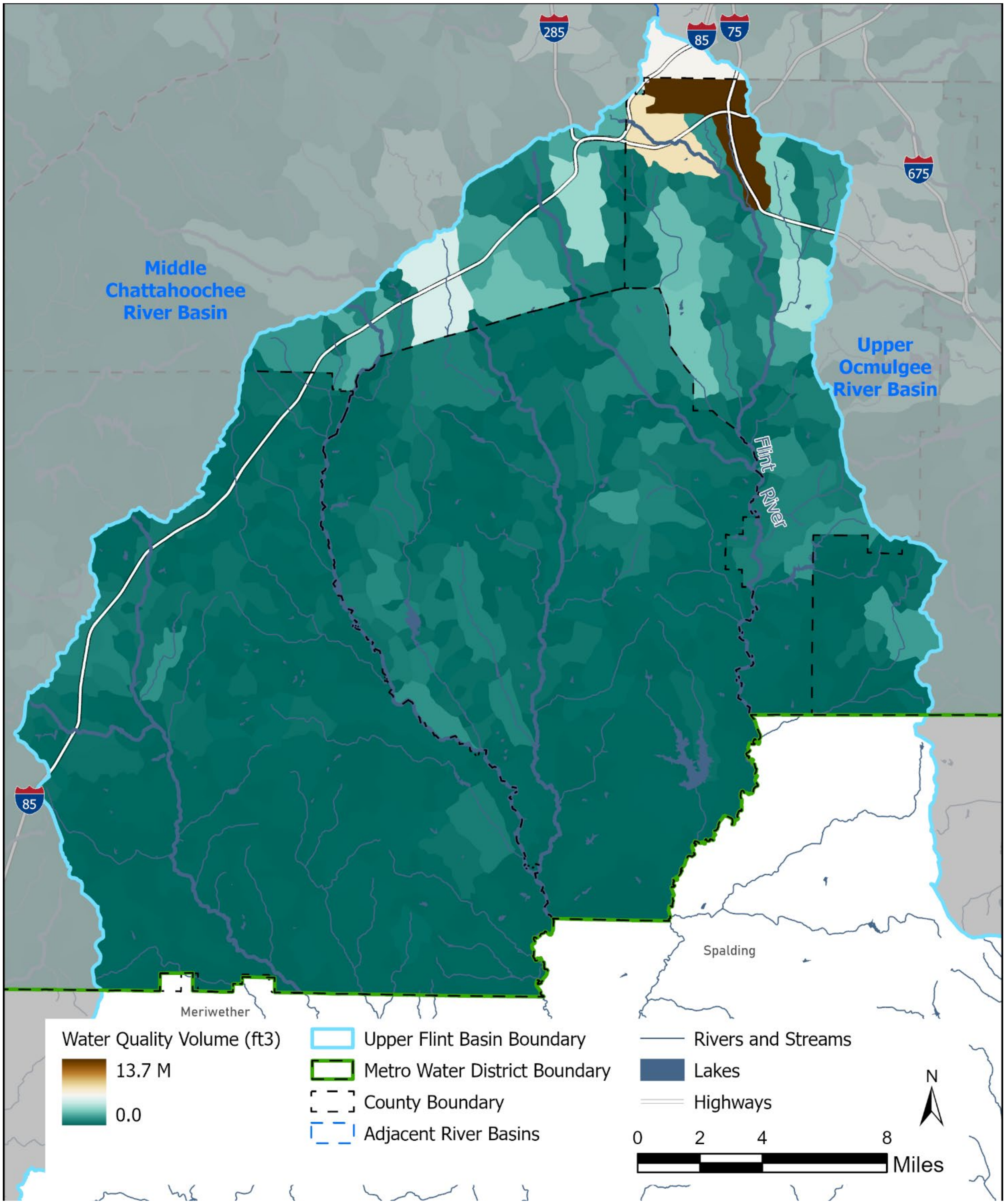

Figure UF-6. Estimated Water Quality Runoff Volume per Subcatchment – 2019

Management Issues and Recommended Strategies

Table UF-8 outlines management issues and strategies for the Upper Flint River Basin within the District. These issues and strategies were used to inform and guide the more specific management measures and requirements found in Sections 5, 6 and 7. The recommended strategies presented in Table UF-8 are based on data presented within this River Basin Profile. These strategies are provided to further describe the commonality of causes and potential solutions to the watershed issues. They provide a foundation for guidance but are not presented here as mandatory requirements.

Table UF-8. Upper Flint River Basin Management Issues and Recommended Strategies

Management Issue	Description	Recommended Strategies
Source water quality	Source water watershed protection of small water supply watersheds.	• Implement source water protection measures in all water supply subwatersheds. • Continue collaborative efforts in small drinking water supply watersheds, such as Shoal Creek, Line Creek, Flat Creek, and White Oak Creek, to protect the viability of these supplies.
Increases in impervious cover (new development)	Increases in impervious cover can lead to a change in the hydrologic regime of a watershed by causing more intense, high-velocity stormwater flows and increased erosion and sedimentation.	• Manage nonpoint source pollution. • Adopt and enforce the post-construction stormwater control ordinance and use of Georgia Stormwater Management Manual (GSMM) design standards. • Watershed improvement projects, such as stream restoration and streambank stabilization, are recommended in areas with failing stream banks to reduce instream sediment load contributions.
Inadequate stormwater controls on existing impervious cover	Much of the development in the basin occurred prior to current GSMM design standards. Limited resources and cost of maintaining and repairing stormwater infrastructure. Varying local strategies of funding stormwater management.	• Implement an asset management program to identify and prioritize maintenance and capital improvement projects to maximize benefit. • Consider updating stormwater controls during redevelopment. • Identify opportunities for watershed improvement projects to retrofit or install updated stormwater controls, green infrastructure, stormwater treatment, or other controls. • Consider dedicated funding sources such as stormwater utilities and seek out opportunities for grants, loans, and partnerships.
Biota TMDLs	12% of the assessed streams have impaired fish communities and 3% have impaired benthic macroinvertebrate communities. Biota impairment in this basin is the result of high sediment loads, primarily associated with existing development with inadequate stormwater controls, which is a concern for drinking water source supplies, biota and recreation.	• Enforce post-construction stormwater ordinance on new development and seek opportunities to retrofit stormwater controls to maximize water quality and channel protection. • Recommend watershed improvement projects, such as stream restoration and streambank stabilization, in areas with failing stream banks to reduce instream sediment load contributions.

Table UF-8. Upper Flint River Basin Management Issues and Recommended Strategies

Management Issue	Description	Recommended Strategies
Bacteria TMDLs	46% of assessed stream segments in the Flint River Basin (within the District) are listed for fecal coliform bacteria.	• Identify bacteria sources through inspections, monitoring, source tracing, and stream walks. • Educate public on pollution prevention, proper septic system maintenance, and reporting a potential illicit discharge. • Address fecal coliform bacteria contributions from sanitary sewer overflows. • Perform regular maintenance to ensure proper functioning of decentralized systems (such as septic tanks).
Lake management	Within the basin, there are public and privately-held and managed lakes that play a significant role in meeting designated uses and downstream hydrologic regimes and water quality.	• Develop a central inventory of lakes, ownership and management practices to facilitate pollutant source identification both up and downstream of the lake. • Coordinate available water quality data and management activities for inventoried lakes. • Implement shoreline protection and upstream sediment management to prevent excessive nutrients and sedimentation within the lake. • Facilitate proper maintenance and management, particularly of small lakes by providing resources, links, or other materials to assist with periodic activities such as inspections, water quality sampling, or dredging. • Conduct public education and involvement activities to promote watershed stewardship to protect lake quality.
Flint River Flows	Due to upstream impacts, the Flint River has significantly reduced or no flow during times of less rainfall. This has an impact not only on stream and ecological health, but also water availability, recreation opportunities and other beneficial downstream uses.	• Partner with local jurisdictions and other stakeholders to develop projects and specific strategies for addressing. • Look to green infrastructure and other multiple benefit solutions. • Apply an integrated water management approach to address issues in the Upper Flint while also increasing resiliency in the system.

Identify Indicators and Monitoring to Measure Implementation Success

A critical component of any watershed management program is the ability to assess progress and determine if management strategies are effectively addressing issues. This Plan includes implementation actions related to watershed monitoring and conducting conditions assessments to evaluate implementation success. These implementation actions include long-term ambient trend (WATERSHED-10), as well as resource-specific implementation actions for Watershed Improvement (WATERSHED-8). Communities may choose to conduct project-specific monitoring associated with a watershed improvement project, such as biological or geomorphological monitoring to evaluate success.

As included in EPA (2008), a monitoring program should "…track progress in meeting load reduction goals and attaining water quality standards and other goals. Measurable progress is critical to ensuring continued support of watershed projects, and progress is best demonstrated with the use of monitoring data that accurately reflect water quality conditions relevant to the identified problems. Monitoring programs should include baseline (before), project-specific (during), and post-project (after) monitoring."

Some potential indicators to measure implementation success for the Upper Flint River Basin are listed as follows, but this list is not exhaustive:

- Select representative monitoring stations within the watershed to monitor for pollutants of concern and other water quality or biological parameters.
- Use USGS stream gage data or collect data to establish stream stage-discharge relationships and calculate or model water quality pollutant loads and potential reductions.
- Calculate or model improvements to hydrologic and hydraulic conditions based on structural project implementation.
- Estimate streambank stability and habitat improvement based on annual stream cross section surveys and bank erosion monitoring.
- Conduct stream walks or structure inspections to inventory structure condition and performance, streambank stability, and riparian condition over time.
- Conduct project monitoring to establish pre-, during-, and post-project conditions, as well as upstream/downstream monitoring during the same time period to reduce the effects of environmental variability.
- To determine if water quality degradation is being prevented, conduct GIS analysis to identify high-activity areas of a watershed using aerial overlays, work orders, facility inspection, erosion and sedimentation control, or new construction inspection data. Identify if monitoring data and GIS data follow similar patterns.
- Track number, location, size, or features (that is, drainage area treated or linear feet of restored stream) of watershed improvement, green infrastructure, or other nonpoint source reduction projects.
- Compare percentage of TMDL stream segments over time.
- Track implementation actions by jurisdiction within the basin, and their measured effectiveness.
- Track enforcement actions by category and location.
- Track stream buffer variances and local permits issued.
- Conduct public surveys for pollution prevention awareness or education effectiveness, particularly pre- and post-data associated with an education event.
- Compare existing water quality modeled loads against future water quality modeled loads.

ATTACHMENT 5

Etowah River Basin Profile

The Etowah River Basin is located in the northwestern portion of the District and represents 24 percent of its total area and 63 percent of the overall Hydrologic Unit Code (HUC)-8 Basin area. With 1,183 square miles, it is the largest river basin in the District, entering the District at the northern border of Forsyth County and exiting at the western edge of Bartow County, where it soon joins the Oostanaula River to form the Coosa River. There are portions of 22 cities and the following six counties within the District portion of the basin: Bartow, Cherokee, Cobb, Forsyth, Fulton, and Paulding. Larger cities include Acworth, Canton, Cartersville, Dallas, Kennesaw, Milton, Mountain Park, and Woodstock. Allatoona Lake, located on the mainstem of the Etowah River in the center of this basin, is managed by the United States Army Corps of Engineers (Corps) and is a significant recreational destination and water supply source within the District, state, and Southeast U.S.

Physical and Natural Features

Geography

The Etowah River has its headwaters in the Blue Ridge Mountains north of the District, northwest of Dahlonega in Lumpkin County. The Etowah River flows southwest to the confluence of the Oostanaula River in Rome, Georgia in Floyd County (Figure ER-1). The Etowah River is entirely within the Piedmont and Valley Ridge provinces, which consist of a series of rolling hills and occasional isolated mountains; however, there are six physiographic districts, making the topography and hydrology highly variable. The Etowah River Basin includes portions of the Blue Ridge Mountains, Central Uplands, Cherokee Uplands, Dahlonega Uplands, Hightower-Jasper Ridges, and Great Valley physiographic districts (District, 2002).

Hydrology and Soils

The Etowah River joins with the Oostanaula River to form the Coosa River in Rome, Georgia. The Coosa River continues to the southwest, joining the Alabama River north of Montgomery, Alabama before entering the Gulf of Mexico at Mobile Bay. The main tributaries feeding the Etowah River Basin through the District include Allatoona Creek, Little River, Settingdown Creek, Noonday Creek, Pumpkinvine Creek, Raccoon Creek, Shoal Creek, and Hickory Log Creek. In contrast to the mainstem Etowah River, with the exception of Allatoona Lake, Hickory Log Reservoir, Hollis Q. Latham Reservoir, various National Resource Conservation Service (NRCS) watershed lakes, and other drainage structures, the majority of its tributaries remain free-flowing within this basin. Groundwater availability is limited due to geologic conditions that restrict the potential yield for water supply.

The flow of the Etowah River through the District is regulated primarily by Allatoona Dam, a federal impoundment forming Allatoona Lake, which is operated by the Corps. Allatoona Lake has a drainage area of 1,100 square miles, and extends from Allatoona Dam about 43 miles up the Etowah River. Constructed in the 1940s, Allatoona Lake is a multipurpose reservoir that provides flood protection, power production, water supply, navigation, recreation and fish and wildlife management. It is the second-largest reservoir in the District (as well as Georgia) and provides approximately 14 percent of the District’s water supply, either through direct withdrawals or downstream releases.

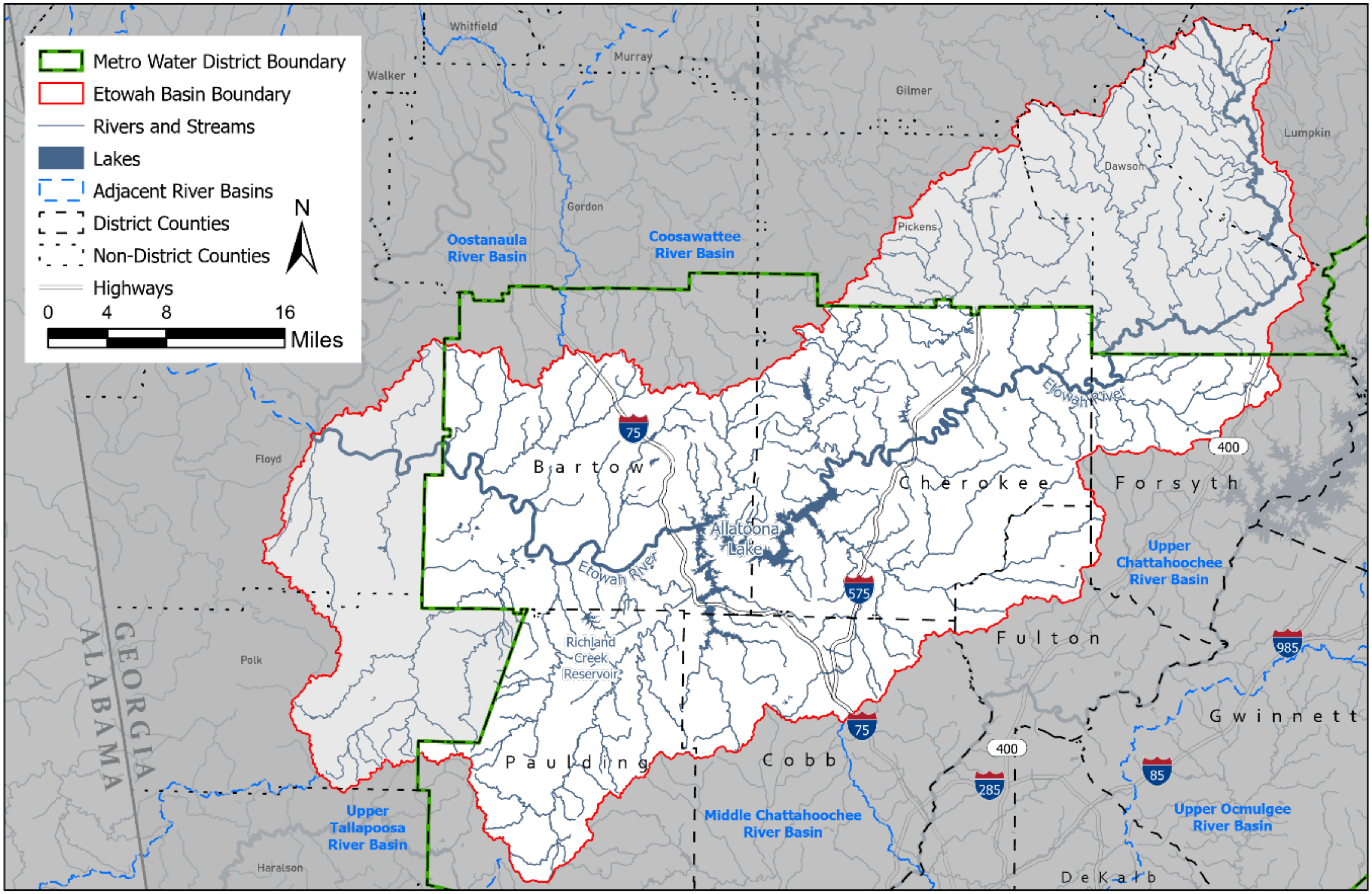

Figure ER-1. Etowah River Basin Within the District

Stream discharges are recorded at U.S. Geological Survey (USGS) Station #02392000, the Etowah River at Canton, and #02394000, the Etowah River at Allatoona Dam above Cartersville (USGS, 2020). USGS Station #02392000 upstream at Canton has recorded annual flows ranging from a low of 135 cubic feet per second (cfs) to a high of 5,262 cfs, with a mean flow of 1,202.8 cfs over the 96-year period of record. USGS Station #02394000 at Allatoona Dam has recorded annual flows ranging from a low of 241.4 cfs to a high of 9,407 cfs, with a mean flow of 1,841.8 cfs over the 73-year period of record. The Etowah River Basin is divided into 15 10-digit HUCs and a total of 66 12-digit HUCs.

An assessment of the availability of groundwater resources in select prioritized aquifers of Georgia was completed as part of Georgia's Comprehensive State-wide Water Management Plan (Georgia EPD, 2010). Within the Etowah River Basin, portions of Bartow and Paulding Counties were included due to the potential of the Valley and Ridge physiographic province of Paleozoic rock aquifers. It found that the Paleozoic rock aquifer in northwestern Georgia could provide a potential sustainable yield ranging from 27 to 70 million gallons per day.

The Georgia Geologic Survey Hydrologic Atlas 18 database identifies approximately 28 areas, representing about four percent of the District, that are likely to contain unconfined aquifers, and 79 areas, representing about 12 percent of the District, that are likely to contain thick soils considered to be an indicator of significant groundwater recharge areas. The recharge areas were mapped based on outcrop area, lithology, soil type and thickness, slope, density of lithologic contacts, geologic structure, the presence of karst and potentiometric surfaces. There are approximately 198 square miles—17 percent of the basin area within the District—of potential recharge areas within the Etowah River Basin, (Table ER-1).

Table ER-1. Groundwater Recharge Areas within the Etowah River Basin

Recharge Area Type	County	Square Miles of Recharge Area Type within County
Probable Areas of Thick Soil	Bartow	2
	Cherokee	11
	Cobb	14
	Forsyth	14
	Fulton	4
	Paulding	7
Unconfined Aquifer	Bartow	134
	Paulding	< 1
Total Recharge Areas		**187**

There are 10 soil associations that describe the soil types in the Etowah River Basin; Cecil-Madison-Pacolet and Madison-Davidson-Pacolet are the dominant soil types (Table ER-2). The Cecil-Madison-Pacolet and Madison-Davidson-Pacolet associations were the most abundant, with the former types associated with moderate rolling hills and the latter with steeper terrain. These soils are well-drained and highly weathered, having a red to yellowish-red subsoil (Brock, 1977; Jordan et al., 1973; Murphy, 1979; Thomas and Tate, 1973; USDA, 1976; Thomas, 1982; Wells, 1961; Robertson et al., 1960; USDA, 1958; Tate, 1967; Thomas and Tate, 1964). The Saluda-Edneytown-Evard association was found in Cherokee County north of Allatoona Lake. These soils are very deep, well-drained and associated with ridges and side slopes (Thomas and Tate, 1973; USDA, 1976; Thomas, 1982; USDA, 1958).

Table ER-2. Major Soil Associations within the Etowah River Basin

Soil Association	Significance to Watershed Management
Cecil-Madison-Pacolet	**Characteristics:** Associated with moderate rolling hills, well-drained, highly weathered. **Significance to Watershed Management:** Sloping surfaces may be more susceptible to increased erosion due to stormwater runoff velocities from impervious surfaces; well-drained soils may be more permeable which increases infiltration capacity in areas without impervious cover, also may improve feasibility for infiltration practices.
Madison-Davidson-Pacolet	**Characteristics:** Associated with steep terrain, well-drained, highly weathered. **Significance to Watershed Management:** Steep terrain may be more susceptible to increased erosion due to stormwater runoff velocities from impervious surfaces; well-drained soils may be more feasible for infiltration practices.
Saluda-Edneytown-Evard	**Characteristics:** Associated with shallow to very deep, well-drained, moderately permeable soils located on ridges or side slopes. **Significance to Watershed Management:** Well-drained soils may be more permeable, which increases infiltration capacity in areas without impervious cover, also may improve feasibility for infiltration practices.
Etowah-Fullerton-Rome	**Characteristics:** Associated with very deep, well-drained, moderately permeable soils on high stream terraces with medium runoff. **Significance to Watershed Management:** Well-drained soils may be more permeable, which increases infiltration capacity in areas without impervious cover, also may improve feasibility for infiltration practices. Deep soils have the capacity to store more water for potential groundwater recharge.
Fullerton-Shack-Chewacla	**Characteristics:** Associated with very deep, moderately to poorly drained, moderately permeable soils located on side slopes and valleys. **Significance to Watershed Management:** Poorly drained soils are less feasible for infiltration, restricted water drainage.
Shack-Fullerton-Bodine	**Characteristics:** Associated with very deep, moderately to excessively well-drained, moderately permeable soils located mainly on uplands. **Significance to Watershed Management:** Well-drained soils may be more permeable, which increases infiltration capacity in areas without impervious cover; deep soils have the capacity to store more water for potential groundwater recharge.
Townley-Fullerton-Montevallo	**Characteristics:** Moderately deep, well-drained, slowly permeable soils on upland ridgetops and side slopes. They formed in clayey residuum weathered from shale or interbedded sandstone and shale. Slope ranges from 2 to 45%. **Significance to Watershed Management:** Well-drained soils may improve feasibility for infiltration practices. Sloping surfaces may be more susceptible to increased erosion due to stormwater runoff velocities from impervious surfaces.
Tallapoosa-Chewacla-Madison	**Characteristics:** Silty sand, clayey-sand, clay, steep terrain, well-drained, weathered material. **Significance to Watershed Management:** Limited capacity for infiltration due to shallow bedrock and steep slope; infiltration is limited. Very slow infiltration rate. These soils have a very slow rate of water transmission.
Etowah-Whitwell-Chewacla	**Characteristics:** Consists of very deep, poorly to well-drained, moderately permeable soils located on low and high stream terraces, alluvial fans and foot slopes. Slopes range from 0 to 35%. **Significance to Watershed Management:** Well-drained soils may improve feasibility for infiltration practices; poorly drained soils are less feasible for infiltration, restricted water drainage. Deep soils have the capacity to store more water for potential groundwater recharge.

Table ER-2. Major Soil Associations within the Etowah River Basin

Soil Association	Significance to Watershed Management
Dekalb-Tallapoosa-Chewacla	**Characteristics:** Shallow to very deep, poorly to excessively drained, moderately to rapidly permeable soils. Formed in material weathered from gray and brown acid sandstone in places interbedded with shale and greywacke. Slope ranges from 0 to 80%. **Significance to Watershed Management:** Sloping surfaces may be more susceptible to increased erosion due to stormwater runoff velocities from impervious surfaces; well-drained soils may improve feasibility for infiltration practices; poorly drained soils are less feasible for infiltration, restricted water drainage.
Ashe-Tusquitee-Edneytown	**Characteristics:** Moderately to very deep, moderately permeable, well-drained soils on gently sloping to very steep ridges and side slopes. Slope ranges from 2 to 95%. **Significance to Watershed Management:** Sloping surfaces may be more susceptible to increased erosion due to stormwater runoff velocities from impervious surfaces; well-drained soils may improve feasibility for infiltration practices.
Madison-Tallapoosa-Hayesville	**Characteristics:** Shallow to very deep, well-drained, moderately permeable soils that formed in residuum weathered from felsic or intermediate, high grade metamorphic or igneous rocks high in mica content. Slope ranges from 2 to 80%. **Significance to Watershed Management:** Well-drained soils may improve feasibility for infiltration practices. Sloping surfaces may be more susceptible to increased erosion due to stormwater runoff velocities from impervious surfaces. Deep soils have the capacity to store more water for potential groundwater recharge.
Urban Soils	**Characteristics:** Highly disturbed and compacted soils created as a result of human activity, vertical and spatial variability. **Significance to Watershed Management:** Compacted soils; poorly drained soils are less feasible for infiltration, restricted water drainage.

Protected Species

Protected species include all species listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service, and those listed as endangered, threatened, rare or unusual by the State of Georgia. The USFWS also may designate critical habitat for a federally listed species, which provides protection for the habitat as well as the species itself. The current listings of these endangered species, including their status, range, and habitat, can be accessed via the USFWS's automated Information, Planning and Conservation System (IPaC, http://ecos.fws.gov/ipac/).

Within the District, and Etowah River Basin in particular, there are a number of protected species that spend all or part of their life cycle in rivers and streams or depend on streams for a significant portion of their life history. In addition, there are protected plants that are either aquatic or semi-aquatic and grow within or along the margins of rivers and streams. Table ER-3 lists the 27 protected species potentially found within the counties of the Etowah River Basin of the District.

Table ER-3. Aquatic and Semi-Aquatic Protected Species in the Etowah River Basin

Fauna Type	Common Name	Status*	Bartow	Cherokee	Cobb	Forsyth	Fulton	Paulding
Bird	Bald eagle	T	X	X		X	X	
Fish	Amber darter	E		X				
	Blue shiner	E	X					
	Bluestripe shiner	R			X		X	
	Cherokee darter	T	X	X	X	X	X	X
	Coldwater darter	E	X					
	Coosa chub	E		X		X		
	Etowah darter	E	X	X		X		X
	Frecklebelly madtom	E		X		X		
	Freckled darter	E		X				
	Highscale shiner	R			X		X	X
	Lined chub	R	X	X	X			X
	Lipstick darter	E						X
	Muscadine darter	R						X
	Rock darter	R	X	X		X		
	Tallapoosa darter	R						X
Invertebrate	Alabama spike	E		X				
	Chattahoochee crayfish	T			X	X	X	
	Delicate spike	E			X		X	
	Etowah crayfish	T	X	X		X		X
	Finelined pocketbook	T		X				X
	Gulf moccasinshell	E			X		X	
	Shineyrayed pocketbook	E					X	
	Tallapoosa crayfish	R						X
Mammal	Gray bat	E	X	X				
	Northern long-eared bat	T	X	X				X
Reptile	Northern map turtle	R	X					

* Status that is not underlined is listed in Georgia. Underlined status is federally listed.

R = Rare
E = Endangered
T = Threatened

Trout Streams

Trout streams are classified in accordance with the primary and secondary designations and criteria defined in Section 15 of Georgia's Water Use Classifications and Water Quality Standards (391-3-6-.03). Streams designated as primary trout streams are waters supporting a self-sustaining population of rainbow, brown or brook trout. Streams designated as secondary trout streams are those with no evidence of natural trout reproduction but are capable of supporting trout throughout the year. Seasonal secondary trout streams are located in Boston Creek in Bartow County and Cherokee County upstream of Georgia Highway 20. Seasonal secondary trout streams are located on Pumpkinvine Creek and Raccoon Creek in Paulding County. Year-round trout streams are located in the following Bartow County streams: Connesena Creek, Dykes Creek, Pine Log Creek, Pyle Creek, Salacoa Creek, Spring Creek, Stamp Creek upstream from Bartow County Road 269, Toms Creek upstream from Bartow County Road 82, Two Run Creek, and Ward Creek. Year-round trout streams are located in the following Cherokee County streams: Bluff Creek, Pine Log Creek, Salacoa Creek, Soap Creek, Stamp Creek, and Wiley Creek. Year-round trout streams are located in the following Paulding County streams: Possum Creek, Powder Creek, Pyle Creek, Thompson Creek, and Ward Creek.

Land Use and Surface Water Quality

Drinking Water Supply

As described in the Water Supply and Water Conservation Plan, the Etowah River Basin is a primary drinking water supply source for several of the District counties including Bartow, Cherokee, Cobb, Forsyth, and Paulding. Withdrawals from this basin provide approximately 14 percent of the District's total public water supplies. Recognizing the linkage between watershed management and water quality for water supply, the Georgia Department of Natural Resources (GADNR) Rule 391-3-16-.01 includes environmental planning criteria (or Part V criteria) to protect natural resources, such as wetlands, stream buffers, water supply watershed areas, groundwater recharge areas, protected rivers, and protected mountains. Table ER-4 lists the water supply sources and Figure ER-2 shows their corresponding water supply watersheds and those waters that are designated to meet State drinking water criteria within the Etowah River Basin.

