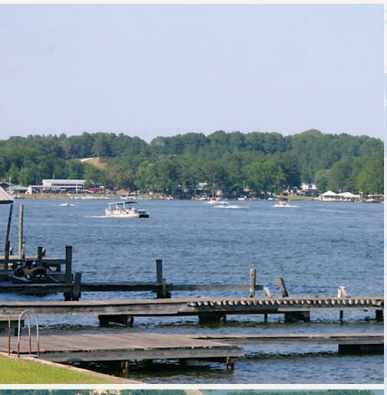
November 2019











Allatoona Lake Water Supply Storage Reallocation Study and Updates to Weiss and Logan Martin Reservoirs Project Water Control Manuals

Draft Feasibility Report and Integrated Supplemental Environmental Impact Statement

Appendix E. Environmental Resources

US Army Corps of Engineers®
Mobile District

Prepared for:
U.S. Army Corps of Engineers
Mobile District
P.O. Box 2288
Mobile, AL 36628

Prepared by:
Tetra Tech, Inc.
10306 Eaton Place
Suite 340
Fairfax, VA 22030

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E.1 Affected Environment

This section describes the *affected environment*, which represents the physical, biological, and socioeconomic conditions of the geographic area in which the impacts of the proposed actions and alternatives are expected to occur. The affected environment serves as a baseline from which potential environmental and socioeconomic effects of proposed actions can be compared. All proposed actions will be evaluated against this affected environmental baseline condition. Figure E-1 shows the Alabama-Coosa-Tallapoosa (ACT) River Basin.

The ACT River Basin includes the Alabama, Coosa, and Tallapoosa rivers and all areas within the basin boundaries from the headwaters downstream to the mouth of the Alabama River, where it joins the Tombigbee River to form the Mobile River. The ACT River Basin (22,739 square miles [sq mi]) has approximately the same drainage area as the Tombigbee River Basin (20,200 sq mi). Thus, flows from the ACT River Basin are roughly half of the total flow in the Mobile River downstream of the juncture of the Alabama and Tombigbee rivers.

This Allatoona-Coosa Reallocation (ACR) Draft Feasibility Report and Integrated Supplemental Environmental Impact Statement (FR/SEIS) addressing proposed actions at Allatoona, Weiss, and Logan Martin dams and lakes supplements the October 2014 Final Environmental Impact Statement (EIS) for the ACT River Basin Water Control Manual (WCM) Update and addresses specific proposed federal actions deferred in that update. Accordingly, this section retains an abbreviated overview of the environmental and socioeconomic resources of the entire ACT River Basin, updated with any new available information on pertinent resources. The balance of detailed information on the entire ACT River Basin is incorporated by reference from the 2014 Final EIS for the ACT River Basin WCM Update. Council on Environmental Quality regulations direct agencies to incorporate relevant material by reference into an EIS to reduce the size of the document and avoid duplicative effort (Title 40 of the *Code of Federal Regulations* [CFR] § 1502.21).

The specific federal actions considered in this Draft FR/SEIS will affect only a portion of the overall ACT River Basin. Hydrologic Engineering Center-Reservoir System Simulation (HEC-ResSim) and Hydrologic Engineering Center water quality model (HEC-5Q) simulation results presented and evaluated in Section E.2 of this appendix and summarized in Sections 4 and 5 of the main report demonstrate that the effects of the proposed actions would be limited to a Region of Influence (ROI) defined as follows: the Etowah River at its confluence with Hickory Log Creek at Canton, GA, downstream to its confluence with the Oostanaula River at Rome, GA, including the U.S. Army Corps of Engineers' (USACE's) Allatoona Dam and Lake; and the Coosa River at Rome downstream to its confluence with the Tallapoosa River near Montgomery, AL (including Weiss Dam and Lake, Logan Martin Dam and Lake, and other Alabama Power Company [APC] reservoirs). The federal actions proposed in this Draft FR/SEIS would affect neither the Oostanaula River Basin nor the Tallapoosa River Basin. Accordingly, this section focuses on the narrowed ROI, which is the area most likely to be affected by the proposed federal actions. The HEC-ResSim and HEC-5Q models also demonstrated that the proposed federal actions would have no discernable effect on hydrologic conditions, including water quality, in the Alabama River downstream of the confluence of the Coosa and Tallapoosa rivers and further downstream into the Mobile River and Bay. Accordingly, other environmental resources of interest in this portion of the basin would not be affected by the proposed federal actions.

Along the river and lake segments in the defined ROI, the lateral extent of expected effects generally includes the fee or easement interest in adjacent lands by USACE and APC or the base floodplain along the rivers where no fee or easement interests exist. Any exceptions to the lateral extent of potential effects on specific resources are noted in the pertinent resource area summaries later in this section.

The resource areas addressed in this section are water quantity and quality, geology and soils, climate conditions, land use, biological resources, socioeconomics, aesthetics, air quality, noise, traffic and transportation, cultural resources, and hazardous and toxic materials. Water supply, navigation, hydropower, recreation, agricultural water supply, environmental justice, and protection of children are addressed in the socioeconomics discussion.


TENNESSEE
Chattanooga
N
Carters Dam
Gainesville
Weiss Dam
Allatoona Dam
Marietta
H. Neely Henry Dam
Atlanta
Birmingham
ALABAMA
Coosa River
Tallapoosa River
Harris Dam
GEORGIA
Logan Martin Dam
Lay Dam
La Grange
Mitchell Dam
Jordan Dam
Martin Dam
Macon
Walter Bouldin Dam
Yates Dam
Thurlow Dam
Columbus
Montgomery
R.F. Henry Lock and Dam
Millers Ferry Lock and Dam
Claiborne Lock and Dam
Albany
Dothan
Alabama River
Mobile
FLORIDA
Pensacola
Tallahassee
Gulf of Mexico
0 25 50
Miles
LEGEND
ACT River Basin Boundary
State Boundary
State Capital
City
Urban Area
Surface Water
USACE Dam
Alabama Power Company Dam
ACT River Basin

Figure E-1

Much of the baseline information on the ACT River Basin presented in this appendix was originally developed during the ACT and Apalachicola-Chattahoochee-Flint (ACF) River Basin Comprehensive Study. USACE, Alabama, Florida, and Georgia undertook the Comprehensive Study in the 1990s for both river basins, as directed by a Memorandum of Agreement (MOA) among the three states and the Department of the Army (DA). The study was consensus-based, requiring the approval of all the participants on all the study elements.

The Comprehensive Study process involved developing multiple reports and studies to document existing (baseline) conditions and tools to address future water management challenges in the ACF and ACT river basins in accordance with a work plan established under the MOA. The specified purpose of the Comprehensive Study was:

> … to determine the capabilities of the water resources of the basins, to describe the water resource demands of the basins, and to evaluate alternatives which utilize the water resources to benefit all user groups within the basins.

These studies and tools provided information for the draft EIS in 1998 titled *Water Allocation for the Alabama-Coosa-Tallapoosa (ACT) River Basin, Draft EIS*. The Comprehensive Study provided technical understanding of the water resources in both river basins and basin-specific tools to evaluate water management alternatives. The Comprehensive Study contained the following elements:

- Process Support–Population and Employment Forecasts; Database; Public Involvement
- Water Resources Availability–Surface Water; Groundwater
- Water Demand–Agricultural; Environmental; Power; Municipal and Industrial; Navigation; Recreation; Water Quality
- Comprehensive Management Strategy–Basinwide Management; Coordination Mechanism

The Comprehensive Study provided substantial baseline information and analytical tools that were used in support of the 2014 Final EIS for the ACT WCM Update, as supplemented by more recent information from numerous other sources. Much of the Comprehensive Study information remains relevant to the currently proposed federal actions. This appendix depicts conditions as they currently exist, based upon the most recent available data for each resource. The level of detail provided corresponds to the intensity, context, and duration of the potential effects on a given resource.

All elevation data in this appendix that addresses USACE project structures, reservoir water surface elevations, and other pertinent elevation information are referenced to the National Geodetic Vertical Datum of 1929 (NGVD29).

E.1.1 Water Quantity

This section examines the complex interrelationships among surface water, groundwater, and the numerous competing demands on water resources in the ACT River Basin by characterizing precipitation, streamflow conditions, reservoir water levels, groundwater quantities, water use, and water planning and management activities. Significant interaction occurs in the basin between surface water and groundwater, with groundwater providing substantial baseflow for some streams. Many other factors can affect water quantity conditions in the basin, including weather; municipal and industrial (M&I) use; agricultural use for irrigation; the operation of thermoelectric power plants; and management activities associated with the 17 major dams on the mainstem rivers in the basin that provide for hydropower, flood risk management, and other purposes.

In the southeastern United States (US), rain falls every month but the need for water in the summer and fall often stresses the available supply of water in the basin. The reservoirs formed by the dams in the ACT River Basin attenuate high river flows during wet periods and augment low flows during dry-weather periods to more effectively address multiple water needs throughout the year. In the complex process of managing water, managers must

consider the many competing demands for water in the basin, consider past and future hydrologic conditions, and optimize the use of water by determining the most appropriate operating conditions for all the reservoirs in the basin. Accordingly, USACE has an active role in water management in the ACT River Basin by operating multiple federal reservoir projects to meet federally authorized project purposes and balance competing demands for water resources.

Water uses in the ACT River Basin include hydropower, navigation, flood risk management, recreation, water quality (such as assimilative capacity for wastewater discharges), water supply, and fish and wildlife conservation. Water demands can be consumptive or nonconsumptive. *Consumptive demands* require withdrawing water from the basin and returning only a portion or none of it to the basin. Consumptive water uses include municipal, industrial, and agricultural uses and some forms of thermoelectric power generation. In this analysis, agricultural water supply withdrawals are assumed to provide no return flow to the surface water streams. In contrast, hydropower demand is a *nonconsumptive* use of water. It uses the flow in the river to drive turbines to generate electricity, but no water is withdrawn or lost from the system. Section E.1.1.6 discusses water demands and uses within the ACT River Basin in more detail.

It is critical in basin water management to account for the various withdrawals/losses from and returns/gains to the system. Water is lost through evapotranspiration (total of evaporation and plant transpiration), M&I water withdrawals, thermoelectric power withdrawals, agricultural water withdrawals, groundwater transfers, and interbasin transfers. Water is returned, or added, to the basin through precipitation; treated M&I and thermoelectric power plant discharges; groundwater baseflow contribution; and interbasin transfers. Figure E-2 illustrates schematically the gains and losses of water to the basin.

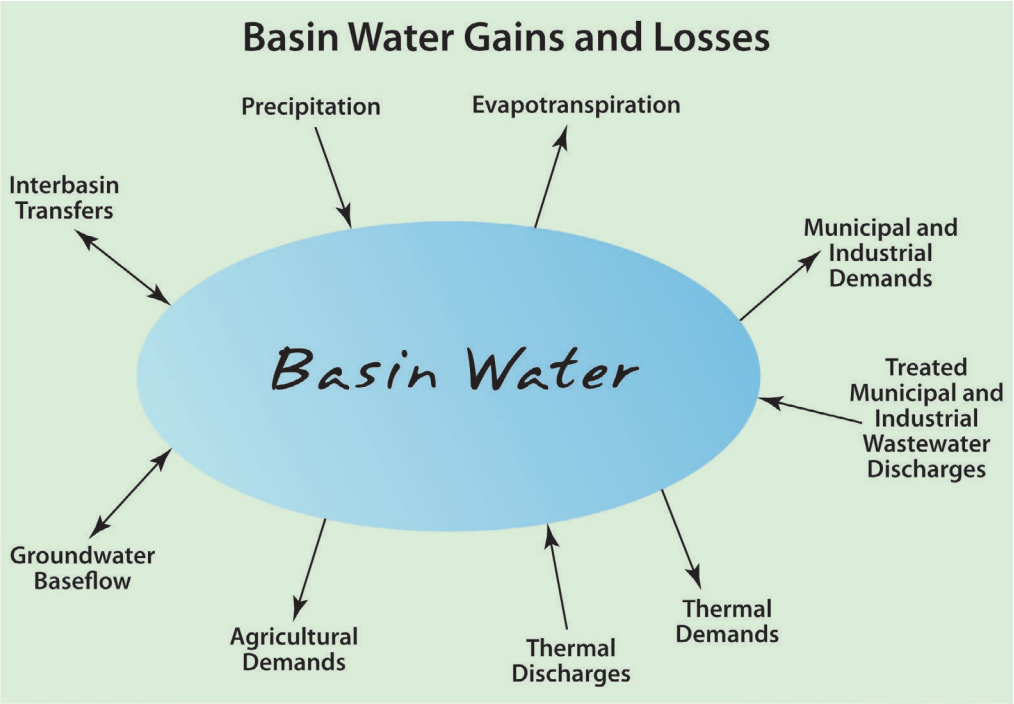


Figure E-2. Illustration of Basin Water Gains and Losses.

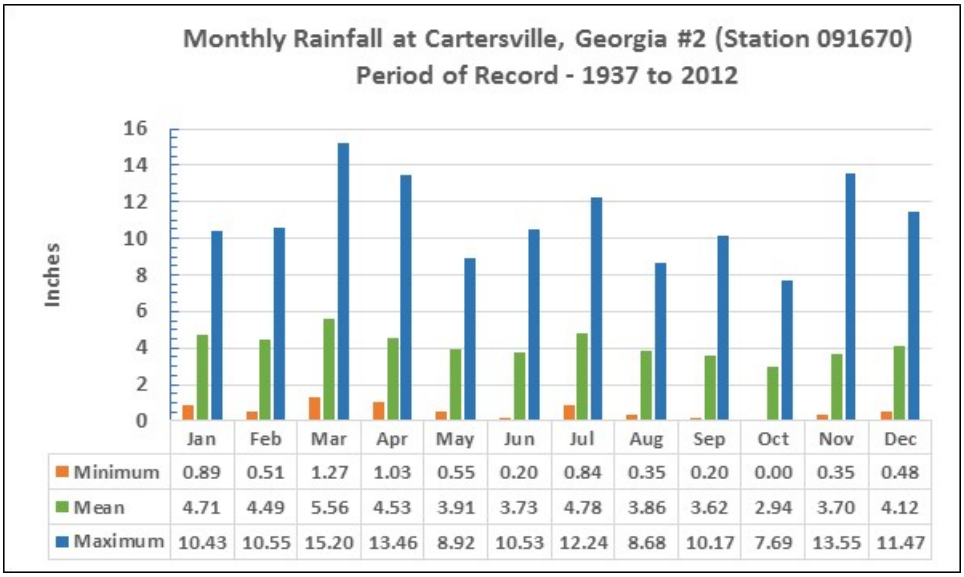
Source: **(USACE Mobile District, 1998b)**.

E.1.1.1 Precipitation

Average yearly precipitation in the ACT River Basin ranges from 49 to 65 inches per year (in/yr), and precipitation typically falls during every month. Precipitation amounts are highest in the mountain ecoregions and the Southeastern Plains ecoregion because of orographic effects and tropical moist air, respectively. Precipitation is normally highest in late winter and early spring, and then again in late summer because of tropical storms and depressions. More than one-half of the water that falls as precipitation in the ACT River Basin is returned to the atmosphere through evapotranspiration. Evapotranspiration can range from 30 to 42 in and increases from north to south (USACE Mobile District, 1998b).

Rainfall amounts in the ACT River Basin can be highly variable from year to year. For example, the difference between the maximum and minimum annual rainfall at Rome, GA, over the period of record analyzed is 48.94 in (SERCC, 2019c). Mean, maximum, and minimum monthly rainfall totals at three locations in the basin are shown in Figure E-3, Figure E-4, and Figure E-5. The wet and dry periods produced by these variations in rainfall are cyclical, and the differences in rainfall can be attributed to changes in climate and weather patterns. Periods of heavy rainfall can be caused by El Niño events, which bring heavy winter rain to the southeastern US, and active hurricane seasons, which can bring heavy rainfall in the late summer and fall. Droughts are loosely associated with La Niña events but are more likely caused by atmosphere-ocean climate variability and by internal atmosphere variability (Seager, Tzanova, & Nakamura, 2009).

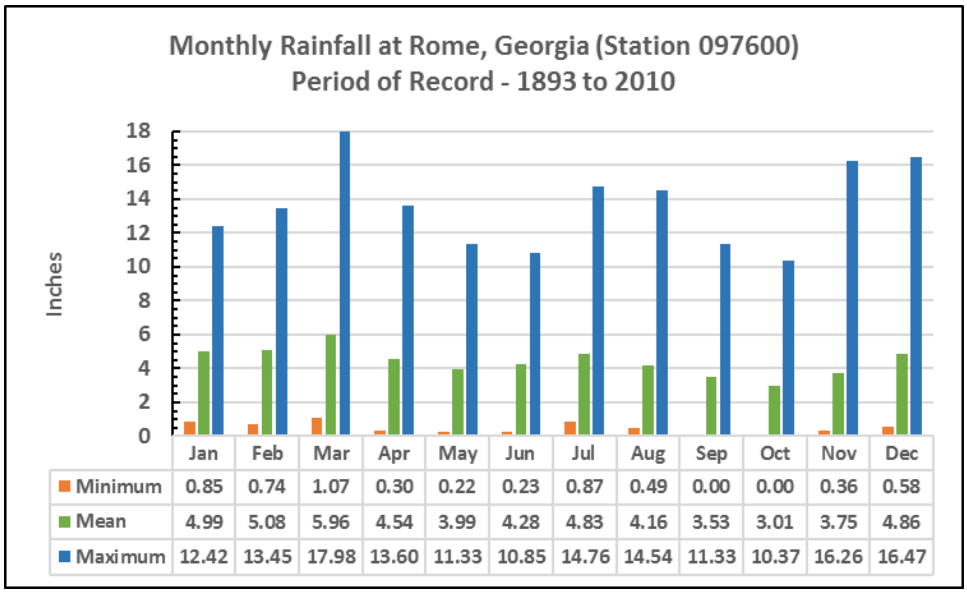
Figure E-3 summarizes monthly rainfall at Cartersville, GA, between 1937 and 2012, specifically depicting the mean, maximum, and minimum monthly rainfalls over the period of record. Cartersville is located on the Etowah River immediately downstream of Allatoona Dam. The mean annual rainfall is 49.95 in at the Cartersville #2 station; the maximum annual rainfall of 69.15 in at this station occurred in 1989; and the minimum annual rainfall of 28.14 in occurred in 2007 (SERCC, 2019a).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Minimum	0.89	0.51	1.27	1.03	0.55	0.20	0.84	0.35	0.20	0.00	0.35	0.48
Mean	4.71	4.49	5.56	4.53	3.91	3.73	4.78	3.86	3.62	2.94	3.70	4.12
Maximum	10.43	10.55	15.20	13.46	8.92	10.53	12.24	8.68	10.17	7.69	13.55	11.47

Figure E-3. Monthly Rainfall at Cartersville, GA.

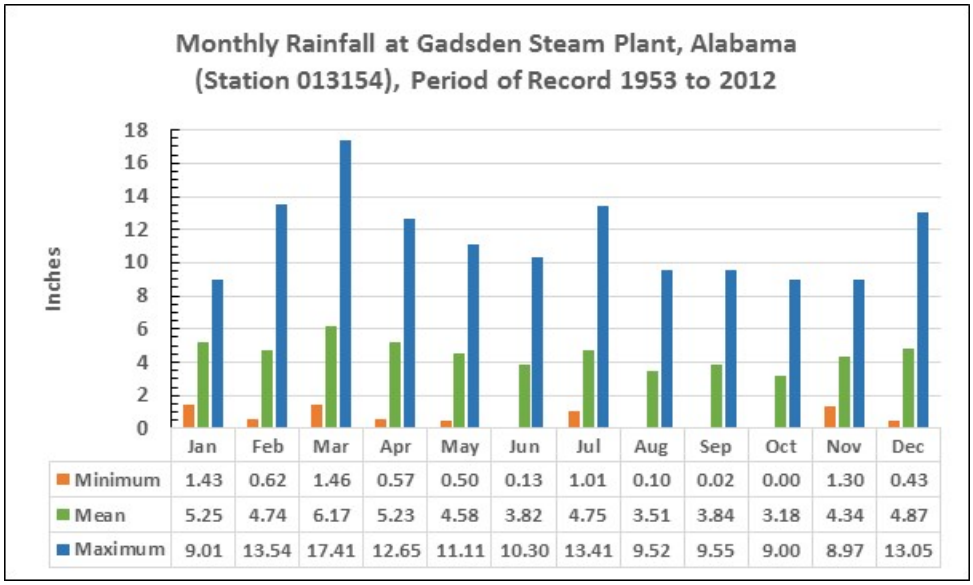
Figure E-4 summarizes monthly rainfall at Rome, GA, between 1893 and 2010, including the mean, maximum, and minimum monthly rainfalls over the period of record. Rome is located at the confluence of the Etowah and Oostanaula rivers that becomes the Coosa River. The mean annual rainfall is 52.99 in at the Rome station; the maximum annual rainfall of 77.65 in at this station occurred in 1932; and the minimum annual rainfall of 28.71 in occurred in 2007 (SERCC, 2019c).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Minimum	0.85	0.74	1.07	0.30	0.22	0.23	0.87	0.49	0.00	0.00	0.36	0.58
Mean	4.99	5.08	5.96	4.54	3.99	4.28	4.83	4.16	3.53	3.01	3.75	4.86
Maximum	12.42	13.45	17.98	13.60	11.33	10.85	14.76	14.54	11.33	10.37	16.26	16.47

Figure E-4. Monthly Rainfall at Rome, GA.

Figure E-5 summarizes monthly rainfall at the Gadsden Steam Plant in Alabama between 1953 and 2012, including the mean, maximum, and minimum monthly rainfalls over the period of record. The Gadsden Steam Plant station is located on the Coosa River between H. Neely Henry Dam and Weiss Dam. The mean annual rainfall is 54.30 in at the Gadsden Steam Plant station; the maximum annual rainfall of 74.89 in at this station occurred in 2009; and the minimum annual rainfall of 36.56 in occurred in 1954 (SERCC, 2019b).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Minimum	1.43	0.62	1.46	0.57	0.50	0.13	1.01	0.10	0.02	0.00	1.30	0.43
Mean	5.25	4.74	6.17	5.23	4.58	3.82	4.75	3.51	3.84	3.18	4.34	4.87
Maximum	9.01	13.54	17.41	12.65	11.11	10.30	13.41	9.52	9.55	9.00	8.97	13.05

Figure E-5. Monthly Rainfall at the Gadsden Steam Plant, AL.

The intensity of drought and wet periods is exacerbated by changes in land use and population demand on water resources. Severe droughts coupled with increased population growth and development, particularly in the upper portion of the basin, have at times led or contributed to shortages and restrictions on limited surface water supplies. The following sections briefly describe some of the major flood and drought events that have occurred in the ACT River Basin since the early 1900s. More detailed information on precipitation and extreme weather events is

included in the ACT River Basin Master Manual and individual project WCMs in Appendix A to the ACR Draft FR/SEIS.

E.1.1.1.1 Extreme Rainfall Events and Floods

Major flood-producing storms over the ACT River Basin are usually of the frontal type, occurring in the winter and spring and lasting from 2 to 4 days, with their effect on the basin depending on their magnitude and orientation. The axes of the storms' frontal zones generally cut across the long, narrow basin. Frequently, a flood in the lower reaches is not accompanied by a flood in the upper reaches and vice versa. Occasionally, a summer or early fall tropical system causes major flooding over the entire basin. Summer storms, however, are usually of the thunderstorm type with high rainfall intensities over small areas producing serious local flooding. With normal runoff conditions, 5–6 in of intense and general rainfall is required to produce widespread flooding. Since 1900, major flooding events occurred in the ACT River Basin in July 1916, December 1919, March 1929, February 1961, March 1990, July 1994, May 2003, and September 2009. These flood events are described in Section 4-06 of the ACT River Basin Master Manual in Appendix A to the Draft FR/SEIS.

E.1.1.1.2 Drought Events

When drought events occur, they tend to progress in stages. The first stage is *meteorological drought*—when precipitation falls below normal levels—which is usually the first drought indicator because it can develop quickly. It is normally expressed as a *rainfall deficit*, in a measure of deviation from normal—such as inches below normal, or a percentile. The second stage of drought is *agricultural drought,* which occurs when the amount of moisture in the soil no longer meets the needs of specific crops. When agricultural drought occurs at a critical time of year, it can result in water-deficient topsoil, which may hinder germination, and reduce crop yield—especially if moisture is not replenished during the growing season. That type of drought is usually measured in soil moisture levels and can be devastating to agricultural communities (GAEPD, 2000).

Hydrological drought is the third stage of drought and occurs when surface and subsurface (ground) water supplies fall below normal levels as a result of prolonged meteorological drought. Indicators of hydrological drought include decreased streamflow rates, lake levels, and groundwater levels. Hydrological drought can be detrimental to the environment, upsetting the hydrologic cycle and impacting fish, wildlife, and plant species. If hydrological drought persists for prolonged periods, demand for water may exceed supply, leading to the fourth stage—*socioeconomic drought*. This stage of drought can take many months or even years to develop, often with devastating social and economic consequences for the people who are dependent on water resources for health, drinking water, and jobs (GAEPD, 2000). The historic droughts affecting the ACT River Basin summarized in this section progressed to hydrological and, in most cases, to socioeconomic drought stages.

During the past 90 years, the ACT River Basin has experienced numerous droughts, many of which have been considered severe. The effects of each drought have varied across the basin. For instance, the 1929 to 1932 drought exceeded the 25-year recurrence interval in the north-central portion of Alabama but only exceeded the 10-year recurrence interval for the northeast portion of the ACT River Basin in Alabama and Georgia. In 1938 to 1945 the northeastern portion of Alabama experienced a drought with a recurrence interval of 25 years, and the northwestern portion of Georgia experienced a drought with a recurrence interval of 50 years. Alabama experienced a statewide, sustained drought from 1950 to 1963, ranging from 27- to 60-year recurrence intervals (USGS, 1991). From 1950 to 1957 north Georgia experienced a 25-year recurrence interval drought (USGS, 2000). Some of the more recent droughts of record are summarized in more detail below:

- **1984–1989 Drought—**Two droughts occurred in Alabama and Georgia in the 1980s, the second of which lasted from 1984 to 1989 and caused water shortages in both states. In the extreme northern portions of the ACT River Basin, the 1984–1989 drought was the worst on record at the time. Precipitation from December 1985 through July 1986 was less than 40 percent of normal. Birmingham, AL, and Chattanooga, TN, received only about 17 in of precipitation. The drought climaxed in July 1986, exacerbated by extreme

temperatures (USACE Mobile District, 2010). In north Georgia, the drought had a magnitude of a 50- to 100-year recurrence interval, causing over one-third of the private wells across the state to run dry (USGS, 2000). Water supplies had to be transported to numerous communities in east-central Alabama (USGS, 1991).

- **1998–2003 Drought—**Another multiyear drought affected the ACT River Basin between 1998 and early 2003, resulting in severe effects on water use and operation of USACE reservoirs. The drought reached peak severity in summer 2000, accompanied by record high temperatures in many areas (USACE Mobile District, 2010).
- **2006–2008 Drought—**The 2006–2008 drought was by far the most devastating recorded in Alabama and western Georgia history. A decline in precipitation began in December 2005. Precipitation shortfalls continued into 2006, through winter 2006-07 and spring 2007, exhibiting the driest winter and spring in the period of record. The drought reached peak intensity in 2007, resulting in a D-4 Exceptional Drought Intensity (the most severe level) throughout the summer of 2007. Reservoirs across the ACT River Basin dropped to record low levels. Rainfall in areas of north Georgia, where the headwater streams of the basin are located, was as low as 20 in for the entire year (USACE Mobile District, 2010).
- **2016 Drought—**Drought conditions begin to intensify in northern Alabama and northern Georgia during the spring of 2016. Drought conditions expanded during the summer and, by late October, severe-to-exceptional (D2–D4) drought covered about 73 percent of Alabama and 50 percent of Georgia. During the 6-month period from May 1 to October 25, much of the southeastern US region received less than 15 in of precipitation. When compared to the short-term climatological average from 2002 to 2015, receiving that small amount of rain was equivalent to the region observing only 30–70 percent of normal precipitation (SERCC, 2016). Flows on the Coosa River at Rome, GA, experienced new record lows during July 2016 (USGS, 2017) and September through November 2016 (USGS, 2018a).

E.1.1.2 Relationship between Land Use and Water Quantity

Land use can significantly alter watershed hydrographs through increases in impervious surfaces and anthropogenic water consumption. Most land in the ACT River Basin is forested. Rainfall interception and evapotranspiration consume a large percentage of the precipitation that falls on forested lands. Following pine plantation harvesting, water yields can increase as much as 35 percent because of decreases in interception and evapotranspiration. Forested ecosystems have high stream baseflows and low, lengthy storm peaks compared to other common land uses because of high infiltration and permeability rates. Forest cover such as leaves and mulch reduces rain drop velocities, allowing for higher infiltration, and forest soils have organic concentrations with higher porosities, allowing for higher permeability. During high storm flows, wetland forests, often streamside, can store a large amount of water and reduce downstream flooding impacts (USACE Mobile District, 1998b).

Agriculture in the ACT River Basin uses both surface water and groundwater for crop irrigation and watering livestock. Groundwater usage for irrigation is highest in the Alabama River Basin, where groundwater supplies just over 50 percent of the water needed for crop irrigation, and lowest in the Coosa River Basin, where groundwater supplies only 15 percent of the water needed by crops. Livestock agriculture occurs across the ACT River Basin, and farmers use both groundwater and surface water for their livestock. Agricultural water use is considered 100 percent consumptive because water is incorporated into crops, lost through evapotranspiration, or consumed by livestock (Hutson, Littlepage, Harper, & Tinney, 2009). Agricultural land uses also produce larger storm flows during rain events than forested areas because of the reduced soil cover.

Urban areas significantly affect water quantity because of their high percentage of impervious cover and increases in water consumption because of denser population. Rain falling on impervious surfaces is immediately transported to streams, causing high peak flows. Urban areas also have large areas of land with significantly reduced infiltration and permeability rates such as grassy and barren land. Those areas also shed water quickly during storm events.

Because less infiltration occurs in residential and industrial areas, little groundwater recharge occurs, and stream baseflows are reduced.

Most surface water or groundwater withdrawn to meet M&I water demands is returned to the basin as treated wastewater, but these actions can affect natural channel flow. Water is lost to the surface water system through evapotranspiration, interbasin transfers, and thermoelectric water demands. Water is often returned downstream of the supply source, and groundwater is often returned to the system as surface water. Water use for hydropower is nonconsumptive, but hydropower dams can alter natural flow regimes because large releases occur during power generation periods. Water used for thermoelectric power generation is moderately consumptive to nonconsumptive. Section E.1.1.6 discusses water withdrawals and returns in the basin in more detail.

E.1.1.3 Surface Water—Rivers

The three main rivers in the ACT River Basin are the Alabama, Coosa, and Tallapoosa rivers. The Coosa and Tallapoosa join to form the Alabama River near Montgomery, AL, and have numerous smaller tributary rivers. Relevant characteristics of the main rivers are described below. The ACT River Basin and its principal rivers are illustrated in Figure E-1. Figure E-6 provides longitudinal views of the Alabama, Coosa, Etowah, and Tallapoosa rivers, depicting the locations of dams and reservoirs, major cities along the rivers, and the Georgia-Alabama state line.

The ACT River Basin includes both natural (or *unregulated*) and regulated rivers. Unregulated rivers exhibit a consistent pattern, responding as expected to precipitation with short periods of high flows and to drought periods with prolonged periods of low flows. Regulated streams exhibit a more variable pattern, with daily variations resulting from reservoir hydropower operations (most prominent below peaking projects), and lower flood peaks and higher sustained minimum flows through dry periods as the upstream reservoirs augment low flows. Appendix A to the Draft FR/SEIS (Sections A.1.1.1, A1.1.2, A.1.1.13, and A.1.1.14) describes the variable stream flow patterns associated with USACE reservoir operations in the ACT River Basin in more detail.

The highest monthly average flows for the basin's main rivers occur in the late winter/early spring months of February to April, which is typically the rainy season. Through late spring and summer, low precipitation and high evapotranspiration combine to reduce river flows. The lowest average monthly flow typically occurs in late September and October (see Figure E-3, Figure E-4, and Figure E-5).

E.1.1.3.1 Coosa River

The Coosa River Basin begins in southeast Tennessee with the Conasauga River, which drains an area of 727 sq mi, about 20 percent of which is in Tennessee and 80 percent of which is in Georgia (Figure E-1). The Conasauga River has a fairly steep slope of about 35.5 feet per mile (ft/mi) for the upper 41 miles (mi) in the mountains, then falls at a gentler slope of 3 ft/mi for the remaining 47 mi to its mouth. The Conasauga River joins the Coosawattee River (drainage area of 862 sq mi) to form the Oostanaula River, which is a primary tributary to the Coosa River. The Coosawattee River initially falls at a steep rate of about 29 ft/mi for 19 mi, then falls at a gentler slope of about 2 ft/mi for the remaining 27 mi to its mouth. Two dams are on the Coosawattee River: Carters Dam and Carters Reregulation Dam. The USACE Carters Dam and Lake project, located on the Coosawattee River about 27 mi upstream of its confluence with the Conasauga River, is a peaking hydropower facility and the only hydropower facility in the basin with pumpback capabilities. Section E.1.1.4.1 provides more detail on the Carters Dam and Lake project. The Cartecay and Ellijay rivers are two primary tributaries to the Coosawattee River (USACE Mobile District, 1997).

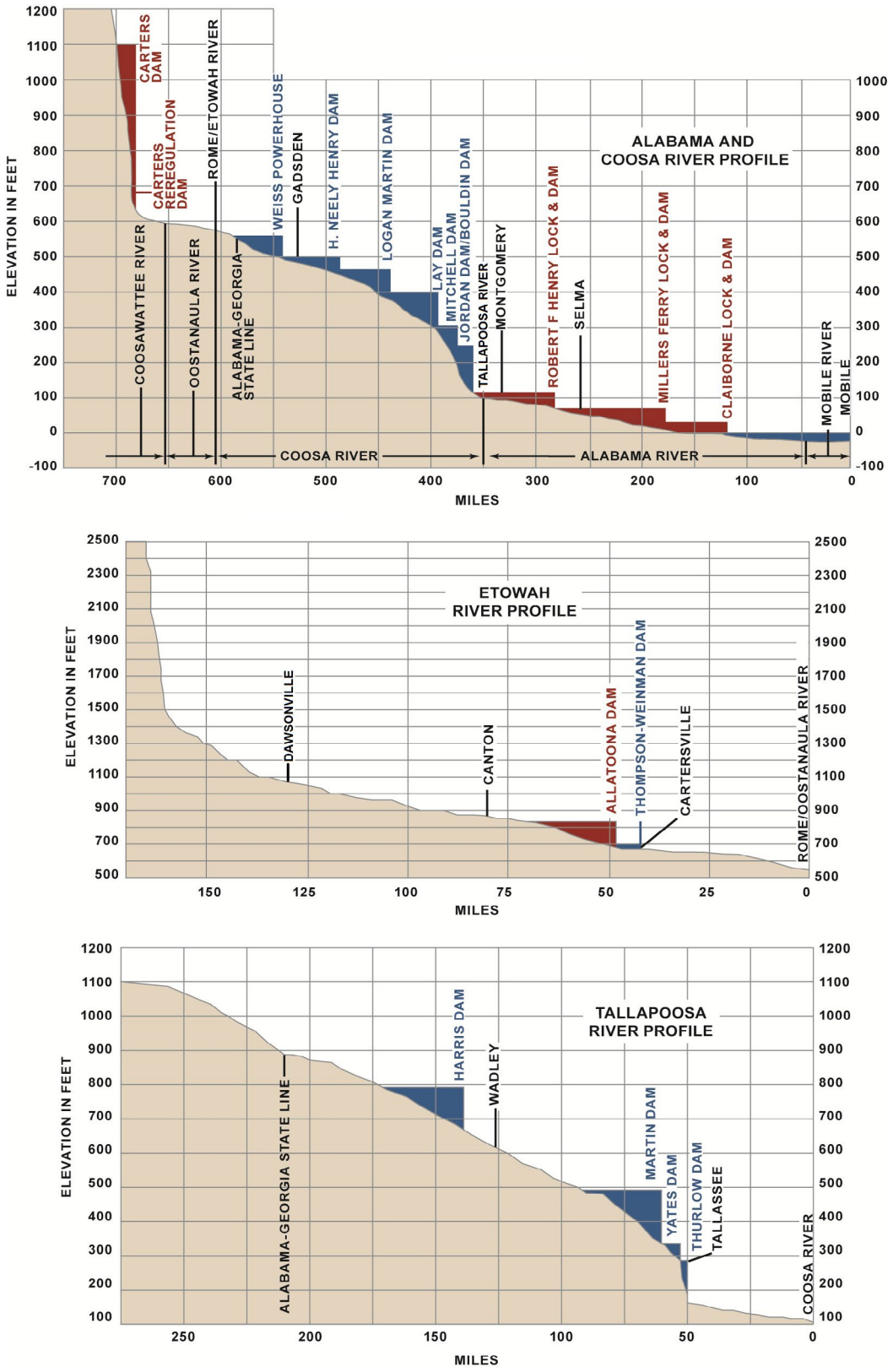


Figure E-6. Longitudinal Profiles of the Alabama and Coosa Rivers (*top*), Etowah River (*middle*), and Tallapoosa River (*bottom*) (ACT River Basin).

The Oostanaula River, downstream of the confluence of the Conasauga and Coosawattee rivers near Resaca, GA, flows south for 47 mi to join the Etowah River at Rome, GA. At that point, the Oostanaula and Etowah rivers form the Coosa River. The Oostanaula River has a drainage area of 2,150 sq mi. The slope of the river is relatively flat, with a fall averaging 1 ft/mi (USACE Mobile District, 1997).

The Etowah River begins in the Blue Ridge Mountains near Dahlonega, GA, and flows about 150 mi southwest to its confluence with the Oostanaula River at Rome. The Etowah River Basin drains an area of 1,861 sq mi, all in Georgia. It has a steep slope initially, falling at a rate of 45 ft/mi. Thereafter, the slope of the river flattens significantly, averaging about 4.5 ft/mi for 93 mi to the USACE Allatoona Dam and Lake near Cartersville, GA (USACE Mobile District, 1997). Section E.1.1.4.2 provides more detail on the Allatoona Dam and Lake project. From Allatoona Dam, the slope of the Etowah River is about 3.2 ft/mi for about 48 mi downstream to its mouth at Rome. A low-head dam, the Thompson-Weinman Dam, is on the Etowah River at Cartersville, about 3.5 mi downstream of Allatoona Dam. The dam dates to the early 1900s and provided Cartersville's first electricity. The dam provided electric power to local industry until the late 1900s, but it no longer produces power or serves a useful purpose.

The Coosa River, which begins at the confluence of the Oostanaula and Etowah rivers near Rome, GA, flows 286 mi downstream to Wetumpka, AL, just north of Montgomery, AL, where it joins the Tallapoosa River to form the Alabama River (Figure E-1). The Coosa River Basin drains an area of 10,156 sq mi. The river falls approximately 420 ft in 267 mi, or 1.6 ft/mi, in a series of successive reservoirs, from its source to Jordan Dam and Lake. Seven APC dams form nearly continuous impoundments over almost the entire length of the Coosa River, with each dam discharging into the upper end of the next downstream reservoir (USACE Mobile District, 1997). The seven dams are, in order from north to south: Weiss Dam, H. Neely Henry Dam, Logan Martin Dam, Lay Dam, Mitchell Dam, Walter Bouldin Dam (or Bouldin Dam), and Jordan Dam. The upper three APC projects are operated as hydropower peaking facilities, with releases occurring several hours each weekday and generally not on the weekend. The lower four APC projects are operated generally as run-of-river projects for hydropower production and to maintain stable flows from Jordan Dam over the weekend, when the upstream peaking facilities are not operated. Section E.1.1.4.3 through Section E.1.1.4.8 provide more detail on these APC projects. Because the reservoirs formed by the dams provide nearly continuous inundation from one dam to the next, the effects of the peaking operation are tempered and attenuated.

Weiss Dam, the furthest upstream of these APC dams, is 60 mi downstream of Rome, GA, and Jordan Dam, the dam furthest downstream, is 19 mi above the Coosa River's confluence with the Tallapoosa River (Figure E-1). APC operates its Coosa River projects to maintain a continuous minimum flow at Jordan Dam and Lake, which varies seasonally; Appendix A to the Draft FR/SEIS (Section A.1.1.8) summarizes the minimum flow requirements. The Coosa River channel varies from 300 to 500 ft wide, with banks 25 ft high along the floodplain. Numerous tributaries enter the Coosa River downstream of Rome, the largest of which is the Chattooga River, which has a drainage area of 660 sq mi.

The capacity of the Coosa River within its banks varies substantially throughout the river's length. Capacity is about 15,000 cubic feet per second (cfs) at Rome, GA, and about 50,000 cfs near Gadsden, AL (USACE Mobile District, 1997). Historically, daily discharges at the U.S. Geological Survey (USGS) gage on the Coosa River near Rome have been as low as 720 cfs (in August 2008) and as high as 64,600 cfs (in January 1947), and 65,500 cfs in more recent years (March 1990) (USGS, 2018a).

Figure E-7, Figure E-8, and Figure E-9 summarize flow data at three gages in the Coosa River Basin. USGS data for water years 1976–2018 were used in the figures (USGS, 2019a) (USGS, 2019b) (USGS, 2019c). That period represents the time since Carters Dam, the final dam in the Coosa River Basin, was completed (it became operational in 1975).

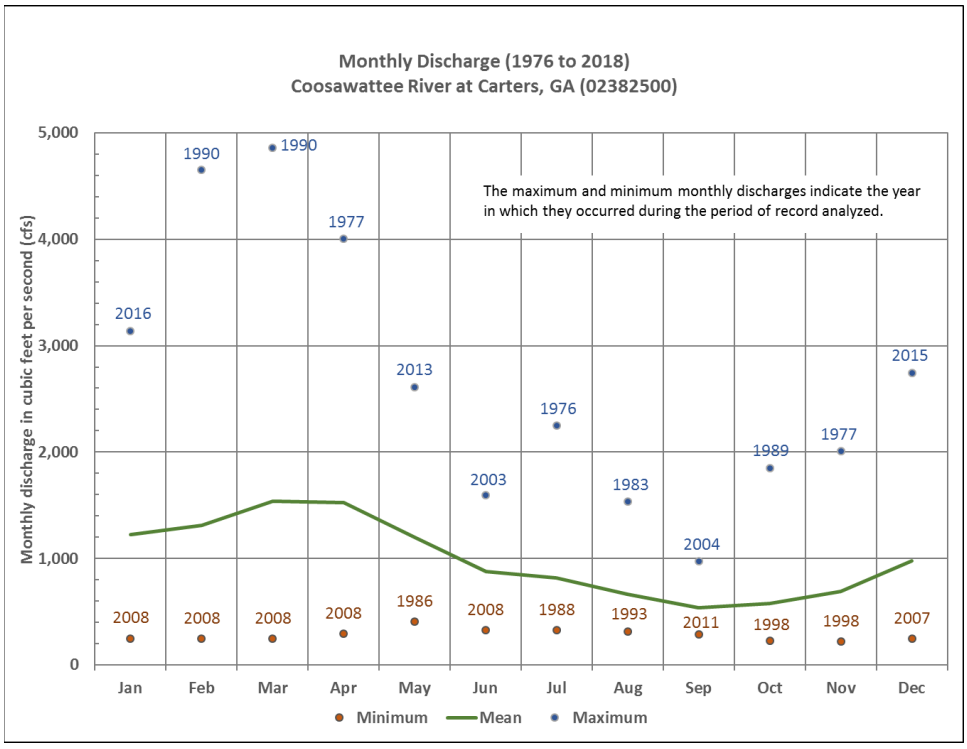


Figure E-7. Monthly Discharge, Coosawattee River at Carters, GA.

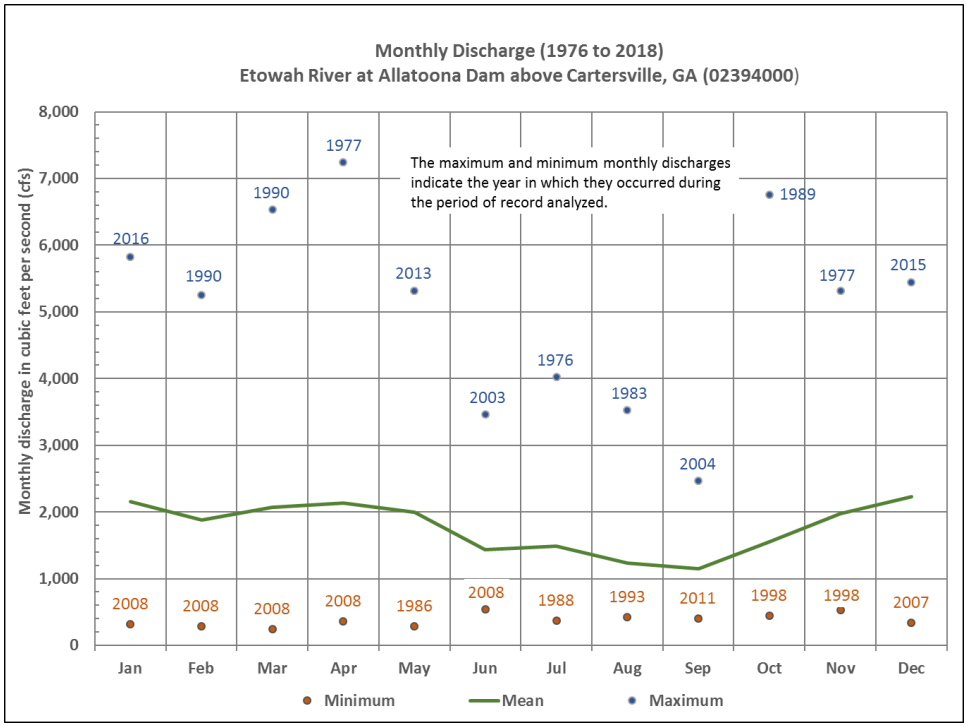


Figure E-8. Monthly Discharge, Etowah River at Allatoona Dam above Cartersville, GA.

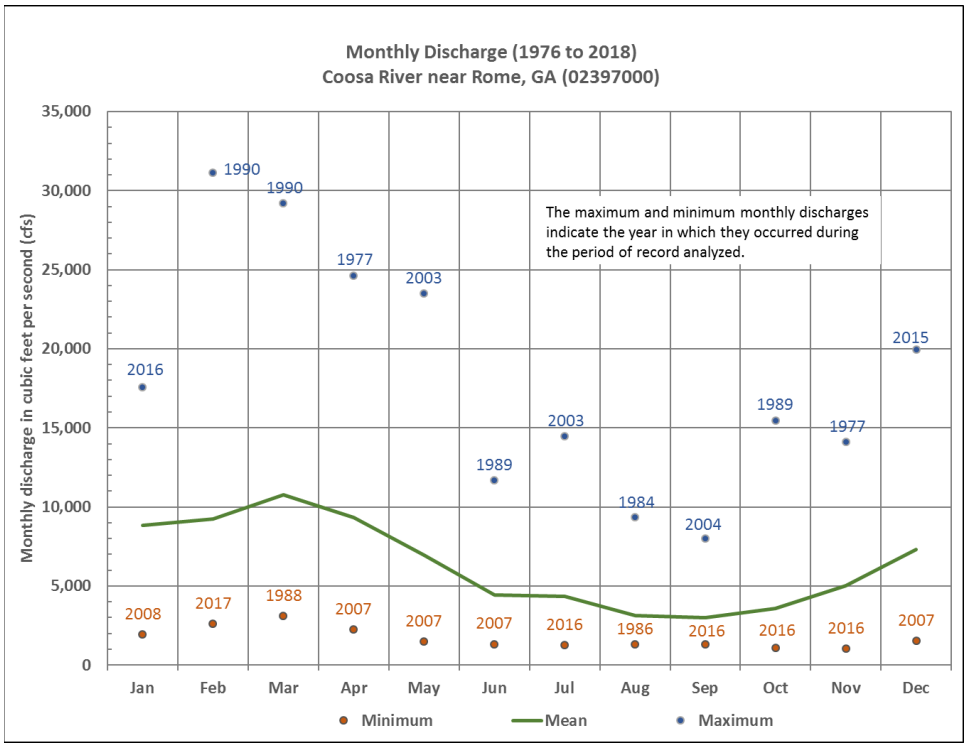


Figure E-9. Monthly Discharge, Coosa River near Rome, GA.

E.1.1.3.2 Tallapoosa River

The Tallapoosa River begins in northwest Georgia, 40 mi west of Atlanta, at an elevation of 1,145 ft. The river flows 235 mi into Alabama to join the Coosa River north of Montgomery (Figure E-1). The basin drains a total area of 4,687 sq mi of which 15 percent is in Georgia and 85 percent is in Alabama. From its source, the river falls at a rate of 12 ft/mi for the first 15 mi, then descends at a more gradual rate of 3.4 ft/mi. In the lower reach from Thurlow Lake to its mouth, the river falls at a rate of 1.6 ft/mi.

APC constructed four dams on the Tallapoosa River. The upper two projects (R.L. Harris Dam and Lake and Martin Dam and Lake) are hydropower peaking facilities that generally are operated several hours each weekday and not on the weekend. The two downstream projects (Yates and Thurlow lakes) are operated as run-of-river facilities, slightly reregulating peak releases and maintaining downstream minimum flows over the weekend when the upstream projects do not operate. Additional information on these projects is presented in Section E.1.1.4.9 through Section E.1.1.4.12 and in Appendix A to the Draft FR/SEIS (Sections A.1.1.9 through A.1.1.12).

The river's width varies from 250 ft to 700 ft and has banks that are 20 ft high along the floodplain. The principal tributary streams are the Little Tallapoosa River and Hillabee, Sougahatchee, South Sandy, and Uphapee creeks (USACE Mobile District, 1997). The river has a capacity of 2,500 cfs in the upper reaches, 22,000 cfs near Wadley, AL, and 60,000 cfs just downstream of Thurlow Lake (USACE Mobile District, 1997). Historically, flows at the USGS stream gage (02414500) on the Tallapoosa River at Wadley have been as low as 41 cfs (in August 1987) and as high as 125,000 cfs (in May 2003) (USGS, 2018b).

USGS flow data at the Wadley, AL, stream gage downstream of R.L. Harris Dam for water years 1984–2017 is summarized in Figure E-10 (USGS, 2019d). Those years represent the period following the completion and initial operation of the final dam on the Tallapoosa River, APC's R.L. Harris Dam, which became operational in 1983.

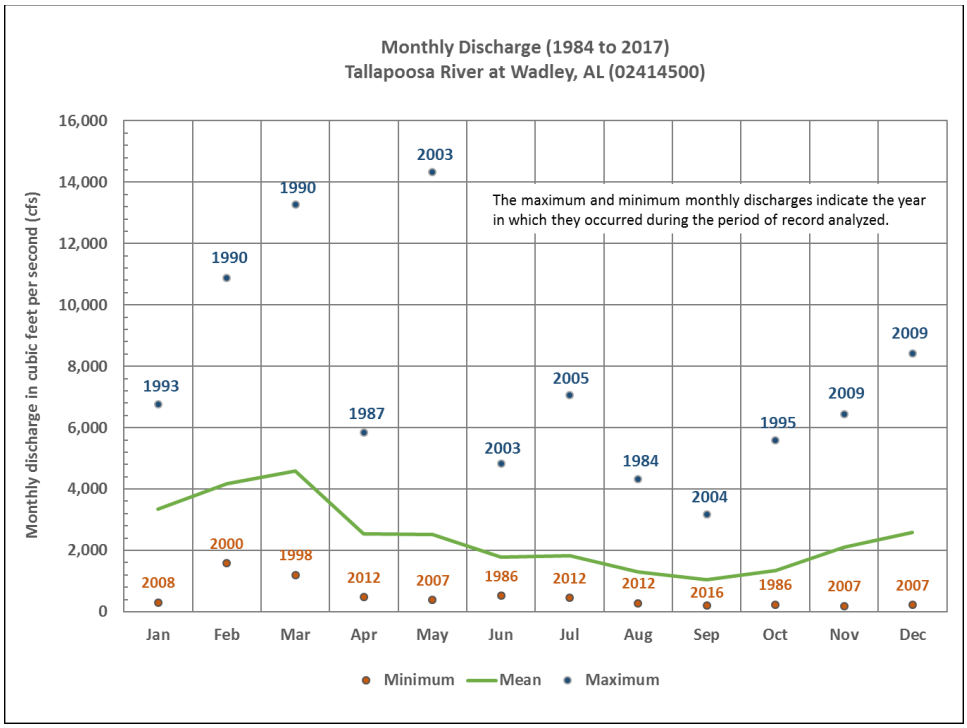


Figure E-10. Monthly Discharge, Tallapoosa River near Wadley, AL.

E.1.1.3.3 Alabama River

The confluence of the Coosa and Tallapoosa rivers forms the Alabama River near Wetumpka, AL, north of Montgomery, AL (Figure E-1). The Alabama River, excluding the Coosa and Tallapoosa River tributary areas, drains an area of 7,896 sq mi, all of which is in Alabama. Montgomery, the largest city on the stream, is about 14 mi downstream from the source of the Alabama River. The river meanders generally in a westerly direction for 100 mi to Selma, AL and then southwesterly 210 mi to join the Tombigbee River. The Alabama and Tombigbee rivers merge to form the Mobile River near Calvert, AL. The Alabama River has a relatively flat slope, averaging 0.3 ft/mi. The channel varies in width from 400 to 600 ft with banks 10 ft high (USACE Mobile District, 1997). The Cahaba River is a major tributary of the Alabama River, originating on the southern slope of Cahaba Mountain northeast of Birmingham, AL, at an elevation of about 1,200 ft. The river drains an area of 1,824 sq mi and flows southwesterly and southerly for 196 mi, joining the Alabama River 17 mi downstream from Selma.

USACE constructed and operates three multipurpose locks and dams (L&Ds) on the Alabama River: Robert F. Henry L&D, 30 mi above Selma, AL, and 245 mi above the river's mouth; Millers Ferry L&D, 73 mi downstream of Selma and 142 mi above the mouth; and Claiborne L&D, 82 mi above the mouth. The Alabama River has a carrying capacity that varies from 100,000 to 150,000 cfs (USACE Mobile District, 1997). Historically, the daily mean flow at the USGS gage on the Alabama River near Montgomery, AL, has been as low as 255 cfs (in June 1975) and the maximum peak flow has been as high as 290,000 cfs (in March 1990). The lowest annual 7-day minimum at the Montgomery gage was 1,914 cfs (in December 2007) (USGS, 2018c). The daily mean flow at the USGS gage on the Alabama River at Claiborne L&D has been as low as 1,540 cfs (in October 2007) and the maximum peak flow as high as 255,000 cfs (in March 1990). The lowest annual 7-day minimum at the Claiborne L&D gage was 2,540 cfs (in December 2007) (USGS, 2018d). Monthly flows at the two USGS gages for the water years 1976–2017 are summarized in Figure E-11 and Figure E-12 (USGS, 2019e) (USGS, 2019f).

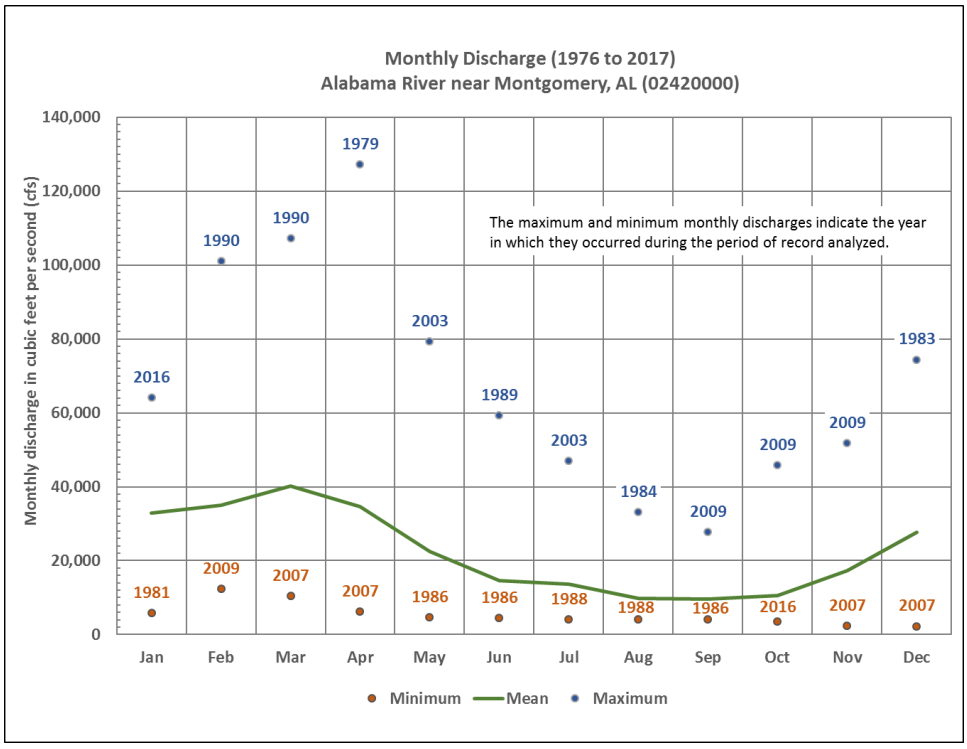


Figure E-11. Monthly Discharge, Alabama River near Montgomery, AL.

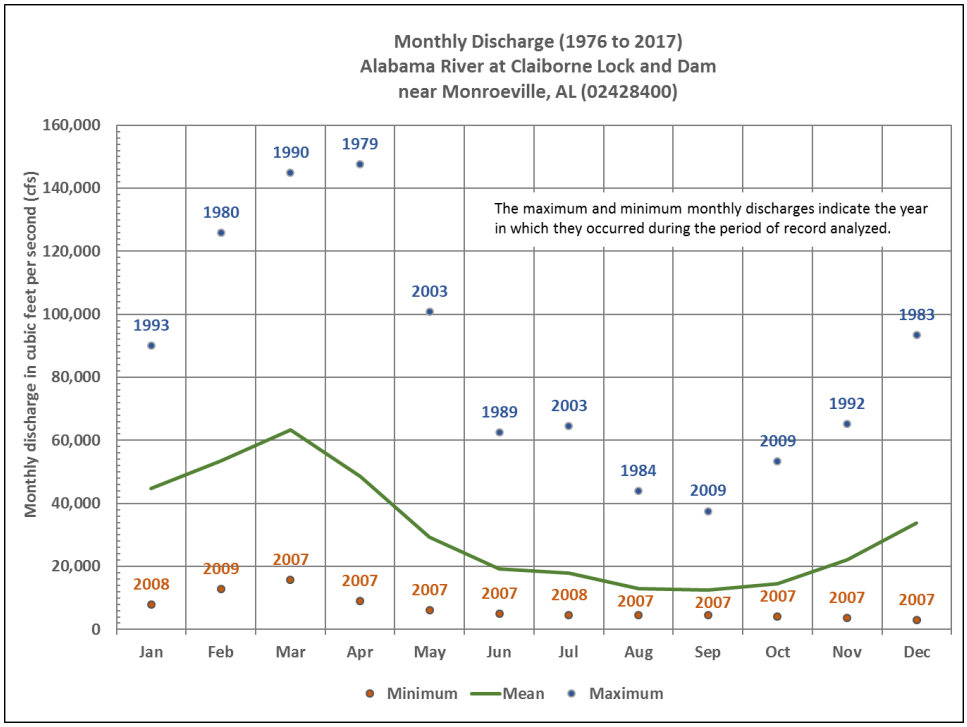


Figure E-12. Monthly Discharge, Alabama River at Claiborne L&D, AL.

E.1.1.3.4 Managed Flows to Support Commercial Navigation in the Alabama River

The Alabama River from Montgomery, AL, downstream to its confluence with the Tombigbee River to form the Mobile River, and thereafter downstream to Mobile, AL, provides an important navigation route for commercial barge traffic, serving as a valuable regional economic resource. Sufficient flows, coupled with the congressionally authorized navigation features, are required to provide usable water depths to support navigation. The authorized 9-ft-deep by 200-ft-wide navigation channel from the mouth of the Alabama River to Montgomery is provided by three locks and dams on the river (described in Sections E.1.1.4.13 through E.1.1.4.15) and a combination of dredging, river training works, and flow augmentation.

During the update of the Master Manual for the ACT River Basin (completed in May 2015), USACE in coordination with APC developed a protocol for the combined releases for Jordan and Bouldin dams on the Coosa River and Thurlow Dam on the Tallapoosa River (referred to as the Jordan-Bouldin-Thurlow [or JBT] minimum release target) to provide downstream flow conditions to support commercial barge navigation on the Alabama River whenever possible. The protocol for seasonally based JBT minimum releases is dependent on established thresholds (or *triggers*) for three specific variables: (1) basin inflows upstream of the JBT projects, (2) flow conditions at the Alabama-Georgia state line, and (3) available composite conservation storage in the APC projects on the Coosa and Tallapoosa rivers. The established flow targets and thresholds in the protocol define the conditions under which a 9.0-ft or 7.5-ft navigation channel depth in the Alabama River can be maintained and under which a viable navigation channel cannot be maintained because of drought conditions in the basin. A more detailed overview of the approved protocol for navigation releases and drought management is provided in Appendix A to the Draft FR/SEIS.

