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 (Metro Water District) and encompasses about 208 square miles, or four percent, of the total District area (Figure A-1). 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 (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 (Metro Water 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 Metro Water 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 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.

The Metro Water 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 Metro Water District. The Georgia Geologic Survey Hydrologic Atlas 18 database identifies approximately 28 areas, representing about 4 percent of the Metro Water District, likely to contain unconfined aquifers and 79 areas, representing about 12 percent of the Metro Water District, 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 EPD, 2010). None of the Upper Oconee River Basin within the Metro Water 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 Metro Water District, as identified by the Georgia Geologic Survey Hydrologic Atlas 18 database.

Figure OC-1
Upper Oconee Basin Within the Metro Water District

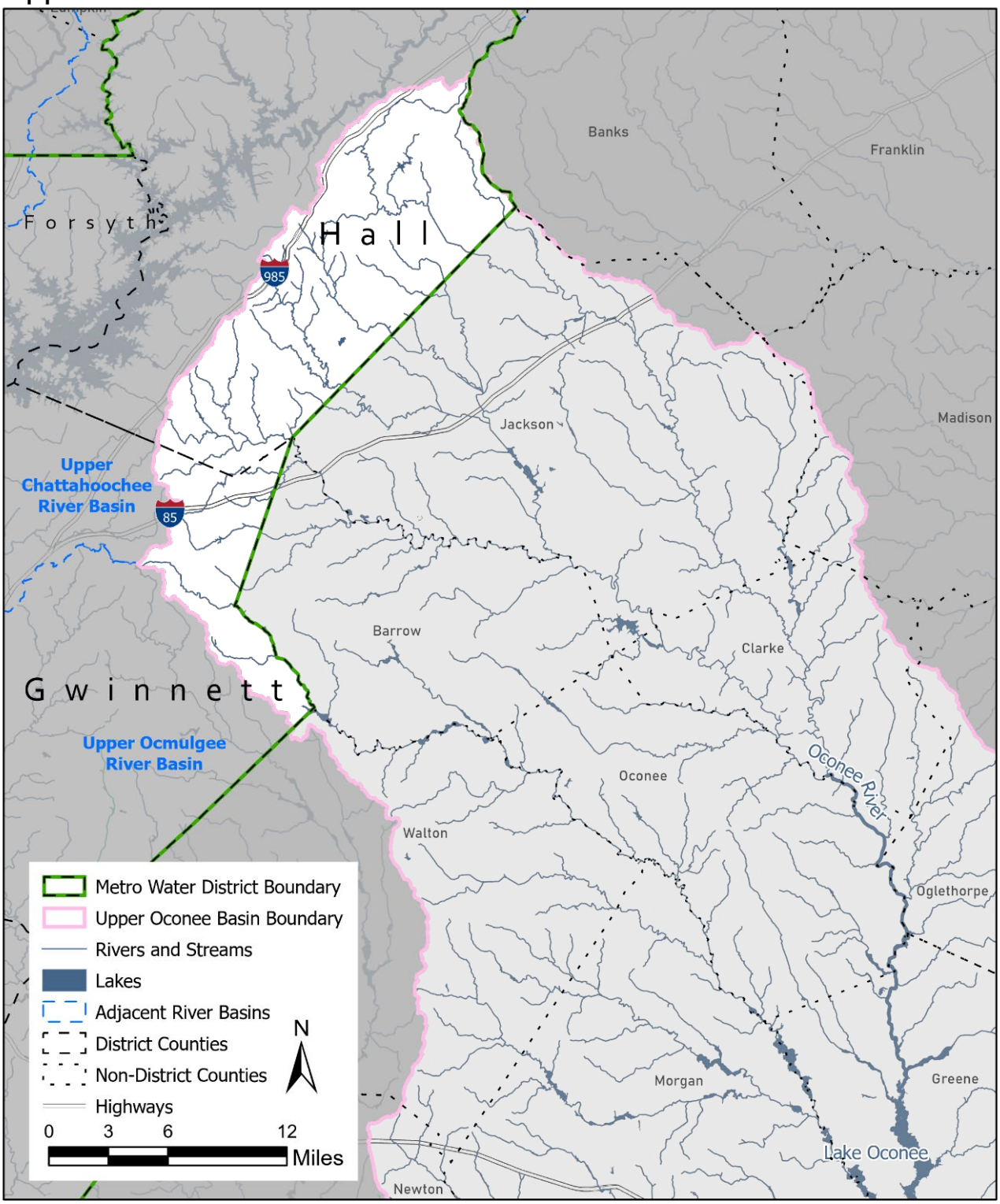


Table OC-1. Groundwater Recharge Areas within the Upper Oconee River Basin

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 [a]

[a] Minor differences in mapping methodologies may cause basin totals to vary slightly from county totals.