Table ER-4. Etowah River Basin Drinking Water Supply Sources

Water Supply Source	Owner/Operator Using Source
Etowah River	City of Canton Water and Sewer Department Cherokee County Water and Sewage Authority Paulding County Water
Allatoona Creek	Cobb County-Marietta Water Authority
Allatoona Lake	City of Cartersville Water Department
Richland Creek Reservoir	Paulding County Water
Moss Springs	City of Emerson
Bolivar Springs	Bartow County

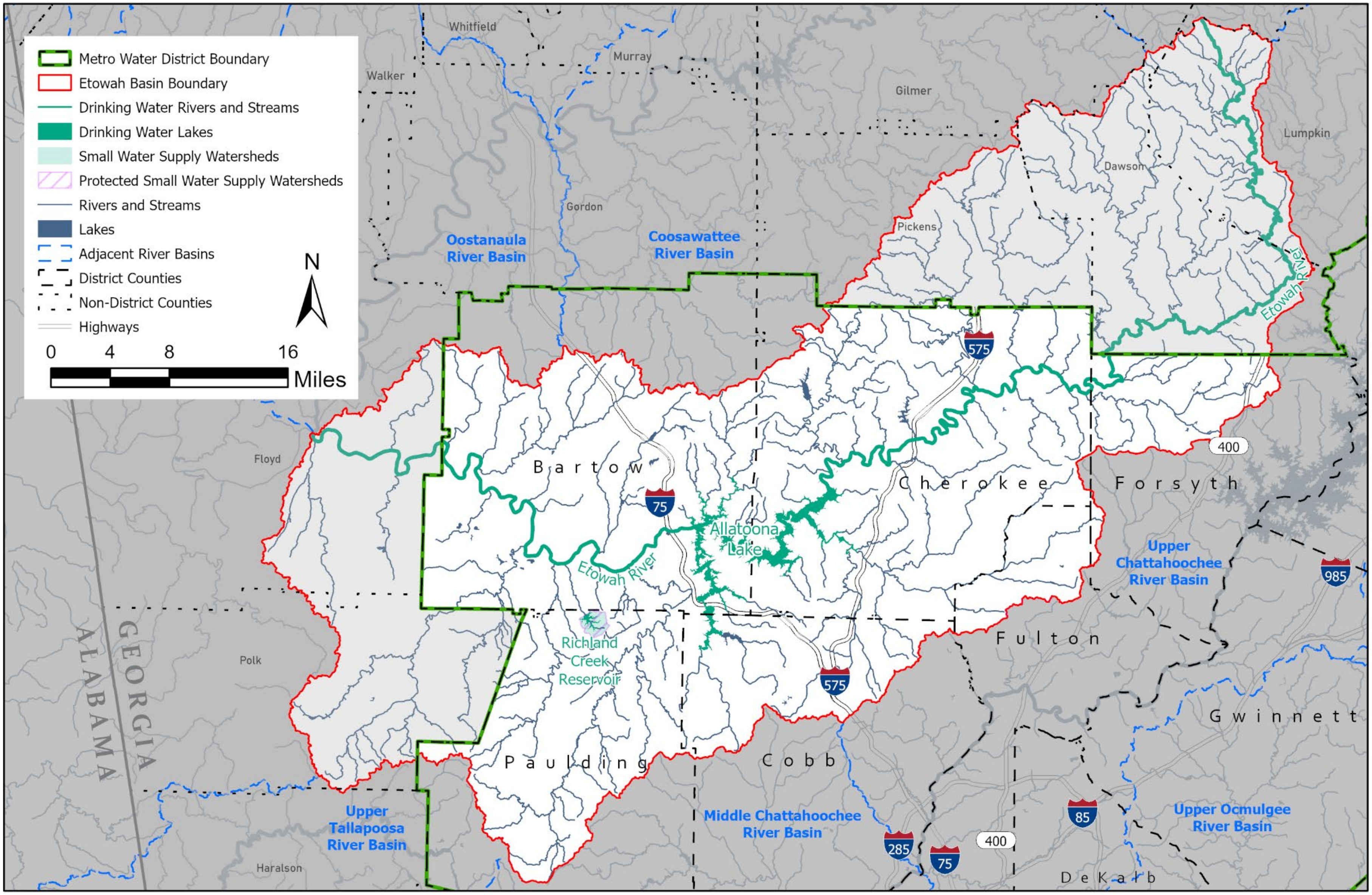

Figure ER-2. Etowah River Basin Drinking Water

Source water assessments were performed for all drinking water supplies within the Etowah River Basin as required by U.S. Environmental Protection Agency (EPA). The source water assessments determined the potential for pollution based on individual source and nonpoint source pollution within drinking water supply watersheds and assigned a susceptibility ranking to each drinking water source. The susceptibility rankings throughout the basin were low for Richland Creek reservoir, low to medium for Etowah River, low-medium for Allatoona Lake, and medium for Allatoona Creek. These susceptibility rankings indicate the suburban and rural nature of most of the watersheds within the Etowah River Basin.

Small Water Supply Watershed

A small water supply watershed is a watershed that has less than 100 square miles of land within the drainage basin upstream of a water supply reservoir. In this context, a water supply reservoir is a governmentally owned impoundment of water for the primary purpose of providing water to one or more governmentally owned public drinking water systems, which excludes the multipurpose reservoirs owned by the Corps.

GADNR Rule 391-3-16-.01(7) requires 100-foot undisturbed buffers and 150-foot impervious surface setbacks for streams in small water supply watersheds within 7 miles upstream of water supply intakes and within 7 miles upstream of water supply reservoirs, excluding federal reservoirs. That portion of a small water supply watershed that includes the corridors of streams within a 7-mile radius upstream of a governmentally owned public drinking water supply intake or a non-federal water supply reservoir is called the protected small water supply watershed.

To facilitate implementation of GADNR Rule 391-3-16-.01(7) and Action Item Integrated-7, all areas of small water supply watersheds that are subject to protection through additional buffers and setbacks have been mapped for all local governments within the District. The Etowah River Basin has 3 square miles of protected small water supply watersheds in Paulding County as shown in Figure ER-2. Additional information and guidance can be found on the District Technical Assistance webpage in a memorandum titled, “District TAP Memo – Integrated-7 Additional Buffers in Small Water Supply Watersheds.”

Land Cover/Land Use

Draining the northwestern portion of the District, the central portion of the Etowah River Basin is bisected by Interstates 75 and 575, while its headwaters are crossed by Georgia 19 (GA 400) in northern Forsyth County. It also includes major east-west corridors, such as Georgia Highways 20 and 92 and the corresponding development that accompanies them. Overall, 28 percent of the Etowah River Basin within the District is developed, 54 percent of the area is forested, and 18 percent of the area falls within the remaining land cover classes (Table ER-5 and Figure ER-3).

Table ER-5. Etowah River Basin Land Cover / Land Use within the District

Land Cover/Land Use	Area (Square Miles)	2019 Existing (%)
Barren Land (Rock/Sand/Clay)	3.83	0.32
Cultivated Crops	9.89	0.84
Deciduous Forest	364.41	30.79
Developed, High Intensity	16.25	1.37
Developed, Low Intensity	103.61	8.75
Developed, Medium Intensity	47.10	3.98
Developed, Open Space	160.09	13.52
Emergent Herbaceous Wetlands	0.98	0.08
Evergreen Forest	168.16	14.21
Grassland/Herbaceous	29.90	2.53
Mixed Forest	108.97	9.21
Open Water	26.37	2.23
Pasture/Hay	112.50	9.50
Shrub/Scrub	24.80	2.09
Woody Wetlands	6.86	0.58
Undeveloped	***856.66***	***72.37***
Developed	***327.04***	***27.63***
Total	**1,183.70**	**100**

Notes:

Developed = High Intensity, Low Intensity, Medium Intensity and Open Space.
Undeveloped = land cover classes not described as Developed.

Data Source:

Aggregated Land Cover categories from USGS National Land Cover Database (NLCD), 2019.

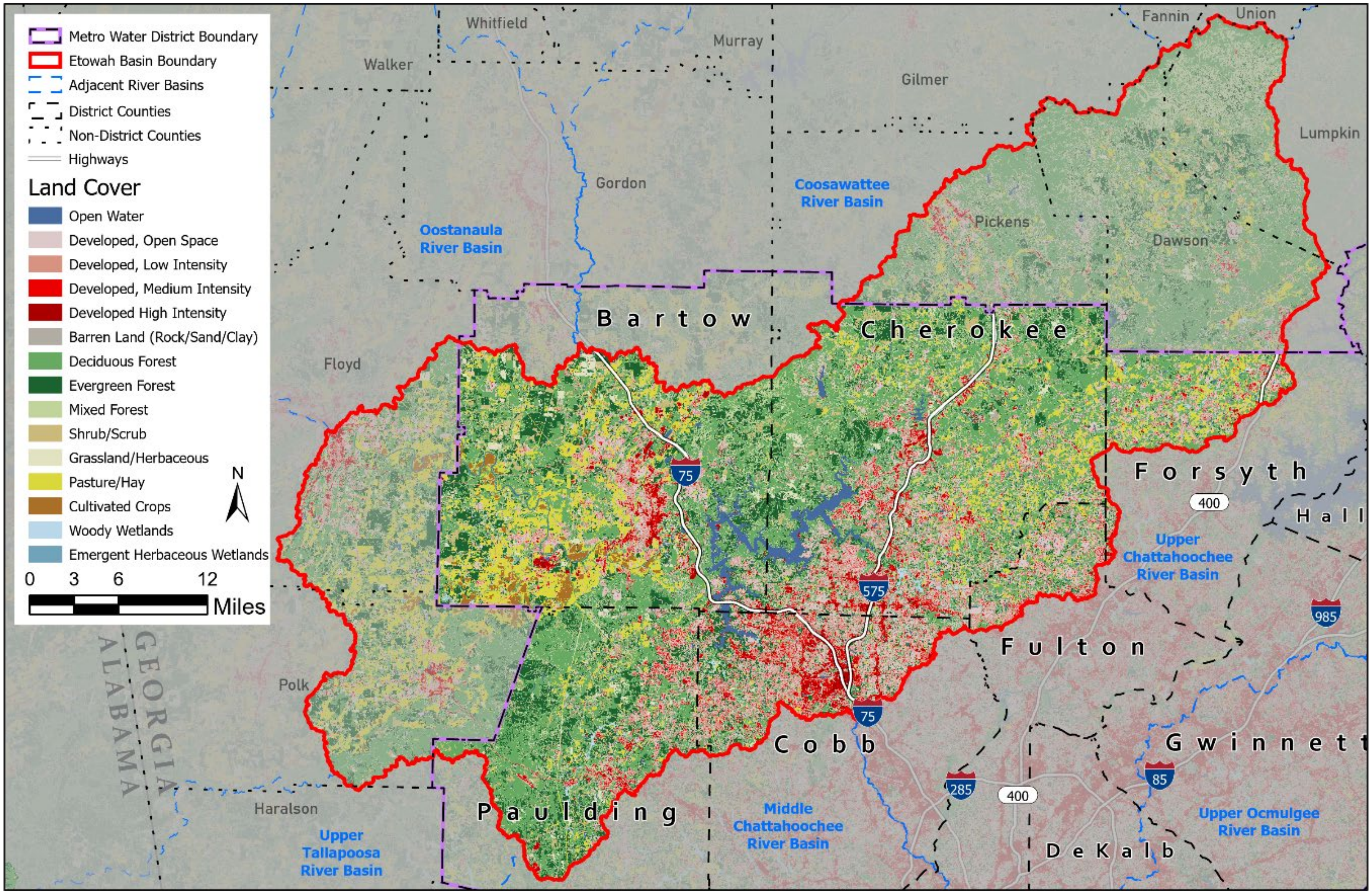

Figure ER-3 Etowah Land Cover
Source: 2019 NLCD

Effective Impervious Areas

The level of watershed imperviousness has long been linked to impacts on changes in hydrologic regimes that lead to increased intensity and frequency of peak stormwater flows, which affect stream stability, water quality, and aquatic habitat and biotic community integrity. In general, the most sensitive aquatic organisms are affected at impervious levels greater than 10 percent. Between 11 and 25 percent of most stream communities become impacted, and over 25 percent of streams are generally no longer able to support viable biotic communities (Schueler, 2001).

Impervious surfaces (such as roofs, streets, parking lots) have a significantly different hydrologic response from pervious surfaces (lawns, forests); therefore, it is important to clearly define terms and assumptions related to the calculation of pervious and impervious areas for the purposes of watershed management. “Total impervious area” quantifies all of the land surfaces impervious to rainfall for the particular land cover category while “effective impervious area” (EIA) refers to the directly connected impervious area used for water quality and stormwater conveyance modeling. For the 2003 District-wide Plan, EIA values were initially defined based on previous studies, including the local watershed assessments, and then further refined based on calibration using available water quality data. For the 2022 District-wide Plan, the EIA of the HUC-12 subwatersheds within the District was calculated using a mathematical model developed by Sutherland for EPA based on land cover data from the 2019 USGS National Land Cover Database.

Of the 64 HUC-12s within the District portion of Etowah River Basin, 13 had an EIA greater than 10 percent, primarily those HUCs that either straddle a major transportation corridor such as the Interstate 75/ Interstate 575 interchange, or the HUCs include the more densely urbanized areas of the cities of Acworth and Cartersville (Figure ER-4).

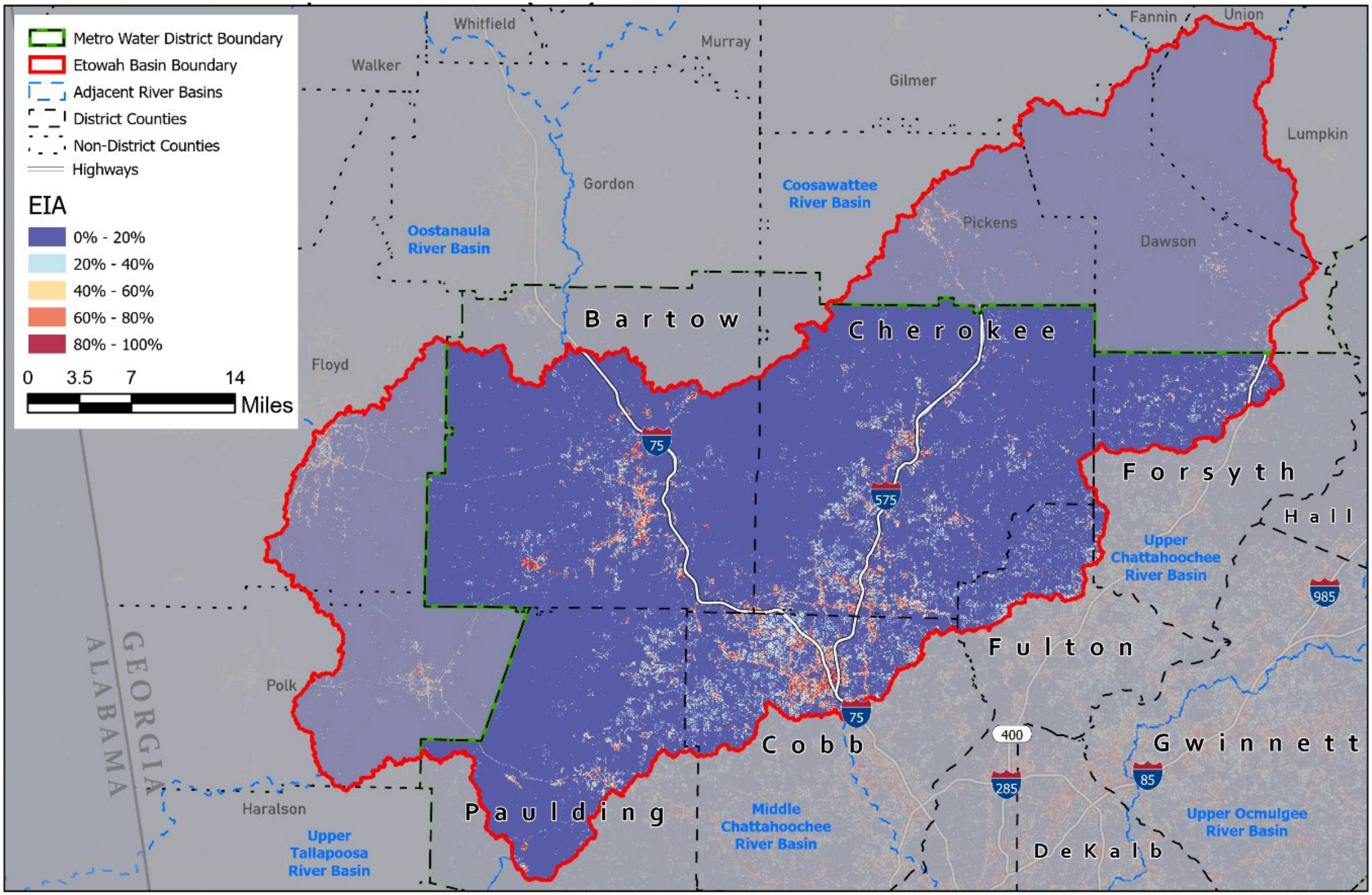

Figure ER-4. Etowah Effective Impervious Area

Wastewater Management

Permitted Wastewater Facility Service Areas

There are 19 municipal wastewater treatment facility in the Etowah River Basin with a permitted capacity of 74.9 maximum monthly flow – million gallons per day (MMF-MGD). Additionally, the Etowah River Basin has 27 non-municipal wastewater treatment facilities with a permitted capacity of 11.3 MMF-MGD.

Combined-sewer Overflow Areas

There are no combined-sewer overflow areas in the Etowah River Basin.

Impaired Water Bodies

The Georgia EPD establishes water quality standards for the state's surface waters. Section 303(d) of the federal Clean Water Act requires that all states list water bodies that do not meet water quality standards. The Georgia EPD publishes a biennial list of streams that do not meet State water quality standards, referred to as the 303(d)/305(b) list. If a water body does not support its designated use (drinking, recreation, fishing, wild/scenic rivers, or coastal fishing) because conditions violate water quality standards, it is considered an "impaired" stream or water body.

Georgia EPD determines whether a water body is supporting its designated uses by collecting water quality data and comparing this data against State water quality criteria. Georgia EPD describes their listing methodology and "preferred minimum dataset" at http://epd.georgia.gov/georgia-305b303d-list-documents. This methodology is important to understand the sample size, extent and timeframe of the dataset that was used to list a water body. Feedback can be given to Georgia EPD if additional data or information are known that may affect future sampling or listing evaluations.

The District portion of the Etowah River Basin contains 2,593 stream miles, 535 of which were assessed for impairments. A total of 255 stream miles, 10 percent of total streams or 48 percent of assessed streams, did not meet State water quality standards based on the 2020 303(d) list. The streams listed as "not supporting" are summarized in Table ER-6 by parameter and graphically shown on Figure ER-5. Several streams are listed for violations of more than one parameter; therefore, the total of impaired miles by parameter will not equal the miles of not supporting stream.

Table ER-6. Etowah River Basin Summary of Impaired Streams

Criterion Violated	Miles of Stream	% of 2020 Assessed Streams	% of Total Stream Mileage
Fecal coliform bacteria	154	29	6
Biota (fish community)	109	20	4
Fish consumption guidance (PCBs	58	11	2
Biota (macroinvertebrate community)	36	7	1
Dissolved oxygen	12	2	<1
Total impaired stream mileage*	255	48	10
Total mileage assessed for possible impairment	535		
Total stream mileage in basin	2,593		

* Several streams are listed for violations of multiple parameters within the same stream segment; therefore, the total of impaired miles by parameter will not equal the total stream mileage of impaired streams.

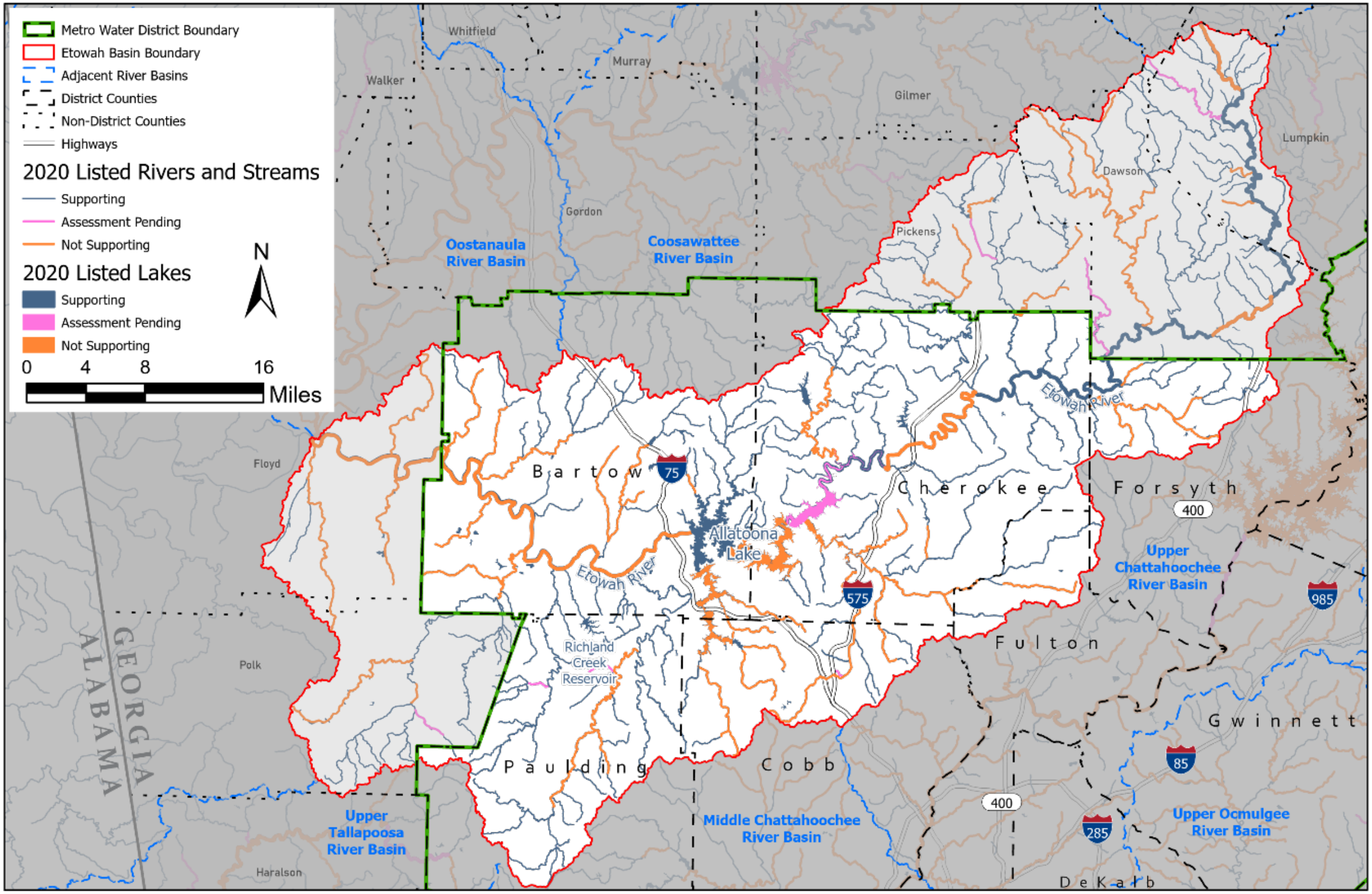

Figure ER-5. Etowah River Basin 305(b)/303(d) Listed Waters

Streams in the Etowah River Basin that do not meet water quality standards for either fecal coliform bacteria as a result of nonpoint source pollution account for 6 percent or 29 percent of total and assessed streams respectively. Fecal coliform is used for water quality purposes as a Fecal Indicator Bacteria (FIB). FIBs are used to provide an approximation of the potential risk a water body poses to human health. Lake Acworth does not meet water quality standards for fecal coliform bacteria as a result of urban runoff. These bacteria enter the stream from both anthropogenic and non-anthropogenic sources, including sanitary sewer overflows, leaking sewer lines, failing septic systems and pet/wildlife waste. Fecal coliform typically is found in both developed and undeveloped watersheds, and monitoring programs in Georgia have found levels that exceed state standards in urban, agricultural, and forested areas (Georgia EPD, 2011). While fecal coliform is ubiquitous in streams across the country (Georgia EPD, 2011), concentrations of bacteria can increase as a result of the higher density of potential pollutant sources and decreased stormwater filtration and stormwater treatment from population growth and development. Biota listings typically indicate high sediment loads in streams, which decreases habitat quality for benthic macroinvertebrates and fish. Sediment sources include runoff from construction sites as well as from streambank erosion due to accelerated streamflow velocities from impervious cover associated with urbanization. Additionally, the following four stream segments, located west of Allatoona Lake, are listed for Commercial Fishing Ban as a result of legacy polychlorinated biphenyl levels: Connesena Creek, Toms Creek, Two Run Creek, and Etowah River from Highway 441 to Coosa River.

Allatoona Lake has a designated use of Recreation and Drinking Water with corresponding chlorophyll a and total nitrogen criteria. A portion of the lake, the Etowah River arm, is pending assessment of the designated uses of Recreation and Drinking Water by meeting State water quality standards for chlorophyll a. A total of 24 percent of Allatoona Lake is listed as supporting its designated use. When Georgia EPD completed modeling to establish total maximum daily loads (TMDLs) to address these exceedances and preliminary load reductions were applied, the growing season average chlorophyll a levels were still occasionally above 5.0 micrograms per liter at some locations; therefore, Georgia EPD has reevaluated the chlorophyll a criteria at these locations (Georgia EPD, 2013).

TMDLs and TMDL Implementation Plans have been developed to help jurisdictions address impaired streams and specific parameters of concern. More information on specific TMDLs in the Etowah River Basin can be found on the Georgia EPD website https://epd.georgia.gov/total-maximum-daily-loadings.

Management Issues and Recommendations

Basin-level Summary

Land development affects the physical, chemical, and biological conditions of the District's watersheds, waterways, and water resources. Based on the Stormwater Forecast analysis, development patterns in the District over the past century have resulted in substantial changes to watershed characteristics. Developed area is projected to increase from 208,360 acres in the current (2019) condition to 310,517 acres in 2040, a 54 percent increase. If current land use policy and recent development patterns continue, future estimates of land use are expected to intensify, with the weighted average curve number (CN) value potentially reaching approximately 84 and total imperviousness potentially reaching 41 percent by 2040, based on the future developed area.

Precipitation rates are also expected to increase based on the future precipitation study results for the District. By 2040, the basin-wide weighted average 85th percentile annual rainfall; 1-year, 24-hour rainfall; and 25-year, 24-hour rainfall events are estimated to potentially increase by 14 percent, 11 percent, and 16 percent, respectively. These changes to watershed characteristics and rainfall intensity will have a direct impact on the total potential runoff management volume generated from development that may require additional management from structural control measures.

Runoff for the three post-construction volumes (Water Quality Volume [WQv], Channel Protection Volume [CPv], and Overbank Flood Protection Volume [OFPv]) were calculated for 1,749 individual subcatchments in the basin. In 2019, a total of 270 million cubic feet of runoff was estimated in the basin for the WQv, 758 million cubic feet for the CPv, and 4,353 million cubic feet for the OFPv, based on 208,360 acres of development. Additional information is provided in the following summary table (Table ER-7) and figure of the 2019 WQv for the basin (Figure ER-6).

Table ER-7. Etowah River Basin Watershed Characteristics and Total Potential Runoff Management Volumes

	Predevelopment	2019	2030	2040
Sub-catchments (count)	1,749	1,749	1,749	1,749
Total area (acres)	757,363	757,363	757,363	757,363
Developed area (acres)	208,360	208,360	267,548	310,517
Total imperviousness (percent)	1.0	27.5	35.0	40.6
CN	60	81	83	84
Slope (percent)	9.2	9.2	9.2	9.2
85th percentile annual rainfall (inches)	1.20	1.20	1.32	1.37
1-year, 24-hour rainfall (inches)	3.38	3.38	3.63	3.75
25-year, 24-hour rainfall (inches)	6.13	6.13	6.77	7.10
WQv (cubic feet)	53.55 M	269.64 M	467.75 M	641.20 M
CPv (cubic feet)	218.83 M	758.48 M	1,182.49 M	1,491.29 M
OFPv (cubic feet)	-	4,352.97 M	7,220.76 M	9,317.20 M

Notes:

M = million

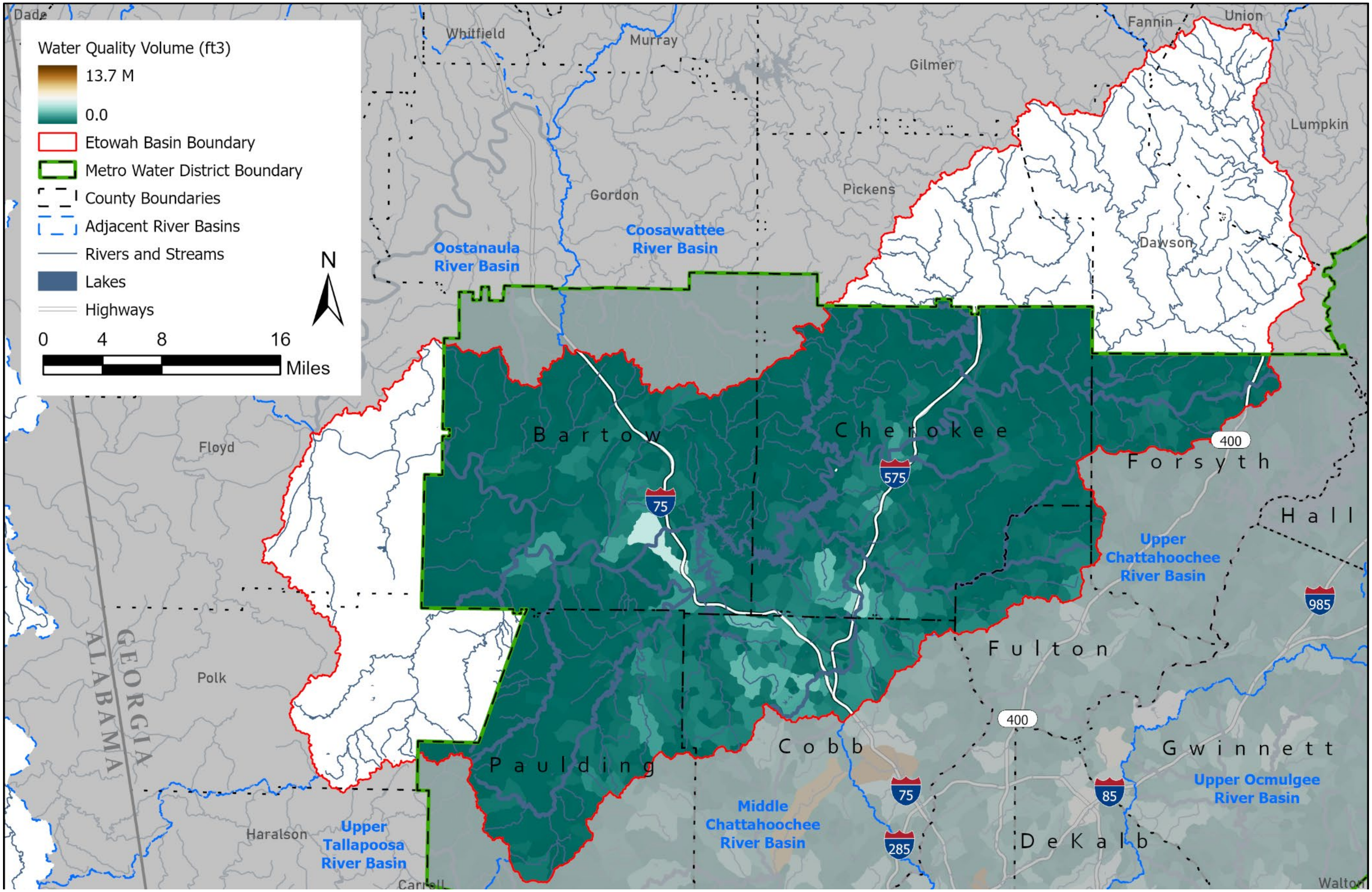

Figure ER-6. Estimated Water Quality Runoff Volume per Subcatchment – 2019

Management Issues and Recommended Strategies

Table ER-8 outlines management issues and strategies for the Etowah River Basin within the District. These issues and strategies were used to inform and guide the more specific management measures and requirements found in Sections 5, 6, and 7. The recommended strategies presented in Table ER-8 are based on data presented within this River Basin Profile. These strategies are provided to further describe the commonality of causes and potential solutions to the watershed issues. They provide a foundation for guidance but are not presented here as mandatory requirements.

Table ER-8. Etowah River Basin Management Issues and Recommended Strategies

Management Issue	Description	Recommended Strategies
Source water quality	Source water watershed protection of Allatoona Lake, Etowah River, and small water supply watersheds.	• Implement source water protection measures in all subwatersheds draining to Allatoona Lake. • Continue collaborative efforts in small drinking water supply watersheds to protect the viability of these supplies.
Nutrient loading	Portions of Allatoona Lake are pending assessment for chlorophyll a standards; therefore, Georgia EPD is in the process of reevaluating the chlorophyll a criteria.	• Implement post-construction stormwater controls and infiltration practices to reduce NPS pollutants associated with multiple land uses, particularly suburban/urban and agricultural. • Educate the public on NPS pollution reduction and proper fertilizer application and the impacts of excess nutrients on the lake and local economy. • Coordinate with Georgia EPD's NPS Program to develop nutrient management plans and strategies to reduce nutrient loading from animal feeding operations in concentrated production regions, as funding allows. • Participate in efforts to educate agricultural stakeholders about the importance of implementing Best Management Practices for Georgia Agriculture Manual for animal production facilities (poultry) and grazing operations. • Coordinate with Georgia Department of Agriculture Livestock/Poultry Section on inspections, complaint investigations, nutrient management plan reviews, permit administrative support, and enforcement assistance (Georgia EPD, 2014).
Increases in impervious cover (new development)	Increases in impervious cover can lead to a change in the hydrologic regime of a watershed by causing more intense, high-velocity stormwater flows and increased erosion and sedimentation.	• Manage nonpoint source pollution. • Adopt and enforce the post-construction stormwater control ordinance and use of Georgia Stormwater Management Manual design standards. • Watershed improvement projects, such as stream restoration and streambank stabilization, are recommended in areas with failing stream banks to reduce instream sediment load contributions.