E.1.1.4 Surface Water—Reservoirs

Modern dam construction in the ACT River Basin dates from the middle to the latter part of the 1800s. Navigation locks and small dams provided sufficient depths for slack-water river traffic on the Coosa River in the early 1900s. Those locks and dams are either gone or their remnants are no longer serviceable. During the middle 1900s, large, multipurpose reservoirs were built throughout the basin for hydropower, navigation, recreation, and water supply (USACE Mobile District, 1997). By 1930, two dams on the Coosa River and three on the Tallapoosa River had been built to take advantage of the natural stream gradients for power production. The last major dam built in the basin—R.L. Harris Dam on the Tallapoosa River—was completed in 1983.

There are 17 major dams on the mainstem rivers in the ACT River Basin (Jordan Dam and Bouldin Dam on the Coosa River share a common reservoir). Six dams are federally owned and operated by USACE and 11 are privately owned and operated by APC. Of the 17 dams, two are on the Coosawattee River, one is on the Etowah River, seven are on the Coosa River, four are on the Tallapoosa River, and three are on the Alabama River. Key features of the USACE and APC projects in the ACT River Basin are summarized in Table E-1. USACE operates the following projects in the ACT River Basin: Allatoona Dam and Lake; Carters Dam and Lake/Carters Reregulation Dam (functions as a single project); Robert F. Henry L&D /R. E. "Bob" Woodruff Lake; Millers Ferry L&D /William "Bill" Dannelly Lake; and Claiborne L&D and Lake. These USACE projects are operated to provide multiple federally authorized purposes. APC operates four projects with federal flood risk management and navigation authorizations: Weiss Dam and Lake; H. Neely Henry Dam and Lake; and Logan Martin Dam and Lake on the Coosa River; and Harris Dam and Lake on the Tallapoosa River. Table E-2 depicts the federally authorized purposes for each of the five USACE projects and the four APC projects in the ACT River Basin. APC also operates seven other dams in the ACT River Basin that do not have any federally authorized project purpose(s). Those seven APC dams are: Martin, Yates, and Thurlow projects on the Tallapoosa River and Lay, Mitchell, and Jordan/Bouldin projects on the Coosa River. Jordan and Bouldin dams share a common reservoir known as Jordan Lake. All the APC projects in the ACT River Basin operate under licenses granted by the Federal Energy Regulatory Commission (FERC).

Table E-1. USACE and APC Reservoirs in the ACT River Basin—Project Data

Basin/river/ project name	Owner/state/ year initially completed	Drainage area (sq mi) [a]	Normal (summer) lake elev (ft) [b]	Reservoir size at normal (summer) pool (ac) [i]	Total storage at normal (summer) pool (ac-ft) [i]	Conservation storage (ac-ft)	Top of flood pool elev (ft) [c]	Total storage at top of flood pool (ac-ft) [i]	Dedicated Flood storage (ac-ft) [i]	Power capacity (megawatt [MW])
Coosawattee River		*862*								
Carters Dam and Lake	USACE/GA/1974	374	1,074	3,275	383,564	141,402 [j]	1099	472,757	89,192	600 [d]
Carters Reregulation Dam	USACE/GA/1974	520	698	990	17,380	16,571 [i]	NA	NA	0	None
Etowah River		*1,861*								
Allatoona Dam and Lake	USACE/GA/1949	1,122	840	11,164	338,253	270,247 [i]	860	626,860	288,606	82.2 [d]
Coosa River		*10,156*								
Weiss Dam and Lake	APC/AL/1961	5,270	564	30,027	306,655	263,417 [i]	574	704,414	397,759 [i]	87.75 [e]
H. Neely Henry Dam and Lake	APC/AL/1966	6,596	508	11,235	120,853	118,210 [i]	NA	NA	0	72.9 [e]
Logan Martin Dam and Lake	APC/AL/1964	7,743	465	15,269	273,467	144,383 [b]	477	519,110	245,673 [i]	128.25 [e]
Lay Dam and Lake	APC/AL/1914	9,053	396	11,795	262,887	92,352 [b]	NA	NA	0	177 [e]
Mitchell Dam and Lake	APC/AL/1923	9,778	312	5,855	170,783	51,577 [b]	NA	NA	0	170 [e]
Jordan Dam and Lake [f]	APC/AL/1929	10,102	252	5,937	210,198	19,057 [f]	NA	NA	0	100 [e]
Bouldin Dam [f]	APC/AL/1967	10,102	252	734	---- [f]	---- [f]	NA	NA	0	225 [e]
Tallapoosa River		*4,687*								
R.L. Harris Dam and Lake	APC/AL/1982	1,454	793	10,660	425,721	207,318 [i]	795	447,501	21,780	135 [b]
Martin Dam and Lake	APC/AL/1927	2,984	491 [g]	39,807	1,667,814	1,202,340 [b]	NA	NA	0	182.5 [b]
Yates Dam and Lake	APC/AL/1928	3,293	345 [g]	2,045	55,992	6,928 [b]	NA	NA	0	44.25 [b]
Thurlow Dam and Lake	APC/AL/1930	3,308	289 [g]	585	18,494	NA	NA	NA	0	81.35 [b]
Alabama River		*22,739*								
R F. Henry L&D / R.E. “Bob” Woodruff Lake	USACE/AL/1972	16,233	126 [h]	13,500	247,210	36,450 [j]	NA	NA	0	82 [d]
Millers Ferry L&D / William “Bill” Dannelly Lake	USACE/AL/1969	20,637	80.8 [h]	18,528	346,254	46,704 [j]	NA	NA	0	90 [d]
Claiborne Lock, Dam, and Lake	USACE/AL/1969	21,473	36 [h]	6,290	102,408	None	NA	NA	0	None

ac = acre; ac-ft = acre-feet

Notes:

a. Source: USGS HUC Units and stream gage data (Subregion 0315)

b. Source: USACE projects – verified by USACE (June 2014); APC projects – values verified by USACE coordination with APC via email (June 2014)

c. Source: USACE email (April 2019), placemat and WCM

d. Declared Power Capacity. The value may vary slightly from week to week depending on factors such as head and cooling capabilities; values shown are the nominal values reported

e. Source: (FERC, 2009)

f. Jordan and Bouldin Dams both impound the same reservoir and share the same reservoir storage.

g. Subtract one (1) ft to convert from ft NGVD29 to Martin datum. Source: Martin Dam FERC FEIS April 2015 (page 13)

h. Represents the upper limit elevation of the normal operating range

i. Source: All projects – verified by USACE HEC-ResSim Input (April 2019)

j. Source: USACE Water Control Manuals

Table E-2. Federally Authorized Purposes for USACE and APC Projects in the ACT River Basin

Federally authorized purposes	Flood risk management	Hydropower	Navigation	Recreation	Water supply	Water quality	Fish & wildlife
USACE Projects							
Carters Dam and Lake	●	●	●	●	●	●	●
Allatoona Dam and Lake	●	●	●	●	●	●	●
Robert F. Henry L&D / R.E. "Bob" Woodruff Lake		●	●	●		●	●
Millers Ferry L&D / William "Bill" Dannelly Lake		●	●	●		●	●
Claiborne L&D and Lake			●	●		●	●
APC Projects							
Weiss Dam and Lake	●		●				
H. Neely Henry Dam and Lake	●		●				
Logan Martin Dam and Lake	●		●				
R.L. Harris Dam and Lake	●		●				

One small low head dam on the Etowah River at Cartersville, GA, is not included in Table E-1. Known as Thompson-Weinman Dam, it was built in the early 1900s and is about 3.5 mi downstream of Allatoona Dam. It has been abandoned and no longer generates electricity or serves a useful purpose. Other locally constructed small impoundments (principally for water supply and recreation) exist in the basin, under construction, or permitted with construction pending (see Section E.1.1.4.16), but none of those projects are located on the mainstem rivers.

Storage reservoirs (not run-of-river reservoirs) are typically subdivided into separate storage levels, or pools, as shown in Figure E-13. The lowest level is defined as the inactive pool. Generally, only emergency reservoir releases are made from the *inactive storage* during extreme drought events. Above the inactive pool is the conservation pool. *Conservation storage* is defined as the volume of reservoir storage available to meet multiple authorized project purposes (e.g., hydropower, water supply, and recreation). USACE Mobile District has further partitioned the conservation storage in its reservoirs into multiple action zones. Each action zone triggers application of different operating criteria designed to increasingly curb or limit reservoir releases to conserve storage during periods when the amount of available conservation storage is depleted as a result of dry or drought conditions. Appendix A to the Draft FR/SEIS (Section A.1.1.2) presents additional information on the configuration of the action zones within the conservation storage of Allatoona Lake.

For reservoirs that include *flood storage*, the flood pool lies above the conservation pool. As shown in the first graphic in Figure E-13, the volume of storage above the conservation pool when the gates on the dam are closed is considered active flood storage. Runoff from a large rainfall event is stored in that area until it can be safely passed through the downstream channel system. In an exceptional rainfall event, the active flood storage volume may be exceeded, requiring that the gates be opened to begin releasing flood waters and concurrently providing additional temporary "surcharge storage" above the top of the active flood storage. As shown in the second graphic in Figure E-13, surcharge operations may continue up to a defined maximum surcharge elevation until the flood event recedes to the extent that the gates can once again be closed.

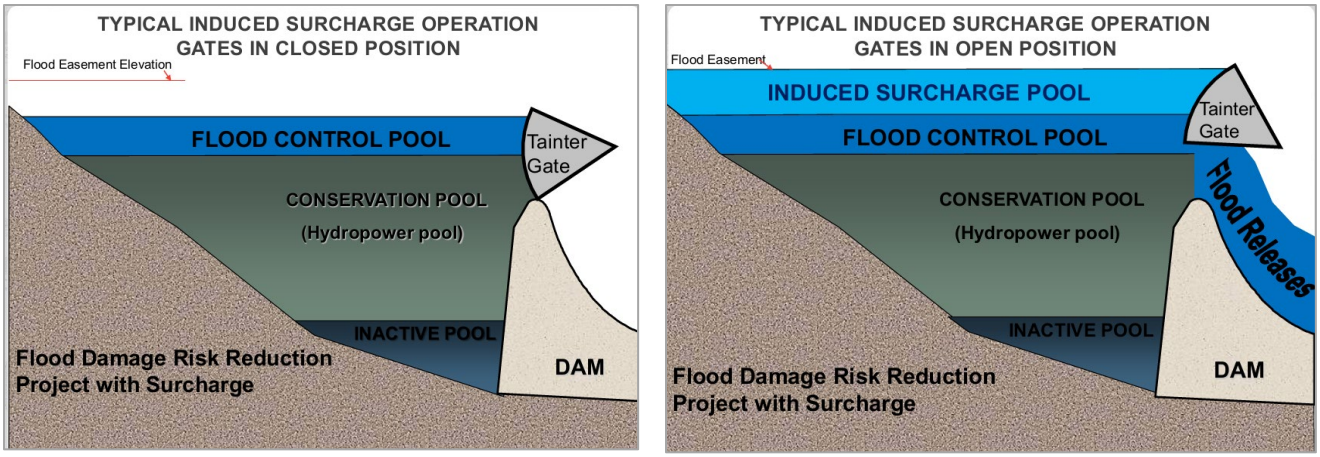


Figure E-13. General Schematic Depicting the Components of Reservoir Storage.

The USACE and APC reservoirs on the mainstem rivers of the ACT River Basin cumulatively have about 2.61 million acre-feet (ac-ft) of conservation storage. As shown in Figure E-14, Martin Lake on the Tallapoosa River has the greatest volume of conservation storage in the basin, about 46 percent of the total. The next largest conservation storage volumes, in decreasing order, are in Allatoona Lake, Weiss Lake, R.L. Harris Lake, Carters Lake/Reregulation Pool (functions as a single project), and Logan Martin Lake. These five reservoirs hold a combined total of about 40 percent of the conservation storage in the basin (Figure E-14). Thurlow Lake and Claiborne Lake are not included in the figure because they have no conservation storage. APC projects control about 80 percent of the conservation storage in the ACT River Basin, and USACE projects (Allatoona Lake, Carters Lake/Reregulation Pool, R.E. "Bob" Woodruff Lake, and William "Bill" Dannelly Lake) control about 20 percent. The two USACE reservoirs that are furthest upstream, Allatoona Lake and Carters Lake/Reregulation Pool, control about 16 percent of the total basin conservation storage. Each reservoir is briefly discussed below; Appendix A to the Draft FR/SEIS provides a more detailed description of each reservoir.

The USACE and APC reservoirs on the mainstem rivers of the ACT River Basin cumulatively have about 1.04 million ac-ft of dedicated flood storage above the normal summer pool level at two USACE and three APC projects in the basin: Allatoona Lake, Carters Lake, Logan Martin Lake, R.L. Harris Lake, and Weiss Lake. As shown in Figure E-15, about 89 percent of the dedicated flood storage capacity is located in Weiss Lake, Allatoona Lake, and Logan Martin Lake. Lowering the top of conservation pool level at these projects and at the APC H. Neely Henry project during the winter months provides additional flood storage capacity during that period.

Most of the dams on the mainstem rivers in the ACT River Basin have hydropower generation as a project purpose. Hydropower dams convert the force of falling water into electrical power. Much of the hydropower generation is *peaking* power. The generators are turned on when there is the highest, or *peak,* demand for power. Air conditioning and heating are the power uses that often cause peak demands for power, so the hydropower releases are usually made when temperatures are extreme. Peaking hydropower projects typically generate power during the peak electrical demand hours on weekdays (generally 2–8 hours per day) and then do not operate on the weekend. In contrast, the run-of-river hydropower projects in the ACT River Basin typically generate power by passing the available inflows from upstream peaking projects. However, run-of-river projects do normally operate for a portion of the day, thus significantly influencing daily flows in the tailrace and downstream water courses. Unlike storage projects, run-of-river projects with hydropower facilities generally maintain a stable pool elevation and do not follow a guide curve or redistribute flows seasonally.

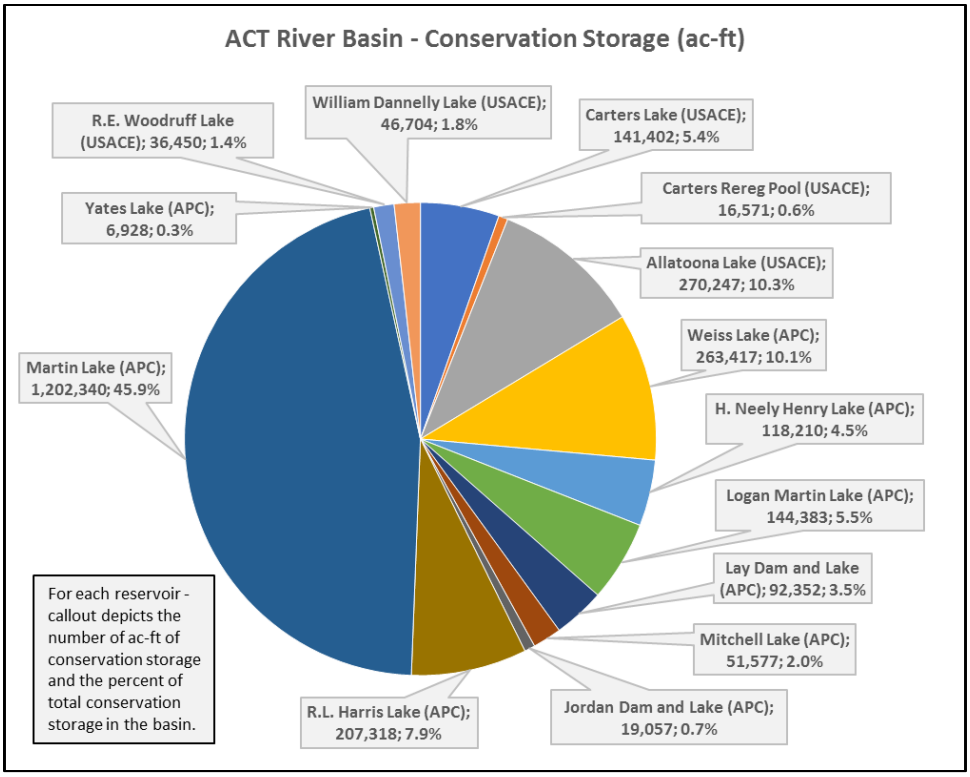


Figure E-14. ACT River Basin Reservoir Conservation Storage Composition.

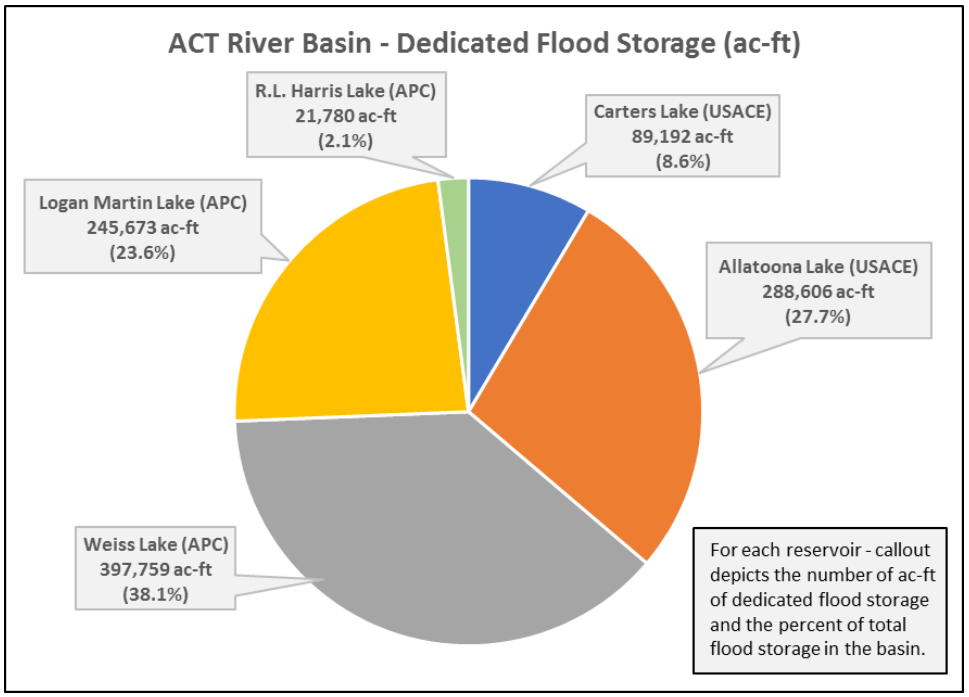


Figure E-15. ACT River Basin Reservoir Flood Storage Composition.

The following subsections briefly describe each of the USACE and APC dams on the mainstem rivers in the ACT River Basin, generally from upstream to downstream. The physical attributes of these projects and their project operations are described in more detail in Appendix A to the Draft FR/SEIS (Section A.1.1).

E.1.1.4.1 Carters Dam and Lake

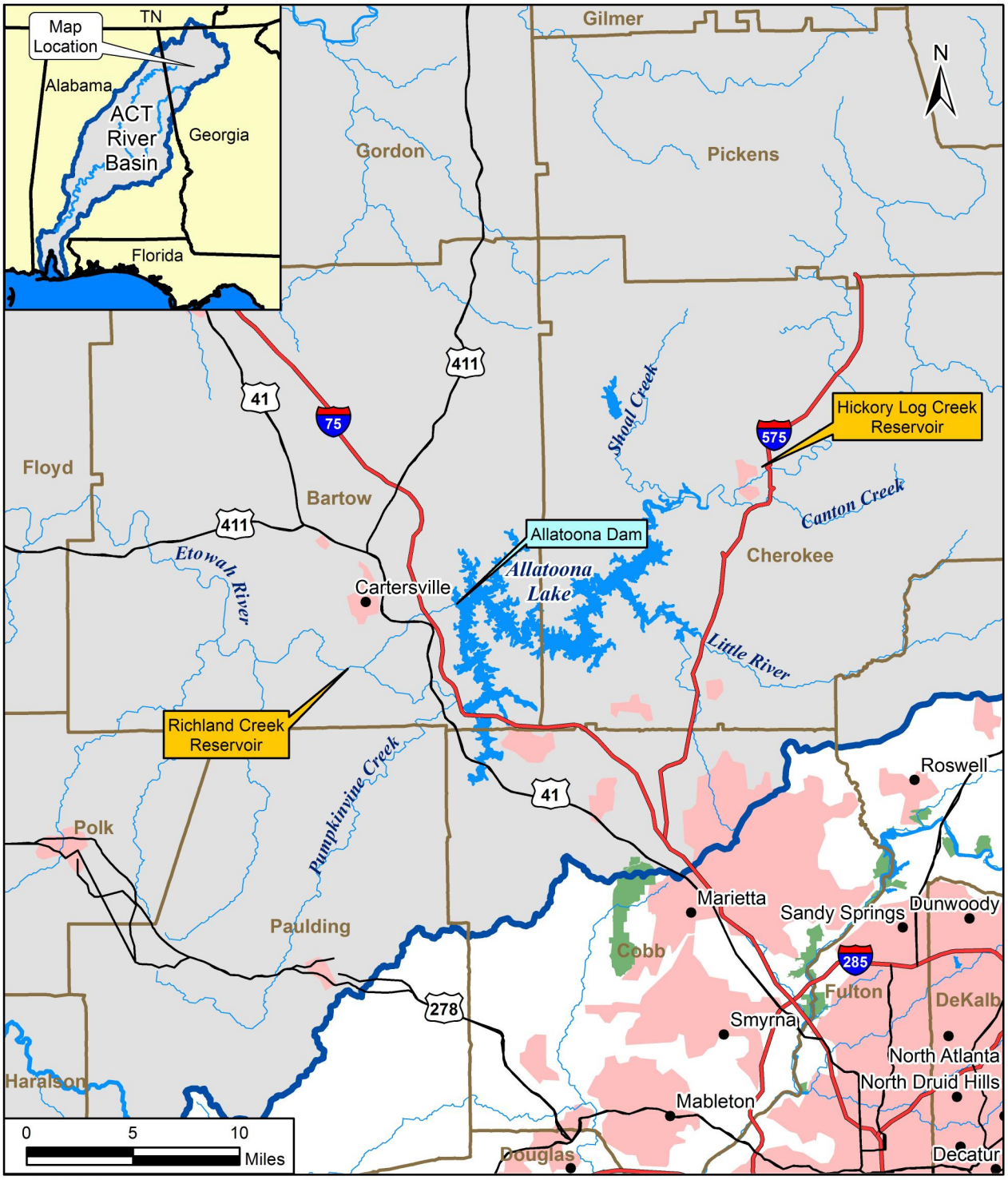
Carters Dam and Lake / Carters Reregulation Dam is a USACE multipurpose project on the Coosawattee River in Murray County, GA. Completed in 1974, the project encompasses portions of Murray and Gilmer counties. Authorized project purposes include flood risk management, hydropower, navigation, water quality, fish and wildlife conservation, and recreation. The general location of Carters Dam and Lake is shown on Figure E-1. Carters Dam is a pumped-storage peaking facility. Water released from Carters Dam flows through the penstock and generates power as it is discharged into the reregulation dam pool. USACE generates power at Carters Dam only a few hours each weekday, when demand for electricity is at its highest. When demand for electricity is low, usually during the night or over the weekend, two of the four generating units can be reversed to pump water back up from the reregulation pool into Carters Lake. Water is available again for hydropower generation in the next peak use period, and Carters Lake is maintained at its optimal power generation level. In addition to providing a lower pool to support pumped storage operations, the reregulation dam reregulates peaking flows from Carters Dam to provide more stable downstream flow conditions.

Key physical attributes of the Carters Dam and Lake project are presented in Table E-1. The Carters Dam project has a hydropower generating capacity of 600 megawatts (MW), the largest capacity of any project in the ACT River Basin and one of the largest plants in Southeastern Power Administration's Georgia-Alabama-South Carolina system for marketing of hydropower generated by USACE projects. The top of the conservation pool is at elevation 1,074 ft in the summer and 1,072 ft in the winter. The bottom of the conservation pool is elevation 1,022 ft. The normal year-round operating range for the pool behind the reregulation dam is elevation 674–698 ft. The Carters Reregulation Dam provides a seasonally adjusted continuous minimum flow to the Coosawattee River, ranging from a minimum of 250 cfs in the month of September to 865 cfs in March when the Carters Lake pool level is within the project's Action Zone 1. When pool levels decline into Action Zone 2, a continuous minimum flow of 240 cfs is released to the Coosawattee River until the Carters Lake pool level recovers to Zone 1. The Carters Dam and Lake project and its operations, including action zone criteria, are described in more detail in Appendix A to the Draft FR/SEIS (Section A.1.1.1).

In 1982, private sector hydropower interests began efforts to acquire a license from FERC to develop nonfederal hydropower generation facilities at the Carters Reregulation Dam. Those efforts by various applicants continued unsuccessfully until March 2011 (FERC, 2013). On April 3, 2019, Cherokee Rivers Company, LLC filed an application for a Preliminary Permit for the Lower Coosawattee Hydroelectric Project at the Carters Reregulation Dam (FERC, 2019b). As of the publication of this document, the Preliminary Permit application was pending. On August 22, 2019, Cherokee Rivers Company, LLC provided FERC a notice of intent to file a license application for the Lower Coosawattee Hydroelectric Project at the Carters Reregulation Dam (FERC, 2019a).

E.1.1.4.2 Allatoona Dam and Lake

The USACE Allatoona Dam project is on the Etowah River in Bartow County, GA, near the city of Cartersville. The 11,164-acre (-ac) Allatoona Lake formed by the dam encompasses portions of Bartow, Cherokee, and Cobb counties. The project, completed in 1949, was built for flood risk management, regulation of stream flow for navigation, hydropower, and recreation. Other authorized purposes of the project are water supply, water quality, and fish and wildlife conservation. The Allatoona Dam and Lake area is shown in Figure E-16.



Allatoona Dam and Lake

Figure E-16

Key physical attributes of the Allatoona Dam and Lake project are presented in Table E-1. The top of the conservation pool is at elevation 840 ft in the summer and 823 ft in the winter. The bottom of the conservation pool is elevation 800 ft. Flood flows captured in the reservoir are gradually released over subsequent weeks, unless additional flood flows are anticipated. Hydropower releases during the low-flow season provide water to meet downstream needs, including M&I water supply, hydropower generation at downstream APC projects on the Coosa River, and support to commercial navigation on the Alabama River. The project guide curve, which provides the target pool level for management of the reservoir throughout the year, is presented in Figure E-17. The conservation storage in Allatoona Lake below the guide curve has been segmented into four action zones, each action zone with an established set of operating criteria that are increasingly constrained to conserve storage when reservoir pool levels decline during extended dry conditions. The project authorization requires a minimum continuous release of 240 cfs from Allatoona Dam, accomplished through a service unit that generates power while providing a continuous flow to the Etowah River. Allatoona Dam typically operates in a peaking mode, generating power between 2 and 6 hours during normal operations each weekday. The period of daily power generation is dependent upon the stage of conservation pool drawdown. Generally, only the 240 cfs minimum release occurs on the weekend, but weekend generation may occur if required to meet customer needs. More details on Allatoona Dam and Lake project and its operations are provided in Appendix A to the Draft FR/SEIS (Section A.1.1.2).

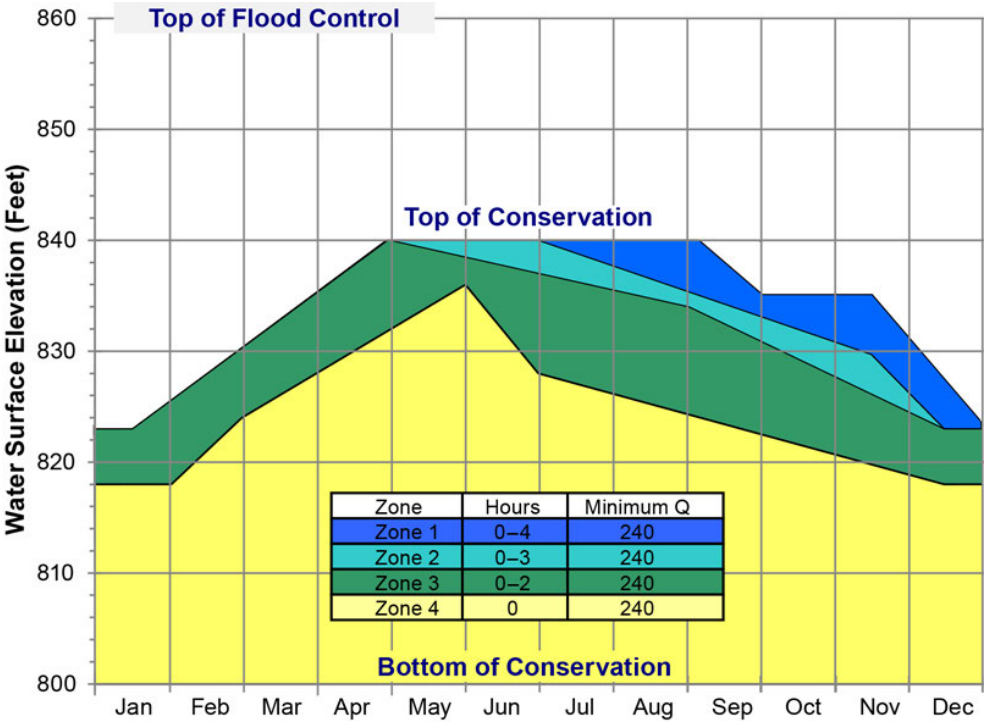
The Cobb County-Marietta Water Authority (CCMWA) and the City of Cartersville have water supply storage contracts with USACE (for 12,485 ac-ft and 6,054 ac-ft, respectively) that accommodate water withdrawals from the lake for M&I water supply. Water reclamation facilities (WRFs) return treated wastewater to Allatoona Lake; the Northwest WRF and Noonday Creek WRF are both in Cobb County and are operated by the Cobb County Water System.

The Allatoona project includes a subimpoundment feature, locally known as Lake Acworth, on the Proctor Creek arm of the lake in the northwest corner of Cobb County. The 325-ac subimpoundment directly supports the project purposes of recreation and fish and wildlife conservation. Lake Acworth is shown on Plate 2-6 of the Allatoona Dam and Lake WCM in Appendix A to the Draft FR/SEIS. The subimpoundment dam provides a nonfluctuating pool level at about elevation 848 ft and has two 24-inch sluices to lower the pool for mosquito control and other purposes as needed. Land around the subimpoundment is leased to the Lake Acworth Authority and Cobb County Parks Department as public parks.

E.1.1.4.3 Weiss Dam and Lake

Weiss Dam and Lake is the furthest upstream of the seven APC reservoirs on the Coosa River. The dam is located near Centre in Cherokee County, AL, and the reservoir extends about 52 mi upstream into Floyd County in northwestern Georgia. The reservoir has a surface area of 30,027 ac at full summer pool of elevation of 564 ft. Key physical attributes of the Weiss Dam and Lake project are presented in Table E-1. The reservoir has 447 mi of shoreline, a maximum depth of about 62 ft, and relatively shallow depths over much of the reservoir area, typically around 10 ft at normal pool elevation. The Weiss Dam and Lake area is shown on Figure E-18.

In addition to its principal purpose for hydropower generation and federally authorized purposes for flood risk management and navigation support (Table E-2), Weiss Dam and Lake provides incidental benefits for maintenance of water quality, M&I water supply, recreation, and fish and wildlife conservation (FERC, 2009). From May through the end of August, the reservoir is normally operated near full-pool elevation of 564 ft with normal inflows and average system-generating requirements. Beginning in September, the reservoir is gradually drawn down to elevation 558 ft by the end of December. Reservoir refilling begins around January 1 and continues until the end of April, when full pool (564 ft) is normally reached. Weiss Dam and Lake provide dedicated storage for flood operations between elevations 564 ft and 574 ft (397,759 ac-ft) and additional storage for flood operations between elevations 558 ft and 564 ft (148,400 ac-ft) during the winter/spring reservoir drawdown period described above (USACE Mobile District, 2004a).

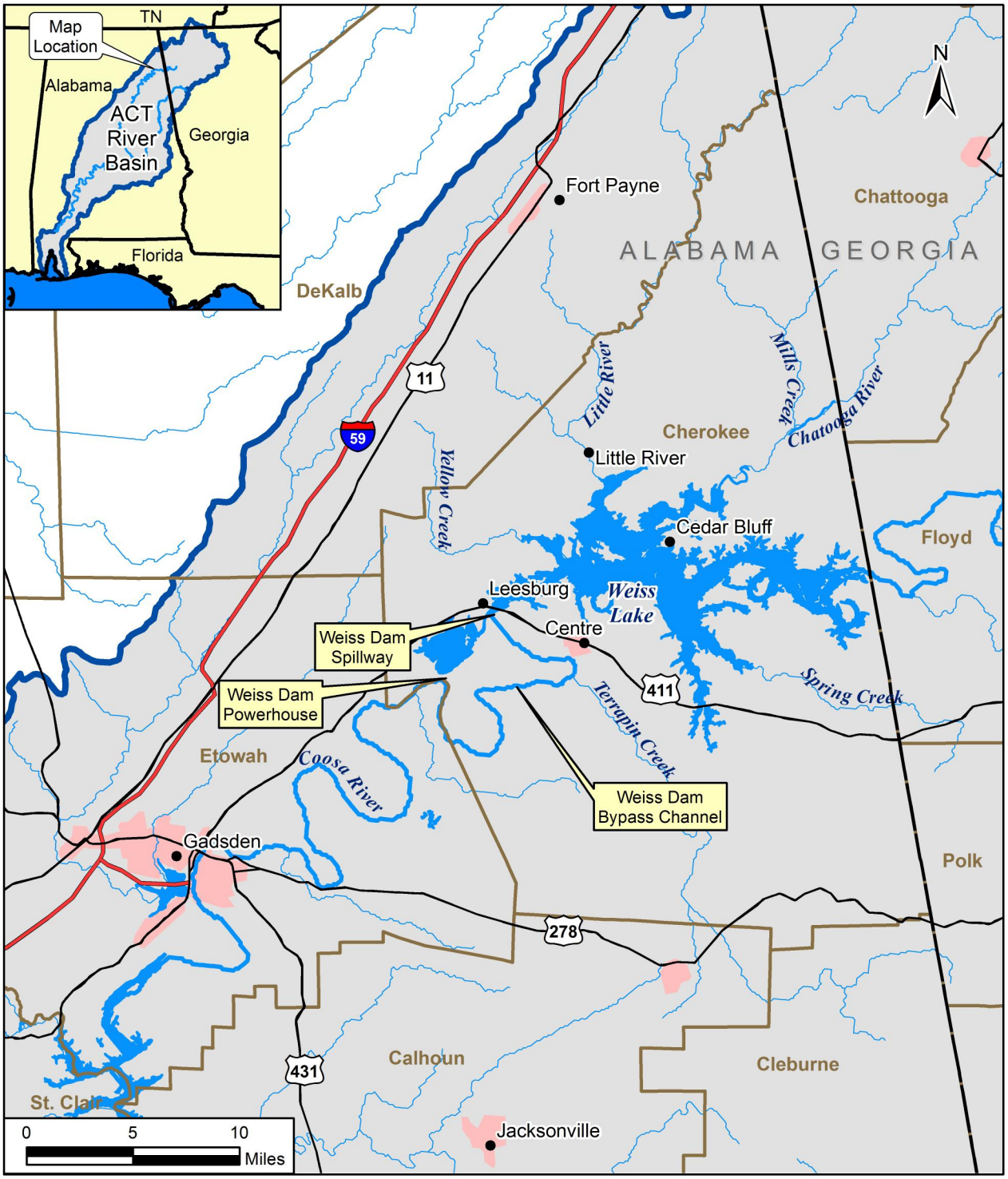


Note: Minimum Q = minimum continuous release from Allatoona Dam (240 cfs)

Figure E-17. Allatoona Lake Guide Curve and Conservation Storage Action Zones.

Discharges from Weiss Dam are made through a powerhouse and a separate spillway structure, which was constructed along the original Coosa River alignment. A canal about 7,000 ft long carries water from the main reservoir to the forebay at the powerhouse. The Weiss Dam powerhouse discharges into a 1,300-ft-long, man-made tailrace canal that re-enters the Coosa River at the downstream end of a bypass about 20 mi downstream of the spillway structure. The bypassed portion of the Coosa River is shown on Figure E-18. The spillway structure is used to pass flood waters exceeding the discharge capacity of the powerhouse, which is 24,650 cfs with all three units in operation. APC implements a variable minimum flow in the bypassed section of the Coosa River from the Weiss Dam spillway during normal (non-flood) operations, which ranges from 4 to 9 percent of the flow in the Coosa River at the USGS gage at Mayo's Bar, near Rome, GA (USGS 02397000), depending on the month of the year (Nix, 2018).

APC normally operates the Weiss Dam project in a peaking mode with generation units kept in the spinning mode to allow for quick hydropower production when needed by the electrical grid. Typical operation for power generation ranges from 1 to 6 hours per day during the week with no generation on the weekend. The generating capacity of the project is 87.75 MW. Discharges from the powerhouse tailrace enter the upper reaches of APC's downstream H. Neely Henry Lake. The dam's operation is coordinated with releases from H. Neely Henry Dam to keep the pool levels stable and in balance (USACE Mobile District, 1997). Current Weiss Dam and Lake operations are described in more detail in Appendix A to the Draft FR/SEIS (Section A.1.1.3).



Weiss Dam and Lake

Figure E-18

APC operates Weiss Dam, in coordination with its other hydropower projects on the Coosa River, for flood risk management in accordance with regulations prescribed by the Secretary of the Army in 33 CFR § 208.65. USACE and APC adopted a Memorandum of Understanding (MOU) in December 1965 concerning the operation of the Weiss Dam and Lake project, which, along with the October 1965 Reservoir Regulation Manual for the project (now called the WCM), has been used to implement the prescribed regulations. The MOU and the associated manual clarify the responsibilities of the two entities regarding operation of the project for flood risk management and other purposes and provide for the orderly exchange of hydrologic data (USACE Mobile District, 1965). The USACE Weiss Dam and Lake WCM is being updated as part of the proposed actions addressed in this Draft FR/SEIS, and an updated USACE/APC MOU is pending completion of the WCM update process.

E.1.1.4.4 H. Neely Henry Dam and Lake

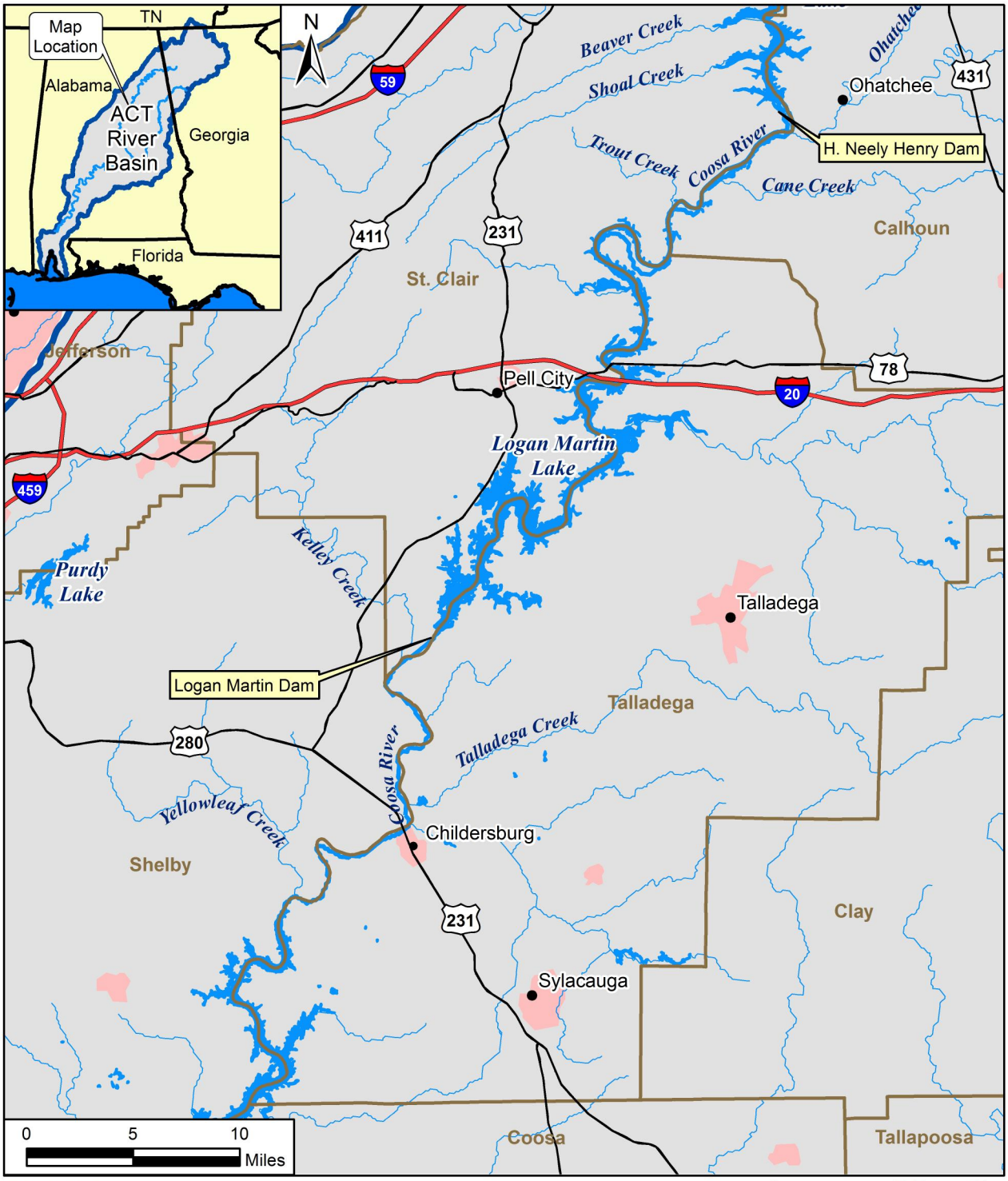
The APC H. Neely Henry Dam and Lake project lies in St. Clair, Calhoun, and Etowah counties in Alabama and extends about 78 river miles (RM) upstream from H. Neely Henry Dam to the tailwater of Weiss Dam. The city of Gadsden, AL, is approximately 27 mi upstream of the dam. The reservoir has a surface area of 11,235 ac at the summer lake elevation of 508 ft, 339 mi of shoreline, a maximum depth of 53 ft, and a relatively shallow average depth of about 11 ft. The general location of H. Neely Henry Dam and Lake is shown on Figure E-1. Key physical attributes of the H. Neely Henry Dam and Lake project are presented in Table E-1. In addition to its principal purpose for hydropower generation and federally authorized purposes for flood risk management and navigation support (Table E-2), H. Neely Henry Dam and Lake provides incidental benefits for maintenance of water quality, M&I water supply, recreation, and fish and wildlife conservation (FERC, 2009) (USACE Mobile District, 2014b).

APC normally operates H. Neely Henry Dam in a peaking mode for several hours each weekday, as power demand requires, with no generation on the weekend. The generating capacity of the project is 72.9 MW. Discharges from the powerhouse enter the upper reaches of Logan Martin Lake. The level of H. Neely Henry Lake is kept at or near the normal maximum water level of elevation 508 ft from May 1 through the end of September. Beginning in October through the end of November, the water level is drawn down to the winter guide curve elevation 507 ft, where it remains until the end of March. By the end of April, the water level is raised to the summer elevation of 508 ft (USACE Mobile District, 2014b). Current H. Neely Henry Dam and Lake operations are described in more detail in Appendix A to the Draft FR/SEIS (Section A.1.1.4).

APC operates the H. Neely Henry Dam, in coordination with its other hydropower projects on the Coosa River, for flood risk management in accordance with regulations prescribed by the Secretary of the Army in 33 CFR § 208.65. USACE and APC adopted an MOU concerning the operation of the H. Neely Henry Dam and Lake project which, along with the January 1979 USACE Reservoir Regulation Manual for the project (now called the WCM), has been used to implement the prescribed regulations. The MOU and associated manual clarify the responsibilities of the two entities regarding operation of the project for flood risk management and other purposes and provide for the orderly exchange of hydrologic data (USACE Mobile District, 2014b). The USACE H. Neely Henry Dam and Lake WCM was updated in December 2014, and an updated USACE/APC MOU is pending.

E.1.1.4.5 Logan Martin Dam and Lake

The APC Logan Martin Dam and Lake project lies in Calhoun, St. Clair, and Talladega counties in Alabama and extends about 48.5 RM upstream from Logan Martin Dam to the tailwater of H. Neely Henry Dam. The Logan Martin Dam and Lake area is shown on Figure E-19. Key physical attributes of the project are presented in Table E-1. The lake has a surface area of 15,269 ac at the normal summer pool elevation of 465 ft, 275 mi of shoreline, and a maximum depth of 69 ft at the dam (FERC, 2009). In addition to its principal purpose for hydropower generation and federally authorized purposes for flood risk management and navigation support (Table E-2), Logan Martin Dam and Lake provides incidental benefits for augmentation of low inflow, recreation, and fish and wildlife habitat.



Logan Martin Dam and Lake

Figure E-19

APC normally operates Logan Martin Dam in a peaking mode for several hours each weekday, depending on electrical power demand. The generating capacity of the project is 128.25 MW. From May 8 through the end of September, Logan Martin Lake is operated from the full-pool elevation of 465.0 ft during normal inflows and system-generating requirements. Beginning on October 1, the guide curve decreases to elevation 463.0 ft by the end of the month. Between November 1 and December 31, the water level drops to elevation 460 ft, where it remains until March 30. On April 1, the water level begins rising toward the normal full-pool elevation (FERC, 2009). Logan Martin Dam and Lake provide dedicated storage for flood operations between elevations 465 ft and 477 ft (245,673 ac-ft) and additional storage for flood operations between elevations 460 ft and 465 ft (66,700 ac-ft) during the winter/spring reservoir drawdown period described above (USACE Mobile District, 2004b). Discharges from Logan Martin Dam enter the upper end of Lay Lake. When Logan Martin Lake inflow exceeds the dam's power plant discharge capacity (32,700 cfs), the excess inflow is released through the spillway. Current Logan Martin Dam and Lake operations are described in more detail in Appendix A to the Draft FR/SEIS (Section A.1.1.5).

APC operates Logan Martin Dam, in coordination with its other hydropower projects on the Coosa River, for flood risk management in accordance with regulations prescribed by the Secretary of the Army in 33 CFR § 208.65. USACE and APC adopted an MOU in November 1967 concerning the operation of the Logan Martin Dam and Lake project which, along with the January 1968 Reservoir Regulation Manual for the project (now called the WCM), has been used to implement the prescribed regulations. The MOU and associated manual clarify the responsibilities of the two entities regarding operation of the project for flood risk management and other purposes and provide for the orderly exchange of hydrologic data (USACE Mobile District, 1968). The USACE Logan Martin Dam and Lake WCM is being updated as part of the proposed actions addressed in this Draft FR/SEIS, and an updated USACE/APC MOU is pending completion of the WCM update process.

E.1.1.4.6 Lay Dam and Lake

The APC Lay Dam and Lake project lies in Chilton, Coosa, Shelby, St. Clair, and Talladega counties in Alabama and extends about 48 RM upstream from Lay Dam to the tailwater of Logan Martin Dam. The 11,795-ac reservoir (at elevation 396 ft) has about 289 mi of shoreline and a maximum depth of 88 ft (FERC, 2009). The general location of Lay Dam and Lake is shown on Figure E-1. Key physical attributes of the Lay Dam and Lake project are presented in Table E-1. APC operates the project principally for hydropower generation, but it also incidentally provides benefits for water quality, water supply, and recreation. The project has a generating capacity of 177 MW. The reservoir is typically maintained near the top of the conservation pool (396 ft), but the level can be drawn down 1 ft to meet high power demands. The power plant operates as necessary to keep the lake from exceeding the top of the conservation pool. Generally, the project is operated in a run-of-river mode, releasing outflows that approximate daily reservoir inflows. Although Lay Lake has no dedicated flood risk management storage, APC coordinates its operation with other projects on the Coosa River to minimize flooding. Discharges from the powerhouse enter the upper reaches of Mitchell Lake. Current Lay Dam and Lake operations are described in more detail in Appendix A to the Draft FR/SEIS (Section A.1.1.6).

E.1.1.4.7 Mitchell Dam and Lake

The APC Mitchell Dam and Lake project lies in Chilton and Coosa counties in Alabama and extends 14 RM upstream from Mitchell Dam to the tailwater of Lay Dam. The 5,855-ac reservoir (at elevation 312 ft) has 147 mi of shoreline and a maximum depth of 90 ft (FERC, 2009). The general location of Mitchell Dam and Lake is shown on Figure E-1. Key physical attributes of the Mitchell Dam and Lake project are presented in Table E-1. The project is operated by APC primarily for hydropower production. The reservoir also provides incidental benefits for water quality, water supply, and recreation. The project is operated in a run-of-river mode with a daily inflow basically equaling outflow. Discharges from the powerhouse enter the upper reaches of Jordan Lake (FERC, 2009). APC maintains the reservoir as close to the top of the conservation pool as possible (312 ft), with drawdowns up to 1 ft if necessary to meet power demands. The project has a generating capacity of 170 MW. There is no dedicated

flood storage at the Mitchell Dam and Lake project. Current Mitchell Dam and Lake operations are described in more detail in Appendix A to the Draft FR/SEIS (Section A.1.1.7).

E.1.1.4.8 Jordan Dam and Lake and Bouldin Dam

The APC Jordan Dam and Lake and Bouldin Dam projects lie in Elmore, Chilton, and Coosa counties in Alabama and extend 18 mi upstream from the Jordan Dam to the tailwater of Mitchell Dam. The 5,937-ac reservoir (at elevation 252 ft) has 118 mi of shoreline and a maximum depth of 110 ft. The general locations of Jordan Dam and Lake and Bouldin Dam are shown on Figure E-1. Key physical attributes of the projects are presented in Table E-1. Jordan Dam and Lake and Bouldin Dam are the furthest downstream APC facilities on the Coosa River, a short distance upstream of the confluence of the Coosa and Tallapoosa rivers at Wetumpka, AL. The Bouldin Dam is on a 3-mi-long forebay canal about 1 mi upstream from Jordan Dam and Lake. The Bouldin Dam tailrace canal is 5 mi long and discharges into the Coosa River downstream of Jordan Dam near the confluence of the Tallapoosa and Coosa rivers. The Bouldin Dam forebay and intake canal have a surface area of 734 ac and a maximum depth of 52 ft (FERC, 2009).

Jordan Dam and Lake and Bouldin Dam provide for peaking hydropower generation by APC. The Jordan Dam and Lake and Bouldin Dam projects have generating capacities of 100 MW and 225 MW, respectively. The projects are normally operated in a run-of-river mode, with daily inflow basically equaling outflow. Normal operations maintain a lake-level near elevation 252 ft throughout the year, with no storage available for flood risk management. The level of Jordan Lake is frequently lowered up to 1 ft to meet power demands or minimum flow targets (FERC, 2009). Current Jordan Dam and Lake and Bouldin Dam operations are described in more detail in Appendix A to the Draft FR/SEIS (Section A.1.1.8).

Lay, Mitchell, and Jordan dams are operated as necessary to maintain downstream flow requirements on the weekend since the upper storage projects normally are not operated on weekends. Jordan Dam is the only APC project on the Coosa River that has a FERC mandatory minimum flow requirement for ecological and recreational purposes. APC has operated Jordan Dam under minimum flow requirements since the late 1960s. Mandatory minimum continuous and pulse flows from Jordan Dam vary seasonally and are described in detail in Appendix A to the Draft FR/SEIS. All flows exceeding the minimum flow requirement at Jordan Dam pass through a canal to Bouldin Dam. Flows greater than the penstock capacity at Bouldin Dam (30,000 cfs) are passed through the Jordan Dam turbines or spillway. Bouldin Dam has no minimum flow requirements and no spillway.

E.1.1.4.9 R. L. Harris Dam and Lake

The APC R.L. Harris Dam and Lake project is located on the Tallapoosa River at RM 139.1 in Randolph County, AL. R.L. Harris Dam, completed in 1983, is the furthest upstream of a series of four APC dams on the Tallapoosa River. The general location of R.L. Harris Dam and Lake is shown on Figure E-1. Key physical attributes of the project are presented in Table E-1. In addition to its principal purpose for hydropower generation and federally authorized purposes for flood risk management and navigation support (Table E-2), R.L. Harris Dam and Lake provides incidental benefits for recreation and fish and wildlife conservation. The project also provides a continuous minimum downstream release to ensure a continuous minimum flow of 45 cfs at the Wadley gage, about 15 mi downstream of the dam, for water quality and fish and wildlife conservation purposes (USACE Mobile District, 2014c).

The lake created by R.L. Harris Dam (also known as Lake Wedowee) extends for 29 mi up both the Tallapoosa and Little Tallapoosa rivers within Randolph and Clay counties, AL. The reservoir summer level is elevation 793 ft, which provides total storage of 425,721 ac-ft and a surface area of about 10,660 ac. During the flood season, the reservoir is normally maintained at elevation 785 ft (USACE Mobile District, 2014c). The project has a 135-MW total generating capacity. The penstock capacity is 16,000 cfs. APC operates R.L. Harris Lake in a peaking mode, generating power as demands dictate, typically on a Monday through Friday schedule. The power plant is operated

as needed to keep the lake from exceeding the guide curve (or top of the conservation pool—summer elevation 793 ft, winter elevation 785 ft). When the reservoir is above the guide curve, releases are made in accordance with prescribed operating plans for flood risk management. The power plant can be used to meet any required releases or supplement the spillway releases as needed to satisfy the designated outflow requirements (USACE Mobile District, 2014c). Current R. L. Harris Dam and Lake operations are described in more detail in Appendix A to the Draft FR/SEIS (Section A.1.1.9).

APC operates the R.L. Harris Dam, in coordination with its other hydropower projects on the Coosa River, for flood risk management in accordance with regulations prescribed by the Secretary of the Army in 33 CFR § 208.65. USACE and APC adopted an MOU on September 27, 1972 (revised on October 11, 1990) concerning the operation of the R.L. Harris Dam and Lake project which, along with the January 1979 USACE Reservoir Regulation Manual for the project (now called the WCM), was used to implement the prescribed regulations. The MOU and associated manual clarify the responsibilities of the two entities regarding operation of the project for flood risk management and other purposes and provide for the orderly exchange of hydrologic data (USACE Mobile District, 2014c). The USACE R.L. Harris Dam and Lake WCM was updated in December 2014, and an updated USACE/APC MOU is pending.

E.1.1.4.10 Martin Dam and Lake

Martin Dam and Lake is a 31-mi-long APC reservoir in Coosa, Elmore, and Tallapoosa counties, on the Tallapoosa River, near Dadeville, in east central Alabama. Martin Dam is approximately 61 mi upstream of the junction of the Tallapoosa and Coosa rivers, which forms the Alabama River. Martin Dam is 79.5 mi downstream of R.L Harris Dam. The general location of Martin Dam and Lake is shown on Figure E-1. Key physical attributes of the project are presented in Table E-1. The lake has a surface area of 39,807 ac and 880 mi of shoreline. Martin Dam and Lake is a multipurpose storage project. The reservoir has a total storage capacity of 1,667,814 ac-ft at the normal summer pool elevation of 491 ft and active storage capacity of 1,381,077 ac-ft at 45.5 ft of drawdown (FERC, 2015a). The lake has a mandatory drawdown of 7 ft to elevation 484 ft in the winter months. The winter guide curve level was revised from elevation 481 ft to 484 ft during the FERC relicensing process completed in December 2015 and is discussed in more detail below (FERC, 2015b). The lake level fluctuates seasonally to provide the benefits the project was built to support, including hydropower, limited seasonal flood risk management when the reservoir is in drawdown condition, recreation, M&I water supply, water quality, and aquatic flow maintenance. The normal tailwater elevation is 343 ft (FERC, 2015a).

APC began construction of the project in 1923, and it was placed in service with three generating units in 1927. APC added a fourth generating unit in 1952. The project features include a concrete gravity dam with an earth dike section about 2,000 ft in length and a maximum height of 168 ft; a 720 ft-long gated spillway section with 20 spillway gates; headworks containing 12 intake gates and four steel penstocks; and a powerhouse containing four vertical Francis turbines that power four generating units (45.8 MW, 41.0 MW, 40.5 MW, and 55.2 MW) for a total installed capacity of 182.5 MW. The project's intake structures' inverts are 68 ft below normal full-pool elevation (FERC, 2015a). The project's boundary, which includes about 49,752 ac of land, including land inundated by the reservoir, generally follows the 491-ft elevation contour line around the reservoir. In addition to the reservoir, the project boundary encompasses the project dam, powerhouse, switchyard, transmission lines, and 12 existing project recreation sites. APC has flowage easements for the entire length of the shoreline up to the 491-ft contour and on some lands above that elevation (FERC, 2015a).

Martin Dam typically generates power on Monday through Saturday to meet peak power demands. During generation, the dam's four turbines release up to 17,900 cfs. There is no specific continuous minimum flow release requirement at Martin Dam. Hours of generation per day depend on reservoir inflow. Normally, the project operates for 8–12 hours daily on weekdays and 5–7 hours on Saturday, as needed. During drier periods (normally May–November), daily generation is typically reduced to 4–6 hours Monday through Saturday (FERC, 2015a). On average, Martin Dam generates about 40 percent of the electricity of APC's Tallapoosa River fleet of dams. In addition, Martin Dam contributes to the energy generated at Yates and Thurlow lakes through its ability to store

and release water that would otherwise be spilled. The Martin Dam and Lake project can be operated to store water during low electrical usage periods and then to generate with the same water during periods of high electrical usage when production costs would normally be higher.

APC filed a Notice of Intent and preapplication with FERC to initiate the relicensing process for the Martin Dam and Lake project in June 2008. As part of the relicensing process, APC proposed to increase the winter guide curve level from elevation 481 ft to 484 ft, to extend the summer guide curve level of elevation 491 ft from September 1 until October 15 to benefit recreational use of the lake, and to make associated proportional adjustments to the guide curves to accommodate those changes. USACE participated in the evaluation process for the proposed changes and commented on the draft EIS addressing the potential impacts of the changes. The new FERC license for the Martin Dam and Lake project was issued on December 17, 2015, for a 30-year period. The license approved and incorporated the APC-proposed operational changes along with other recreational, environmental, shoreline management, and project boundary revisions. The seasonal extension of the summer guide curve elevation was approved subject to certain hydrological and operational conditions (FERC, 2015b). Current Martin Dam and Lake operations are described in more detail in Appendix A (Section A.1.1.10) to the Draft FR/SEIS.

E.1.1.4.11 Yates Dam and Lake

Yates Dam and Lake, completed in 1928, is the third in a series of four APC projects on the Tallapoosa River. The dam is located at Tallapoosa River RM 52.7 in Elmore and Tallapoosa counties, AL, and the reservoir extends about 7.9 mi upstream to the Martin Dam. The general location of Yates Dam and Lake is shown on Figure E-1. Key physical attributes of the project are presented in Table E-1. The primary purpose for the project is hydropower, but the reservoir also provides for water quality, water supply, and recreation. APC coordinates the Yates Lake operation with the other Tallapoosa River projects to minimize flooding. Releases from Martin Dam and Lake flow directly into the headwaters of Yates Lake. Yates Lake has a surface area of 2,045 ac with an open-crest spillway at an elevation of 345 ft. Flows that exceed turbine capacity flow over the spillway. The project has a 44.25-MW powerhouse with a hydraulic capacity of approximately 12,400 cfs (APC, 2008).

APC operates Yates Dam together with the downstream Thurlow Dam to meet a 1,200-cfs minimum flow requirement from Thurlow Dam on the weekend because the upper two storage projects—R.L. Harris Dam and Martin Dam—are not normally operated on weekends.

E.1.1.4.12 Thurlow Dam and Lake

Thurlow Dam and Lake, completed in 1930, is the fourth, and furthest downstream, of the APC projects on the Tallapoosa River in Elmore and Tallapoosa counties, AL. The dam is located at Tallapoosa River RM 49.7, and the reservoir extends about 3.0 mi upstream to Yates Dam. The general location of Thurlow Dam and Lake is shown on Figure E-1. Key physical attributes of the project are presented in Table E-1. APC operates Thurlow Dam together with Yates Dam to meet downstream flow requirements on the weekend. Thurlow Dam's primary purpose is hydropower, but the reservoir also provides for water quality, water supply, and recreation. Thurlow Lake (commonly referred to as Lake Talisi) has no flood risk management storage. APC coordinates Thurlow Dam operation with the other Tallapoosa River projects to minimize flooding. Thurlow Lake is the smallest of the four APC Tallapoosa River reservoirs. The surface area of the lake is 585 ac, and APC typically operates the project at elevation 289 ft with little fluctuation. Generating capacity at Thurlow Dam is 81.35 MW with a hydraulic capacity of approximately 13,200 cfs. Downstream of Thurlow Dam, the Tallapoosa River flows unimpeded for 49 mi to its confluence with the Coosa River (APC, 2008).