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 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 Metro Water 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 Metro Water District.

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

Fauna Type	Common Name	Status^	Gwinnett	Hall
Mammal	Northern Long-eared Bat	T		X
Bird	Bald Eagle	T		X
Fish	Altamaha Shiner	T	X	X
Fish	Bluestripe Shiner	R		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 Metro Water 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

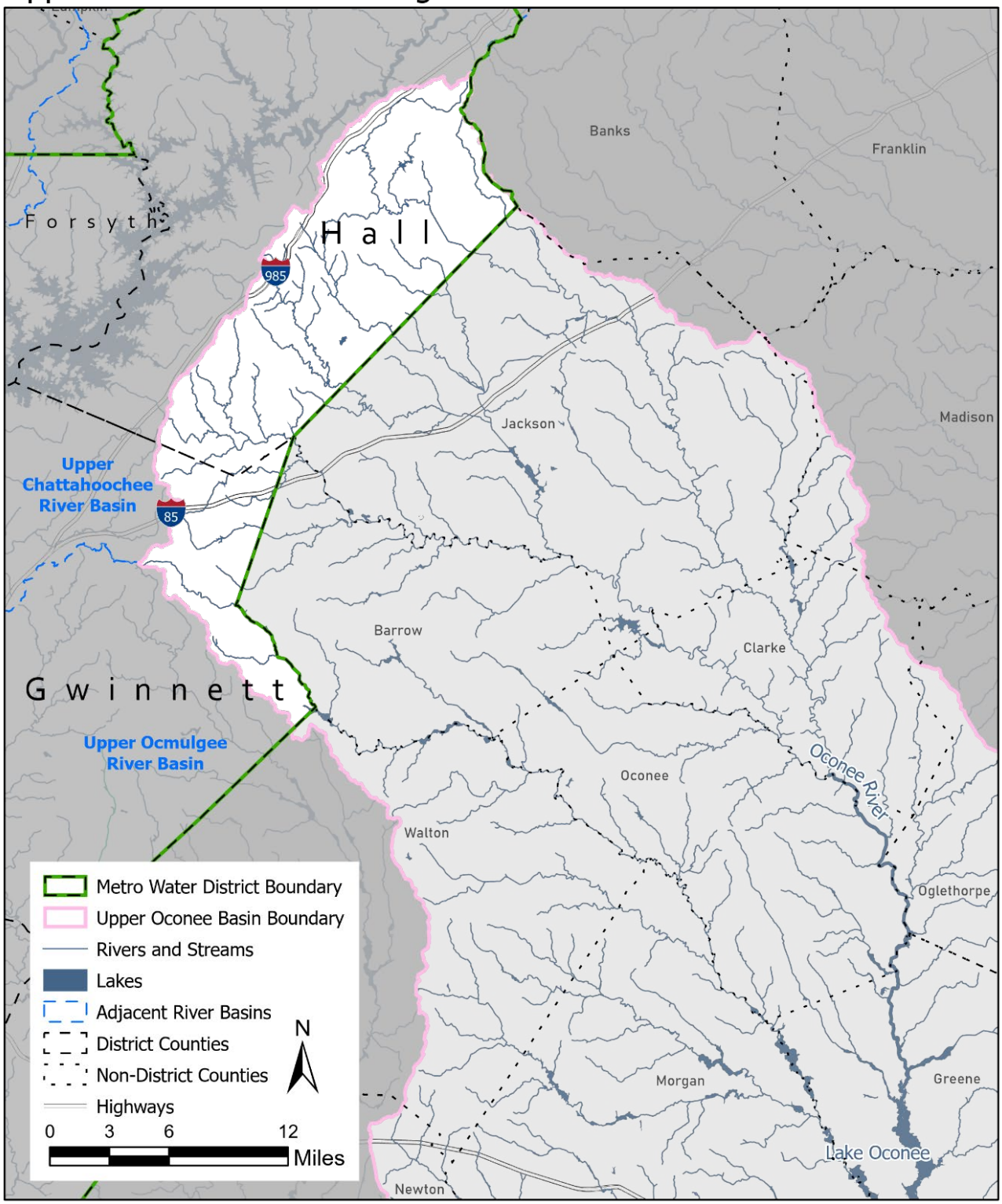
Drinking Water Supply

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 Metro Water District. Recognizing the linkage between watershed management and water quality for water supply, the Georgia Department of Natural Resources (DNR) 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 Metro Water District drinking sources in the Upper Oconee Basin	

Figure OC-2
Upper Oconee Basin Drinking Water*



*There are no Metro Water 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 Metro Water 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.