Table ER-8. Etowah River Basin Management Issues and Recommended Strategies

Management Issue	Description	Recommended Strategies
Inadequate stormwater controls on existing impervious cover	Much of the development in the basin occurred prior to current Georgia Stormwater Management Manual design standards. Limited resources and cost of maintaining and repairing stormwater infrastructure. Varying local strategies of funding stormwater management.	• Implement an asset management program to identify and prioritize maintenance and capital improvement projects to maximize benefit. • Consider updating stormwater controls during redevelopment. • Identify opportunities for watershed improvement projects to retrofit or install updated stormwater controls, green infrastructure, stormwater treatment, or other controls. • Consider dedicated funding sources, such as stormwater utilities, and seek out opportunities for grants, loans, and partnerships.
Aquatic resources	Several secondary trout streams are located within the Etowah River Basin.	• Balancing nonpoint source temperature inputs from tributaries with natural cold water base flows to meet secondary trout stream criteria.
Biota TMDLs	20% of assessed instream fish communities and 7% of the benthic macroinvertebrate communities are impaired. Biota impairment in this basin is the result of high sediment loads, primarily associated with existing development with inadequate stormwater controls, which is a concern for drinking water source supplies, biota, and recreation.	• Enforce post-construction stormwater ordinance on new development and seek opportunities to retrofit stormwater controls to maximize water quality and channel protection. • Recommend watershed improvement projects, such as stream restoration and streambank stabilization, in areas with failing stream banks to reduce instream sediment load contributions.
Bacteria TMDLs	29% of assessed stream segments in the Etowah River Basin (within the District) are listed for fecal coliform.	• Identify bacteria sources through inspections, monitoring, source tracing, and stream walks. • Educate public on pollution prevention, proper septic system maintenance, and reporting a potential illicit discharge. • Address fecal coliform bacteria contributions from sanitary sewer overflows. • Perform regular maintenance to ensure proper functioning of decentralized systems (such as septic tanks) near the Etowah River and Allatoona Lake.
Lake management	Allatoona Lake is the largest lake within this basin. There are 303(d) assessments pending for potential chlorophyll (a) exceedances in the Little River Embayment. There are also other publicly and privately held and managed lakes that play a significant role in meeting designated uses, water supply needs, and downstream hydrologic regimes. Other major reservoirs and lakes are found in Table ER-4.	• Develop a central inventory of lakes, ownership and management practices to facilitate pollutant source identification both up and downstream of the lake. • Coordinate available water quality data and management activities for inventoried lakes. • Implement shoreline protection and upstream sediment management to prevent excessive nutrients and sedimentation within the lake. • Facilitate proper maintenance and management, by providing resources, links, or other materials to assist with periodic activities, such as inspections, water quality sampling, or dredging. • Conduct public education and involvement activities to promote watershed stewardship to protect lake quality.

Note:

NPS = nonpoint source pollution

Identify Indicators and Monitoring to Measure Implementation Success

A critical component of any watershed management program is the ability to assess progress and determine if management strategies are effectively addressing issues. The Plan includes implementation actions related to watershed monitoring and conducting conditions assessments to evaluate implementation success. These implementation actions include long-term ambient trend monitoring (WATERSHED-10), as well as resource-specific implementation actions for Watershed Improvement (WATERSHED-8). Communities may choose to conduct project-specific monitoring associated with a watershed improvement project, such as biological or geomorphological monitoring to evaluate success.

As included in EPA (2008), a monitoring program should "…track progress in meeting load reduction goals and attaining water quality standards and other goals. Measurable progress is critical to ensuring continued support of watershed projects, and progress is best demonstrated with the use of monitoring data that accurately reflect water quality conditions relevant to the identified problems. Monitoring programs should include baseline (before), project-specific (during), and post-project (after) monitoring."

Some potential indicators to measure implementation success for the Etowah River Basin are listed as follows, but this list is not exhaustive:

- Select representative monitoring stations within the watershed to monitor for pollutants of concern and other water quality or biological parameters.
- Use USGS stream gage data or collect data to establish stream stage-discharge relationships and calculate or model water quality pollutant loads and potential reductions.
- Calculate or model improvements to hydrologic and hydraulic conditions based on structural project implementation.
- Estimate streambank stability and habitat improvement based on annual stream cross section surveys and bank erosion monitoring.
- Conduct stream walks or structure inspections to inventory structure condition and performance, streambank stability and riparian condition over time.
- Conduct project monitoring to establish pre-, during-, and post-project conditions, as well as upstream/downstream monitoring during the same time period to reduce the effects of environmental variability.
- To determine if water quality degradation is being prevented, conduct GIS analysis to identify high-activity areas of a watershed using aerial overlays, work orders, facility inspection, erosion and sedimentation control, or new construction inspection data. Identify if monitoring data and GIS data follow similar patterns.
- Track number, location, size, or features (that is, drainage area treated or linear feet of restored stream) of watershed improvement, green infrastructure, or other nonpoint source reduction projects.
- Compare percentage of TMDL stream segments over time.
- Track implementation actions by jurisdiction within the basin, and their measured effectiveness.
- Track enforcement actions by category and location.
- Track stream buffer variances and local permits issued.
- Conduct public surveys for pollution prevention awareness or education effectiveness, particularly pre- and post-data associated with an education event.
- Compare existing water quality modeled loads against future water quality modeled loads.

ATTACHMENT 6

Coosawattee River Basin Profile

The Coosawattee River Basin is located on the north-central border of the District and includes portions of the City of Adairsville, Bartow County and Cherokee County. The District represents 12 percent of the overall Coosawattee River Hydrologic Unit Code (HUC)-8 Basin while that portion of this HUC-8 within the District represents only two percent of the total District area. Drinking water supplies from the Coosawattee River Basin provide water supply for municipalities outside of the District.

Physical and Natural Features

Geography

The Coosawattee River Basin encompasses about 104 square miles of the District. It has its headwaters in the Blue Ridge Mountains northwest of the District near Ellijay, Georgia and flows southwest to the confluence of the Oostanaula River east of Calhoun, Georgia in Gordon County. The southeast portion of the Coosawattee River Basin is located within Bartow and Cherokee Counties within the District (Figure CO-1). The Coosawattee River is entirely within the Piedmont and Valley Ridge province, which consists of a series of rolling hills and occasional isolated mountains. The Coosawattee River Basin includes portions of the Great Valley and Blue Ridge Mountains physiographic districts (District, 2002).

Hydrology and Soils

The Coosawattee River is one of three 8-digit HUCs within the Coosa River Basin, with the others being the Etowah River and the Oostanaula River. The Coosawattee River begins at the confluence of the Cartecay and Ellijay Rivers. Draining the northern portions of Bartow and Cherokee Counties via tributaries, the Coosawattee River flows westward to its confluence with the Oostanaula River. There are two reservoirs that drain to the Coosawattee River north of the District: Carters Lake and Talking Rock Reservoir. Carters Lake is a multipurpose water resource project constructed and operated by the United States Army Corps of Engineers, while Talking Rock Reservoir (also known as the Carters Lake Reregulation Reservoir) is located just downstream of Carters Lake Dam at the confluence of the Coosawattee River and Talking Rock Creek.

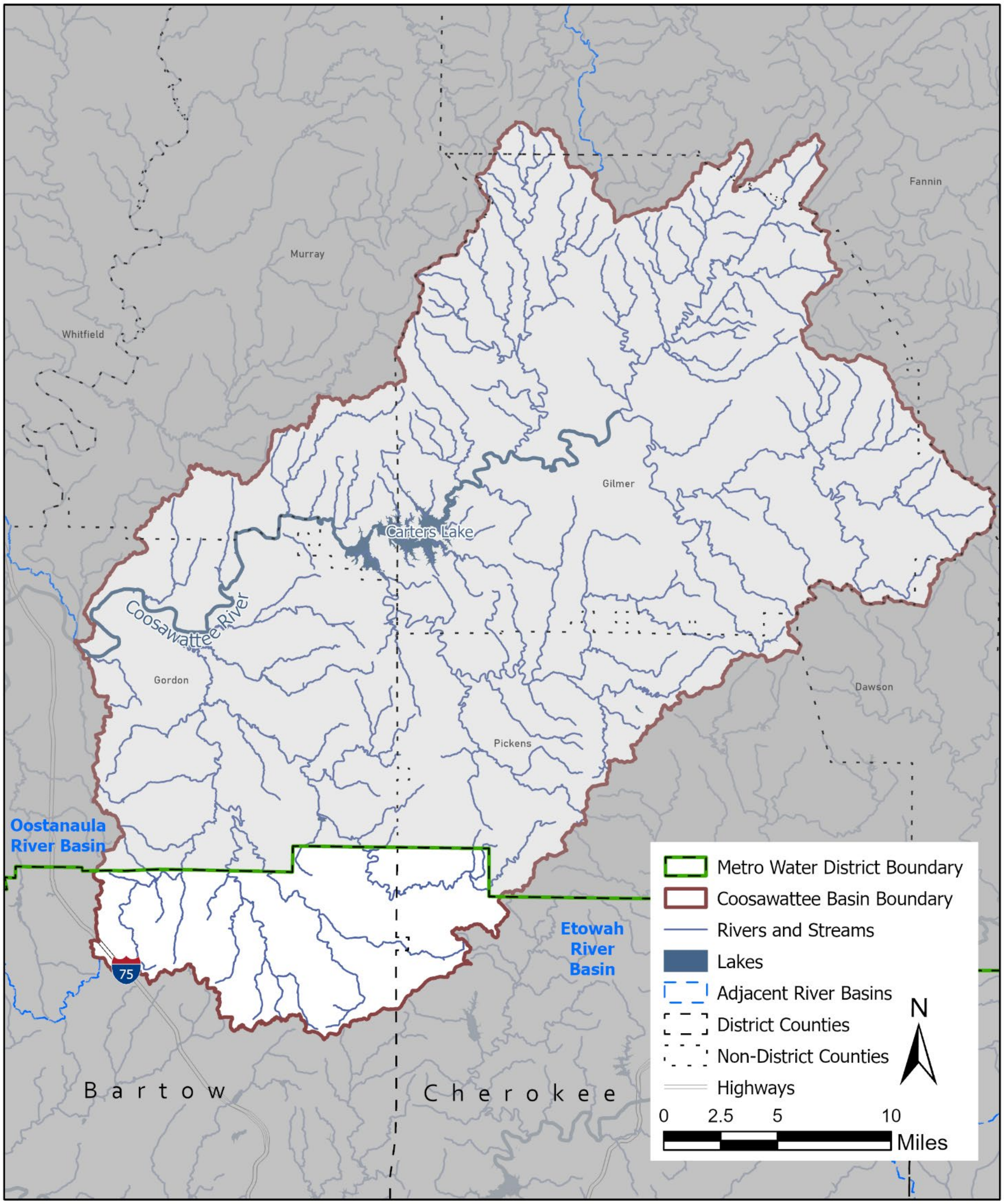

Figure CO-1. Coosawattee Basin Within the District

The District lies almost completely within the Piedmont and the Blue Ridge (Ridge and Valley) geologic provinces. The aquifers in these provinces overlie crystalline rocks that crop out in the northern portion of the basin and extend to the fall line. The rock is overlain with deposits of weathered, unconsolidated rock debris (regolith) that make up the available aquifer spaces. These deposits are thickest in valleys, but generally provide insufficient yield for uses other than very low density residential and thus surface water is the primary source of potable water for the District. The Georgia Geologic Survey Hydrologic Atlas 18 database identifies approximately 28 areas, representing about four percent of the District, that are likely to contain unconfined aquifers, and 79 areas, representing about 12 percent of the District, that are likely to contain thick soils considered to be an indicator of significant groundwater recharge areas. The recharge areas were mapped based on outcrop area, lithology, soil type and thickness, slope, density of lithologic contacts, geologic structure, the presence of karst, and potentiometric surfaces. An assessment of the availability of groundwater resources in select prioritized aquifers of Georgia was completed as part of Georgia's Comprehensive State-wide Water Management Plan (Georgia Environmental Protection Division [EPD], 2010). None of the Coosawattee River Basin within the District was selected as a priority aquifer for assessment. Table CO-1 summarizes the limited groundwater recharge areas, only 5 square miles or five percent of the Coosawattee River Basin within the District, as identified by the Georgia Geologic Survey Hydrologic Atlas 18 database.

Table CO-1. Groundwater Recharge Areas within the Coosawattee River Basin

Recharge Area Type	County	Square Miles of Recharge Area Type within County
Unconfined Aquifer	Bartow	5
Total Recharge Areas		5

There are five soil associations that describe the soil types in the Coosawattee River Basin: Fullerton-Shack-Chewacla, Montevallo-Townley-Tidings, Shack-Fullerton-Bodine, Talladega-Tallapoosa-Wickham, and Townley-Fullerton-Montevallo (Table CO-2). The Shack-Fullerton-Bodine, Talladega-Tallapoosa-Wickham and the Fullerton-Shack-Chewacla associations were the most abundant, with the former types associated with moderate rolling hills and the latter with side slopes and valleys. These soils are well-drained and moderately permeable (Brock, 1977; Jordan et al., 1973; Murphy, 1979; Thomas and Tate, 1973; USDA, 1976; Thomas, 1982; Wells, 1961; Robertson et al., 1960; USDA, 1958; Tate, 1967; Thomas and Tate, 1964).

Table CO-2. Major Soil Associations within the Coosawattee River Basin

Soil Association	Significance to Watershed Management
Fullerton-Shack-Chewacla	**Characteristics**: Associated with very deep, moderately to poorly drained, moderately permeable soils located on side slopes and valleys. Significance to Watershed Management: Poorly drained soils are less feasible for infiltration, restricted water drainage. Deep soils have the capacity to store more water for potential groundwater recharge.
Montevallo-Townley-Tidings	**Characteristics**: Consists of shallow to deep, well-drained, slowly to moderately permeable soils formed in materials weathered from sandstone containing strata of siltstone and shale. Slopes range from 2 to 70%. **Significance to Watershed Management**: Steep terrain may be more susceptible to increased erosion due to stormwater runoff velocities from impervious surfaces; well-drained soils may improve feasibility for infiltration practices.

Table CO-2. Major Soil Associations within the Coosawattee River Basin

Soil Association	Significance to Watershed Management
Shack-Fullerton-Bodine	**Characteristics**: Associated with very deep, moderately to excessively well-drained, moderately permeable soils located mainly on uplands. **Significance to Watershed Management**: Well-drained soils may be more permeable, which increases infiltration capacity in areas without impervious cover.
Talladega-Tallapoosa-Wickham	**Characteristics**: Shallow to very deep, well-drained, moderately permeable soils with medium to rapid runoff. Soils are formed from in residual materials from metamorphic rocks and mica schist; located from stream terraces to narrow ridges and side slopes. Slope ranges from 0 to 80%. **Significance to Watershed Management**: Well-drained soils may improve feasibility for infiltration practices; steep slopes may be more susceptible to increased erosion due to stormwater runoff velocities from impervious surfaces. Deep soils have the capacity to store more water for potential groundwater recharge.
Townley-Fullerton-Montevallo	**Characteristics**: Moderately deep, well-drained, slowly permeable soils on upland ridgetops and side slopes. They are formed in clayey residuum weathered from shale or interbedded sandstone and shale. Slope ranges from 2 to 45%. **Significance to Watershed Management**: Well-drained soils may improve feasibility for infiltration practices. Sloping surfaces may be more susceptible to increased erosion due to stormwater runoff velocities from impervious surfaces.

Protected Species

Protected species include all species listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service, and those listed as endangered, threatened, rare, or unusual by the State of Georgia. The USFWS also may designate critical habitat for a federally listed species, which provides protection for the habitat as well as the species itself. The current listings of these endangered species, including their status, range, and habitat, can be accessed via the USFWS's automated Information, Planning and Conservation System (IPaC, http://ecos.fws.gov/ipac/).

Native Species

The District is home to a number of species that are considered threatened or endangered. Protecting watershed health is more than protecting water quality; it also includes protection of biological resources. Within the District, there are a number of protected animal species that spend all or part of their life cycle in rivers and streams or depend on streams for a significant portion of their life history. In addition, there are protected plants that are either aquatic or semi-aquatic and grow within or along the margins of rivers and streams. Table CO-3 lists the 17 protected species potentially found within the counties of the Coosawattee River Basin of the District.

Trout Streams

Trout streams are classified in accordance with the primary and secondary designations and criteria defined in Section 15 of Georgia's Water Use Classifications and Water Quality Standards (391-3-6-.03). Streams designated as Primary Trout Streams are waters supporting a self-sustaining population of rainbow, brown or brook trout. Streams designated as Secondary Trout Streams are those with no evidence of natural trout reproduction but are capable of supporting trout throughout the year. All of the waters in the Coosawattee River Basin are classified as year-round trout streams including Pine Log and Salacoa Creeks.

Table CO-3. Aquatic and Semi-aquatic Protected Species in the Coosawattee River Basin

Fauna Type	Common Name	Status*	Bartow	Cherokee
Bird	Bald eagle	T	X	X
Fish	Amber darter	<u>E</u>		X
	Blue shiner	E	X	
	Cherokee darter	<u>T</u>	X	X
	Coldwater darter	E	X	
	Coosa chub	E		X
	Etowah darter	<u>E</u>	X	X
	Frecklebelly madtom	<u>E</u>		X
	Freckled darter	E		X
	Lined chub	R	X	X
	Rock darter	R	X	X
Invertebrate	Alabama spike	E		X
	Etowah crayfish	T	X	X
	Finelined pocketbook	<u>T</u>		X
Mammal	Gray bat	<u>E</u>	X	X
	Northern long-eared bat	<u>T</u>	X	X
Reptile	Northern map turtle	R	X	

* Status that is not underlined is listed in Georgia. <u>Underlined status</u> is federally listed.

R = Rare
E = Endangered
T = Threatened

Land Use and Surface Water Quality

Drinking Water Supply

The Coosawattee River Basin serves as a drinking water supply source to downstream (to the north) communities, but it does not supply residents of the District (Figure CO-2).

Table CO-4. Coosawattee River Basin Drinking Water Supply Sources

Water Supply Source	Owner/Operator Utilizing Source
There are no District drinking water sources in the Coosawattee Basin	N/A

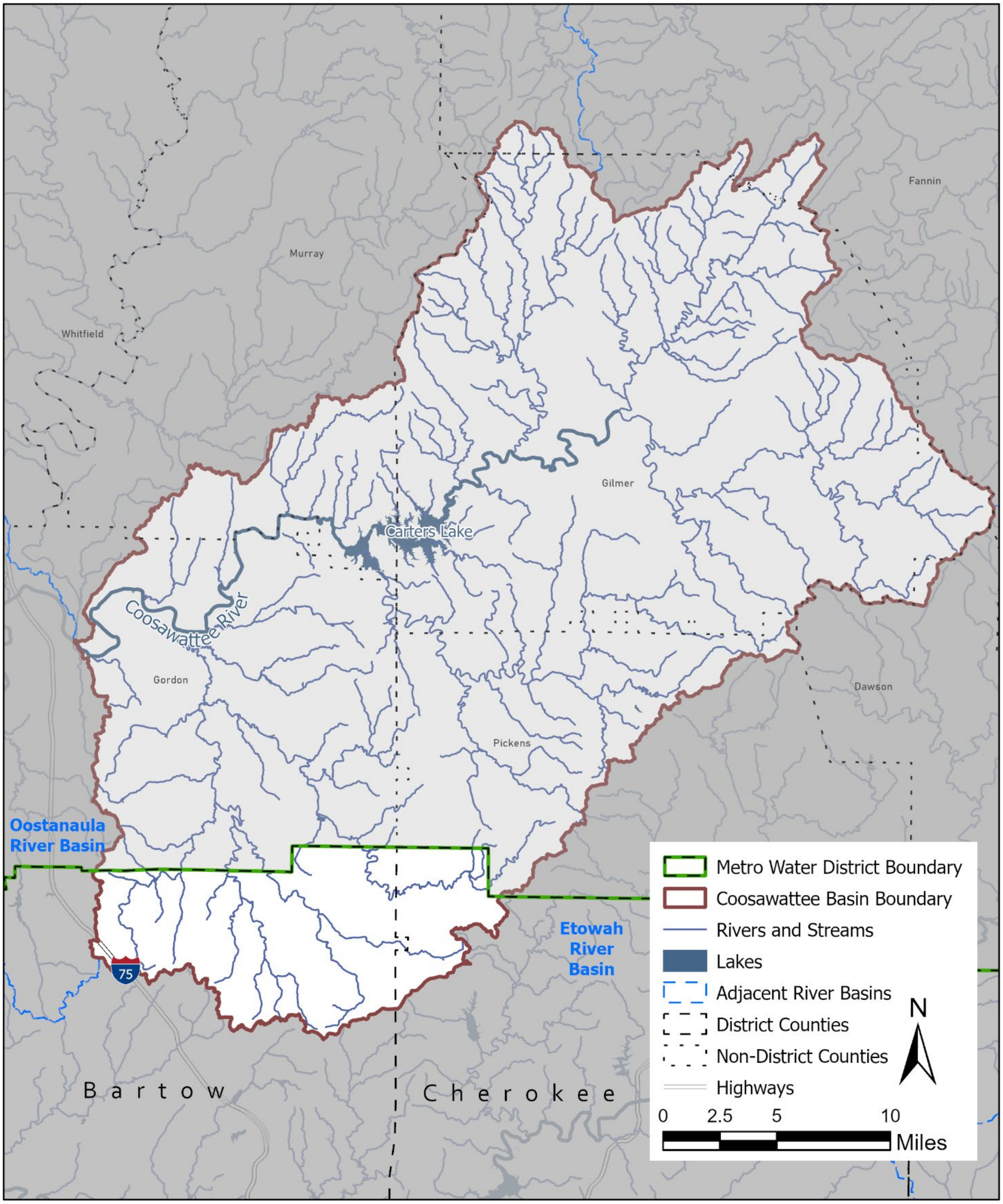

Figure CO-2. Coosawattee Basin Drinking Water

Note: There are no Metro Water District drinking water sources in the Coosawattee Basin

Land Cover/Land Use

The Coosawattee River Basin within the District includes the northern edges of Bartow and Cherokee Counties. With the exception of a small portion of Interstate 75 near the City of Adairsville, this basin remained primarily undeveloped, 93 percent, in 2019. Overall, seven percent of the Coosawattee River Basin within the Metro Water District is developed, 65 percent is forested, and 28 percent of the area falls within the remaining land cover classes (Table CO-5 and Figure CO-3).

Table CO-5. Coosawattee River Basin Land Cover / Land Use within the District

Land Cover/Land Use	Area (Square Miles)	2019 Existing (%)
Barren Land (Rock/Sand/Clay)	0.08	0.08
Cultivated Crops	0.40	0.39
Deciduous Forest	34.26	33.07
Developed High Intensity	0.08	0.08
Developed, Low Intensity	1.32	1.28
Developed, Medium Intensity	0.33	0.32
Developed, Open Space	5.03	4.85
Emergent Herbaceous Wetlands	0.03	0.03
Evergreen Forest	19.35	18.67
Grassland/Herbaceous	4.06	3.92
Mixed Forest	13.73	13.25
Open Water	0.22	0.21
Pasture/Hay	19.10	18.44
Shrub/Scrub	5.35	5.16
Woody Wetlands	0.27	0.26
Undeveloped	***96.85***	***93.48***
Developed	***6.76***	***6.52***
Total	**103.61**	**100**

Notes:

Developed = High Intensity, Low Intensity, Medium Intensity and Open Space.
Undeveloped = land cover classes not described as Developed.

Data Source:

Aggregated Land Cover categories from U.S. Geological Survey (USGS) National Land Cover Database (NLCD), 2019.

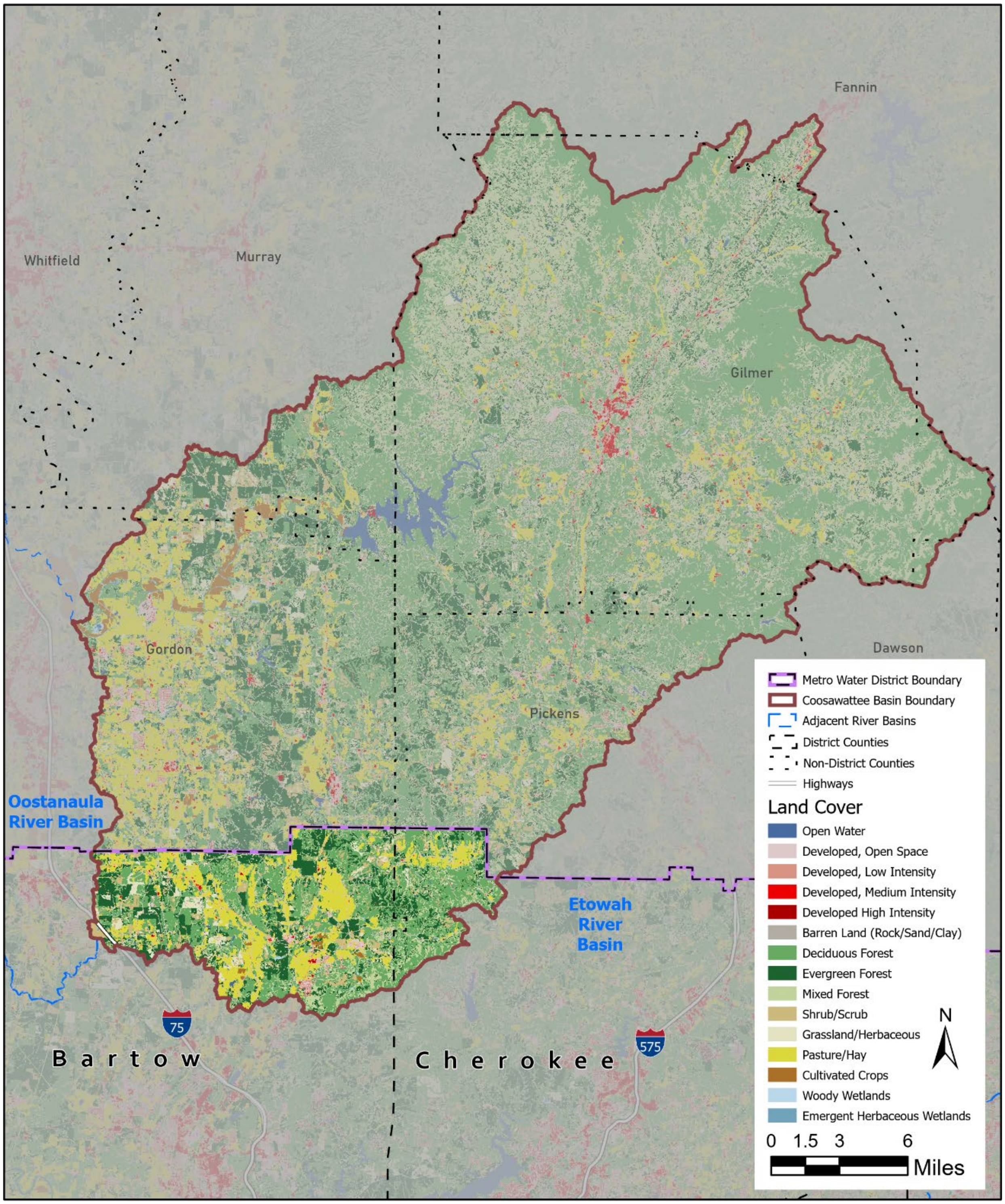

Figure CO-3. Coosawattee Land Cover
Source: 2019 NLCD

Effective Impervious Areas

The level of watershed imperviousness has long been linked to impacts on changes in hydrologic regimes that lead to increased intensity and frequency of peak stormwater flows, which affect stream stability, water quality, and aquatic habitat and biotic community integrity. In general, the most sensitive aquatic organisms are affected at impervious levels greater than 10 percent. Between 11 and 25 percent of most stream communities become impacted, and over 25 percent of streams are generally no longer able to support viable biotic communities (Schueler, 2001).

Impervious surfaces (such as roofs, streets, parking lots) have a significantly different hydrologic response from pervious surfaces (lawns, forests); therefore, it is important to clearly define terms and assumptions related to the calculation of pervious and impervious areas for the purposes of watershed management. "Total impervious area" quantifies all of the land surfaces impervious to rainfall for the particular land cover category while "effective impervious area" (EIA) refers to the directly connected impervious area used for water quality and stormwater conveyance modeling. For the 2003 District-wide Plan, EIA values were initially defined based on previous studies, including the local watershed assessments, and then further refined based on calibration using available water quality data. For the 2022 District-wide Plan, the EIA of the HUC-12 subwatersheds within the District was calculated using a mathematical model developed by Sutherland for U.S. Environmental Protection Agency (EPA) based on land cover data from the 2019 USGS National Land Cover Database.

Of the six HUC-12s within the District portion of Coosawattee River Basin, none had an EIA of greater than 10 percent. The lack of significant regional transportation corridors contributes to low EIA (Figure CO-4).

Wastewater Management

Permitted Wastewater Facility Service Areas

There are no permitted wastewater treatment facilities in the Coosawattee River Basin.

Combined-sewer Overflow Areas

There are no combined-sewer overflow areas in the Coosawattee River Basin.