APC operates Yates and Thurlow dams as run-of-river projects that take advantage of peaking releases from Martin Lake. Since 1991, APC has provided a continuous 1,200 cfs minimum release from the Thurlow Dam powerhouse, except in extreme drought conditions. On many occasions, releases from Martin Lake and Dam are necessary to allow the Thurlow Dam powerhouse to meet this requirement. Procedures are included in the FERC license for the

Yates Dam and Lake and Thurlow Dam and Lake projects (FERC Project No. 2407) that reduce the release requirement at Thurlow Dam whenever inflows to Yates and Thurlow lakes are abnormally low. Normal flows downstream of Thurlow Dam typically vary from 1,200 cfs to 17,900 cfs (APC, 2008).

E.1.1.4.13 Robert F. Henry L&D and R. E. "Bob" Woodruff Lake

R.E. "Bob" Woodruff Lake is created by the Robert F. Henry L&D project, 281 mi upstream of Mobile Bay in Alabama. This is the furthest upstream of three USACE projects on the Alabama River. R.E. "Bob" Woodruff Lake extends from Robert F. Henry L&D upstream to Montgomery, AL. The general location of the project is shown on Figure E-1. Key physical attributes of the project are presented in Table E-1. The lake is 81 mi long and has an average width of about 1,300 ft. It has a surface area of 13,500 ac at a normal pool elevation of 126 ft. Lake levels are typically stable with minimal fluctuation, except for temporary periods during flood events when some increases are observed.

The project purposes are navigation, hydropower, recreation, water quality, and fish and wildlife conservation. There is a 9-ft-deep by 200-ft-wide navigation channel over the entire length of the lake. The hydropower generating capacity of the project is 82 MW. In addition to the management of project lands for fish and wildlife conservation, USACE acquired 10,566 ac of land along the lake in Lowndes County, AL, in the 1990s as part of a comprehensive mitigation plan for effects of construction of the Tennessee-Tombigbee Waterway in Alabama and Mississippi (Day, 2010). The mitigation plan was authorized in the Water Resources Development Act of 1986 (WRDA). The acquired lands are dedicated solely to intensive management for fish and wildlife mitigation. The mitigation land is located on the left bank of the Alabama River, just upstream of the Robert F. Henry L&D, near Selma, AL. The Alabama Department of Conservation and Natural Resources (ADCNR) manages the fish and wildlife mitigation lands under a lease with USACE and with funding provided by USACE. ADCNR acquired additional contiguous lands with other funding from other sources and manages the entire 12,531-ac site as the Lowndes Wildlife Management Area (WMA).

The Robert F. Henry L&D project is operated in tandem with the downstream Millers Ferry L&D project to provide an average daily outflow of 6,600 cfs downstream of Claiborne L&D for navigation and waste assimilation needs on the Alabama River. This flow is a nonmandatory minimum flow target or guide, representing the 7Q10 flow level at Claiborne L&D. The 7Q10 flow is the lowest average discharge at a given location over a period of one week with a recurrence interval of 10 years. That flow level cannot be met in all circumstances, particularly under extreme drought conditions. Current Robert F. Henry L&D operations are described in more detail in Appendix A to the Draft FR/SEIS (Section A.1.1.13).

E.1.1.4.14 Millers Ferry L&D and William "Bill" Dannelly Lake

William "Bill" Dannelly Lake is created by the Millers Ferry L&D project on the Alabama River, approximately 178 mi upstream of Mobile Bay. The general location of the project is shown on Figure E-1. Key physical attributes of the project are presented in Table E-1. The lake is about 103 mi long from Millers Ferry L&D upstream to the Robert F. Henry L&D and has an average width of almost 1,400 ft. William "Bill" Dannelly Lake has a surface area of 18,528 ac at a normal pool elevation of 80.8 ft. Lake levels generally remain stable but rise slightly in wet weather. The reservoir partially inundates several tributary streams.

Project purposes for this multipurpose USACE reservoir are navigation, hydropower, recreation, water quality, and fish and wildlife conservation. There is a 9-ft-deep by 200-ft-wide navigation channel extending the entire length of the reservoir. The hydropower generating capacity of the project is 90 MW. In addition to management of project lands for fish and wildlife conservation, consistent with other project purposes, 1,703 ac of project lands are specifically designated for intensive management as part of a comprehensive mitigation plan for impacts from construction of the Tennessee-Tombigbee Waterway in Alabama and Mississippi (Lyon, 2010). The mitigation plan was authorized by WRDA 1986.

A daily average minimum outflow of 6,600 cfs is provided from Millers Ferry L&D to support navigation and assimilative flow needs on the Alabama River, whenever basin inflows are sufficient to provide it. Current Millers Ferry L&D operations are described in more detail in Appendix A to the Draft FR/SEIS (Section A.1.1.14).

E.1.1.4.15 Claiborne L&D and Lake

The Claiborne L&D and Lake project is on the Alabama River about 118 mi upstream of Mobile Bay in Alabama. The lake resembles a wide river, averaging about 800 ft wide, with a surface area of 6,290 ac. Claiborne L&D and Lake is a run-of-river project that extends 60 mi upstream from Claiborne L&D to Millers Ferry L&D at a normal pool elevation of 36 ft. The general location of the project is shown on Figure E-1. Key physical attributes of the project are presented in Table E-1. The lake has a 9-ft-deep by 200-ft-wide navigation channel extending over its entire length. The authorized project purposes are navigation, recreation, water quality, and fish and wildlife conservation. In addition to managing project lands for fish and wildlife conservation, 2,567 ac of project lands are specifically designated for intensive management as part of a comprehensive mitigation plan for impacts from construction of the Tennessee-Tombigbee Waterway in Alabama and Mississippi (Lyon, 2010). The mitigation plan was authorized in the WRDA 1986.

Between May 1983 and March 2017, multiple private-sector hydropower interests have attempted unsuccessfully to acquire a license from FERC to add nonfederal hydropower generation at the Claiborne L&D. The most recent attempt by Lock+ Hydro Friends Fund XIX, LLC concluded in March 2017 when FERC rejected the final license application because of major deficiencies (FERC, 2017). No other efforts are currently underway to pursue nonfederal hydropower development at Claiborne L&D.

From Claiborne L&D, the Alabama River flows about 72 mi further downstream to its confluence with the Tombigbee River, forming the Mobile River. This reach of the Alabama River has a federally authorized navigation channel, authorized at 9-ft deep by 200-ft wide. The navigation channel is sustained by a combination of flows from Claiborne L&D, maintenance dredging, and training works.

E.1.1.4.16 Other Reservoirs in the ACT River Basin

In 2002, USACE, Mobile District conducted a preliminary survey of existing reservoirs in the ACT River Basin other than the USACE and APC projects on the mainstem rivers. The survey identified approximately 280 reservoirs in the ACT River Basin (170 in Alabama and 110 in Georgia) that were 20 ac or larger (USACE Mobile District, 2014d). The total surface area of the reservoirs in Alabama was about 10,413 ac (an average size of 61 ac). The total surface area of the reservoirs in Georgia was about 6,807 ac (an average size of 62 ac). These impoundments serve a variety of purposes, including water supply for livestock and irrigation; M&I water supply; fish and wildlife conservation; and recreation. Hundreds of other ponds and impoundments smaller than 20 ac scattered across the ACT River Basin also were identified. The preliminary USACE survey was considered detailed enough to provide a reasonable summary of the more noteworthy surface water impoundments in the ACT River Basin in addition to the mainstem river reservoirs.

One of the more significant non-mainstem reservoirs in the ACT River Basin in Alabama is Purdy Lake, a 990-ac reservoir in the headwaters of the Cahaba River, southeast of the city of Birmingham, in Shelby and Jefferson counties. The project was completed in 1964 with the primary purpose of providing water supply for the Birmingham area. The dam and reservoir are owned and operated by the Birmingham Water Works Board.

USACE issues DA permits for reservoir projects under Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act of 1899 (as applicable). Table E-3 summarizes the DA permits issued (or pending permit actions) for non-USACE water supply reservoirs since 1988 in the ACT River Basin (USACE Mobile District, 2014d). The general locations of these reservoirs are shown on Figure E-20. Those projects are in the upper Tallapoosa, upper Etowah, and Conasauga River basins in Georgia and have generally been pursued for the

primary purpose of water supply; however, they may also serve other collateral purposes such as recreation. They represent the substantial reservoir projects in the upper ACT River Basin over the past 30 years in size, yield, and costs. No similar projects have recently been pursued in portions of the ACT River Basin in Alabama (Turney, 2019).

Table E-3. Nonfederal Water Supply Reservoir Projects in the ACT River Basin (with DA Permits since 1988 or with DA Permits Pending)

River basin (subbasin)	Stream	Project name	County	Yield (mgd)	Reservoir size (ac)	Status
Tallapoosa	Sharpe Creek	Sharpe Creek Reservoir	Carroll, GA	-- [a]	230	Permitted 1988 Constructed 1991
Coosa (Conasauga)	Conasauga River (off stream)	River Road Reservoir	Whitfield, GA	18	118	Permitted 1992 Constructed 1997
Coosa (Conasauga)	Haig Mill Creek	Lower Haig Mill Reservoir	Whitfield, GA	5	109	Permitted 1993 Constructed 1995
Coosa (Etowah)	Yellow Creek	Hollis Q. Lathem Reservoir	Cherokee/ Dawson, GA	33 [b]	334	Permitted 1994 Constructed 1999
Coosa (Etowah)	Hickory Log Creek	Hickory Log Creek Reservoir	Cherokee, GA	44	411	Permitted 2004 Constructed 2009
Coosa (Etowah)	Richland Creek	Richland Creek Reservoir	Paulding/ Bartow, GA	35	305	Permitted 2015 Construction to be completed 2019
Coosa (Etowah)	Russell Creek	Russell Creek Reservoir	Dawson, GA	11.5	137	Permitted 2017 Construction to be completed 2023
Tallapoosa	Indian Creek	Indian Creek Water Supply Reservoir	Carroll, GA	6 [c]	643	Permit pending [c]

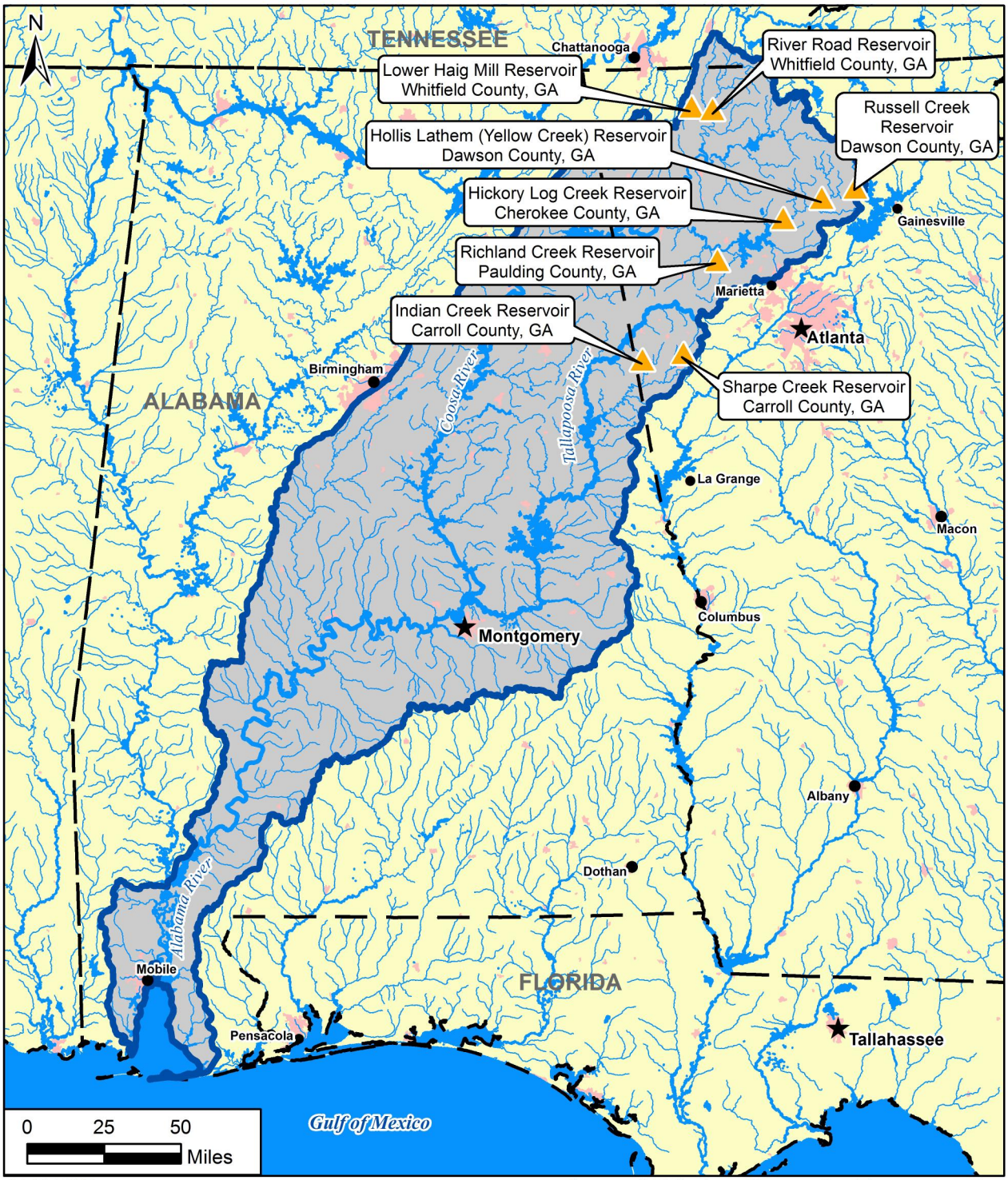
Notes: mgd = million gallons per day.

a. Sharpe Creek Reservoir releases support downstream water supply withdrawals, as needed, from the Little Tallapoosa River by the city of Carrollton, GA.

b. Hollis Q. Lathem Reservoir is a drought contingency reservoir designed to work in conjunction with the Cherokee County Water and Sewer Authority's Etowah River water intake during periods of drought to support permitted withdrawals from the river up to 36 mgd (monthly average).

c. The Indian Creek Water Supply Reservoir permit application was administratively withdrawn due to population and water demand projections being revised downward by the State of Georgia in early 2016. The original project proposal had a projected yield of 18 mgd. Carroll County Water Authority reevaluated water supply options to meet the reduced service area need of 6 mgd (Carroll County Water Authority, 2018), completed a revised alternative analysis, and submitted a revised permit application to USACE, Savannah District in January 2018 (Windom, 2019).

The following paragraphs discuss three specific water supply reservoir projects in the Etowah River portion of the ACT River Basin (identified in Table E-3), where their proposed reservoir operations are interrelated to the proposed actions addressed in this Draft FR/SEIS. Those projects are the Hickory Log Creek Dam and Reservoir, Richland Creek Dam and Reservoir, and Russell Creek Dam and Reservoir. In addition to the reservoirs presented in Table E-3 and discussed in this section, planning efforts over the last decade for potential reservoir development or existing reservoir expansion to meet longer range water supply needs in the upper ACT River Basin in north Georgia are summarized in Section E.1.1.8.1.5.



Local Water Supply Reservoirs with DA Permits (or Permits Pending) in the ACT River Basin since 1988

Figure E-20

Source: Johnson, personal communication 2010.

E.1.1.4.16.1 Hickory Log Creek Dam and Reservoir

The Hickory Log Creek Dam and Reservoir project is a locally constructed water supply reservoir located on Hickory Log Creek in Cherokee County, near Canton, GA, about 1.4 mi upstream of the creek's confluence with the Etowah River, and about 4 RM upstream of Allatoona Lake (see Figure E-20). The project was jointly constructed by CCMWA and the City of Canton to serve as an additional water supply source. Construction of the project began in 2004, and the reservoir was filled in 2010. The dam is approximately 1,000 ft wide and 180 ft high, one of the largest dams in the state not constructed by USACE or the Georgia Power Company (City of Canton, 2019). The dam impounds approximately 17,702 ac-ft of usable storage and is an off-channel pumped-storage reservoir. The Hickory Log Creek project has a water withdrawal permit from the Georgia Environmental Protection Division (GAEPD) for withdrawals up to 39 million gallons per day (mgd) from the Etowah River to be shared by the City of Canton and CCMWA. In addition to the dam and reservoir, the project includes an intake and pump station, and a pipeline to transport water from the Etowah River to the reservoir. The total storage in Hickory Log Creek Reservoir is equivalent to about 6 percent of the conservation storage in Allatoona Lake (or equal to about 1.4 ft of elevation at the summer guide curve elevation of 840 ft).

As proposed by CCMWA and the City of Canton in the original DA permit application to USACE, water would be pumped from the Etowah River to fill the reservoir during high-flow periods and released during low-flow periods to supplement Etowah River flows, enabling dependable water supply withdrawals from the existing City of Canton intake on the Etowah River just downstream of Hickory Log Creek and from CCMWA's existing intake in Allatoona Lake. The DA permit application was modified in 2003 to reflect that CCMWA would withdraw water from a new intake to be constructed on the Etowah River upstream of Allatoona Lake (USACE Savannah District, 2004).

After the DA permit was issued in 2004, CCMWA sought agreement from USACE to credit CCMWA's water supply storage account at Allatoona Lake with additional *made inflows* that CCMWA would release from Hickory Log Creek Reservoir into the Etowah River and, subsequently, into Allatoona Lake. In January 2013, the Governor of Georgia submitted a request to the Assistant Secretary of the Army for Civil Works for reallocation of additional storage in Allatoona Lake to support increased water supply withdrawals and adoption of the state's proposal to grant credit for made inflows from Hickory Log Creek Reservoir releases and treated wastewater returns to Allatoona Lake (Office of the Governor, 2013). Following litigation (discussed in Section 2.2 of this Draft FR/SEIS), the GAEPD submitted a revised proposal to the USACE in January 2018 for reallocation of storage for water supply at Allatoona Lake and credit for made inflows (GAEPD, 2018d). USACE has incorporated the proposed Hickory Log Creek Reservoir operation into its HEC-ResSim modeling and analysis system and has evaluated GAEPD's updated January 2018 water supply request in preparation of this Draft FR/SEIS. The HEC-ResSim modeling report is included in Appendix C to the Draft FR/SEIS. USACE has made no final decisions regarding the state's request for additional water supply storage and credit for made inflows to the water supply storage account. Those decisions may depend in part on information developed through the process resulting in this Draft FR/SEIS and in part on separate policy decisions that might be made by the DA.

E.1.1.4.16.2 Richland Creek Dam and Reservoir

Richland Creek Dam and Reservoir is a pumped-storage water supply project that provides infrastructure for water withdrawals from the Etowah River as well as reservoir storage, treatment, and distribution to meet the water supply needs of Paulding County, GA. The raw water intake and pump station feature of the project is located about 8 RM downstream of the Allatoona Dam (see Figure E-20). Water will be pumped to the reservoir on Richland Creek via a 3.7-mi raw water pipeline. The top of the Richland Creek Dam is at elevation is 925 ft, and the height of the dam from the downstream toe of the slope is 125 ft. The reservoir is 305 ac, and the project provides sufficient capacity to produce a safe yield of 35 mgd (USACE Savannah District, 2015). Water treatment facilities will be constructed adjacent to the reservoir.

USACE issued a DA permit for construction of the Richland Creek Reservoir and associated withdrawal, treatment, and distribution infrastructure in October 2015. Construction is underway and is expected to be completed by the end of 2019 (Paulding County Water System, 2018). The Paulding County Water System will operate the project. Currently, Paulding County purchases its M&I water supply from CCMWA at a current rate of about 10 mgd. With the completion of the Richland Creek Reservoir project, Paulding County will discontinue its purchase of water from CCMWA (Landers, 2017). The pending water supply request from CCMWA addressed in this Draft FR/SEIS accounts for that future reduction in water demand from Paulding County (Zitsch, 2018b).

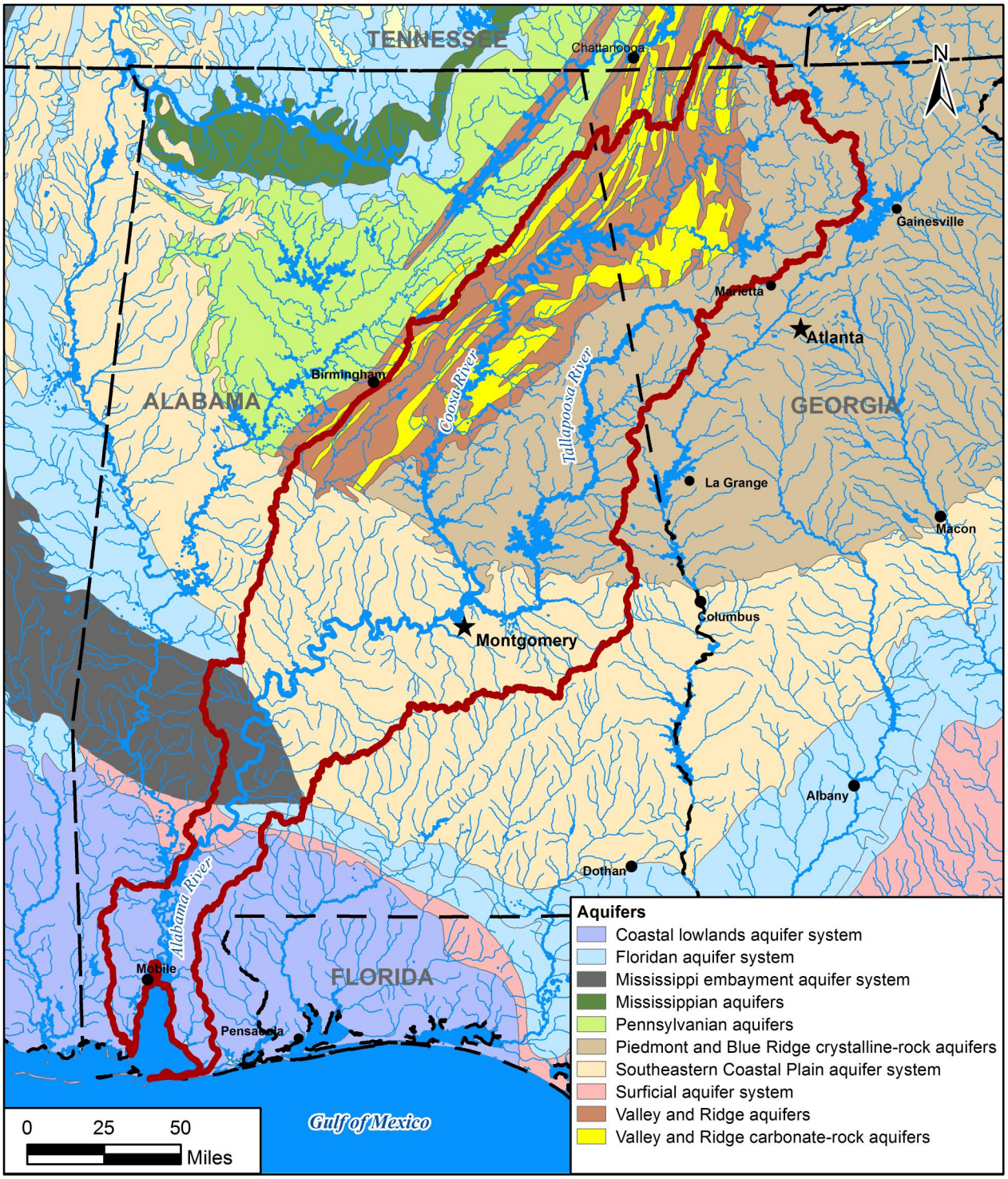
Water will be pumped from the Etowah River to the Richland Creek Reservoir to maintain adequate water supply storage when hydropower generation and/or spillway releases from Allatoona Dam produce flow conditions in the Etowah River that exceed minimum release levels from the dam. The raw water intake is designed, constructed, and will be operated so flows downstream of the intake comply with the state's minimum in-stream flow requirements in the Etowah River as stipulated in the GAEPD water withdrawal permit (USACE Savannah District, 2015). The Richland Creek Dam and Reservoir project and its operational criteria have been incorporated into the USACE HEC-ResSim model for the ACT River Basin that serves as the basis for the analysis of the effects of the proposed actions presented in this SEIS. The HEC-ResSim modeling is discussed in detail in Appendix C to the Draft FR/SEIS.

E.1.1.4.16.3 Russell Creek Dam and Reservoir

The Etowah Water and Sewer Authority (ESWA) received a DA permit from USACE in July 2017 to construct a dam and reservoir on Russell Creek in Dawson County, GA, for public water supply purposes within the service area of the unincorporated county (see Figure E-20) (USACE Savannah District, 2017). The reservoir will expand a smaller watershed reservoir originally constructed by the Natural Resources Conservation Service (NRCS) during the 1960s for purposes of flood control. In addition to basin inflows from Russell Creek, the project will function as a pumped-storage water supply reservoir with the Etowah River as the source. The reservoir project will provide off-stream storage of raw water as needed to augment streamflow in the Etowah River in drought conditions, enabling ESWA to increase its downstream water supply withdrawals from the river to meet the projected 2050 water demands in Dawson County (Anderson, 2019). The proposed reservoir, as permitted, will impound an area of about 137 ac at a normal pool elevation of 1,195 ft, and the dam height will be about 100 ft. The project also includes a water intake and refill pump station near the confluence of Russell Creek and the Etowah River and a 1-mi-long raw water transmission line to the reservoir. The reservoir will produce a safe yield of 11.5 mgd (Anderson, 2019). The project is expected to be completed and put into operation by 2023.

E.1.1.5 Groundwater

The major aquifer formations in the ACT River Basin include the solution-conduit aquifers, crystalline rock aquifers, and the sand and gravel aquifers (Figure E-21). Groundwater in the ACT River Basin generally flows from northwest to southeast, with some variation in local flow. Near major stream channels and in areas of major water withdrawals, the flow is vertically upward and downward, but is mainly perpendicular to the stream channel, which demonstrates good hydraulic connection between groundwater and surface water. Rivers and streams in the southern half of the basin are deeply incised into the underlying aquifers and can receive substantial amounts of groundwater. The aquifers located in the principal ROI of the actions under consideration in this Draft FR/SEIS are the Valley and Ridge aquifers, the Blue Ridge and Piedmont aquifers, and, to a much lesser extent, the Southeastern Coastal Plain aquifer system.



Major Aquifers in the ACT River Basin

Figure E-21

Source: USGS 2010.

E.1.1.5.1 Valley and Ridge Aquifers

Aquifers in the Valley and Ridge ecoregion are typically contained in sandstone, siltstone, and limestone. They are generally composed of deep, fractured bedrock and an overlying layer of chert. In the chert layer, groundwater flows through pore spaces, and porosity can range from 20 to 30 percent. Porosity in the rock portion of the aquifer is very low, and the groundwater flow is generally along secondary porosity routes such as fractures and bedding planes. Groundwater storage is primarily in the overlying chert, and the volume of water in the chert is controlled by its porosity and thickness. In addition to the large rock aquifers, sand and gravel deposits found in the valley floor of the Coosa River form small, local aquifers (Robinson, Journey, & Atkins, 1997).

Well yield in the limestone and sandstone deposits is dependent on the interception of fractures and bedding plains in the aquifer. Wells that intercept several high-yield fractures can produce several thousand gallons per minute (gpm), although most wells yield between 1 and 25 gpm (Robinson, Journey, & Atkins, 1997). While the water is suitable for municipal drinking water, it is not often used for that purpose because of the typically low yield of wells. Extensive evaluations of the hydrogeology of the Valley and Ridge and Southwestern Appalachian aquifers (Kidd, Atkins, & Scott, 1997) can increase the likelihood of drilling a high-yield well (Robinson, Journey, & Atkins, 1997). Wells in the sand and gravel aquifers in the valley floor of the Coosa River typically yield less than 10 gpm.

E.1.1.5.2 Blue Ridge and Piedmont Aquifers

The Blue Ridge and Piedmont ecoregions are underlain by a metamorphic and igneous crystalline rock aquifer. The crystalline aquifer is overlain by a regolith of soils and saprolite of thicknesses ranging from 10 to 150 ft. The crystalline rocks have less than 2 percent primary porosity and little permeability. Most groundwater is stored in the saprolite, which has porosities of 20–30 percent. Water is transmitted from the saprolite to the crystalline bedrock via fractures formed in the rock from differential weathering at joints, faults, and quartz veins (Robinson, Journey, & Atkins, 1997). The volume of water stored in the saprolite is controlled by the porosity and thickness, while the volume of water stored in the bedrock is controlled by the degree of fracturing. The surface water drainage basins directly overlay the groundwater basins, and the two are interconnected (Robinson, Journey, & Atkins, 1997).

The crystalline rock aquifers are used for private water supplies and livestock watering. The groundwater supply in the crystalline aquifer is typically not sufficient to meet M&I supply demands (Robinson, Journey, & Atkins, 1997). Well yield is dependent on the number and type of intersections of crack and fractures in the bedrock. Wells typically yield 1–25 gpm, but yield can range from 0 gpm in wells with no fracture intersections to 700 gpm in wells with primary fracture intersections (Robinson, Journey, & Atkins, 1997). Thorough evaluations of hydrogeologic settings can lead to an increased likelihood of developing groundwater resources, although recent studies have yielded mixed results.

E.1.1.5.3 Southeastern Coastal Plain Ecoregion Aquifer System

The aquifers of the Southeastern Coastal Plain ecoregion aquifer system are difficult to distinguish from each other and are often mapped as one unit. The Lisbon Aquifer crops out at the fall line and is composed of sand and sandy limestone from the Eocene age. Yields are typically less than 100 gpm, and the aquifer is often used as a source for domestic wells. The Nanfalia-Clayton Aquifer has high yields that range from 75 to 900 gpm. The water is mineralized in some locations, however, and is not suitable for public or domestic drinking water. Wells yield ranges from 100 to 700 gpm. The Ripley Aquifer is one of the most prominent aquifers in the Upper Cretaceous sediment and is a major source of water in part of its outcrop area, supplying from 75 to 200 gpm. The aquifer becomes thin and relatively impermeable toward the west of the ACT River Basin and is not used as a source of water in those areas (Kidd, Atkins, & Scott, 1997).

E.1.1.6 Water Withdrawals, Consumptive Use, and Return Flows

E.1.1.6.1 Historical Perspective on Water Use and Water-Use Trends in the ACT River Basin

When the implementation of federal water resource projects in the ACT River Basin began in the late 1940s, water use was generally consistent with the predominant socioeconomic pursuits and population distribution in the southeastern US region. The region's favorable climate and generally good soil conditions were responsible for the predominance of an agricultural economy. According to the 1950 census, the population of the ACT River Basin was about 1.3 million, predominately rural, with about 80 percent of the people living on farms or in small rural communities. About 20 percent of the population resided in five larger urban centers: Rome, GA, and Anniston, Gadsden, Montgomery, and Selma, AL. After World War II, the area experienced slow net growth because of out-migration, and the overall population balance began to shift from the rural areas to the urban centers because of increased economic activity in the cities and industrialization of the southeastern US (USACE Mobile District, 1951). Most domestic water supply was provided by wells and springs, and municipal water systems supplied by surface water withdrawals and treatment plants were generally limited to the larger urban centers.

In 1950, corn and cotton were the principal agricultural products in the region, followed by peanuts, potatoes, and beans. Groundwater or surface water withdrawals for crop irrigation were negligible. Cattle production was an important agricultural pursuit in the basin. Almost all the mixed stands of hardwoods and pines in the upland areas of the basin and the hardwood stands in the lowlands had been stripped of their original growth, and the lands were either deforested or had second-growth trees. Longleaf pines dominated forest land in the southern portion of the basin, providing ample supply for the pulpwood and naval stores industries. Sand, gravel, coal, iron, marble, lime, and clay were mineral resources that were mined commercially in the basin (USACE Mobile District, 1951).

Industrialization in the basin was relatively new at that time but developing rapidly into a dominant feature of the regional economy. The urban centers of the '40s—Anniston, Gadsden, Montgomery, Rome, and Selma—were becoming the basin's major industrial centers. Textile industries became prominent across the region, with facilities in or near Alexander City, Montgomery, Opelika, Tallassee, and Talladega, AL, as well as Rome, GA. Steel and iron mills opened in Anniston and Gadsden, AL. Manufacture of cut stone, marble, building brick, and ceramic tile occurred across the central and upper portions of the basin. Tires were manufactured at a large facility in Gadsden. Forest lands provided raw materials for saw mills, pulp and paper manufacturers, and naval stores plants. Chemical manufacturers produced fertilizers and cottonseed oil (USACE Mobile District, 1951). Most of these industries required substantial amounts of water to support their manufacturing processes, predominately from plentiful surface-water sources. Hydropower generation supported early economic development and industrialization in the basin. As urban population centers and industry expanded, demand for thermoelectric power generation also expanded in the region, dramatically increasing the demand for cooling water from surface-water sources.

Through the 1960s and 1970s, the upper portion of the ACT River Basin was significantly influenced by rapid suburban growth expanding west, northwest, and north of Atlanta and the emergence of the carpet industry in and around Dalton, GA. Both occurrences had major impacts on population growth, land use, and water resources in the basin. Irrigation demands increased for lawns, parks, golf courses, and emerging agricultural pursuits such as sod farms in the Etowah River corridor.

From 1980 to the present, the ACT River Basin has experienced rapid population growth, particularly in the northwest quadrant of Metro Atlanta. Additionally, the acreage of irrigated agriculture has increased in the ACT River Basin, although not as extensively as in the adjacent ACF River Basin. Both factors indicated a continued upward trend in both surface-water and groundwater withdrawal and use. However, several technological and economic factors, in part, offset increased water demands in the ACT River Basin, including the following:

- Improved cooling water technologies for thermoelectric power plants.

- Reduced water demands in the commercial-industrial water-use category because of the changing economy of the region. The industrial sector of the economy in the region (which frequently requires significant quantities of water to support manufacturing processes) has significantly declined as business has shifted to more of a service-based economy.
- Numerous water conservation/water efficiency technologies and programs instituted by the states and public water supply providers (WSPs), particularly in northwest Georgia.
- Increased agricultural irrigation efficiencies.

These trends from 1980 through 2005, and their associated effects on surface-water and groundwater use in Georgia and Alabama, including in the ACT River Basin, were analyzed and documented in USGS water-use reports for 2005 (Fanning & Trent, 2009) (Hutson, Littlepage, Harper, & Tinney, 2009).

E.1.1.6.2 Surface Water Withdrawals

E.1.1.6.2.1 Georgia

Table E-4 summarizes permitted surface water withdrawals for M&I uses in the ACT River Basin in Georgia (GAEPD, 2018c). The surface water withdrawal permits are required by Georgia law for withdrawals exceeding 100,000 gallons per day (gpd). The permits are issued by GAEPD (see Section E.1.1.8.1.1 for more information on Georgia's water withdrawal permit program). The information in Table E-4 is presented beginning with the permits in the furthest upstream counties in the Coosa River watershed and working downstream, followed by permits in the Tallapoosa River Basin. The withdrawal limits for each permit are defined by two numbers (both expressed in mgd): (1) a maximum daily limit (for any day) and (2) an average daily limit (based on monthly average). The permitted withdrawal limits depicted in the table define the maximum allowable for each permit, not the actual quantities withdrawn by permit holders.

Table E-4. M&I Surface Water Withdrawal Permits in the Georgia Portion of the ACT River Basin

River basin	Permit holder	Permit number	County	Source water	Permit limit maximum day (mgd)	Permit limit monthly average (mgd)
Coosa River Basin (Georgia)—upstream counties to downstream counties						
Coosa	Dalton Utilities - Conasauga R	155-1404-01	Whitfield	Conasauga River	40.300	40.300
Coosa	Dalton Utilities - Mill Creek	155-1404-02	Whitfield	Mill Creek	13.200	7.500
Coosa	Dalton Utilities - Coahulla Cr	155-1404-03	Whitfield	Coahulla Creek	6.000	5.000
Coosa	Dalton Utilities - River Road	155-1404-05	Whitfield	Conasauga River	35.000	18.000
Coosa	Chatsworth Water Works Commission	105-1405-01	Murray	Holly Creek	1.100	1.000
Coosa	Chatsworth Water Works Commission	105-1405-02	Murray	Eton Springs	1.800	1.800
Coosa	Chatsworth Water Works Commission	105-1409-01	Murray	Carters Lake	2.550	2.300
Coosa	Chatsworth, City of	105-1493-02	Murray	Coosawattee River	2.200	2.000
Coosa	Ellijay - Gilmer County W & S Authority	061-1407-01	Gilmer	Ellijay River	0.550	0.450

River basin	Permit holder	Permit number	County	Source water	Permit limit maximum day (mgd)	Permit limit monthly average (mgd)
Coosa	Ellijay - Gilmer County W & S Authority	061-1408-01	Gilmer	Cartecay River	4.000	4.000
Coosa	Calhoun, City of	064-1411-03	Gordon	Big Spring	7.000	6.000
Coosa	Calhoun, City of	064-1412-01	Gordon	City of Calhoun Spring	0.638	0.537
Coosa	Calhoun, City of	064-1492-02	Gordon	Oostanaula River	6.200	3.000
Coosa	Calhoun, City of	064-1493-01	Gordon	Coosawattee River	18.000	16.000
Coosa	Jasper, City of	112-1417-02	Pickens	Long Swamp Creek	1.000	1.000
Coosa	Bent Tree Community, Inc.	112-1417-03	Pickens	Chestnut Cove Creek	0.250	0.230
Coosa	Bent Tree Community, Inc.	112-1417-04	Pickens	Lake Tamarack	0.250	0.230
Coosa	Big Canoe Utilities Company, Inc.	112-1417-06	Pickens	Blackwell Creek	2.650	2.650
Coosa	Etowah Water & Sewer Authority	042-1415-01	Dawson	Etowah River	5.500	4.400
Coosa	Eagle Point Landfill LLC	058-1417-07	Forsyth	On-site sedimentation ponds	0.210	0.130
Coosa	Cherokee County Water & Sewerage Authority	028-1416-01	Cherokee	Etowah River	43.200	36.000
Coosa	American Proteins, Inc.	028-1491-03	Cherokee	Etowah River	5.000	4.500
Coosa	Canton, City of	028-1491-04	Cherokee	Etowah River	23.000	18.700
Coosa	Canton, City of (Hickory Log Creek)	028-1491-05	Cherokee	Etowah River	39.000	39.000
Coosa	Bartow County Water Department	008-1411-02	Bartow	Bolivar Springs	0.800	0.800
Coosa	Adairsville, City of	008-1412-02	Bartow	Lewis Spring	5.100	4.100
Coosa	New Riverside Ochre Company, Inc.	008-1421-01	Bartow	Etowah River	5.000	5.000
Coosa	New Riverside Ochre Company, Inc.	008-1421-02	Bartow	Etowah River	6.000	6.000
Coosa	Emerson, City of	008-1422-02	Bartow	Moss Springs	0.625	0.500
Coosa	Gerdau AmeriSteel US, Inc. – Cartersville Steel Mill	008-1423-01	Bartow	Pettit Creek	2.000	1.500
Coosa	Cartersville, City of	008-1423-04	Bartow	Etowah River	26.420	23.000
Coosa	Georgia Power Co. - Plant Bowen	008-1491-01	Bartow	Etowah River	520.000	85.000
Coosa	Cartersville, City of	008-1491-06	Bartow	Allatoona Lake	21.420	18.000
Coosa	CCMWA	008-1491-05	Cobb	Allatoona Lake	86.000	78.000
Coosa	La Fayette, City of - Dry Creek	146-1401-01	Walker	Dry Creek	1.000	0.900

River basin	Permit holder	Permit number	County	Source water	Permit limit maximum day (mgd)	Permit limit monthly average (mgd)
Coosa	La Fayette, City of - Big Spring	146-1401-02	Walker	Big Spring	1.650	1.310
Coosa	Mount Vernon Mills - Riegel Apparel Div.	027-1401-03	Chattooga	Trion Spring	9.900	6.600
Coosa	Summerville, City of	027-1402-02	Chattooga	Raccoon Creek	3.000	2.500
Coosa	Summerville, City of	027-1402-04	Chattooga	Lowe Spring	0.750	0.500
Coosa	Mohawk Industries, Inc.	027-1402-05	Chattooga	Chattooga River/ Raccoon Creek	4.500	4.000
Coosa	Oglethorpe Power Corp.	057-1402-03	Floyd	Heath Creek	438.000	140.000
Coosa	Floyd County - Brighton Plant	057-1414-02	Floyd	Woodward Creek	0.800	0.700
Coosa	Cave Spring, City of	057-1428-06	Floyd	Cave Spring	1.500	1.300
Coosa	Floyd County	057-1428-08	Floyd	Old Mill Spring	4.000	3.500
Coosa	Berry Schools, The (Berry College)	057-1429-01	Floyd	Berry (Possum Trot) Reservoir	1.000	0.700
Coosa	TIN, Inc.	057-1490-01	Floyd	Coosa River	34.000	32.000
Coosa	Georgia Power Co. - Plant Hammond	057-1490-02	Floyd	Coosa River	655.000	655.000
Coosa	Rome, City of	057-1492-01	Floyd	Oostanaula & Etowah Rivers	18.000	16.400
Coosa	Cedartown, City of	115-1428-04	Polk	Big Spring	3.000	2.600
Coosa	Polk County Water Authority	115-1428-05	Polk	Aragon, Ammons, & Mulco Springs	1.600	1.100
Coosa	Polk County Water Authority	115-1428-07	Polk	Deaton Spring	4.000	4.000
Tallapoosa River Basin (Georgia)						
Tallapoosa	Haralson County Water Authority	071-1301-01	Haralson	Tallapoosa River	3.750	3.750
Tallapoosa	Bremen, City of	071-1301-02	Haralson	Beech Creek & Bremen Reservoir (Bush Creek)	0.800	0.580
Tallapoosa	Bowdon, City of - Indian	022-1302-01	Carroll	Indian Creek	0.400	0.360
Tallapoosa	Southwire Company	022-1302-02	Carroll	Buffalo Creek	2.000	1.000
Tallapoosa	Villa Rica, City of	022-1302-04	Carroll	Lake Paradise & Cowens Lake	1.500	1.500
Tallapoosa	Carrollton, City of	022-1302-05	Carroll	Little Tallapoosa River	12.000	12.000
Tallapoosa	Bowdon, City of	022-1302-06	Carroll	Lake Tysinger	4.100	3.500

1 *Source*: (GAEPD, 2018c)

USGS completed comprehensive inventories of surface water use for Georgia in 2005 (Fanning & Trent, 2009) and 2010 (Lawrence, 2016). Table E-5 summarizes individual M&I surface water withdrawals in the ACT River Basin from those inventories. Cumulative surface water withdrawals in the Georgia portion of the ACT River Basin in 2010 totaled 697.60 mgd. That surface water use, summarized by water-use category, is presented in Table E-6. Overall, the most significant use of surface water in the ACT River Basin in Georgia in 2010 was for thermoelectric power generation (about 69 percent). Public supply and domestic/commercial uses represented about 22 percent of the surface water withdrawals. Domestic/commercial uses in the USGS analysis generally include those that are self-supplied instead of purchasing water supplies from a local M&I water provider. According to the 2010 report, less than 4 percent of surface water withdrawals in the Georgia portion of the ACT River Basin was used for irrigation and livestock (Lawrence, 2016).

Table E-5. M&I Surface Water Withdrawals in the ACT River Basin (Georgia), 2005 and 2010

Basin (subbasin)	Withdrawal by	County	2005 withdrawal (mgd)	2010 withdrawal (mgd)
Coosa River Basin (Georgia)				
Coosa (Conasauga)	Dalton Utilities	Whitfield	35.38	20.68
Coosa (Conasauga)	Chatsworth Water Works Commission	Murray	1.26	1.89
Coosa (Coosawattee)	Ellijay-Gilmer County Water System	Gilmer	3.12	3.05
Coosa (Coosawattee)	City of Fairmount	Gordon	0.06	NR
Coosa (Oostanaula)	City of Calhoun	Gordon	9.10	7.33
Coosa (Oostanaula)	(Domestic/Commercial)	Floyd	0.30	0.32
Coosa (Etowah)	Big Canoe Utilities	Pickens	0.48	0.98
Coosa (Etowah)	City of Jasper	Pickens	1.00	1.00
Coosa (Etowah)	Bent Tree Community	Pickens	0.07	0.23
Coosa (Etowah)	(Rubber)	Pickens	0.01	NR
Coosa (Etowah)	Etowah Water and Sewer Authority	Dawson	1.50	1.25
Coosa (Etowah)	City of Dawsonville	Dawson	0.10	0.00
Coosa (Etowah)	City of Canton	Cherokee	2.83	2.87
Coosa (Etowah)	Cherokee County Water and Sewer Authority	Cherokee	15.81	14.74
Coosa (Etowah)	Gold Kist, Inc.	Cherokee	1.94	3.16
Coosa (Etowah)	City of Cartersville	Bartow	13.26	11.18
Coosa (Etowah)	New Riverside Ochre Company, Inc. (Chemicals)	Bartow	1.67	0.00
Coosa (Etowah)	Gerdau AmeriSteel US, Inc. – Cartersville Mill	Bartow	0.16	NR
Coosa (Etowah)	Georgia Power Co – Plant Bowen	Bartow	38.92	47.92
Coosa (Etowah)	CCMWA	Bartow	44.42	40.07
Coosa (Etowah)	Vulcan Construction Materials	Polk	0.09	0.00
Coosa (Etowah/Oostanaula)	City of Rome	Floyd	9.98	8.55
Coosa (Upper Coosa)	City of Lafayette	Walker	1.20	1.1
Coosa (Upper Coosa)	City of Summerville	Chattooga	2.05	2.51
Coosa (Upper Coosa)	Mt. Vernon Mills – Riegel Apparel Division (Textiles)	Chattooga	2.74	5.31

Basin (subbasin)	Withdrawal by	County	2005 withdrawal (mgd)	2010 withdrawal (mgd)
Coosa (Upper Coosa)	Floyd County Water System	Floyd	2.57	3.08
Coosa (Upper Coosa)	Inland-Rome Inc. (Paper)	Floyd	25.74	25.71
Coosa (Upper Coosa)	Georgia Power Co - Plant Hammond	Floyd	535.00	432.17
Coosa (Upper Coosa)	Polk County Water Authority	Polk	2.22	2.37
Tallapoosa River Basin (Georgia)				
Tallapoosa (Upper)	City of Bremen	Haralson	0.32	0.19
Tallapoosa (Upper)	Haralson County Water Authority	Haralson	2.05	2.34
Tallapoosa (Upper)	City of Bowdon	Carroll	0.75	0.65
Tallapoosa (Upper)	Southwire Company	Carroll	0.09	0.02
Tallapoosa (Upper)	City of Carrollton	Carroll	5.37	5.04
Tallapoosa (Upper)	City of Temple	Carroll	0.26	NR
Tallapoosa (Upper)	City of Villa Rica	Carroll	0.58	1.31
Tallapoosa (Upper)	Carroll County Water System	Carroll	4.08	4.32

Sources: (Fanning & Trent, 2009) and (Lawrence, 2016).
Note: NR = not reported.

Table E-6. Surface Water Use—ACT River Basin (Georgia), 2005 and 2010

Water-use category	2005 water withdrawals		2010 water withdrawals	
	mgd	% of total	mgd	% of total
Total Use	788.98		697.60	
Public Supply	154.78	19.6%	147.00	21.1%
Domestic and Commercial	0.30	0.0%	6.28	0.9%
Industrial and Mining	32.49	4.1%	40.24	5.8%
Irrigation	11.31	1.4%	14.91	2.1%
Livestock	16.18	2.1%	9.05	1.3%
Thermoelectric Power Generation	573.92	72.8%	480.10	68.8%

Sources: (Fanning & Trent, 2009) and (Lawrence, 2016).

Compared to the 2005 water-use data (Fanning & Trent, 2009), total surface water withdrawals in the ACT River Basin in 2010 declined by 11.6 percent. The largest contributor to the decline was thermoelectric power generation, which experienced a 16.4 percent decline in water withdrawals. Cumulatively, public supply and domestic/commercial withdrawals remained about the same from 2005 to 2010. Industrial and mining withdrawals increased slightly. Cumulatively, irrigation and livestock withdrawals decreased slightly from 2005 to 2010, with irrigation individually showing a moderate increase and livestock showing a substantial decrease.

Estimates of surface water and groundwater pumping rates for agricultural irrigation in Georgia for 2011–2050 were developed in studies conducted by the University of Georgia College of Agricultural and Environmental Sciences (Hook, 2009). Estimates for surface water withdrawals for irrigation in the Coosa and Tallapoosa river basins (for year 2011) are presented in Table E-7. In the table, the *Wet year* equals the wettest 25th percentile (1 in

4 years) and *Dry year* equals the driest 25th percentile (1 in 4 years). The results of the studies were used to characterize and quantify surface water withdrawals for agricultural irrigation in the Georgia Comprehensive Statewide Water Plan (SWP) and the associated regional water plans (RWPs). Surface water withdrawals for agricultural irrigation in the Coosa and Tallapoosa river basins are relatively minor, as estimates ranged from a total of 2.76 mgd in a wet year to 9.96 mgd in a dry year. Approximately 75 percent of those agricultural surface water withdrawals occurred in the Etowah River subbasin. Estimates from the studies indicate that surface water withdrawals for agricultural irrigation in the ACT River Basin in Georgia might be smaller than the estimates presented in the USGS Georgia water-use reports for 2005 (Fanning & Trent, 2009) and 2010 (Lawrence, 2016).

Table E-7. Coosa and Tallapoosa River Basins, Georgia—Agricultural Irrigation (Surface Water) Annualized Pumping Rates in mgd (estimated for year 2011)

Basin/subbasin HUC	Wet year	Median year	Dry year
Basin Total – Coosa River	2.76	6.06	9.96
Conasauga (03150101)	0.12	0.23	0.36
Coosawattee (03150102)	0.39	0.70	1.08
Oostanaula (03150103)	0.31	0.56	0.86
Etowah (03150104)	1.93	4.58	7.67
Upper Coosa (03150105)	0	0	0
Basin Total – Tallapoosa River	0	0	0
Upper Tallapoosa (03150108)	0	0	0

Source: (Hook, 2009).
Note: HUC = hydrologic unit code.

E.1.1.6.2.2 Alabama

USGS also conducted comprehensive inventories of surface water use in Alabama in 2005 (Hutson, Littlepage, Harper, & Tinney, 2009) and 2010 (Harper & Turner, 2015). Table E-8 summarizes specific M&I surface water withdrawals in the Alabama portion of the ACT River Basin, based on data from those inventories. Table E-9 summarizes surface water use by water-use category. Surface water use in the ACT River Basin in Alabama during 2010 totaled 1,148.05 mgd. As in Georgia, overall, the most significant use of surface water within the Alabama portion of the ACT River Basin also was for thermoelectric power generation (about 69 percent). Public water supply and industrial/mining uses represented about 13 and 15 percent, respectively, of surface water withdrawals. Less than 5 percent of surface water use in the Alabama portion of the ACT River Basin was for irrigation and livestock.

Compared to the 2005 water-use data (Hutson, Littlepage, Harper, & Tinney, 2009), total surface water withdrawals in the Alabama portion of the ACT River Basin in 2010 declined by 14.1 percent. Thermoelectric power generation experienced the largest decline, decreasing by 18.0 percent. Public supply withdrawals in the basin decreased by 14.4 percent from 2005 to 2010, but the percentage share of the total withdrawals for each year remained about the same. Industrial and mining withdrawals decreased slightly between 2005 and 2010. Cumulatively, irrigation and livestock withdrawals increased by 43.8 percent from 2005 to 2010, but the overall share of total withdrawals for those uses remained at less than 5 percent.

Table E-8. M&I Surface Water Withdrawals in the ACT River Basin (Alabama), 2005 and 2010

Basin (subbasin)	Withdrawal by	County	2005 withdrawal (mgd)	2010 withdrawal (mgd)
Coosa River Basin (Alabama)				
Coosa (Upper)	Centre Water Works & Sewer Board	Cherokee	1.19	0.96
Coosa (Upper)	Piedmont Water Works & Sewer Board	Calhoun	0.93	1.00
Coosa (Middle)	Jacksonville Water Works & Sewer Board	Calhoun	1.34	1.31
Coosa (Middle)	Anniston Water Works & Sewer Board	Calhoun	0.08	0.15
Coosa (Middle)	Fort Payne Water Works Board	DeKalb	8.10	6.30
Coosa (Middle)	Goodyear Tire and Rubber Company	Etowah	9.87	9.21
Coosa (Middle)	Gadsden Water Works & Sewer Board	Etowah	14.86	15.68
Coosa (Middle)	Alabama Power Co – Gadsden Steam Plant	Etowah	142.68	114.66
Coosa (Middle)	Cement and Concrete Product Manufacturing	St. Clair	3.49	4.45
Coosa (Middle)	Talladega/Shelby Water Treatment Plant	Talladega	6.44	5.33
Coosa (Middle)	Talladega County Water Department	Talladega	0.81	0.82
Coosa (Middle)	Talladega Water Works & Sewer Department	Talladega	1.62	0.99
Coosa (Middle)	Bowater Newsprint, Coosa Pines Operation	Talladega	52.47	24.67
Coosa (Lower)	Sylacauga Utilities Board	Talladega	3.25	0.88
Coosa (Lower)	SIC 22 – Unnamed Textile	Talladega	0.89	NR
Coosa (Lower)	Goodwater Water Works & Sewer Board	Coosa	0.46	NR
Coosa (Lower)	Shelby County Water Services	Shelby	NR	2.63
Coosa (Lower)	Alabama Power Co – E.C. Gaston Plant	Shelby	812.32	666.25
Coosa (Lower)	Clanton Water Works & Sewer Board	Chilton	1.79	1.83
Coosa (Lower)	Five Star Water Supply	Elmore	5.46	4.32
Tallapoosa River Basin (Alabama)				
Tallapoosa (Upper)	Heflin Water Works	Cleburne	0.51	0.56
Tallapoosa (Upper)	Wedowee Gas, Water, and Sewer	Randolph	0.39	0.46
Tallapoosa (Middle)	Roanoke Utilities Board	Randolph	1.29	1.05
Tallapoosa (Middle)	Clay County Water Authority	Clay	1.87	1.66
Tallapoosa (Middle)	Lafayette	Chambers	0.53	0.53
Tallapoosa (Middle)	Central Elmore Water & Sewer Authority	Elmore	4.83	5.33
Tallapoosa (Middle)	Alexander City Water Department	Tallapoosa	10.57	8.53
Tallapoosa (Lower)	West Point Home, Inc	Lee	2.23	NR
Tallapoosa (Lower)	Auburn Water Works Board	Lee	5.75	6.26
Tallapoosa (Lower)	Tallassee	Tallapoosa	1.98	1.85
Tallapoosa (Lower)	Tuskegee Utilities	Macon	2.71	3.12
Tallapoosa (Lower)	Montgomery Water Works & Sewer Board	Montgomery	25.17	19.47

Basin (subbasin)	Withdrawal by	County	2005 withdrawal (mgd)	2010 withdrawal (mgd)
Alabama River Basin				
Alabama (Upper)	Montgomery Water Works & Sewer Board	Montgomery	10.40	0.00
Alabama (Upper)	Pulp, Paper, and Paperboard Mills	Autauga	30.63	31.13
Alabama (Upper)	Southern Power Co – Plant E. B. Harris	Autauga	4.14	5.83
Alabama (Cahaba)	Birmingham Water Works & Sewer Board	Shelby	52.90	52.39
Alabama (Middle)	Pulp, Paper, and Paperboard Mills	Wilcox	21.04	18.31
Alabama (Lower)	Pulp, Paper, and Paperboard Mills	Monroe	54.61	46.29

Sources: (Hutson, Littlepage, Harper, & Tinney, 2009) and (Harper & Turner, 2015).
Note: NR = not reported.

Table E-9. Surface Water-Use—ACT River Basin (Alabama), 2005 and 2010

Water-use category	2005 water withdrawals		2010 water withdrawals	
	mgd	% of total	mgd	% of total
Total Use	1,337.11		1,148.05	
Public Supply	167.83	12.6%	143.72	12.5%
Industrial and Mining	175.23	13.1%	166.39	14.5%
Irrigation	30.70	2.3%	47.43	4.2%
Livestock	4.21	0.3%	3.77	0.3%
Thermoelectric Power Generation	959.14	71.7%	786.74	68.5%

Sources: (Hutson, Littlepage, Harper, & Tinney, 2009) and (Harper & Turner, 2015).

E.1.1.6.3 Groundwater Withdrawals

E.1.1.6.3.1 Georgia

In the Georgia portion of the Coosa River Basin, 32 M&I water users hold permits issued by GAEPD for groundwater withdrawals totaling up to 35.13 mgd (monthly average). In the Tallapoosa River Basin in Georgia, two M&I water users hold permits for groundwater withdrawals totaling up to 1.57 mgd (monthly average) (GAEPD, 2018b). The withdrawal permits are required by Georgia law for groundwater withdrawals exceeding 100,000 gpd.

Estimates of groundwater withdrawals for 2005 and 2010 in the 19 Georgia counties entirely or partly within the ACT River Basin are presented in Table E-10 (Fanning & Trent, 2009) (Lawrence, 2016). Those estimates indicate that about 44.7 mgd were withdrawn in 2010 for various beneficial uses. In 2010, 74 percent of the groundwater use in the Georgia portion of the ACT River Basin comprised public supply and domestic/commercial uses, while the remaining 26 percent comprised industrial/mining, irrigation, and livestock uses. Overall, groundwater withdrawals represented about 6 percent of total water withdrawals (surface and groundwater) in the Georgia portion of the ACT River Basin in 2010. Compared to 2005 values, groundwater withdrawals for all uses in 2010 decreased by about 30 percent. The most sizeable portion of that decline is attributable to a reduction in groundwater withdrawals for industrial and mining uses.

Table E-10. Groundwater Use—ACT River Basin (Georgia), 2005 and 2010

Water-use category	2005 water withdrawals		2010 water withdrawals	
	mgd	% of total	mgd	% of total
Total Use	64.0		44.7	
Public Supply	21.0	33%	15.4	34%
Domestic and Commercial	20.3	31%	18.0	40%
Industrial and Mining	20.5	31%	6.6	15%
Irrigation	2.3	4%	3.9	9%
Livestock	0.7	1%	0.8	2%
Thermoelectric Power Generation	0.0	0%	0.0	0%

Sources: (Fanning & Trent, 2009) and (Lawrence, 2016).

Studies conducted by the University of Georgia College of Agricultural and Environmental Sciences produced estimates of groundwater water pumping rates for agricultural irrigation for 2011 in the Coosa and Tallapoosa river basins (Hook, 2009). Those estimates are presented in Table E-11. In the table, the *Wet year* equals the wettest 25th percentile (1 in 4 years) and *Dry year* equals the driest 25th percentile (1 in 4 years). The results of the studies were used to characterize and quantify groundwater withdrawals for agricultural irrigation to support development of the Georgia SWP and the associated RWPs. Groundwater use for agriculture in these two river basins in Georgia is minor and generally confined to the Etowah River subbasin.

Table E-11. Coosa and Tallapoosa River Basins, Georgia—Agricultural Irrigation (Groundwater) Annualized Pumping Rates in mgd (estimated for year 2011)

Basin/subbasin HUC	Wet year	Median year	Dry year
Basin Total – Coosa River	0.11	0.28	0.45
Conasauga (03150101)	0	0	0
Coosawattee (03150102)	0	0	0
Oostanaula (03150103)	0	0	0
Etowah (03150104)	0.11	0.28	0.45
Upper Coosa (03150105)	0	0	0
Basin Total – Tallapoosa River	0	0	0
Upper Tallapoosa (03150108)	0	0	0

Source: (Hook, 2009).
Note: HUC = hydrologic unit code.

E.1.1.6.3.2 Alabama

Groundwater withdrawals within the ACT River Basin in Alabama in 2005 and 2010 are summarized in Table E-12 (Hutson, Littlepage, Harper, & Tinney, 2009) (Harper & Turner, 2015). Total groundwater withdrawals in this area in 2010 were estimated at 135.92 mgd. About 84 percent of those withdrawals was used for public water supply, and about 12 percent was used for agricultural irrigation and livestock. About 80 percent of the groundwater withdrawals in the Alabama portion of the ACT River Basin occur in three specific subbasins: (1) the Middle Coosa (31 percent), which coincides with several communities in the vicinity of Gadsden and Anniston; (2) the Upper

Alabama (28 percent), including the Montgomery area and surrounding communities; and (3) the Cahaba River Basin (21 percent), including several communities between Montgomery and Birmingham. Overall, groundwater withdrawals represent only about 11 percent of total water withdrawals (surface and groundwater) in the Alabama portion of the ACT River Basin. Total groundwater withdrawals in 2010 slightly decreased (by about 6 percent) compared to 2005. Groundwater withdrawals broken down by water-use category and by subbasin within the ACT River Basin in Alabama showed negligible differences between 2005 and 2010.

Table E-12. Groundwater Use—ACT River Basin (Alabama), 2005 and 2010

Water-use category	2005 water withdrawals		2010 water withdrawals	
	mgd	% of total	mgd	% of total
Total Use	144.70		135.92	
Public Supply	120.18	83%	114.34	84%
Industrial	6.23	4%	4.55	3%
Irrigation	15.20	11%	14.26	10%
Livestock	3.09	2%	2.77	2%
Thermoelectric Power Generation	0.0	0%	0.0	0%

Sources: (Hutson, Littlepage, Harper, & Tinney, 2009) and (Harper & Turner, 2015).