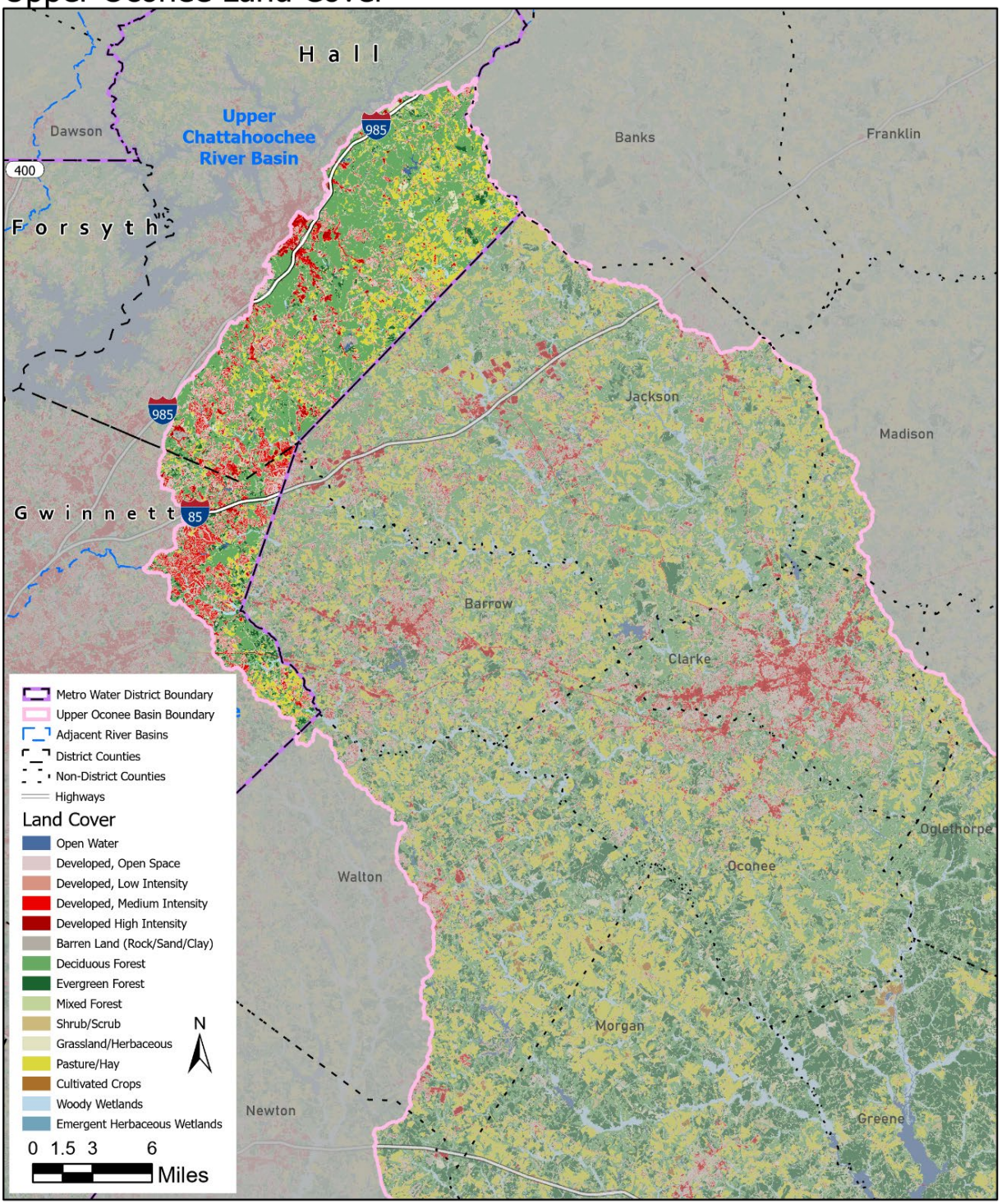
Table OC-5. Upper Oconee River Basin Land Cover / Land Use within the Metro Water District

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 2019.