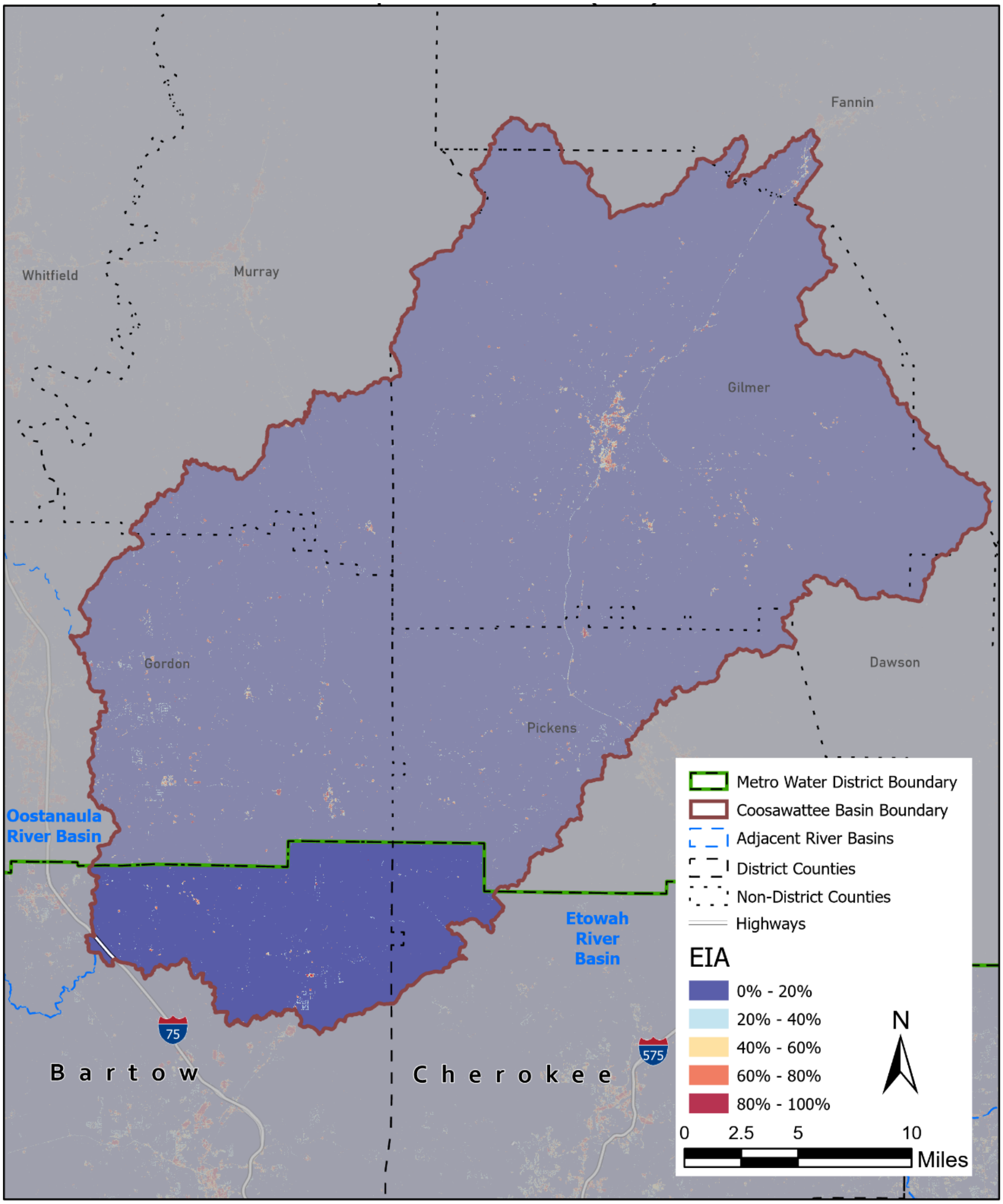

Figure CO-4. Coosawattee Effective Impervious Area

Impaired Water Bodies

The Georgia EPD establishes water quality standards for the state's surface waters. Section 303(d) of the federal Clean Water Act requires that all states list water bodies that do not meet water quality standards. The Georgia EPD publishes a biennial list of streams that do not meet State water quality standards, referred to as the 303(d)/305(b) list. If a water body does not support its designated use (drinking, recreation, fishing, wild/scenic rivers, or coastal fishing) because conditions violate water quality standards, it is considered an "impaired" stream or water body.

The Georgia EPD determines whether a water body is supporting its designated uses by collecting water quality data and comparing this data against State water quality criteria. Georgia EPD describes their listing methodology and "preferred minimum dataset" at http://epd.georgia.gov/georgia-305b303d-list-documents. This methodology is important to understand the sample size, extent, and timeframe of the dataset that was used to list a water body. Feedback can be given to Georgia EPD if additional data or information are known that may affect future sampling or listing evaluations.

The District portion of the Coosawattee River Basin contains 228 stream miles, 29 of which were assessed for impairments. One stream mile, less than one percent of total streams or three percent of assessed streams, did not meet State water quality standards based on the 2020 303(d) list. The streams listed as "not supporting" are summarized in Table CO-6 by parameter and graphically shown in Figure CO-5.

Table CO-6. Coosawattee River Basin Summary of Impaired Streams

Criterion Violated	Miles of Stream	% of 2020 Assessed Streams	% of Total Stream Mileage
Fecal coliform bacteria	< 1	2	< 1
Biota (macroinvertebrate community)	< 1	1	< 1
Total impaired stream mileage*	1	11	< 1
Total mileage assessed for possible impairment	29		
Total stream mileage in the basin	228		

* Several streams are listed for violations of multiple parameters within the same stream segment; therefore, the total of impaired miles by parameter will not equal the total stream mileage of impaired streams.

Biota listings typically indicate high sediment loads in streams, which decreases habitat quality for benthic macroinvertebrates and fish. Sediment sources include runoff from construction sites as well as from streambank erosion due to accelerated streamflow velocities from impervious cover associated with urbanization.

Streams in the Coosawattee River Basin that do not meet water quality standards for fecal coliform bacteria as a result of nonpoint source pollution account for less than one percent or two percent of total and assessed streams, respectively. Fecal coliform is used for water quality purposes as a Fecal Indicator Bacteria (FIB). FIBs are used to provide an approximation of the potential risk a water body poses to human health.

These bacteria enter the stream from both human and non-human sources, including sanitary sewer overflows, leaking sewer lines, failing septic systems, and pet/wildlife waste. Fecal coliform typically is found in both developed and undeveloped watersheds, and monitoring programs in Georgia have found levels that exceed State standards in urban, agricultural, and forested areas (Georgia EPD, 2011). While fecal coliform is ubiquitous in streams across the country (Georgia EPD, 2011), concentrations of bacteria can increase as a result of the higher density of potential pollutant sources and decreased stormwater filtration and stormwater treatment from population growth and development. Biota listings typically indicate high sediment loads in streams, which decrease habitat quality for benthic macroinvertebrates and fish. Sediment sources include runoff from construction sites as well as from streambank erosion caused by accelerated streamflow velocities from impervious cover associated with urbanization.

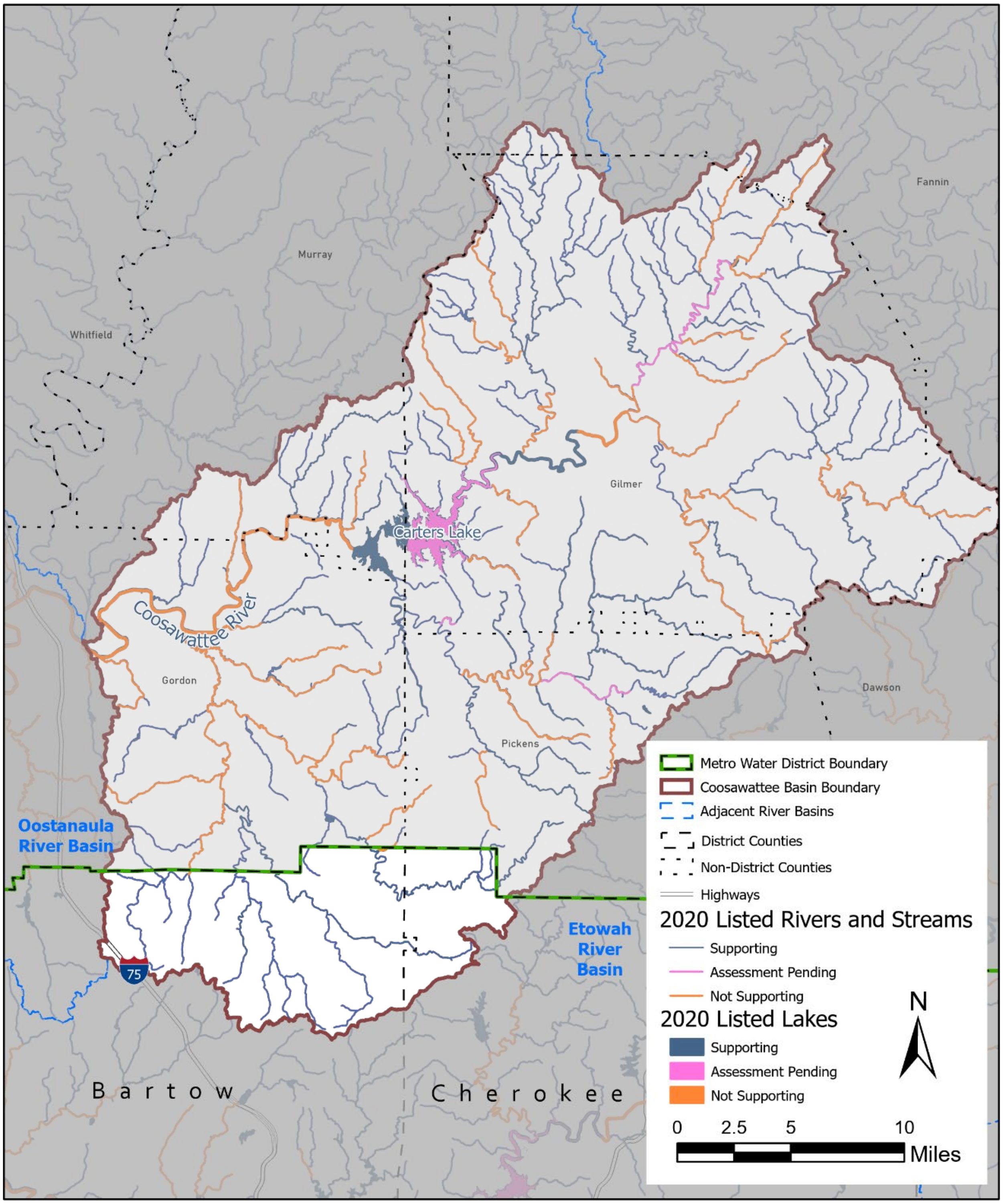

Figure CO-5. Coosawattee Basin 305(b)/303(d) Listed Waters

Management Issues and Recommendations

Basin-level Summary

Land development affects the physical, chemical, and biological conditions of the District's watersheds, waterways, and water resources. Based on the Stormwater Forecast analysis, development patterns in the District over the past century have resulted in substantial changes to watershed characteristics. Developed area is projected to increase from 4,229 acres in the current (2019) condition to 6,803 acres in 2040, a 61 percent increase. If current land use policy and recent development patterns continue, future estimates of land use are expected to intensify, with the weighted average curve number (CN) value potentially reaching approximately 86 and total imperviousness potentially reaching nearly 37 percent by 2040, based on the future developed area.

Precipitation rates are also expected to increase based on the future precipitation study results for the District. By 2040, the basin-wide weighted average 85th percentile annual rainfall; 1-year, 24-hour rainfall; and 25-year, 24-hour rainfall events are estimated to potentially increase by 14 percent, 11 percent, and 16 percent, respectively. These changes to watershed characteristics and rainfall intensity will have a direct impact on the total potential runoff management volume generated from development that may require additional management from structural control measures.

Runoff for the three post-construction volumes (Water Quality Volume [WQv], Channel Protection Volume [CPv] and Overbank Flood Protection Volume [OFPv]) were calculated for 190 individual subcatchments in the basin. In 2019, a total of 3.33 million cubic feet of runoff was estimated in the basin for WQv, 6.06 million cubic feet for CPv, and 71.71 million cubic feet for OFPv, based on 4,229 acres of development. Additional information is provided in the following summary table (Table CO-7) and figure of the 2019 WQv for the basin (Figure CO-6).

Table CO-7. Coosawattee River Basin Watershed Characteristics and Total Potential Runoff Management Volumes

	Predevelopment	2019	2030	2040
Subcatchments (count)	190	190	190	190
Total area (acres)	66.279	66.279	66.279	66.279
Developed area (acres)	4,229	4,229	5,398	6,803
Total imperviousness (percent)	1.0	14.6	27.0	36.9
CN	67	84	85	86
Slope (percent)	8.9	8.9	8.9	8.9
85th percentile annual rainfall (inches)	1.20	1.20	1.32	1.37
1-year, 24-hour rainfall (inches)	3.34	3.34	3.58	3.70
25-year, 24-hour rainfall (inches)	6.06	6.06	6.69	7.01
WQv (cubic feet)	1.09 M	3.33 M	7.57 M	12.94 M
CPv (cubic feet)	7.46 M	17.42 M	25.95 M	35.27 M
OFPv (cubic feet)	-	71.71 M	126.72 M	183.48 M

Notes:

M = million

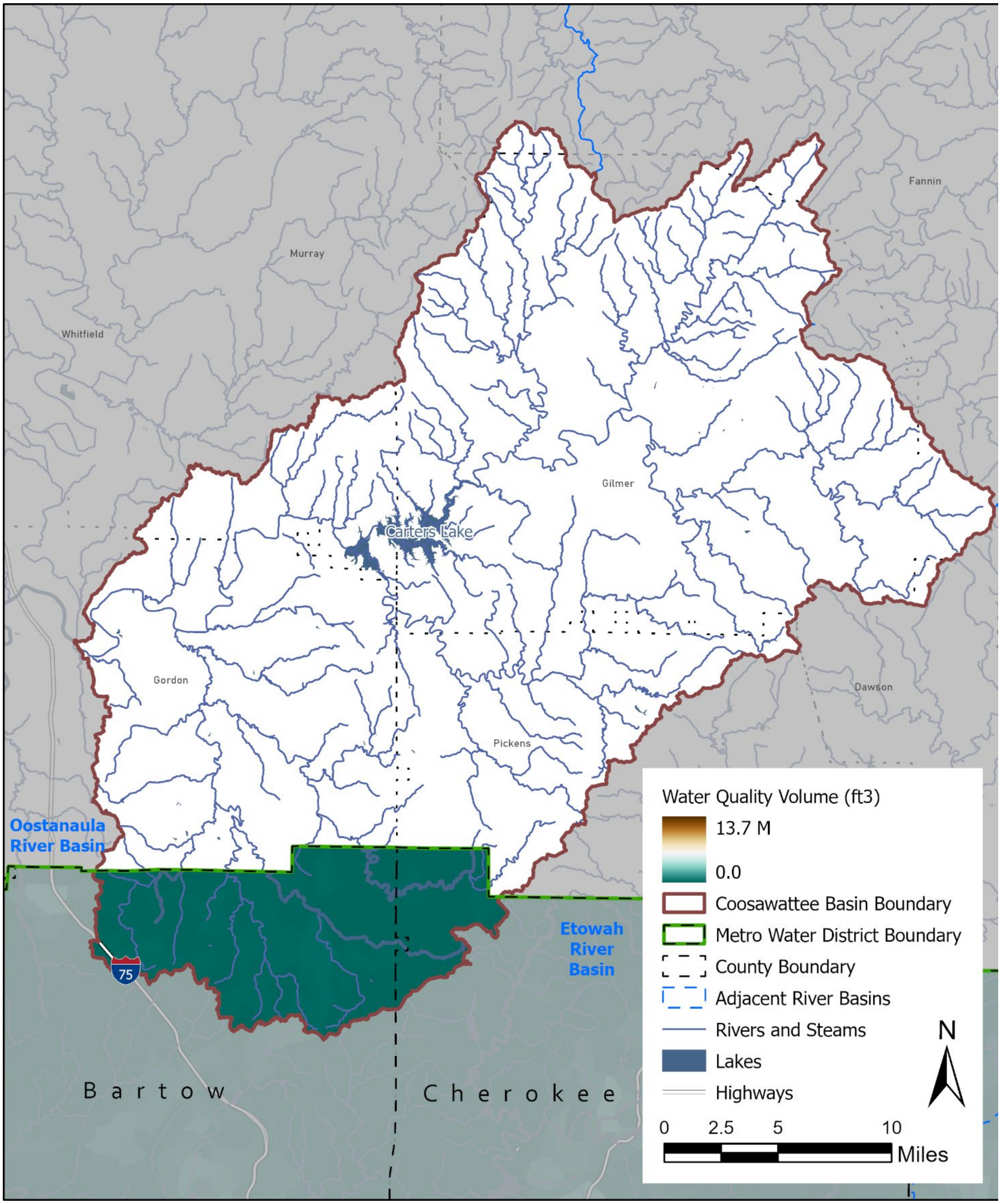

Figure CO-6. Estimated Water Quality Runoff Volume per Subcatchment – 2019

Management Issues and Recommended Strategies

Table CO-8 outlines management issues and strategies for the Coosawattee River Basin within the District. These issues and strategies were used to inform and guide the more specific management measures and requirements found in Sections 5, 6, and 7. The recommended strategies presented in Table CO-8 are based on data presented within this River Basin Profile. These strategies are provided to further describe the commonality of causes and potential solutions to the watershed issues. They provide a foundation for guidance but are not presented here as mandatory requirements.

Table CO-8. Coosawattee River Basin Management Issues and Recommended Strategies

Management Issue	Description	Recommended Strategies
Increases in impervious cover (new development)	Increases in impervious cover can lead to a change in the hydrologic regime of a watershed by causing more intense, high-velocity stormwater flows and increased erosion and sedimentation.	• Manage nonpoint source pollution. • Adopt and enforce the post-construction stormwater control ordinance and use of Georgia Stormwater Management Manual design standards.
Inadequate stormwater controls on existing impervious cover	Much of the development in the basin occurred prior to current Georgia Stormwater Management Manual design standards. Limited resources and cost of maintaining and repairing stormwater infrastructure. Varying local strategies of funding stormwater management.	• Implement an asset management program to identify and prioritize maintenance and capital improvement projects to maximize benefit. • Consider updating stormwater controls during redevelopment. • Identify opportunities for watershed improvement projects to retrofit or install updated stormwater controls, green infrastructure, stormwater treatment, or other controls. • Consider dedicated funding sources such as stormwater utilities and seek out opportunities for grants, loans, and partnerships.
Aquatic resources	All of the streams in this river basin are designated as year-round trout streams.	• Balance nonpoint source temperature inputs from tributaries and branches to meet trout stream temperature criteria.
Biota total maximum daily loads (TMDLs)	< 1 of assessed instream benthic macroinvertebrate communities were found to be impaired.	• Enforce post-construction stormwater ordinance on new development and seek opportunities to retrofit stormwater controls to maximize water quality and channel protection. • Recommend watershed improvement projects, such as stream restoration and streambank stabilization, in areas with failing streambanks to reduce instream sediment load contributions.
Lake management	While there are no large reservoirs within the District in this basin, there are other public and privately held and managed lakes that play a significant role in meeting designated uses and downstream hydrologic regimes and water quality.	• Develop a central inventory of lakes, ownership and management practices to facilitate pollutant source identification both up and downstream of the lake. • Coordinate available water quality data and management activities for inventoried lakes. • Implement shoreline protection and upstream sediment management to prevent excessive nutrients and sedimentation within the lake. • Facilitate proper maintenance and management, particularly of small lakes, by providing resources, links, or other materials to assist with periodic activities such as inspections, water quality sampling, or dredging. • Conduct public education and involvement activities to promote watershed stewardship to protect lake quality.

Identify Indicators and Monitoring to Measure Implementation Success

A critical component of any watershed management program is the ability to assess progress and determine if management strategies are effectively addressing issues. As discussed in Section 5, the Plan includes implementation actions related to watershed monitoring and conducting conditions assessments to evaluate implementation success. These implementation actions include long-term ambient trend monitoring (WATERSHED-10), as well as resource-specific implementation actions Watershed Improvement (WATERSHED-8). Communities may choose to conduct project-specific monitoring associated with a watershed improvement project, such as biological or geomorphological monitoring to evaluate success.

As included in EPA (2008), a monitoring program should "…track progress in meeting load reduction goals and attaining water quality standards and other goals. Measurable progress is critical to ensuring continued support of watershed projects, and progress is best demonstrated with the use of monitoring data that accurately reflect water quality conditions relevant to the identified problems. Monitoring programs should include baseline (before), project-specific (during), and post-project (after) monitoring."

Some potential indicators to measure implementation success for the Coosawattee River Basin are listed as follows, but this list is not exhaustive:

- Select representative monitoring stations within the watershed to monitor for pollutants of concern and other water quality or biological parameters.
- Use USGS stream gage data or collect data to establish stream stage-discharge relationships and calculate or model water quality pollutant loads and potential reductions.
- Calculate or model improvements to hydrologic and hydraulic conditions based on structural project implementation.
- Estimate streambank stability and habitat improvement based on annual stream cross-section surveys and bank erosion monitoring.
- Conduct stream walks or structure inspections to inventory structure condition and performance, streambank stability, and riparian condition over time.
- Conduct project monitoring to establish pre-, during-, and post-project conditions, as well as upstream/downstream monitoring during the same time period to reduce the effects of environmental variability.
- To determine if water quality degradation is being prevented, conduct geographical information system (GIS) analysis to identify high-activity areas of a watershed using aerial overlays, work orders, facility inspection, erosion and sedimentation control, or new construction inspection data. Identify if monitoring data and GIS data follow similar patterns.
- Track number, location, size, or features (such as drainage area treated or linear feet of restored stream) of watershed improvement, green infrastructure, or other nonpoint source reduction projects.
- Compare percentage of TMDL stream segments over time.
- Track implementation actions by jurisdiction within the basin, and their measured effectiveness.
- Track enforcement actions by category and location.
- Track stream buffer variances and local permits issued.
- Conduct public surveys for pollution prevention awareness or education effectiveness, particularly pre- and post-data associated with an education event.
- Compare existing water quality modeled loads against future water quality modeled loads.

ATTACHMENT 7

Oostanaula River Basin Profile

The Oostanaula River Basin is located in the northwest corner of Bartow County and the District, representing only one percent of the total District area and six percent of the overall Oostanaula River Hydrologic Unit Code (HUC)-8 Basin. The City of Adairsville and a segment of Interstate 75 are located within this 35-square-mile drainage area that flows to the north. Lewis Springs, a drinking water source for the City of Adairsville, is the only water supply source within the Oostanaula River Basin.

Physical and Natural Features

Geography

The Oostanaula River Basin has its headwater in the Blue Ridge Mountains north of the District (Figure OO-1). The Oostanaula River Basin is entirely within the Valley Ridge and Piedmont province, which consists of a series of rolling hills and occasional isolated mountains that are within the Great Valley physiographic districts (District, 2002). In the Great Valley district, which includes much of Bartow County, the topography is generally broad and open with scattered ridges and hills. Elevations throughout the area range from 700 to 800 feet mean sea level. On land north of the Etowah River, the intervening streams drain relatively narrow valleys that extend southwestward. To the south of the Etowah River, the topography consists of a heterogeneous mix of upland mountains characterized by steep terrain in the north (Cherokee County) and rolling topography farther south (Paulding County) (Clark and Zisa, 1976). The floor of the valley is underlain by shales, dolomites, and limestones of the Cambrian and Ordovician ages. The eastern boundary of the Great Valley follows the escarpment of the Great Smoky-Cartersville Fault (Clark and Zisa, 1976).

Hydrology and Soils

The Oostanaula River is one of three 8-digit HUCs within the Coosa River Basin, with the others being the Etowah River and the Coosawattee River. The Oostanaula River Basin within the District includes portions of two 10-digit HUCs and three 12-digit HUCs. The Oostanaula River begins at the confluence of the Coosawattee River and the Conasauga River northeast of Calhoun, Georgia in Gordon County. It then flows southwest toward the confluence with the Etowah River in Rome, Georgia in Floyd County. The river basin within the District includes a portion of Oothkalooga Creek, a tributary to the Oostanaula, which is designated for fishing. None of the waterways in this portion of Bartow County are designated as primary or secondary trout streams.

An assessment of the availability of groundwater resources in select prioritized aquifers of Georgia was completed as part of Georgia's Comprehensive State-wide Water Management Plan (Georgia Environmental Protection Division [EPD], 2010). None of the Oostanaula River Basin within the District was selected as a priority aquifer for assessment. The Georgia Geologic Survey Hydrologic Atlas 18 database identifies approximately 28 areas, representing about four percent of the District, that are likely to contain unconfined aquifers, and 79 areas, representing about 12 percent of the District, that are likely to contain thick soils considered to be an indicator of significant groundwater recharge areas. There are approximately 6 square miles of potential recharge areas within Bartow County in the District (Table OO-1). Only a limited portion of this recharge area is within the Oostanaula River Basin.

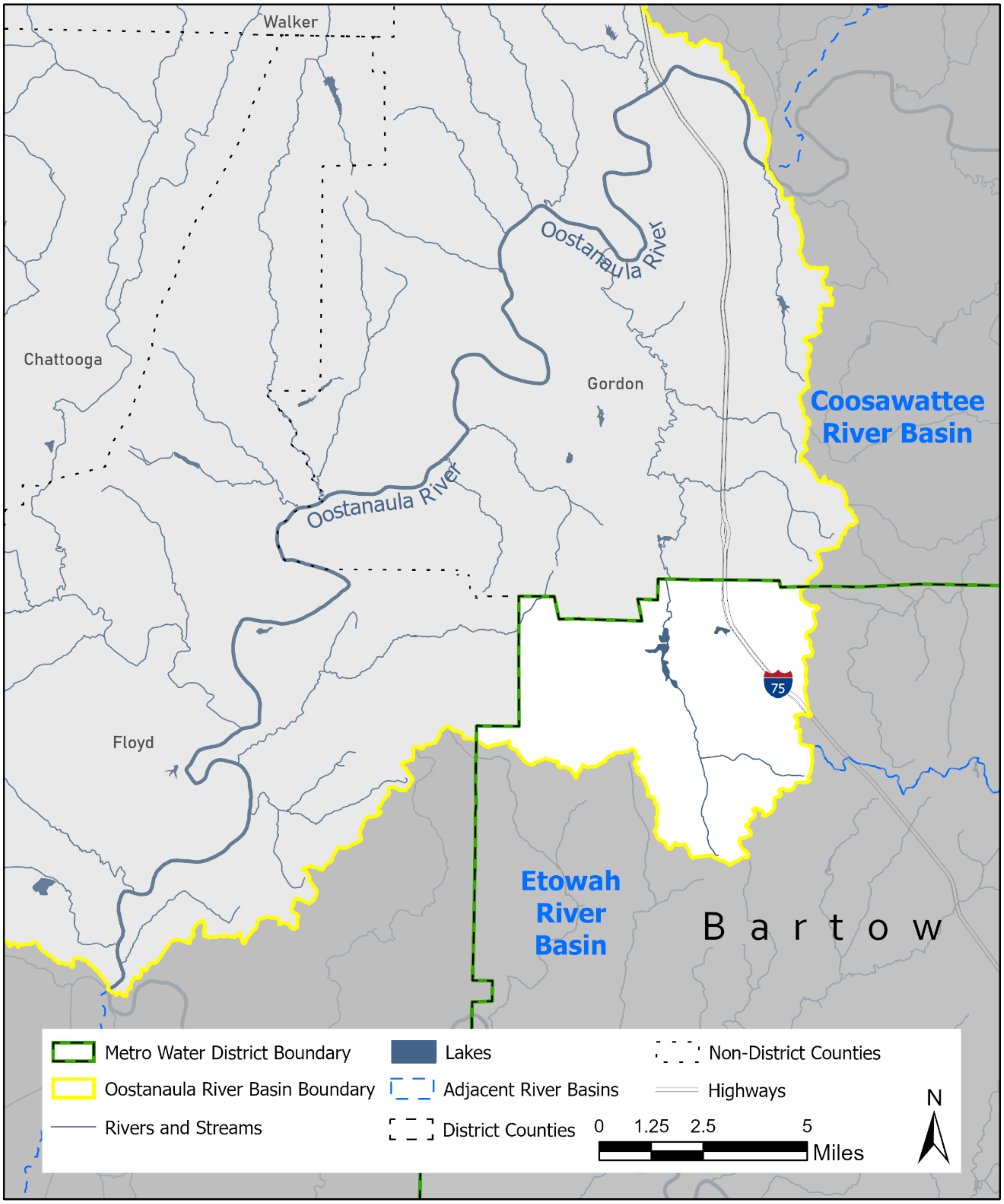

Figure OO-1. Oostanaula Basin Within the District

Table OO-1. Groundwater Recharge Areas within the Oostanaula River Basin

Recharge Area Type	County	Square Miles of Recharge Area Type within County
Unconfined Aquifer	Bartow	6
Total Recharge Areas		6

There are three soil associations that describe the soil types in the Oostanaula River Basin: Shack-Fullerton-Bodine, Townley-Fullerton-Montevallo, and Fullerton-Shack-Chewacla. These soil types-are dominant in north Bartow County (Table OO-2). The Shack-Fullerton-Bodine and Townley-Fullerton-Montevallo associations were the most abundant, associated with side slopes and upland ridges. These soils are moderate to well-drained and highly weathered, (Brock, 1977; Jordan et al., 1973; Murphy, 1979; Thomas and Tate, 1973; USDA, 1976; Thomas, 1982; Wells, 1961; Robertson et al., 1960; USDA, 1958; Tate, 1967; Thomas and Tate, 1964).

Table OO-2. Major Soil Associations within the Oostanaula River Basin

Soil Association	Significance to Watershed Management
Fullerton-Shack-Chewacla	**Characteristics:** Associated with very deep, moderately to poorly drained, moderately permeable soils located on side slopes and valleys. **Significance to Watershed Management:** Poorly drained soils may be less permeable, which increases runoff rates and decreases infiltration capacity in areas without impervious cover. Deep soils have the capacity to store more water for potential groundwater recharge.
Shack-Fullerton-Bodine	**Characteristics:** Associated with very deep, moderately to excessively well-drained, moderately permeable soils located mainly on uplands. **Significance to Watershed Management:** Well-drained soils may be more permeable, which increases infiltration capacity in areas without impervious cover, also may improve feasibility for infiltration practices. Deep soils have the capacity to store more water for potential groundwater recharge.
Townley-Fullerton-Montevallo	**Characteristics:** Moderately deep, well-drained, slowly permeable soils on upland ridgetops and side slopes. They formed in clayey residuum weathered from shale or interbedded sandstone and shale. Slope ranges from two percent to 45 percent. **Significance to Watershed Management:** Well-drained soils may increase infiltration capacity in areas without impervious cover, also may improve feasibility for infiltration practices. Deep soils have the capacity to store more water for potential groundwater recharge.

Protected Species

Protected species include all species listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service, and those listed as endangered, threatened, rare, or unusual by the State of Georgia. The USFWS also may designate critical habitat for a federally listed species, which provides protection for the habitat as well as the species itself. The current listings of these endangered species, including their status, range, and habitat, can be accessed via the USFWS's automated Information, Planning and Conservation System (IPaC, http://ecos.fws.gov/ipac/).

The District is home to a number of species that are considered threatened or endangered. Protecting watershed health is more than protecting water quality; it also includes protection of biological resources. Within the District, there are a number of protected animal species that spend all or part of their life cycle in rivers and streams or depend on streams for a significant portion of their life history. In addition, there are protected plants that are either aquatic or semi-aquatic and grow within or along the margins of rivers and streams. Table OO-3 lists the 11 protected species potentially found within Bartow County.

Table OO-3. Aquatic and Semi-Aquatic Protected Species in the District

Fauna Type	Common Name	Status*	Bartow
Bird	Bald eagle	T	X
Fish	Blue shiner	<u>E</u>	X
	Cherokee darter	<u>T</u>	X
	Coldwater darter	E	X
	Etowah darter	<u>E</u>	X
	Lined chub	R	X
	Rock darter	R	X
Invertebrate	Etowah crayfish	T	X
Mammal	Gray bat	<u>E</u>	X
	Northern long-eared bat	<u>T</u>	X
Reptile	Northern map turtle	R	X

* Status that is not underlined is listed in Georgia. <u>Underlined status</u> is federally listed.

R = Rare
E = Endangered
T = Threatened

Trout Streams

Trout streams are classified in accordance with the primary and secondary designations and criteria defined in Section 15 of Georgia's Water Use Classifications and Water Quality Standards (391-3-6-.03). Streams designated as primary trout streams are waters supporting a self-sustaining population of rainbow, brown or brook trout. Streams designated as secondary trout streams are those with no evidence of natural trout reproduction but are capable of supporting trout throughout the year. While there are multiple segments in adjacent watersheds, this portion of Bartow County has no streams designated as trout streams.

Land Use and Surface Water Quality

Drinking Water Supply

As described in the Water Supply and Water Conservation Plan, the Coosa River Basin is the primary drinking water supply source for the District, providing water to Cobb, Bartow, and Cherokee Counties; however, this portion of the Coosa only serves as a limited water supply source to the City of Adairsville. Table OO-4 notes this water supply source while Figure OO-2 illustrates that there are no waters that are designated to meet State drinking water criteria within the Oostanaula River Basin.