E.1.1.6.4 Consumptive Water Use and Return Flows

Consumptive use returns only a portion of the water withdrawn. The rest of the water is evaporated, transpired, incorporated into products or crops, consumed by humans or livestock, or otherwise removed from the immediate water environment (Hutson, et al., 2004).

The USGS 2005 water-use report for Georgia summarized the amount of water consumptively used for various categories of water use in the region (consumptive-use coefficients) (Fanning & Trent, 2009). Consumptive-use coefficients vary for each of the water-use categories. Because public supplies deliver water to domestic, commercial, industrial, and thermoelectric-power users, consumptive use is estimated for those individual water-use categories. For domestic water use, consumptive use is estimated at about 18 percent of the total. The consumptive-use coefficient for commercial use was developed by the Georgia Water-Use Program and supported by calculations using withdrawal and discharge data for some commercial users and estimated to be 18 percent. For industrial and mining use, consumptive-use coefficients were determined by industry type and type of mining activity. For example, the consumptive-use coefficient for the pulp and paper industry was estimated at 7 percent and for the textile industry at 13 percent in 2005. Irrigation and livestock water uses are considered to be 100 percent consumed (i.e., all the water withdrawn for those purposes is evaporated or transpired, incorporated into crops, or consumed by livestock). Sprinkler and microirrigation methods are used for irrigation in the region, which do not use the large amounts of nonconsumptive water used in flood irrigation methods. Consumptive use is negligible for in-stream hydropower generation (Fanning & Trent, 2009).

For thermoelectric power generation, the amount of consumptive water use, relative to the amount withdrawn, is primarily determined by the type of cooling system used at the power plant. *Once-through cooling* (also known as open-loop cooling) refers to systems in which water is withdrawn from a source, circulated through heat exchangers, and then returned to a surface waterbody. *Recirculating cooling* (also known as closed-loop cooling) refers to systems in which water is withdrawn from a source, circulated through heat exchangers, cooled, and then recycled. Subsequent water withdrawals for a recirculating-cooling system are used to replace water lost to evaporation, blowdown, drift, and leakage. In a 2009 report, the percentage of consumptive use from generating units with once-through cooling ranged from zero to nearly 7 percent (median - 0.1 percent) compared to the percentage of

consumptive use from generating units with recirculating cooling, which ranged from 30 percent to 65 percent (median - 44 percent) (Hutson, Littlepage, Harper, & Tinney, 2009).

Table E-13 depicts the cooling system types and consumptive water-use characteristics of the five thermoelectric power plants in the ACT River Basin (Lawrence, 2016) (Harper & Turner, 2015).

Table E-13. Consumptive Water Use at Thermoelectric Power Plants in the ACT River Basin

Plant name	Company	Location	River	Cooling system	Water quantity (2010) (mgd, average annual)		
					Withdrawn	Returned	Consumed
Bowen	GA Power	Bartow Co, GA	Etowah	Closed cycle	47.9	16.0	31.9
Hammond	GA Power	Floyd Co, GA	Coosa	Once-through	432.2	432.0	0.2
Gadsden	AL Power	Etowah Co, AL	Coosa	Once-through	114.6	114.1	0.5
Gaston	AL Power	Shelby Co, AL	Coosa	Once-through	665.5	662.6	2.9
Harris	Southern Power Co.	Autauga Co, AL	Alabama	Closed cycle	5.8	2.4	3.4

Sources: (Lawrence, 2016) and (Harper & Turner, 2015).

In 2005 total consumptive use across Georgia was estimated to be about 24 percent of total withdrawals (Fanning & Trent, 2009). For counties in northwest Georgia entirely or partially within the ACT River Basin, consumptive use (applying the above coefficients) was estimated to be approximately 117 mgd, or about 15 percent of total withdrawals. Surface water that is not *consumed* when used will be discharged (returned), with appropriate treatment, to the surface water system, which will generally be at or near the point of withdrawal. Return flows to rivers and streams are governed by discharge permits under the CWA.

Current withdrawals from Allatoona Lake and associated returns of treated wastewater to the ACT River Basin, either directly to the lake or downstream of the dam, are of specific interest in considering the proposed reallocation of storage addressed in this Draft FR/SEIS. Table E-14 presents withdrawal and return data for 2018 as compiled by USACE, Mobile District from data provided by the applicable water supply and wastewater utilities to GAEPD. The CCMWA had average gross withdrawals of 47.3 mgd and a combined 14.6 mgd in treated wastewater returns to Allatoona Lake from two WRFs, Noonday and Northwest Cobb. Approximately 31 percent of CCMWA's water supply withdrawals are returned to Allatoona Lake as treated wastewater. That relatively low rate of return directly to Allatoona Lake is attributable to two factors. First, CCMWA's principal customer, the Cobb County Water System (CCWS), has a large service area that overlays portions of both the Chattahoochee and Etowah river basins. The larger portion of the CCWS service area overlays the Chattahoochee River Basin, including the two largest CCWS WRFs along the Chattahoochee River. Thus, a sizeable amount of the water withdrawn from Allatoona Lake is used and subsequently treated and discharged into the Chattahoochee River. Secondly, a small amount of the CCMWA water supply withdrawals from Allatoona Lake are sold to other local water providers such as the city of Woodstock, Douglas County, and Paulding County, GA. Treated wastewater associated with those customers is generally returned to the ACT River Basin but not directly to Allatoona Lake.

Table E-14. Water Supply Withdrawals from Allatoona Lake and Returns of Treated Wastewater

Agency/Facility	Avg. gross withdrawals (mgd) (2018)	Permitted treatment capacity (mgd)	Avg. returns (mgd) (2018)	Percent returned	Returned to
CCMWA	47.3				
CCWS (Noonday & Northwest Cobb WRFs)		25.6 (Noonday WRF – 16; NW Cobb WRF – 9.6)	14.6 (combined)	31%	Allatoona Lake
City of Carterville	13.9				
Cartersville Water Pollution Control Plant		15	8.9	64%	Etowah River downstream of Allatoona Dam
Total	61.2	40.6			

Source: USACE Mobile District (compiled from water use data provided by CCMWA, Cobb County Water System, and City of Cartersville)

The city of Cartersville had average gross withdrawals for Allatoona Lake of about 13.9 mgd in 2018. Approximately 8.9 mgd, or 64 percent of the withdrawal amount, was returned to the Etowah River through the Cartersville Water Pollution Control Plant, located downstream of the Allatoona Dam. Overall, CCMWA and Cartersville withdrew about 61.2 mgd from Allatoona Lake in 2018. CCWS returned about 14.6 mgd of treated wastewater directly to the lake; but the city of Cartersville made no returns directly to the lake. The net withdrawal from Allatoona Lake under current conditions is approximately 46.6 mgd.

USACE water management models addressing reservoir and river operations for the ACT River Basin account for all water withdrawals and return flows. Actual withdrawal and return flow data have been included in the models to evaluate existing conditions and to run alternative scenarios associated with the proposed actions.

E.1.1.6.5 Interbasin Transfers

Interbasin transfer is commonly described as a withdrawal of water from one river basin, followed by use and/or return of some, or all, of that water to a second river basin. In the mid-1990s, interbasin transfers were investigated by Planning and Management Consultants, Ltd. as part of the *ACT-ACF Comprehensive Study* (USACE Mobile District, 1998b). For the ACT River Basin, estimated surface water transfers from the basin totaled 55 mgd (43 mgd to the ACF River Basin and 12 mgd elsewhere). Estimated transfers into the ACT River Basin totaled 61 mgd (9 mgd from the ACF River Basin and 52 mgd from elsewhere). The overall net gain was about 6 mgd to the ACT River Basin at that time.

Most of the interbasin transfers (both in numbers and volume) occur within the 15-county Metropolitan North Georgia Water Planning District (MNGWPD). The water and wastewater systems within MNGWPD operate as an interconnected service network. Transfers among basins are particularly common within counties that straddle the ridges between two or more basins. The MNGWPD 2017 *Water Resource Management Plan* estimated net interbasin transfers within the District based on 2013 data. The Plan estimated that the Coosa River Basin gained 3 mgd from adjacent river basins and lost 12 mgd to adjacent river basins, for a net loss to the ACT River Basin of about 9 mgd (MNGWPD, 2017). In comparison, the MNGWPD 2009 *Water Supply and Water Conservation Management Plan* estimated a net transfer (loss) of 14 mgd from the Coosa River Basin to the Chattahoochee River Basin by MNGWPD counties, based on 2006 withdrawal and discharge data (MNGWPD, 2009). Therefore, the net loss to the ACT River Basin attributable to water supply activities in the MNGWPD was estimated to be 5 mgd lower in 2013 than it was in 2006.

The Tennessee Valley Authority identified several water supply utilities either on or near the Tennessee River Basin boundary (TVA, 2007). In river basins adjacent to the Tennessee River (including the ACT River Basin), water can be transferred into or from the basin depending on water suppliers' local service areas. The net effect of water transferred from the ACT River Basin and water transferred into the ACT River Basin is minimal. Fort Payne, AL, (located in the ACT River Basin) has a pipeline that transfers about 4 mgd from the Tennessee River system to meet local needs. Dalton, GA, in Whitfield County, has contracts with a water utility on Chickamauga Reservoir to purchase up to 10 mgd. Additional purchases can be expected as the Dalton area continues to grow. Walker and Catoosa counties in Georgia already purchase some water from a utility on the Tennessee River, and increased purchases are likely as those areas continue to grow (TVA, 2007). These transfers result in a small net gain to water resources in the ACT River Basin. Table E-15 summarizes the actual interbasin transfers between the Tennessee River and the ACT River Basin in 2015 (TVA, 2018).

Table E-15. Interbasin Transfers between the Tennessee River Basin and Coosa River Basin, 2015

Transfer from			Transfer to			
System	State	Basin	System	State	Basin	2015 mgd
Fort Payne Water Works	AL	Tennessee	Fort Payne Water Works Service Area	AL	Coosa	0.13
Tennessee-American Water Company	TN	Tennessee	Walker County	GA	Coosa	No Data
Cleveland Utilities	TN	Tennessee	Ocoee Utility District	TN	Coosa	0.16
Eastside Utility District	TN	Tennessee	Dalton Utilities	GA	Coosa	0.76
Ocoee Utility District	TN	Tennessee	Ocoee Utility District Service Area	TN	Coosa	0.02
Cleveland Utilities	TN	Coosa	Cleveland Utilities Service Area	TN	Tennessee	0.5
Ocoee Utility District	TN	Coosa	Ocoee UD Service Area	TN	Tennessee	No Data

Source: (TVA, 2018).

E.1.1.6.6 Per Capita Use

Per capita public water supply use is determined by dividing the total amount of water provided by public suppliers by the total population served. USGS water-use data for Georgia indicate that public water supply use per capita averaged 185 gpd in 2000 (Fanning J. L., 2003). USGS 2005 water-use data indicate that per capita use in Georgia had declined to an average of 158 gpd (Fanning & Trent, 2009), and 2010 water-use data showed a further decline to about 136 gpd (Lawrence, 2016). In Alabama, public water supply use per capita averaged 233 gpd in 2000, declining to about 199 gpd in 2005 (Hutson, Littlepage, Harper, & Tinney, 2009), and further declining to about 196 gpd in 2010 (Harper & Turner, 2015). While those are statewide averages, per capita use in the Georgia and Alabama portions of the ACT River Basin is likely to be similar.

Maddaus Water Management, Inc. and CH2M Hill summarized per capita water use in a report based upon a national survey of 41 metropolitan water agencies in 22 different states between 2005 and 2007. That period was relatively free of external factors that could significantly affect water use, including abnormal weather, droughts, and unusual economic conditions. Agencies surveyed represented metropolitan areas geographically distributed across the United States. The surveyed communities had a total population of almost 46 million and total water use

of over 7.7 billion gpd, yielding an average per capita water use of 174 gpd (Maddaus Water Management, Inc. and CH2M Hill, 2011). Key statistical results from the survey of the 41 water agencies include the following:

- The lowest per capita use was 104 gpd (Seattle Public Utilities, Seattle, WA);
- Four agencies had per capita use less than 130 gpd;
- Twenty agencies were in the range of 130–170 gpd;
- Seventeen agencies had per capita water use of 170 gpd or higher;
- The highest per capita water use of the agencies surveyed was 293 gpd (Savannah, GA);
- The median per capita water use was 162 gpd and the average was 174 gpd.

The MNGWPD was one of the 41 agencies surveyed in the Maddaus Water Management/CH2M Hill report. Background on the MNGWPD is provided in Section E.1.1.8.1.7. The per capita water use for the MNGWPD in the survey was 128 gpd, which was the fourth lowest number of the 41 surveyed metropolitan water agencies. Per capita water use for other agencies in the study in the southeastern US region included the following (Maddaus Water Management, Inc. and CH2M Hill, 2011):

- Columbus, GA (143 gpd);
- Greenville, SC (150 gpd);
- West Point, GA (153 gpd);
- Mobile, AL (159 gpd);
- Montgomery, AL (162 gpd);
- Birmingham, AL (167 gpd);
- LaGrange, GA (172 gpd);
- Phenix City, AL (173 gpd);
- Tallahassee, FL (176 gpd);
- Augusta-Richmond County, GA (212 gpd).

Implementing effective water conservation and efficiency practices and the resulting decreases in per capita water use have been at the foundation of water supply planning in the MNGWPD since it was created in 2001. The MNGWPD area includes Allatoona Dam and Lake and the service areas for the WSPs presently requesting additional water supply storage from Allatoona Lake (CCMWA and city of Cartersville). The first MNGWPD water supply plan in 2003 introduced innovative water conservation strategies expanded upon in the 2009 plan update and subsequent 2010 amendments. The 2010 amendments were largely instituted in response to the Georgia Water Stewardship Act of 2010 (see Section E.1.1.8.1.6). Table E-16 lists the water conservation and efficiency programs implemented by the MNGWPD since its creation in 2001. These programs were selected based on their cost-effectiveness and applicability to MNGWPD water users, as well as their potential ability to decrease water demand across the region. Through each revision, the programs were strengthened by building on the success already achieved and continue to move the MNGWPD forward as a national leader in water conservation and efficiency (MNGWPD, 2017).

Table E-16. MNGWPD Water Conservation Measures based on Requirements in the 2003 Plan, 2009 Plan Update, and 2010 Plan Amendments

Measure no.	Conservation measure [a, b]	2003 plan	2009 plan	2010 amendments
1	Implement conservation pricing.	●	●	●
2	Replace older, inefficient plumbing fixtures.	●	●	●
3	Require prerinse spray valve retrofit education program.	●	●	●
4	Require rain sensor shut-off switches on new irrigation systems.	●	●	●
5	Require submeters in new multifamily residential buildings.	●	●	●
6	Assess and reduce water system leakage.	●	●	●
7	Conduct residential water audits.	●	●	●
8	Distribute low-flow retrofit kits to residential users.	●	●	●
9	Conduct commercial water audits.	●	●	●
10	Implement public education and awareness plan.	●	●	●
11	Install high-efficiency toilets and urinals in government buildings.		●	●
12	Require new car washes to recycle water.		●	●
13	Expedite water loss reduction (Chattahoochee and Lanier).[c]			●
14	Implement multifamily high-efficiency toilet rebates (Chattahoochee and Lanier).[c]			●
15	Require meters with point-of-use leak detection (Chattahoochee and Lanier).[c]			●
16	Require private fire lines to be metered (Chattahoochee and Lanier).[c]			●
17	Maintain a water conservation program (Chattahoochee and Lanier).[c]			●
18	Implement a water waste policy.			●
19	Require high-efficiency plumbing fixtures consistent with state legislation.			●

Source: (MNGWPD, 2017).

Notes:

[a] Conservation practices listed in the 2003 and 2009 MNGWPD Plans were developed prior to the enactment of the Georgia Water Stewardship Act in 2010.

[b] In 2010, measures 13–19 were added by a Plan amendment.

[c] Water conservation measures adopted in 2010 were recommended for Chattahoochee River Basin utilities only.

The MNGWPD's water conservation program is comprehensive, and it has contributed to a marked decline in the region's water use. Highlights of these programs include the following:

- Water conservation pricing that includes higher residential water rates as customers use more water.
- A toilet rebate program that has replaced over 110,000 inefficient toilets, saving more than 2.5 mgd.
- A requirement for rain sensors to be installed on new irrigation systems in the MNGWPD since 2005.
- Water loss assessment and leak detection programs that predated the state's award-winning program by 5 years.
- National recognition of public education and outreach efforts—The MNGWPD received the 2015 WaterSense Excellence Award for Outreach and Education from the U.S. Environmental Protection Agency's (USEPA's) WaterSense program for making a difference through water efficiency innovation and WaterSense promotion (MNGWPD, 2017).

Since 2001, the MNGWPD has implemented activities and policies that have helped per capita water use in the region drop by more than 30 percent, as shown on Figure E-22 (MNGWPD, 2017). The downward trend in per capita water use is expected to continue into the future as renovation and replacement of older residences and businesses in the MNGWPD comply with the new water conservation and efficiency requirements (Zitsch, 2018b).

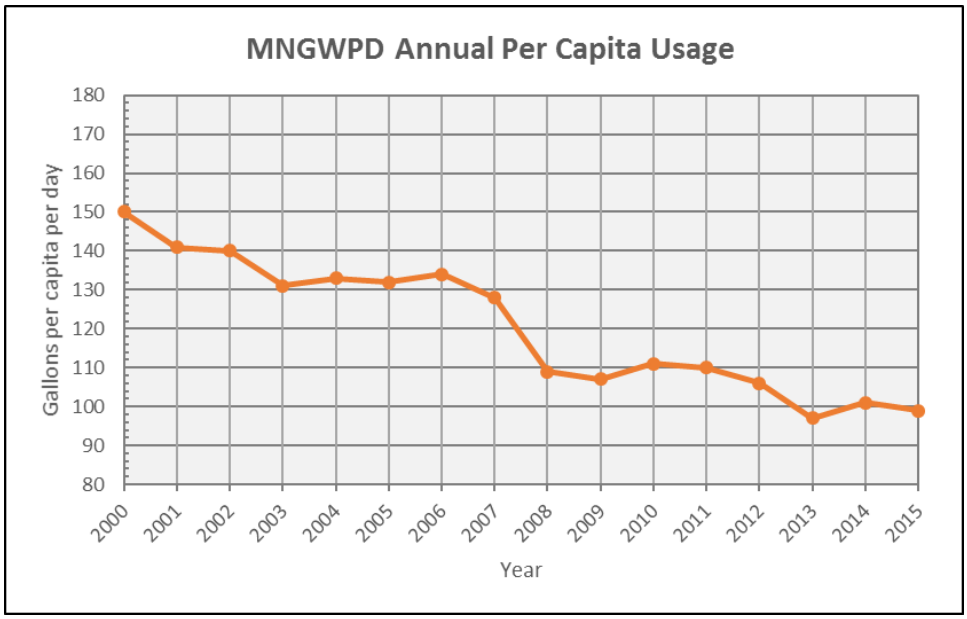
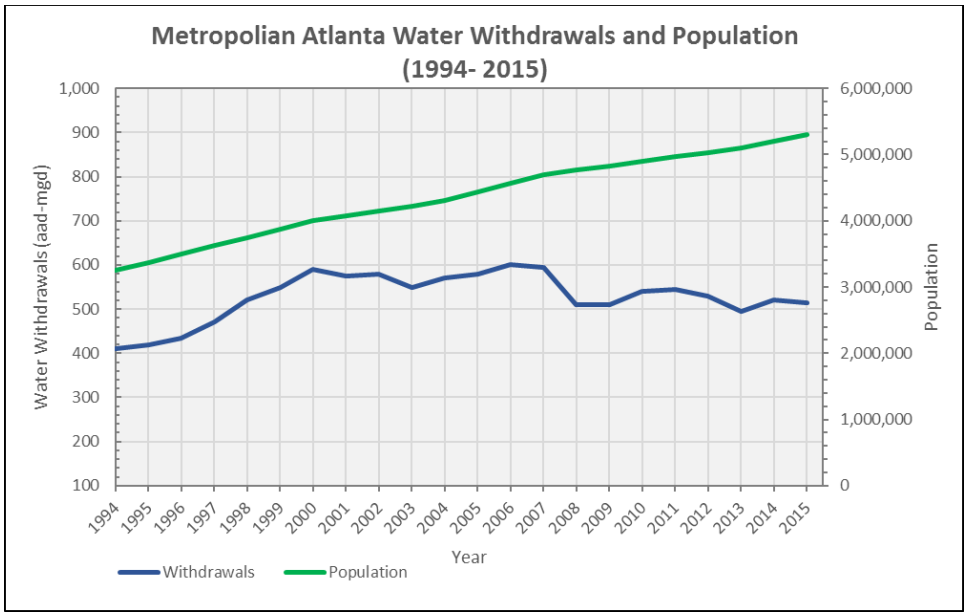


Figure E-22. MNGWPD per Capita Water-Use Trend (2000–2015).

As shown in Figure E-23, water conservation and efficiency measures implemented by the MNGWPD since its establishment in 2001, plus mandatory drought management measures implemented by the state of Georgia (see Section E.1.1.8.1.2), have leveled off and steadily reduced M&I water withdrawals. From 2006 to 2015, withdrawals have decreased by as much as 20 percent. While the population in the MNGWPD area grew about 60 percent between 1994 and 2015, water withdrawals in the area in 2015 were only about 25 percent higher than 1994 levels (Zitsch, 2018a).



Note: aad-mgd = average annual day-million gallons per day

Figure E-23. Total Water Withdrawals in the MNGWPD Compared to Population Trend (1994 to 2015).

E.1.1.7 Critical Yield from USACE's Two Storage Reservoirs in the ACT River Basin

Critical yield is defined as the maximum amount of water that can be consistently removed from a reservoir through releases from the dam and/or withdrawals from the reservoir, during the most severe drought in the hydrologic period of record, exactly depleting the reservoir conservation storage once during the period of record. *Conservation storage* is the amount of water available in a reservoir to meet project purposes other than flood risk management. The conservation storage in a reservoir can be allocated to project purposes (including joint use and storage specifically allocated to and sold as water supply storage) based on a percent of critical yield. A change in critical yield can result in modification of the allocations for a project purpose and/or an understanding that the risk of not being able to obtain the desired water flow has changed.

In 2010, USACE conducted a critical yield analysis for its two storage reservoirs in the ACT River Basin, Allatoona and Carters lakes. That analysis was updated in 2018 in conjunction with the current Georgia request for water supply storage from Allatoona Lake. Critical drought periods analyzed for the 2010 critical yield analysis included 1940–41, 1954–58, 1984–89, 1999–2003, and 2006–2008. Critical yield was computed for each drought period and the lowest value (from the yield event period of Jan 2006–Dec 2009) represented the critical yield in the 2010 analysis. The Jan 2006–Dec 2009 yield event period was also used for the 2018 critical yield update. For purposes of the critical yield analysis, ACT River Basin diversions included M&I and agricultural withdrawals and returns from the Etowah River and its tributaries upstream of Allatoona Lake and from the Coosawattee River above Carters Lake. Critical yield was calculated with and without diversions so the impact of river withdrawals on critical yield could be determined. Maximum river withdrawals in the ACT River Basin occurred in 2006 and are reflected in the critical yield calculation for each drought period. The USACE HEC-ResSim model was used to simulate reservoir operations. Details on the critical yield analysis, including modeling assumptions, are presented in the report for the 2018 critical yield analysis update in Appendix C, Attachment 11, to the Draft FR/SEIS.

The results of the 2010 and updated 2018 critical yield analyses for Allatoona and Carters lakes are presented in Table E-17. The updated 2018 critical yield at Allatoona Lake is 765 cfs, which is equal to 495 mgd.

Table E-17. Allatoona Lake and Carters Lake—Critical Yield Analysis Results (2010 and 2018)

Project	2010		2018	
	cfs	mgd	cfs	mgd
Allatoona Lake (with diversions)	693	447	**765**	**495**
Allatoona Lake (without diversions)	729	471	784	507
Carters Lake (with diversions)	387	250	383	247
Carters Lake (without diversions)	390	252	387	250

E.1.1.8 Water Planning, Management, and Conservation Activities in the ACT River Basin

This section provides a brief overview of water resource planning, management, and conservation activities undertaken by state, regional, and local interests within Georgia and Alabama that directly influence the water resources in the ACT River Basin and the proposed actions considered in the Draft FR/SEIS. This section does not provide in-depth detail on these activities or programs or identify every related activity within the ACT River Basin by individual counties and municipalities.

E.1.1.8.1 Georgia

E.1.1.8.1.1 Georgia Water Withdrawal Permit Program

Georgia laws, the Georgia Water Quality Control Act (O.C.G.A. § 12-5-31, 2018) and the Georgia Groundwater Use Act (O.C.G.A. §§ 12-5-90 et seq., 2018), require any water user who withdraws more than 100,000 gpd on a monthly average to obtain a withdrawal permit from GAEPD. Since 1988, Georgia has required water withdrawal permits for agricultural users who pump water from either surface waters or groundwater exceeding 100,000 gpd when use is averaged over any month. Permit holders generally must report their withdrawals by month, and the GAEPD stores the reported data in the Georgia Water-Use Data System. The law does not transfer any property right to the water or the water permit to the permit holder beyond the right to reasonable use of the water. Before granting a permit, GAEPD applies specific criteria identified in the statute to evaluate the reasonableness of the proposed use and the extent of potential injury to other water uses (O.C.G.A. § 12-5-31, 2018). M&I permits are issued for a term of 10–50 years, after which they must be renewed, and for a specific quantity determined by reasonable use. The permits can be revoked for extended periods of nonuse. Farm use permits for all areas of the state, other than the Flint River Basin, are issued for an unlimited term. Farm permits issued after 1991 have defined quantities, whereas those issued before 1991 were based on pump capacity as of July 1, 1988. Farm permits cannot be revoked after initial use but can be revoked if water is never withdrawn.

E.1.1.8.1.2 Georgia Drought Management Plan

Following the 1998–2002 drought, the Georgia Department of Natural Resources (GADNR) Board adopted the *Georgia Drought Management Plan* in March 2003 (GAEPD, 2003). The Plan was developed using a collaborative approach involving stakeholders representing a geographical and political cross section of the state and a cross section of business, industry, environmental, and water management interests. The director of the GAEPD has principal responsibilities for implementing the drought management plan, and numerous agencies and organizations are tasked in the Plan with some level of water resource or related management responsibilities. GAEPD and the other agencies and organizations coordinate closely and share information about their drought or water conservation concerns and solutions.

The predrought strategies contained in the Plan are principally water conservation strategies. They are generally longer-term actions implemented before a drought for preparedness, mitigation, monitoring, and conservation. As water conservation plans are developed by other agencies—regional development centers (RDCs), regional water planning councils, local governments, and WSPs—they are to reflect the predrought strategies of the state plan (GAEPD, 2003). The state climatologist's office and GAEPD routinely monitor and evaluate drought indicators that reflect the health of the hydrologic system, including stream flows, lake levels, precipitation, groundwater levels, and other climatic indicators supplied by USACE, USGS, the National Drought Mitigation Center, and others. Georgia is divided into nine climate divisions (or *regions*), and each region has several specific indicators. When the indicators in any one or more of the nine regions signal the possible need for a drought response declaration, the GAEPD director consults with a designated Drought Response Committee (that includes state, federal, and stakeholder representatives) to determine the potential severity of the drought condition(s), the expected impacts, and the appropriate level of response. Depending on the severity of drought conditions, drought response actions include increasingly stringent mandatory restrictions on outdoor water use. At Drought Level Four, for example, outdoor water use is banned except for a limited number of specific exemptions (GAEPD, 2003).

During a declared drought, the GAEPD director will notify the local RDCs, local governments, WSPs, and the public of the appropriate actions to be taken. The state climatologist and GAEPD will monitor the drought indicators for changing conditions and will act in response if conditions change. As drought conditions improve, the GAEPD director will apply a conservative approach in taking actions to ease the drought level response (GAEPD, 2003).

On June 24, 2015, the DNR Board adopted Drought Management Rules that replaced former rule provisions relating to outdoor water use as well as the 2003 Drought Management Plan. The Drought Management Rules, Chapter 391-3-30, require specific drought response strategies during specified levels of declared drought that may limit or restrict outdoor water uses (GAEPD, 2019b).

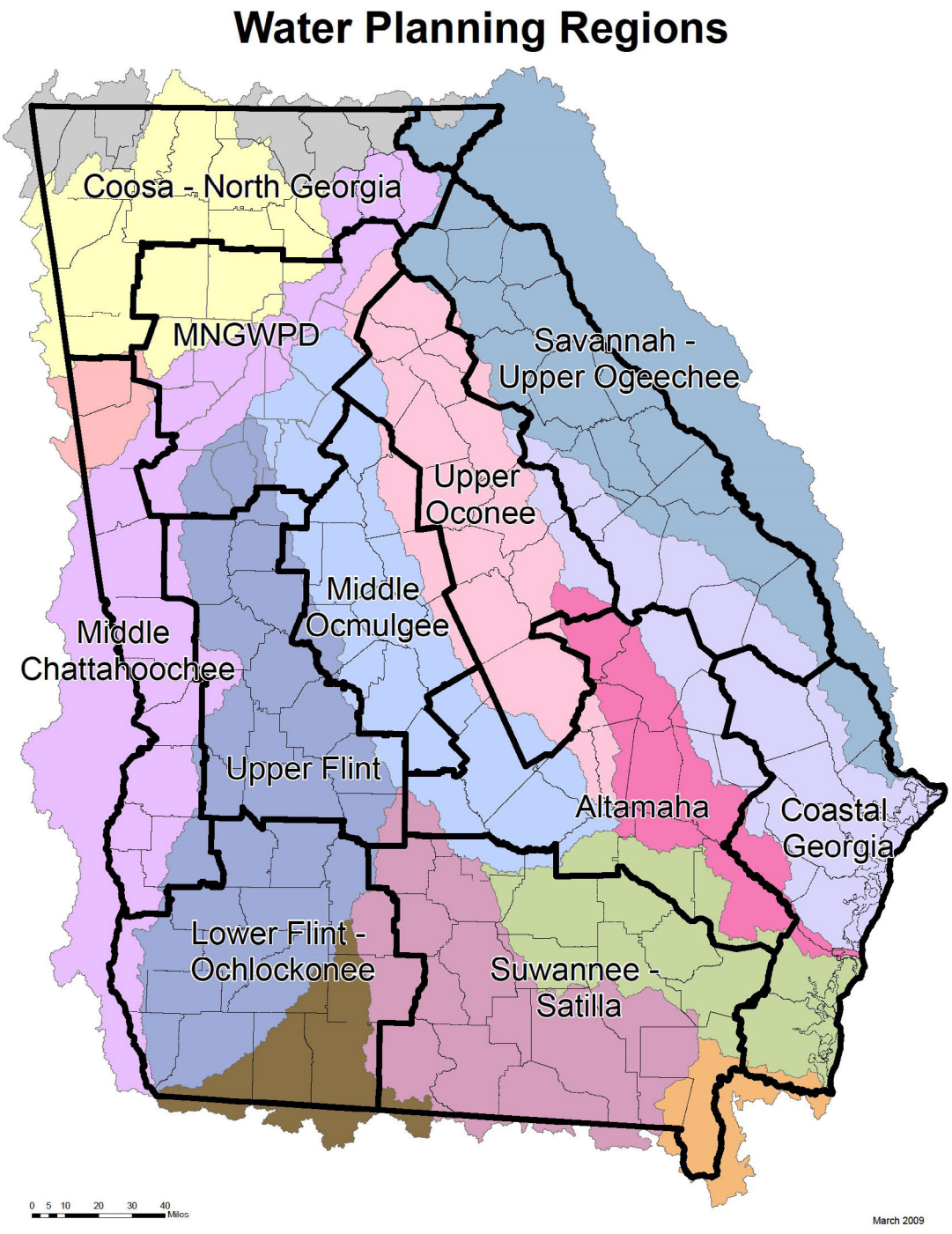
E.1.1.8.1.3 Georgia State Water Plan

The 2004 Comprehensive Statewide Water Management Planning Act authorized the development of the Georgia SWP. The act established the vision to "manage water resources in a sustainable manner to support the state's economy, to protect public health and natural systems, and to enhance the quality of life for all citizens" (O.C.G.A. §§ 12-5-520 et seq., 2018). GAEPD developed the SWP, with an intensive public involvement process and oversight by the Georgia Water Council, a 14-member coordinating committee composed of the heads of state agencies with water-related responsibilities, legislators, and citizen members. The Georgia General Assembly adopted the SWP in January 2008 (GAEPD, 2008).

The SWP has three major components: (1) resource assessments and needs forecasts; (2) a toolbox of water management practices; and (3) a framework for regional water planning. The resource assessments focus on water quantity (surface water and groundwater) and water quality. The water quantity resource assessment addressed the amount of water available to withdraw for beneficial use, while still supporting the ability of downstream users, or users from the same aquifer, to benefit from that water resource. The water quality resource assessment addressed wastewater treatment levels from a watershed perspective that were required to protect water quality. In addition, statewide and regional population and economic forecasts were used to develop water and wastewater demand forecasts over a 50-year planning horizon. The SWP explicitly recognized that regions throughout the state might need to apply different water management practices (tools) to their specific regional resource conditions, including those addressing water demands, returns, supply, and quality. Water conservation is established as a priority practice for use across the state for all water-use sectors (GAEPD, 2008).

The SWP provides a framework for regional water planning, through which appropriate water management practices are selected and defined for implementation. Ten water planning regions, shown in Figure E-24, were established to develop and recommend RWPs for adoption by GAEPD. An 11th planning region, the MNGWPD,

was already in existence, as it was established by the state legislature in 2001. The water planning regions are drawn along political (county) boundaries but they are generally aligned with the major river basins in the state. Each regional council consists of 25 members that represent the water users and the water-related interests in each region. Council members are appointed by the Governor, Lieutenant Governor, and Speaker of the House (GAEPD, 2008).



Source: (GAEPD, 2019c)

Figure E-24. Georgia State Water Plan—Water Planning Regions.

RWPs characterize the water needs for each region and identify preferred water management practices to close any gaps between water capacities and water needs. The regional councils used the SWP resource assessments and forecasts to develop recommended RWPs in 2010 and 2011. The initial RWPs were adopted by the GAEPD director in November 2011. In accordance with the 2004 act, which established the SWP, water withdrawal permits and state loans for infrastructure projects must be consistent with the adopted RWPs. The SWP requires periodic review and revision/update of RWPs. As shown on Figure E-24, the water planning regions that include portions of the ACT River Basin in Georgia are the Coosa-North Georgia (CNG) (includes most of the upper Coosa River Basin), Middle Chattahoochee (includes the upper Tallapoosa River Basin), and MNGWPD (includes Bartow, Cherokee, and parts of Cobb and Paulding counties in the Etowah River subbasin). These three water planning regions adopted their revised RWPs in 2017, and the RWPs are available on the Georgia State Water Plan website (GAEPD, 2018e). Since the actions proposed in the SEIS are most directly related to the plans and proposals of the MNGWPD, further discussion of the District's currently approved *Water Resource Management Plan* and activities within the ACT River Basin is provided in Section E.1.1.8.1.7.

E.1.1.8.1.4 Georgia Water Conservation Implementation Plan

In May 2009, GAEPD published a comprehensive Water Conservation Implementation Plan (WCIP), as a product of the Georgia SWP process, to foster a culture of conservation in the state and guide more efficient use of the state's finite water resources. The WCIP was last updated in March 2010 (GAEPD, 2010a). It provides a multipronged strategy to achieve more efficient and sustainable water use through conservation (defined as beneficial reduction in water use, water waste, and water loss) and measures to promote more efficient use of water (maximizing benefit from each gallon used). The Plan was developed in conjunction with representatives of state agencies, local government, and stakeholder interests.

The WCIP provides specific guidance for seven major water-use sectors: (1) agricultural irrigation, (2) electric power generation, (3) golf courses, (4) industrial and commercial, (5) landscape irrigation, (6) domestic and nonindustrial public uses, and (7) state agencies. For each sector, the WCIP details water conservation goals, benchmarks, best practices, and implementation actions designed to reduce water waste, water loss, and, where necessary, water use. The WCIP guides decisions related to water use and management in the state by (1) educating water users about water conservation practices and the associated benefits; (2) informing RWP preparation by regional water planning councils; (3) helping water-use sectors collectively improve water-use efficiency; and (4) informing GADNR rule-making regarding water conservation and efficiency requirements in permitting.

E.1.1.8.1.5 Georgia Water Supply Act of 2008

In 2008, the Georgia General Assembly passed the Water Supply Act (O.C.G.A. § 12-5-470, 2018), which tasked the Georgia Environmental Finance Authority (GEFA) with responsibilities and powers related to water supply project development in the state. The Water Supply Act established the Governor's Water Supply Program, authorized GEFA to conduct a study to identify feasible sites for water supply reservoir development, and authorized GEFA to assist local governments with the reservoir and water supply permitting process in coordination with GAEPD. The GEFA water division can also plan, design, acquire, construct, operate, manage, and maintain new reservoirs on behalf of local governments. GEFA administers the Governor's Water Supply Program, which provides low-interest loans and state direct investment funding (grants) from the Georgia Reservoir Fund to local governments for water supply projects such as system interconnections, new and rehabilitated wells, reservoir modifications for water supply purposes, and the construction of new water supply reservoirs (GEFA, 2019).

GEFA conducted an inventory and survey of feasible sites for multijurisdictional drinking water supply reservoirs in Georgia (GEFA, 2008). The study considered reservoirs under development or specifically proposed, existing reservoirs with potential for volume expansion, and possible new reservoir locations extracted from prior studies. The report focused on the need for water supply reservoirs in a 78-county area in Georgia north of the fall line and provided preliminary information and analysis to assist local governments and regional water planning councils in considering measures to augment local water supply. Above the fall line, surface water is the principal source of

public water supply and reservoirs are essential for water supply storage, whereas groundwater aquifers are the principal source of public water supply below the fall line.

The study acknowledged that reservoir development is only one tool that can be used to increase water supply and, considering all available options, the most expensive, environmentally sensitive, and time-consuming tool. Local water providers were encouraged to first consider conservation and efficiency in water planning to meet future needs, potential interconnectivity to other systems, and the potential for drilling wells. Upon determining that a reservoir is the best alternative, the report recommended that local water providers give priority to expanding existing reservoirs, then to developing regional reservoirs to serve multiple jurisdictions, and lastly to single-jurisdiction facilities. The study further recommended that communities consider opportunities to build reservoirs on smaller streams, supplemented by pumping from large streams, rather than proposing reservoirs on large streams (GEFA, 2008).

While the GEFA report provided local governments and regional planning agencies with basic information and guidance concerning developing future water supplies, the process ending in the establishment of the Georgia SWP provided for development of comprehensive data and analysis tools to guide future water supply planning at the state and regional levels. In addition to the information and guidance provided in the GEFA report and subsequently supplemented by data and analysis tools developed during the SWP process, the Richland Creek, Russell Creek, and Indian Creek reservoir projects in the ACT River Basin (see Section E.1.1.4.16) have received direct financial assistance from the Governor's Water Supply Program (GEFA, 2018).

E.1.1.8.1.6 Georgia Water Stewardship Act of 2010 and Water System Interconnection, Redundancy and Reliability Act of 2010

Facing significant water resource management challenges in Georgia—including rapid growth in the Metro Atlanta and severe drought conditions in 2006–2008—the General Assembly enacted the Georgia Water Stewardship Act during the 2010 legislative session. Based on recommendations from the 2009 Governor's Water Contingency Task Force, the legislation established a process for developing new fresh water supply sources while also reaffirming "the imminent need to create a culture of water conservation in the state of Georgia" (Georgia General Assembly, 2010a).

The Act required the following specific actions by local governments, public water systems, and state agencies (UGA CAES, 2014):

- Local Governments
  - By January 1, 2011, adopt or amend local ordinances to uniformly restrict outdoor water use for landscapes between 10 a.m. and 4 p.m. daily.
  - After July 1, 2012, enforce updated plumbing code specifying:
    - ♦ High-efficiency flow specification for plumbing fixtures (toilets, urinals, and showerheads).
    - ♦ Submeters installed in new multiunit buildings, including residential, commercial, and light industrial facilities.
    - ♦ High-efficiency cooling towers in new construction.
- Public Water Systems
  - Complete annual water loss audits by systems serving 10,000 or more people by January 1, 2012, and by systems serving 3,000 or more people by January 1, 2013.
  - Submit annual water loss audits to the GAEPD within 60 days of audit.

- State Agencies
  - Collaboration between agencies that deal with water to enhance programs and incentives for voluntary water conservation.
  - Submit annual reports to the General Assembly summarizing programmatic changes implemented to encourage conservation and enhance water supplies.
  - Review and revise state water-related policies, procedures, regulations, and programs by August 1, 2010.

In 2010, the General Assembly also passed the Water System Interconnection, Redundancy and Reliability Act (Water Interconnection Act) to explore the potential of optimizing water supply through the interconnection of water systems in the MNGWPD. The primary objective of the Water Interconnection Act was to complete a thorough and detailed engineering study to develop an emergency water supply plan for all qualified water systems within the MNGWPD (Georgia General Assembly, 2010b). GEFA completed the Plan, consistent with the Water Interconnection Act, in September 2011 (GEFA, 2011).

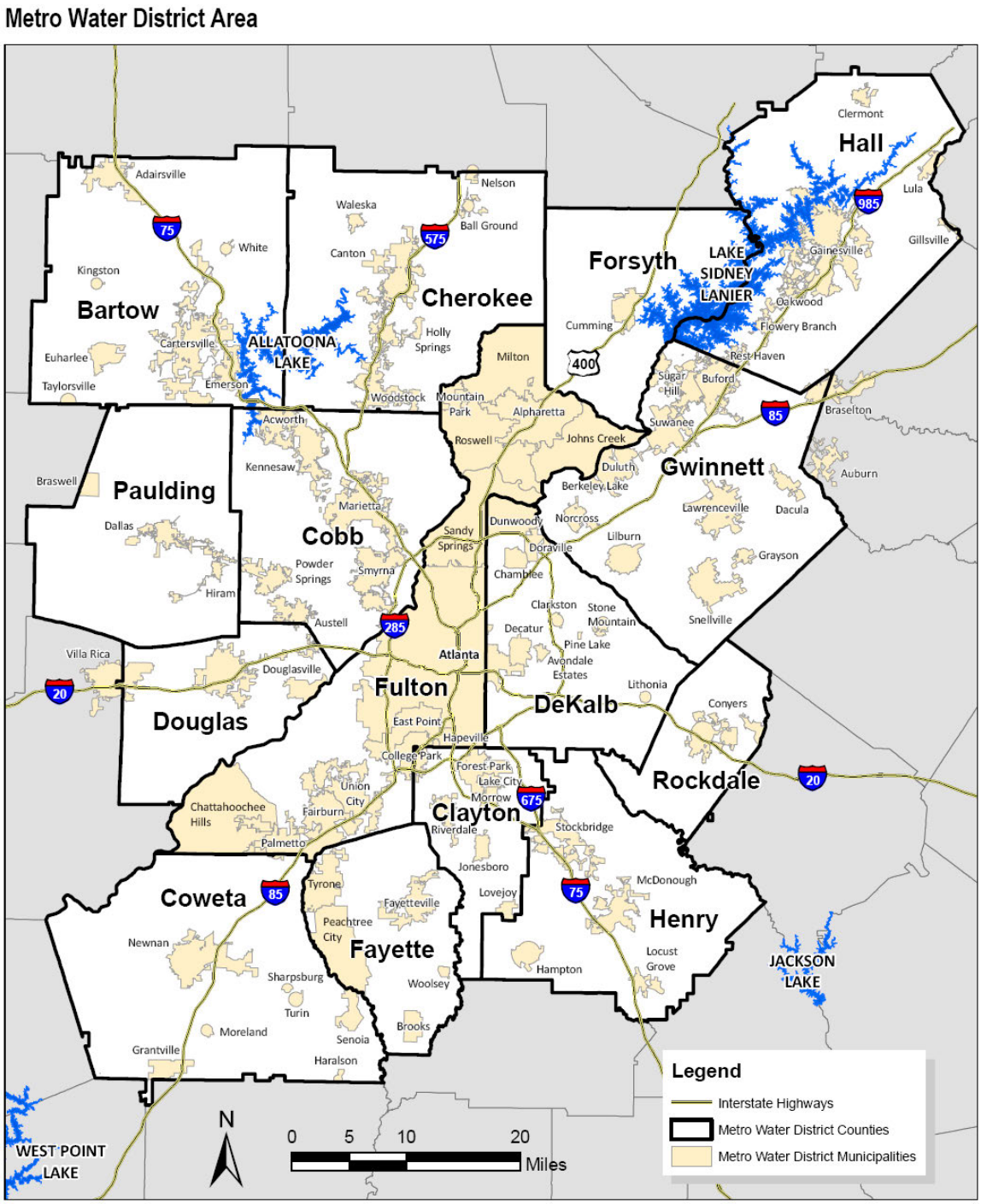
Implementing these laws has had a positive and significant direct impact on water conservation and efficiency efforts in the state, particularly in the MNGWPD. The resulting improvements are reducing per capita water use within the MNGWPD and, consequently, have lowered long-range water demand projections in the MNGWPD for 2050 compared to earlier estimates in the 2003 and 2009 MNGWPD water supply plans (see Section E.1.1.6.6).

E.1.1.8.1.7 Metropolitan North Georgia Water Planning District

The MNGWPD (also referred to as the Planning District) was created by the Georgia General Assembly in 2001 (O.C.G.A. §§ 12-5-570 et seq., 2019) to preserve and protect water resources in the 15-county Metro Atlanta area. The MNGWPD's purpose is to establish policy, create plans, and promote intergovernmental coordination of water issues in the Planning District from a regional perspective. The Planning District's efforts provide local jurisdictions and state officials with recommended actions, policies, and investments for water supply and water conservation, wastewater management, and watershed management activities. The following description of the MNGWPD and its activities is summarized from the Planning District's 2017 *Water Resource Management Plan* (MNGWPD, 2017).

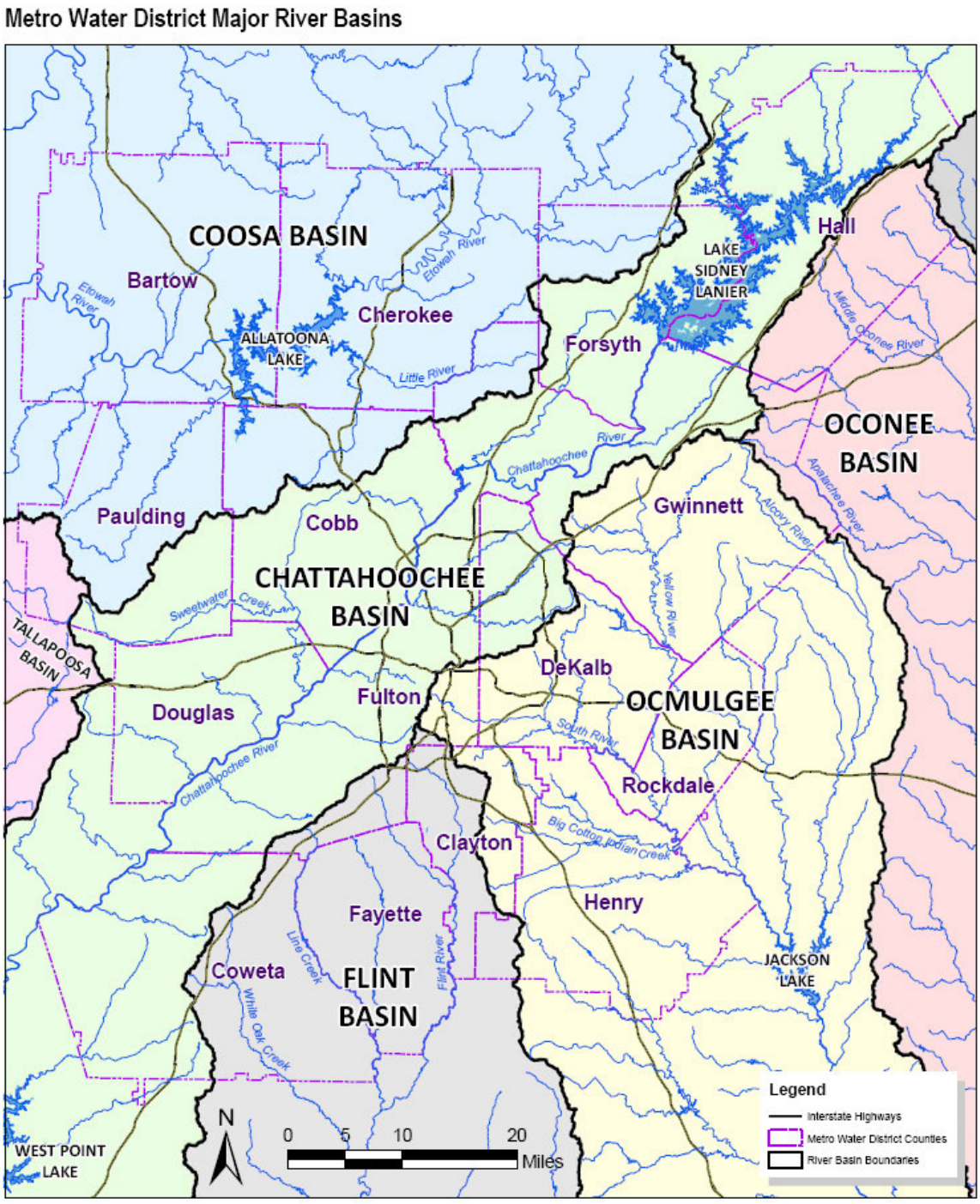
The MNGWPD includes 15 counties (Bartow, Cherokee, Clayton, Cobb, Coweta, DeKalb, Douglas, Fayette, Forsyth, Fulton, Gwinnett, Hall, Henry, Paulding, and Rockdale counties) as well as 92 municipalities partially or fully within those counties. The MNGWPD also has seven authorities that provide water, sewer, or stormwater services. The Planning District's plans and policies work to protect water resources in the Chattahoochee, Coosa, Flint, Ocmulgee, Oconee, and Tallapoosa river basins. The area represented by the MNGWPD includes a portion of the Coosa and Tallapoosa river basins in all, or parts, of the following counties: Bartow, Cherokee, Cobb, Forsyth, Fulton, and Paulding. Overall, the MNGWPD covers a total area of 4,800 sq mi and had approximately 5.2 million residents in 2014 (MNGWPD, 2017). The MNGWPD area by county is shown in Figure E-25 and the MNGWPD area by major river basin is shown in Figure E-26.

The MNGWPD was established in 2001 as the first regional water planning organization in Georgia. With the adoption of the Georgia SWP by the General Assembly in 2008 (see Section E.1.1.8.1.3), the Planning District became one of 11 regional water planning regions in the state and conducts its planning within the framework of the state's regional water planning process. The MNGWPD follows the guidance of the GAEPD in that process as well as additional GAEPD guidance specific to water planning activities within the Planning District. MNGWPD water planning also considers the most recent water resource assessment information developed in the regional water planning process.



Source: (MNGWPD, 2017).

Figure E-25. Metropolitan North Georgia Water Planning District Area.



Source: (MNGWPD, 2017).

Figure E-26. Metropolitan North Georgia Water Planning District by Major River Basin.

The MNGWPD issued its first water resource management plan documents in 2003: the *Water Supply and Water Conservation Management Plan*, *Wastewater Management Plan*, and *Watershed Management Plan*. These plans were updated by the Planning District in 2009 and amended in 2010 in response to the provisions of the Georgia Water Stewardship Act of 2010. The 2017 plan update combined the three separate plan documents into one comprehensive plan to highlight the interrelationships between approaches to water, wastewater, and watershed management. While the primary focus of the 2017 plan update was to integrate the previous plans into one comprehensive document, other major areas of focus included the following:

- Updated water demand and wastewater flow forecasts based on current usage patterns, revised population and employment projections, changes in state requirements and building codes that affect water use, and implementation of the region's water conservation and efficiency program.
- Enhanced strategies that maintain the region as a national leader in water conservation and efficiency, with specific consideration of the potential role of commercial water users in water supply and water conservation programs.
- Improved efforts to promote management of septic systems across the Planning District to protect water quality and public health.
- Better alignment of watershed management action items with existing federal stormwater management programs (e.g., the National Pollutant Discharge Elimination System [NPDES] municipal separate storm sewer system [MS4] program) to reduce duplication of effort and simplify implementation.
- Improved design of public education requirements to more closely match the range of community sizes in the Planning District.
- Identification of new information on sources of financing for implementation.
- Coordination of MNGWPD planning with the SWP and the RWPs of neighboring regional water planning councils.

The primary participants in the District's water resource management planning process include the following:

- **Governing Board–**The 26-member Governing Board is the decision-making body for the MNGWPD. The Board includes 16 elected representatives from member jurisdictions and 10 citizen members.
- **Technical Coordinating Committee (TCC)–**The TCC members are primarily local government officials and staff from counties, cities, and authorities in the District. The TCC provides planning and policy support to the Governing Board and staff in the areas of water supply and conservation, wastewater management, stormwater and watershed management, septic systems, and public education.
- **Basin Advisory Councils (BACs)–**The BACs are composed of basin stakeholders, including water professionals, business leaders, environmental advocates, and other interested individuals and groups. Six BACs represent the Chattahoochee, Coosa/Etowah, Flint, Ocmulgee, and Oconee river basins and the Lake Lanier Basin. The BACs advise the Governing Board, TCC and District staff on developing and implementing policy related to basin-specific issues and provide input on plan content.

The planning process relies on local jurisdictions, the Governing Board, the TCC, and the BACs for direction and input. The process also receives support and guidance from GAEPD and the MNGWPD planning staff.

The MNGWPD, GAEPD, and local governments all play important roles in implementing the District's *Water Resource Management Plan*. The District develops the Plan, local jurisdictions implement the Plan (and are required to comply with its provisions), and GAEPD enforces the Plan's provisions through an auditing and permitting process. For example, local jurisdictions must demonstrate compliance with the Plan to obtain permits for new or expanded water withdrawals or wastewater discharges and renewal of NPDES MS4 permits. Furthermore, consistency with Plan requirements is necessary to obtain GEFA grant or loan funding for water projects.

Progress on implementing the Plan is tracked in two ways:

- The GAEPD audits local jurisdictions on a recurring basis to ensure local compliance with the Plan.
- The MNGWPD periodically surveys implementation progress by local jurisdictions, typically on an annual basis.

Through its implementation surveys, the MNGWPD has documented the following achievements in the region:

- The Toilet Rebate program has supported the replacement of over 120,000 toilets with high-efficiency toilets. Water savings from this program are estimated to be over 860,000,000 gallons per year.
- Every water provider in the District has a multitiered conservation rate structure that encourage water conservation by its residential customers.
- Local utilities have distributed over 200,000 door hangers since 2010 to educate residents on the negative impacts of fats, oils, and grease in sewer pipes. Grease-related sewer overflows have decreased by 55 percent since 2003.
- Most local jurisdictions have adopted one or more of the following model ordinances (or equivalent regulations) that protect the region's watersheds: Post-Development Stormwater Management, Stream Buffer Protection, Illicit Discharge and Illegal Connection, Floodplain Management, and Litter Control.

E.1.1.8.2 Alabama

E.1.1.8.2.1 Alabama Office of Water Resource/Alabama Water Resource Commission

The Alabama Office of Water Resources (ALOWR), a division of the Alabama Department of Economic and Community Affairs, plans, coordinates, develops, and manages Alabama's surface water and groundwater resources in a manner that is in the best interest of the state. These responsibilities include recommending policies and legislation, conducting technical studies, implementing and participating in programs and projects, and actively representing Alabama's intrastate and interstate water resource interests (ALOWR, 2018b).

The Alabama Water Resources Commission (AWRC) oversees the ALOWR and serves in an advisory capacity to the Governor and presiding officers of the Alabama House and Senate. The AWRC consists of 19 voting members selected by the Governor, the Lieutenant Governor, and the Speaker of the House to serve 6-year, staggered terms. The AWRC membership includes representatives from each congressional district and each major surface water region in Alabama. In addition to geographic representation requirements, the membership must also represent a cross section of water user groups, including rural and urban public water systems, nonpublic (e.g., industrial and manufacturing) groups, commercial navigation groups, conservation and the environment, organizations, or water-based recreation interests within Alabama (ALOWR, 2018b).

E.1.1.8.2.2 Alabama Drought Management Plan

The *Alabama Drought Management Plan*, initially established in 2013, is administered and coordinated by the ALOWR working closely with numerous local, state, and federal agencies and other water resources professionals to pursue a statewide approach to drought planning and management (ALOWR, 2013). The Alabama Drought Planning and Response Act (Code of Alabama 1975 §§ 9-10C-1 et seq.) became law on April 9, 2014 (Code of Alabama, 2016) and replaced a previously issued executive order (EO) to formally establish the Alabama Drought Assessment and Planning Team (ADAPT) and define permanent drought management roles for the ALOWR and other state agencies.

The purposes of the *Alabama Drought Management Plan* are to minimize the impact of drought, develop identifying methodology, develop action plans to be used during a drought, and reduce the risk of drought disasters. The Plan outlines both long- and short-term measures to be used to mitigate the effects of drought and to respond to drought

conditions. To accomplish those goals, the Plan (1) defines a process to address drought and drought-related activities such as monitoring, vulnerability assessment, mitigation, impact assessment, and response; (2) identifies long- and short-term activities that can be implemented to reduce and prevent drought impacts; (3) identifies local, state, federal, and private sector entities that are involved with state drought management and defines their responsibilities; and (4) acts as a catalyst for creating and implementing local drought response plans.

The Plan creates a statewide regional structure to identify the different areas affected by drought conditions, risks associated with drought conditions, ways to possibly avoid droughts and, when drought emergencies cannot be avoided, ways to mitigate the impacts of droughts. ALOWR accomplishes these objectives by developing drought triggers and indicators and by providing guidance on responses to drought conditions for the various sectors affected by droughts. The state is divided into nine regions and drought indicators have been determined for each region (ALOWR, 2013).

The Plan established the ADAPT to advise the ALOWR and the Governor's Office and to coordinate intergovernmental drought response and management for all drought-related activities. ADAPT is composed of members from several Alabama agencies, the U.S. Department of Agriculture (USDA), the chairman of the Monitoring and Impact Group (MIG), and two at-large members appointed by the Governor. MIG provides technical support to ADAPT and is composed of representatives from federal, state, and local agencies and other water resources professionals. MIG provides drought impact and mitigation support to ADAPT, including identifying drought effects on water users in the following five drought impact sectors: agriculture, domestic, environmental, industrial, and recreation (ALOWR, 2013).

When drought indicators signal the potential onset of drought conditions, the ALOWR, in coordination with ADAPT and MIG, declares appropriate drought stage determinations with increasing levels of severity (advisory, watch, warning, and emergency) as the drought deepens. Upon the inception of a new or increased drought alert phase, ADAPT is responsible for disseminating public information concerning all aspects of the drought. The initial action in responding to drought is to provide information on existing and potential conditions and associated water conservation measures necessary to meet the demand at each drought watch phase. Drought triggers do not automatically invoke a required response from the various categories of water users. Instead, they prompt additional monitoring and notices to the water systems and public regarding the ongoing drought conditions. ALOWR, in coordination with ADAPT, notifies local governments and water utilities of the severity of the drought and makes recommendations and provides guidance on the appropriate actions to be taken during the various stages of drought (ALOWR, 2013).

ALOWR finalized an update to the *Alabama Drought Management Plan* on November 30, 2018. The update did not substantially change the primary elements of the 2013 plan, but it incorporated the pertinent provisions of the USACE drought management plan for reservoir operations in the ACT River Basin included in the WCM Update for the basin that was approved in May 2015 (ALOWR, 2018a).

E.1.1.8.2.3 Alabama Water Use Reporting Program

ALOWR administers the Alabama Water Use Reporting Program, which requires all public water systems and those other individuals and organizations with the capacity to withdraw 100,000 gpd or more to register with ALOWR and obtain a *Certificate of Use* (ALOWR, 2018b). The process begins with the submittal of an application form–a *Declaration of Beneficial Use*–and other required information. When ALOWR has reviewed the Declaration of Beneficial Use and supporting documentation and has determined it to be complete, ALOWR issues a Certificate of Use that lists the name of the public water system, individual, or other organization as well as information concerning all registered surface water and/or groundwater withdrawal points and pertinent withdrawal information. The certificate owner must annually report water usage information to ALOWR. In accordance with the Alabama Administrative Code, Chapter 305-7-11, Certificates of Use are issued by ALOWR for periods of not less than 5 years and not more than 10 years. A Certificate of Use can be suspended, revoked, terminated, or

modified by the ALOWR if pertinent provisions of the Alabama Administrative Code or its implementing rules or specific terms and conditions in the certificate are violated (ALOWR, 2018b).

E.1.1.8.2.4 Alabama Water Conservation Program

The Alabama Water Use Reporting Program includes a water conservation checklist to describe the applicant's conservation practices or program that must accompany each Declaration of Beneficial Use when registering and applying for a Certificate of Use (ALOWR, 2018b).