Figure OC-3
Upper Oconee Land Cover



Source: 2019 NLCD

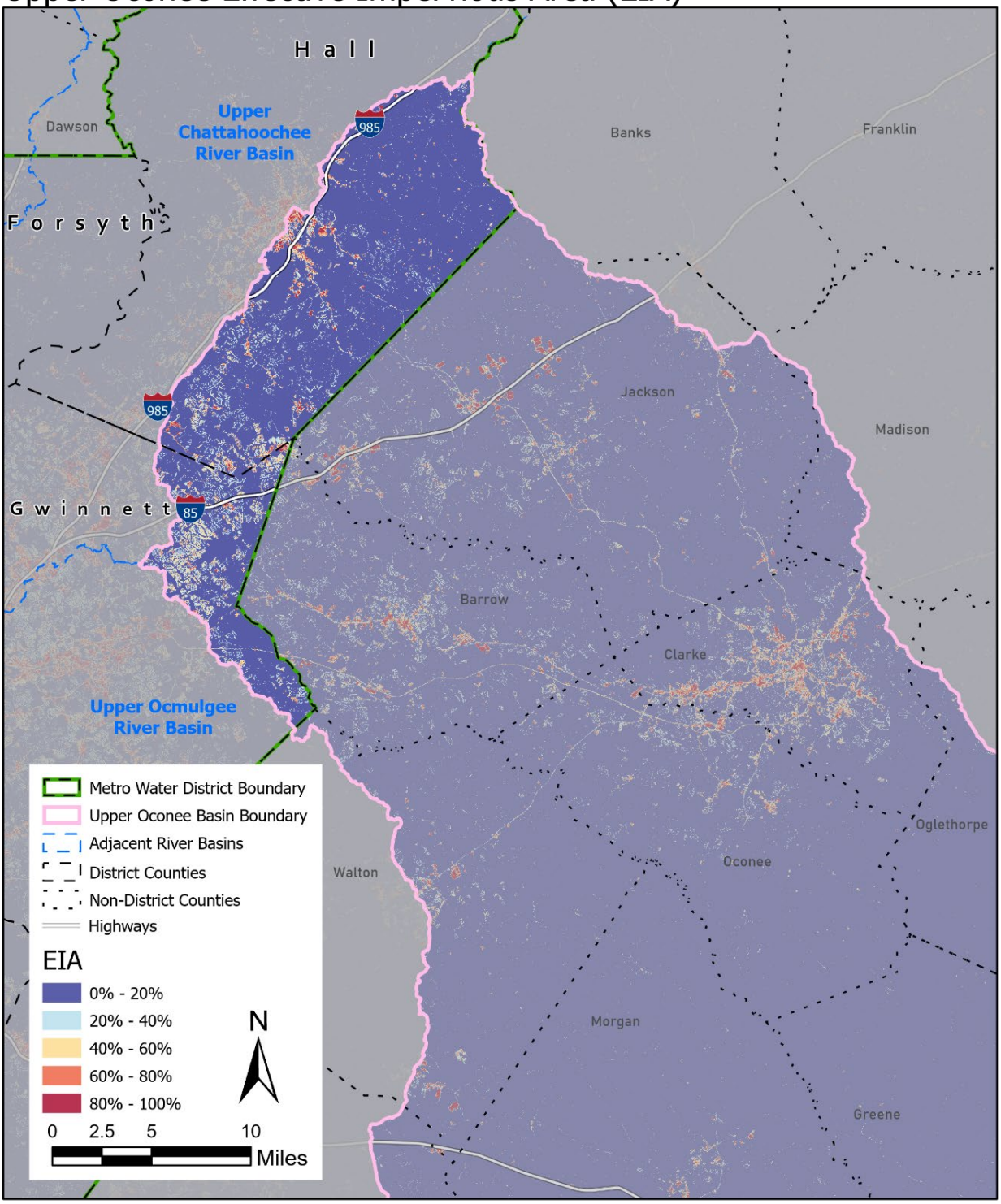
Effective Impervious Areas

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 Metro Water 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 12 HUC-12s within the Metro Water District portion of Upper Oconee River Basin, six had an effective impervious area (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 (EIA)



Impaired Waterbodies

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.

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 Metro Water 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 or 58 percent of total and assessed streams respectively, 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.

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 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. 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 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 Oconee River Basin can be found on the Georgia EPD website https://epd.georgia.gov/total-maximum-daily-loadings.