Table OO-4. Coosa River Basin Drinking Water Supply Sources

Water Supply Source	Owner/Operator Using Source
Lewis Spring	City of Adairsville

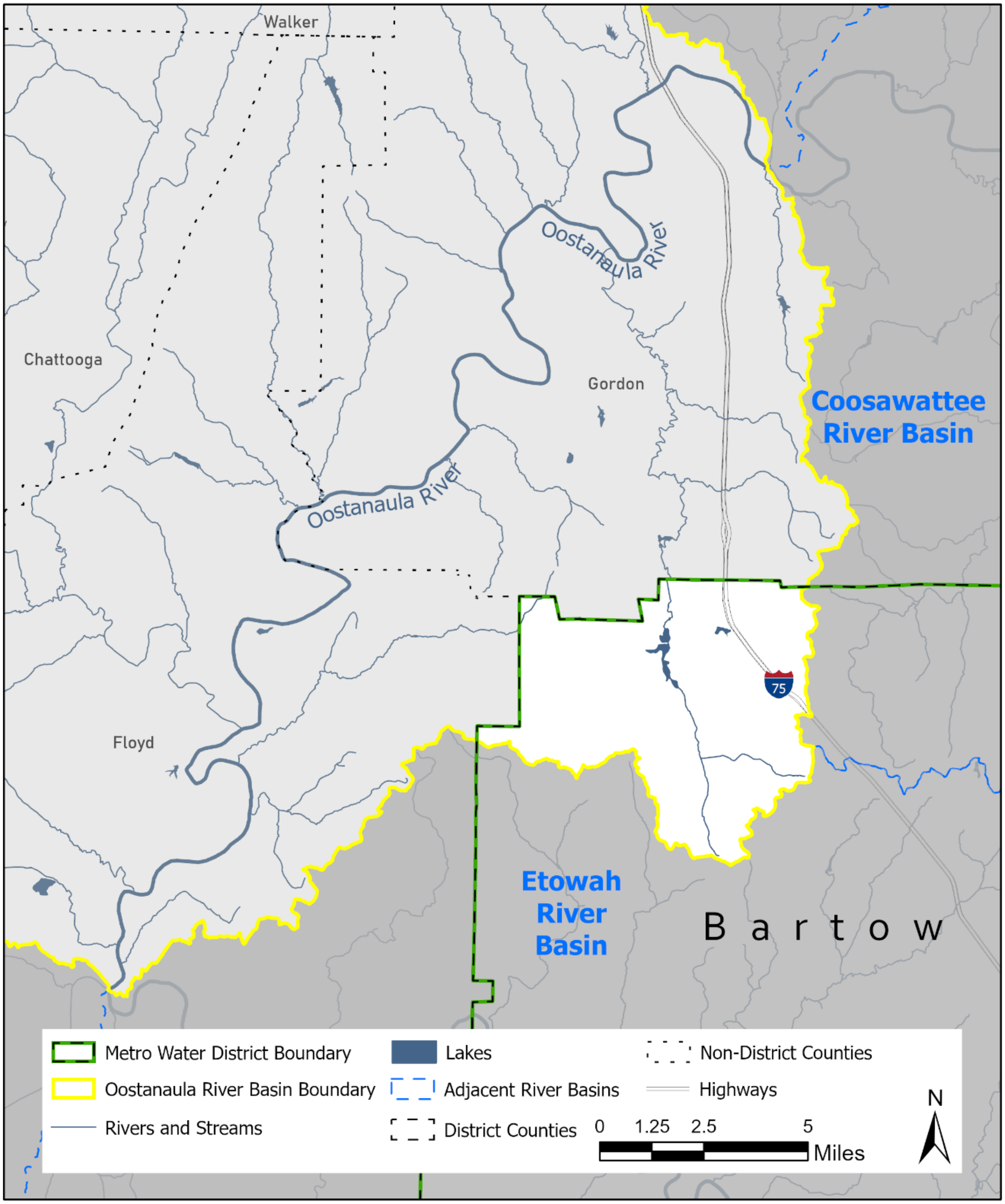

Figure OO-2. Oostanaula Basin Drinking Water

Note: The only District drinking water source is a spring and is not shown

Land Cover/Land Use

Table OO-5 summarizes the land use/land cover characteristics of the Oostanaula River Basin portion of the District in Bartow County. As illustrated by Figure OO-3, the 2019 land cover indicates the ongoing growth along Interstate 75 near Adairsville. Overall, 21 percent of the Oostanaula River Basin within the District is developed, 43 percent of the area is forested, and 36 percent of the area falls within the remaining cover classes (Table OO-5, Figure OO-3).

Table OO-5. Oostanaula River Basin Land Cover / Land Use within the District

Land Cover/Land Use	Area (Square Miles)	2019 Existing (%)
Barren Land (Rock/Sand/Clay)	0.43	1.24
Deciduous Forest	5.65	16.33
Developed High Intensity	0.47	1.35
Developed, Low Intensity	2.13	6.16
Developed, Medium Intensity	0.92	2.67
Developed, Open Space	3.70	10.69
Emergent Herbaceous Wetlands	0.05	0.14
Evergreen Forest	6.69	19.34
Grassland/Herbaceous	2.41	6.98
Mixed Forest	2.49	7.20
Open Water	0.19	0.55
Pasture/Hay	6.56	18.96
Shrub/Scrub	2.80	8.10
Woody Wetlands	0.10	0.29
Undeveloped	***27.37***	***79.13***
Developed	***7.22***	***20.87***
Total	**34.59**	**100**

Notes:

Developed = High Intensity, Low Intensity, Medium Intensity and Open Space.
Undeveloped = land cover classes not described as Developed.

Data Source:

Aggregated Land Cover categories from U.S. Geological Survey (USGS) National Land Cover Database (NLCD), 2019.

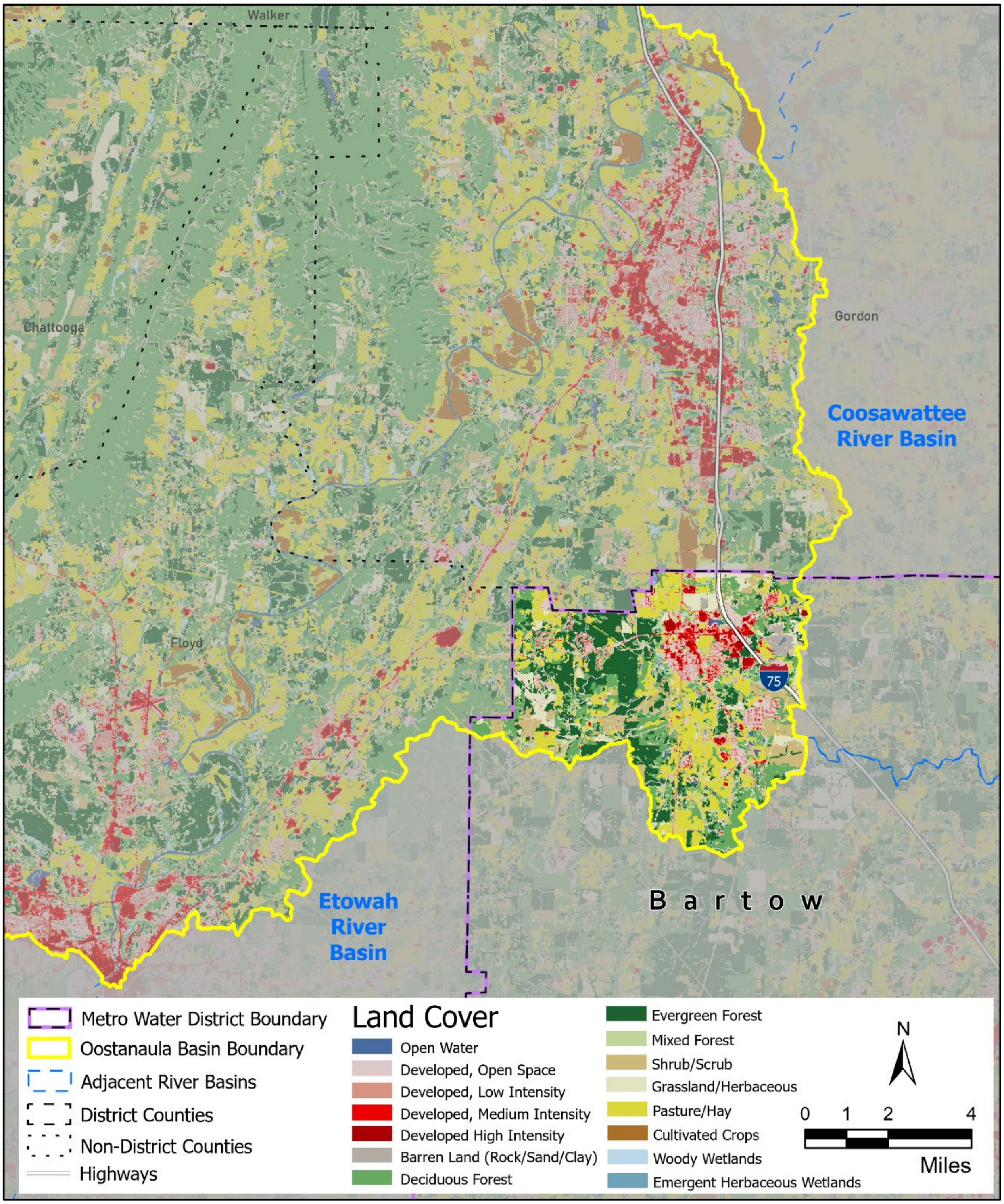

Figure OO-3. Oostanaula Land Cover

Source: 2019 NLCD

Effective Impervious Areas

The level of watershed imperviousness has long been linked to impacts on changes in hydrologic regimes that lead to increased intensity and frequency of peak stormwater flows, which affect stream stability, water quality, and aquatic habitat and biotic community integrity. In general, the most sensitive aquatic organisms are affected at impervious levels greater than 10 percent. Between 11 and 25 percent of most stream communities become impacted, and over 25 percent of streams are generally no longer able to support viable biotic communities (Schueler, 2001).

Impervious surfaces (such as roofs, streets, parking lots) have a significantly different hydrologic response from pervious surfaces (lawns, forests); therefore, it is important to clearly define terms and assumptions related to the calculation of pervious and impervious areas for the purposes of watershed management. “Total impervious area” quantifies all of the land surfaces impervious to rainfall for the particular land cover category while “effective impervious area” (EIA) refers to the directly connected impervious area used for water quality and stormwater conveyance modeling. For the 2003 District-wide Plan, EIA values were initially defined based on previous studies, including the local watershed assessments, and then further refined based on calibration using available water quality data. For the 2022 District-wide Plan, the EIA of the HUC-12 subwatersheds within the District was calculated using a mathematical model developed by Sutherland for U.S. Environmental Protection Agency (EPA) based on land cover data from the 2019 USGS National Land Cover Database.

Of the three HUC-12s within the District portion of Oostanula River Basin, one has an EIA greater than 10 percent: the Middle Oothkalooga Creek portion of the river basin, which straddles the major transportation corridor of Interstate 75 (Figure OO-4).

Wastewater Management

Permitted Wastewater Facility Service Areas

There is one municipal wastewater treatment facility in the Oostanaula River Basin with a permitted capacity of 2.0 maximum monthly flow – million gallons per day (MMF-MGD). Additionally, there are no non-municipal treatment facilities in the Oostanaula River Basin.

Combined-sewer Overflow Areas

There are no combined-sewer overflow areas in the Oostanaula River Basin.

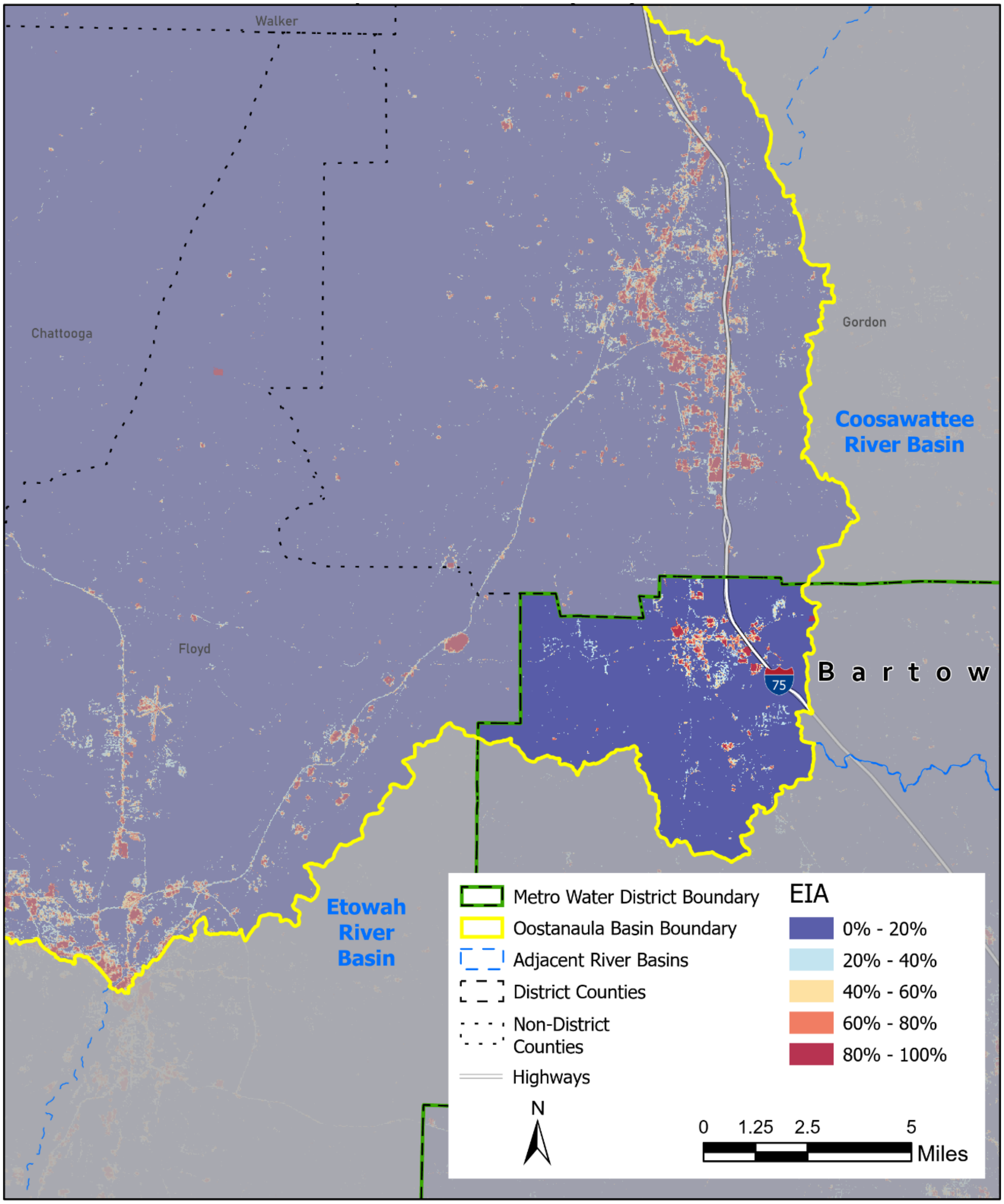

Figure OO-4. Oostanaula Effective Impervious Area

Impaired Water Bodies

The Georgia EPD establishes water quality standards for the state's surface waters. Section 303(d) of the federal Clean Water Act requires that all states list waterbodies that do not meet water quality standards. The Georgia EPD publishes a biennial list of streams that do not meet State water quality standards, referred to as the 303(d)/305(b) list. If a water body does not support its designated use (drinking, recreation, fishing, wild/scenic rivers, or coastal fishing) because conditions violate water quality standards, it is considered an "impaired" stream or water body.

The Georgia EPD determines whether a water body is supporting its designated uses by collecting water quality data and comparing it against State water quality criteria. Georgia EPD describes their listing methodology and "preferred minimum dataset" at http://epd.georgia.gov/georgia-305b303d-list-documents. This methodology is important to understand the sample size, extent and timeframe of the dataset that was used to list a water body. Feedback can be given to Georgia EPD if additional data or information are known that may affect future sampling or listing evaluations.

The District portion of the Upper Chattahoochee River Basin contains 77 stream miles, five of which were assessed for impairments. A total of one stream mile, one percent of total streams or 20 percent of assessed streams, did not meet State water quality standards based on the 2020 303(d) list. The streams listed as "not supporting" are summarized in Table OO-6 by parameter and graphically shown on Figure OO-5.

Table OO-6. Oostanaula River Basin Summary of Impaired Streams

Criterion Violated	Miles of Stream	% of 2020 Assessed Streams	% of Total Stream Mileage
Fecal coliform bacteria	1	12	1
Biota (macroinvertebrate community)	1	12	1
Total impaired stream mileage*	1	20	1
Total mileage assessed for possible impairment	5		
Total stream mileage in basin	77		

* Several streams are listed for violations of multiple parameters within the same stream segment; therefore, the total of impaired miles by parameter will not equal the total stream mileage of impaired streams.

The District portion of the Oothkalooga Creek stream segment in the Oostanaula River Basin does not meet water quality standards for fecal coliform bacteria or biota (macroinvertebrate communities) as a result of nonpoint source pollution. Fecal coliform is used for water quality purposes as a Fecal Indicator Bacteria (FIB). FIBs are used to provide an approximation of the potential risk a water body poses to human health. These bacteria enter the stream from both human and non-human sources, including sanitary sewer overflows, leaking sewer lines, failing septic systems and pet/wildlife waste. Fecal coliform typically is found in both developed and undeveloped watersheds, and monitoring programs in Georgia have found levels that exceed state standards in urban, agricultural, and forested areas (Georgia EPD, 2011). While fecal coliform is ubiquitous in streams across the country (Georgia EPD, 2011), concentrations of bacteria can increase as a result of the higher density of potential pollutant sources and decreased stormwater filtration and stormwater treatment from population growth and development. Biota listings typically indicate high sediment loads in streams, which decrease habitat quality for benthic macroinvertebrates and fish.

Sediment sources include runoff from construction sites as well as from streambank erosion due to accelerated streamflow velocities from impervious cover associated with urbanization.

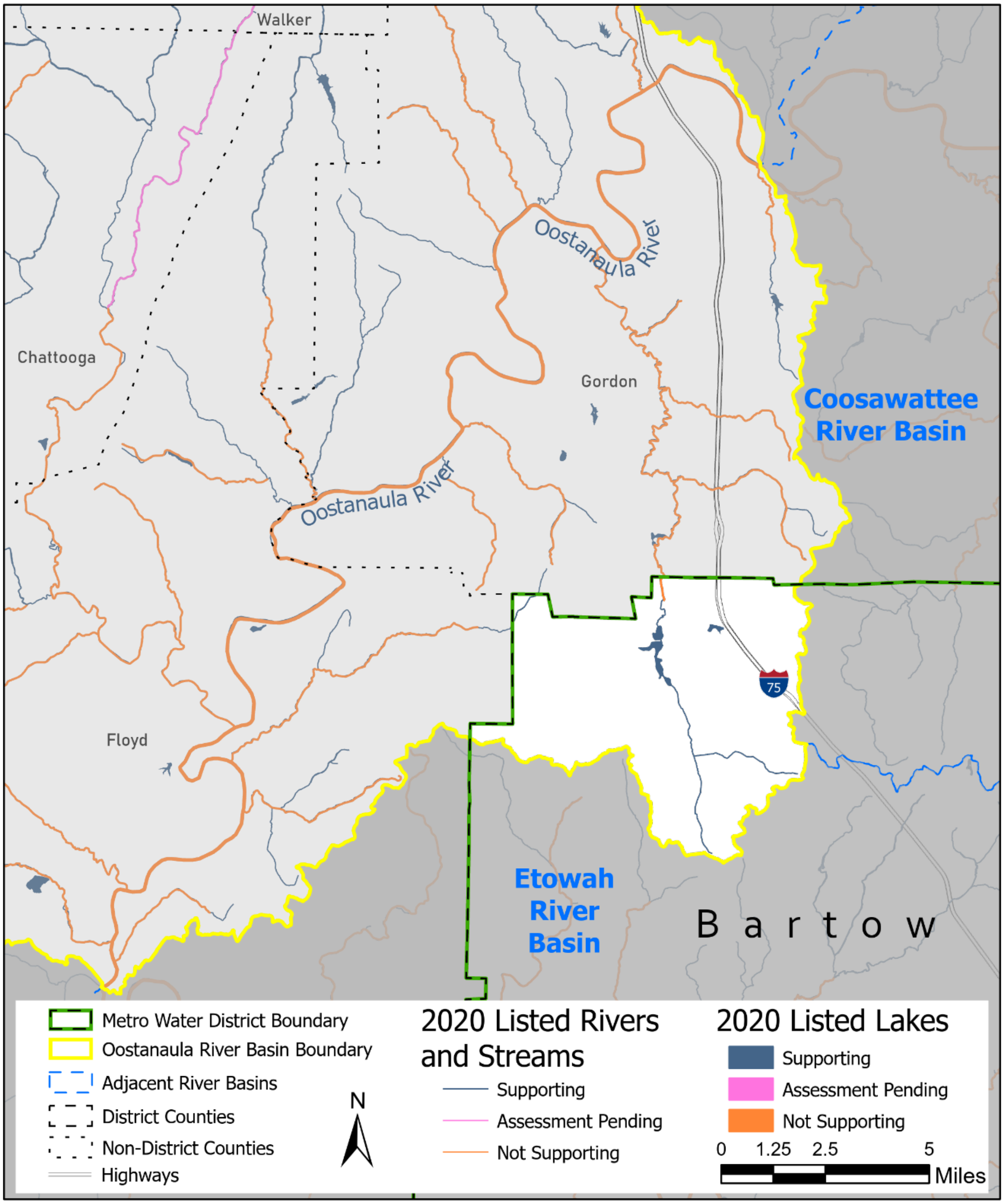

Figure OO-5. Oostanaula Basin 305(b)/303(d) Listed Waters

Total maximum daily loads (TMDLs) and TMDL Implementation Plans have been developed to help jurisdictions address impaired streams and specific parameters of concern. More information on specific TMDLs in the Oostanaula River Basin can be found on the Georgia EPD website https://epd.georgia.gov/total-maximum-daily-loadings.

Management Issues and Recommendations

Basin-level Summary

Land development affects the physical, chemical, and biological conditions of the District's watersheds, waterways, and water resources. Based on the Stormwater Forecast analysis, development patterns in the District over the past century have resulted in substantial changes to watershed characteristics. Developed area is projected to increase from 4,610 acres in the current (2019) condition to 7,512 acres in 2040, a 63 percent increase. If current land use policy and recent development patterns continue, future estimates of land use are expected to intensify, with the weighted average curve number (CN) value potentially reaching approximately 86 and total imperviousness potentially reaching nearly 50 percent by 2040, based on the future developed area.

Precipitation rates are also expected to increase based on the future precipitation study results for the District. By 2040, the basin-wide weighted average 85th percentile annual rainfall; 1-year, 24-hour rainfall; and 25-year, 24-hour rainfall events are estimated to potentially increase by 14 percent, 11 percent, and 16 percent, respectively. These changes to watershed characteristics and rainfall intensity will have a direct impact on the total potential runoff management volume generated from development that may require additional management from structural control measures.

Runoff for the three post-construction volumes (Water Quality Volume [WQv], Channel Protection Volume [CPv], and Overbank Flood Protection Volume [OFPv]) were calculated for 77 individual subcatchments in the basin. In 2019, a total of 5.9 million cubic feet of runoff was estimated in the basin for the WQv, 18.89 million cubic feet for the CPv, and 93.43 million cubic feet for the OFPv, based on 4,610 acres of development. Additional information is provided in the following summary table (Table OO-7) and figure of the 2019 WQv for the basin (Figure OO-6).

Table OO-7. Oostanaula River Basin Watershed Characteristics and Total Potential Runoff Management Volumes

	Predevelopment	**2019**	**2030**	**2040**
Subcatchments (count)	77	77	77	77
Total area (acres)	22,514	22,514	22,514	22,514
Developed area (acres)	4,610	4,610	6,153	7,512
Total imperviousness (percent)	1.0	27.2	39.4	49.6
CN	67	84	85	86
Slope (percent)	6.6	6.6	6.6	6.6
85th percentile annual rainfall (inches)	1.20	1.20	1.32	1.37
1-year, 24-hour rainfall (inches)	3.31	3.31	3.55	3.67
25-year, 24-hour rainfall (inches)	6.10	6.10	6.74	7.06
WQv (cubic feet)	1.18 M	5.91 M	11.94 M	18.54 M
CPv (cubic feet)	7.67 M	18.89 M	29.39 M	38.52 M
OFPv (cubic feet)	-	93.43 M	159.70 M	220.02 M

Note: M = million

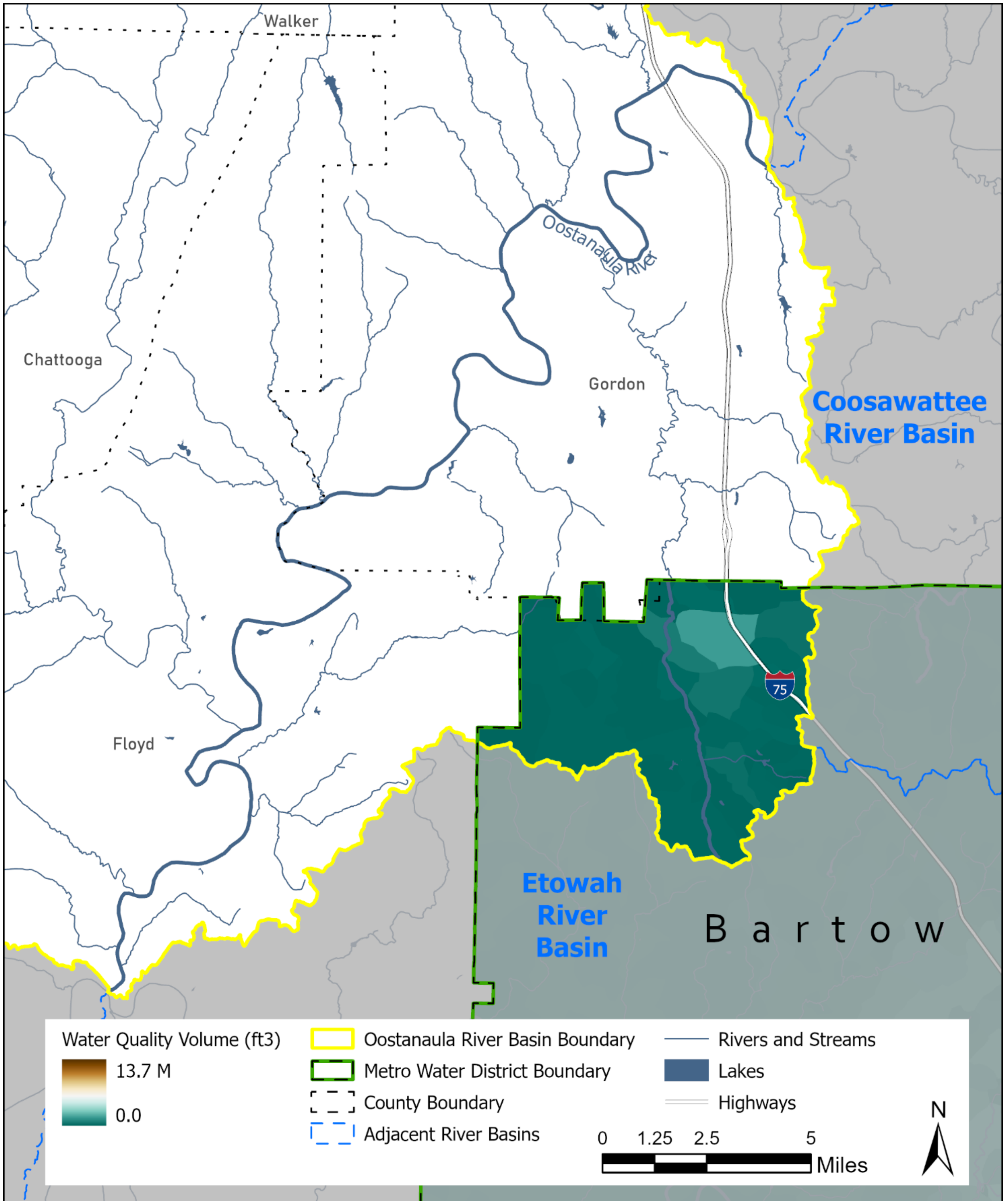

Figure OO-6. Estimated Water Quality Runoff Volume per Subcatchment – 2019

Management Issues and Recommended Strategies

Table OO-8 outlines management issues and strategies for the Oostanaula River Basin within the District. These issues and strategies were used to inform and guide the more specific management measures and requirements found in Sections 5, 6, and 7. The recommended strategies presented in Table OO-8 are based on data presented within this River Basin Profile. These strategies are provided to further describe the commonality of causes and potential solutions to the watershed issues. They provide a foundation for guidance but are not presented here as mandatory requirements.

Table OO-8. Oostanaula River Basin Management Issues and Recommended Strategies

Management Issue	Description	Recommended Strategies
Source water quality	Source water watershed protection of small water supply watersheds.	• Implement source water protection measures in all small water supply subwatersheds. • Continue collaborative efforts in small drinking water supply watersheds, such as Lewis Springs, to protect the viability of these supplies.
Increases in impervious cover (new development)	Increases in impervious cover can lead to a change in the hydrologic regime of a watershed by causing more intense, high-velocity stormwater flows and increased erosion and sedimentation.	• Manage nonpoint source pollution. • Adopt and enforce the post-construction stormwater control ordinance and use of Georgia Stormwater Management Manual design standards. • Recommend watershed improvement projects, such as stream restoration and streambank stabilization, in areas with failing streambanks to reduce instream sediment load contributions.
Inadequate stormwater controls on existing impervious cover	Limited resources and cost of maintaining and repairing stormwater infrastructure. Varying local strategies of funding stormwater management.	• Identify opportunities for watershed improvement projects to retrofit or install updated stormwater controls, green infrastructure, stormwater treatment, or other controls. • Consider dedicated funding sources such as stormwater utilities and seek out opportunities for grants, loans, and partnerships.
Aquatic resources	Several streams located in Bartow County are designated secondary trout streams.	• Balancing nonpoint source temperature inputs from tributaries with background cool water temperatures to meet secondary trout stream criteria. • Participate in efforts to educate agricultural stakeholders about the importance of implementing Best Management Practices for Georgia Agriculture Manual for animal production facilities (poultry) and grazing operations. • Coordinate with Georgia Department of Agriculture Livestock/Poultry Section on inspections, complaint investigations, nutrient management plan reviews, permit administrative support, and enforcement assistance (Georgia EPD, 2014).
Biota TMDLs	Oothkalooga Creek is listed for impaired benthic macroinvertebrate communities. Biota impairment in this basin is the result of high sediment loads, primarily associated with existing development with inadequate stormwater controls, which is a concern for drinking water source supplies, biota, and recreation.	• Enforce post-construction stormwater ordinance on new development and seek opportunities to retrofit stormwater controls to maximize water quality and channel protection. • Watershed improvement projects, such as stream restoration and streambank stabilization are recommended in areas with failing streambanks to reduce instream sediment load contributions.