In addition to the *Alabama Drought Management Plan*, which specifically supports conservation efforts during periods of drought, the state actively encourages voluntary water conservation and water efficiency initiatives on the ALOWR website (ALOWR, 2018b). The website promotes and maintains conservation suggestions and ideas on indoor and outdoor water use, including links to assist (1) residential customers to investigate water-saving opportunities in each area of the home; (2) agricultural interests in considering adopting conservation practices that are used on agricultural land across the country to conserve and improve natural resources for use on their land; and (3) municipal water planners with step-by-step approaches and conservation measures that can be used to develop and implement plans for water conservation. The website also provides a sample water conservation ordinance for use by municipal and county government officials.

E.1.1.8.2.5 Alabama Water Agencies Working Group

In August 2011, Governor Bentley established the Alabama Water Agencies Working Group (AWAWG), initially comprised of the following four state agencies with water resource responsibilities: ALOWR, ADCNR, Alabama Department of Environmental Management (ADEM), and the Geological Survey of Alabama. Subsequently, a fifth state agency, the Alabama Department of Agriculture and Industries, was added to the AWAWG. In April 2012, the Governor formalized the AWAWG and directed the group to (1) create a comprehensive database of Alabama's water resources, (2) meet with stakeholders, and (3) recommend a statewide water management action plan and timeline by December 1, 2013. The work of the AWAWG was coordinated by a chairman appointed by the Governor. Six subcommittees were created to help carry out the group's responsibilities and provide focus on legal, database, stakeholders, legislation, reporting, and public information (AWAWG, 2012).

The AWAWG submitted a report to the Governor on August 1, 2012, titled *Water Management Issues in Alabama* as an interim step in response to the Governor's directive (AWAWG, 2012). The report identified and summarized 12 key water issues and associated policy options for the state:

- Water Resources Management Plan
- Expanded Certificates of Use / Permitting
- Economic Development
- Surface Water and Groundwater Availability
- Drought Planning
- Water Conservation and Water Reuse
- Interbasin Transfers
- Instream Flows
- Interstate Coordination
- Water Resources Data
- Key Stakeholder Education and Outreach
- Public Education and Outreach

The AWAWG reaffirmed the need for a statewide water management plan to enable the state to address these issues responsibly and effectively. The August 2012 report provided a common base of information to assist the various water agencies and others interested in water resource matters to take the first steps toward resolving policy issues and creating a comprehensive water management plan for Alabama.

The December 2013 report responding to the Governor's third directive to AWAWG summarized actions taken by AWAWG through *Water Management Issues in Alabama* and subsequent steps to develop and recommend a conceptual framework for a comprehensive statewide water resource management plan. The recommendations were developed with substantial stakeholder participation. The conceptual framework included a vision statement, guiding principles, and an action plan addressing all 12 water resource issue areas identified in the August 2012 report. The recommended actions included proposed responsible agencies, estimated costs, relative priorities, and proposed timelines for implementation (AWAWG, 2013).

Subsequent to the 2013 AWAWG report, Governor Ivey decided after careful consideration to disband the AWAWG in favor of following the process for change to Alabama's water resources planning and management programs and policies outlined under the 2014 Alabama Water Resources Act (Code of Alabama, 1975 §§ 9-10B-1 *et seq.*). That process is overseen by ALOWR and AWRC. Those two entities have the primary statutory role in advising the Governor and the Legislature on changes in how Alabama manages its water resources. The information developed under the AWAWG process will serve as a resource for future efforts to improve and enhance Alabama's water resources management efforts (ALOWR, 2018b).

E.1.1.8.2.6 Alabama Surface Water Resource Assessment

In 2017, ALOWR completed a comprehensive surface water assessment report (ALOWR, 2017). The principal purposes of the assessment were to (1) develop a better understanding Alabama's surface water resources, including the estimation of surface water withdrawals, returns, and net water availability in each subbasin, and (2) help guide potential enhancements to state water policies and water resource management activities as well as indicate where additional focus might be needed in the future. The report consisted of four specific elements:

- An assessment of the 2010 water withdrawals and returns and resulting consumptive use in the state;
- An estimate of projected 2040 water withdrawals and returns and resulting consumptive use in the state;
- An assessment of streamflows at 201 locations throughout the state; and
- Development of ratios between both the 2010 and projected 2040 consumptive water use and the streamflows (called *relative net demand ratios*) by subbasin for each month of the year, four seasonal periods, and average annual.

E.1.2 Water Quality

As stated in Section E.1.1, the specific federal actions under consideration in this Draft FR/SEIS, which addresses proposed actions at Allatoona, Weiss, and Logan Martin lakes, will affect only a portion of the overall ACT River Basin. This section, therefore, primarily focuses on the ROI of the actions proposed herein, the Coosa River Basin. Local, state, and federal agencies continue to quantify water quality conditions from both point and nonpoint sources along the Coosa River, Etowah River, Oostanaula River, and their tributaries to comply with the CWA as well as with other local and state laws to address water pollution. This section focuses on reservoir and riverine water quality conditions in the portion of the Coosa River Basin affected by the proposed actions addressed in this Draft FR/SEIS.

E.1.2.1 Surface Water Quality

E.1.2.1.1 Reservoir Water Quality

The main body of a reservoir contains lower velocities and less suspended sediment than the reservoir's upper reaches and shallower tributary streams feeding it; therefore, better water quality conditions typically exist in the main body. Water in deep reservoirs like Allatoona Lake and Carters Lake is relatively clear and generally has a uniform density and temperature during the colder winter months. Wind action on the surface mixes the reservoirs' water and provides high levels of dissolved oxygen (DO).

As the deeper reservoirs in the basin warm during the spring and summer months, the water stratifies into three distinct layers: the epilimnion on the surface, the metalimnion (or thermocline) in the middle, and the hypolimnion on the bottom. The thickness of the epilimnion varies from 15 to 30 ft, remains uniform in temperature, and maintains a high level of DO from wind action and photosynthesis. The hypolimnion becomes isolated with a colder temperature (45–55 °F) and no longer mixes with the warm, well-oxygenated epilimnion. By the end of the summer, the reservoir becomes strongly stratified with a hypolimnion characterized by cold water and low DO (less than 3 milligrams per liter [mg/L]). These conditions provide a poor habitat for aquatic life and allow metals and sulfides in the lake sediments to become soluble and to be released downstream in the river.

In 2013, when FERC issued a new license for the APC's seven developments in the Coosa River Basin, the license contained a condition requiring APC to ensure that DO levels downstream of all seven developments remain above 4.0 mg/L at all times. APC filed a Request for Rehearing to challenge FERC's interpretation of ADEM's water quality certification, asserting that the certification correctly requires APC to ensure minimum DO levels downstream of the projects only during periods of generation and in its minimum flow releases from the Weiss and Jordan projects. On April 21, 2016, FERC concurred with the APC request (FERC, 2016).

APC implemented a variety of methods to achieve the required DO levels, including centrifugal blowers and peripheral aeration distribution rings at the Weiss, H. Neely Henry, and Logan Martin projects, an additional forebay oxygen diffuser system at Logan Martin Lake, vacuum breakers at Lay Lake, conventional draft tube aeration at Mitchell Lake, and conventional turbine aeration at Jordan Lake (APC, 2016). APC completed installation of the proposed aeration systems in advance of the initiation of compliance monitoring and operation, which began May 1, 2018.

E.1.2.1.2 Water Quality Standards

Title 33 of the *United States Code* (U.S.C.) § 1313(3)(A), requires that states adopt water quality standards after public review and USEPA approval. States designate uses such as public water supply and recreation for their waterbodies, establish numeric criteria, and establish antidegradation policies to protect their water resources. Water quality standards applicable to the proposed actions considered in this Draft FR/SEIS are defined in Alabama Administrative Code R. 335-6 (ADEM, 2018a) and Georgia Administrative Rule 391 3 6-.03, *Water Use Classifications and Water Quality Standards* (GAEPD, 2015a).

Relevant water quality numeric criteria are applied based on a waterbody's designated use(s). Table E-18 and Table E-19 present water quality criteria for Alabama and Georgia, respectively. The designated uses of the mainstem waterbodies in the ACT River Basin are shown on Figure E-27. The proposed actions and alternatives considered in this Draft FR/SEIS would not be expected to contribute to metals or other toxic substances in the basin. More information relevant to water quality criteria for metals and other toxic substances is provided in Alabama Administrative Code, R. 335-6 (ADEM, 2018a) and Georgia Administrative Rule 391-3-6-.03 (GAEPD, 2015a). Changes to reservoir operations may be expected to affect DO, water temperature, and nutrients.

Table E-18. Alabama Water Quality Standards

Designated use	*E. coli / Enterococci*	DO	pH	Temperature
Outstanding Alabama Water	< 126 colonies/100 ml as geometric mean in noncoastal waters > 235 colonies/100 ml as maximum in noncoastal waters < 35 colonies/100 ml as geometric mean in coastal waters > 104 colonies/100 ml as maximum in coastal waters	> 5.5 mg/L at all times Not < 4 mg/L under extreme conditions from natural causes	Between 6.0 and 8.5 for all Between 6.5 and 8.5 for saltwater and estuarine waters	< 90 ºF (32 ºC) < 86 ºF (30 ºC)
Outstanding Alabama Water Public Water Supply	< 548 colonies/100 ml as geometric mean, no more than 2,507 colonies/100 ml in any given sample in noncoastal waters > 275 colonies/100 ml as maximum in coastal waters. May-Oct. incidental and whole-body water contact and recreation < 126 colonies/100 ml, no more than 298 colonies/ ml in any given sample in noncoastal waters. May-Oct incidental and whole-body water contact and recreation < 35 colonies/100 ml, no more than 158 colonies/100 ml in any given sample in coastal waters.	> 5 mg/L at all times Not < 4 mg/L under extreme conditions from natural causes	Between 6.0 and 8.5	< 90 ºF (32ºC) < 86 ºF (30 ºC)
Swimming and Other Whole-Body Contact Sports	< 126 colonies/100 ml as geometric mean in noncoastal waters > 235 colonies/100 ml as maximum in noncoastal waters < 35 colonies/100 ml as geometric mean in coastal waters > 104 colonies/100 ml as maximum in coastal waters	> 5 mg/L at all times Not < 4 mg/L under extreme conditions from natural causes	Between 6.0 and 8.5 for all Between 6.5 and 8.5 for saltwater and estuarine waters	< 90 °F (32 °C) < 86 °F (30 °C)
Shellfish Harvesting	< 275 colonies/100 ml for bacteria of the *enterococci* group in coastal waters	> 5 mg/L at all times Not < 4 mg/L under extreme conditions from natural causes	Between 6.5 and 8.5	< 90 °F (32 °C) < 86 °F (30 °C)
Fish and Wildlife	< 548 colonies/100 ml as geometric mean, no more than 2,507 colonies/100 ml in any given sample in noncoastal waters. > 275 colonies/100 ml as maximum in coastal waters. May–Oct incidental and whole-body water contact and recreation < 126 colonies/100 ml, no more than 298 colonies/100 ml in any given sample in noncoastal waters. Jun–Sep incidental water contact and recreation < 35 colonies/100 ml, no more than 158 colonies/100 ml in any given sample in coastal waters.	> 5 mg/L at all times Not < 4 mg/L under extreme conditions from natural causes	Between 6.0 and 8.5 for all Between 6.5 and 8.5 for saltwater and estuarine waters	< 90 °F (32 °C) < 86 °F (30 °C)

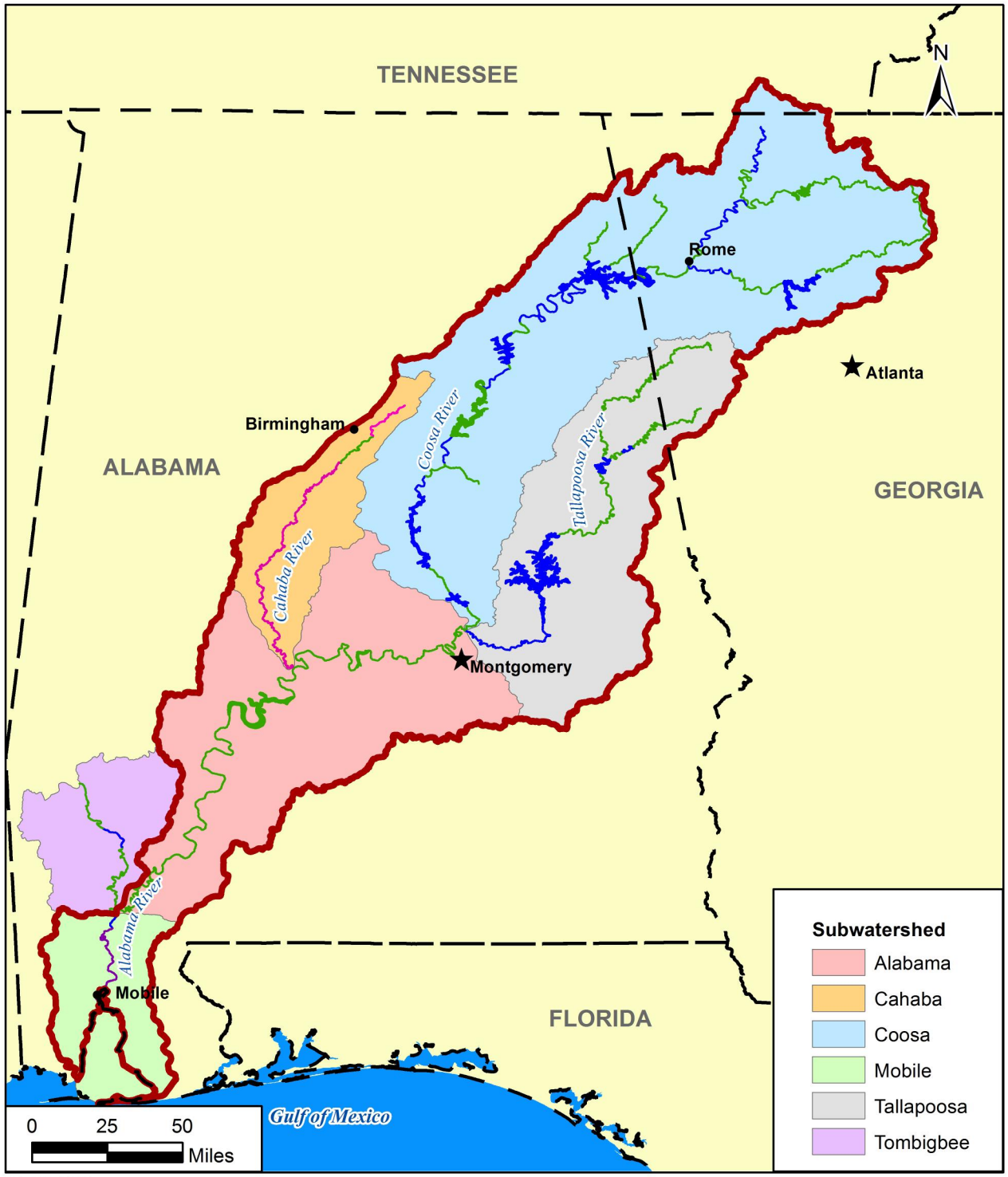
Designated use	*E. coli* / *Enterococci*	DO	pH	Temperature
Limited Warmwater Fishery	< 548 colonies/100 ml as geometric mean, no more than 2,507 colonies/100 ml in any given sample in noncoastal waters > 275 colonies/100 ml as maximum for enterococci group in coastal waters	> 3 mg/L at all times		
Agricultural and Industrial Water Supply	< 700 colonies/100 ml as geometric mean, no more than 3,200 colonies/100 ml in any given sample in noncoastal waters. No more than 500 colonies/100 ml in any given sample in coastal waters	> 3 mg/L at all times	Between 6.0 and 8.5 for all Between 6.5 and 8.5 for saltwater and estuarine waters	< 90 °F (32 °C)

Source: (ADEM, 2018a)
Note: ml = milliliter.

Table E-19. Georgia Water Quality Standards

Designated use	Fecal coliform bacteria	DO	pH	Temperature
Drinking Water Supply (not treated drinking water)	May–Oct < 200 colonies/100 ml as geometric mean Nov–Apr < 4,000 colonies/100 ml (instantaneous max)	> 5 mg/L daily average, no less than 4 mg/L at all times Trout streams 6.0 mg/L daily average, no less than 5.0 mg/L at all times	Between 6.0 and 8.5	< 90 °F (32 °C)
Recreation	Coastal waters: 35 colonies/100 ml Other: 126 colonies/100 ml	> 5 mg/L daily average, no less than 4 mg/L at all times Trout streams 6.0 mg/L daily average, no less than 5.0 mg/L at all times	Between 6.0 and 8.5	< 90 °F (32 °C)
Fishing	May–Oct < 500 colonies/100 ml as geometric mean Nov–Apr < 4,000 colonies/100 ml (instantaneous max)	> 5 mg/L daily average, no less than 4 mg/L at all times Trout streams 6.0 mg/L daily average, no less than 5.0 mg/L at all times	Between 6.0 and 8.5	< 90 °F “(32 °C)
Coastal Fishing	May–Oct < 500 colonies/100 ml as geometric mean Nov–Apr <4,000 colonies/100 ml (instantaneous max)	Site-specific	Between 6.0 and 8.5	< 90 °F (32 °C)
Wild River	No alteration of natural water quality	No alteration of natural water quality	No alteration of natural water quality	No alteration of natural water quality

Source: (GAEPD, 2015a)



LEGEND

ACT River Basin Boundary

Water Classification

Drinking Water, Public Water Supply

Limited Warmwater Fishery

Outstanding Alabama Waters

Recreation, Swimming, Fishing & Wildlife

ACT River Basin - Designated Use Classifications of the Mainstem Rivers

Figure E-27

Source: ADEM 2018a, GAEPD 2015a.

In addition to the parameters presented in Table E-18 and Table E-19, both Alabama and Georgia have site-specific water quality criteria for nutrients, metals, and other toxic substances that are based on human use and consumption rates. Chlorophyll *a* standards are enforced at monitoring stations in the following APC reservoirs on the Coosa River: Weiss Lake; H. Neely Henry Lake; Logan Martin Lake; Lay Lake; Mitchell Lake; and Jordan Lake. The standards range from 14 to 20 micrograms per liter (µg/L) for mean samples collected monthly from April to October. Table E-20 and Table E-21 present site-specific water quality criteria applied to Allatoona Lake and Carters Lake in Georgia, respectively.

Table E-20. Allatoona Lake Water Quality Standards

Water quality parameter	Water quality standards
Chlorophyll *a*	1. Upstream from the Dam: Apr-Oct < 10µg/L monthly average 2. Allatoona Creek upstream from I-75: Apr-Oct < 12 µg/L monthly average 3. Mid-Lake downstream from Kellogg Creek: Apr-Oct < 10 µg/L monthly average 4. Little River upstream from SR 205: Apr-Oct < 15 µg/L monthly average 5. Etowah River upstream from the Sweetwater Creek: < 14 µg/L monthly average
pH	Between 6.0 and 9.5 standard units
Total Nitrogen	Growing season average < 4 mg/L as nitrogen in the photic zone
Total Phosphorus	Total lake loading < 1.3 pounds per ac-ft of lake volume per year
Bacteria	1. Etowah River, SR 5 to SR 20: Fecal coliform bacteria shall not exceed the Recreation criterion as presented in the Georgia Administrative Rule 391-3-6-.03(6)(c)(iii) 2. Etowah River, SR 20 to Allatoona Dam: E. coli shall not exceed the Recreation criterion as presented in the Georgia Administrative Rule 391-3-6-.03(6)(b)(i)
Dissolved Oxygen	5.0 mg/L daily average and no less than 4.0 mg/L at all times at the depth specified in 391-3-6-.03(5)(g)
Temperature	1. Etowah River, SR 5 to SR 20: Water temperature shall not exceed the Fishing criterion as presented in 391-3-6-.03(6)(c)(iv) 2. Etowah River, SR 20 to Allatoona Dam: Water temperature shall not exceed the Recreation criterion as presented in 391-3-6-.03(6)(b)(iv)
Major Lake Tributaries	1. Etowah River at SR 5 spur and SR 140, at the USGS gage: Annual total phosphorous loading < 340,000 lbs/yr 2. Little River at SR 5 (State Highway 754): Annual total phosphorous loading < 42,000 lbs/yr 3. Noonday Creek at North Rope Mill Road: Annual total phosphorous loading < 38,000 lbs/yr 4. Shoal Creek at SR 108 (Fincher Road): Annual total phosphorous loading < 12,500 lbs/yr

Source: (GAEPD, 2015a)

Note: I- = interstate; lbs/yr = pounds per year; SR = state route.

Table E-21. Carters Lake Water Quality Standards

Water quality parameter	Water quality standards
Chlorophyll *a*	1. Carters Lake upstream from Woodring Branch: Apr-Oct < 10 µg/L monthly average 2. Carters Lake at Coosawattee River embayment mouth: Apr-Oct < 10 µg/L monthly average
pH	Between 6.0 and 9.5 standard units
Total Nitrogen	< 4.0 mg/L as nitrogen in the photic zone
Total Phosphorus	Total lake loading < 172,500 pounds or 0.46 pounds per ac-ft of lake volume per year
Bacteria	E. coli shall not exceed the Recreation criterion as presented in 391-3-6- .03(6)(b)(i)
Dissolved Oxygen	5.0 mg/L daily average and no less than 4.0 mg/L at all times at the depth specified in 391-3-6-.03(5)(g)
Temperature	Water temperature shall not exceed the Recreation criterion as presented in 391-3-6-.03(6)(b)(iv)
Major Lake Tributaries	1. Coosawattee River at Old Highway 5: Annual total phosphorous loading < 151,500 pounds 2. Mountaintown Creek at U.S. Route 76: Annual total phosphorous loading < 16,000 pounds

Source: (GAEPD, 2015a)

Water quality impairment of state waterbodies from nutrient over-enrichment is addressed on a site-specific basis in Georgia. GAEPD designates the state's publicly owned lakes with additional lake-specific water quality standards to address impairments. These site-specific standards have led to the implementation of nutrient control strategies and the management of point source discharges in watersheds draining to nutrient sensitive lakes. GAEPD continues to monitor water quality to improve standards and quantify the effects of nutrient over-enrichment (GAEPD, 2015b).

According to a draft review of Georgia's assimilative capacity, from 2001 through 2007, the Coosa River exceeded its growing-season median concentration for total phosphorus (TP) (GAEPD, 2010b).

ADEM developed nutrient criteria for the state's reservoirs with the goal of protecting each lake's designated uses. Chlorophyll *a* concentration, an indicator of nutrient over-enrichment, is affected by geographical region as well as reservoir characteristics including reservoir depth, retention time, and power generation schedule. ADEM analyzed historical data, trends in trophic conditions, stability of reservoir conditions, and existing impairments from nutrient over-enrichment to determine site-specific chlorophyll *a* limits at each reservoir (ADEM, 2016).

In a 2008 Total Maximum Daily Load (TMDL) for Weiss Lake, site-specific criteria were set for growing-season median TP to be protective of water quality standards for chlorophyll *a*. A TMDL is the load of pollutant a waterbody can assimilate while still meeting water quality standards (see Section E.1.2.1.4.2. Alabama has established a growing season average 20-µg/L chlorophyll *a* criteria at two locations in Weiss Lake. Coordination between USEPA, Alabama, and Georgia resulted in establishment of allowable growing season concentrations of TP for Alabama and the Coosa and Chattooga rivers in Georgia. The allowable load into Weiss Lake from the Coosa River was calculated to allow a growing-season median concentration of 60 µg/L (or 0.06 mg/L) of TP (USEPA Region 4, 2008).

E.1.2.1.3 Monitoring and Other Studies

Water quality monitoring and study conditions in the ACT River Basin up to 2013 were documented in previous work (USACE Mobile District, 2014d). Water quality monitoring is performed by a number of federal, state, and local agencies as well as by industrial entities.

USACE WCMs detail monitoring conducted at federal projects that includes one water quality station located in Allatoona Lake's tailrace. The U.S. Fish and Wildlife Service (USFWS) identified a need to monitor water quality—including temperature, pH, hardness, turbidity, oxygen content, and other chemical characteristics—in the ACT River Basin to ensure the normal behavior, growth, and viability of all life stages of mussels (USFWS, 2010c).

The USGS also collects water quality data throughout the ACT River Basin. Local or state sponsors coordinate, and often pay for, those efforts. In Alabama and Georgia, 259 USGS water quality monitoring stations are in the ACT River Basin, 55 of which are located in the Coosa River Basin. Of the 259 stations, 10 have real-time reporting of DO, temperature, and specific conductivity. GAEPD has sponsored 119 monitoring stations in the ACT River Basin.

ADEM and GAEPD also monitor water quality in rivers and lakes. Alabama has several water quality sampling programs that focus on reservoir monitoring, trend monitoring, and specialty studies that address needs identified by ADEM for TMDL development and wasteload allocations. Georgia has a similar water quality monitoring program and has collected water quality data at 36 sampling points in the Coosa River Basin from 2018 to 2019.

Local agencies and commercial and industrial organizations also collect water quality samples to meet regulatory requirements for NPDES permits and to support management decisions. For example, the Bartow County Water Department, near Allatoona Lake, routinely conducts water quality testing to ensure that their water supply meets the National Primary Drinking Water Regulations established by the USEPA. This includes publishing and distributing annual water quality reports to serviced customers and the general public. In addition to releasing this report, the city of Rome, GA, has also been a designated member of WaterFirst!, a program dedicated to improving and maintaining Georgia's water quality by exceeding standards required by law, since 2007. Other cities monitor water for specific compounds to meet government regulations. In 2016, USEPA issued health advisories for perfluorooctanoic acid and perfluorooctanesulfonic acid and, subsequently, found the city of Gadsden water supply test results to be above the health advisory limits. That finding led to the Gadsden Water Works and Sewer Board implementing weekly monitoring of perfluorinated compounds (PFCs) and releasing results to ensure the city was meeting USEPA regulations.

Nonprofit and volunteer organizations are very active in water quality monitoring throughout the ACT River Basin. Those efforts are supported by ADEM through the Clean Water Partnership and by GAEPD through the Adopt-a-Stream program. The Coosa River Basin Initiative, an Adopt-a-Stream group, monitors seven sites on the Etowah River and the Coosa River downstream of Allatoona Lake, along with several other sites in the area. Other citizen organizations monitoring waterbodies in the Coosa River Basin include the Alabama Water Watch, Alabama Rivers Alliance, Coosa Riverkeeper, Georgia Water Coalition, Georgia River Network, and a variety of associations for residents of lake communities.

E.1.2.1.4 Existing Conditions

E.1.2.1.4.1 Impaired Waterbodies

ADEM and GAEPD monitor conditions in their respective states to ensure water quality standards are met. If standards are not achieved for a designated use, a waterbody is identified as impaired. Each of the two state agencies submit to USEPA biennially a list of any waters identified as not meeting standards consistent with CWA Section 305(b). The goal of the program is to identify the cause of impairment to a waterbody, establish the load of that pollutant the waterbody can assimilate, establish the waterbody's assimilative capacity as a TMDL, and develop an implementation plan to ensure the waterbody achieves water quality standards in the future. Table E-22 and Table E-23 list the impaired waterbodies in Alabama and Georgia, respectively, that are within the ROI in the Coosa River Basin, excluding unaffected rivers like the Oostanaula River and tributaries.

Table E-22. Impaired Waterbodies in the Alabama Portion of the Coosa River Basin

Assessment unit ID	Waterbody name	Uses	Causes	Sources	Downstream/ upstream locations
AL03150105-1002-102	Coosa River (Weiss Lake)	Swimming, Fish & Wildlife	Pathogens (E. coli)	Sources outside state	Spring Creek / AL-GA state line
AL03150106-0803-100	Coosa River (Logan Martin Lake)	Swimming, Fish & Wildlife	Priority organics (PCBs)	Contaminated sediments	Logan Martin Dam / Broken Arrow Creek
AL03150106-0603-111	Coosa River (Logan Martin Lake)	Public Water Supply, Swimming, Fish & Wildlife	Priority organics (PCBs)	Contaminated sediments	Broken Arrow Creek / Trout Creek
AL03150106-0603-112	Coosa River (Logan Martin Lake)	Swimming, Fish & Wildlife	Priority organics (PCBs)	Contaminated sediments	Trout Creek / H. Neely Henry Dam
AL03150106-0802-111	Clear Creek (Logan Martin Lake)	Swimming, Fish & Wildlife	Priority organics (PCBs)	Contaminated sediments	Coosa River / end of embayment
AL03150106-0803-311	Easonville Creek (Logan Martin Lake)	Swimming, Fish & Wildlife	Priority organics (PCBs)	Contaminated sediments	Coosa River / end of embayment
AL03150106-0514-111	Choccolocco Creek (Logan Martin Lake)	Swimming, Fish & Wildlife	Priority organics (PCBs)	Contaminated sediments	Coosa River / end of embayment
AL03150106-0605-211	Dye Creek (Logan Martin Lake)	Swimming, Fish & Wildlife	Priority organics (PCBs)	Contaminated sediments	Coosa River / end of embayment
AL03150106-0604-111	Blue Eye Creek (Logan Martin Lake)	Swimming, Fish & Wildlife	Priority organics (PCBs)	Contaminated sediments	Coosa River / end of embayment
AL03150106-0408-111	Cane Creek (Logan Martin Lake)	Swimming, Fish & Wildlife	Priority organics (PCBs)	Contaminated sediments	Coosa River / end of embayment
AL03150106-0108-111	Big Wills Creek (Neely Henry Lake)	Fish & Wildlife	Nutrients	Agriculture, Industrial, Municipal	US Hwy 411/ end of embayment
AL03150106-0107-111	Black Creek (Neely Henry Lake)	Fish & Wildlife	Nutrients	Agriculture, urban runoff/storm sewers	US Highway 411 / end of embayment
AL03150107-0503-110	Coosa River (Lay Lake)	Public Water Supply, Swimming, Fish & Wildlife	Priority organics (PCBs)	Contaminated sediments	Lay Dam / Southern RR Bridge
AL03150107-0301-102	Coosa River (Lay Lake)	Swimming, Fish & Wildlife	Priority organics (PCBs)	Contaminated sediments	Southern RR Bridge / RM 89
AL03150107-0301-102	Coosa River (Lay Lake)	Swimming, Fish & Wildlife	Metals (Mercury)	Atmospheric deposition	Southern RR Bridge / RM 89
AL03150106-0810-102	Coosa River (Lay Lake)	Public Water Supply, Swimming, Fish & Wildlife	Priority organics (PCBs)	Contaminated sediments	RM 89 / Logan Martin Dam

Assessment unit ID	Waterbody name	Uses	Causes	Sources	Downstream/ upstream locations
AL03150106-0810-102	Coosa River (Lay Lake)	Public Water Supply, Swimming, Fish & Wildlife	Metals (Mercury)	Atmospheric deposition	RM 89 / Logan Martin Dam
AL03150107-0406-111	Waxahatchee Creek (Lay Lake)	Public Water Supply, Swimming, Fish & Wildlife	Priority organics (PCBs)	Contaminated sediments	Coosa River / end of embayment
AL03150107-0501-111	Peckerwood Creek (Lay Lake)	Public Water Supply, Swimming, Fish & Wildlife	Priority organics (PCBs)	Contaminated sediments	Coosa River / end of embayment
AL03150107-0304-111	Dry Branch (Lay Lake)	Public Water Supply, Swimming, Fish & Wildlife	Priority organics (PCBs)	Contaminated sediments	Coosa River / end of embayment
AL03150107-0205-111	Yellowleaf Creek (Lay Lake)	Public Water Supply, Swimming, Fish & Wildlife	Priority organics (PCBs)	Contaminated sediments	Coosa River / end of embayment
AL03150107-0106-111	Tallaseehatchee Creek (Lay Lake)	Swimming, Fish & Wildlife	Priority organics (PCBs)	Contaminated sediments	Coosa River / end of embayment
AL03150107-0106-111	Tallaseehatchee Creek (Lay Lake)	Swimming, Fish & Wildlife	Metals (mercury)	Atmospheric deposition	Coosa River / end of embayment
AL03150106-0703-111	Talladega Creek (Lay Lake)	Swimming, Fish & Wildlife	Priority organics (PCBs)	Contaminated sediments	Coosa River / end of embayment
AL03150106-0703-111	Talladega Creek (Lay Lake)	Swimming, Fish & Wildlife	Metals (mercury)	Atmospheric deposition	Coosa River / end of embayment
AL03150106-0808-111	Kelly Creek (Lay Lake)	Public Water Supply, Swimming, Fish & Wildlife	Priority organics (PCBs)	Contaminated sediments	Coosa River / end of embayment
AL03150106-0808-111	Kelly Creek (Lay Lake)	Public Water Supply, Swimming, Fish & Wildlife	Metals (mercury)	Atmospheric deposition	Coosa River / end of embayment

Source: (ADEM, 2018b)
Note: PCBs = polychlorinated biphenyls.

Table E-23. Impaired Waterbodies in the Georgia Portion of the Coosa River Basin

Assessment unit ID	Waterbody name	Uses	Causes	Sources	Downstream/ upstream locations
GAR031501050208	Coosa River	Fishing	FCG(PCBs)	Industrial Site Runoff, Urban Runoff	Rome to Beach Creek
GAR031501050209	Coosa River	Fishing, Recreation	FCG(PCBs), Temp	Nonpoint Sources, Industrial Point Source Discharge, Industrial Site Runoff	
GAR031501040113	Etowah River	Fishing, Drinking Water	Bio F	Nonpoint Sources	Headwaters to Edmunston Creek
GAR031501040110	Etowah River	Fishing	FC	Nonpoint Sources	Proctor Creek to Black Creek
GAR031501040601	Etowah River	Fishing, Drinking Water	FC	Nonpoint Sources, Urban Runoff	Sharp Mountain Creek to Allatoona Lake
GAR031501041309	Etowah River	Drinking Water	pH, DO, FCG(PCBs)	Nonpoint Sources	Allatoona Dam to Pumpkinvine Creek
GAR031501041310	Etowah River	Fishing, Drinking Water	FCG(PCBs), FC	Nonpoint Sources	Pumpkinvine Creek to Richland Creek
GAR031501041303	Etowah River	Fishing	FCG(PCBs)	Nonpoint Sources	Richland Creek to Euharlee Creek
GAR031501041503	Etowah River	Fishing	FCG(PCBs), FC	Urban Runoff	Euharlee Creek to U.S. 411
GAR031501041601	Etowah River	Fishing, Drinking Water	FCG(PCBs)	Industrial Site Runoff, Nonpoint Sources	U.S. 411 to Coosa River
GAR031501041013	Allatoona Lake	Drinking Water, Recreation	(None listed)	(None listed)	Dam Pool
GAR031501041012	Allatoona Lake	Drinking Water, Recreation	(None listed)	(None listed)	Mid Lake
GAR031501040809	Allatoona Lake	Drinking Water, Recreation	(None listed)	(None listed)	Little River embayment
GAR031501040911	Allatoona Lake	Drinking Water, Recreation	(None listed)	(None listed)	Allatoona Creek arm
GAR031501041011	Allatoona Lake	Drinking Water, Recreation	(None listed)	(None listed)	Etowah River arm

Source: (GAEPD, 2018a).
Notes: Bio F = biota impacted (fish community); FC = fecal coliform bacteria; FCG = fish consumption guidance; NP = nonpoint sources; PCBs = polychlorinated biphenyls; U.S. = U.S. Highway.

E.1.2.1.4.2 Total Maximum Daily Loads

TMDLs are developed for impaired waterbodies to identify the sources of impairment, the levels to which contaminants must be reduced, and the methods to be used to reduce contamination to an acceptable level. Established TMDLs in the Coosa River Basin in Alabama and Georgia are shown in Table E-24 and Table E-25, respectively.

Table E-24. TMDLs in the Coosa River Basin in Alabama

Assessment unit ID	Reach name	Violations	TMDL year
AL03150106-050-01	Little Wills Creek	OE/DO	1997
AL03150107-050-01	UT to Dry Branch	OE/DO	1997
AL03150107-090-01	Buxahatchee Creek	OE/DO	1997
AL03150105	Weiss Lake	Priority organics (PCBs)	2004
AL03150105	Weiss Lake	Nutrients	2004
AL03150107-0502-100	Buxahatchee Creek	Nutrients	2008
AL03150105-1003-102	Weiss Lake	Nutrients	2008
AL03150105-1001-102	Weiss Lake	Nutrients	2008
AL03150106-0801-100	Coosa River (Logan Martin Lake)	Nutrients	2008
AL03150106-0801-100	Coosa River (Logan Martin Lake)	OE (CBOD, NBOD)	2008
AL03150106-0501-101	Coosa River (Logan Martin Lake)	Nutrients	2008
AL03150106-0501-101	Coosa River (Logan Martin Lake)	OE (CBOD, NBOD)	2008
AL03150106-0501-102	Coosa River (Logan Martin Lake)	Nutrients	2008
AL03150106-0501-102	Coosa River (Logan Martin Lake)	OE (CBOD, NBOD)	2008
AL03150106-0309-101	Coosa River (H. Neely Henry Lake)	Nutrients	2008
AL03150106-0309-101	Coosa River (H. Neely Henry Lake)	pH	2008
AL03150106-0309-101	Coosa River (H. Neely Henry Lake)	OE (CBOD, NBOD)	2008
AL03150106-0309-102	Coosa River (H. Neely Henry Lake)	Nutrients	2008
AL03150106-0309-102	Coosa River (H. Neely Henry Lake)	pH	2008
AL03150106-0309-102	Coosa River (H. Neely Henry Lake)	OE (CBOD, NBOD)	2008
AL03150106-0104-101	Coosa River (H. Neely Henry Lake)	Nutrients	2008
AL03150106-0104-101	Coosa River (H. Neely Henry Lake)	pH	2008
AL03150106-0104-101	Coosa River (H. Neely Henry Lake)	OE (CBOD, NBOD)	2008
AL03150106-0104-102	Coosa River (H. Neely Henry Lake)	Nutrients	2008
AL03150106-0104-102	Coosa River (H. Neely Henry Lake)	pH	2008
AL03150106-0104-102	Coosa River (H. Neely Henry Lake)	OE (CBOD, NBOD)	2008
AL03150107-0401-100	Coosa River (Lay Lake)	Nutrients	2008
AL03150107-0401-100	Coosa River (Lay Lake)	OE (CBOD, NBOD)	2008
AL03150107-0101-102	Coosa River (Lay Lake)	Nutrients	2008
AL03150107-0101-102	Coosa River (Lay Lake)	OE (CBOD, NBOD)	2008
AL03150106-0808-102	Coosa River (Lay Lake)	Nutrients	2008
AL03150106-0808-102	Coosa River (Lay Lake)	OE (CBOD, NBOD)	2008
AL03150107-0601-100	Coosa River (Mitchell Lake)	Nutrients	2008
AL03150107-0502-100	Buxahatchee Creek (Revised)	Nutrients	2009

Assessment unit ID	Reach name	Violations	TMDL year
AL03150105-0807-200	Mud Creek	Pathogens	2011
AL03150105-0807-102	Spring Creek	Pathogens	2011
AL03150105-0807-103	Spring Creek	Pathogens	2011

Source: (ADEM, 2018c)
Notes: CBOD = carbonaceous biochemical oxygen demand; NBOD = nitrogenous biochemical oxygen demand; OE = organic enrichment.

Table E-25. TMDLs in the Coosa River Basin in Georgia

Reach name	Violations	TMDL year
Jacks River	FC	2009
Conasauga River	FC	2009
Mill Creek	FC	2009
Mill Creek Tributary	Bio F	2009
Coahulla Creek	FC	2003
Coahulla Creek	FC	2009
Haig Mill Creek	Bio F	2009
Mill Creek	Bio F	2009
Holly Creek	FC	2009
Holly Creek	FC	2003
Conasauga River	FC	2003
Conasauga River	FCG(PCBs)	2003
Drowning Bear Creek	FC	2009
Drowning Bear Creek	Bio F	2009
Polecat Creek	FC	2009
Polecat Creek	Bio F	2009
Stover Creek	Bio F	2009
Swamp Creek	FC	2009
Cartecay River	FC	2003
Cox Creek	FC	1998
Ellijay River	FC	2003
Mountaintown Creek	FC	2003
Coosawattee River	FC	2003
Flat Creek	FC	2003
Tails Creek	FC	2003
Talking Rock Creek	FC	2003
Lick Creek	Bio F	2009
Salacoa Creek	Bio(sediment)/Habitat	2003

Reach name	Violations	TMDL year
Salacoa Creek	FC	2009
Cedar Creek	Bio F	2009
Jacks Creek	Bio F	2009
Pine Log Creek	Bio(sediment)	2003
Pine Log Creek	FC	2003
Noblet Creek	Bio F	2009
Bow Creek	Bio F	2009
Camp Creek	FC	2009
Oostanaula River	FC	2009
Oostanaula River	FCG(PCBs)	2003
Oostanaula River	FC	2003
Oostanaula River Tributary	Bio F	2009
Snake Creek	Bio F	2009
Snake Creek	FC	2009
Lynn Creek	Bio F	2009
Oothkalooga Creek	FC	2009
Oothkalooga Creek	Bio(sediment)/Habitat	2003
Tributary to Oothkalooga Creek	FC	2003
Johns Creek	FC	2009
Heath Creek	FC	2009
Armuchee Creek	CFB(PCBs)	2003
Armuchee Creek	Bio F	2009
Big Dry Creek	CFB(PCBs)	2003
Big Dry Creek	FC	2003
Burwell Creek	CFB(PCBs)	2003
Dozier Creek	CFB(PCBs)	2003
Dozier Creek	FC	2009
Little Dry Creek	CFB(PCBs)	2003
Lovejoy Creek	Bio F	2009
Oostanaula River	CFB(PCBs)	2003
Oostanaula River	FC	2003
Oostanaula River	FCG(PCBs)	2003
Woodward Creek	CFB(PCBs)	2003
Woodward Creek	FC	2003
Etowah River	FC	2003
Etowah River	Bio F	2009

Reach name	Violations	TMDL year
Hurricane Creek	Bio F	2009
Amicalola Creek	FC	2003
Cochran Creek	FC	2009
Holly Creek	Bio F	2009
Holly Creek	FC	2009
Little Amicalola Creek	FC	2009
Bannister Creek	Bio(sediment)/Habitat	2003
Settingdown Creek	Bio(sediment)/Habitat	2003
Settingdown Creek	Bio F	2009
Avery Creek	Bio F	2009
Chastain Branch	FC	1998
Allatoona Lake	Chlorophyll *a*	2003
Little Noonday Creek	FC	2003
Little River	FC	2009
Noonday Creek	Bio F	2009
Noonday Creek	FC	2009
Rocky Creek	FC	2003
Rubes Creek	Bio F	2009
Toonigh Creek	Bio F	2009
Acworth Creek	FC	2003
Allatoona Creek	Bio F	2009
Allatoona Creek	FC	2003
Butler Creek	Bio F	2009
Butler Creek	FC	2003
Lake Acworth	FC	2003
Little Allatoona	FC	2003
Proctor Creek	Bio F	2009
Proctor Creek	FC	2003
Tanyard Creek	FC	2003
Tributary to Allatoona Creek	FC	2003
Owl Creek	FC	2003
Rowland Springs Branch	FC	1998
Stamp Creek	FC	1998
Lawrence Creek	Bio F	2009
Pumpkinvine Creek	FC	2003
Pumpkinvine Creek	Bio F	2009

Reach name	Violations	TMDL year
Etowah River	FCG(PCBs)	2003
Etowah River	DO	1999
Etowah River	FC	2003
Etowah River	FCG(PCBs)	2003
Nancy Creek	Bio F	2009
Pettit Creek	FC	2009
Tributary to Pettit Creek	FC	2003
Euharlee Creek	FC	2003
Euharlee Creek	Bio(sediment)	2003
Euharlee Creek	Bio(sediment)	2003
Fish Creek	Bio F	2009
Hills Creek	Bio F	2009
Jones Branch	Bio F	2009
Connesenna Creek	Bio F	2009
Connesenna Creek	CFB(PCBs)	2003
Connesenna Creek	Bio(sediment)	2003
Etowah River	FCG(PCBs)	2003
Etowah River	FC	2003
Macedonia Slough	Bio F	2009
Mud Creek	Bio F	2009
Two Run Creek	FC	2003
Two Run Creek	CFB(PCBs)	2003
Dykes Creek	Bio(sediment)/Habitat	2003
Dykes Creek	FC	2009
Etowah River	CFB(PCBs)	2003
Etowah River	FCG(PCBs)	2003
Etowah River	FC	2003
Silver Creek	Bio F	2009
Silver Creek	CFB(PCBs)	2003
Silver Creek	FC	2003
Spring Creek	Hg	2003
Spring Creek	CFB(PCBs)	2003
Toms Creek	CFB(PCBs)	2003
Toms Creek	FC	2009
Beech Creek	Bio F	2009
Beech Creek	CFB(PCBs)	2003

Reach name	Violations	TMDL year
Beech Creek	FC	2003
Coosa River	DO	2003
Coosa River	CFB(PCBs)	2003
Coosa River	FCG(PCBs)	2003
Coosa River	FC	2003
Hamilton Creek	CFB(PCBs)	2003
Horseleg Creek	FC	2009
Horseleg Creek	CFB(PCBs)	2003
Kings Creek	CFB(PCBs)	2003
Kings Creek	Bio F	2009
Kings Creek	FC	2009
Mt. Hope Creek	Bio F	2009
Mt. Hope Creek	CFB(PCBs)	2003
Smith Creek/Cabin Creek	CFB(PCBs)	2003
Webb Creek	CFB(PCBs)	2003
Big Cedar Creek/Cedar Creek	FC	2003
Big Cedar Creek/Cedar Creek	CFB(PCBs)	2003
Cedar Creek Tributary	Bio F	2009
Little Cedar Creek	Bio F	2009
Cane Creek	FC	2003
Chappel Creek	FC	1998
Chattooga River	Bio F	2009
Chelsea Creek	Bio F	2009
Duck Creek	FC	2009
Spring Creek	FC	2003
Town Creek	Bio F	2009
Chattooga River	FC	2003
Perennial Springs	Bio F	2009
Raccoon Creek	FC	2003
Alpine Creek	Bio F	2009

Source: (GAEPD, 2011)

Notes: Bio F = biota impacted (fish community); Bio (sediment) = biota impacted (sediment); CFB = commercial fishing ban; FC = fecal coliform bacteria; FCG = fish consumption guidance; Hg = mercury.

Various nonprofits; federal, state, and local agencies; and universities have conducted specialty studies that describe watershed conditions, including sources and stressors affecting water quality. GAEPD developed the *Coosa River Basin Management Plan* (GAEPD, 1998) in 1998 for the Coosa River Basin watersheds in Georgia. The Alabama Clean Water Partnership then developed the *Mid-Coosa River Basin Management Plan* (ACWP [Alabama Clean Water Partnership], 2003), the *Upper Coosa Basin Watershed Management Plan* (ACWP, 2004), and the *Lower Coosa River Basin Management Plan* (ACWP, 2005) in 2003, 2004, and 2005, respectively. These documents describe the watersheds and outline basin water quality improvement programs by identifying potential sources of pollution and strategies to reduce them.

E.1.2.1.4.3 Point Sources

The NPDES was created in 1972 with the passing of the CWA to prohibit nonpermitted point source pollutant discharges. Historically, point source permits applied only to M&I pipe discharges; however, in the late 1990s, USEPA began regulating stormwater discharges from MS4s, construction activities, and industrial activities under the NPDES program.

MS4s are regulated as either Phase I for medium and large cities or counties with populations over 100,000, or Phase II for small urbanized areas and nontraditional MS4s, including public universities, departments of transportation, hospitals, and prisons. Construction activities that disturb over 1 ac of land require an NPDES permit and the implementation of best management practices to prevent erosion. Industrial and commercial wastewater discharges are regulated by NPDES limits based on the type of facility, activities, and pollutants produced. Those sources were identified as contributing to surface water impairment and decreased water quality; however, NPDES regulations attempt to mitigate the effects of point source discharges by decreasing the amount of pollutants entering storm sewers and surface waters.

Historical point sources include legacy pollutants like polychlorinated biphenyl (PCB) were believed to have been released by the General Electric manufacturing plant in Rome, GA, and the Solutia (Monsanto) facility in Anniston, AL. PCBs are preserved in contaminated soils that, if disturbed, could release the contaminants into the ecosystem and create a hazard to human health.

ADEM and GAEPD develop wasteload allocations to set NPDES limits that ensure instream water quality standards are met. The entities within Alabama and Georgia responsible for point sources are required to submit discharge monitoring reports (DMRs) to ADEM and GAEPD, respectively, to demonstrate that those discharges adhere to their NPDES limits. Table E-26 and Table E-27 identify NPDES permits within the ROI for this Draft FR/SEIS (Coosa River Basin) for point sources discharging over 1 mgd of wastewater.

Table E-26. NPDES Permits in the Coosa River Basin in Alabama

Permit number	Facility	Stream	Design flow (mgd)	Latitude	Longitude
AL0057657	Attalla Lagoon	--	1.93	34.011950	-86.070620
AL0053201	Gadsden West WWTP	Coosa River	11.32	33.990311	-86.035813
AL0022659	Gadsden East WWTP	--	6.18	33.967222	-85.972388
AL0002119	Tyson Foods	--	1.60	33.581400	-85.582000
AL0001007	Goodyear Tire and Rubber	Nowlin Branch	10.00	34.355780	-86.574630
AL0054356	Lincoln South WWTP	Coosa River	2.50	33.591711	-86.171386
AL0045993	Pell City Dye Creek WWTP	Coosa River	4.75	33.568056	-86.241111

Permit number	Facility	Stream	Design flow (mgd)	Latitude	Longitude
AL0031534	National Cement Company of Alabama	Beaver Creek	--[a]	33.481000	-86.143100
AL0058408	Oxford Water Works and Sewage Board	Choccolocco Creek	4.9	33.344900	-85.545600
AL0022586	Jacksonville Water Works and Sewer Board	Williams Branch	3.5	33.485000	-85.455060
AL0072451	Shelby County Public Works	Coosa River	--[a]	33.373889	-86.342500
AL0003158	Kimberley-Clark Corporation	Coosa River	--[a]	33.321700	-86.359300
AL0003140	APCO Gaston PLT intake	--	907.0	33.581400	-85.582000
AL0003140	APCO Gaston PLT cooling outfall	--	863.0	31.144280	-86.274550
AL0003140	APCO Gaston PLT ash pond outfall	--	25.0	31.144280	-86.274550
AL0003158	Bowater Alabama Inc. intake	--	77.0	33.191820	-86.213350
AL0003158	Bowater Alabama Inc. cooling	--	16.0	33.191820	-86.213350
AL0003158	Bowater Alabama Inc. process	--	27.0	33.191820	-86.213350
AL0025984	Tuskegee South WWTP (Calebee Creek)	--	1.25	34.285110	-85.464910
AL0020141	Ashland WWTP (Horsetrough Creek)	--	1.07	33.162700	-85.483640
AL0050245	Auburn Northside WWTP (Sougahatchee Creek)	--	2.2	32.373830	-85.323950
AL0050237	H.C. Morgan WPCF (Parkerson Mill Creek)	--	9	32.321000	-85.302790
AL0062839	Lafayette Mill Creek WWTP	--	1	32.542200	-85.260800
AL0021156	Alexander City Coley Creek WWTP	--	1.95	32.554770	-85.552530
AL0048861	Alexander City Sugar Creek WWTP (Sugar Creek – Inactive)	--	8.5	32.540500	-85.570500
AL0048861	Alexander City Sugar Creek WWTP (Lake Martin – Active)	--	8.5	32.540500	-85.570500
AL0050130	Opelika Westside WWTP (Sougahatchee Creek)	Sougahatchee Creek	4	32.660450	-85.448950
AL0054631	Clanton Waterworks and Sewer Board	Walnut Creek	2.25	32.251200	-86.275100
AL0064025	Wetumka City of Water Works Sewer Bd	Coosa River	4.5	32.522700	-86.220900
AL0049921	Millbrook WWTP	Coosa River	2.3	32.501110	-86.304440

Note: WWTP = wastewater treatment plant.
[a] Design flow not mentioned in NPDES permit

Table E-27. NPDES Permits in the Coosa River Basin in Georgia

Permit number	Facility	Stream	Design flow (mgd)	Latitude	Longitude
GA0033251	Fulton County - Little River WPCP	Little River	1	34.10368	-84.4295
GA0038555	Cherokee County - Fitzgerald Creek	Little River	5	34.09767	-84.4476
GA0026263	Woodstock - Rubes Creek WPCP	Rubes Creek	2.5	34.09841	-84.5086
GA0025674	Canton WPCP	Etowah River	1.89	34.23046	-84.5038
GA0024988	Cobb County - Noonday Creek WPCP	Noonday Creek	12	34.07347	-84.538
GA0046035	Adairsville - North WPCP	Oothkalooga Creek	1	34.23264	-84.5624
GA0046451	Cherokee County - Rose Creek	Allatoona Lake	6	34.15879	-84.6131
GA0046761	Cobb County - Northwest WPCP	Allatoona Lake	8	34.13074	-84.6339
GA0000281	Chemical Products Corporation	Etowah River	2.4	34.1433	-84.7849
GA0024091	Cartersville WPCP	Etowah River	15	34.14276	-84.8386
GA0026042	Rockmart WPCP	Euharlee Creek	3	34.00424	-85.0303
GA0024074	Cedartown WPCP	Cedar Creek	3.5	34.01222	-85.1617
GA0024112	Rome WPCP	Coosa River	18	34.22916	-85.1968
GA0025712	Lafayette WPCP	Chattooga River	--[a]	34.69357	-85.2864
GA0025607	Trion WPCP	Chattooga River	5	34.54017	-85.3015
GA0024341	Rome - Coosa WPCP	Coosa River	2	34.21747	-85.3063
GA0025704	Summerville WPCP	Chattooga River	2	34.45916	-85.3446
GA0001104	TIN Inc./DBA Temple-Inland	Coosa River	--[a]	34.24992	-85.346
GA0024104	Mohawk Carpets	Chattooga River	--[a]	34.40945	-85.3873

Note: WPCP = Water Pollution Control Plant.
[a] Design flow not mentioned in NPDES permit

E.1.2.1.4.4 Nonpoint Sources

Nonpoint sources of pollution are associated with a watershed's land-use activities and include contaminants like fecal coliform bacteria, metals, nutrients (biochemical oxygen demand [BOD], nitrogen, and phosphorus), pesticides, and suspended solids from erosion. The sources include areas associated with agricultural, forested, and urban activities that the NPDES program does not regulate. The metal, mercury, for example, is a nonpoint source known to be released by atmospheric deposition that bioaccumulates in fish tissue. The Alabama Department of Public Health and the Georgia Wildlife Resources Division have in the past issued fish consumption advisories for reaches of the ACT River Basin.

CWA Section 319 requires each state to develop a nonpoint source management program to reduce nonpoint source pollution in navigable waters. The programs must include goals and strategies to protect each state's natural resources, strengthen stakeholder relationships, and prioritize the restoration of impaired waters. In 2014, USEPA approved Alabama's Nonpoint Source Management Plan (ADEM, 2014), which details implementing the state's Nonpoint Source Management Program. Under the program, Alabama releases an annual report that documents monitoring and assessment results and provides updates to Alabama's nonpoint source pollution reductions. Georgia's Statewide Nonpoint Source Management Plan (GAEPD, 2019a) was updated in 2019 by GAEPD and will be in effect through 2024.

E.1.2.2 Groundwater Quality

There are four major aquifer systems in the southeastern US that contribute groundwater resources to the ACT River Basin. The Piedmont and Blue Ridge aquifers dominate the northeastern portion of the basin, the Valley and Ridge aquifer and the Appalachian Plateau aquifer dominate the western portion, and the Southeastern Coastal Plain aquifer dominates the southern portion of the basin (USGS, 2003b). Groundwater quality is affected by dissolved minerals from rocks with which the water comes into contact, including bicarbonate, calcium, chloride, magnesium, potassium, sodium, and sulfate. The groundwater quality of a region depends on its geology and varies among aquifer systems.

E.1.3 Geology and Soils

The ACT River Basin is divided into five Level III ecoregions with similar physical, chemical, and biological environmental attributes (USEPA, 2019b). All levels of government and research organizations use the ecoregions as the spatial framework for research and policy decisions, including the development of site-specific water quality standards and stream pollutant loads. The five ecoregions in the ACT River Basin are the Southwestern Appalachians, Ridge and Valley, Blue Ridge, Piedmont, and Southeastern Plains (Figure E-28). Those ecoregions reflect a geologic history of mountain-building in the Appalachian Mountains and long periods of repeated land submergence in the Southeastern Plains ecoregion. Of the 17 dams on the mainstem rivers in the basin, 14 are in the higher relief ecoregions—Southwestern Appalachians, Ridge and Valley, Blue Ridge, and Piedmont; with Weiss, H. Neely Henry, and Logan Martin in the Ridge and Valley; and Allatoona at the intersection of the Ridge and Valley, Piedmont, and Blue Ridge ecoregions.

E.1.3.1 ACT River Basin Ecoregions

E.1.3.1.1 Ridge and Valley and Southwestern Appalachians Ecoregions

The Ridge and Valley ecoregion has a high relief, with altitudes ranging from 400 ft in valleys to 1,600 ft on ridge tops (Robinson, Journey, & Atkins, 1997). The ridges run northeast to southwest and are composed of sandstone, siltstone, and shale (Griffith, et al., 2001). Stream drainage patterns are typically trellised and rectangular, with their movement controlled by the ridge features and weathering of the rocks. Soils are shallow and well drained, and water moves rapidly toward streams during precipitation events.

Located in the Southwestern Appalachians, the Cumberland Plateau is a high-altitude, flat plateau with altitudes ranging from 1,500 to 1,800 ft (Mooty & Kidd, 1997). The plateau runs parallel to the northeast-southwest trending ridges and valleys and is composed of sandstone, siltstone, and shale. The area receives more precipitation than the surrounding ecoregions because of its higher altitude (Griffith, et al., 2001).

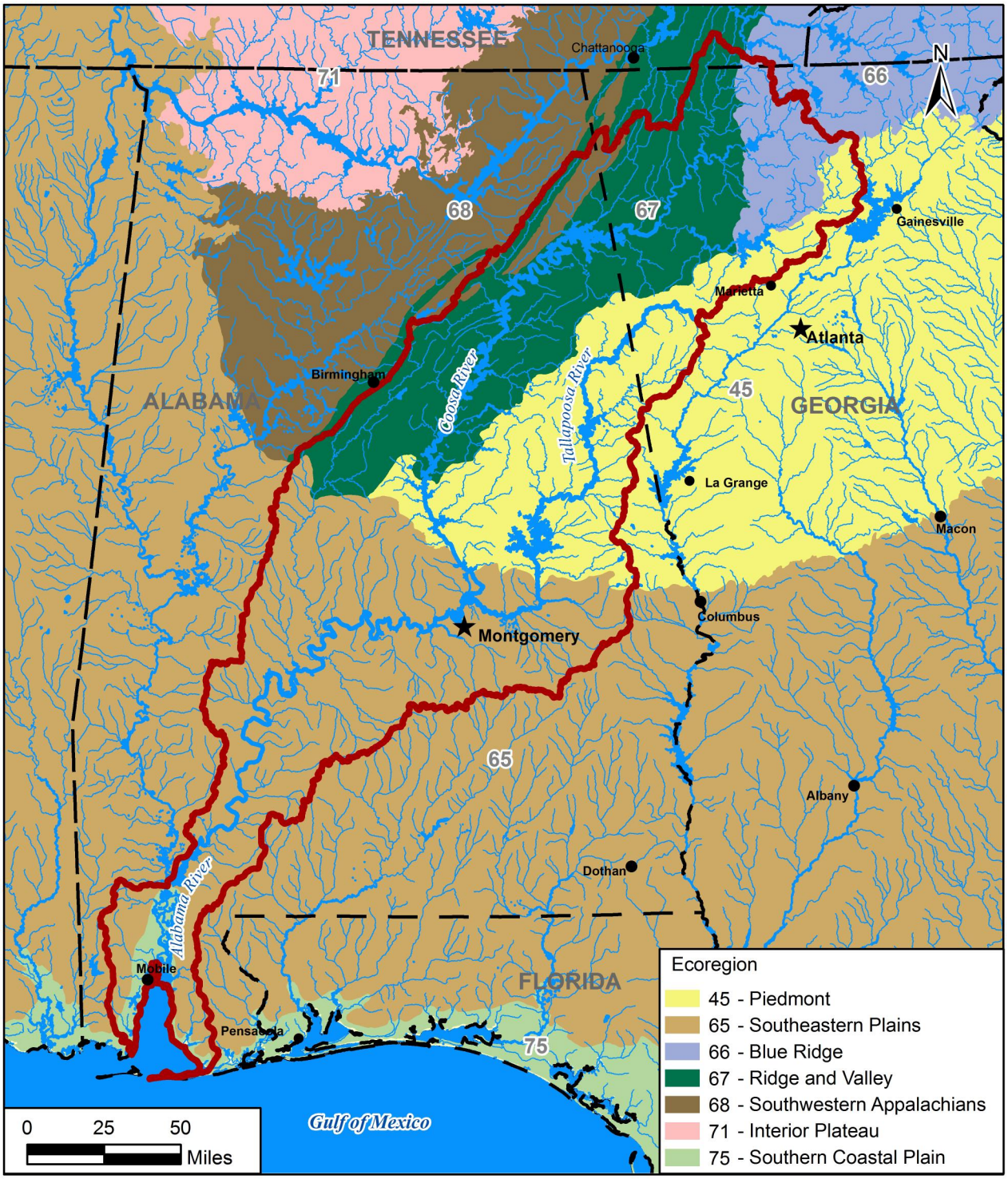


Figure E-28

Source: USEPA 2010.