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

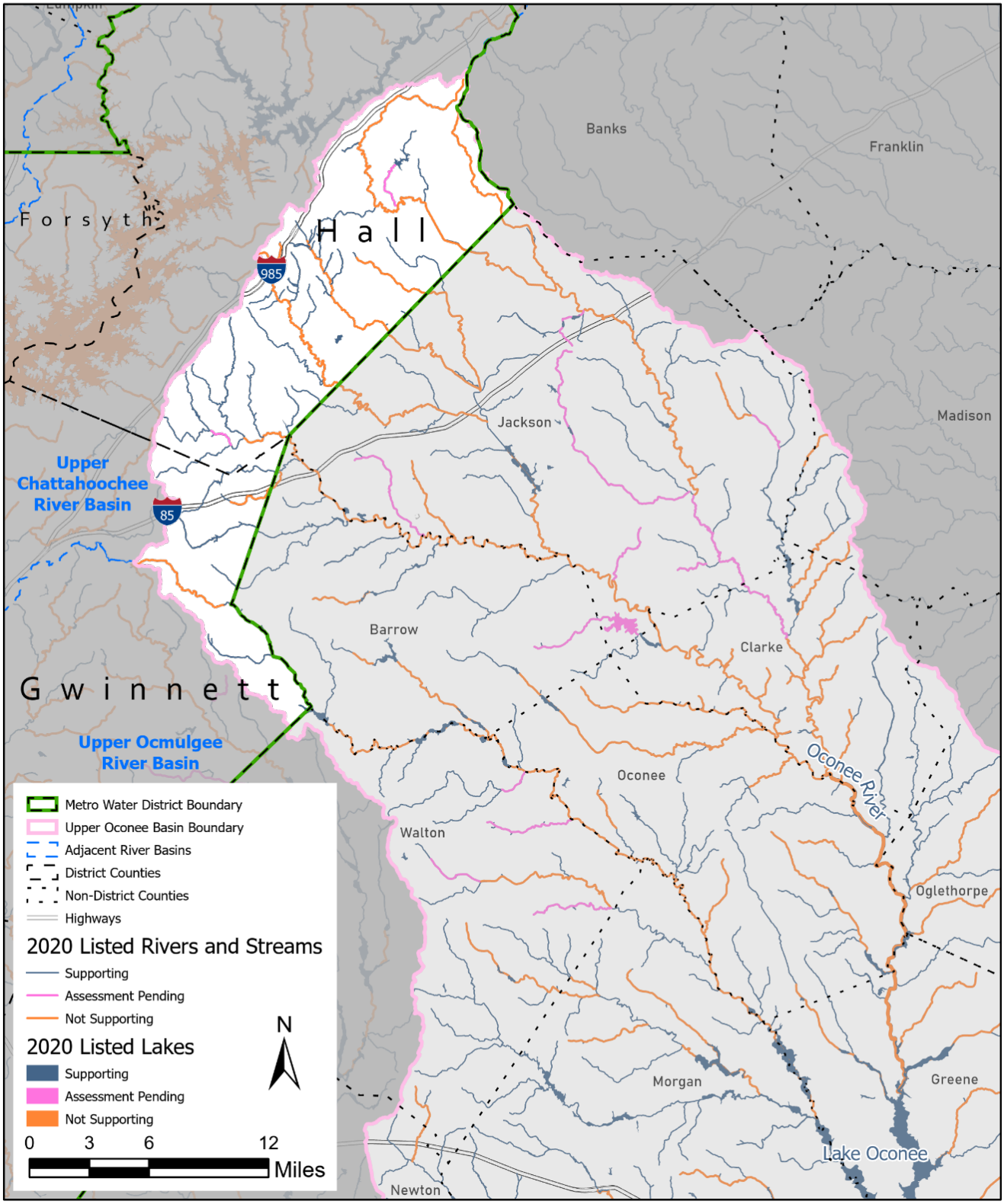
Criterion Violated	Miles of Stream	% of 2020 Assessed Streams	% of Total Stream Mileage
Fecal Coliform Bacteria	38	32	7
Biota (Macroinvertebrate Community)	36	31	7

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

Criterion Violated	Miles of Stream	% of 2020 Assessed Streams	% of Total Stream Mileage
Total Impaired Stream Mileage[a]	67	58	12
Total Mileage Assessed for Possible Impairment	116		
Total Stream Mileage in Basin	538		

[a] 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



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 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.