Table OO-8. Oostanaula River Basin Management Issues and Recommended Strategies

Management Issue	Description	Recommended Strategies
Bacteria TMDLs	Oothkalooga Creek is listed as not supporting its designated use of fishing due to fecal coliform bacteria.	• Identify bacteria sources through inspections, monitoring, source tracing, and stream walks. • Educate public on pollution prevention, proper septic system maintenance, and reporting a potential illicit discharge. • Perform regular maintenance to ensure proper functioning of decentralized systems (that is, septic tanks). • Participate in efforts to educate agricultural stakeholders about the importance of implementing the *Best Management Practices for Georgia Agriculture Manual* for animal production facilities (poultry) and grazing operations. • Coordinate with Georgia Department of Agriculture Livestock/Poultry Section on inspections, complaint investigations, nutrient management plan reviews, permit administrative support, and enforcement assistance (Georgia EPD, 2014).
Lake management	While there are no major lakes or reservoirs within the District in this basin, there are other public and privately-held and managed lakes that play a significant role in meeting designated uses and downstream hydrologic regimes and water quality.	• Develop a central inventory of lakes, ownership and management practices to facilitate pollutant source identification both up and downstream of the lake. • Coordinate available water quality data and management activities for inventoried lakes. • Implement shoreline protection and upstream sediment management to prevent excessive nutrients and sedimentation within the lake. • Facilitate proper maintenance and management, particularly of small lakes by providing resources, links, or other materials to assist with periodic activities such as inspections, water quality sampling, or dredging. • Conduct public education and involvement activities to promote watershed stewardship to protect lake quality.

Identify Indicators and Monitoring to Measure Implementation Success

A critical component of any watershed management program is the ability to assess progress and determine if management strategies are effectively addressing issues. The Plan includes implementation actions related to watershed monitoring and conducting conditions assessments to evaluate implementation success. These implementation actions include long-term ambient trend monitoring (WATERSHED-10), as well as resource-specific implementation actions for Watershed Improvement (WATERSHED-8). Communities may choose to conduct project-specific monitoring associated with a watershed improvement project, such as biological or geomorphological monitoring to evaluate success.

As included in EPA (2008), a monitoring program should "…track progress in meeting load reduction goals and attaining water quality standards and other goals. Measurable progress is critical to ensuring continued support of watershed projects, and progress is best demonstrated with the use of monitoring data that accurately reflect water quality conditions relevant to the identified problems. Monitoring programs should include baseline (before), project-specific (during), and post-project (after) monitoring."

Some potential indicators to measure implementation success for the Oostanaula River Basin are listed as follows, but this list is not exhaustive:

- Select representative monitoring stations within the watershed to monitor for pollutants of concern and other water quality or biological parameters.
- Use USGS stream gage data or collect data to establish stream stage-discharge relationships and calculate or model water quality pollutant loads and potential reductions.
- Calculate or model improvements to hydrologic and hydraulic conditions based on structural project implementation.
- Estimate streambank stability and habitat improvement based on annual stream cross section surveys and bank erosion monitoring.
- Conduct stream walks or structure inspections to inventory structure condition and performance, streambank stability, and riparian condition over time.
- Conduct project monitoring to establish pre-, during-, and post-project conditions, as well as upstream/downstream monitoring during the same time period to reduce the effects of environmental variability.
- To determine if water quality degradation is being prevented, conduct GIS analysis to identify high-activity areas of a watershed using aerial overlays, work orders, facility inspection, erosion and sedimentation control, or new construction inspection data. Identify if monitoring data and GIS data follow similar patterns.
- Track number, location, size, or features (that is, drainage area treated or linear feet of restored stream) of watershed improvement, green infrastructure, or other nonpoint source reduction projects.
- Compare percentage of TMDL stream segments over time.
- Track implementation actions by jurisdiction within the basin, and their measured effectiveness.
- Track enforcement actions by category and location.
- Track stream buffer variances and local permits issued.
- Conduct public surveys for pollution prevention awareness or education effectiveness, particularly pre- and post-data associated with an education event.
- Compare existing water quality modeled loads against future water quality modeled loads.

ATTACHMENT 8

Upper Oconee River Basin Profile

The Upper Oconee River Basin is located along the eastern edge of the Metropolitan North Georgia Water Planning District (District) and encompasses about 208 square miles, or four percent, of the total District area. The Upper Oconee River flows to the Altamaha River before draining to the Atlantic Ocean just north of Little St. Simons Island on the Georgia coast. The main tributaries draining the District portion of the Upper Oconee River are the North Oconee River, Middle Oconee River and Mulberry River in Hall County, and Little Mulberry River and Apalachee River in Gwinnett County (Figure OC-1). The District represents seven percent of the overall Upper Oconee River Hydrologic Unit Code (HUC)-8 Basin and includes portions of Hall and Gwinnett Counties as well as portions of the following seven cities: Braselton (not a District member), Dacula, Flowery Branch, Gainesville, Gillsville, Lula, and Oakwood. The City of Gainesville provides drinking water for much of eastern Hall County from Cedar Creek and the North Oconee River (Atlanta Regional Commission [ARC], 2010).

Physical and Natural Features

Geography

The Upper Oconee River is entirely within the Piedmont province, which consists of rolling hills and occasional isolated mountains; however, there are six physiographic districts, making the topography and hydrology highly variable. The Upper Oconee River Basin includes portions of the Gainesville Ridge and the Winder Slope physiographic districts (District, 2002).

Hydrology and Soils

The Upper Oconee River Basin has its headwaters along a ridgeline generally following Interstate 985 and Braselton Highway (GA 124) in the northeast portion of the District before flowing southeast to the confluence with the Middle Oconee River and Lake Oconee. Two headwater tributaries, the North Oconee River and the Middle Oconee River, originate at the northern end of the Upper Oconee River Basin, draining the eastern edges of Hall and Gwinnett Counties while the Apalachee River and its tributaries drain the eastern portion of Gwinnett County. Of the 143 miles of assessed streams within or straddling the Upper Oconee River Basin, 117 miles are designated for fishing and 26 miles, 18 percent, for drinking water. Since the portions of the Upper Oconee River Basin that are in the District are mainly tributaries, no U.S. Geological Survey (USGS) flow stations meeting the study criteria exist within the District in this portion of the basin. Accordingly, no flow data are presented for this basin. No significant impoundments currently exist within the portion of this basin within the District.

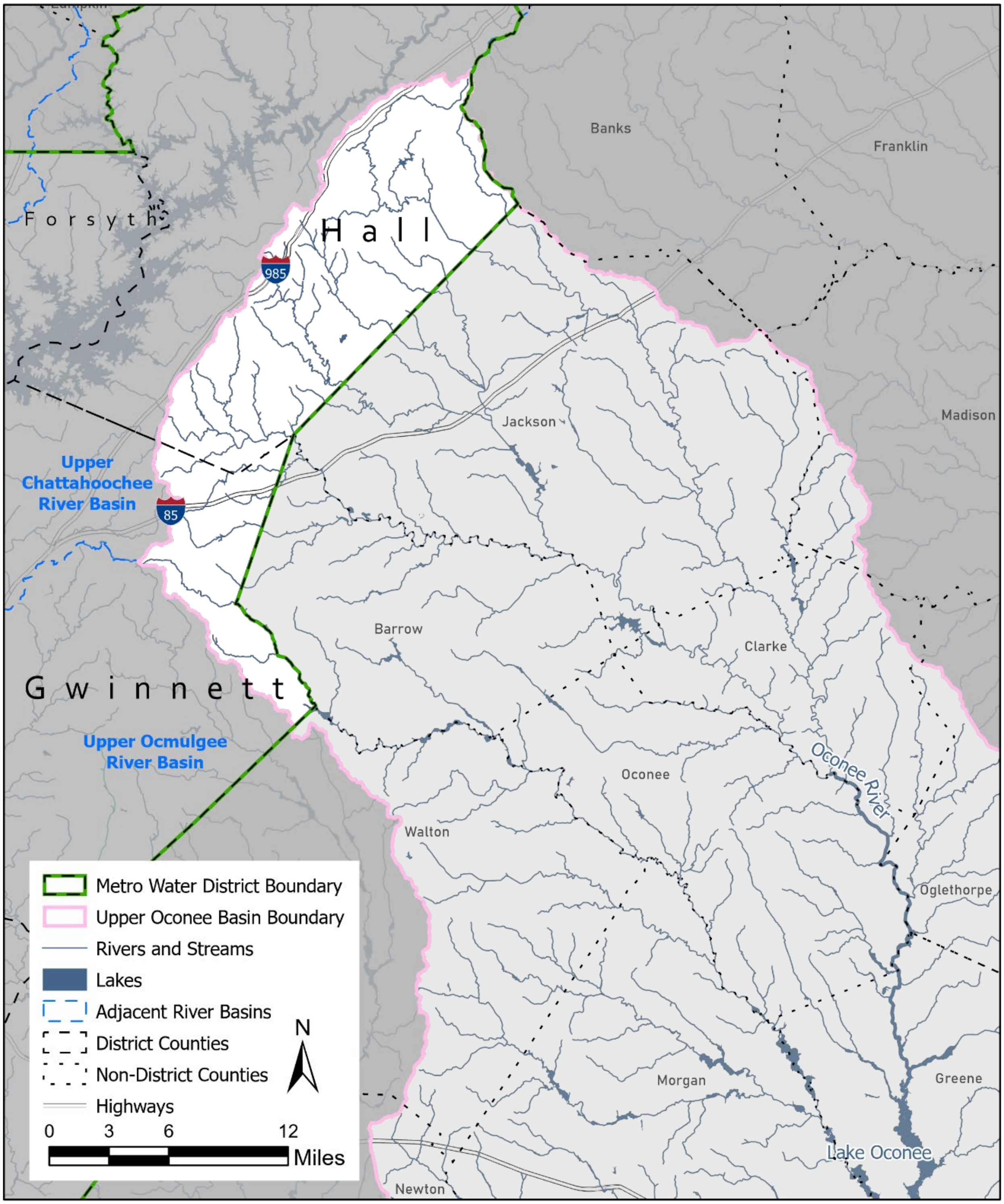

Figure OC-1. Upper Oconee Basin Within the District

The District lies almost completely within the Piedmont and the Blue Ridge (Ridge and Valley) geologic provinces. The aquifers in these provinces overlie crystalline rocks that crop out in the northern portion of the basin and extend to the fall line. The rock is overlain with deposits of weathered, unconsolidated rock debris (regolith) that make up the available aquifer spaces. These deposits are thickest in valleys, but generally provide insufficient yield for uses other than very low density residential and thus surface water is the primary source of potable water for the District. The Georgia Geologic Survey Hydrologic Atlas 18 database identifies approximately 28 areas, representing about four percent of the District, that are likely to contain unconfined aquifers, and 79 areas, representing about 12 percent of the District, that are likely to contain thick soils considered to be an indicator of significant groundwater recharge areas. The recharge areas were mapped based on outcrop area, lithology, soil type and thickness, slope, density of lithologic contacts, geologic structure, the presence of karst, and potentiometric surfaces. An assessment of the availability of groundwater resources in select prioritized aquifers of Georgia was completed as part of Georgia's Comprehensive State-wide Water Management Plan (Georgia Environmental Protection Division [Georgia EPD], 2010). None of the Upper Oconee River Basin within the District was selected as a priority aquifer for assessment. Table OC-1 summarizes the limited groundwater recharge areas, only 10 square miles or five percent of the Upper Oconee River Basin within the District, as identified by the Georgia Geologic Survey Hydrologic Atlas 18 database.

Table OC-1. Groundwater Recharge Areas within the Upper Oconee River Basin

Recharge Area Type	County	Square Miles of Recharge Area Type within County
Probable Areas of Thick Soil	Gwinnett	8
	Hall	2
Total Recharge Areas		10

There are two soil associations that best characterize the overall soil types in the Upper Oconee River Basin: Cecil-Madison-Pacolet and Madison-Davidson-Pacolet (Table OC-2). The Cecil-Madison-Pacolet and Madison-Davidson-Pacolet associations were the most abundant, with the former types associated with moderate rolling hills and the latter with steeper terrain. These soils are well-drained and highly weathered, having a red to yellowish-red subsoil (Brock, 1977; Jordan et al., 1973; Murphy, 1979; Thomas and Tate, 1973; USDA, 1976; Thomas, 1982; Wells, 1961; Robertson et al., 1960; USDA, 1958; Tate, 1967; Thomas and Tate, 1964).

Table OC-2. Major Soil Associations within the Upper Oconee River Basin

Soil Association	Significance to Watershed Management
Cecil-Madison-Pacolet	**Characteristics:** Associated with moderate rolling hills, well-drained, highly weathered. **Significance to Watershed Management:** Sloping surfaces may be more susceptible to increased erosion due to stormwater runoff velocities from impervious surfaces; well-drained soils may be more permeable, which increases infiltration capacity in areas without impervious cover, also may improve feasibility for infiltration practices.
Madison-Davidson-Pacolet	**Characteristics:** Associated with steep terrain, well-drained, highly weathered. **Significance to Watershed Management:** Steep terrain may be more susceptible to increased erosion due to stormwater runoff velocities from impervious surfaces; well-drained soils may be more feasible for infiltration practices.

Protected Species

Protected species include all species listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service, and those listed as endangered, threatened, rare or unusual by the State of Georgia. The USFWS also may designate critical habitat for a federally listed species, which provides protection for the habitat as well as the species itself. The current listings of these endangered species, including their status, range, and habitat, can be accessed via the USFWS's automated Information, Planning and Conservation System (IPaC, http://ecos.fws.gov/ipac/).

Within the District, there are a number of protected animal species that spend all or part of their life cycle in rivers and streams or depend on streams for a significant portion of their life history. In addition, there are protected plants that are either aquatic or semi-aquatic and grow within or along the margins of rivers and streams. Table OC-3 lists the five protected species potentially found within the counties of the Upper Oconee River Basin of the District.

Table OC-3. Aquatic and Semi-Aquatic Protected Species in the District

Fauna Type	Common Name	Status*	Gwinnett	Hall
Bird	Bald eagle	T		X
Fish	Altamaha shiner	T	X	X
	Bluestripe shiner	R		X
Mammal	Northern long-eared bat	<u>T</u>		X
Invertebrate	Chattahoochee crayfish	T	X	X

* Status that is not underlined is listed in Georgia. Underlined status is federally listed.

R = Rare
T = Threatened

Trout Streams

Trout streams are classified in accordance with the primary and secondary designations and criteria defined in Section 15 of Georgia's Water Use Classifications and Water Quality Standards (391-3-6-.03). There are no stream segments within the District of the Upper Oconee River Basin that are classified as a primary trout stream or a secondary trout stream.

Land Use and Surface Water Quality

Drinking Water Supply

As described in the Water Supply and Water Conservation Plan, the Upper Oconee River Basin provides a drinking water supply source for the City of Gainesville within the District. Recognizing the linkage between watershed management and water quality for water supply, the Georgia Department of Natural Resources (GADNR) Rule 391-3-16.01 includes environmental planning criteria (or Part V criteria) to protect natural resources, such as wetlands, stream buffers, water supply watershed areas, groundwater recharge areas, protected rivers, and protected mountains. The Act is further described in Section 3. Table OC-4 lists the water supply sources and Figure OC-2 shows those waters that are designated to meet State drinking water criteria within the Upper Oconee River Basin.

Table OC-4. Upper Oconee River Basin Drinking Water Supply Sources

Water Supply Source	Owner/Operator Using Source
*There are no District drinking sources in the Upper Oconee Basin	--

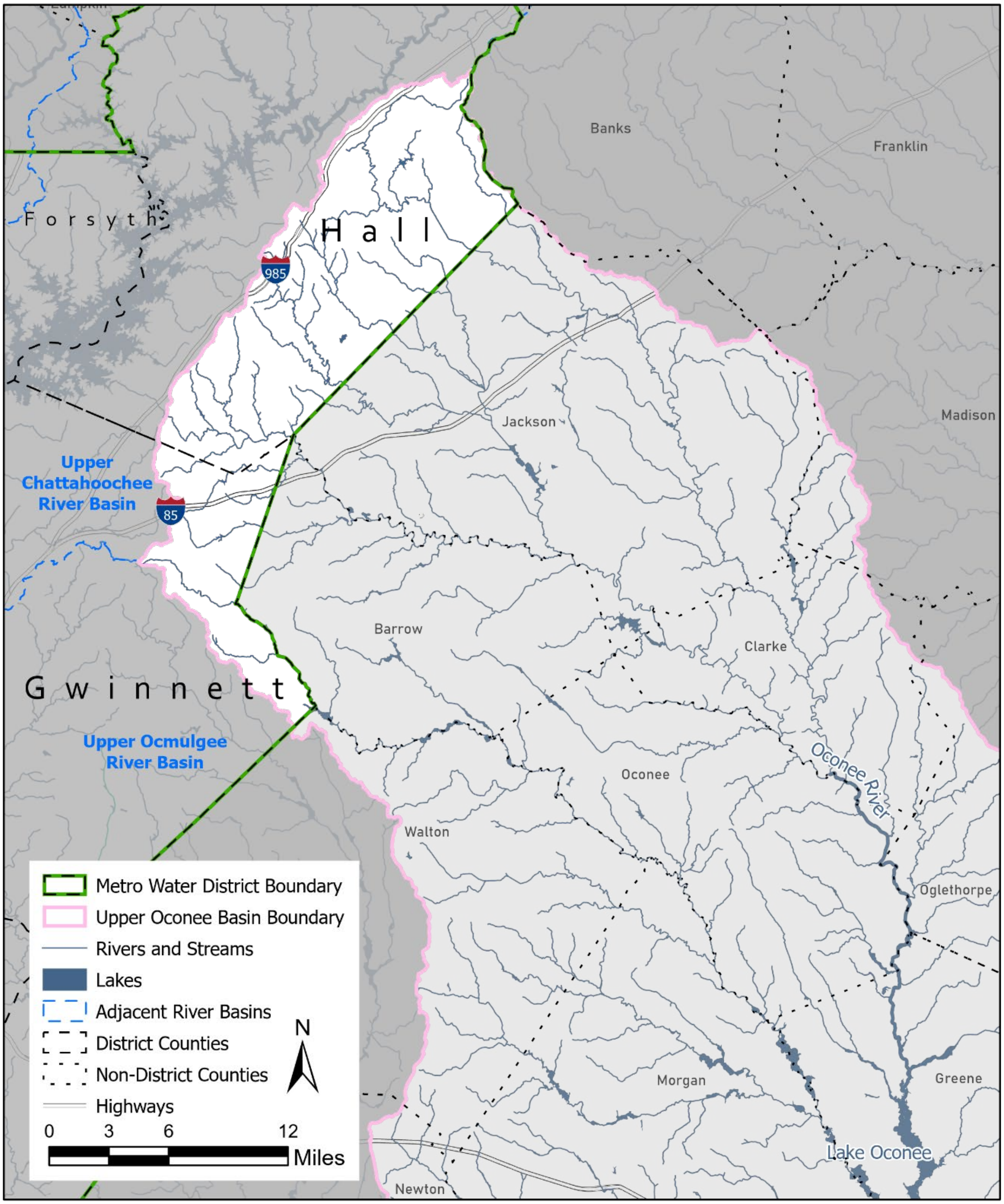

Figure OC-2. Upper Oconee Basin Drinking Water

Note: There are no District drinking water sources in the Oconee Basin

Land Cover/Land Use

Figure OC-3 illustrates the land cover characteristics of the Upper Oconee River Basin, which show the more densely developed lands clustered along the Interstate 985 and 85 corridors and the cities of Dacula and Gainesville. Overall, 32 percent of the Upper Oconee River Basin within the District is developed, 50 percent of the area is forested, and 18 percent of the area falls within the remaining land cover classes. (Table OC-5). Much of the future growth is anticipated to occur in the southwest portion of the basin in Gwinnett County with infill development and redevelopment resulting in increased density based on current land use data.

Table OC-5. Upper Oconee River Basin Land Cover / Land Use within the District

Land Cover/Land Use	Area (Square Miles)	2019 Existing (%)
Barren Land (Rock/Sand/Clay)	1.07	0.5
Deciduous Forest	85.39	41.1
Developed High Intensity	2.76	1.3
Developed, Low Intensity	25.31	12.2
Developed, Medium Intensity	13.52	6.5
Developed, Open Space	23.92	11.5
Emergent Herbaceous Wetlands	0.10	0.0
Evergreen Forest	7.52	3.6
Grassland/Herbaceous	3.77	1.8
Mixed Forest	11.24	5.4
Open Water	0.98	0.5
Pasture/Hay	28.03	13.5
Shrub/Scrub	1.41	0.7
Woody Wetlands	2.63	1.3
Undeveloped	***142.15***	***68.46***
Developed	***65.51***	***31.54***
Total	**207.66**	**100.0%**

Notes:

Developed = High Intensity, Low Intensity, Medium Intensity, and Open Space.
Undeveloped = land cover classes not described as Developed.

Data Source:
Aggregated Land Cover categories from USGS National Land Cover Database (NLCD), 2019.

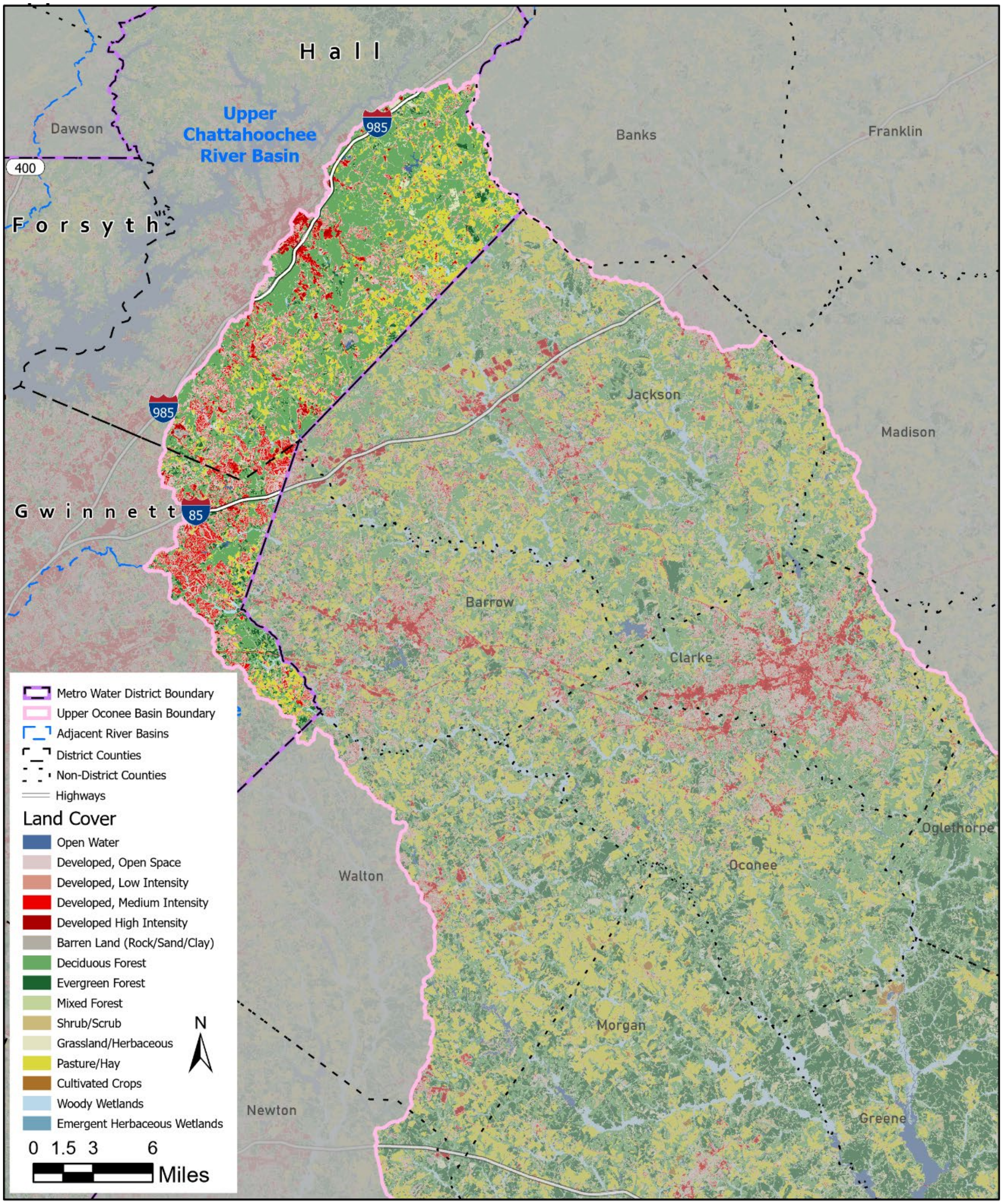

Figure OC-3. Upper Oconee Land Cover
Source: 2019 NLCD

Effective Impervious Areas

The level of watershed imperviousness has long been linked to impacts on changes in hydrologic regimes that lead to increased intensity and frequency of peak stormwater flows, which affect stream stability, water quality, and aquatic habitat and biotic community integrity, with the most sensitive aquatic organisms affected at impervious levels greater than 10 percent. Between 11 and 25 percent of most stream communities become impacted, and over 25 percent of streams are generally no longer able to support viable biotic communities (Schueler, 2001).

Impervious surfaces (such as roofs, streets, parking lots) have a significantly different hydrologic response from pervious surfaces (lawns, forests); therefore, it is important to clearly define terms and assumptions related to the calculation of pervious and impervious areas for the purposes of watershed management. “Total impervious area” quantifies all of the land surfaces impervious to rainfall for the particular land cover category while “effective impervious area” (EIA) refers to the directly connected impervious area used for water quality and stormwater conveyance modeling. For the 2003 District-wide Plan, EIA values were initially defined based on previous studies, including the local watershed assessments, and then further refined based on calibration using available water quality data. For the 2022 District-wide Plan, the EIA of the HUC-12 subwatersheds within the District was calculated using a mathematical model developed by Sutherland for the U.S. Environmental Protection Agency (EPA) based on land cover data from the 2019 USGS National Land Cover Database.

Of the 12 HUC-12s within the District portion of Upper Oconee River Basin, six had an EIA greater than 10 percent. These HUC-12s either straddle major interstate corridors such as Interstate 85 and Interstate 985 or they encompass clusters of residential developments in Gwinnett County, north of the City of Dacula (Figure OC-4).

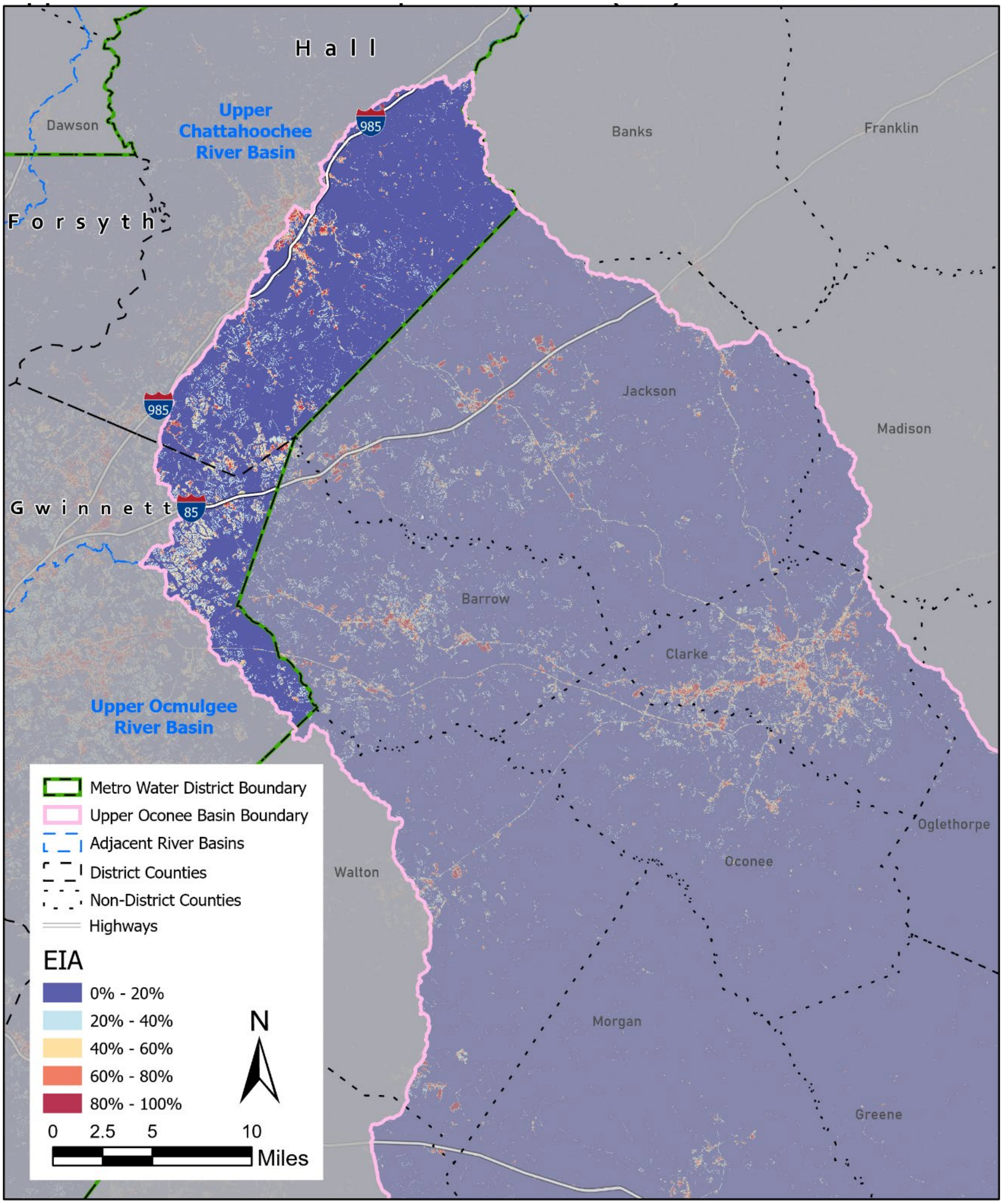

Figure OC-4. Upper Oconee Effective Impervious Area

Wastewater Management

Permitted Wastewater Facility Service Areas

There is one municipal wastewater treatment facility in the Upper Oconee River Basin with a permitted capacity of 0.8 maximum monthly flow – million gallons per day (MMF-MGD). Additionally, the Upper Oconee River Basin has eight non-municipal treatment facilities with a permitted capacity of 5.1 MMF-MGD.

Combined-sewer Overflow Areas

There are no combined-sewer overflow areas in the Upper Oconee River Basin.

Impaired Water Bodies

The Georgia EPD establishes water quality standards for the state's surface waters. Section 303(d) of the federal Clean Water Act requires that all states list water bodies that do not meet water quality standards. The Georgia EPD publishes a biennial list of streams that do not meet State water quality standards, referred to as the 303(d)/305(b) list. If a water body does not support its designated use (drinking, recreation, fishing, wild/scenic rivers, or coastal fishing) because conditions violate water quality standards, it is considered an "impaired" stream or water body.

Georgia EPD determines whether a water body is supporting its designated uses by collecting water quality data and comparing it against State water quality criteria. Georgia EPD describes their listing methodology and "preferred minimum dataset" at http://epd.georgia.gov/georgia-305b303d-list-documents. This methodology is important to understand the sample size, extent, and timeframe of the dataset that was used to list a water body. Feedback can be given to Georgia EPD if additional data or information are known that may affect future sampling or listing evaluations.

The District portion of the Upper Oconee River Basin contains 538 stream miles, 116 of which were assessed for impairments. A total of 67 stream miles, 12 percent of total streams or 58 percent of assessed streams, did not meet State water quality standards based on the 2020 303(d) list. The streams listed as "not supporting" are graphically shown on Figure OC-5 and summarized in Table OC-6 by criterion violated.