E.1.3.1.2 Blue Ridge and Piedmont Ecoregions

The Blue Ridge ecoregion is in the northeastern corner of the ACT River Basin and comprises a relatively small amount of the basin. The topography is steep, and mountain elevations are as high as 3,000–3,500 ft. Compared to other ecoregions in the ACT River Basin, soils are shallow and poorly developed. They are underlain by weathered saprolitic rock, and impermeable metamorphic and igneous crystalline rocks. Runoff in the Blue Ridge is rapid because the steep terrain sheds water quickly, and the shallow soils do not store large quantities of water. Average runoff ranges from 15 to 40 in/yr and is relatively high compared to other ACT River Basin ecoregions because of excessive precipitation and soil-runoff potential (Journey & Atkins, 1997).

The topography of the Piedmont ecoregion is characterized by low, rolling hills in the north and broad rolling uplands in the south. Land surface altitudes range from 500 to 1000 ft (Journey & Atkins, 1997)). Like the Blue Ridge, the Piedmont is underlain by impermeable metamorphic and igneous crystalline rocks. The regolith, composed of soils and saprolite, can be 10–150 ft thick depending on the differential weathering of the crystalline rocks. Groundwater is stored in the regolith and enters the crystalline rocks at fault zones. The ecoregion has a dissected upland with rounded interstream valleys with typically dendritic streams. The streams in the Piedmont are fast flowing and are characterized by rapids and riffles, making them ideal for hydropower development (Journey & Atkins, 1997)).

Both the Blue Ridge and Piedmont ecoregions are underlain by Precambrian and Paleozoic crystalline rocks, which include mica schist, felsic gneiss and schist, and granite and granite gneiss. Less extensive outcrops of quartzites are also present. The principal aquifers in the Blue Ridge and Piedmont provinces are fracture-conduit aquifers in the bedrock, where water-bearing zones occur along geologic features such as lithologic contacts, joints, fractures, faults, folds, and veins (Robinson, Journey, & Atkins, 1997).

E.1.3.1.3 Southeastern Plains Ecoregion

The Southeastern Plains ecoregion begins at the contact point, known as the fall line, between the crystalline bedrock of the Piedmont and unconsolidated sediments of the plains. The soils are deep, and parent material in the northern portion of the plains is composed of Cretaceous or Tertiary-age sand, silt, and clays and parent material in the southern portion of the plains is composed of limestone, shale, and sandstone. The Southeastern Plains ecoregion is hilly with rolling topography that ranges from 50 to 850 ft (Kidd, Atkins, & Scott, 1997).

E.1.3.2 Soils

E.1.3.2.1 Soil Types

The sediments transported by the streams and deposited in the reservoirs of the ACT River Basin originate as soils throughout the watershed. The different soils have a variety of compositions and differing proportions of rocks, sand, silt, and clay. The composition and location of the soils indicate the portions of the ACT River Basin most likely to contribute eroded sand, silt, and clay materials into streams and river. Six soils orders occur within the ACT River Basin, three of which—ultisols, inceptisols, and entisols — make up most of the soils:

- Ultisols are characterized by sandy or loamy surface horizons overlying loamy or clayey subsurface horizons. These soils are formed in place through the deep, long-term weathering of parent igneous and metamorphic bedrock. Although commonly called red clay soil, these soils range in color from bright orange to pale yellow-brown.
- Inceptisols are characterized by minimal horizon development and are often found on young geomorphic surfaces, steep slopes, or weathering-resistant parent material. The soils typically have a weak indication of either an argillic or spodic horizon and still retain most weatherable minerals.

- Entisols are characterized as sandy, deep, infertile, well-drained, and subject to active erosion. These soils show poorly developed horizons and are called young because little change is exhibited from the parent material.

Ultisols dominate the Piedmont ecoregion. They generally lack the original topsoil because of erosion that occurred during intensive cotton farming beginning in the 18th century (Couch, Hopkins, & Hardy, 1996). The soils of the Coastal Plain ecoregion are formed from marine sediments. These soils are primarily ultisols with the exception of entisols along major river basins.

E.1.3.2.2 Hydraulic Connectivity

The portions of precipitation that either run off the landscape or infiltrate the soil are regulated by the ability of soil layers to infiltrate water. The infiltration ability is expressed as the hydraulic conductivity of the least pervious soil layer in a soil profile. For use in hydrologic runoff calculations, the many different soil types in a watershed are typically classified into one of four hydrologic groups—A, B, C, or D—based on hydraulic conductivity, expressed in inches per hour (Table E-28). Infiltration ability can also be affected by the proximity of the water table to the ground surface. If a D group soil, when drained, has a higher hydraulic conductivity, it is given a dual group name (Table E-28). The Disturbed Soil classification is used for soils with hydraulic conductivities that might have become altered during land development; these soils need to be directly tested to determine their hydrologic soil groups (NRCS, 2009).

Table E-28. Hydraulic Conductivities of the Hydrologic Soil Groups

Hydrologic soil group	Hydraulic conductivity (in/hr)	Runoff potential when thoroughly wet
A	Greater than 5.67	Low
B	1.42 to 5.67	Moderately Low
C	0.14 to 1.42	Moderately High
D	Less than 0.14	High
Disturbed Soil	N/A	N/A
A/D, B/D, C/D	D group soil, but drainable to the greater conductivity.	High when undrained

Source: (NRCS, 2009)

The soil groups can also be described qualitatively:

- Group A soils are typically less than 10 percent clay and more than 90 percent sand or gravel, with textures described as a sand, gravel, or loam.
- Group B soils are typically 10–20 percent clay and 50–90 percent sand, with textures typically described as a loamy-sand.
- Group C soils are typically 20–40 percent clay and less than 50 percent sand, with textures that include loam plus sand, silt, or clay.
- Group D soils are typically more than 40 percent clay and less than 50 percent sand and are described as having a clayey texture. Also, a soil is classified as Group D if the water table is within 2 ft of the surface.

The four soil hydrologic groups can be found throughout the ACT River Basin, but occurrence tends to coincide with the five ecoregions of the basin (Figure E-29). North of the fall line, within the Piedmont, Blue Ridge, and Southwestern Appalachians ecoregions, the soils are more than 85 percent group B. The Ridge and Valley and

Southeastern Plains ecoregions are composed of about 50 percent group C soils. The group A soils occur primarily in a thin band directly south of the fall line in the Southeastern Plains ecoregion, although most of that ecoregion is dominated by C and D soils (NRCS, 2010a) (NRCS, 2010b).

In general, regions of C and D soil groups generate the greatest amount of runoff per acre. That effect is increased in areas with steep topography, where precipitation has less time to infiltrate before running off into streams. The areas with the highest runoff potential are in the mountain areas of the Ridge and Valley, the clay-rich C soils south of the fall line, the clay-rich stream valleys in the Southeastern Plains ecoregion, and the areas of the Southeastern Plains ecoregion that have a high-water table.

In general, regions of A and B soil groups promote the greatest amount of infiltration and groundwater recharge. That effect is increased in areas of low relief where precipitation is slow to run off and might even pond. The areas with the highest infiltration potential include the sandy A group soils south of the fall line and the sandy soils in the northern portion of the Southeastern Plains ecoregion.

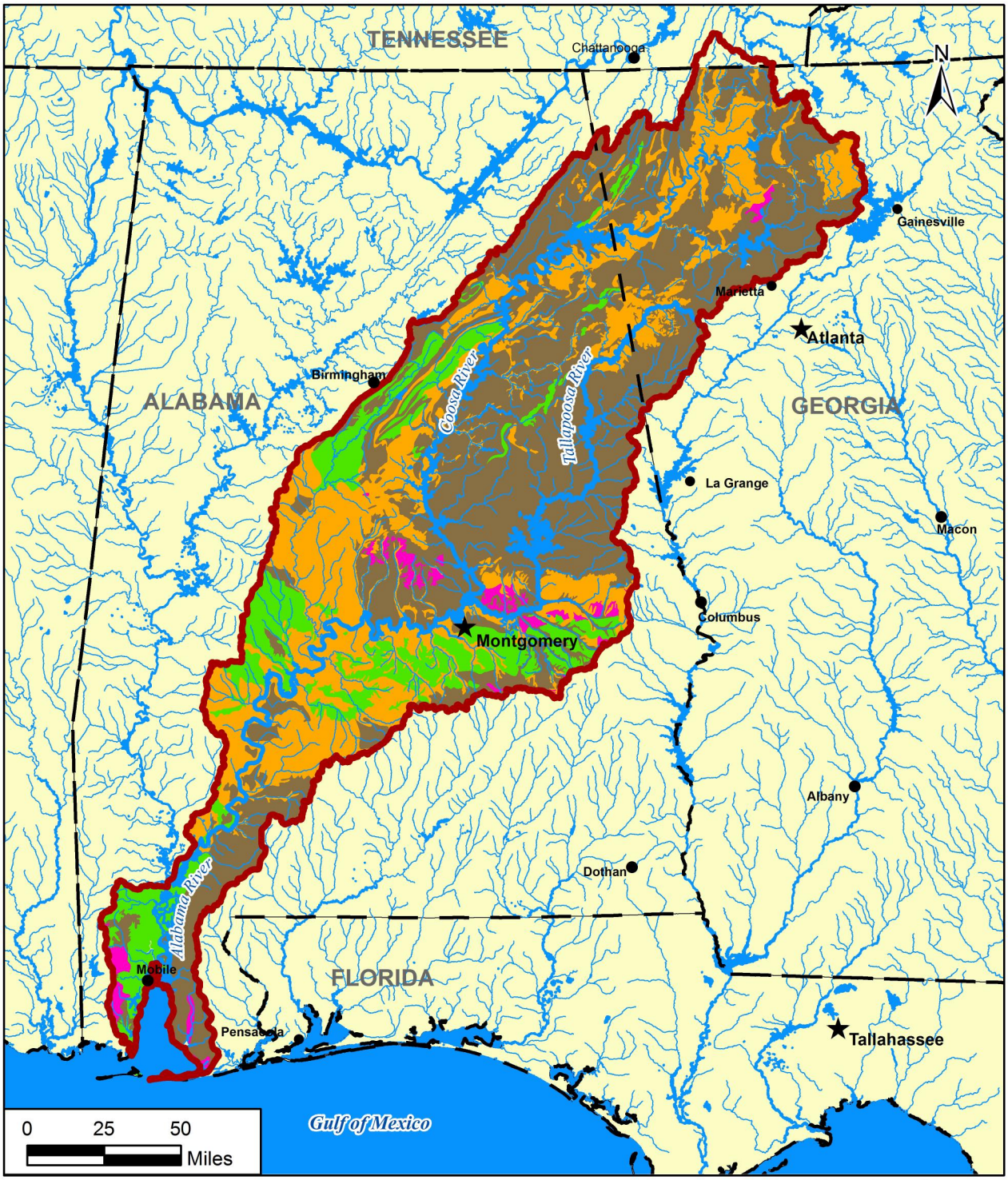
E.1.3.2.3 Prime Farmland

As designated by the USDA, prime farmland has the best combination of physical and chemical characteristics for producing beneficial crops. Prime farmland can be cropland, pastureland, rangeland, forestland, or other land but not urban built-up land or water. In general, prime farmlands have an adequate and dependable water supply, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, few or no rocks, and soils that are permeable to water and air. Prime farmlands are not excessively erodible or saturated with water for long periods, and they either do not flood frequently or are protected from flooding. Based on information from the NRCS State Soil Geographic Database, approximately 18 percent of the ACT River Basin has been designated as prime farmland. Most of the prime farmland is concentrated in the southern third of the ACT River Basin along stream channels and in areas in which groundwater resources are more readily available (Figure E-30). The presence of actively cultivated prime farmland creates greater local demands on supplies of surface water or groundwater (or both) for irrigation during the growing season from April through September for the region.

E.1.3.2.4 Erosion and Sedimentation

This study is focused on the operations of the reservoirs; therefore, it is most appropriate to focus on sediment transported by rivers rather than inputs from overland sources. However, comments are included where information was found that links land-use change with an apparent effect on sediment loads. In general, the quantity and particle size of sediment transported by rivers is related to the number and size of dams in the river system. Impoundments behind dams serve as sediment traps where coarse bed material particles, typically sand and larger, settle in the lake headwaters where entering flows are slowed. Fine particles, typically silts and clays, can remain in suspension and pass through the lake downstream. Large impoundments typically trap most of the sediment load, retaining all the sand and coarser particles plus much of the silt- and clay-sized particles. Smaller, run-of-river impoundments tend to pass all sizes of suspended particles during low-to-moderate flows and coarser bed material particles during high flows. The impact of the impoundments on river form is aggrading the upstream channels with sediment and causing an increase in bed elevation, thus reducing the channel gradient. Downstream of a dam, the river typically becomes sediment-starved. The channel downstream of a dam might or might not respond to the reduction in sediment load. The channel response depends on how resistant to erosion the channel bed and banks are and how quickly sediment is replenished from downstream tributaries and upland erosion sources. A typical response for channels, with bed and banks composed of easily eroded sands, silts, or soft clays, is for the bed to degrade to a reduced elevation; the channel might also widen through bank erosion.

In addition to the information on erosion and sedimentation provided in the following sections, the Final EIS for ACT River Basin WCM Update (which includes the Master Manual and individual project WCMs) provides detailed information on erosion and sedimentation at the projects (USACE Mobile District, 2014d).



Hydrologic Soil Groups

Figure E-29

Source: NRCS 2009.



Prime Farmland

Figure E-30

Source: NRCS GIS 2010.

E.1.3.2.5 Tailwater Degradation

Tailwater degradation is the lowering of the river bed elevation immediately downstream of a dam. Three factors drive the occurrence and rate of tailwater degradation: a ready supply of sediment from upstream, erodibility of the bed material, and flow energy sufficient to transport the bed material. After a dam's construction, a large portion of the sediment (as much as 90 percent for large reservoirs) often becomes trapped in the lake above the dam. Flow downstream of the dam, having lost its sediment load to the lake, now has excess capacity to transport sediment. If the bed and bank materials downstream of the dam are composed primarily of erodible sands, silts, and clays, tailwater degradation occurs until either the gradient of the river is sufficiently reduced to dissipate the flow energy or the bed erodes to a more durable material such as bedrock. A cursory investigation of the tailwater degradation downstream of the ACT River Basin projects was made using available data. The method entailed comparing water surface elevations over time for the same low-flow discharge. Changes in water surface elevation for the same discharge are indicative of changes in the channel form; typically, bed degradation or channel widening. Because the APC projects appear to cause negligible impacts to the Alabama River below Montgomery, AL, only the four major projects within the ROI are included in this section. Descriptions of the Alabama River USACE and APC projects outside the ROI can be found in the October 2014 Final EIS for the ACT River Basin WCM Update.

E.1.3.2.5.1 Allatoona Dam and Lake

Construction on the dam was completed in 1949. The USGS gage 02394000 (Etowah River at Allatoona Dam above Cartersville, GA) is 0.8 mi downstream from Allatoona Dam. Historic rating curve data extending from 1979 to 2017 at this gage were obtained from USGS. The curves were plotted to determine the degree of movement in the curve over time. The curves, over the full range of flows in Figure E-31, show little difference over the period of record. Physical changes to the channel in the form of bed and bank erosion are typically more clearly represented in the lower part of the curve (Figure E-32). The lower part of the curve shows no tailwater degradation over the 1979–2017 period. If tailwater degradation had occurred following impoundment in 1949, by 1979 the erosion had ceased due the channel becoming stable. The stable condition was likely due to the exposure of erosion-resistant bed and bank materials such as bedrock.

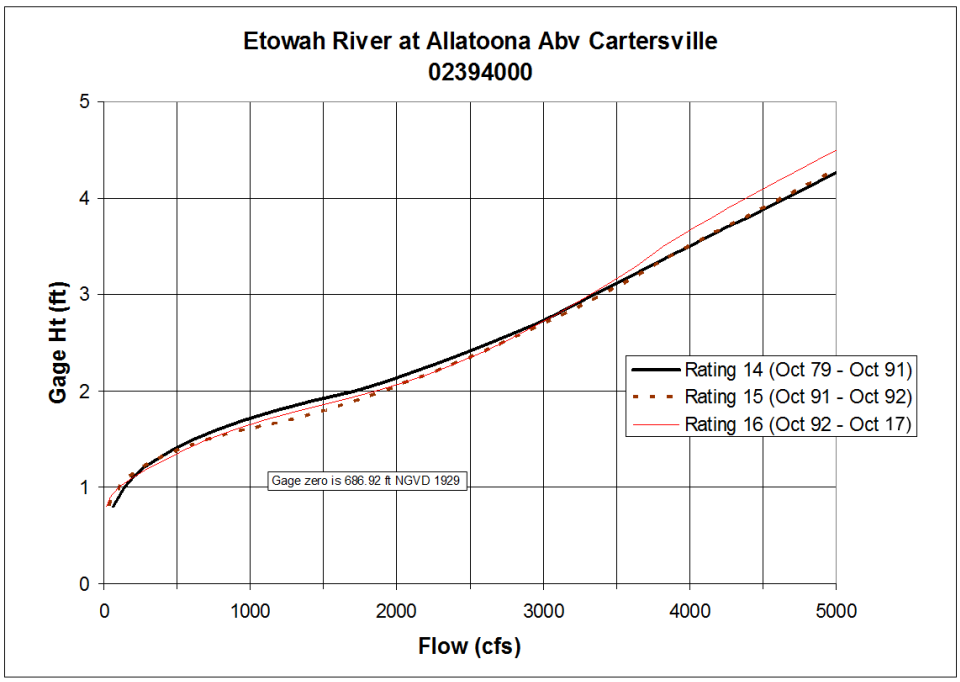


Figure E-31. Allatoona Dam Tailwater Rating Curve.

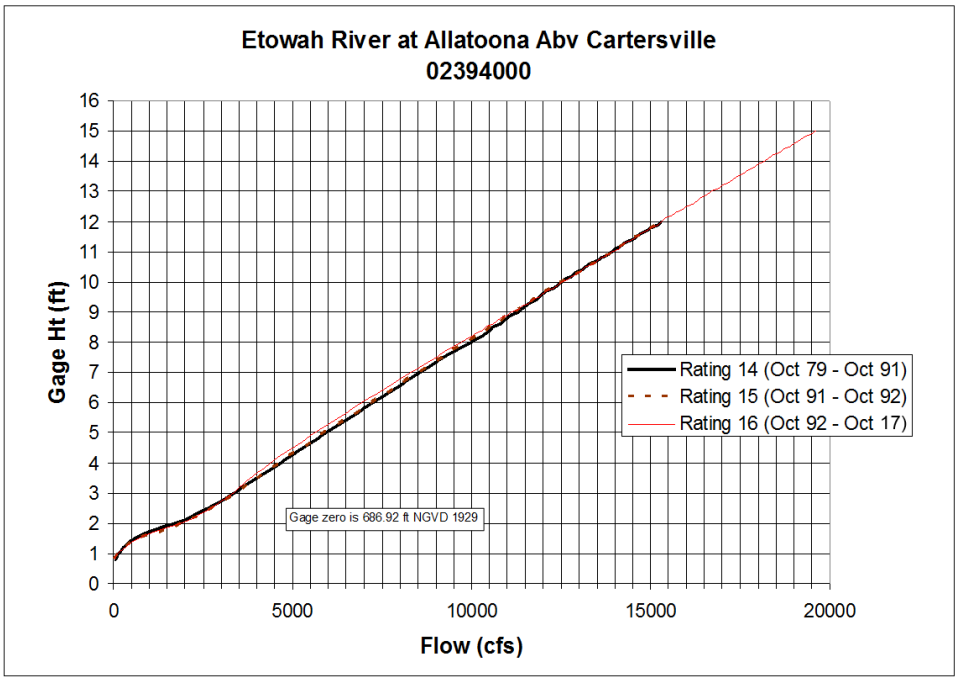


Figure E-32. Allatoona Dam Low-Flow Tailwater Rating Curve.

E.1.3.2.5.2 Weiss Dam and Lake

Construction of Weiss Dam and Lake was initiated in 1958, and the project was placed into operation in 1961. Tailwater degradation was evaluated using low-flow tailwater stage and discharge data from 2000 to 2018. To minimize the influence of the H. Neely Henry Lake pool level on the analysis, flows only from the month of January, when H. Neely Henry Lake is fully drawn down, were included. All flows of 800 +/- 10 cfs were plotted and compared for changes in tailwater elevation over time (Figure E-33). The upward sloping trendline indicates that either the tailwater channel has narrowed or the bed has come up. The broad range in elevations from 512 ft to 518 ft indicates other factors might be involved.

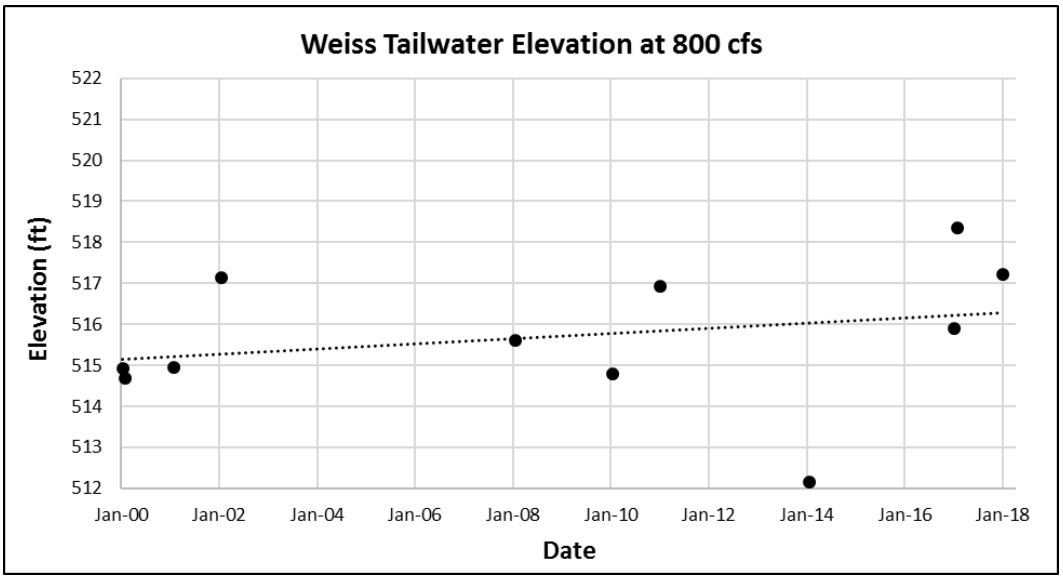


Figure E-33. Low-Flow Elevation Trend of the Weiss Dam Tailwater.

E.1.3.2.5.3 H. Neely Henry Dam and Lake

Construction of H. Neely Henry Dam and Lake was initiated in 1962, and the project was placed into operation in 1966. Tailwater degradation was evaluated using low-flow tailwater stage and discharge data from 2000 to 2018. To minimize the influence of the Logan Martin Lake pool level on the analysis, flows only from the month of January, when Logan Martin Lake is fully drawn down, were included. All flows of 1,000 +/- 10 cfs were plotted and compared for changes in tailwater elevation over time (Figure E-34). The nearly level trendline supports a stable channel with little or no erosion or deposition in the tailwater area.

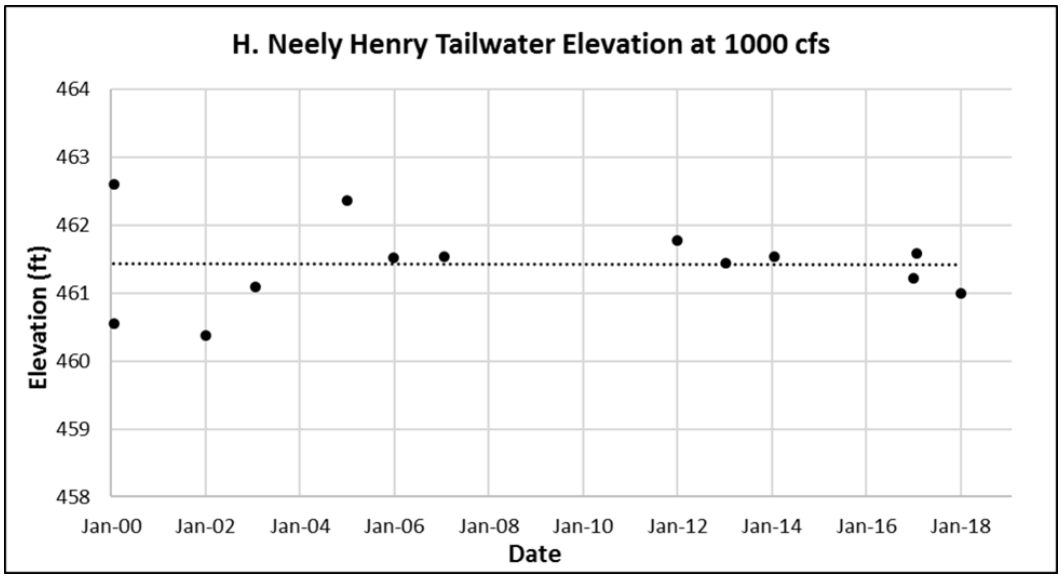


Figure E-34. Low-Flow Elevation Trend of the H. Neely Henry Dam Tailwater.

E.1.3.2.5.4 Logan Martin Dam and Lake

Construction of Logan Martin Dam and Lake was initiated in 1960, and the project was placed into operation in 1964. Tailwater degradation was evaluated using low-flow tailwater stage and discharge data from 2000 to 2018. All flows of 2,500 +/- 25 cfs were plotted and compared for changes in tailwater elevation over time (Figure E-35). The frequent variation in elevation between 396 ft and 399 ft within the same year indicates that it is likely that management of the pool above Lay Dam influences the Logan Martin Dam tailwater and obscures any trends in channel erosion or deposition. The nearly level trendline, however, supports a stable channel with little or no erosion or deposition in the tailwater area.

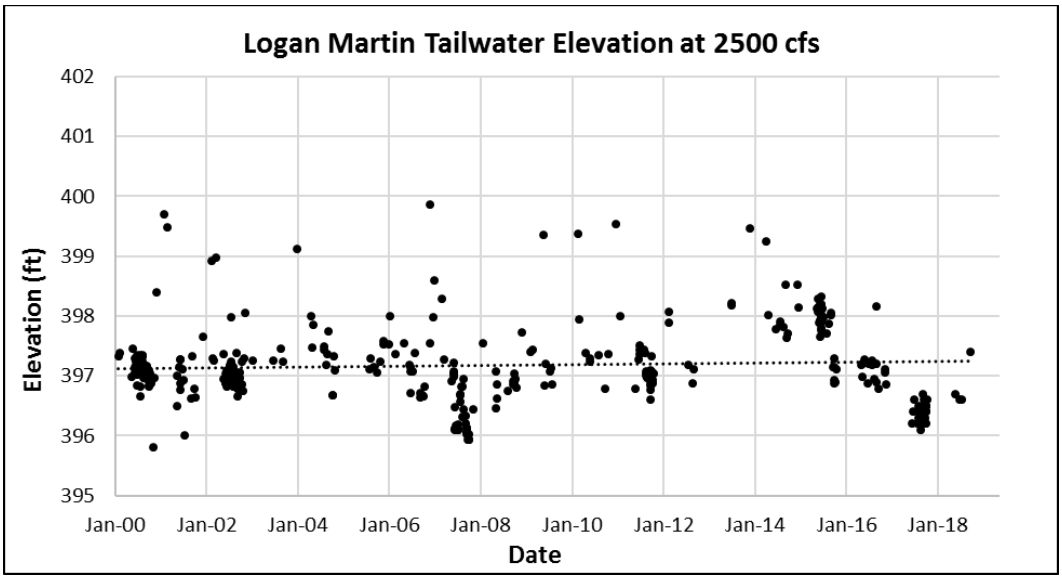


Figure E-35. Low-Flow Elevation Trend of the Logan Martin Dam Tailwater.

E.1.3.2.6 Sedimentation

An investigation of the condition of the pools was made to determine the degree of shoaling. Historic sediment ranges were evaluated where possible.

In general sedimentation impacts are greatest where flowing tributaries enter the nonflowing body of the lake. When flows transition from streams to the lake, flow velocity drops. As the velocity decreases, so does the ability to transport any sediment carried by the tributary.

The two types of areas most severely impacted by sedimentation are where streams draining urban areas enter the lake and where large watersheds drain to the lake. Urban land uses are often associated with the highest soil erosion rates and correspondingly the highest stream sediment loads. The high soil erosion rates are generated on bare soil during land development and by increased urban stormwater runoff, which result in increased streambank erosion. The largest contributing subwatersheds simply have the largest number of acres of land and the most miles of streams to serve as sediment sources

The main lake bodies tend not to be impacted by sedimentation as most of the sediment tends to become deposited in the tributary bays before reaching the main lake.

E.1.3.2.6.1 Allatoona Dam and Lake

One hundred thirty-one sedimentation ranges were established in 1949 for long-term monitoring of sedimentation and shoreline erosion. These ranges were resurveyed in 1981-84, 1997, and 2010. An analysis comparing the historic and recent data was conducted to determine the sedimentation and erosion trends throughout the lake (USACE Mobile District, 2011). The analysis concluded that, in general, the erosion processes occur along the shoreline near the prevailing water surface elevation. The 17-ft range between winter and summer pool elevations creates an annual cycle of varying erosional surfaces with those near the summer pool elevation being the most highly impacted. In general, sedimentation occurs beneath the water surface only in still or slow-moving water. Therefore, although sedimentation is occurring at elevations up to the summer pool level, the summertime deposits may become reeroded during the winter months and transported beneath the winter pool water surface.

Summer pool shoreline erosion was pervasive along the downstream sections of major tributary bays and along the main lake body. Unconsolidated materials near the summer pool level have been eroded until either underlying bedrock or erosion-resistant partially weathered rock is exposed. This erosion likely occurred within the first few decades after the lake was constructed. Thus, these bedrock and partially weathered rock-lined shores now appear to be very stable and presently are undergoing little erosion. Where unconsolidated materials still line the shore, erosion is likely driven by the fluctuating lake levels and wave action from wind and boat wakes. Erosion appears the most severe along more steeply sloping shorelines, with the mass wasting of high banks being the primary process.

Virtually all the uppermost portions of the Allatoona Lake bays are impacted by sedimentation. The mainstem of the Etowah River and the Little River bay have the heaviest deposits.

A second component of the 2010 study was collecting sufficient bathymetric data to update and evaluate the area-capacity curves for Allatoona Lake (Tetra Tech, Inc., 2012). The results indicate about a 10-percent reduction in the capacity of Allatoona Lake over time when compared to the previous area-capacity curves. That change is partially the result of (1) actual sedimentation and (2) differences in historical and current bathymetric survey methods. It is unclear how much of the change is attributable to actual sedimentation and how much to differences in survey methodologies over time.

E.1.3.2.6.2 Weiss Dam and Lake

Siltation studies by APC have been limited to evaluating the recreational impact of siltation at the mouths of tributaries. Weiss Lake is sufficiently far downstream from the major impoundments, Allatoona Lake and Carters Lake, that they likely do not buffer sediment loads. Thus, the Coosa River and its numerous tributaries likely deliver a large sediment load to the upper end of Weiss Lake. Two major tributaries, Little River and Chattooga River, flow directly into Weiss Lake from the north side and likely are the major contributors to shoaling in their bays.

Shoaling rates for Lake Weiss likely have been reduced over the years in relation to the reduction of cultivated acres in the Coosa River Basin, and by a decrease in soil erosion rates (Table E-29). Erosion data indicate that sheet and rill erosion on cropland in Alabama has been steadily decreasing since 1982, the first year for available data (USDA, 2018). Similarly, cropland acreages obtained from the National Agricultural Statistics Service (NASS) website for the years 1982, 1997, and 2015 (USDA, 2019) show a decline. Much of the land has transitioned from row crops to hay land use with a reduction in erosion rate from 4.22 to 0.4 tons per acre per year (USDA, 2018). The impact of the erosion on the area/capacity relationship has not been determined.

E.1.3.2.6.3 H. Neely Henry Dam and Lake

Shoaling of the main Coosa River channel within H. Neely Henry Lake is attenuated by the sediment trapping within Weiss Lake immediately upstream. Thus, sedimentation and shoaling within the lake are likely greatest near the mouths of the three major tributaries draining to the lake: Big Canoe Creek, Big Willis Creek, and Terrapin Creek. A set of sedimentation range monuments were installed when the lake was impounded; however, no post-impoundment surveys have been conducted.

Shoaling rates for H. Neely Henry Lake likely have been reduced over the years in relation to the reduction of cultivated acres in the Coosa River Basin, and by a decrease in soil erosion rates (Table E-29). Erosion data indicate that sheet and rill erosion on cropland in Alabama has been steadily decreasing since 1982, the first year for available data (USDA, 2018). Similarly, cropland acreages obtained from the National Agricultural Statistics Service (NASS) website for the years 1982, 1997, and 2015 (USDA, 2019) show a decline. Much of the land has transitioned from row crops to hay land use with a reduction in erosion rate from 4.22 to 0.4 tons per acre per year (USDA, 2018). The impact of the erosion on the area/capacity relationship has not been determined.

Table E-29. Soil Erosion (between 1982 and 2017) for Selected Coosa River Basin Counties

County	Year	Row crop acres cultivated	% change from 1982	Cultivated land use erosion rate (tons/ac/yr)	Tons soil eroded	% change from 1982
Calhoun	1982	34,615	--	5.02	173,767	--
	1997	7,287	-78.9%	4.72	34,395	-80.2%
	2015	8,665	-75.0%	4.22	36,566	-79.0%
Cherokee	1982	84,950	--	5.02	426,449	--
	1997	32,761	-61.4%	4.72	154,632	-63.7%
	2015	37,000	-6.1%	4.22	156,140	-21.0%
Etowah	1982	37,095	--	5.02	186,217	--
	1997	7,722	-79.2%	4.72	36,448	-80.4%
	2015	9,600	-51.8%	4.22	40,512	-59.4%
St. Clair	1982	7,400	--	5.02	37,148	--
	1997	157	-97.9%	4.72	741	-98.0%
	2015	79	-99.6%	4.22	333	-99.6%
Talladega	1982	52,430	--	5.02	263,199	--
	1997	23,849	-54.5%	4.72	112,567	-57.2%
	2015	21,400	-59.2%	4.22	90,308	-65.7%

E.1.3.2.6.4 Logan Martin Dam and Lake

Logan Martin Lake is in the Alabama counties of Calhoun, St. Clair, and Talladega. The lake has a surface area of 15,269 ac and 275 mi of shoreline at a normal pool elevation of 465 ft. Siltation studies by APC have been limited to evaluating the recreational impact of siltation at the mouths of tributaries. Shoaling of the main Coosa River channel within Logan Martin Lake is attenuated by the sediment trapping within Neely Henry Lake immediately upstream. Thus, sedimentation and shoaling within the lake are likely greatest near the mouths of the three major tributaries draining to the east side of the lake: Choccolocco Creek, Cane Creek, and Ohatchee Creek. A set of sedimentation range monuments were installed when the lake was impounded, however, no post-impoundment surveys have been conducted.

Shoaling rates for Logan Martin Lake likely have been reduced over the years in relation to the reduction of cultivated acres in the Coosa River Basin, and by a decrease in soil erosion rates (Table E-29). Erosion data indicate that sheet and rill erosion on cropland in Alabama has been steadily decreasing since 1982; the first year for available data (USDA, 2018). Similarly, cropland acreages obtained from the National Agricultural Statistics Service (NASS) website for the years 1982, 1997, and 2015 (USDA, 2019) show a decline. Much of the land has transitioned from row crops to hay land use with a reduction in erosion rate from 4.22 to 0.4 tons per acre per year (USDA, 2018). The impact of the erosion on the area/capacity relationship has not been determined.

E.1.4 Climate Conditions

E.1.4.1 Existing Climate Conditions

The climate of Alabama and Georgia including all areas associated with the ACT River Basin is classified as humid subtropical and is characterized by hot, humid summers and cool winters. Significant amounts of precipitation occur in all seasons in most areas. Winter rainfall (and sometimes snowfall) is associated with large storms steering from west to east. Most summer rainfall occurs during thunderstorms and an occasional tropical storm, hurricane, or tropical cyclone (Peel, Finlayson, & McMahon, 2007). This section provides a brief outline of the existing climate in Alabama and Georgia. Detailed information about precipitation in the ACT River Basin is provided in Section E.1.1.1.

Alabama's three climatic regions are the lower coastal plain, largely subtropical and strongly influenced by the Gulf of Mexico; the northern plateau, marked by occasional snowfall in winter; and the Black Belt and upper coastal plain, lying between the two extremes. The ACT River Basin traverses all three regions, but the Alabama region most affected by the proposed actions considered in this Draft FR/SEIS would be the northern plateau. The city of Birmingham lies in this area and has an annual mean temperature of 62 °F (17 °C), with a normal July daily maximum of 90 °F (32 °C) and a normal January daily minimum of 34 °F (1 °C) (City-Data, 2019a).

The Chattahoochee River divides Georgia into separate climatic regions. The mountain region to the northwest is colder than the rest of the state, with the average temperatures in January of 39 °F (4 °C) and 78 °F (26 °C) in July. Summers are hot in the Piedmont, with July temperatures averaging 80 °F (27 °C) or above. Humidity is high, averaging from 82 percent in the morning to 56 percent in the afternoon in Atlanta. Winter is characterized by mild temperatures and occasional snowfalls, with colder, snowier weather and icing most likely across northern and central Georgia (City-Data, 2019b).

E.1.4.2 Greenhouse Gases and Global Warming

Greenhouse gases (GHGs) are components of the atmosphere that contribute to the greenhouse effect and global warming. Some GHGs occur naturally in the atmosphere, while others result from human activities such as burning fossil fuels. Federal agencies, states, and local communities address global warming by preparing GHG inventories and adopting policies that will result in a decrease of GHG emissions. According to the Kyoto Protocol and California Climate Action Registry, there are six GHGs: carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), hydrofluorocarbons, PFCs, and sulfur hexafluoride (UNFCCC, 2008) (CARB, 2017). Although the direct GHGs (CO_2, CH_4, and N_2O) occur naturally in the atmosphere, human activities have increased their atmospheric concentrations. From the preindustrial era (which ended about 1750) to 2004, concentrations of CO_2 have increased globally by 35 percent. In the United States, fossil fuel combustion accounted for 78 percent of all CO_2 emissions released in 2011. On a global scale, fossil fuel combustion added approximately 29 by 10^9 tons (32 by 10^9 metric tons) of CO_2 to the atmosphere in 2014, of which the United States accounted for about 15 percent (USEPA, 2019c). U.S. CO_2 emissions have grown by an average of 1.6 percent annually since 1990 and energy-related CO_2 emissions constitute as much as 83 percent of the total annual CO_2 emissions (USEPA, 2019a).

The average surface temperature across the contiguous 48 states has risen an average rate of 0.14 °F per decade since 1901, which is similar to the global rate. Since 1979, the contiguous 48 states have warmed by 0.29 °F to 0.46 °F per decade, which is faster than the global rate. Some parts of the United States have experienced more warming than others. The North, the West, and Alaska have seen temperatures increase the most, while some parts of the southeastern US have experienced little change (USEPA, 2016).

E.1.4.3 Historical Precipitation and Droughts

Hydrological variability in a catchment over time is influenced by variations in precipitation over daily, seasonal, annual, and decadal time scales. The frequency of low or drought flows in a river basin is affected primarily by changes in the seasonal distribution of precipitation, year-to-year variability, and occurrence of prolonged droughts. Evaporation from the land surface includes evaporation from open water, soil, shallow groundwater, and water stored on vegetation as well as transpiration through plants. The rate of evaporation from the land surface is essentially driven by meteorological controls, mediated by the characteristics of vegetation and soils, and constrained by the amount of water available. Climate change has the potential to affect all these factors—in a combined way that is not yet clearly understood—with different components of evaporation affected differently (IPCC, 2014).

The recent drought in the southeastern US began in the winter of 2005–2006. It was part of a drying cycle that stretched from Arizona to the Atlantic Ocean, and it persisted through October 2007. After a few years with precipitation in the normal range, drought conditions returned in 2011. The drought was caused by a reduction in both precipitation and evaporation; it cannot be specifically linked to man-made climate change or global warming (Seager, Tzanova, & Nakamura, 2009). Although the exact areas of the southeastern US affected by this drought varied, precipitation reduction has not exceeded earlier droughts, including in the earlier centuries and one as recently as 1998–2002 (IPCC, 2007). Historically, the drought was a typical event in terms of amplitude and duration. Tree-ring records show a 21-year-long drought in the mid-16th century, a long dry period in the early- to mid-19th century, medieval mega-droughts centered in western North America that affected the southeastern US. In general, the 20th century was moist from the perspective of the previous millennium and free of long, severe droughts that were abundant in previous centuries (Seager, Tzanova, & Nakamura, 2009).

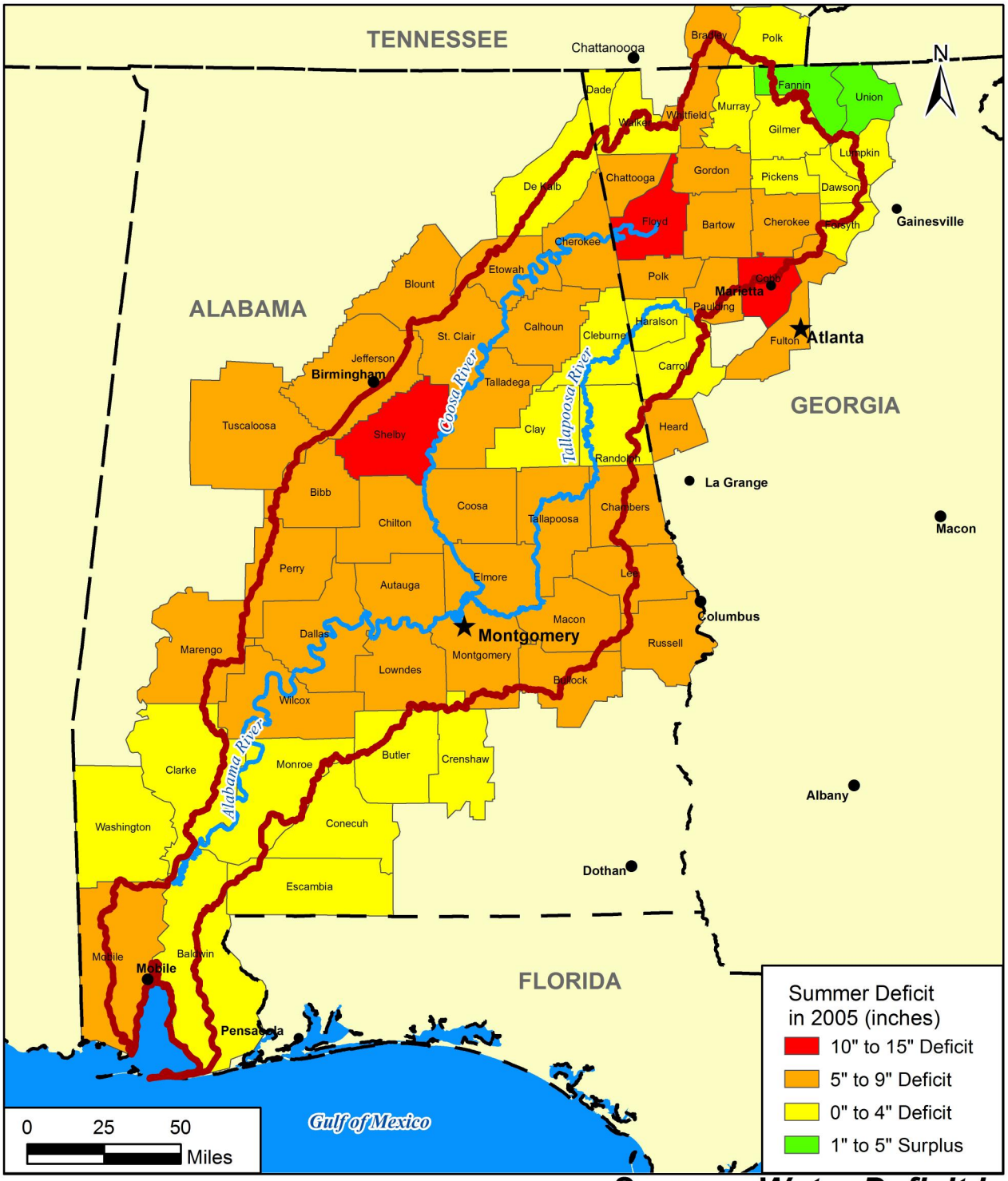
Available precipitation is the total precipitation minus potential evapotranspiration. It is a direct measure of inflows in the basin. The *summer deficit* is the available precipitation minus withdrawal in June, July, and August—typically the three warmest months of the year that correspond to increased municipal, thermoelectric cooling, and irrigation demand. The summer deficit is an indicator of water shortage (in inches) on a seasonal basis that must be met through stored sources (e.g., ACT River Basin projects) or groundwater. The historical average (1934–2000) ranges between a summer deficit of 13 in and a surplus of 1 in for any given county in the ACT River Basin (Figure E-36). Historically, the average summer deficit is 5.3 in across all counties in the basin.

E.1.4.4 Historical Sea Level Rise

The ROI associated with the proposed actions addressed in this Draft FR/SEIS does not extend into coastal areas that may be affected by sea level rise.

E.1.5 Land Use

This section summarizes overall land use in the ACT River Basin as well as land use around lakes and along rivers in the basin. As stated in Section E.1, the effects of proposed actions considered in this Draft FR/SEIS are limited to the Coosa River Basin within the ACT River Basin, with a focus on the projects most likely to be affected by the proposed federal actions: USACE's Allatoona Dam and Lake and APC's Weiss, H. Neely Henry, Logan Martin, Lay, Mitchell, and Jordan/Bouldin projects. This section focuses on project shorelines, and the land around the projects and downstream. The land-use analysis is organized by project running from north to south in the ACT River Basin. geographic information system data, maps, shoreline management plans, and a master plan were used to identify and define the land use in the ACT River Basin and around the project lakes and along the rivers.



Summer Water Deficit in 2005 for Counties in the ACT River Basin

Figure E-36

Source: Seager, Tzanova, & Nakamura 2009.

E.1.5.1 Current ACT River Basin Land Use

ACT River Basin land-use data were compiled from the USGS 2011 National Land Cover Database (NLCD). The data were specifically developed to provide consistent land-use coverage for the United States. NLCD land-cover uses are categorized as water, developed land (urban or built-up), barren land, forested land, shrubland, cultivated herbaceous or planted (i.e., agricultural), and wetlands. The overall proportions of the land-cover categories in the ACT River Basin are illustrated in Figure E-37, and the acreages associated with the land-cover categories are summarized in Table E-30.

Water includes all areas of open water, generally with less than 25-percent cover of vegetation or soil. Water covers 564,864 ac, or almost 4 percent of the ACT River Basin. Developed land is urban or built-up land for residential, commercial, and industrial uses, and developed open space is used for lawns, vegetation for aesthetics or erosion control, and recreational land use (e.g., parks and golf courses). Developed land accounts for more than 1.4 million ac, or about 9 percent of the ACT River Basin land use (NRCS, 2011). The largest developed areas in the ACT River Basin are the northwest suburbs of Metro Atlanta (in Bartow, Cherokee, Cobb, and Paulding counties), which are in the northern portion of the ACT River Basin; Birmingham, AL (Alabama's largest city), in the west-central portion of the ACT River Basin; Montgomery, AL (the state capital), in the east-central portion of the ACT River Basin along the Alabama River; and Mobile, AL, on Mobile Bay at the southern end of the ACT River Basin.

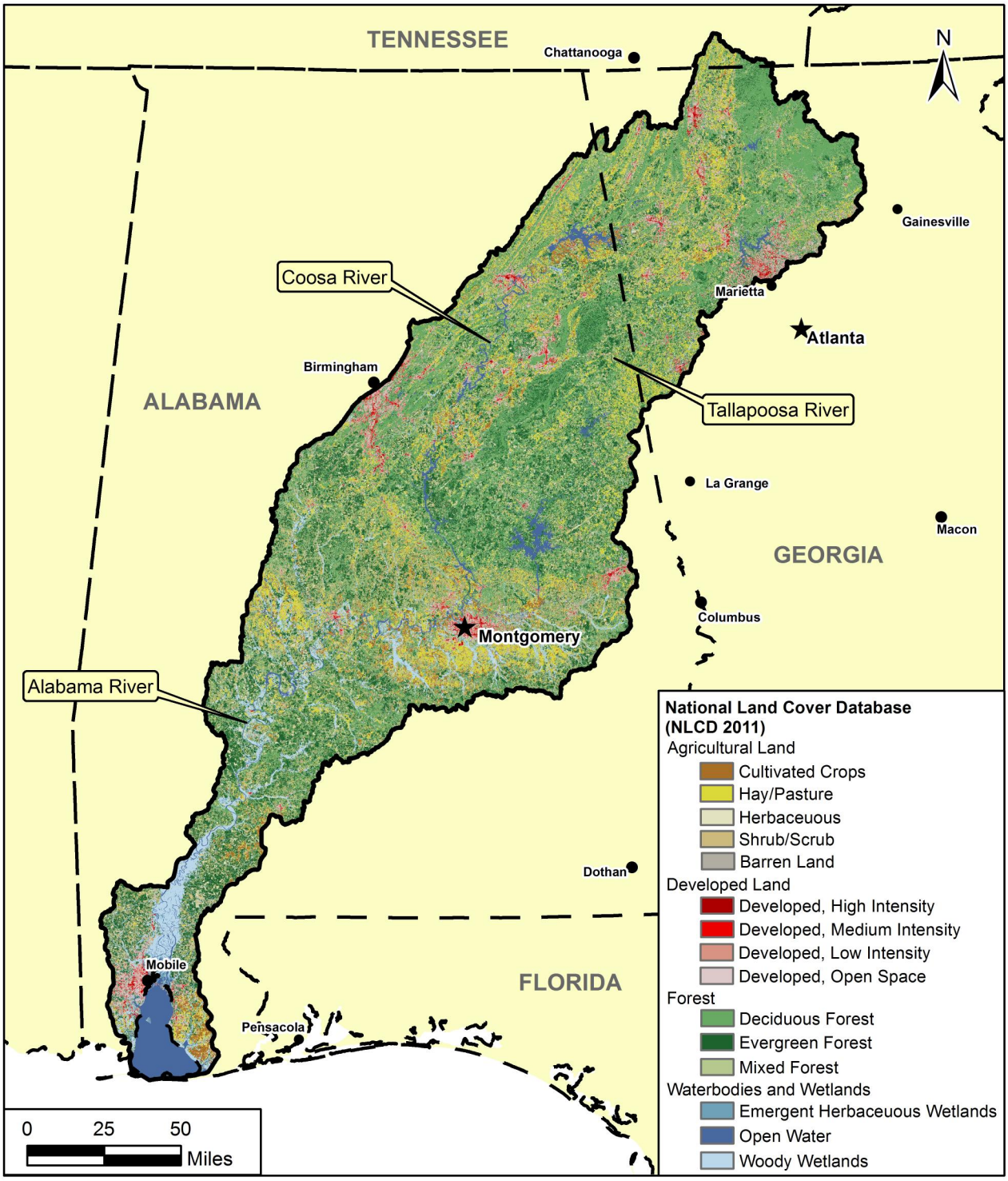
Barren land consists of areas of bedrock, desert pavement, sand dunes, strip mines, gravel pits, and other accumulations of earthen material, with generally less than 15 percent of vegetative cover (NRCS, 2011). Barren land covers 54,676 ac, or less than 1 percent of the land in the ACT River Basin.

Forested lands are areas where trees are more than 20 percent of total vegetation cover and can be deciduous forest (more than 75 percent of tree species that shed foliage in response to seasonal change), evergreen forest (more than 75 percent of tree species that maintain their foliage all year), and mixed forest (where neither deciduous or evergreen trees are more than 75 percent of total tree cover) (NRCS, 2011). Forested land is the predominant land use in the ACT River Basin and accounts for more than 8.4 million ac, or 54 percent of land use.

Shrubland includes areas dominated by shrubs, young trees, and trees stunted from environmental conditions (NRCS, 2011). Shrubland accounts for about 1.3 million ac, or about 8 percent of ACT River Basin land.

Cultivated herbaceous or planted land is the second most predominant land use in the ACT River Basin, accounting for about 2.8 million ac, or about 18 percent of land use. Cultivated land consists of grazing land planted for livestock grazing or the production of seed or hay crops, or cropland planted to produce annual crops such as corn, soybeans, vegetables, tobacco, cotton, and perennial woody crops such as orchards and vineyards (NRCS, 2011).

Wetlands account for more than 1 million ac, or about 7 percent of ACT River Basin land. Emergent herbaceous wetlands have more than 80-percent herbaceous vegetation cover and the soil is periodically saturated with or covered with water. Woody wetlands have forest or shrubland vegetation that account for more than 20 percent of vegetative cover and the soil is periodically saturated with or covered with water (NRCS, 2011).



ACT River Basin Land Use

Figure E-37

Source: NLCD 2011.

Table E-30. ACT River Basin Land Use (2011)

Land use classification	Acres	Percent of total acreage
Water	566,864	3.6%
Developed (urban or built-up land)	1,444,582	9.2%
Barren	54,676	0.3%
Natural forested upland (forested lands)	8,474,963	54.0%
Shrubland	1,311,237	8.4%
Cultivated herbaceous/planted	2,820,263	18.0%
Wetlands	1,018,372	6.5%
Total - ACT River Basin	15,690,957	100.0%

Source: (NLCD, 2011)

E.1.5.2 Historic ACT River Basin Land Use

Historic land uses in the ACT River Basin are available for 1992 from the NLCD. The 1992 NLCD land-cover uses included water, developed land, barren land, forested land, shrubland, pasture and row cropland (i.e., agricultural), and wetlands. The overall proportions of those land-cover categories in the ACT River Basin as of 1992 are summarized in Table E-31.

Table E-31. ACT River Basin Historic Land Use

Land use classification	Acres	Percent of total acreage
Water	522,839	3%
Developed	342,557	2%
Barren	330,132	2%
Forested	11,146,703	71%
Grassland/herbaceous	568	0.004%
Agricultural	2,507,336	16%
Wetlands	843,518	15%
Total Basin	15,693,651	100%

Source: (NLCD, 1992)

USGS does not recommend direct comparison of the 1992 land-cover data with later data sets because they were mapped using different methods and slightly different classes. The slight differences in classifications, combined with the final accuracy of the mapping, result in two distinct products. The typical result of direct comparison will result in a change map showing a difference between mapping methods rather than real change on the ground (NLCD, 2009).

As of 1992, forested land—which includes evergreen, deciduous, and mixed forest—accounted for the largest percentage (71 percent) of total land use in the basin. Agricultural land use—which includes pasture and hay areas; row crops; and orchards, vineyards, and other planted areas—represented the next highest percentage of total acreage, accounting for 16 percent of ACT River Basin land use. Wetlands were 15 percent of total acreage. Water

accounted for 3 percent of ACT River Basin land use. Developed land—residential, commercial, industrial, transportation, and urban/recreation grasses such as parks, lawns, golf courses, and airport and industrial sites—and barren land—barren land of rock, sand, or clay; quarries, strip mines, or gravel pits; and transitional areas of sparse vegetative cover—each accounted for 2 percent of ACT River Basin land use. The smallest percentage of total acreage (less than 1 percent) was grasslands and herbaceous land (NLCD, 1992).

E.1.5.3 Allatoona Dam and Lake

The USACE Allatoona Dam and Lake project is in north Georgia on the Etowah River (a tributary of the Coosa River) about 30 mi north of Atlanta, GA (Figure E-1). At normal summer lake elevation of 840 ft, the lake shoreline is 270 mi. The Allatoona project consists of 49,545 ac at normal summer level—11,164 ac of water and 38,381 ac of land. The project land was acquired to a contour elevation of 863 ft to provide an area necessary for flood risk management. In some areas around the lake, blocks of land above the 863 ft contour were purchased to provide recreational areas, natural resource protection areas, and public access areas. The land acquisition provides a continuous area of land around the reservoir above the flood storage pool to ensure public access along the shore and to accommodate project-related activities (USACE Mobile District, 1998a) (USACE Mobile District, 2014a).

USACE developed the *Allatoona Lake Shoreline Management Plan* to provide guidance and information for the effective management of the Allatoona Lake shoreline and adjacent public land and water. The Plan allocates the lake's shoreline into four land-use categories: prohibited access areas, protected shoreline areas, public recreation, and limited development for shoreline and lake access (USACE Mobile District, 1998a).

Prohibited access land protects certain project operation areas for public safety. No shoreline use permits or licenses are issued for those areas. Prohibited access land is in the proximity of the dam and spillway. Of the 270 mi of shoreline at normal summer level, 1 percent is categorized as prohibited access land (USACE Mobile District, 1998a).

Protected shoreline areas are designated in accordance with USACE regulations (Engineer Regulation 1130-2-406, *Shoreline Management at Civil Works Projects*) to protect or restore fish and wildlife habitat, aesthetics, cultural resources, or other environmental values. Shoreline use permits or licenses are not issued for protected shoreline areas, but pedestrian access and boating are permitted provided aesthetic, environmental, historical, and natural resources are not damaged. Protected areas around the lake account for 40 percent of the shoreline. On the north side of Allatoona Lake is a nearly 7,000-ac WMA operated by the GADNR Game and Fish Division (USACE Mobile District, 2019b).

Public recreation areas are specifically designated for present or future recreational development such as campgrounds, day-use parks, hiking and biking trails, primitive or natural areas, and marine services. No permits for private uses are issued for public recreation areas. Public recreation, the largest shoreline allocation at Allatoona Lake, accounts for 45 percent of the shoreline. USACE has 16 day-use parks, 16 boat ramps, 8 campgrounds (with a total of 580 camp sites), and 188 picnic sites at Allatoona Lake and additional recreational facilities are found in nine city and county parks, one state park (Red Top Mountain State Park), and eight commercial marinas (USACE Mobile District, 2019b). These additional facilities are located on project lands the USACE leases to city, county, or state governments, organizations, or private citizens that operate them. Popular recreational activities around the lake are boating, camping, fishing, hiking, hunting, picnicking, sightseeing, swimming, and observing wildlife (USACE Mobile District, 2017).

Under the last shoreline allocation category, limited development (which accounts for 14 percent of the shoreline), USACE allows for specific private uses of public lands. The Allatoona Lake Project Management Office (PMO) issues permits and licenses in limited development zone areas for various shoreline uses, including docks, under brushing, grass mowing, shoreline protection, steps, and walkways (USACE Mobile District, 2019b). Permits are issued for floating facilities (e.g., docks) and vegetation modification (e.g., mowing); licenses are issued for land-

based structures (e.g., walkways, handrails, water lines, and picnic shelters). As of March 2019, the PMO had issued 680 shoreline use permits and licenses (Jackson, 2019).

Allatoona Lake is a long-established project; consequently, options for resource use are limited primarily to improvements within the existing pattern of land use and framework of land use controls and practices. Proposed future development on Allatoona Lake project lands includes updating and upgrading aging facilities, improving accessibility for persons with disabilities, and when needs arise develop additional day-use or camping facilities such as additional boat ramps, camp sites, comfort stations, fishing jetties, parking sites, picnic sites, and playing fields (USACE Mobile District, 2017).

The lands at the Allatoona project are a mix of residential, commercial, recreational, and undeveloped forested land. As Metro Atlanta has expanded, residential and commercial development on the southern side of Allatoona Lake has expanded (USACE Mobile District, 1998a). Homes, boat docks, and marinas line the shoreline. In comparison, the northern side of the lake is much less populated, with the project land bordered primarily by forested land and a few housing developments or individual homes.

Upstream of Allatoona Lake to the Hickory Log Creek Dam in Canton, GA, is primarily residential housing development south of the Etowah River and undeveloped, forested land north of the river upstream to Canton. In Canton, commercial, residential, and community parks have been established along both sides of the river.

Downstream of Allatoona Dam to Weiss Lake is a mix of developed, agricultural, and forested land uses along the Etowah and Coosa rivers. Developed areas are focused around the communities of Cartersville, Coosa, Euharlee, and Rome, GA. Between the communities is a mix of primarily agricultural and forested land, with some industrial development at Coosa.

E.1.5.4 APC Projects

APC maintains shoreline management plans and a permitting program to manage the property within its project boundaries. The permitting program controls all development activities and monitors the shoreline areas to preserve the scenic, recreational, and environmental attributes of the lakes. All construction activity and vegetation modification within the project boundaries are subject to preapproval and permitting by APC. The goals of APC's shoreline management plans and permitting program are to provide for reasonable public access, protect fish and wildlife habitat, protect cultural resources, protect operational needs, facilitate compliance with license articles, minimize adverse effects on water quality, minimize erosion, minimize adverse scenic effects, and guide shoreline development at the lakes (FERC, 2009).