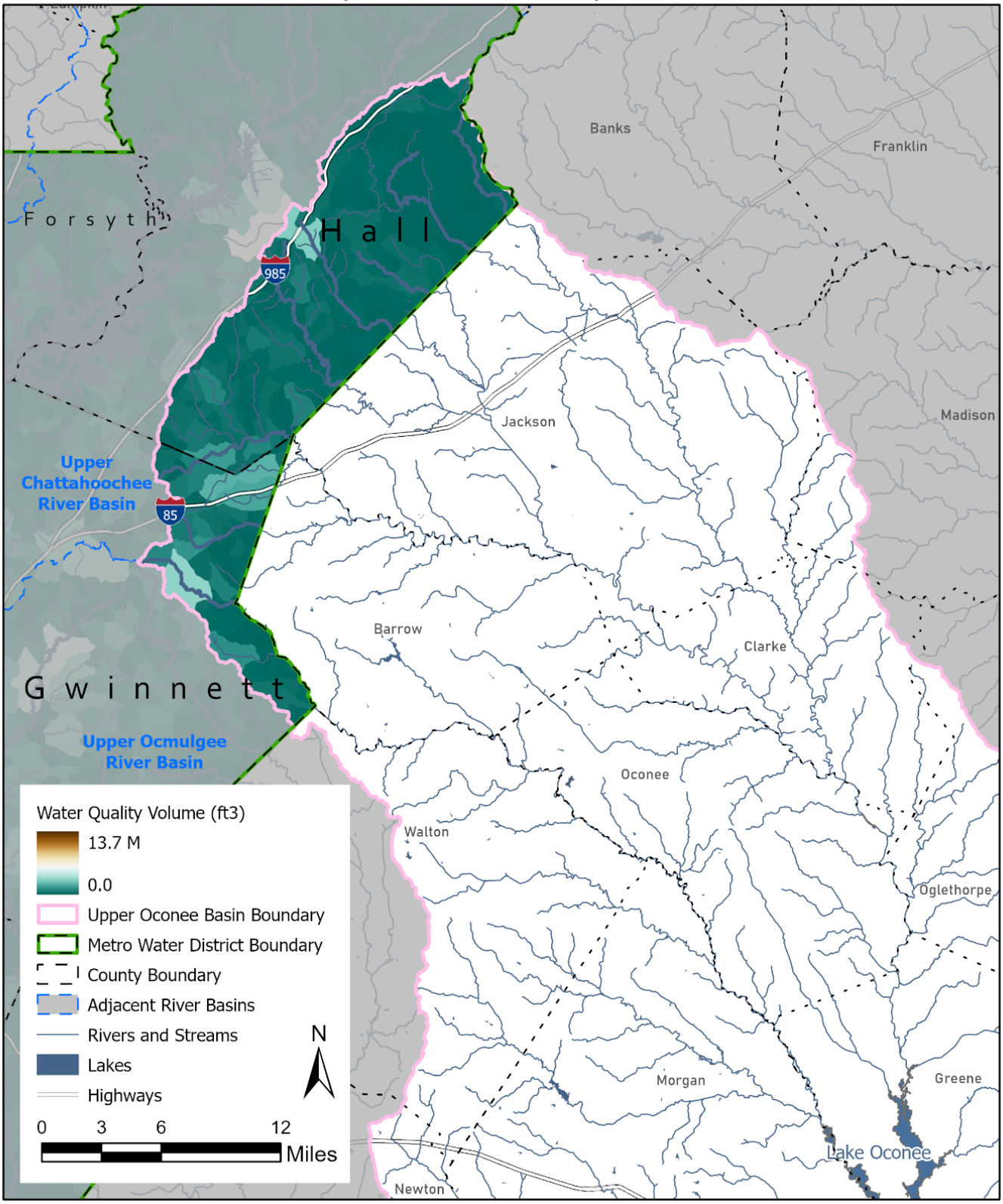
Runoff for the three post-construction volumes (WQv, CPv, and OFPv) were calculated for 317 individual subcatchments in the Basin. In 2019, a total of 61.8 million cubic feet of runoff was estimated in the Basin for the Water Quality (WQv), 137.4 million cubic feet for the Channel Protection Volume (CPv), and 868.9 million cubic feet for the Overbank Flood Protection Volume (OFPv), based on 41,566 acres of development. See additional information in the following summary table and a figure of the 2019 WQv for the Basin.

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

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 Metro Water 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 out opportunities for grants, loans and partnerships.
Biota TMDLs	31% of the assessed benthic macroinvertebrate communities are impaired. Biota impairment in this basin are 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.
Bacteria TMDLs	32% of assessed stream segments in the Upper Oconee River Basin (within the Metro Water 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

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

Management Issue	Description	Recommended Strategies
		• 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 Metro Water 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.