Table OC-6. Upper Oconee River Basin Summary of Impaired Streams

Criterion Violated	Miles of Stream	% of 2020 Assessed Streams	% of Total Stream Mileage
Fecal coliform bacteria	38	32	7
Biota (macroinvertebrate community)	36	31	7
Total impaired stream mileage*	67	58	12
Total mileage assessed for possible impairment	116		
Total stream mileage in basin	538		

* Several streams are listed for violations of multiple parameters within the same stream segment; therefore, the total of impaired miles by parameter will not equal the total stream mileage of impaired streams.

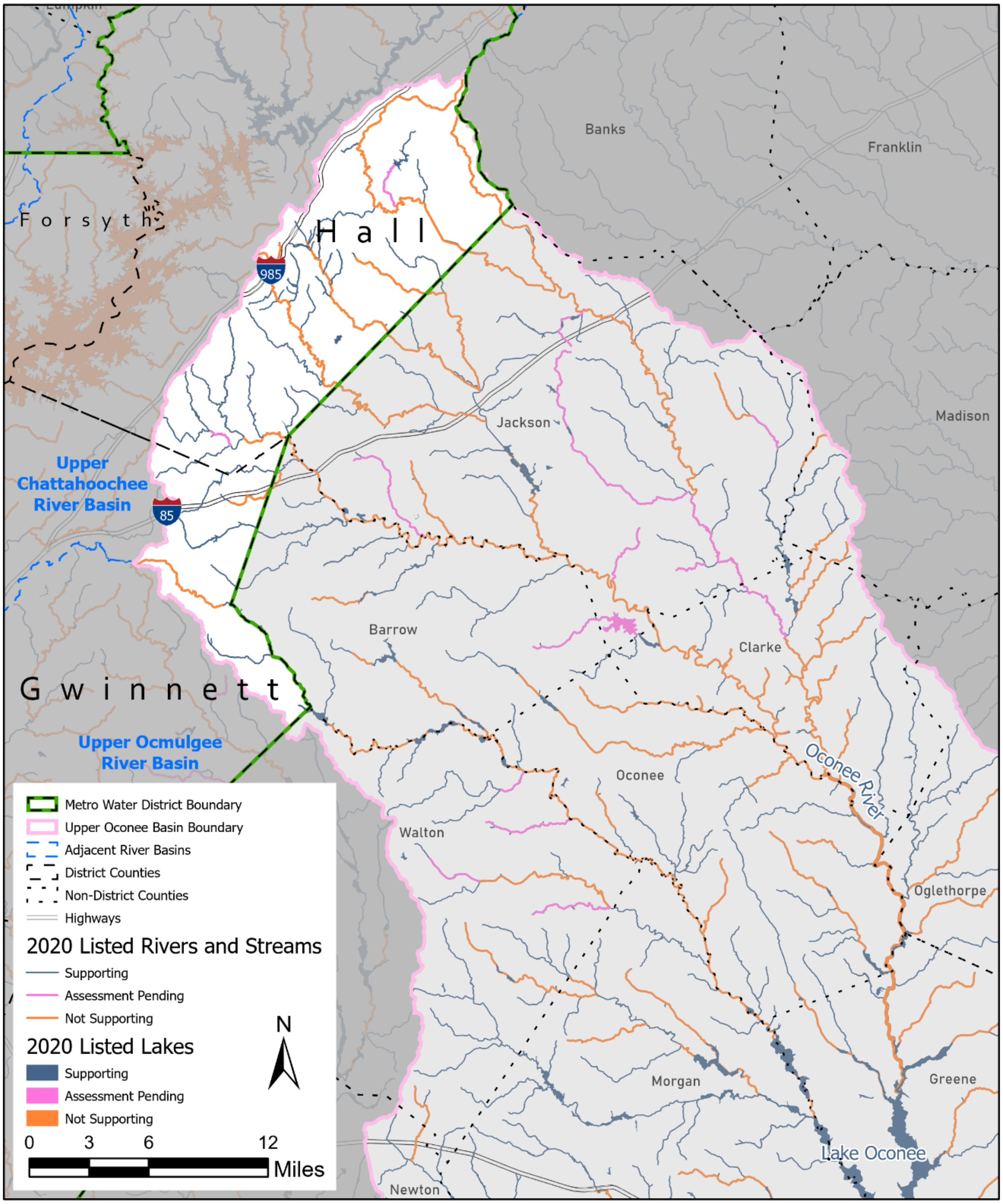

Figure OC-5. Upper Oconee Basin 305(b)/303(d) Listed Waters

Streams in the Upper Oconee River Basin that do not meet water quality standards for fecal coliform bacteria as a result of nonpoint source pollution account for 7 percent or 32 percent of total and assessed streams, respectively. Fecal coliform is used for water quality purposes as a Fecal Indicator Bacteria (FIB). Fecal coliform is used for water quality purposes as a FIB. FIBs are used to provide an approximation of the potential risk a water body poses to human health. These bacteria enter the stream from both human and non-human sources, including sanitary sewer overflows, leaking sewer lines, failing septic systems, and pet/wildlife waste. Fecal coliform typically is found in both developed and undeveloped watersheds and monitoring programs in Georgia have found levels that exceed state standards in urban, agricultural, and forested areas (Georgia EPD, 2011). While fecal coliform is ubiquitous in streams across the country (Georgia EPD, 2011), concentrations of bacteria can increase as a result of the higher density of potential pollutant sources and decreased stormwater filtration and stormwater treatment from population growth and development. Just over 40 percent of the streams assessed were found to not be supporting of biota, specifically benthic macroinvertebrates, which typically indicate high sediment loads in streams, which decreases habitat quality. Sediment sources include runoff from construction sites as well as from streambank erosion caused by accelerated streamflow velocities from impervious cover associated with urbanization.

Total maximum daily loads (TMDLs) and TMDL Implementation Plans have been developed to help jurisdictions address impaired streams and specific parameters of concern. More information on specific TMDLs in the Upper Oconee River Basin can be found on the Georgia EPD website https://epd.georgia.gov/total-maximum-daily-loadings.

Management Issues and Recommendations

Basin-level Summary

Land development affects the physical, chemical, and biological conditions of the District's watersheds, waterways, and water resources. Based on the Stormwater Forecast analysis, development patterns in the District over the past century have resulted in substantial changes to watershed characteristics. Developed area is projected to increase from 41,566 acres in the current (2019) condition to 60,086 acres in 2040, a 45 percent increase. If current land use policy and recent development patterns continue, future estimates of land use are expected to intensify, with the weighted average curve number (CN) value potentially reaching approximately 82 and total imperviousness potentially reaching 46 percent by 2040, based on the future developed area.

Precipitation rates are also expected to increase based on the future precipitation study results for the District. By 2040, the basin-wide weighted average 85th percentile annual rainfall; 1-year, 24-hour rainfall; and 25-year, 24-hour rainfall events are estimated to potentially increase by 14 percent, 11 percent, and 16 percent, respectively. These changes to watershed characteristics and rainfall intensity will have a direct impact on the total potential runoff management volume generated from development that may require additional management from structural control measures.

Runoff for the three post-construction volumes (Water Quality Volume [WQv], Channel Protection Volume [CPv], and Overbank Flood Protection Volume [OFPv]) were calculated for 317 individual subcatchments in the basin. In 2019, a total of 61.8 million cubic feet of runoff was estimated in the basin for the WQv, 137.4 million cubic feet for the CPv, and 868.9 million cubic feet for the OFPv, based on 41,566 acres of development. Additional information is provided in the following summary table (Table OC-7) and a figure of the 2019 WQv for the basin (Figure OC-6).

Table OC-7. Upper Oconee River Basin Watershed Characteristics at and Total Potential Runoff Management Volumes

	Predevelopment	2019	2030	2040
Subcatchments (count)	317	317	317	317
Total Area (acres)	132,947	132,947	132,947	132,947
Developed Area (acres)	41,566	41,566	50,998	60,086
Total Imperviousness (percent)	1.0	32.4	39.8	46.1
CN	56	79	81	82
Slope (percent)	10.3	10.3	10.3	10.3
85th Percentile Annual Rainfall (inches)	1.20	1.20	1.32	1.37
1-Year, 24-Hour Rainfall (inches)	3.36	3.36	3.60	3.73
25-Year, 24-Hour Rainfall (inches)	6.06	6.06	6.69	7.01
WQv (cubic feet)	10.68 M	61.78 M	99.70 M	138.99 M
CPv (cubic feet)	28.18 M	137.42 M	207.30 M	271.14 M
OFPv (cubic feet)	-	868.91 M	1,361.91 M	1,798.32 M

Note: M = million

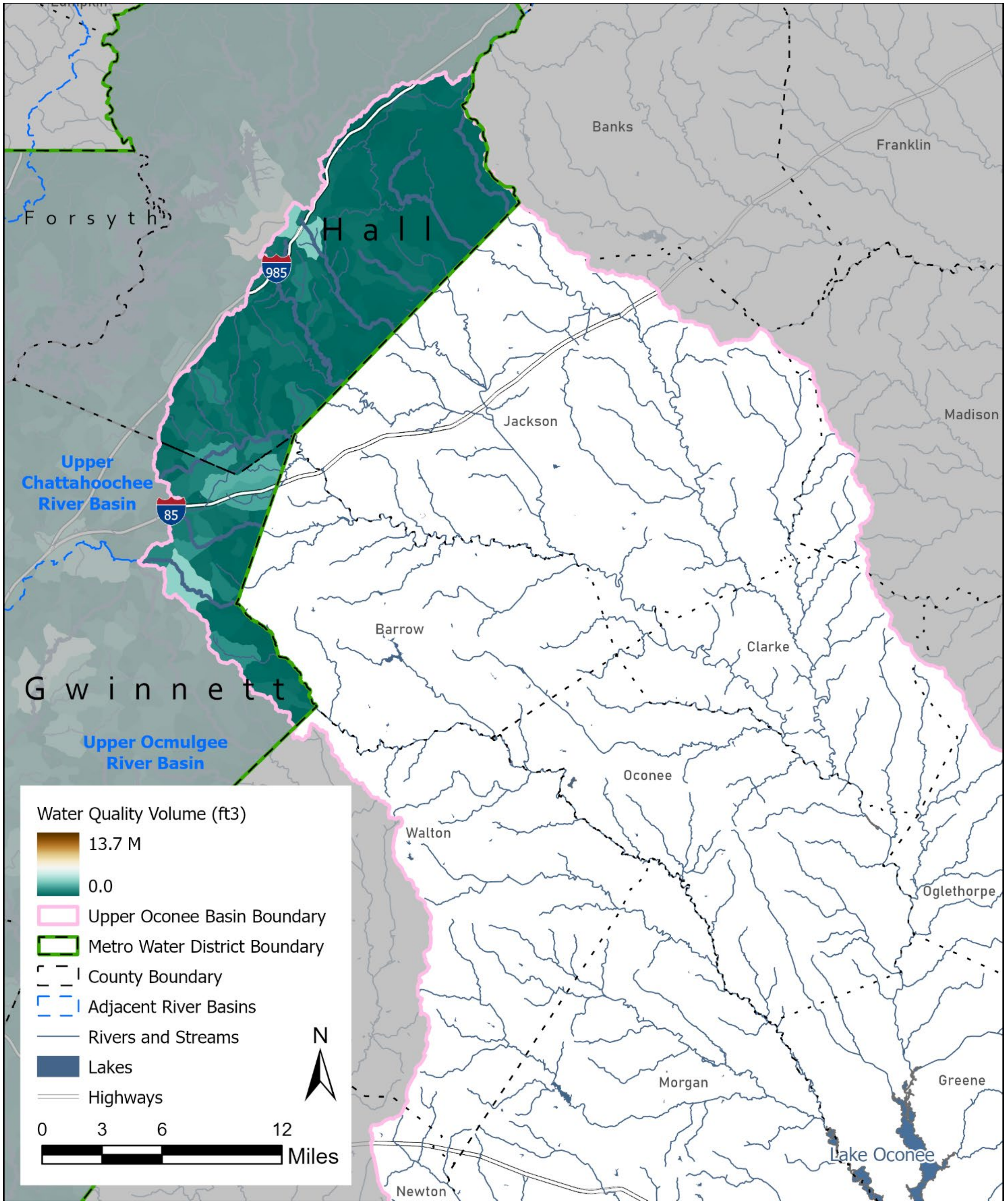

Figure OC-6. Estimated Water Quality Runoff Volume per Subcatchment – 2019

Management Issues and Recommended Strategies

Table OC-8 outlines management issues and strategies for the Upper Oconee River Basin within the District. The recommended strategies presented in Table OC-8 are based on data presented within this River Basin Profile. These strategies are provided to further describe the commonality of causes and potential solutions to the watershed issues. They provide a foundation for guidance but are not presented here as mandatory requirements.

Table OC-8. Upper Oconee River Basin Management Issues and Recommended Strategies

Management Issue	Description	Recommended Strategies
Increases in impervious cover (new development)	Increases in impervious cover can lead to a change in the hydrologic regime of a watershed by causing more intense, high-velocity stormwater flows and increased erosion and sedimentation.	• Manage nonpoint source pollution. • Adopt and enforce the post-construction stormwater control ordinance and use of Georgia Stormwater Management Manual design standards. • Recommend watershed improvement projects, such as stream restoration and streambank stabilization, in areas with failing streambanks to reduce instream sediment load contributions.
Inadequate stormwater controls on existing impervious cover	Much of the development in the basin occurred prior to current Georgia Stormwater Management Manual design standards. Limited resources and cost of maintaining and repairing stormwater infrastructure. Varying local strategies of funding stormwater management.	• Implement an asset management program to identify and prioritize maintenance and capital improvement projects to maximize benefit. • Consider updating stormwater controls during redevelopment. • Identify opportunities for watershed improvement projects to retrofit or install updated stormwater controls, green infrastructure, stormwater treatment, or other controls. • Consider dedicated funding sources, such as stormwater utilities, and seek opportunities for grants, loans, and partnerships.
Biota TMDLs	31% of the assessed benthic macroinvertebrate communities are impaired. Biota impairment in this basin is the result of high sediment loads, primarily associated with existing development with inadequate stormwater controls, which is a concern for drinking water source supplies, biota, and recreation.	• Enforce post-construction stormwater ordinance on new development and seek opportunities to retrofit stormwater controls to maximize water quality and channel protection. • Watershed improvement projects, such as stream restoration and streambank stabilization are recommended in areas with failing streambanks to reduce instream sediment load contributions.

Table OC-8. Upper Oconee River Basin Management Issues and Recommended Strategies

Management Issue	Description	Recommended Strategies
Bacteria TMDLs	32% of assessed stream segments in the Upper Oconee River Basin (within the District) are listed for fecal coliform.	• Identify bacteria sources through inspections, monitoring, source tracing, and stream walks. • Educate public on pollution prevention, proper septic system maintenance, and reporting a potential illicit discharge. • Address fecal coliform bacteria contributions from sanitary sewer overflows. • Regular maintenance to ensure proper functioning of decentralized systems (such as septic tanks). • Participate in efforts to educate agricultural stakeholders about the importance of implementing Best Management Practices for Georgia Agriculture Manual for animal production facilities (poultry) and grazing operations. • Coordinate with Georgia Department of Agriculture Livestock/Poultry Section on inspections, complaint investigations, nutrient management plan reviews, permit administrative support, and enforcement assistance (Georgia EPD, 2014).
Lake Management	Lake Oconee is located downstream from the District within this basin, but there are other public and privately held and managed lakes that play a significant role in meeting designated uses and downstream hydrologic regimes and water quality.	• Develop a central inventory of lakes, ownership and management practices to facilitate pollutant source identification both up and downstream of the lake. • Coordinate available water quality data and management activities for inventoried lakes. • Implement shoreline protection and upstream sediment management to prevent excessive nutrients and sedimentation within the lake. • Facilitate proper maintenance and management, particularly of small lakes by providing resources, links, or other materials to assist with periodic activities such as inspections, water quality sampling, or dredging. • Conduct public education and involvement activities to promote watershed stewardship to protect lake quality.

Identify Indicators and Monitoring to Measure Implementation Success

A critical component of any watershed management program is the ability to assess progress and determine if management strategies are effectively addressing issues. The Plan includes implementation actions related to watershed monitoring and conducting conditions assessments to evaluate implementation success. These implementation actions include long-term ambient trend monitoring (WATERSHED-10), as well as resource-specific implementation actions for Watershed Improvement (WATERSHED-8). Communities may choose to conduct project-specific monitoring associated with a watershed improvement project, such as biological or geomorphological monitoring to evaluate success.

As included in EPA (2008), a monitoring program should "…track progress in meeting load reduction goals and attaining water quality standards and other goals. Measurable progress is critical to ensuring continued support of watershed projects, and progress is best demonstrated with the use of monitoring data that accurately reflect water quality conditions relevant to the identified problems. Monitoring programs should include baseline (before), project-specific (during), and post-project (after) monitoring."

Some potential indicators to measure implementation success for the Upper Oconee River Basin are listed as follows, but this list is not exhaustive:

- Select representative monitoring stations within the watershed to monitor for pollutants of concern and other water quality or biological parameters.
- Use USGS stream gage data or collect data to establish stream stage-discharge relationships and calculate or model water quality pollutant loads and potential reductions.
- Calculate or model improvements to hydrologic and hydraulic conditions based on structural project implementation.
- Estimate streambank stability and habitat improvement based on annual stream cross section surveys and bank erosion monitoring.
- Conduct stream walks or structure inspections to inventory structure condition and performance, streambank stability, and riparian condition over time.
- Conduct project monitoring to establish pre-, during-, and post-project conditions, as well as upstream/downstream monitoring during the same time period to reduce the effects of environmental variability.
- To determine if water quality degradation is being prevented, conduct GIS analysis to identify high-activity areas of a watershed using aerial overlays, work orders, facility inspection, erosion and sedimentation control, or new construction inspection data. Identify if monitoring data and GIS data follow similar patterns.
- Track number, location, size, or features (that is, drainage area treated or linear feet of restored stream) of watershed improvement, green infrastructure, or other nonpoint source reduction projects.
- Compare percentage of TMDL stream segments over time.
- Track implementation actions by jurisdiction within the basin, and their measured effectiveness.
- Track enforcement actions by category and location.
- Track stream buffer variances and local permits issued.
- Conduct public surveys for pollution prevention awareness or education effectiveness, particularly pre- and post-data associated with an education event.
- Compare existing water quality modeled loads against future water quality modeled loads.

ATTACHMENT 9

Upper Tallapoosa River Basin Profile

A small portion of southwest Paulding County is drained by the headwaters of the Tallapoosa River, which originates in the southwestern corner of the county and flows west outside of the District. This portion of the Tallapoosa River Basin, at 37 square miles, represents only one percent of the total District area while only presenting three percent of the overall Upper Tallapoosa River Hydrologic Unit Code (HUC)-8 Basin. There are no incorporated areas within this river basin; however, the Upper Tallapoosa River does supply drinking water to the City of Villa Rica in the western portion of Douglas County within the District (ARC, 2010).

Physical and Natural Features

Geography

The Upper Tallapoosa River Basin is located on the western border of the District, encompassing about 37 square miles (Figure UT-1). The small area of the Upper Tallapoosa River Basin within the District boundary is located entirely within the Piedmont province and includes the Central Uplands district. The area is characterized by a well-dissected uplands with rounded interstream areas. Prominent topographic features generally reflect erosional and weathering resistance of the underlying geologic units. Stream patterns are predominantly dendritic flow ways (Clark and Zisa, 1976).

Hydrology and Soils

This small watershed is included in one 8-digit HUC, one 10-digit HUC, and three 12-digit HUCs (Brooks Creek, Hannah Swamp, and Water Mill Creek). The Upper Tallapoosa River Basin is a portion of the Apalachicola-Coosa-Tallapoosa River Basin; as such, future water allocations and minimum instream flows continue to be subject to litigation between the states of Georgia and Alabama.

The Upper Tallapoosa River Basin portion of the District lies completely within the Piedmont geologic province. The aquifers in this province are in crystalline rocks that crop out in the northern portion of the basin and extend to the fall line. The rock is overlain with deposits of weathered, unconsolidated rock debris (regolith) that make up the available aquifer spaces. These deposits are thickest in valleys but generally provide insufficient yield for uses other than very low-density residential and thus surface water is the primary source of potable water for the District. An assessment of the availability of groundwater resources in select prioritized aquifers of Georgia was completed as part of Georgia's Comprehensive State-wide Water Management Plan (Georgia EPD, 2010). None of the Upper Tallapoosa River Basin within the District was selected as a priority aquifer for assessment.

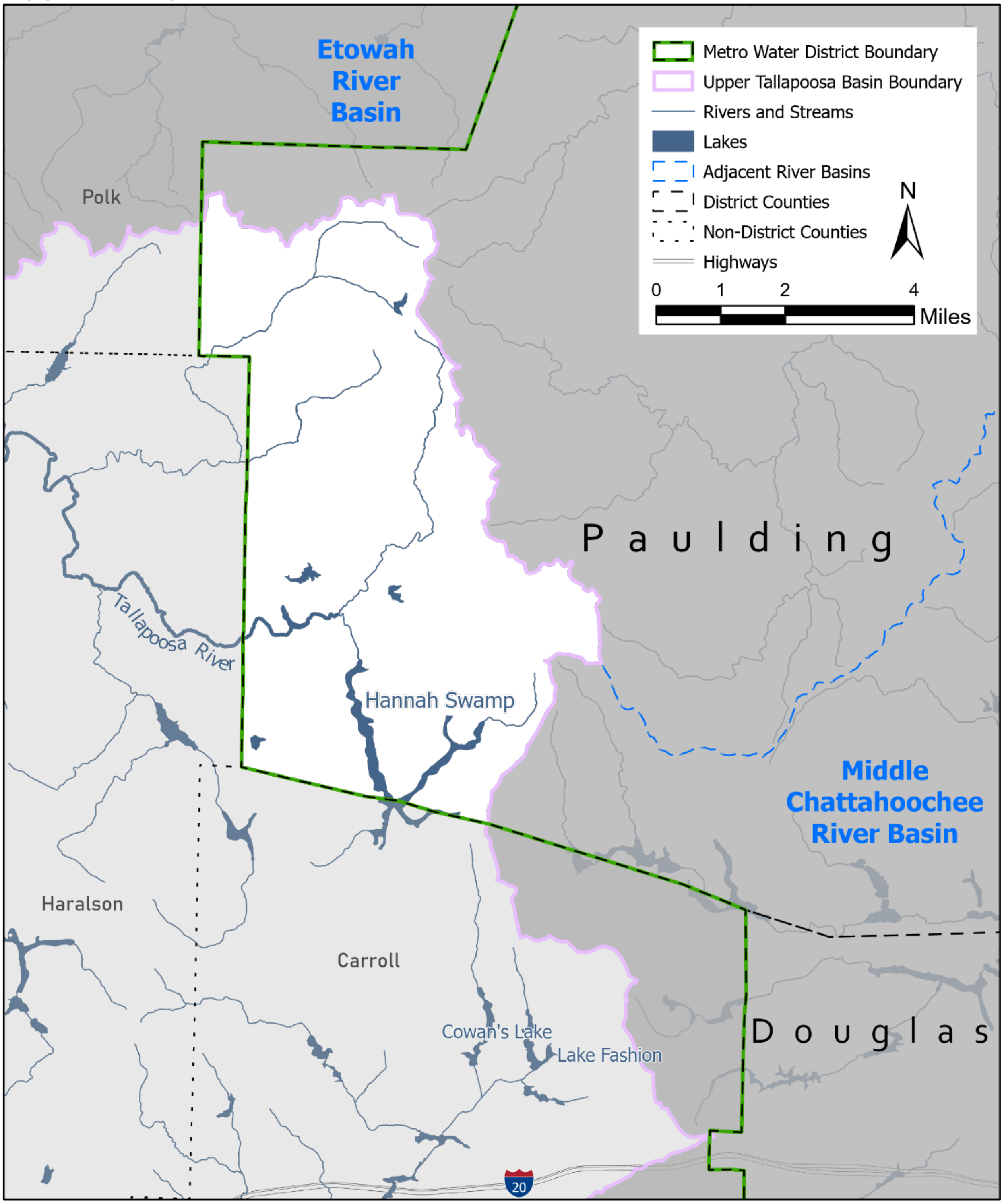

Figure UT-1. Upper Tallapoosa Basin Within the District

The Georgia Geologic Survey Hydrologic Atlas 18 database identifies approximately 28 areas, representing about four percent of the District, that are likely to contain unconfined aquifers, and 79 areas, representing about 12 percent of the District, that are likely to contain thick soils considered to be an indicator of significant groundwater recharge areas. The recharge areas were mapped based on outcrop area, lithology, soil type and thickness, slope, density of lithological contacts, geologic structure, the presence of karst, and potentiometric surfaces. There are approximately 16 square miles—16 percent of the basin area within the District—of potential recharge areas within the Upper Tallapoosa River Basin (Table UT-1). There are no significant impoundments currently within this portion of the District.

Table UT-1. Groundwater Recharge Areas within the Upper Tallapoosa River Basin

Recharge Area Type	County	Square Miles of Recharge Area Type within County
Probable Areas of Thick Soil	Paulding	16
Total Recharge Areas		16*

* Minor differences in mapping methodologies may cause basin totals to vary slightly from county totals.

There are three soil associations that describe the soil types in the Upper Tallapoosa River Basin: Cecil-Madison-Pacolet, Madison-Davidson-Pacolet, and Tallapoosa-Chewacla-Madison soils that start in west Paulding County (Table UT-2). The Cecil-Madison-Pacolet and Madison-Davidson-Pacolet associations are the most abundant, with the former types associated with moderate rolling hills and the latter with steeper terrain. These soils are well-drained and highly weathered, having a red to yellowish-red subsoil (Brock, 1977; Jordan et al., 1973; Murphy, 1979; Thomas and Tate, 1973; USDA, 1976; Thomas, 1982; Wells, 1961; Robertson et al., 1960; USDA, 1958; Tate, 1967; Thomas and Tate, 1964).
The Tallapoosa-Chewacla-Madison association was found along the banks of Water Mill Creek, particularly the headwaters of the Tallapoosa River. These soils are variable and less well-drained than soils on higher elevations (Thomas and Tate, 1973; USDA, 1976; Thomas, 1982; USDA, 1958).

Table UT-2. Major Soil Associations within the Upper Tallapoosa River Basin

Soil Association	Significance to Watershed Management
Cecil-Madison-Pacolet	**Characteristics:** Associated with moderate rolling hills, well-drained, highly weathered. **Significance to Watershed Management:** Sloping surfaces may be more susceptible to increased erosion due to stormwater runoff velocities from impervious surfaces; well-drained soils may be more permeable, which increases infiltration capacity in areas without impervious cover, also may improve feasibility for infiltration practices.
Madison-Davidson-Pacolet	**Characteristics:** Associated with steep terrain, well-drained, highly weathered. **Significance to Watershed Management:** Steep terrain may be more susceptible to increased erosion due to stormwater runoff velocities from impervious surfaces; well-drained soils may be more feasible for infiltration practices.
Tallapoosa-Chewacla-Madison	**Characteristics:** Silty sand, clayey-sand, clay, steep terrain, well-drained, weathered material. **Significance to Watershed Management:** Limited capacity for infiltration due to shallow bedrock and steep slopes.

Protected Species

Protected species include all species listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS) or National Marine Fisheries Service, and those listed as endangered, threatened, rare, or unusual by the State of Georgia. The USFWS also may designate critical habitat for a federally listed species, which provides protection for the habitat as well as the species itself. The current listings of these endangered species, including their status, range, and habitat, can be accessed via the USFWS's automated Information, Planning and Conservation System (IPaC, http://ecos.fws.gov/ipac/).

The District is home to a number of species that are considered threatened or endangered. Protecting watershed health is more than protecting water quality; it also includes protection of biological resources. Within the District, there are a number of protected animal species that spend all or part of their life cycle in rivers and streams or depend on streams for a significant portion of their life history. In addition, there are protected plants that are either aquatic or semi-aquatic and grow within or along the margins of rivers and streams. Table UT-3 lists the 12 protected species potentially found within Douglas or Paulding County.

Table UT-3. Aquatic and Semi-Aquatic Protected Species in the Upper Tallapoosa River Basin

Fauna Type	Common Name	Status*	Douglas	Paulding
Bird	Bald Eagle	T	X	
Fish	Cherokee darter	<u>T</u>		X
	Highscale shiner	R		X
	Lined chub	R		X
	Lipstick darter	E		X
	Muscadine darter	R		X
	Tallapoosa darter	R		X
	Etowah darter	<u>E</u>		X
Invertebrate	Etowah crayfish	T		X
	Tallapoosa crayfish	R		X
	Finelined pocketbook	<u>T</u>		X
Mammal	Northern long-eared bat	<u>T</u>	X	X

* Status that is not underlined is listed in Georgia. <u>Underlined status</u> is federally listed.

R = Rare
E = Endangered
T = Threatened

Trout Streams

Trout streams are classified in accordance with the primary and secondary designations and criteria defined in Section 15 of Georgia's Water Use Classifications and Water Quality Standards (391-3-6-.03). There are no primary trout streams or secondary trout streams located within the Upper Tallapoosa River Basin.

Land Use and Surface Water Quality

Drinking Water Supply

As described in the Water Supply and Water Conservation Plan, the Upper Tallapoosa River Basin is the primary drinking water supply source for the City of Villa Rica in the western portion of Douglas County, (Table UT-4). Figure UT-2 illustrates that the contributing water supply watershed for Villa Rica is located outside of the District in Carroll County. Figure UT-2 also shows that portions of the mainstem of the Tallapoosa River in Paulding County are designated to meet State drinking water criteria.