APC issues residential use permits for residential activities (e.g., building a boat dock and vegetation modification) on or around the APC lakes, and nonresidential use permits to persons or businesses conducting commerce along a project shoreline (e.g., a marina). Table E-32 lists the number of residential and nonresidential use permits APC has issued to date at each project.

Table E-32. Shoreline Use Permits Issued at APC Projects as of April 2019

Type of permit	Weiss	H. Neely Henry	Logan Martin	Lay	Mitchell	Jordan	Bouldin
Residential Use Permits	5,337	2,900	4,448	2,696	908	1,406	79
Nonresidential Use Permits	6	5	11	2	0	1	0

Source: (St. John, 2019).

APC evaluated land use within 500 ft of the Coosa River Basin projects and identified seven categories of shoreline land use at its projects—project operations, developed recreation, industrial/commercial, residential, sensitive resources, forest management, and agricultural. Sensitive resources are project lands managed for protecting and enhancing sensitive resources that consist of resources protected by state or federal law, EO, and other natural features considered important to the area or natural environment. Table E-33 lists the categories and percent use of each category at APC Coosa River Basin projects. The top three land uses at all except the Jordan/Bouldin project are forest management, residential, and sensitive resources. The top three uses at Jordan/Bouldin are forest management, project operations, and residential.

Table E-33. Percentage of Shoreline Land Use at APC Projects

Land use classification	Weiss	H. Neely Henry	Logan Martin	Lay	Mitchell	Jordan/ Bouldin
Project operations	10	<1	<1	<1	4	13
Developed recreation	2	2	2	1	1	3
Industrial/Commercial	1	4	<1	2	0	<1
Residential	36	29	52	25	21	50
Sensitive resources [a]	17	13	22	5	26	3
Forest management	30	46	16	63	49	30
Agricultural	5	6	6	3	0	<1

Source: (FERC, 2009)

Note:

a. Sensitive resources include archaeological sites or structures listed on or eligible for listing on the National Register of Historic Places, wetlands, floodplains, habitat protection areas, and significant scenic areas.

E.1.5.4.1 Weiss Dam and Lake

Weiss Lake is on the Coosa River in northeast Alabama, about 80 mi northeast of Birmingham (Figure E-1). The dam impounds a reservoir of approximately 30,000 ac with 447 mi of shoreline at the normal summer elevation of 564 ft (FERC, 2009). APC owns fee interest in lands up to the normal pool elevation and has a combination of fee and easement interests for flood storage above elevation 564. The major shoreline land uses at Weiss Lake are residential, forest management, sensitive resources, and project operations (Table E-33). The shoreline of Weiss Lake is heavily developed by commercial and private entities (FERC, 2009). Residential, commercial, retail, and recreational land uses border the reservoir, with the highest density of development around the communities of Cedar Bluff on the north shore of the lake; Leesburg on the western end of the lake; and Centre south of the lake. Recreational access to Weiss Lake is provided by APC and numerous other public and private entities through formal recreation areas with boat launches, marinas, boat slips, campgrounds, picnic areas, beaches, fishing piers, general piers, bank fishing, trails, and playgrounds (FERC, 2009).

E.1.5.4.2 H. Neely Henry Dam and Lake

Downstream of Weiss Dam along the Coosa River to H. Neely Henry Lake is a mix of mostly agricultural and forested land use with small, low-density communities, including Owens and Turkeytown, before reaching Hokes Bluff, AL a suburb of Gadsden, AL. Gadsden is the largest city in the area and borders the northern end of H. Neely Henry Lake.

H. Neely Henry Lake is on the Coosa River in northeast Alabama, about 60 mi northeast of Birmingham (Figure E-1). The dam impounds an 11,235-ac reservoir with 339 mi of shoreline at the normal summer elevation of 508 ft (FERC, 2009). APC owns fee interest in lands up to the full-pool elevation of 508 ft and has a combination of fee and easement interests for flood storage above elevation 508 ft. The major shoreline land uses at H. Neely Henry Lake are forest management, residential, and sensitive resources (Table E-33). Commercial and private development in the vicinity of the reservoir is moderate but growing, and much of the shoreline property directly adjacent to the reservoir is developed (FERC, 2009). Besides Hokes Bluff and Gadsden, other Alabama cities around the lake include Glencoe, Rainbow City, Southside, and Ohatchee, with the higher density developed areas concentrated around the northern portion of the lake. Recreational facilities on the lake include boat launches, marinas, boat slips, campgrounds, picnic areas, beaches, fishing piers, general piers, trails, and playgrounds (FERC, 2009). Two Alabama birding trail parks border the lake, with the Jim Martin Wildlife Refuge at the northern end of the lake and the Ten Islands Historic Park at the southern end.

E.1.5.4.3 Logan Martin Dam and Lake

Downstream of H. Neely Henry Dam along the Coosa River to Logan Martin Lake is primarily forested and agricultural land use, with one mining operation within 1 mi of the Coosa River around Ragland, AL before reaching the city of Riverside, AL on the western bank of the river and the city of Lincoln, AL on the eastern bank. Riverside and Lincoln have commercial, industrial, recreational, and residential development along and near the river, including a Honda manufacturing plant in Lincoln.

Logan Martin Lake is in northeast Alabama on the Coosa River, about 40 mi east of Birmingham (Figure E-1). The dam impounds a reservoir of approximately 15,300 ac with 275 mi of shoreline at the normal summer elevation of 465 ft (FERC, 2009). APC owns fee interest in lands up to the full-pool elevation of 465 ft and has a combination of fee and easement interest for flood storage above elevation 465 ft. The major shoreline land uses at Logan Martin Lake are residential, sensitive resources, and forest management (Table E-33). The reservoir shoreline is heavily developed by commercial and private entities (FERC, 2009). Besides Riverside and Lincoln, the largest cities near Logan Martin Lake are Pell City, AL to the west and Talladega, AL to the east. The Talladega Superspeedway is about 10 mi east of the lake. Recreational use of the lake includes watersports, boating, fishing, canoeing, and scenic viewing. The lake has private clubs, golf courses, and marinas and is heavily used by the public for recreation and private residences (FERC, 2009).

E.1.5.4.4 Lay Dam and Lake

Downstream of Logan Martin Dam along the Coosa River to Lay Lake is a mix of land uses, with agricultural land, forested land, industrial operations (an oil refinery, plastics manufacturing plant, power plant, pulp and paper mill, steel fabricator, and water treatment plant), low-density residential, and recreational use (golf course). Nearby communities include Childersburg, Fayetteville, Harpersville, Vincent, Talladega Springs, and Wilsonville, AL.

Lay Lake is in central Alabama on the Coosa River, about 50 mi north of Montgomery (Figure E-1). The dam is operated in a run-of-river mode (i.e., no flood storage) and impounds a reservoir of approximately 12,000 ac with 289 mi of shoreline at the normal summer elevation of 396 ft. The Lay Dam and Lake project occupies 133.5 ac of federal land administered by the Bureau of Land Management, most of which is inundated by the reservoir. APC recently purchased additional flowage easements on lands around Lay Lake (about 235 ac of land included within the project boundary) associated with APC's proposal to USACE to modify flood operations at the upstream Logan Martin Dam (FERC, 2009) (St. John, 2019).

The major shoreline land uses at Lay Lake are forest management and residential (Table E-33). The shoreline is developed extensively by commercial and private entities. Recreational facilities at Lay Lake include boat launches, marinas, boat slips, campgrounds, picnic areas, beaches, fishing piers, general piers, trails, and playgrounds (FERC, 2009).

E.1.5.4.5 Mitchell Dam and Lake

Downstream of Lay Dam along the Coosa River to Mitchell Lake is mostly forested land, with some small residential developments along the river. Alabama's 37,000-ac Coosa WMA is on Mitchell Lake, and APC owns 3,200 ac within that area that are reserved for hunting.

Mitchell Dam is in central Alabama, about 40 mi north of Montgomery, AL (Figure E-1). Nearby is the city of Clanton, AL and the community of Verbena, AL to the west, and the town of Rockford, AL to the east. Mitchell Dam is operated in run-of-river mode and impounds a 5,855-ac reservoir with 147 mi of shoreline at the normal summer elevation of 312 ft. The Mitchell Dam and Lake project occupies 127.3 ac of federal land administered by the Bureau of Land Management; most of which is inundated by the reservoir. Recreational facilities at Mitchell Lake include boat launches, marinas, boat slips, campgrounds, picnic areas, beaches, fishing piers, general piers, trails, and playgrounds. The major shoreline land uses at Mitchell Lake are forest management, sensitive resources, and residential (Table E-33). Mitchell Lake is relatively well developed and has several residential developments and commercial establishments (FERC, 2009).

E.1.5.4.6 Jordan Dam and Lake/Bouldin Dam

Downstream of Mitchell Dam along the Coosa River to Jordan Dam and Lake and Bouldin Dam, the land is mostly forested, with some small residential developments along the river and farmland mostly to the west and southwest. Jordan and Bouldin dams are in central Alabama, about 25 mi north of Montgomery, AL (Figure E-1). Nearby communities are Elmore, Holtville, Marbury, Mountain Creek, Titus, and Wetumpka, AL.

Jordan Lake, which supplies water to both Jordan and Bouldin powerhouses, is a 5,880-ac reservoir operated in run-of-river mode, with 118 mi of shoreline at the normal summer elevation of 252 ft (FERC, 2009). The major shoreline land uses around Jordan Lake are residential, forest management, and project operations (Table E-33). Land around Jordan Lake is well-developed both commercially and privately, while the Bouldin Dam area has one commercial recreational facility and a limited number of private residences. Recreational facilities around Jordan Lake include boat launches, marinas, boat slips, campgrounds, picnic areas, beaches, fishing piers, trails, and playgrounds (FERC, 2009).

APC recently purchased additional acreage for recreational use at Jordan Dam, adding 120 ac within the Jordan project boundary on the west side of the Coosa River about one-half mi downstream of the dam and allocated for barrier-free hunting opportunities for people with disabilities. APC purchased another 9 ac of land on the east side of the Coosa River about 1 mi downstream of Jordan Dam, also allocated for recreational use (FERC, 2009) (St. John, 2019).

E.1.6 Biological Resources

E.1.6.1 Vegetation Resources

The ACT River Basin contains portions of five Level III ecoregions (Griffith, et al., 2001), which are described in detail in the 2014 Final EIS for the ACT River Basin WCM Update (see Figure E-28). The ROI is primarily within the Ridge and Valley ecoregion (ecoregion 67); however, there are areas of Blue Ridge (ecoregion 66) and Piedmont (ecoregion 45) ecoregions along the edges of Allatoona Lake.

The primary vegetative communities in the ROI include the riverine and reservoir aquatic macrophyte communities and wetland communities.

E.1.6.1.1 Riverine and Reservoir Aquatic Macrophyte Communities

APC manages aquatic vegetation on its reservoirs to protect the ecology of the river and to comply with federal license requirements. Aquatic plant management activities include control and enhancement. During the FERC relicensing process, APC developed an Invasive Species Management Plan for each hydroelectric project with the assistance of stakeholders and federal and state agencies. The plans also include aquatic plant management guidelines (APC, 2018).

E.1.6.1.1.1 Emergent Aquatic Vegetation

Emergent aquatic vegetation is usually found along the shoreline and includes species where the majority of the plant is above the water line and can supports itself. Dominant freshwater marsh species in the ARC basin include giant reed (*Phragmities australis*) which is an invasive species, cattail (*Typha latifolia*), bulrushes (*Scirpus spp.*), sedges (*Carex spp.*), and spikerushes (*Eleocharis spp.*) (USACE Mobile District, 1998b). Nonnative freshwater emergent species that are common throughout Alabama include wild taro (*Colocasia esculenta*), parrotfeather, (*Myriophyllum aquaticum*) and torpedograss (*Panicum repens*) (Lovell, 2011). All of these nonnative species are considered invasive by the Alabama Invasive Plan Council. Species commonly found in reservoirs includes water willow (*Justicia americana*), water primrose (*Ludwigia peploides*), and alligator weed (*Alternanthera phyloxeroides*). Water willow is a native emergent plant that provides excellent habitat for aquatic organisms. Water primrose is a native plant that is rooted along the shoreline and forms floating mats. Alligatorweed is a nonnative, invasive species found rooted along the shoreline and forming a floating mat of erect stems (Lovell, 2011) (APC, 2018).

Coastal marches do not occur within the ROI but do occur in the ACT River Basin. The saline marshes of the Mobile-Tensaw Delta are dominated by smooth cordgrass (*Spartina alterniflora*) and black needlerush (*Juncus roemerianus*). Most of the saline marsh area is covered by black needlerush, and the seaward boundaries are dominated by smooth cordgrass. The brackish marshes occur farther inland and have less smooth cordgrass and black needlerush than the saline marshes. The brackish marshes are mostly made up of freshwater species such as sawgrass (*Cladium jamaicense*), club rush (*Eleocharis cellulosa*), and three-square bulrush (*Scirpus americanus*).

E.1.6.1.1.2 Submerged Aquatic Vegetation

Submerged aquatic vegetation (SAV) includes species where the entire plant is usually below the water line. Species commonly found in reservoirs includes hydrilla (*Hydrilla verticillata*) and Eurasian watermilfoil (*Myriophyllum spicatum*). Hydrilla is a nonnative plant that aggressively outcompetes native plants and reduces DO levels. Eurasian watermilfoil is a fast-growing, nonnative plant that can quickly overtake a lake and outcompete native vegetation (Lovell, 2011) (APC, 2018) . Both species are considered invasive by the Alabama Invasive Plan Council. Other freshwater submerged vegetation that is common throughout Alabama includes coontail (*Ceratophyllum demersum*), muskgrass (*Chara spp.*), slender spikerush (*Eleocharis baldwinii*), creeping rush (*Juncus repens*), variable watermilfoil (*Myriophyllum heterophyllum*), southern naiad (*Najas guadalupensis*), spiny-leaf naiad (*Najas minor*), stonewort (*Nitella spp.*), variable-leaf pondweed (*Potamogeton diversifolius*), long-leaf pondweed (*Potamogeton nodosus*), and widgeongrass (*Ruppia spp.*), bladderworts (*Utricularia spp.*), eel grass (*Vallisneria americana*), and horned pondweed (*Zannichellia palustris*).

E.1.6.1.1.3 Floating Aquatic Vegetation

Freshwater plants that grow as floating aquatic vegetation (FAV) include those with only the leaves floating and others with the entire plant floating (Lovell, 2011). The leaf-floating group includes one considered nonnative and four species native to Alabama—the yellow floating heart (*Nymphoides peltata*) is the nonnative; and the native species are the watershield (*Brasenia schreberi*), American lotus (*Nelumbo spp.*), spatterdock (*Nuphar luteum*), and fragrant water lily (*Nymphaea odorata*). Four Alabama-native whole-plant FAV species are mosquito fern (*Azola caroliniana*), potentially several species of duckweed (*Lemna spp.*), giant duckweed (*Spirodela polyrhiza*), and potentially several species of watermeal (*Wolffia spp.*). Two whole-plant FAV species are nonnative and are considered invasive by the Alabama Invasive Plan Council: water hyacinth (*Eichhornia crassipes*) and water lettuce (*Pistia stratiodes*). Both species, which are commonly found in reservoirs (APC, 2018), are nonnative floating plants with extremely high-growth and reproductive rates. They form mats that reduce water quality, make navigation more difficult, and increase mosquito reproduction.

E.1.6.1.2 Wetland Communities

Wetlands are transitional lands between terrestrial and aquatic habitats. As defined by USACE, wetlands are:

> …those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (USACE Mobile District, 1987).

Wetland communities found within the ROI are primarily palustrine wetlands, nontidal wetlands commonly dominated by trees, shrubs, persistent or emergent species, and emergent mosses or lichens. The majority of wetlands in the ACT River Basin are forested palustrine wetlands in the floodplains of rivers. The basin comprises approximately 273,595 ac of palustrine wetlands (USFWS NWI, 2018). The Alabama River subbasin contains the majority of the palustrine wetlands in the ACT River Basin (86 percent), and the Coosa and Tallapoosa river subbasins each have approximately equal shares of the remaining 14 percent.

Within the ROI, there are approximately 223,413 ac of wetlands and deepwater habitats in the Coosa River subbasin and approximately 39,162 ac of wetlands and deepwater habitats in the Etowah River subbasin (USFWS NWI, 2018). The majority of this acreage comprises deepwater habitats such as lakes and rivers. Freshwater emergent wetland, freshwater forested/shrub wetland, and freshwater pond are all considered types of palustrine wetlands. Most of the palustrine wetlands are found in the riparian (river-associated) areas along the edges of streams and rivers, and they depend on natural flooding to maintain the water and habitat quality of the riverine ecosystems. Other palustrine wetlands in the ACT River Basin occur along and are influenced by reservoirs. Table E-34 provides a breakdown of the acreage of different wetland and deepwater types by subbasin, as calculated from the USFWS National Wetland Inventory (USFWS NWI, 2018).

The palustrine wetlands in the ACT River Basin largely consist of riparian forested areas, or *bottomland hardwoods*. Dominant tree species found in bottomland hardwoods include water tupelo *(Nyssa aquatica*), bald cypress (*Taxodium distichum*), Carolina ash (*Fraxinus caroliniana*), swamp tupelo (*Nyssa sylvatica*), red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), overcup oak (*Quercus lyrata*), plantertree (*Planera aquatica*), green ash (*Fraxinus pennsylvanica*), and water hickory (*Carya aquatica*) (USACE Mobile District, 1998b).

Table E-34. Wetland and Deepwater Habitat Acreages in the Coosa and Etowah River Subbasins

Wetland or deepwater type	Acres
Upper Coosa (Etowah River to Weiss Lake)	
Freshwater Emergent Wetland	1,405
Freshwater Forested/Shrub Wetland	7,698
Freshwater Pond	3,323
Lake	31,358
Riverine	10,826
Total	**54,609**
Middle Coosa (Weiss Lake Dam to Logan Martin Lake)	
Freshwater Emergent Wetland	4,885
Freshwater Forested/Shrub Wetland	36,661
Freshwater Pond	7,235
Lake	31,881
Riverine	15,614
Total	**96,276**
Lower Coosa (Logan Martin Dam to confluence with the Tallapoosa River)	
Freshwater Emergent Wetland	2,060
Freshwater Forested/Shrub Wetland	30,758
Freshwater Pond	4,060
Lake	25,483
Riverine	10,167
Total	**72,528**
Etowah	
Freshwater Emergent Wetland	872
Freshwater Forested/Shrub Wetland	8,698
Freshwater Pond	5,046
Lake	14,375
Riverine	10,171
Total	**39,162**

E.1.6.2 Wildlife Resources

This section is focused on the wildlife resources in the ACT River Basin, specifically those species known or likely to occur in riparian or wetland areas. Fish and aquatic resources are discussed separately in Section E.1.6.3. The ROI is limited to aquatic, riparian, and wetland communities due to the current water control measures along the Coosa and Etowah rivers. Because flow in those rivers is controlled at the hydroelectric dams, the rivers and reservoirs are not expected to inundate upland areas beyond the river banks and managed reservoir pool elevations

except in the case of catastrophic flooding. The 2014 Final EIS for the ACT River Basin WCM Update discusses wildlife that inhabits the ACT River Basin in detail, including birds, mammals, reptiles, and amphibians known or with the potential to occur in at least a portion of the basin.

Because riparian zones form the interface between aquatic and terrestrial components of the landscape, many important ecological connections are maintained by their protection and enhancement. Maintaining floodplain connectivity is critical not only to provide appropriate moisture regimes to vegetative communities in the surrounding landscape, but also to support the wildlife assemblages dependent on the vegetation for habitat and nutritional resources.

E.1.6.2.1 Birds

There are approximately 142 species of birds known to occur in, or potentially inhabit areas of, the ACT River Basin (USGS, 2003a) (AL-GAP, 2010). Riparian forests typically support a wide diversity of birds; however, the exact makeup of a bird assemblage depends on specific characteristics of the forest.

Various raptors prefer living and hunting in riparian hardwood forests, including the Mississippi kites (*Ictinia mississippiensis*) and American swallow-tailed kites (*Elanoides forficatus*), bald eagles (*Haliaeetus leucocephalus*), and ospreys (*Pandion haliaetus*). The nesting population of bald eagles has been growing in Georgia. A 2017 survey conducted by GADNR documented a record 218 nests across the state. In Georgia, bald eagles are commonly seen on barrier islands, and on large reservoirs and rivers. Eagles are especially abundant on Allatoona Lake (GADNR, 2019b). Ospreys also nest near open water. In 1995, a pair of ospreys built a nest near the Victoria Day Use Area on Allatoona Lake. According to GADNR biologists, it was one of only two known nests in north Georgia at the time. In 1998 USACE partnered with the Georgia Power Company to create a lasting habitat for ospreys at Allatoona Lake. Six locations were selected around the margins of the lake on which to erect poles with nesting platforms on top. Today, all six platforms are still in use on the lake and are frequently used. It is estimated that 8–10 nesting osprey pairs are found on Allatoona Lake each year (USACE Mobile District, 2018).

Wood storks (*Mycteria americana*), purple gallinules (*Porphyrio martinicus*), and moorhens (*Gallinula chloropus*) rely on aquatic areas for habitat and for foraging zones; in addition, wood storks require tall cypress and hardwoods for nesting spots. Bottomland hardwood forests support a diverse bird assemblage, which can include Prothonotary (*Protonotaria citrea*), Swainson's (*Limnothlypis swainsonii*), northern parula (*Setophaga americana*), Kentucky (*Geothlypis formosa*), and hooded (*Setophaga citrina*) warblers, some of which nest in cavities of trees killed by floods (the Prothonotary warblers) or prefer bottomland understory thickets (the Swainson's warbler) or Spanish moss (the northern parula warbler) (Dickson & Warren, 1993). Many of the species mentioned above, including all of the raptors, the wood stork, moorhen, Prothonotary warbler, and Swainson's warbler are protected under the Migratory Bird Treaty Act. Numerous other species that could potentially inhabit areas of the ACT River Basin are also protected under this Act. Four birds in Alabama are considered exotic, all of which are found in the ACT River basin: the house sparrow (*Passer domesticus*), rock dove (*Columbia livia),* Eurasian collared dove (*Streptopelia decaocto*), and European starling (*Sturnus vulgaris*) (ADCNR, 2019e).

E.1.6.2.2 Mammals

Approximately 68 species of mammals actually or potentially inhabit riparian and/or upland areas in the ACT River Basin (USGS, 2003a) (AL-GAP, 2010). In addition to the larger species such as black bear (*Ursus americana*), white-tailed deer (*Odocoileus virginianus*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), wild pig (*Sus scrofa*), red fox (*Vulpes vulpes*), and American beaver (*Castor canadensis*), several species each of bats, squirrels, shrews and voles, otters, skunks, and mice are included. The extent to which each species uses riparian habitat differs depending on specific life history traits, especially requirements for food, cover, protection from natural enemies, and refuge from extreme weather events. There are six exotic mammal species that have been introduced in Alabama that likely occur within the ACT River Basin: the black rat (*Rattus rattus*), Norway rat (*Rattus norvegicus*), house mouse

(*Mus musculus*), nutria (*Myocastor coypus*) , fallow deer (*Dama dama*), and feral swine (*Sus scrofa*) (ADCNR, 2019e).

Habitat features often present in riparian areas such as ample forage, fruits, seeds, downed logs, debris, and stumps have been found to be positively correlated to the abundance and diversity of small mammals. Three species of squirrels—eastern gray squirrel (*Sciurus carolinensis*), eastern fox squirrel (*S. niger*), and southern flying squirrel (*Glaucomys volans*)—have a solid association with riparian woodlands (Dickson & Warren, 1993).

E.1.6.2.3 Reptiles

The diversity of reptile fauna known or likely to occur in the ACT River Basin is reflected by approximately 81 species (USGS, 2003a) (AL-GAP, 2010), including the American alligator (*Alligator mississippiensis*), common and alligator snapping turtles (*Chelydra serpentine* and *Macroclemys temmincki*, respectively), 24 other turtles and tortoises, 46 species of snakes (of which six are venomous), the green anole (*Anolis carolinensis*), six skinks, and five lizards. Many reptiles are associated with riparian areas because of their reliance on the moisture and/or on the locations of food sources, whether they are predators or herbivores. Four exotic lizard species have established populations in south Alabama and may occur within the ACT River Basin: the Turkish house gecko (*Hemidactylus turcicus*), Indo-Pacific gecko (*Hemidactylus garnotii*), Texas horned lizard (*Phrynosoma cornutum*), and brown anole (*Norops sagrei*) (ADCNR, 2019e).

E.1.6.2.4 Amphibians

Amphibians are represented by approximately 57 species known or likely to occur in the ACT River Basin (USGS, 2003a) (AL-GAP, 2010). Salamanders and frogs are the most diverse groups of amphibians in the basin. There are 27 species of salamanders representing nine genera. *Eurycea*, *Desmognathus*, and *Ambystoma* have eight, five, and four species, respectively. These genera include species such as the Southern two- and three-lined, long-tailed, cave, blackbelly, flatwoods, seepage, tiger, and dwarf salamanders. The 21 frog species are in the genera *Rana*, *Hyla*, *Pseudacris*, and *Acris*; this group includes species such as the southern leopard, wood, pickerel, and gopher frogs. There are six tree frogs of the genus *Hyla*—the bird-voiced (*H. avivoca*), Cope's gray (*H. chrysoscelis*), green (*H. cinerea*), pinewoods (*H. femoralis*), barking (*H. gratiosa*), and squirrel (*H. squirella*). The three chorus frogs (*Pseudacris*) are the southern (*P. nigrita*), western (*P. triseriata*), and ornate (*P. ornata*) chorus frogs. Other than the salamanders and frogs, there are three toads, two sirens, two- and three-toed amphiuma, one newt, the hellbender (*Cryptobranchus alleganiensis*), and the Alabama waterdog (*Necturus alabamensis*). Although some salamanders and frogs can be found in upland areas, most amphibians require nearly constant contact with moisture for most of their life cycle, if not for their entire life cycle.

E.1.6.3 Fish and Aquatic Resources

This section describes the current state of fish and aquatic resources in the ROI within the Coosa River and Etowah River basins, with a focus on riverine and reservoir community resources with a potential to be affected by changes in ACT River Basin operations.

E.1.6.3.1 Riverine

Coosa River Subbasin

The mainstem of the Coosa River forms at the confluence of the Etowah and Oostanaula rivers in Georgia and runs 255 mi into and through Alabama (Figure E-1). APC dams impound approximately 238 mi of the Coosa River before it meets the Tallapoosa River to form the Alabama River, effectively, fragmenting the few remaining reaches of free-flowing riverine habitat found in the subbasin.

The subbasin contains approximately 147 fish species, including several that are unique to the Coosa River: the pygmy sculpin (*Cottus paulus*), holiday darter (*Etheostoma brevirostrum*), Coosa darter (*Etheostoma coosae*), coldwater darter (*Etheostoma ditrema*), trispot darter (*Etheostoma trisella*), as well as some species that are unique to the Coosa River and only found in Georgia: the Etowah darter (*Etheostoma etowahae*), Cherokee darter (*Etheostoma scotti*), amber darter (*Percina antesella*), and Conasauga logperch (*Percina jenkinsi*) .

Lake sturgeon (*Acipenser fluvesens*) is a state-protected species in Georgia (S1–Critically Imperiled) that has disappeared from much of its original range, including the Coosa River. Through collaborative efforts between several state and federal agencies, GADNR has released more than 85,000 fingerlings to the Coosa River in northwest Georgia since December 2002 in an effort to return the lake sturgeon to a healthy, self-sustained population in the river (GADNR, 2018c). The University of Georgia, Warnell School of Forest Resources monitored the initial success of the lake sturgeon reintroduction using radiotelemetry and population assessment techniques. Study results indicated that the lake sturgeon is using the Coosa River from Rome downstream into, and throughout, Weiss Lake. Recent angler reports indicate the fish have moved further downstream to H. Neely Henry and Logan Martin lakes in Alabama. The sturgeon move seasonally, ranging throughout the lakes and river in the winter and moving upstream in mid-to-late summer. The sturgeon can occasionally be found in the Etowah River as well.

The Coosa River subbasin is home to approximately 91 species of aquatic snails, of which 82 are endemic to the subasin, meaning they are native and restricted to that place. In 2004, ADCNR researchers discovered two species of snails previously thought to be extinct— the cobble elimia (*Elimia vanuxemiana*) and the teardrop elimia (*Elimia lachryma*) — in a stretch of the Coosa River between Logan Martin Lake and H. Neely Henry Lake (MBRC, 2005). Approximately 53 freshwater mussel species also have been documented in the subbasin, 11 of which are endemic to the Coosa River subbasin (USACE Mobile District, 1998b) (ADCNR, 2019b).

Although seven dams impound most of the river (Jordan and Bouldin dams share a single reservoir), some significant reaches of free-flowing riverine habitat on the mainstem Coosa River remain (USACE Mobile District, 1998b):

- An 8-mi reach of free-flowing habitat extends from Jordan Dam and Lake downstream to the lower Coosa River. The tailwaters of Jordan Dam and Lake support the federally listed endangered tulotoma snail (*Tulotoma magnifica*) (DeVries, et al., 2003) and the federally threatened finelined pocketbook mussel (*Hamiota altilis*). This reach also supports many important local recreational fish species, including in a regional spotted bass fishery.
- A 21-mi reach of bypassed historic Coosa River channel that extends downstream from Weiss Lake is a free-flowing segment of that river caused by the diversion of flow at the dam for hydropower generation. Recent surveys have documented 53 fish species within the bypassed reach (FERC, 2009). Fish community diversity is highest downstream of Terrapin Creek, comprising species typically associated with rapidly moving fresh water—bronze darter (*Percina palmaris*), greenbreast darter (*Etheostoma jordani*), tricolor shiner (*Cyprinella trichroistia*), riffle minnow (*Phenacobius catostomus*), and southern studfish (*Fundulus stellifer)*. Slower moving waters upstream of Terrapin Creek are dominated by species in the sunfish family, including bluegill (*Lepomis macrochirus*) and redear sunfish (*Lepomis microlophus*).
- A 9-mi, free-flowing reach extends from Rome, GA, downstream to the headwaters of Weiss Lake. The reach provides potential habitat for upstream migration by striped bass and other game fish. GADNR issued a fish consumption advisory in 1996 from elevated PCB levels of fish tissues.

Etowah River Subbasin

The Etowah River originates as a high-gradient stream in the Blue Ridge province of the Southern Appalachian Mountains and flows approximately 69 mi westward through Piedmont upland to Allatoona Lake. Habitat loss and modifications resulting from impoundments, timbering, agriculture, gold mining, and urban development have

caused at least 35 mussel species and seven fish species to be extirpated from the Etowah River subbasin. The upper mainstem and tributaries of the Etowah River support the federally endangered amber darter and Etowah darter, and the federally threatened Cherokee darter.

In monitoring of the 1,120-sq-mi upper Etowah River Basin draining into Allatoona Lake by the Lake Allatoona/Upper Etowah River Watershed Partnership, the benthic macroinvertebrate assemblage (which includes aquatic insects, crustaceans, worms, and snails) was used as an indicator of overall ecological condition. Through 3 years of sampling and analysis (2005–07), approximately 43 percent of the stream channel miles in the upper watershed were assessed (686 mi out of 1,613 mi) (Stribling, Hill, Davie, Jokay, & Miller, 2006) (Millard, Stribling, Jokay, Moiz, & Davie, 2007) (Millard, Stribling, Jokay, & Davie, 2008). Of those, the structure and function of the benthic macroinvertebrate assemblage show that there are 271 mi of biologically degraded streams (LAUE, 2009). Cumulatively, there have been 421 taxa (primarily, genera) of benthic macroinvertebrates collected, of which approximately 37 percent are considered stressor sensitive. Biological degradation is attributed to physical and chemical stressors produced by the habitat loss and land use/land cover conversions discussed in the preceding paragraph.

The lower Etowah River extends 48.6 mi from Allatoona Lake to its confluence with the Oostanaula River, forming the Coosa River in Rome, GA (Figure E-1). Historically, the lower Etowah River contained more than 91 native fish species, including lake sturgeon and at least 51 mussel species. Most federal and state endangered fish species within the Etowah River subbasin are found in the upper Etowah River (above Allatoona Lake) and, to a lesser extent, in the lower Etowah River. Nevertheless, the Cherokee darter, listed as threatened by the USFWS, has been documented in several tributaries of the lower Etowah River (Freeman & Wenger, 2000).

In the lower Etowah River, between Allatoona Dam and the confluence with the Oostanaula River at Rome, common fish species include carp, smallmouth buffalo, redhorse suckers, blue catfish, channel catfish, striped bass, redbreast sunfish, bluegill, redear sunfish, redeye bass, spotted bass, largemouth bass, and freshwater drum (GADNR, 2018b). Catfish are common in the river with channel catfish being the most abundant and blue catfish second in abundance. Flathead catfish are also present. Striped bass use the river seasonally as a cool-water refuge. The remainder of the year, cooler water temperatures allow the fish to disperse downstream into Lake Weiss and very few fish remain in the river. Bass, bream, and crappie inhabit the river year-round, but fishing is best in the cooler waters of spring and fall. Spotted bass are the most prevalent black bass species; however, redeye and largemouth bass are also present. Bluegill are the most abundant pan fish, but there are also good numbers of redbreast sunfish, green sunfish, and redear sunfish. Freshwater drum are abundant in the river.

E.1.6.3.2 Reservoirs

Coosa River Subbasin

Weiss Lake is fertile and shallow, making it very productive for fish. Known as the "crappie fishing capital of the world," it offers outstanding fishing for largemouth bass and striped bass (ADCNR, 2018).

H. Neely Henry Lake is a popular area for recreational fishing. Fishing for largemouth bass and spotted bass is excellent. Locally renowned for its crappie fishing, H. Neely Henry Lake is starting to receive recognition for its striped bass fishing as well (ADCNR, 2018).

Logan Martin Lake is popular for Alabama spotted bass and largemouth bass fishing (ADCNR, 2018). Bass clubs in Alabama and neighboring states submit their tournament results to help ADCNR manage their resource. White, hybrid and striped bass make annual spring runs upriver and have created quite a fishery at the headwaters (below Neely Henry dam). The striped bass fishery fluctuates depending upon 1) reproduction and migration of striped bass down the Coosa River from Weiss Lake and 2) stocking success into Logan Martin Lake. Striped bass and hybrid striped bass will continue to be stocked at three to five fish per acre each year (ADCNR, 2019d).

Etowah River Subbasin

Allatoona Dam impounds approximately 30 mi of the Etowah River and creates approximately 11,862 ac of reservoir habitat. Allatoona Lake is used for recreational fishing. GADNR develops a list each year of the best bets for fishing prospects based on sampling efforts by its Wildlife Resources Division and on knowledge of past fishing trends, fishing experiences, and discussions with anglers and marina owners. For 2018, the most likely fishing prospects included striped bass, hybrid striped bass, white bass, and crappie (GADNR, 2018a).

E.1.6.4 Protected Species

This section presents information on federal and state protected species that could be affected by changes in reservoir depths and water allocation. The ACT River Basin supports a wide variety of wildlife and is home to approximately 230 species that are protected by the federal government and the states according to a 1998 Draft EIS (USACE Mobile District, 1998b) and the 2003 Biological Assessment (USACE Mobile District, 2003) addressing project operations in the ACT River Basin. This updated study focuses on the Coosa River and Etowah River basins, which includes the ROI. According to recent USFWS Official Species Lists, there are 54 federally protected species associated with these river basins, which have the greatest potential to be affected by changes in basin operations (USFWS, 2019a) (USFWS, 2019b) (USFWS, 2019c). These species are listed in Table E-35, with their state status. Of the 54 potentially affected species, 19 are endemic to the ACT River Basin.

Sensitive species are unique plants and animals that have been observed to be declining toward extinction. Using available scientific research, state, federal, and nongovernmental organizations have assigned conservation priority to many rare and declining species. The most significant protection for sensitive species is the Endangered Species Act (ESA) (16 U.S.C. 1531 *et seq*.), passed in 1973 (and significant amendments made in 1978, 1982, 1988, and 2004) to address concerns about declining populations. The law offers two classes of protection for rare species—endangered and threatened. *Endangered status* indicates the species is in danger of extinction throughout all or a significant portion of its range. *Threatened status* indicates the species is likely to become endangered within the foreseeable future. All species of plants and animals, except pest insects, are eligible for listing as federally endangered or threatened. All federal agencies are required to protect threatened and endangered (T&E) species while carrying out projects and to preserve (T&E) species habitats on federal land (USFWS, 2001). Because it is unlawful to hunt or collect T&E species, habitat degradation is the primary reason for population declines in listed species (USFWS, 2001).

Under the ESA, it is illegal to *take* T&E species. As defined in the ESA:

> …the term *take* means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct.

The Secretary of the Interior, through regulations, defined the term *harm* in that passage as:

> …an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.

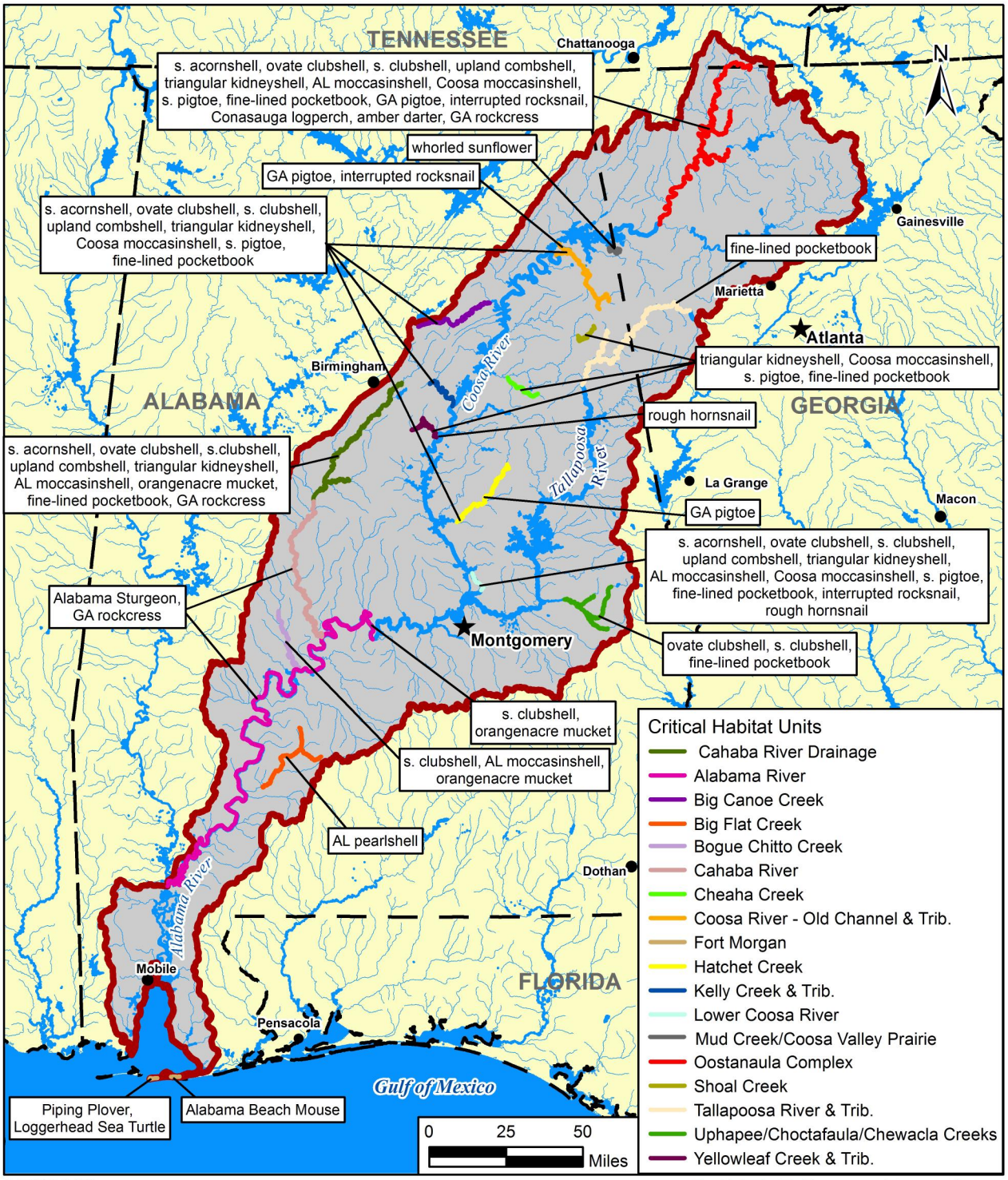
Critical habitat is defined in the ESA. Species listed as threatened or endangered under the ESA are afforded protection within specific areas of their geographic range that offer physical or biological features essential to their conservation and that may require special management considerations. Habitat not used by the species may also be included if it is deemed necessary for recovery. Proposed designations and the final determination of critical habitat are published in the *Federal Register*. Critical habitat for all federally protected species in the ACT River Basin, as designated based on the USFWS Threatened & Endangered Species Active Critical Habitat Report, is shown in Figure E-38 (USFWS, 2019d). Critical habitat for aquatic species associated with the Coosa River and Etowah River basins is discussed below.

Table E-35. Federally Protected Species Occurring in the Coosa and Etowah Subbasins of the ACT River Basin

Scientific name	Common name	Endemic[a]	Federal status[b]	Alabama status[b]	Tennessee status[b]	Georgia status[b]
Mammals						
Myotis grisescens	Gray Bat	—	E	SP	—	E
Myotis sodalis	Indiana Bat	—	E	SP	—	E
Myotis septentrionalis	Northern Long-Eared Bat	—	T	SP	—	T
Birds						
Picoides borealis	Red-Cockaded Woodpecker	—	E	SP	—	—
Mycteria americana	Wood Stork	—	T	SP	—	—
Reptiles						
Glyptemys muhlenbergii	Bog Turtle	—	SAT	—	—	E
Sternotherus depressus	Flattened Musk Turtle	Y	T	SP	—	—
Amphibians						
Necturus alabamensis	Black Warrior (=sipsey Fork) Waterdog	—	E	SP	—	—
Fish						
Percina antesella	Amber Darter	—	E	—	—	E
Cyprinella caerulea	Blue Shiner	Y	T	SP	—	E
Notropis cahabae	Cahaba Shiner	—	E	SP	—	—
Etheostoma scotti	Cherokee Darter	Y	T	—	—	T
Percina jenkinsi	Conasauga Logperch	Y	E	—	—	E
Etheostoma etowahae	Etowah Darter	Y	E	—	—	E
Percina aurolineata	Goldline Darter	Y	T	SP	—	E
Etheostoma phytophilum	Rush Darter	—	E	SP	—	—
Percina tanasi	Snail Darter	—	T	—	—	E
Etheostoma trisella	Trispot Darter	Y	T	—	T	E
Etheostoma chermocki	Vermilion Darter	—	E	SP	—	—
Clams						
Medionidus acutissimus	Alabama Moccasinshell	—	T	SP	—	T
Medionidus parvulus	Coosa Moccasinshell	Y	E	SP	—	E
Pleurobema furvum	Dark Pigtoe	—	E	—	—	—
Lampsilis altilis	Finelined Pocketbook	—	T	—	—	—
Pleurobema hanleyianum	Georgia Pigtoe	Y	E	SP	—	E
Lampsilis perovalis	Orangenacre Mucket	—	T	—	—	—
Pleurobema perovatum	Ovate Clubshell	—	E	SP	—	—
Epioblasma othcaloogensis	Southern Acornshell	Y	E	SP	—	—

Scientific name	Common name	Endemic[a]	Federal status[b]	Alabama status[b]	Tennessee status[b]	Georgia status[b]
Pleurobema decisum	Southern Clubshell	—	E	SP	—	E
Pleurobema georgianum	Southern Pigtoe	Y	E	SP	—	E
Ptychobranchus greenii	Triangular Kidneyshell	—	E	SP	—	E
Epioblasma metastriata	Upland Combshell	—	E	SP	—	—
Snails						
Lioplax cyclostomaformis	Cylindrical Lioplax (snail)	Y	E	SP	—	—
Leptoxis foremani	Interrupted (=georgia) Rocksnail	Y	E	SP	—	E
Elimia crenatella	Lacy Elimia (snail)	Y	T	SP	—	—
Leptoxis taeniata	Painted Rocksnail	Y	T	SP	—	—
Leptoxis plicata	Plicate Rocksnail	—	E	SP	—	—
Pleurocera foremani	Rough Hornsnail	Y	E	SP	—	—
Tulotoma magnifica	Tulotoma Snail	Y	T	SP	—	—
Flowering Plants						
Sarracenia rubra ssp. alabamensis	Alabama Canebrake Pitcher-Plant	Y	E	—	—	—
Clematis socialis	Alabama Leather Flower	Y	E	—	—	E
Spigelia gentianoides	Gentian Pinkroot	—	E	—	—	—
Arabis georgiana	Georgia Rockcress	—	T	—	—	T
Sarracenia oreophila	Green Pitcher-Plant	—	E	—	—	E
Ptilimnium nodosum	Harperella	—	E	—	—	—
Sagittaria secundifolia	Kral's Water-Plantain	—	T	—	—	T
Scutellaria montana	Large-Flowered Skullcap	—	T	—	—	T
Rhus michauxii	Michaux's Sumac	—	E	—	—	E
Marshallia mohrii	Mohr's Barbara's Buttons	—	T	—	—	T
Isotria medeoloides	Small Whorled Pogonia	—	T	—	—	T
Helonias bullata	Swamp Pink	—	T	—	—	T
Xyris tennesseensis	Tennessee Yellow-Eyed Grass	—	E	—	—	E
Spiraea virginiana	Virginia Spiraea	—	T	—	—	T
Platanthera integrilabia	White Fringeless Orchid	—	T	—	—	T
Helianthus verticillatus	Whorled Sunflower	—	E	—	—	E

Sources: (USFWS, 2019b) (USFWS, 2019c) (USFWS, 2019a) (USFWS, 2018) (ANHP, 2017) (GADNR, 2019a) (TWRA, 2019) (Tennessee Department of State, 2016).
Notes:
a. Y = endemic to ACT River Basin.
b. Status. E = listed as endangered; SAT = similarity of appearance, threatened; SP = state protected; T = threatened.



ACT River Basin - Critical Habitat Units

Figure E-38

Source: USFWS GIS 2019.

Critical habitat has been established in the Coosa River subbasin for several mussel and snail species, including Alabama moccasinshell (*Medionidus acutissimus*), Coosa moccasinshell (*M. parvulus*), finelined pocketbook (*Lampsilis altilis*), Georgia pigtoe (*Pleurobema hanleyianum*), interrupted rocksnail (*Leptoxis foreman*), ovate clubshell (*Pleurobema perovatum*), rough hornsnail (*Pleurocera foremani*), southern acornshell (*Epioblasma othcaloogensis*), southern clubshell (*Pleurobema decisum*), southern pigtoe (*Pleurobema georgianum*), triangular kidneyshell (*Ptychobranchus greenii*), upland combshell (*E. metastriata*).

Critical habitat has been established in the Etowah River subasin for several mussel and snail species, including Georgia pigtoe, interrupted rocksnail, southern acornshell, ovate clubshell, southern clubshell, upland combshell, triangular kidneyshell, Alabama moccasinshell, Coosa moccasinshell, southern pigtoe, and finelined pocketbook. Critical habitat also has been established for a single fish species in the Etowah River Basin, the amber darter.

E.1.6.4.1 Protected Mammal Species

There are three federally listed mammals in the ACT River Basin that could be affected by changes in basin operations (Table E-35).

E.1.6.4.1.1 Gray Bat (Myotis grisescens)

The gray bat roosts and hibernates exclusively in suitable caves in the southeastern US. Less than 5 percent of available caves in the region have the right properties of temperature, humidity, and structure to make them suitable for gray bat occupation. Most foraging occurs within 16 ft of the surface over open water near a forested shoreline. The bats will forage 12 mi or more from the roost sites and seem to prefer traveling within forested areas.

In Georgia, gray bats are known to occupy only three caves regularly during the summer in Catoosa, Chattooga, and Walker counties. The most important caves to gray bats, those that house large populations, are found in Alabama, Arkansas, Kentucky, Missouri, and Tennessee. (GADNR, 2009a). Gray bats are known from approximately 40 cave systems in 11 counties in northern Alabama (USACE ERDC, 2007). Shelby county is the only one of these counties that borders the Coosa River.

E.1.6.4.1.2 Indiana Bat (Myotis sodalis)

The Indiana bat is known to occur throughout much of the midwestern and eastern United States. The species has been virtually eliminated from much of its former range. Indiana bats gather in large groups in suitable caves to hibernate, with more than 85 percent of the population in just nine caves in Indiana, Kentucky, and Missouri. There are very few records of this species in Georgia, and no known occupied habitat. It has been documented in Georgia in only two caves in Dade County in the northwestern part of the state. The Georgia records are from fall and winter collections. During the summer, Indiana bats roost in trees, usually under loose, exfoliating bark as found on shagbark hickories and dead hardwoods, or in hollow trees. The roost sites are typically at a woodland edge where the trees are warmed by the sun. The bats forage in the surrounding riparian, floodplain, and upland forest, and sometimes over open areas and water as well. There are no known significant hibernacula (that is, with large numbers of bats) in Georgia for this species. The Georgia records are from fall and winter collections; the nearest known maternity colonies are in southern Kentucky (GADNR, 2009b). A 2017 USFWS Indiana bat population status update estimates the Indiana Bat population in Georgia to be 1 based on winter surveys of conducted in January and February of 2017 at known Priority 1 and 2 hibernacula (USFWS, 2017).

E.1.6.4.1.3 Northern Long-Eared Bat (Myotis septentrionalis)

The northern long-eared bat is known to occur throughout southern Canada and the central and eastern United States. It is more common in the northern part of its range and has only been documented in northern and western Georgia. Populations of northern long-eared bats in Georgia are small and widely distributed. Most summer roosts occur in tree cavities and under exfoliating bark, but they have also been found in buildings and behind shutters.

During winter, northern long-eared bats hibernate in tight crevices in caves and mines. They tend to forage in the canopy of floodplain forests and wooded hillsides (GADNR, 2015).

E.1.6.4.2 Protected Bird Species

There are two federally listed birds in the ACT River Basin that could be affected by changes in basin operations (Table E-35).

E.1.6.4.2.1 Wood Stork (Mycteria americana)

Historically, the breeding range of the wood stork (federally listed as endangered) spanned the southeastern US, extending from South Carolina to Texas (USFWS, 1997). Today, breeding is limited to coastal areas of Florida, Georgia, and South Carolina. Post-breeding storks generally disperse, occasionally occurring as far north as North Carolina and as far west as Alabama and Mississippi (USFWS, 1997). In Alabama, the species is known to forage during summer and early fall in the western Inland Coastal Plain near the Tombigbee River and lakes in Hale, Marengo, and Perry counties; at ponds near Montgomery, AL; and at Eufaula National Wildlife Refuge (ADCNR, 2019f).

E.1.6.4.2.2 Red-Cockaded Woodpecker (Picoides borealis)

The red-cockaded woodpecker (federally listed as endangered) historically inhabited open pine forest from Maryland, New Jersey, and Virginia to Florida. Their range also extended west to Texas and north to parts of Kentucky, Missouri, Oklahoma, and Tennessee. Due to the drastic decline of the longleaf pine ecosystem, the red-cockaded woodpecker has disappeared from much of its original range. The current range extends from Florida to Virginia and west to Oklahoma and eastern Texas. In Alabama, most of the red-cockaded woodpeckers are found in the Conecuh, Oakmulgee, and Talladega National Forests (ADCNR, 2014c).

E.1.6.4.3 Protected Fish Species

There are 10 federally protected fish species in the ACT River Basin that could be affected by changes in basin operations (Table E-35). That group consists of darters and shiners. One federally protected fish species in the basin that was addressed in the Final EIS for the ACT River Basin WCM update (USACE Mobile District, 2014d) has been removed from this Draft FR/SEIS based on additional information. The pygmy sculpin is found only in Coldwater Spring and the spring run, well above, by several tributary watersheds, the Coosa River. The federally protected species are described below. In rivers, preferred habitat is deep mid-river areas and pools, where water depths vary between 4 and 9 meters (m), often with a continuous strong flow and occasional periods of sustained flooding (NatureServe, 2019e).

E.1.6.4.3.1 Amber Darter (Percina antesella)

The amber darter (federally listed as endangered) is endemic to the Conasauga and Etowah river systems in the upper Coosa River system. The amber darter was first discovered in 1948 in Shoal Creek (Cherokee County, GA), a tributary to the Etowah River that now flows into Allatoona Reservoir. Subsequent collection efforts in the Etowah River system yielded only a single specimen until the early 1990s, when amber darters were discovered at eight localities in the mainstem Etowah River upstream of Allatoona Reservoir and in the lower portion of Sharp Mountain Creek (a tributary to the Etowah River in Cherokee County). In June 1993, the amber darter was rediscovered in the lower portion of Shoal Creek, upstream from the 1948 locality and just above the area influenced by the Allatoona Reservoir. More recently, the amber darter has been found along the Etowah River from near the mouth of Amicalola Creek downstream to Canton, GA. The amber darter also occurs in an approximate 55 km reach of the Conasauga River, from the vicinity of the U.S. 411 bridge in Polk County, TN to the vicinity of Browns Bridge Road outside of Dalton, GA (Murray and Whitfield Counties). A single amber darter was collected in the Coosawattee River, downstream of Carter's Lake Reservoir, in 2010. Amber darters occur in riffles or shoals with

cobble and gravel, and moderate to swift currents, typically 30-70 cm/sec. They are often found in shoals with the submerged aquatic macrophyte, riverweed (*Podostemum ceratophyllum*). Amber darters rarely occur in very shallow or low-velocity areas, or areas with accumulated silt. Spawning likely occurs in late winter and spring. Eggs are deposited in gravel sediment (GADNR, 2016a). Critical habitat has been designated within the Oostanaula complex (Figure E-38) (USFWS, 2019d).

E.1.6.4.3.2 Blue Shiner (Cyprinella caerulea)

The blue shiner (federally listed as threatened) is endemic to the Mobile River drainage basin and was historically known from the Coosa and Cahaba river systems of Alabama, Georgia, and Tennessee (USFWS, 1992b). Water quality and habitat degradation, primarily because of dam construction, are the primary threat to the species (USFWS, 1995). It is restricted to the lower reaches of Little River, Weogufka Creek, and Choccolocco Creek in Alabama (ADCNR, 2014a) and the upper Conasauga River system above the junction with Holly Creek in Georgia (USFWS, 1995). Blue shiners prefer clear, medium or large streams and are found in shallow pools with slow currents or in backwaters over sand and gravel substrates. Spawning in the upper Coosa River system occurs from late April to late July (Mettee, O'Neil, & Pierson, 1996). The blue shiner is a fluvial specialist, being found only in flowing water. It prefers low to moderate velocity current, and a depth of about 0.15–1 m (0.5–3 ft) (USFWS, 1995).

E.1.6.4.3.3 Cahaba Shiner (Notropis cahabae)

The Cahaba shiner (federally listed as endangered) is endemic to the main channel of the Cahaba River. The historic range of the Cahaba shiner included about 76 RM from Centreville, AL, upstream to Helena, AL, but recent studies indicate that the species is now limited to about 15 RM from Centreville upstream to Piper Bridge. In the Cahaba River, it occurs sympatrically with the undescribed "Mobile mimic shiner," another species of *Notropis*. The preferred habitat of the Cahaba shiner is the main channel of the Cahaba River, in areas of shallow shoals up to 5 ft deep and downstream of riffles composed of clean sand or a sand-gravel mix. Individuals have also been observed in shallow waters flowing through beds of the emergent aquatic vegetation Fusticia. Spawning occurs from mid-May through early July, with peak activity in June (Mettee, O'Neil, & Pierson, 1996).

E.1.6.4.3.4 Cherokee Darter (Etheostoma scotti)

The Cherokee darter (federally listed as threatened) is endemic to upper portions of the middle Etowah River system in Georgia, upstream of Allatoona Lake. Cherokee darters are found in the Blue Ridge and Piedmont physiographic sections in this area with most populations occurring in the Northern Piedmont Upland. The Cherokee darter inhabits small-to-medium-sized creeks with moderate gradient, in low current areas with large gravel, cobble, and small boulder substrates. It occurs in runs above and below riffles, typically in waters 1–2 ft deep over large gravel, cobble, and small boulders. Little is known about the life history of this species, although it is assumed to be similar to the Coosa darter, which eats aquatic insects and spawns in the spring (Mettee, O'Neil, & Pierson, 1996) (USFWS, 2000).

E.1.6.4.3.5 Conasauga Logperch (Percina jenkinsi)

The Conasauga logperch (federally listed as endangered) is one of the rarest darters in North America. It is endemic to the Mobile basin, its entire range limited to approximately 11 mi of the upper Conasauga River of the Coosa River system in Tenessee and Georgia. This species occurs in flowing pools over silt-free substrates of gravel and small rubble. Little is known of the Conasauga logperch's life history, although it is assumed to be similar to that of other logperches. Spawning probably extends from late March to May (Mettee, O'Neil, & Pierson, 1996). Critical habitat has been designated for this species in the Oostanaula complex (Figure E-38) (USFWS, 2019d).

E.1.6.4.3.6 Etowah Darter (Etheostoma etowahae)

The Etowah darter (federally listed as endangered) is restricted to the Etowah River system of the upper Coosa River of Georgia, above and below Allatoona Dam, including the mainstem and seven tributaries: Amicalola Creek, Shoal Creek in Dawson County, Long Swamp Creek, Yellow Creek, Smithwick Creek, Stamp Creek, and Raccoon Creek. Adults occur in small-to-medium-sized streams with cobble and gravel riffles and moderate-to-swift current. Because this species is newly described, little is known of its life history. Based on what is known of other species, spawning probably occurs from late April to early June, peaking in May (Mettee, O'Neil, & Pierson, 1996) (USFWS, 2000) (NatureServe, 2019b).

E.1.6.4.3.7 Goldline Darter (Percina aurolineata)

The goldline darter (federally listed as threatened) is endemic to the ACT River Basin and has been found only in the Coosawattee River system in Georgia and the Cahaba River in Alabama (USFWS, 2000). Goldline darters inhabit free-flowing mainstem rivers and large tributaries primarily in runs and riffles with swift currents. Water quality degradation, particularly sedimentation, is the primary threat to the species.

E.1.6.4.3.8 Rush Darter (Etheostoma phytophilum)

The range of the rush darter includes the upper Black Warrior River system in Alabama. The species is known in tributaries of Sipsey Fork and Locust Fork. The species currently occupies tributaries of three watersheds in three counties in Alabama: Turkey Creek watershed (Jefferson County); Clear Creek watershed; and Cove Creek watershed (Etowah County).

The rush darter has been collected from various habitats: root masses of emergent vegetation along the margins of spring-fed streams in very shallow, clear, cool and flowing water; small clumps and dense stands of bur-reed (*Sparganium sp*.) and coontail (*Ceratophyllum sp.*) in streams with substrates of silt, sand, sand and silt; muck and sand or some gravel with sand, and bedrock. This species of fish appears to prefer relatively low-gradient small streams, and some of the streams where they occur are not influenced by springs. Water depth at collection sites ranges from 3.0 centimeters (cm) to 0.5 m with moderate water velocity in riffles and no flow or low flow in pools (NatureServe, 2019h).

E.1.6.4.3.9 Snail Darter (Percina tanasi)

The snail darter inhabits larger creeks and small rivers, where it occurs in areas with moderate-to-swift flow over mixed sand and gravel. The snail darter is endemic to the upper Tennessee River system in Alabama, Tennessee, and Georgia. In Georgia, the snail darter is known only in South Chickamauga Creek downstream of the Swanson Mill Dam at Graysville. In Georgia, it is especially vulnerable due to its occurrence in a single stream reach draining an area that is rapidly developing. As part of a status survey for the snail darter, 18 sites were surveyed in South Chickamauga Creek during 2005. Only five individual snail darters were encountered, and all five were encountered downstream of the Georgia state line. The last confirmed record of the snail darter in Georgia was from 1983 (GADNR, 2016b).

E.1.6.4.3.10 Trispot Darter (Etheostoma trisella)

The trispot darter requires two distinct, interconnected habitats to complete its life cycle. Nonbreeding adults occupy low velocity (e.g., <35 cm/sec) habitats, including backwaters and edgewater pools (often at the shallow edges of faster riffles), in the Conasauga River and larger tributaries. Beginning in late autumn, mature adults move up into small streams to spawning areas. The trispot darter is endemic to the upper Coosa River system in Georgia, Alabama, and southeastern Tennessee. It was thought to be extirpated from Alabama until a discovery in late 2008 revealed a population on protected forest land east of Gadsden, AL. In Georgia, the trispot darter occurs in the Conasauga River and some of its tributaries, including Swamp Creek, Holly Creek, Coahulla Creek, Mill Creek

(Whitfield County), and Sugar Creek; the Coosawattee River and three tributaries below Carters Lake (Gordon County); and tributaries to the Oostanaula River system, including Johns Creek (Floyd County) (GADNR, 2016c).