Table UT-4. Upper Tallapoosa River Basin Drinking Water Supply Sources

Water Supply Source	Owner/Operator Using Source
Lake Fashion	City of Villa Rica Public Works Department
Cowan's Lake	City of Villa Rica Public Works Department

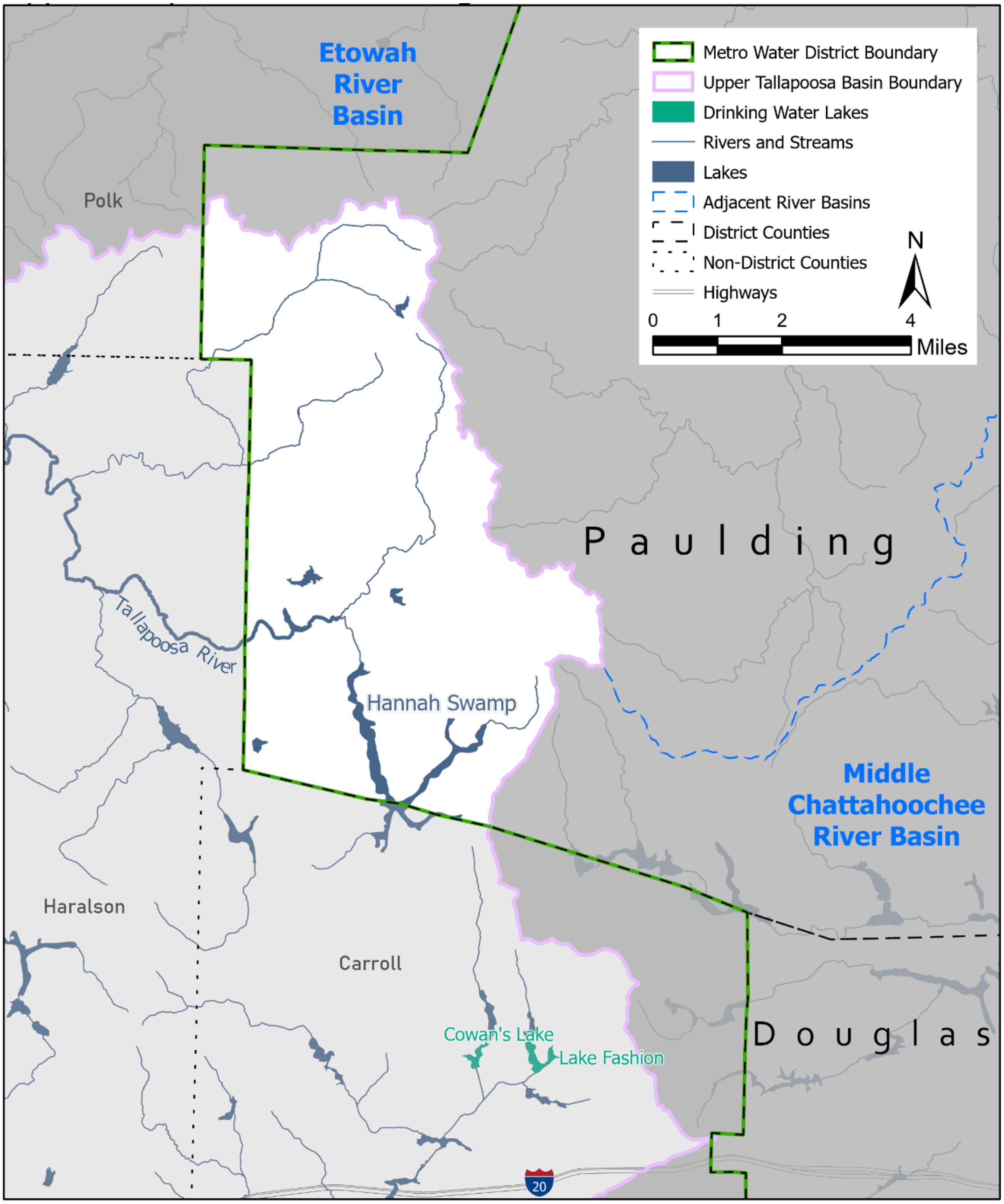

Figure UT-2. Upper Tallapoosa Basin Drinking Water

Source water assessments were performed for all drinking water supplies within the Upper Tallapoosa River Basin as required by the U.S. Environmental Protection Agency (EPA). The source water assessments determined the potential for pollution based on individual source and nonpoint source pollution within drinking water supply watersheds and assigned a susceptibility ranking to each drinking water source. The susceptibility rankings throughout the basin were low for Cowan's Lake and Lake Fashion.

Land Cover/Land Use

The northern extent of the Upper Tallapoosa River Basin is predominantly rural in character within Paulding County. Overall, 15 percent of the Upper Tallapoosa River Basin within the District is developed, 56 percent of the area is forested, and 29 percent of the area falls within the remaining land cover classes (Table UT-5 and Figure UT-3).

Table UT-5. Upper Tallapoosa River Basin Land Cover / Land Use within the District

Land Cover/Land Use	Area (Square Miles)	2019 Existing (%)
Barren Land (Rock/Sand/Clay)	0.06	0.15
Deciduous Forest	11.19	30.28
Developed, High Intensity	0.05	0.14
Developed, Low Intensity	1.68	4.54
Developed, Medium Intensity	0.31	0.84
Developed, Open Space	3.50	9.49
Emergent Herbaceous Wetlands	0.01	0.04
Evergreen Forest	6.77	18.32
Grassland/Herbaceous	1.07	2.90
Mixed Forest	2.81	7.62
Open Water	0.27	0.73
Pasture/Hay	7.25	19.62
Shrub/Scrub	0.93	2.53
Woody Wetlands	1.04	2.80
Undeveloped	***31.40***	***85.00***
Developed	***5.54***	***15.00***
Total	**36.94**	**100**

Notes:

Developed = High Intensity, Low Intensity, Medium Intensity, and Open Space.
Undeveloped = land cover classes not described as Developed.

Data Source:

Aggregated Land Cover categories from U.S. Geological Survey (USGS) National Land Cover Database (NLCD), 2019.

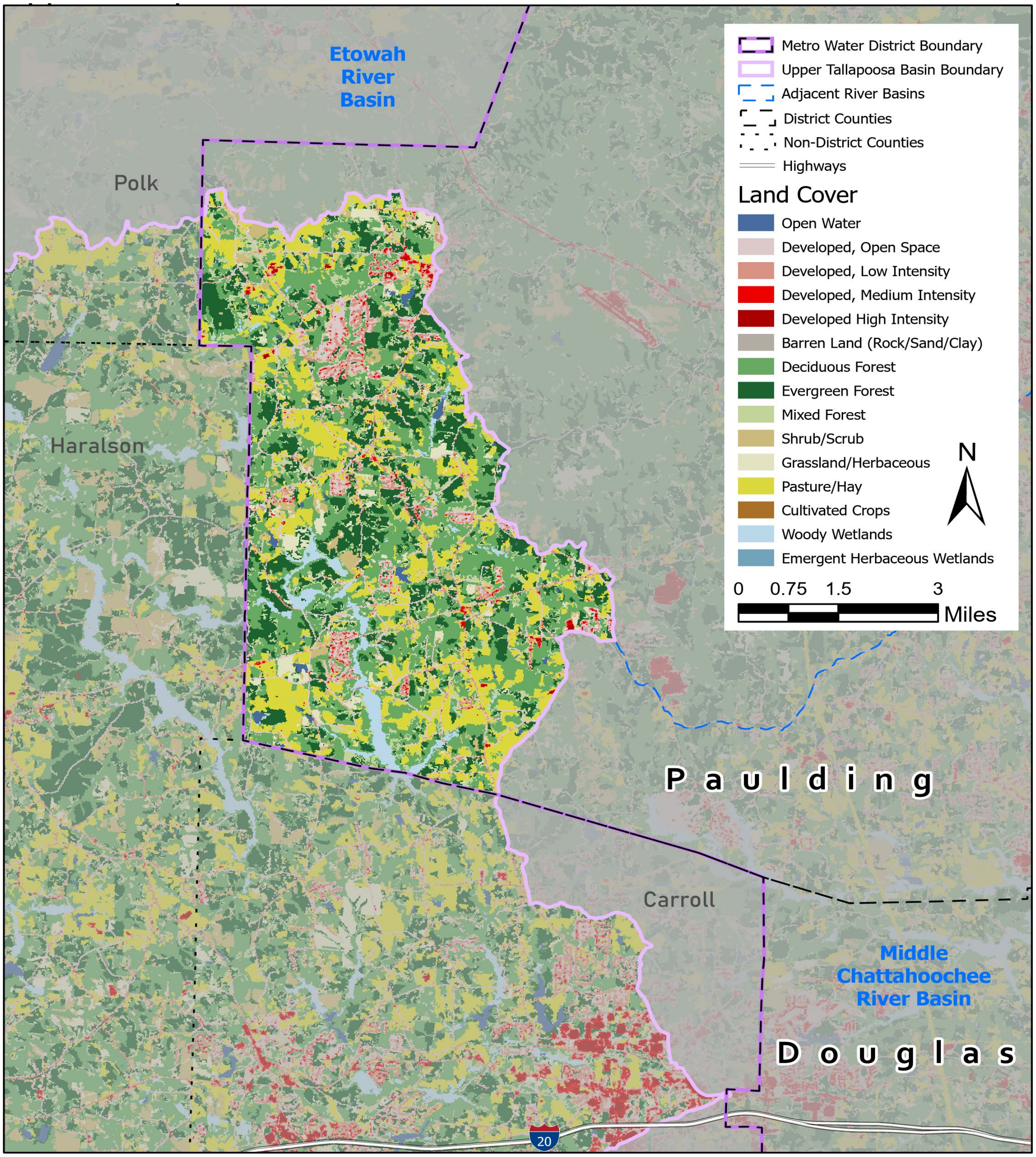

Figure UT-3. Upper Tallapoosa Land Cover
Source: 2019 NLCD

Effective Impervious Areas

The level of watershed imperviousness has long been linked to impacts on changes in hydrologic regimes that lead to increased intensity and frequency of peak stormwater flows, which affect stream stability, water quality, and aquatic habitat and biotic community integrity. In general, the most sensitive aquatic organisms are affected at impervious levels of greater than 10 percent. Between 11 and 25 percent of most stream communities become impacted, and over 25 percent of streams are generally no longer able to support viable biotic communities (Schueler, 2001).

Impervious surfaces (such as roofs, streets, parking lots) have a significantly different hydrologic response from pervious surfaces (lawns, forests); therefore, it is important to clearly define terms and assumptions related to the calculation of pervious and impervious areas for the purposes of watershed management. “Total impervious area” quantifies all of the land surfaces impervious to rainfall for the particular land cover category while “effective impervious area” (EIA) refers to the directly connected impervious area used for water quality and stormwater conveyance modeling. For the 2003 District-wide Plan, EIA values were initially defined based on previous studies, including the local watershed assessments, and then further refined based on calibration using available water quality data. For the 2022 District-wide Plan, the EIA of the HUC-12 subwatersheds within the District was calculated using a mathematical model developed by Sutherland for EPA based on land cover data from the 2019 USGS National Land Cover Database.

Of the three HUC-12s within the District portion of Upper Tallapoosa River Basin, none had an EIA greater than 10 percent. The small portion of the Upper Tallapoosa River Basin does not include major transportation infrastructure that increases the likelihood for impervious surfaces that contribute to impacts to stream stability. The EIA of each HUC-12 within the District portion of Upper Tallapoosa River Basin is shown on Figure UT-4.

Wastewater Management

Permitted Wastewater Facility Service Areas

There is one municipal wastewater treatment facility in the Upper Tallapoosa River Basin with a permitted capacity of 2.2 maximum monthly flow – million gallons per day (MMF-MGD). Additionally, there are no non-municipal wastewater treatment facilities in the Upper Tallapoosa River Basin.

Combined-sewer Overflow Areas

There are no combined-sewer overflow areas in the Upper Tallapoosa River Basin.

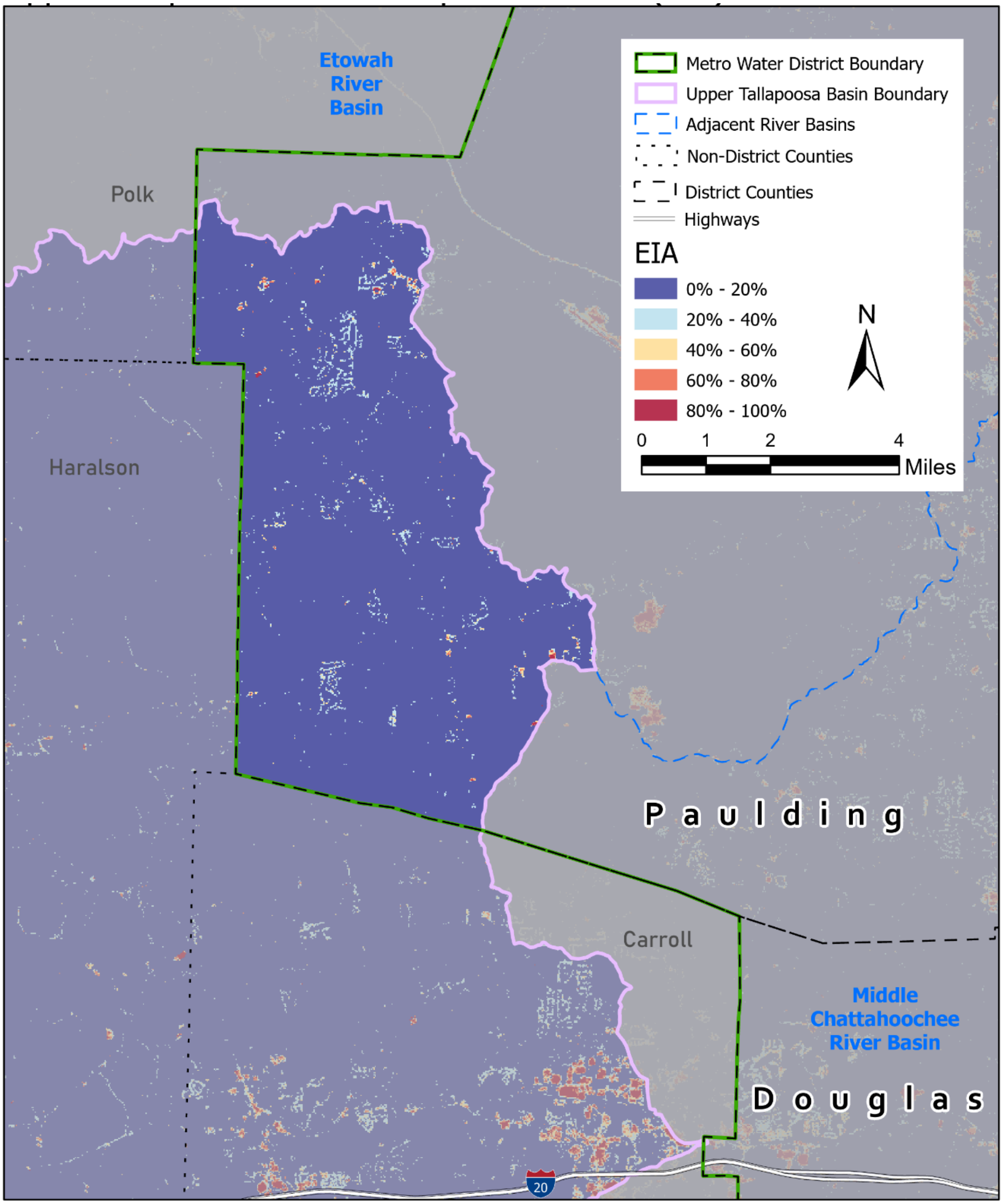

Figure UT-4. Upper Tallapoosa Effective Impervious Area

Impaired Water Bodies

Georgia Environmental Protection Division (Georgia EPD) establishes water quality standards for the state's surface waters. Section 303(d) of the federal Clean Water Act requires that all states list water bodies that do not meet water quality standards. Georgia EPD publishes a biennial list of streams that do not meet State water quality standards, referred to as the 303(d)/305(b) list. If a water body does not support its designated use (drinking, recreation, fishing, wild/scenic rivers, or coastal fishing) because conditions violate water quality standards, it is considered an "impaired" stream or water body.

Georgia EPD determines whether a water body is supporting its designated uses by collecting water quality data and comparing it against State water quality criteria. Georgia EPD describes their listing methodology and "preferred minimum dataset" at http://epd.georgia.gov/georgia-305b303d-list-documents. This methodology is important to understand the sample size, extent, and timeframe of the dataset that was used to list a water body. Feedback can be given to Georgia EPD if additional data or information are known that may affect future sampling or listing evaluations.

The District portion of the Upper Tallapoosa River Basin contains 86 stream miles, 11 of which were assessed for impairments. A total of three stream miles, three percent of total streams or 27 percent of assessed streams, did not meet State water quality standards based on the 2020 303(d) list. The streams listed as "not supporting" are summarized in Table UT-6 by parameter and graphically shown in Figure UT-5. Mud Creek is listed for biota impairment.

Table UT-6. Upper Tallapoosa River Basin Summary of Impaired Streams

Criterion Violated	Miles of Stream	% of 2020 Assessed Streams	% of Total Stream Mileage
Biota (fish community)	3	27	3
Total stream mileage listed	3	27	3
Total stream mileage assessed for possible impairment	11		
Total stream mileage in basin	86		

* Several streams are listed for violations of multiple parameters within the same stream segment; therefore, the total of impaired miles by parameter will not equal the total stream mileage of impaired streams.

Mud Creek is the only stream segment within the District portion of the Upper Tallapoosa River Basin that does not meet water quality standards for biota, a result of nonpoint source pollution. Biota listings typically indicate high sediment loads in streams, which decreases habitat quality for benthic macroinvertebrates and fish. Sediment sources include runoff from construction sites as well as from streambank erosion due to accelerated streamflow velocities from impervious cover associated with urbanization.

Total maximum daily loads (TMDLs) and TMDL implementation plans have been developed to help jurisdictions address impaired streams and specific parameters of concern. More information on specific TMDLs in the Upper Tallapoosa River Basin can be found on the Georgia EPD website.

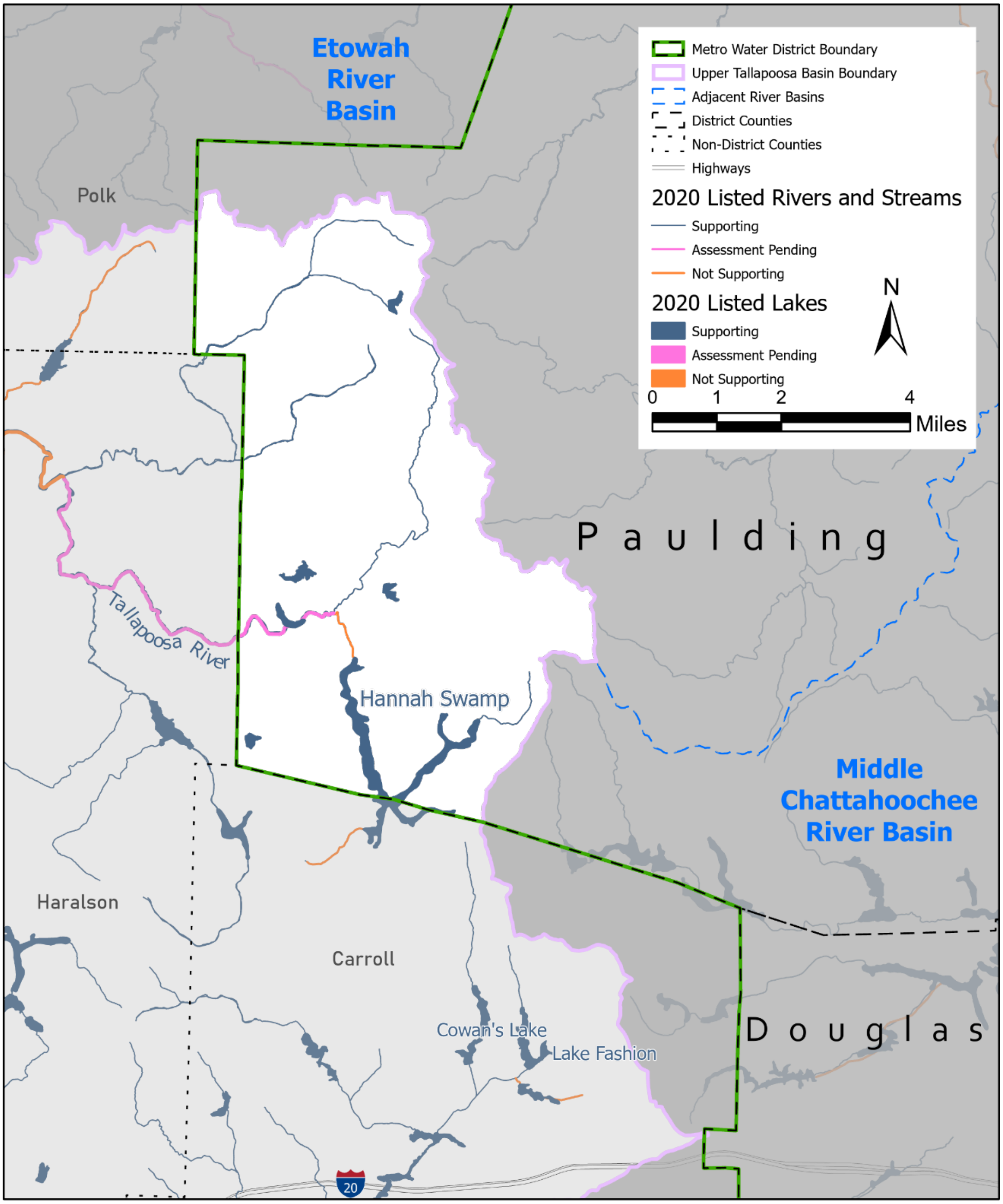

Figure UT-5. Upper Tallapoosa Basin 305(b)/303(d) Listed Waters

Management Issues and Recommendations

Basin-level Summary

Land development affects the physical, chemical, and biological conditions of the District's watersheds, waterways, and water resources. Based on the Stormwater Forecast analysis, development patterns in the District over the past century have resulted in substantial changes to watershed characteristics. Developed area is projected to increase from 3,456 acres in the current (2019) condition to 8,398 acres in 2040, a 143 percent increase. If current land use policy and recent development patterns continue, future estimates of land use are expected to intensify, with the weighted average curve number (CN) value potentially reaching approximately 84 and total imperviousness potentially reaching over 43 percent by 2040, based on the future developed area.

Precipitation rates are also expected to increase based on the future precipitation study results for the District. By 2040, the basin-wide weighted average 85th percentile annual rainfall; 1-year, 24-hour rainfall; and 25-year, 24-hour rainfall events are estimated to potentially increase by 14 percent, 11 percent, and 16 percent, respectively. These changes to watershed characteristics and rainfall intensity will have a direct impact on the total potential runoff management volume generated from development that may require additional management from structural control measures.

Runoff for the three post-construction volumes (Water Quality Volume [WQv], Channel Protection Volume [CPv], and Overbank Flood Protection Volume [OFPv]) were calculated for 46 individual subcatchments in the basin. In 2019, a total of 3.2 million cubic feet of runoff was estimated in the basin for the WQv, 11.23 million cubic feet for the CPv, and 68.48 million cubic feet for the OFPv, based on 3,456 acres of development. Additional information is provided in the following summary table (Table UT-7) and figure of the 2019 WQv for the basin (Figure UT-6).

Table UT-7. Upper Tallapoosa River Basin Watershed Characteristics at and Total Potential Runoff Management Volumes

	Predevelopment	2019	2030	2040
Subcatchments (count)	46	46	46	46
Total area (acres)	23,640	23,640	23,640	23,640
Developed area (acres)	3,456	3,456	4,959	8,398
Total imperviousness (percent)	1.0	18.1	29.0	43.8
CN	56	78	81	84
Slope (percent)	6.0	6.0	6.0	6.0
85th percentile annual rainfall (inches)	1.20	1.20	1.32	1.37
1-year, 24-hour rainfall (inches)	3.42	3.42	3.67	3.79
25-year, 24-hour rainfall (inches)	6.22	6.22	6.88	7.21
WQv (cubic feet)	0.89 M	3.20 M	7.38 M	18.54 M
CPv (cubic feet)	2.52 M	11.23 M	20.93 M	41.67 M
OFPv (cubic feet)	-	68.48 M	133.65 M	272.77 M

Note:

M = million

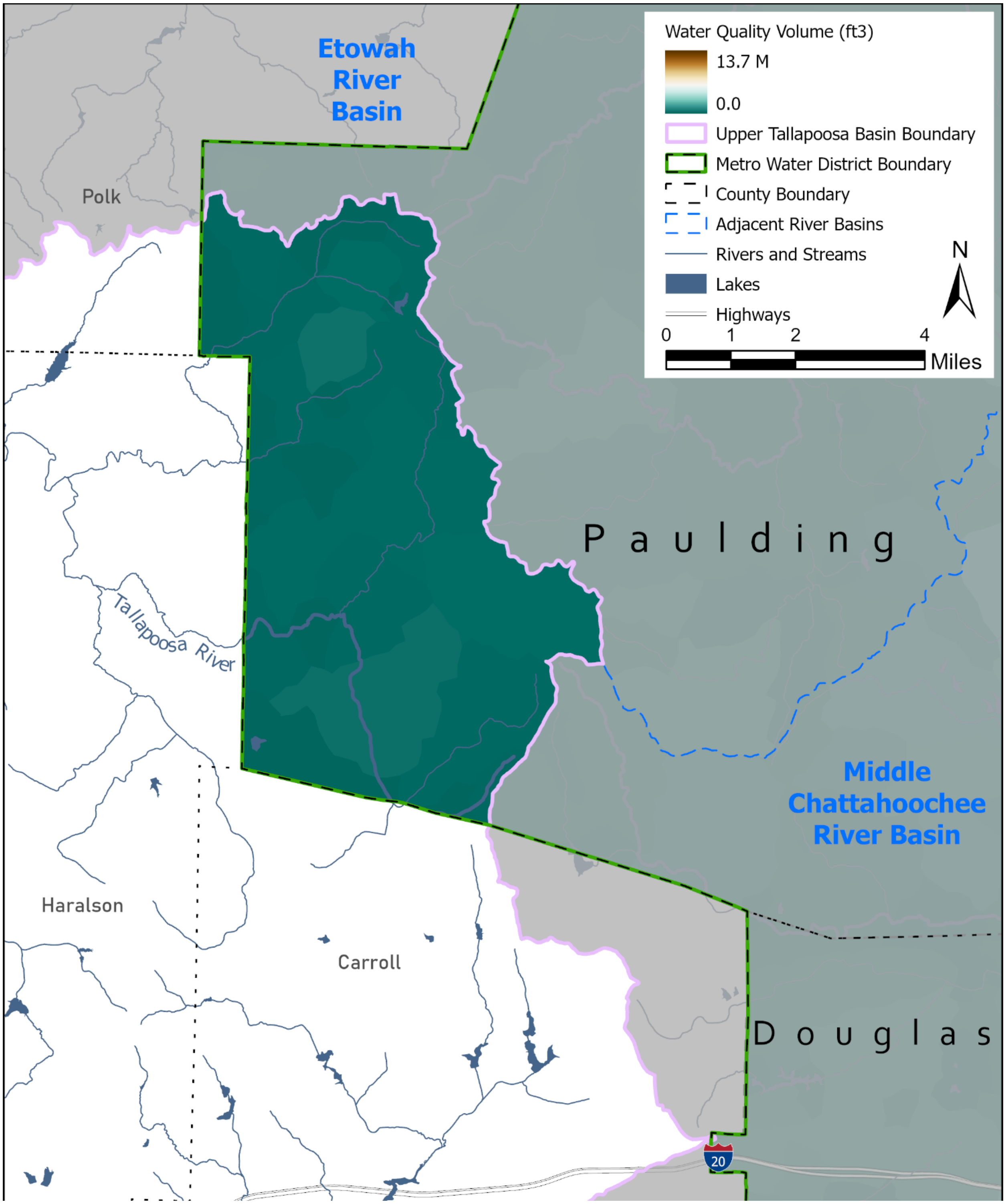

Figure UT-6. Estimated Water Quality Runoff Volume per Subcatchment – 2019

Management Issues and Recommended Strategies

Table UT-8 outlines management issues and strategies for the Upper Tallapoosa River Basin within the District. The recommended strategies presented in Table UT-8 are based on data presented within this River Basin Profile. These strategies are provided to further describe the commonality of causes and potential solutions to the watershed issues. They provide a foundation for guidance but are not presented here as mandatory requirements.

Table UT-8. Upper Tallapoosa River Basin Management Issues and Recommended Strategies

Management Issue	Description	Recommended Strategies
Increases in impervious cover (new development)	Increases in impervious cover can lead to a change in the hydrologic regime of a watershed by causing more intense, high-velocity stormwater flows and increased erosion and sedimentation While none of the HUC-12 watersheds currently have an EIA of > 10 percent, new development continues to encroach on this portion of Paulding County due its proximity to Interstate 20.	• Manage nonpoint source pollution. • Adopt and enforce the post-construction stormwater control ordinance and use of Georgia Stormwater Management Manual design standards. • Watershed improvement projects, such as stream restoration and streambank stabilization, are recommended in areas with failing streambanks to reduce instream sediment load contributions.
Biota TMDLs	27% of assessed instream fish communities were impaired. Biota impairment in this basin is the result of high sediment loads, primarily associated with existing development with inadequate stormwater controls, which is a concern for drinking water source supplies, biota, and recreation.	• Enforce post-construction stormwater ordinance on new development and seek opportunities to retrofit stormwater controls to maximize water quality and channel protection. • Watershed improvement projects, such as stream restoration and streambank stabilization, are recommended in areas with failing streambanks to reduce instream sediment load contributions. • Participate in efforts to educate agricultural stakeholders about the importance of implementing the *Best Management Practices for Georgia Agriculture Manual* for animal production facilities (poultry) and grazing operations. • Coordinate with Georgia Department of Agriculture Livestock/Poultry Section on inspections, complaint investigations, nutrient management plan reviews, and permit administrative support.
Lake management	While there are no major lakes or reservoirs within the District in the basin there are other public and privately-held and managed lakes that play a significant role in meeting designated uses and downstream hydrologic regimes and water quality. There are also downstream lakes within this basin outside the District.	• Develop a central inventory of lakes, ownership and management practices to facilitate pollutant source identification both up and downstream of the lake. • Coordinate available water quality data and management activities for inventoried lakes. • Implement shoreline protection and upstream sediment management to prevent excessive nutrients and sedimentation within the lake. • Facilitate proper maintenance and management, particularly of small lakes by providing resources, links, or other materials to assist with periodic activities such as inspections, water quality sampling, or dredging. • Conduct public education and involvement activities to promote watershed stewardship to protect lake quality.

Identify Indicators and Monitoring to Measure Implementation Success

A critical component of any watershed management program is the ability to assess progress and determine if management strategies are effectively addressing issues. The Plan includes implementation actions related to watershed monitoring and conducting conditions assessments to evaluate implementation success. These implementation actions include long-term ambient trend monitoring (WATERSHED-10) and habitat and biological monitoring (5.F.2), as well as resource-specific implementation actions for Watershed Improvement (WATERSHED-8). Communities may choose to conduct project-specific monitoring associated with a watershed improvement project, such as biological or geomorphological monitoring to evaluate success.

As included in EPA (2008), a monitoring program should "…track progress in meeting load reduction goals and attaining water quality standards and other goals. Measurable progress is critical to ensuring continued support of watershed projects, and progress is best demonstrated with the use of monitoring data that accurately reflect water quality conditions relevant to the identified problems. Monitoring programs should include baseline (before), project-specific (during), and post-project (after) monitoring."

Some potential indicators to measure implementation success for the Upper Tallapoosa River Basin are listed as follows, but this list is not exhaustive:

- Select representative monitoring stations within the watershed to monitor for pollutants of concern and other water quality or biological parameters.
- Use USGS stream gage data or collect data to establish stream stage-discharge relationships and calculate or model water quality pollutant loads and potential reductions.
- Calculate or model improvements to hydrologic and hydraulic conditions based on structural project implementation.
- Estimate streambank stability and habitat improvement based on annual stream cross section surveys and bank erosion monitoring.
- Conduct stream walks or structure inspections to inventory structure condition and performance, streambank stability, and riparian condition over time.
- Conduct project monitoring to establish pre-, during-, and post-project conditions, as well as upstream/downstream monitoring during the same time period to reduce the effects of environmental variability.
- To determine if water quality degradation is being prevented, conduct GIS analysis to identify high-activity areas of a watershed using aerial overlays, work orders, facility inspection, erosion and sedimentation control, or new construction inspection data. Identify if monitoring data and GIS data follow similar patterns.
- Track number, location, size, or features (that is, drainage area treated or linear feet of restored stream) of watershed improvement, green infrastructure, or other nonpoint source reduction projects.
- Compare percentage of TMDL stream segments over time.
- Track implementation actions by jurisdiction within the basin, and their measured effectiveness.
- Track enforcement actions by category and location.
- Track stream buffer variances and local permits issued.
- Conduct public surveys for pollution prevention awareness or education effectiveness, particularly pre- and post-data associated with an education event.
- Compare existing water quality modeled loads against future water quality modeled loads.