E.1.6.4.3.11 Vermilion Darter (Etheostoma chermocki)

The vermilion darter is known only from the Turkey Creek drainage, a tributary to Locust Fork, Black Warrior River system, Jefferson County, AL. Habitat for this species includes small-to-medium-sized streams (3-20 m wide) with pools of moderate current alternating with riffles of moderately swift current. Substrate varies from coarse gravel, cobble, and small rubble in riffles to rock, sand, and silt in pools. This darter apparently favors swifter chutes where there is some vegetation such as watercress or pondweed (NatureServe, 2019n). The vermilion darter is not known to occur in the ACT River Basin, but it appears in the USFWS Official Species List (USFWS, 2019b), likely due to a slight overlap in the GIS shapefile of the ACT River Basin and the range of this species. A species description is included here to ensure that all species included in the USFWS Official Species List are addressed, but the species is not believed to inhabit the affected environment.

E.1.6.4.4 Protected Mussel Species

There are twelve federally protected mussel species in the ACT River Basin that could be affected by changes in basin operations (Table E-35).

E.1.6.4.4.1 Alabama Moccasinshell (Medionidus acutissimus)

The Alabama moccasinshell (federally listed as threatened) historically occurred in the Mobile River Basin in Alabama, Mississippi, Georgia, and Tennessee. It prefers moderate-to-strong currents in streams and small rivers and is often associated with shoal habitat and sand, gravel, or cobble substrate (USFWS, 2000). In the ACT River Basin, the Alabama moccasinshell is generally found in small, localized populations in the upper Conasauga River in Georgia and Tennessee and in portions of the Cahaba River system in Alabama. Critical habitat has been designated in four units, including portions of the Cahaba, Lower Coosa, and Oostanuala rivers as well as in Bogue Chitto Creek (Figure E-38) (USFWS, 2019d).

E.1.6.4.4.2 Coosa Moccasinshell (Medionidus parvulus)

Historically, the Coosa moccasinshell (federally listed as endangered) was known from tributaries of the middle and upper Coosa River drainage, including Choccolocco Creek, Chattooga River, Little River, Conasauga River, Cahaba River, and Sipsey Fork in the Black Warrior River (USACE Mobile District, 2003). The species prefers sand, gravel, and cobble substrate in moderate-to-strong current along shoals of streams and small rivers (USFWS, 2000). Recent collections have been made from the Little River in Alabama and the upper Conasauga in Georgia and Tennessee (USFWS, 1993). Nine critical habitat units have been designated, only one (the Oostanaula complex) of which supports the species (Figure E-38) (USFWS, 2019d).

E.1.6.4.4.3 Dark Pigtoe (Pleurobema furvum)

The dark pigtoe (federally listed as endangered) generally is found in highly oxygenated, clear streams with moderate flow. It may be found in sand but is usually found in a sand-and-gravel substrate in small rivers and large streams. This species is only found in the Black Warrior River system in Alabama. The current range is limited to the tributaries of the Sipsey Fork, Winston County, and the North River in Tuscaloosa and Fayette counties and its tributary Clear Creek in Fayette County (NatureServe, 2019a).

E.1.6.4.4.4 FineLined Pocketbook (Lampsilis altilis)

The historical distribution of the finelined pocketbook (federally listed as threatened) included most of the Mobile River Basin, to which the species is endemic (USFWS, 2000). Within the ACT River Basin, it occurs in the Little Cahaba River, the Tallapoosa River drainage, three tributaries of the middle Coosa River, and the Conasauga River

(USACE Mobile District, 2003) (Williams & Hughes, 1998). It has been found associated with swift flowing riffles and gravel-cobble substrates in the Conasauga River. It has been found in stable sand and in gravel in small streams above the Fall Line (NatureServe, 2019c). Twelve critical habitat units, all within the ACT River Basin, have been established on approximately 546 mi of rivers and streams (Figure E-38) (USFWS, 2019d).

E.1.6.4.4.5 Georgia Pigtoe (Pleurobema hanleyianum)

The Georgia pigtoe (federally listed as endangered) was historically present in large creeks and rivers of the Coosa River drainage of Alabama, Georgia, and Tennessee. It is found in shallow runs and riffles with strong-to-moderate current and coarse sand-gravel-cobble bottoms. The Georgia pigtoe is currently known from a few isolated shoals in the Upper Conasauga River in Murray and Whitfield counties, GA, and in Polk County, TN. In November 2010, the Georgia pigtoe was listed as endangered, and critical habitat for the species was designated for the following three areas: 52 mi of the upper Conasauga River upstream of US Route 76 in Murray and Whitfield counties; 15 mi of Terrapin Creek upstream of its confluence with the Coosa River and 11 mi of the Coosa River immediately below Weiss Dam in Cherokee County, AL; and 41 mi of Hatchet Creek in Clay and Coosa counties, AL (Figure E-38) (USFWS, 2010a) (USFWS, 2019d).

E.1.6.4.4.6 Orange-Nacre Mucket (Lampsilis perovalis)

The orange-nacre mucket (federally listed as endangered) is endemic to the Mobile River Basin, historically occurring in the Alabama, Tombigbee, Black Warrior, and Cahaba river systems (USFWS, 2000). The species prefers high water quality streams and is generally found on sand, gravel, or cobble substrate in moderate-to-fast currents. In the ACT River Basin, the orange-nacre mucket persists in the Little Cahaba River, but it has not been reported from the Alabama River since its description. Three critical habitat units were designated in portions of the Cahaba River, Alabama River, and Bogue Chitto Creek in 2004 (Figure E-38) (USFWS, 2019d).

E.1.6.4.4.7 Ovate Clubshell (Pleurobema perovatum)

The ovate clubshell (federally listed as threatened) was historically found throughout the Mobile River Basin tributaries, including inhabiting large creeks and small-to-large rivers such as the Tombigbee, Black Warrior, Alabama, Cahaba, lower Tallapoosa, and Coosa river systems (USFWS, 2000). Within the ACT River Basin, recent surveys indicate the species is only known from Chewacla Creek in the Uphapee Creek system in the lower Tallapoosa River drainage, AL, and from the upper Coosa River mainstem (bypass reach) near Weiss Lake in Alabama (USACE Mobile District, 2003). Habitat in Tennessee includes a sand and fine gravel substrate in stretches of river with moderate current and typically at a depth of less than 3 ft (NatureServe, 2019f). Approximately 494 mi of critical habitat have been designated for the ovate clubshell, comprising eight distinct units (Figure E-38) (USFWS, 2019d).

E.1.6.4.4.8 Southern Acornshell (Epioblasma othcaloogensis)

The range of the southern acornshell (federally listed as endangered) historically spanned the Coosa and Cahaba river systems above the fall line in Alabama, Georgia, and Tennessee (USFWS, 2000). The species is presumed to be extirpated from the Tennessee portion of the Conasuaga River and appears restricted to the Coosa River drainage in Alabama and Georgia (Parmalee & Bogan, 1998). Species of this genus have typically been found in strong currents and coarse particle substrates (NatureServe, 2019i). Critical habitat has been designated in seven units comprising 341 mi of streams in the Southern acornshell's former range (Figure E-38) (USFWS, 2019d).

E.1.6.4.4.9 Southern Clubshell (Pleurobema decisum)

Historically, the southern clubshell (federally listed as endangered) was found throughout the Mobile River Basin, inhabiting sand, gravel, or cobble shoals in highly oxygenated large streams and small rivers (USFWS, 2000) (NatureServe, 2019j). Its current distribution in the ACT River Basin includes Bogue Chitto Creek in the Alabama River, the mainstem Alabama River, and Chewacla Creek in the lower Tallapoosa River (USACE Mobile District,

2003). It has been previously found in the lower Coosa River mainstem in the bypass reach downstream of Weiss Lake, but recent surveys failed to collect any live specimens. In 2004 critical habitat was designated as 19 units in Alabama, Georgia, Mississippi, and Tennessee (USFWS, 2004). Within the ACT River Basin, critical habitat has been designated in10 units, encompassing approximately 467 mi of habitat (Figure E-38) (USFWS, 2019d).

E.1.6.4.4.10 Southern Pigtoe (Pleurobema georgianum)

The southern pigtoe (federally listed as endangered) is endemic to the ACT River Basin, historically occurring in the Coosa River in Alabama, Georgia, and Tennessee (USFWS, 2000). It is generally found in small, restricted populations in high-quality large streams and small rivers. The species prefers coarse substrate (sandy-gravel and gravel) in moderate flows and depths of less than 60 cm (Parmalee & Bogan, 1998). Its current distribution is restricted to the upper Conasauga River of Georgia and Tennessee and along the lower Coosawattee River mainstem, but only the Oostanaula complex supports a population (USFWS, 2004). Critical habitat has been designated in nine units, comprising 393 mi of habitat in the ACT River Basin (Figure E-38) (USFWS, 2019d).

E.1.6.4.4.11 Triangular Kidneyshell (Ptychobranchus greeni)

The triangular kidneyshell (federally listed as endangered) is endemic to the Mobile River Basin. This species appears most prevalent in sections of river 3 ft in depth and having a good current and a firm substrate as opposed to coarse gravel and sand in shoals and runs of small rivers and large streams (USFWS, 2000) (NatureServe, 2019k). In the ACT River Basin, the species is known to exist in the Upper Conasauga River, the Oostanaula River, and the Coosawattee River downstream of Carters Dam in Georgia (USACE Mobile District, 2003). In 2004 critical habitat was established in 13 units in Alabama, Georgia, and Tennessee (USFWS, 2004). Critical habitat has been designated in ten units, comprising 400 mi, in the ACT River Basin (Figure E-38) (USFWS, 2019d).

E.1.6.4.4.12 Upland Combshell (Epioblasma metastriata)

The upland combshell (federally listed as endangered) is endemic to the Mobile River Basin and historically occurred in portions of the Black Warrior, Cahaba, middle Coosa and upper Coosa rivers and their tributaries (USACE Mobile District, 2003). It is generally found in high-quality habitat in small-to-medium-sized rivers, where it is found on sand and gravel substrate in riffles in moderate to swift currents (USACE Mobile District, 2003) (NatureServe, 2019m). Today, its range is drastically diminished. Surveys have failed to relocate the species, except in the Conasauga River in Georgia (USFWS, 2000). Despite the absence of live specimens, critical habitat has been designated in seven units of the upland combshell's former range (Figure E-38) (USFWS, 2019d).

E.1.6.4.5 Protected Snail Species

There are seven federally protected species of snail in the ACT River Basin that could be affected by changes in basin operations (Table E-35).

E.1.6.4.5.1 Cylindrical Lioplax (Lioplax cyclostomaformis)

The cylindrical lioplax (federally listed as endangered) is endemic to the Mobile River Basin, historically inhabiting the Alabama, Black Warrior, Coosa, and Cahaba river systems (USFWS, 2005b). It generally inhabits mud under large rocks in rapid currents in free-flowing riffles and shoals in mainstem rivers and in major tributaries (USFWS, 1998). Recent surveys indicate, however, that the species is now known only from a 24-kilometer reach of the Cahaba River in Shelby and Bibb counties, AL (USFWS, 2005b). As a result, a 5-year review concluded that the cylindrical lioplax should retain its current endangered status (USFWS, 2006).

E.1.6.4.5.2 Interrupted Rocksnail (Leptoxis foremani)

The interrupted rocksnail was listed as an endangered species in November 2010 (USFWS, 2010a). Historically, it occurred in the Coosa River drainage in Alabama and Georgia. Surveys of the Oostanaula, Coosa, Coosawattee,

Etowah, and Conasauga rivers since 1999, however, have documented the species in only about 7.5 mi of the Oostanaula River upstream of the Gordon-Floyd county line. Rocksnails live in shoals, riffles, and reefs of small to large rivers. Their habitats are generally subject to moderate currents during low flows and strong currents during high flows. These snails live attached to bedrock, boulders, cobble, and gravel, and tend to move little, except in response to changes in water level. Interrupted rocksnails are currently found in shoal habitats with sand-boulder substrate, at depths less than 50 cm (20 in), and in currents less than 40 cm/sec (16 in/sec) (NatureServe, 2019d). Critical habitat was designated in November 2010 for the following three areas: 7 mi of the Coosa River below Weiss Dam; 8 mi of the Coosa River below Jordan Dam; and 48 mi of the Oostanaula River downstream of its origin at the confluence of the Conasauga and Coosawattee rivers (USFWS, 2010a) (USFWS, 2019d).

E.1.6.4.5.3 Lacy Elimia (Elimia crenatella)

The lacy elimia (federally listed as threatened) was historically abundant from St. Clair to Chilton County, AL, along the mainstem of the Coosa River. Several tributaries, including Big Will's Creek, Kelley's Creek, and Choccolocco and Tallaseehatchee creeks also supported populations (USFWS, 2005b). Recent surveys, however, have found populations in just three Coosa River tributaries—Cheaha, Emauhee, and Weewoka creeks, Talladega County, AL. Because of its limited distribution and vulnerability to habitat and water quality degradation, the lacy elimia continues to maintain its threatened classification (USFWS, 2006).

E.1.6.4.5.4 Painted Rocksnail (Leptoxis taeniata)

The painted rocksnail (federally listed as threatened) historically maintained the largest range of any rocksnail in the Mobile River Basin drainage, ranging from the Coosa River and its tributaries in St. Clair County, AL, downstream into the mainstem of the Alabama River to Claiborne, Monroe County, AL, and the Cahaba River downstream of the fall line in Perry and Dallas counties, AL (USFWS, 2005b). Populations exist in only three Coosa River tributaries—Choccolocco Creek, Talladega County; Buxahatchee Creek, Shelby County; and Ohatchee Creek, Calhoun County, AL. Two of these systems, Choccolocco Creek and Buxahatchee Creek, have recently been identified on Alabama's draft listing of 303d impaired waterbodies for organic pollution and excessive nutrients, respectively (USFWS, 2006). This species is found in the shoals and riffles and strong currents of rivers on substrates of gravel and cobble (NatureServe, 2019g).

E.1.6.4.5.5 Plicate Rocksnail (Leptoxis plicata)

The plicate rocksnail (federally listed as threatened) is endemic to the Black Warrior River system, historically, occurring from the headwaters to near the confluence with Tombigbee River, Greene County, AL. It is now restricted to 15 shoals in a 30-km (18.6-mi) reach of Locust Fork, Jefferson County, between Kimberly and Sayre. The species occurs in shoals, on silt-free bedrock, cobble, and boulders, in less than 1 m (3.75 ft) of water. It is often found on the undersides of large, flat boulders, and is more commonly found marginally than at mid-channel (ADCNR, 2014b).

E.1.6.4.5.6 Rough Hornsnail (Pleurocera foremani)

The rough hornsnail (federally listed as endangered) is endemic to the Coosa River and its tributaries in Alabama and is generally found on gravel, cobble, and bedrock substrate in areas of moderate currents. It is known to occur at only two locations: Lower Yellowleaf Creek in Shelby County, AL; and the Lower Coosa River downstream of Wetumpka Shoals in Elmore County, AL. In November 2010, the rough hornsnail was listed as endangered, and critical habitat for the species was designated for the following areas: 13 mi of the Coosa River from Jordan Dam to the confluence with the Tallapoosa River and 4 mi of Yellowleaf Creek in Shelby County, AL (USFWS, 2010a) (USFWS, 2019d).

E.1.6.4.5.7 Tulotoma Snail (Tulotoma magnifica)

The tulotoma snail (federally listed as endangered) inhabits cool, well-oxygenated, free-flowing waters in mainstem rivers and major tributaries. The habitat is riffles and shoals on the undersides of large rocks, with current velocities sufficient to prevent silt accumulation (NatureServe, 2019l). Historically, it occurred throughout the Coosa River drainage to the Alabama River (USFWS, 2000). Recent studies suggest an increase in the abundance and distribution of the species, as it now occurs in eight populations in more than 10 percent of its former range (USFWS, 2007). Minimum flow criteria established by APC have expanded the populations downstream of Jordan Dam and Lake. In 2006 a 5-year review recommended downlisting the tulotoma snail to threatened status (USFWS, 2007).

E.1.6.4.6 Protected Reptile and Amphibian Species

There are three federally protected reptile and amphibian species in the ACT River Basin that could be affected by changes in basin operations (Table E-35).

E.1.6.4.6.1 Bog Turtle (Glyptemys muhlenbergii)

Bog turtles inhabit Georgia bogs that are generally found along slowly flowing spring creeks and seepages within low mountain valleys. Habitats capable of supporting a viable bog turtle population may be as small as 1 ac. Suitable habitat requires the presence of soft, deep, mucky organic soil and open wet areas with shallow water. These bogs are ideally quite open and characterized by a rich growth of sedges, rushes, bulrushes, and, especially, sphagnum moss. Woody vegetation may also be present (GADNR, 2011).

E.1.6.4.6.2 Flattened Musk Turtle (Sternotherus depressus)

The flattened musk turtle is restricted to the upper Black Warrior River Basin in the Southwestern Appalachians. It has been extirpated from many formerly occupied streams. Although most habitat is degraded, a few sizeable populations remain in certain free-flowing streams with good water quality. Some reservoir habitats also are inhabited (ADCNR, 2019c). The flattened musk turtle is not known to occur in the ACT River Basin, but it appears in the USFWS Official Species List (USFWS, 2019b), likely due to a slight overlap in the GIS shapefile of the ACT River Basin and the range of this species. A species description is included here to ensure that all species included in the USFWS Official Species List are addressed, but the species is not believed to inhabit the affected environment.

E.1.6.4.6.3 Black Warrior Waterdog (Necturus alabamensis)

The black warrior waterdog is restricted to streams above the fall line within the Black Warrior River Basin in Alabama. Surveys of 59 potential streams in the 1990s yielded this species at only 14 of 113 sites. The status of this species at reservoirs is unknown. The black warrior waterdog is susceptible to water quality degradation. It is presently known from 14 scattered locations in the Black Warrior River, North River, Locust Fork, Mulberry Fork, and Sipsey Fork drainages and their tributaries in Blount, Tuscaloosa, Walker, and Winston counties, AL. The species likely occurs in suitable stream habitat throughout the Upper Black Warrior River drainage, with a distribution similar to that of the flattened musk turtle (ADCNR, 2019a). The black warrior waterdog is not known to occur in the ACT River Basin, but it appears in the USFWS Official Species List (USFWS, 2019b), likely due to a slight overlap in the GIS shapefile of the ACT River Basin and the range of this species. A species description is included here to ensure that all species included in the USFWS Official Species List are addressed, but the species is not believed to inhabit the affected environment.

E.1.6.4.7 Protected Plant Species

There are 16 federally protected plant species within the ACT River Basin that could be affected by changes in basin operations (Table E-35).

E.1.6.4.7.1 Alabama Canebreak Pitcherplant (Sarracenia rubra ssp. alabamensis)

The Alabama canebrake pitcherplant (federally listed as endangered) is found in sandy and gravelly bogs; in damp, peaty soil around springheads or seeps; and in swamps. It grows in highly acidic sands and clays. Within the ACT River Basin, the Alabama canebrake pitcherplant is restricted to 12 sites in three counties in central Alabama: five populations each in Autauga and Chilton counties, and two in Elmore County (USFWS, 1992a). A 5-year review of the species has been initiated (USFWS, 2008a).

E.1.6.4.7.2 Alabama Leather Flower (Clematis socialis)

The Alabama leather flower (federally listed as endangered) is only known from three locations in northeast Alabama with one population occurring in St. Clair County and two in Cherokee County (USFWS, 1989). A 5-year review of the species is being conducted by (USFWS, 2005a).

E.1.6.4.7.3 Gentian Pinkroot (Spigelia gentianoides)

Gentian pinkroot is composed of two varieties: *S. gentianoides* var. *gentianoides* (hereafter var. *gentianoides*) restricted to five locations within three counties in the Florida Panhandle and southern Alabama, and *S. gentianoides* var. *alabamensis* (hereafter var. *alabamensis*) limited to Bibb County, AL. The populations are located on both public and private lands. Var. *gentianoides* can be found growing as a solitary individual or in small clumps in predominately well-drained upland pinelands and in pine-oak-hickory woods. Var. *alabamensis* is found in glades that have developed over an ancient rock formation known as Ketona Dolomite (USFWS, 2009).

E.1.6.4.7.4 Georgia Rockcress (Arabis georgiana)

The Georgia rockcress (federally listed as threatened) grows in various dry situations, including shallow soil accumulations on rocky bluffs, in ecotones of gently sloping rock outcrops, and in sandy loam along eroding riverbanks. Currently, 19 populations are known from four counties in Alabama (Bibb, Elmore, Russell, and Wilcox) and six counties in Georgia (Clay, Chattahoochee, Floyd, Gordon, Harris, and Muscogee). Critical habitat has been designated in four units in the ACT basin, including the Oostanaula complex, the Cahaba River drainage, the Cahaba River, and the Alabama River (Figure E-38) (USFWS, 2019d).

E.1.6.4.7.5 Green Pitcher Plant (Sarracenia oreophilia)

The green pitcherplant (federally listed as endangered) occurs in a relatively wide variety of habitats, including mixed oak or pine flatwoods, seepage bogs, and stream banks. It is found near seepage bogs in sandy clays or loams that contain abundant organic matter. On the basis of historic records, the species is most likely to occur in the ACT River Basin in DeKalb, Etowah, and Cherokee counties, AL (USFWS, 1994).

E.1.6.4.7.6 Harperella (Ptilimnium nodosum)

Harperella (federally listed as endangered) typically grows in two habitat types: (1) rocky or gravel shoals and margins of clear, swift-flowing stream sections and (2) edges of intermittent pineland ponds in the Coastal Plain. Two extant populations occur in Alabama. One consisting of several thousand individuals occurs along the Little River on the border of Cherokee and DeKalb counties (USFWS, 1990). The other population has less than 100 plants and is on Town Creek in DeKalb County. More recent data for the species within the basin are unavailable, but a 5-year review is underway (USFWS, 2008c).

E.1.6.4.7.7 Kral's Water Plantain (Sagittaria secundifolia)

Kral's water plantain (federally listed as threatened) typically occurs on frequently exposed shoals or is rooted in quiet pools up to 3 ft deep. In the ACT River Basin, the species has been collected from the Little River (Cherokee and DeKalb counties, AL, and Chattooga County, GA), a tributary to the Coosa River; and from Town Creek

(DeKalb County, AL), a tributary to the Tennessee River (USFWS, 1991a). More recent data are unavailable; however, a 5-year review of the species is underway (USFWS, 2008b).

E.1.6.4.7.8 Large-Flowered Skullcap (Scutellaria montana)

Large-flowered skullcap inhabits moist hardwood and hardwood-pine forests with few shrubs. The range of this species includes the Ridge and Valley physiographic province of northwest Georgia and southeast Tennessee. Populations are concentrated on Lookout and Signal mountains in Tennessee and in Floyd County, GA. In Georgia, 53 populations are known, including 12 on conservation land (GADNR, 2008a).

*E.1.6.4.7.9 Michaux's Sumac (*Rhus michauxii*)*

Michaux's sumac (federally listed as endangered) is a species historically endemic to the Inner Coastal Plain and lower Piedmont of North Carolina, South Carolina, and Georgia. Extant populations occur in North Carolina, Virginia, and Georgia. In Georgia both extant and historical populations of this species occur on substrates with dark-colored minerals rich in magnesium and iron. This type of habitat in Georgia is extremely limited (NatureServe, 2014a).

E.1.6.4.7.10 Mohr's Barbara's Buttons (Marshalla mohrii)

Mohr's Barbara's buttons (federally listed as threatened) typically occurs in moist, prairie-like openings in woodlands and along shale-bedded streams (USACE Mobile District, 2003). At the time of its listing, it was known to exist at 15 sites in Alabama, all of which are within the ACT River Basin (one population in Bibb County, four in Etowah County, and 10 in Cherokee County) (USFWS, 1991b). The species is also known from Floyd County, GA (within the ACT River Basin). In 2010 the USFWS initiated a 5-year status review of Mohr's Barbara's buttons (USFWS, 2010b).

E.1.6.4.7.11 Small Whorled Pogonia (Isotria medeoloides)

The small whorled pogonia is an orchid that grows in older hardwood stands of beech, birch, maple, oak, and hickory that have an open understory. Sometimes it grows in stands of softwoods such as hemlock. It prefers acidic soils with a thick layer of dead leaves, often on slopes near small streams. Although widely distributed, the small whorled pogonia is rare. It is found in 18 eastern states and Ontario, Canada. Populations are typically small with less than 20 plants (USFWS, 2016).

E.1.6.4.7.12 Swamp Pink (Helonias bullata)

Swamp pink inhabits shady seepage swamps and sphagnum bogs with continually saturated, though not flooded, soils. It often occurs with red maple, purple pitcherplant, mountain laurel, rosebay rhododendron, and tag alder. The range of this species includes Georgia, South Carolina, North Carolina, Virginia, Maryland, Delaware, New Jersey, and New York. In Georgia, one population on private land is extant but endangered. Efforts to establish plants at other sites are underway (GADNR, 2007).

E.1.6.4.7.13 Tennessee Yellow-Eyed Grass (Xyris tennesseensis)

At the time of its listing as endangered, the Tennessee yellow-eyed grass occurred in extant populations at 14 sites in five areas: (1) northwest Georgia (Bartow and Whitfield counties - one population each; (2) northeast Alabama (Calhoun County - two populations); (3) central Alabama (Bibb County - five populations); (4) northwest Alabama (Franklin County - one population); and (5) southcentral Tennessee (Lewis County - four populations). Conditions of the sites generally feature nearly permanent (all-year) moisture regimes; open, sunny conditions; and calcareous bedrock (shale, limestone, dolomite) or thin calcareous soils (USACE Mobile District, 2003). Recent survey data are not available in the ACT River Basin; however, a 5-year review of the species is underway and should provide new information (USFWS, 2008a).

E.1.6.4.7.14 Virginia Spiraea (Spiraea virginiana)

Virginia spiraea inhabits rocky streams over sandstone, including bouldery stream banks, edges of waterfalls, and rock ledges. This plant requires occasional scouring floods to reduce competition from other shrubs. Fewer than 30 populations are known in Georgia, Alabama, North Carolina, Tennessee, Virginia, West Virginia, Kentucky, and Ohio. In Georgia, three populations are known, including two that are protected on state and private conservation lands (GADNR, 2008b).

E.1.6.4.7.15 White Fringeless Orchid (Platanthera integrilabia)

White fringeless orchid (a candidate species) is documented from 53 extant locations within six states: Alabama, Georgia, Kentucky, Mississippi, South Carolina, and Tennessee. In the ACT River Basin, it is found in the Etowah, Upper Coosa, Lower Coosa, and Upper Tallapoosa watersheds. This species is generally found in wet, flat, boggy areas at the head of streams or seepage slopes (NatureServe, 2014b).

E.1.6.4.7.16 Whorled Sunflower (Helianthus verticillatus)

The whorled sunflower (federally listed as endangered) is known only from Alabama (Cherokee County), Georgia (Floyd County), and Tennessee (Madison and McNairy counties). This species is a narrow habitat specialist occurring in remnant wet prairie areas and calcareous barrens, in moist, prairie-like openings in woodlands, and along adjacent creeks (NatureServe, 2014c). Critical habitat has been designated in the Mud Creek/Coosa Valley Prairie (Figure E-38) (USFWS, 2019d).

E.1.6.5 Fish and Wildlife Management Facilities

Fish and wildlife management facilities include all fish hatcheries, wildlife refuges, and fish and wildlife management areas in the ACT River Basin. There are several state and federal facilities in the ACT River Basin that use surface water or groundwater in operations for fish and wildlife management, including fish hatcheries and a public fishing area, and are listed in the 2014 Final EIS for the ACT River Basin WCM Update. However, none of these facilities are within the ROI.

There are no National Wildlife Refuges or Alabama state parks within the ROI; however, there are two WMAs and one Georgia state park within it. Coosa WMA is a 17,486-ac property that borders the Coosa River in Alabama and is managed by ADCNR in cooperation with the Forever Wild Land Trust and numerous private companies and landowners. The WMA offers hunting opportunities for large and small game including deer, turkey, dove, quail, rabbit, squirrel, crow, raccoon, opossum, fox, woodcock, snipe, waterfowl, and feral swine. WMA regulations allow the use of firearms, bow and arrow, and falconry, with restrictions.

Allatoona WMA is a federal property located in Cherokee and Bartow counties in Georgia that is owned by USACE and managed by GADNR. This 6,818-ac property on the northeastern end of Allatoona Lake offers hunting opportunities for deer, bear, turkey, small game, and waterfowl (USACE Mobile District, 2019a). Red Top Mountain State Park is a 1,776-ac park on Allatoona Lake. The park includes a marina with two boat docks, a swimming beach, hiking and biking trails, and fishing areas.

E.1.7 Socioeconomic Resources

E.1.7.1 Municipal and Industrial Water Supply

A critical function of the rivers in the ACT River Basin is water supply. The purpose of this section is to estimate water usage rates in the year 2050. This analysis represents the existing and projected future water supply demands and returns for Allatoona Lake. Section E.1.1.6 provides a general summary of existing M&I water withdrawals in

the ACT River Basin (for both surface water and groundwater). More detailed information on existing conditions and projected future needs relative to the state of Georgia's water supply request for Allatoona Lake is provided in Appendix B to the Draft FR/SEIS.

E.1.7.1.1 Water Demand Methodology

The methodology and analysis for determining water demand were developed by MNGWPD and verified by the USACE, Mobile District staff. Appendix B to the Draft FR/SEIS (Plan Formulation/Water Supply Reallocation Report) describes the process in more detail. M&I demands for Allatoona Lake include all water uses for jurisdictions that withdraw water from the lake. The projections incorporate the most recent information concerning regional population trends and projected population and employment growth rates, the effects of existing and projected water conservation measures, and economic activity (Zitsch, 2018b).

E.1.7.1.2 State-Collected Water Use Data

USACE, Mobile District receives monthly M&I water use reports from the states of Alabama and Georgia, which are used to determine the state water use withdrawn from the reservoirs. Table E-36 summarizes surface withdrawal data for the ACT River Basin in Alabama from Weiss Lake to Jordan Lake, above the city of Montgomery, for the period 2002 through 2012. Additional information regarding Georgia withdrawals can be found in Appendix D to the Draft FR/SEIS.

Table E-36. M&I Water Use Data in the ACT River Basin, Alabama (2002–2012)

	Net withdrawals (mgd) by reservoir/reach						
Year	Coosa	Jordan	Mitchell	Lay	Logan Martin	H. Neely Henry	Weiss
2002	-37.08	0.00	0.65	352.11	-218.25	203.68	10.22
2003	-39.63	63.10	-26.75	167.99	-261.76	83.12	15.71
2004	-40.39	4.63	-0.16	57.26	-240.76	118.33	8.30
2005	-36.28	3.87	-3.44	145.59	-270.31	111.37	24.45
2006	-37.73	3.11	1.19	344.56	-252.65	163.77	19.73
2007	-33.24	69.91	6.41	245.13	-204.95	228.54	17.19
2008	-25.28	58.53	-15.41	5.23	-239.40	156.13	11.16
2009	-15.32	51.83	19.67	-417.62	98.95	84.15	13.54
2010	-12.85	51.28	-0.29	-351.52	28.48	148.02	17.74
2011	-20.98	51.38	1.86	-372.70	165.12	119.80	-16.50
2012	-18.08	0.00	0.33	22.69	-165.12	-1200.14	0.00

Source: USACE

E.1.7.1.3 Future M&I Water Demand at Allatoona Lake

As part of MNGWPD's mission to prepare and periodically update comprehensive water resource management plans within their area of responsibility, the Planning District developed projected water supply demands for Allatoona Lake. The USACE team reviewed and vetted the analysis to ensure reliability and accuracy of the data, and then the data were used as the future demands in the planning process. The demand projections were developed using a Monte Carlo analysis, which included uncertainty factors for the data used, and were heavily based on (1)

population and employment forecasts; (2) water billing, production, and withdrawal data; and (3) plumbing fixture and appliance stock. The 2050 demand for withdrawals from Allatoona Lake for CCMWA and the City of Cartersville/Bartow County is 94 mgd, as shown in Table E-37. Year 2006 was used as a baseline year for comparison because more water was withdrawn in the ACT River Basin (including withdrawals from Allatoona Lake) in that year than in any other year recorded.

Table E-37. Projected Water Demands from Allatoona Lake

Water provider	2006 level of use (mgd)	Projected 2050 demand (mgd)	Additional water to meet projected demand (mgd)
Cobb County-Marietta Water Authority	47.3	57	9.7
City of Cartersville/ Bartow County	13.9	37	23.1
Total Demand	61.2	94	32.8

Source: (Hazen and Sawyer, Inc., 2018).

E.1.7.2 Navigation

The federally authorized Alabama River navigation project in southwest Alabama stretches 289 mi from its confluence with the Mobile River upstream to Montgomery, AL. The authorization provides for a 9-ft deep by 200-ft wide navigation channel from its junction with the Mobile River upstream to Montgomery and includes three L&Ds: Claiborne, Millers Ferry, and Robert F. Henry.

The Alabama River is a terminus on the inland waterway system. It is accessed by the Black Warrior Tombigbee Waterway and Mobile Harbor and the Gulf Intracoastal Waterway (GIWW). Its major value as a water transportation resource is its ability to carry traffic to and from inland waterway points in Mississippi, Louisiana, and Texas. Barge navigation is provided by a series of three L&Ds. Claiborne L&D is the lowermost structure at navigation mile 72.5, which is 117.5 mi above the Bankhead Tunnel at Mobile, AL, and has a lift of 30 ft. Millers Ferry L&D is upstream of Claiborne L&D at navigation mile 178 and has a lift of 45 ft. Robert F. Henry L&D is upstream of Millers Ferry L&D at navigation mile 281.2 has a lift of 45 ft. All three lock chambers have dimensions of 84 ft by 600 ft.

The Alabama River is bounded on all fronts by navigable waterways; the Tennessee River to the north, the ACF on the east, Mobile Harbor and the GIWW on the south, and the Black Warrior–Tombigbee River to the west. It competes with other waterways and other modes of transportation. Cost disadvantages that arise when barges must be light-loaded for low water conditions plus the lack of backhaul cargoes limit the opportunity for sustained growth and diversification of Alabama's cargoes. The bulk of the traffic on the Alabama River is linked to resources originating along the river, which makes barge transportation essential and convenient for moving these resources. Table E-38 summarizes the ACT River Basin's use for navigation, especially noncommercial use and lockages.

Table E-39 summarizes waterborne commerce for 1999 through 2017 as reported by USACE Institute for Water Resources traffic statistics.

Table E-38. ACT River Basin Navigation—Cumulative Lockage Use Data (1999–2017)

Alabama River L&Ds (Claiborne, Millers Ferry, and Robert F. Henry)	No. of vessels	No. of lockages/cuts
Commercial Vessels	684	499
Noncommercial Vessels	391	368
Recreational Vessels	6,189	4,439
Total Vessels	7,264	5,306

Source: (USACE Institute for Water Resources, 2018b).

Table E-39. Cumulative Waterborne Commerce for Alabama River (1999-2017)

Commodity	Total tons (1999-2017)
All Units (Ferried Autos, Passengers, Railway Cars)	0
All Crude Materials, Inedible, Except Fuels	957,055
All Primary Manufactured Goods	22
All Manufactured Equipment and Machinery	37,303
All Waste Material	1,100
All Unknown or Not Elsewhere Classified	600

Source: (USACE Institute for Water Resources, 2018a).

E.1.7.3 Hydropower Generation

The ACT River Basin was heavily developed for hydropower generation by private power companies, municipalities, and USACE. The power resources serve all sectors; however, some of the agricultural and industrial users are dependent upon economical power sources for continued operations of their enterprises. More detailed information on existing conditions for hydropower generation in the ACT River Basin is presented in Appendix D to the Draft FR/SEIS.

E.1.7.3.1 ACT River Basin Bulk Power System Overview

A bulk power system is a large interconnected electrical system comprised of generation and transmission facilities and their control systems. The ACT River Basin is in the southeastern subregion of the Southeastern Electric Reliability Corporation (SERC). SERC's southeastern subregion comprises five smaller control areas, each of which is individually managed by PowerSouth (formerly Alabama Electric Cooperative), Oglethorpe Power Corporation, South Mississippi Electrical Power Association, the Southern Company, or Walton Electric Membership Corporation. APC is a division of the Southern Company and is the primary private operator in the ACT River Basin.

E.1.7.3.2 ACT River Basin Hydropower System

USACE operates four projects with hydropower capabilities in the ACT River Basin. Robert F. Henry L&D and Millers Ferry L&D are both on the Alabama River and work together with a combined generating capacity of 172 MW in support of hydropower generation while also serving other project purposes. Allatoona Dam, on the Etowah River in Georgia, is operated as a peaking plant with an installed generating capacity of 82.2 MW. Carters Dam/Reregulation Dam, on the Coosawattee River in Georgia, is operated as a pump storage plant with a total generating capacity of 600 MW.

APC operates a total of 14 peaking hydropower projects in Alabama, with 1,403.5 MW of declared generating capacity. Of that total number, 11 are on the Tallapoosa and Coosa rivers in the ACT River Basin system. The 11 APC hydropower projects in the basin are identified in Section E.1.1.4 and are shown on Figure E-1. Table E-40 displays generation from 2008 through 2018 for USACE and APC projects in the ACT River Basin.

Table E-40. ACT River Basin—USACE and APC Power Generation (MWh) by Fiscal Year

Project	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
APC Power Projects (11)	444,314	645,867	660,838	506,146	564,291*	564,291*	564,291*	564,291*	564,291*	564,291*	564,291*
Allatoona Dam	50,541	100,222	174,927	86,790	67,903	189,901	68,531	0	0	11,138	134,856
Carters Dam	535,959	577,565	610,566	544,692	490,110	473,761	479,980	490,758	492,970	415,831	439,700
Robert F. Henry L&D	195,711	306,682	313,766	210,441	235,152	396,013	296,922	311,444	196,113	315,481	300,549
Millers Ferry L&D	238,177	340,076	324,713	194,871	302,109	416,148	358,854	377,331	241,123	377,267	310,855

Note: MWh = megawatt hours
Source: USACE Mobile District
* Average APC project generation from 2008-2011

E.1.7.4 Flood Risk Management

Flood risk management has long been an important USACE focus for the reservoirs it operates. Allatoona Lake provides important flood-control storage, with spillway capacities sufficient to discharge floods with return intervals of 500 years. Downstream of the dam, the Etowah River extends through Bartow and Floyd counties, GA, and, with the confluence of the Oostanaula River, becomes the Coosa River at Rome, GA.

The majority of the floodplain structures that would be affected are in the cities of Cartersville, Euharlee, and Rome, GA. The Hydrologic Engineering Center-Flood Impact Analysis (HEC-FIA) model results indicate that a maximum of 511 structures would be affected under the base (existing) conditions in Georgia below Allatoona Dam, of which 360 are in Floyd County, GA. In Alabama, most of floodplain structures are in Etowah, St. Clair, and Talladega counties. Additional details on the HEC-FIA model results can be found in Appendix C.

The composition of residential structures within or in close proximity to the ACT River Basin floodplain from Allatoona Lake in Georgia to Montgomery, AL, is very diverse with a wide range of structure types from trailer parks and fishing cabins to mansions and large estates. Nonresidential structures are also diverse and include hospitals, shopping malls, marinas, and large industrial complexes such as power plants. In Georgia below Allatoona Dam, most of the structures at risk for flooding during flood events are largely concentrated in the city of Rome. In Alabama, the areas directly downstream of the APC projects receive most of the flooding and are mostly rural agricultural lands without large concentrations of development. The flood risk along the Coosa River is spread over a much larger area from Weiss Lake in Cherokee County, AL, to Jordan Lake in Elmore County, AL. St. Clair, Talladega, and Etowah counties in Alabama contain the largest number of structures within the floodplain of the Coosa River.

More detailed information on existing conditions for flood risk related to operation of USACE and APC projects in the ACT River Basin is presented in Appendix D to the Draft FR/SEIS.

E.1.7.5 Recreation

The lakes, rivers, and streams of the ACT River Basin are heavily used for recreation. The lakes and rivers provide important recreation opportunities for residents in northern Georgia and a majority of Alabama. This discussion focuses specifically on recreational activities and facilities in the Coosa River Basin, with emphasis on the mainstem rivers and lakes potentially affected by the proposed actions addressed in this Draft FR/SEIS. Northern Georgia and Alabama have several national forests, national and state parks, and resort communities that are favorite weekend and vacation destinations. In Georgia, the upper portion of the Coosa River Basin is in the Chattahoochee National Forest. The Coosa River suns through the Talladega National Forest, south of Birmingham and Anniston, AL. The developed sites provide a range of primitive-to-modern facilities. Dispersed activities include hunting, fishing, boating, hiking, and off-road vehicle riding.

Little River Canyon National Preserve is a popular National Park Service site located on the Little River in northeast Alabama, a tributary to the Coosa River that drains into Weiss Lake from the north. Sightseeing, picnicking, hiking, wading, advanced whitewater paddling, canoeing, mountain biking, horseback riding, and rock climbing are popular activities at the 816-ac area. Hunting, fishing, and trapping are permitted in designated areas. There are no federally designated Wild and Scenic Rivers within the ACT River Basin.

While all of the USACE and APC reservoirs in the ACT River Basin provide water-based recreational opportunities, the following sections focus on the reservoirs in the Coosa River portion of the basin that would be directly affected by the proposed actions addressed in this Draft FR/SEIS: Allatoona Dam and Lake (USACE), Weiss Dam and Lake (APC), and Logan Martin Dam and Lake (APC). Recreational activities and facilities at these projects are summarized in the following paragraphs.

E.1.7.5.1 Allatoona Dam and Lake

Allatoona Lake, located on the Etowah River about 30 mi northwest of Atlanta, GA, is one of the most frequently visited USACE lakes in the nation. The size of the lake at the normal summer pool elevation of 840 ft is 11,164 ac, with 270 mi of shoreline. USACE, in conjunction with other public and private organizations, provides a wide spectrum of quality recreation opportunities that inject nearly $250 million into the regional economy each year (USACE Mobile District, 2019b). Recreational opportunities at Allatoona Lake include boat fishing, pleasure boating, water skiing, kayaking, hiking, biking, swimming, picnicking, camping, and hunting. Public visitation to Allatoona Dam and Lake in fiscal year (FY) 2014 was approximately 5.4 million; in FY 2015, it was 5.7 million; and in FY 2016, it was 6.4 million.

Public recreation areas are specifically designated for present or future recreational development such as campgrounds, day-use parks, hiking and biking trails, primitive or natural areas, or marine services. No permits for private uses are issued for public recreation areas. Public recreation areas, the largest shoreline allocation at Allatoona Lake, account for 45 percent of the shoreline. USACE has 14 day-use parks, 16 boat ramps, 589 camp sites, and 188 picnic sites at Allatoona Lake and additional recreational facilities are found in nine city and county parks, one state park (Red Top Mountain State Park), and eight commercial marinas (USACE Mobile District, 2019b). The marinas provide varying types of service, including covered and uncovered boat slips, dry storage, fuel, boat repairs, rentals, and supplies. USACE leases project lands to city, county, and state governments; organizations, and private citizens to operate facilities that provide for public access to the lake.

E.1.7.5.2 Weiss Dam and Lake

Weiss Lake provides opportunities and access for a variety of recreational activities, including fishing, hunting, boating, swimming, picnicking, walking, and scenic viewing. APC and numerous other public and private entities provide recreational access to Weiss Lake through formal recreation areas that include boat launches, marinas, boat slips, campgrounds, picnic areas, beaches, fishing piers, general piers, bank fishing, trails, and playgrounds. The marinas at Weiss Lake generally provide launching facilities, fuel services, groceries/food services, boat rental or

repair, marine supplies, bait and tackle, and piers. Several marinas also provide camping facilities and day-use areas. Additionally, camping facilities and resorts provide a variety of day- and overnight-use facilities. Parks for recreational vehicles (RVs) provide boat launching facilities and picnic areas (FERC, 2009).

There are 44 formal recreational areas at Weiss Lake comprising 13 publicly owned sites and 31 privately owned areas. APC owns and operates three of these areas (the Weiss tailrace access area, the Weiss Dam spillway overlook area, and the Leesburg boat launch area). ADCNR maintains two other facilities owned by APC (State Launch at Cobia Bridge and Bay Springs boat launch). The fishing pier and parking area at the Weiss tailrace access area are on the eastern bank, upstream of the powerhouse discharge area. The Weiss spillway area offers parking and trails to the water on the western shore near the spillway structure to accommodate fishing from the banks near the spillway. There also are 35 informal recreation sites that provide access to Weiss Lake for camping, bank fishing, and boating access (FERC, 2009).

Annual recreational use at Weiss Dam and Lake is about 1.5 million recreation days. About 84 percent of the total annual use at the project occurs during the spring and summer months. Boat fishing is by far the most popular recreational pursuit, followed in descending order by pleasure boating, picnicking, and swimming (FERC, 2009).

E.1.7.5.3 Logan Martin Dam and Lake

Logan Martin Lake provides a variety of different recreational opportunities. The downstream portion of the lake provides a broad surface area and many coves for water sports, motorized boating, and other land- and water-based recreational activities. In contrast, the upstream portion up to the H. Neely Henry tailrace is riverine, less developed, and offers opportunities for fishing, canoeing, scenic viewing, and other water- and land-based recreation. This popular lake has numerous private clubs, golf courses, and marinas and is heavily used by the visiting public and residents living on the lake. APC and numerous other public and private entities provide recreational access to Logan Martin Dam and Lake through both formal and informal recreational areas (FERC, 2009).

Logan Martin Dam and Lake has 38 designated recreational areas, including eight publicly owned areas and 30 privately owned sites. APC owns and operates the Logan Martin Dam tailrace facility and owns the Stemley Bridge bank fishing site and Choccolocco Creek boat launch. The Logan Martin Dam tailrace area has a fishing pier and parking area located on the western shoreline (FERC, 2009). APC also operates the Logan Martin Dam Park, a day-use area located on the eastern edge of the embankment at the dam. The park includes a fishing pier, grills, pavilions, and picnic tables (APC, 2019). APC leases property around the lake to various state and local entities and private interests that provide recreation facilities for the public. In addition to the formal access sites, APC has identified 24 informal access areas at the Logan Martin project that primarily provide shoreline fishing opportunities (FERC, 2009).

The lake has numerous private clubs, golf courses, and marinas and is heavily used by the visiting public and those residing on the lake. The downstream portion of the lake, which is more heavily developed, provides a broad surface area and many coves for water sports, motorized boating, and other water-based recreational activities. The area downstream of the H. Neely Henry Dam tailrace is riverine, less developed, and offers fishing, canoeing, scenic viewing opportunities, and other water-based recreational opportunities (FERC, 2009).

Annual recreational use at Logan Martin Dam and Lake is about 1.5 million recreation days. About 82 percent of the total annual use at the project occurs during the spring and summer months. Boat fishing is by far the most popular recreational pursuit, followed in descending order by pleasure boating, swimming, picnicking, and camping (FERC, 2009).

E.1.7.6 Agricultural Water Supply

Section E.1.1.6 summarizes agricultural withdrawals in the ACT River Basin as well as water withdrawals for other uses. Overall, agricultural water supply withdrawals from surface water and groundwater sources in the basin for irrigation and livestock uses comprise a relatively small portion of the total water withdrawals for all uses in the basin. Surface water and groundwater withdrawals for irrigation and livestock purposes are considered 100 percent consumptive (Fanning & Trent, 2009).

As presented in Table E-6, surface water withdrawals for agriculture (irrigation and livestock) in the Georgia portion of the ACT River Basin totaled 23.96 mgd in 2010 (Lawrence, 2016) compared to 27.49 mgd in 2005 (Fanning & Trent, 2009). These totals represent about 3.5 percent of the total surface water withdrawals in the Georgia portion of the basin in both years, but the total agricultural surface water withdrawals slightly decreased in 2010 compared to 2005.

Groundwater use for agricultural purposes in the Georgia portion of the ACT River Basin totaled 4.7 mgd in 2010 (Lawrence, 2016), a slight increase from 3.0 mgd in 2005 (Fanning & Trent, 2009). The 2010 agricultural withdrawals represent about 11 percent of the total 2010 groundwater withdrawals, compared to only 5 percent of the total 2005 groundwater withdrawals (see Table E-10). Overall, groundwater withdrawals for all uses in the Georgia portion of the basin declined by about 30 percent from 2005 to 2010. The agricultural groundwater withdrawals in 2010 comprised a larger share of total groundwater withdrawals than the 2005 withdrawals, but only a slight increase in actual agricultural groundwater withdrawals occurred.

Most of the surface water and groundwater withdrawals for agricultural purposes in the Georgia portion of ACT River Basin occur in the Etowah River subbasin. Current levels of agricultural water supply withdrawals in area have not changed appreciably from 2010 levels.

As presented in Table E-9, surface water withdrawals for agriculture (irrigation and livestock) in the Alabama portion of the ACT River Basin totaled 51.20 mgd in 2010 (Harper & Turner, 2015) compared to 34.91 mgd in 2005 (Hutson, Littlepage, Harper, & Tinney, 2009). These totals represent about 4.5 percent of the total surface water withdrawals in the Alabama portion of the basin in 2010 and 2.6 percent of the total surface water withdrawals in 2005. The 2010 surface water withdrawals for agriculture were 47 percent higher than the 2005 levels.

Groundwater use for agricultural purposes in the Alabama portion of the ACT River Basin totaled 17.03 mgd in 2010 (Harper & Turner, 2015), a slight decrease from 18.29 mgd in 2005 (Hutson, Littlepage, Harper, & Tinney, 2009). These withdrawal levels represent about 13 percent of total groundwater withdrawals for all purposes in both years (see Table E-12).

Surface water and groundwater withdrawals for livestock in the Alabama portion of the ACT River Basin declined slightly between 2005 and 2010, and current withdrawals for livestock is not expected to have changed appreciably. Surface water and groundwater withdrawals for irrigation in the Alabama portion of the ACT River Basin increased by about 36 percent between 2005 and 2010. The growth trend in withdrawals for irrigation is expected to have continued since 2010. However, a substantial share of the agricultural water withdrawals in the Alabama portion of the ACT River Basin occur downstream of Montgomery, AL, which is outside the primary area of focus for this Draft FR/SEIS.

E.1.7.7 Population

The total population in the ACT River Basin in 2016 was 5,507,182. Table E-41 presents the estimated total population within the basin for the decades from 1960 to 2016, including the number of people residing in the Alabama and Georgia portions of the basin. Population data for 2016 for the counties in the basin were collected from the Centers for Disease Control and Prevention's (CDC's) Social Vulnerability Index (SVI). The SVI is a

compilation of the U.S. Census Bureau's American Community Survey 2012–2016 estimates. About 60 percent of the population in the ACT River Basin resides in Alabama and about 40 percent resides in Georgia. The population in the basin sharply increased between 1960 and 2016. While the overall percentage of population is larger in Alabama, Georgia's population has increased at a faster rate. Since 1960, Georgia's ACT River Basin population has increased by about 355 percent, while Alabama's ACT River Basin population has increased only about 42 percent (Centers for Disease Control and Prevention, 2019) (U.S. Census Bureau, 2019). A more detailed summary of existing population conditions in the ACT River Basin is presented in Appendix D to the Draft FR/SEIS.

Table E-41. ACT River Basin—Population Data between 1960 and 2016

	Percent of basin population (2016)	2016	2010	2000	1990	1980	1970	1960
ACT (AL)	60%	3,307,059	3,255,514	3,042,112	2,766,512	2,688,651	2,379,925	2,330,066
ACT (GA)	40%	2,200,123	2,019,492	1,594,408	1,153,046	854,126	636,681	484,100
ACT River Basin		5,507,182	5,275,006	4,636,520	3,919,558	3,542,777	3,016,606	2,814,166

Sources: (Centers for Disease Control and Prevention, 2019) (U.S. Census Bureau, 2019).

E.1.7.8 Housing

Table E-42 presents housing estimates for the entire ACT River Basin for the decades from 1960 to 2016, including the number of housing units in both the Alabama and the Georgia portions of the basin. In 2016, a total of 2,391,261 housing units existed in the ACT River Basin, of which 63% were in Alabama. Housing unit estimates, however, have increased much faster in the Georgia portion of the basin. More detailed information on existing housing conditions for residents within the ACT River Basin is presented in Appendix D to the Draft FR/SEIS.

Table E-42. ACT River Basin—Housing Units within the Basin between 1960 and 2016

	2016	2010	2000	1990	1980	1970	1960
ACT River Basin (AL)	1,510,687	1,530,108	1,336,384	1,141,341	1,010,899	773,949	691,644
ACT River Basin (GA)	880,574	819,161	627,987	471,315	318,845	204,074	144,153
ACT River Basin (Total)	2,391,261	2,349,269	1,964,371	1,612,656	1,329,744	978,023	835,797

Sources: (Centers for Disease Control and Prevention, 2019) (U.S. Census Bureau, 2019).

E.1.7.9 Income

Table E-43 presents per capita income statistics for residents of the ACT River Basin at 10-year intervals between 1959 and 2016, including per capita incomes in both the Alabama and the Georgia portions of the basin. In 2016, the average per capita income within the ACT River Basin was $22,988 (Centers for Disease Control and Prevention, 2019). More detailed information on existing income conditions for residents within the ACT River Basin is presented in Appendix D to the Draft FR/SEIS.

Table E-43. ACT River Basin—Per Capita Income Statistics

	Personal income per capita						
	2016	2009	1999	1989	1979	1969	1959
ACT (AL)	$21,125	$19,895	$15,738	$9,779	$8,514	$6,046	$3,824
ACT (GA)	$24,850	$22,174	$18,841	$11,709	$9,544	$7,234	$4,362
ACT River Basin	$22,988	$20,679	$16,806	$10,444	$8,868	$6,455	$4,009

Source: (Centers for Disease Control and Prevention, 2019).

E.1.7.10 Employment

Table E-44 provides details of employment statistics for the ACT River Basin. In 2016, an estimated 206,408 people were unemployed in the basin, 126,685 of whom were residents of Alabama. The average unemployment rate for the areas within Alabama was 10.36 percent, while the average unemployment rate for the Georgia portion of the basin was lower at 7.99 percent (Centers for Disease Control and Prevention, 2019). More detailed information on existing employment conditions for residents within the ACT River Basin is presented in Appendix D to the Draft FR/SEIS.

Table E-44. ACT River Basin—Employment Statistics

	Unemployed (2016)	Percent unemployed (2016)
ACT River Basin (AL)	126,685	10.36
ACT River Basin (GA)	79,723	7.99
ACT River Basin	206,408	9.13

Source: (Centers for Disease Control and Prevention, 2019).

E.1.7.11 Environmental Justice

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,* requires that federal agencies identify and address disproportionately high and adverse human health or environmental effects on minority and low-income populations that might result from their programs, policies, and activities. Under the EO, USEPA was directed to ensure that agencies analyze environmental effects on minority and low-income communities, including human-health, social, and economic effects. Table E-45 provides information on the demographic characteristics of the ACT River Basin with a specific focus on the minority, low-income, and disadvantaged communities.

Most of the communities along the rivers of the ACT River Basin are rural and range from developments of large estates to trailer parks and fishing cabins along the shores of the reservoirs and rivers. Many of the communities nearest to the water have been built along the shores of the reservoirs, and the residents express close ties to the water and the recreation and lifestyle the reservoirs provide. Many minority and low-income residents in these communities and rural areas depend heavily on the resources of these rivers and reservoirs as a source of income, food, and outdoor enjoyment.

E.1.7.12 Protection of Children

EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, recognizes that a growing body of scientific knowledge demonstrates children may suffer disproportionately from environmental health and safety risks and requires federal agencies, to the maximum extent permitted by law and mission, to identify and assess such environmental health and safety risks. Table E-45 provides information on the number and general characteristics of children residing in the ACT River Basin.

Table E-45. ACT River Basin—Demographics (2016)

Location	Minority (all except white, non- Hispanic)	Minority (all except white, non-Hispanic) (%)	Persons below poverty level	Persons below poverty level (%)	Single-parent household with children under 18	Single-parent households with children (%)	Persons age 17 and younger (%)
ACT River Basin (AL)	1,249,404	38.78	601,746	21.77	125,381	9.78	22.55
ACT River Basin (GA)	626,893	17.89	276,120	16.24	70,321	8.69	23.70
ACT River Basin	1,876,297	28.33	877,866	19.01	195,702	9.24	23.12

Source: (Centers for Disease Control and Prevention, 2019).

A sizeable portion of the recreation visits to Allatoona Lake, Weiss Lake, and Logan Martin Lake involve children participating in all types of water-based recreation activities (swimming, boating, kayaking, skiing, fishing, etc.) while camping, attending summer camps, or visiting day-use parks. The principal health and safety risks to children while engaged in these activities are drownings, accidental injuries, and waterborne illnesses. USACE conducts a proactive program to promote water safety on its reservoir projects through education of adults and children and implements measures on the projects to reduce health and safety risks. APC also emphasizes water safety on its reservoirs. The GADNR and Alabama Department of Public Safety, Marine Patrol, enforce state laws governing watercraft safety and actively promote water safety in carrying out their missions on the reservoir projects.

E.1.8 Aesthetic Resources

Scenic views and vistas within the river and stream corridors of the ACT River Basin encompass a wide range of river, stream, and reservoir settings, including cascading streams rising from the upper reaches of the Coosa River watershed in the mountains and foothills of the Southern Appalachian highlands; rivers and streams in the Piedmont province and along the fall line in the lower Coosa River and Tallapoosa River watersheds; and the imposing Alabama River below Montgomery, AL, that meanders through the coastal plain toward the Mobile River delta and Gulf of Mexico. Interspersed along the rivers and primary streams throughout the ACT River Basin are both federal and nonfederal reservoirs, as discussed in Section E.1.1.4. The streams, rivers, and lakes of the ACT River Basin provide valued aesthetic resources to the residents and tourists in the region that are associated with a variety of water-based recreational pursuits.

The three reservoirs directly affected by the proposed actions under consideration in this Draft FR/SEIS are Allatoona Dam and Lake (USACE), Weiss Dam and Lake (APC), and Logan Martin Dam and Lake (APC). The water levels in these reservoirs are drawn down substantially during the winter months in accordance with their authorized purpose of flood risk management. The reduced water levels in the lakes during those months provide additional reservoir storage capacity to more effectively manage flood risk during the normally wettest period of the year. The normal winter drawdown of these lakes temporarily exposes a substantial amount of shoreline and unvegetated lake bottoms over the aerial extent of the projects, decreasing their aesthetic value during the period. For example, the Allatoona Lake level is typically drawn down from a normal summer elevation of 840 ft to

elevation 823 ft (a difference of 17 ft) at the end of December, prior to refilling the reservoir in the spring. The reservoir size decreases from 11,164 ac at elevation 840 ft to 6,962 ac at elevation 823 ft, leaving as much as 4,200 ac of exposed lake bottom during the winter drawdown period (Tetra Tech, Inc., 2012). Similarly, the winter drawdown of 6 ft at Weiss Lake exposes up to 10,700 ac of lake bottom (USACE Mobile District, 2004a), and the 5-ft drawdown at Logan Martin Lake exposes up to 3,370 ac of lake bottom (USACE Mobile District, 2004b).

The aesthetic resources along the rivers, streams, and reservoirs of the ACT River Basin are institutionally recognized by federal, state, and local agencies and non-government organizations. Accordingly, there are many established public access points, public use areas, and national, state, and local parks along their shorelines. While there are no formally designated National Wild and Scenic Rivers within the ACT River Basin, several river corridors within the basin such as the Cartecay and Conasauga rivers in Georgia and the Little River in Alabama are publicly recognized within the states and the region as scenic and minimally impacted by man's activities. The Alabama and Coosa rivers are an integral part of the blueway known as the Alabama Scenic River Trail (Alabama Scenic River Trail, 2019).

E.1.9 Air Quality and General Conformity

USEPA Region 4 and ADEM regulate air quality in Alabama; USEPA Region 4 and GADNR regulate air quality in Georgia.

The Clean Air Act (CAA) (42 U.S.C. §§ 7401–7671q), as amended, gives USEPA the responsibility to establish the primary and secondary National Ambient Air Quality Standards (NAAQS) (40 CFR Part 50) that set acceptable concentration levels for six criteria pollutants: particulate matter (less than 10 microns in diameter [PM_{10}] and less than 2.5 microns in diameter [$PM_{2.5}$]), sulfur dioxide (SO_2), carbon monoxide (CO), nitrous oxides (NO_x), ozone (O_3), and lead. Short-term NAAQS (1-, 8-, and 24-hour periods) have been established for pollutants contributing to acute health effects, while long-term NAAQS (annual averages) have been established for pollutants contributing to chronic health effects. Each state has the authority to adopt standards stricter than those established under the federal program; however, both Alabama and Georgia accept the federal standards.

Federal regulations designate Air Quality Control Regions (AQCRs) in violation of the NAAQS as *nonattainment* areas. The CAA defines an AQCR as a contiguous area where air quality, and thus air pollution, is relatively uniform. Each AQCR is treated as a unit for the purposes of pollution reduction and achieving NAAQS. AQCRs may cross multiple city, county, and regional political jurisdictions, and may even cross state lines. Federal regulations designate AQCRs with levels below the NAAQS as *attainment* areas. *Maintenance* areas are AQCRs that have previously been designated as nonattainment and have been redesignated to attainment for a probationary period through implementation of maintenance plans. USEPA has designated eight out of the 64 counties in the ACT River Basin as nonattainment or maintenance areas for at least one criteria pollutant (Table E-46).

Table E-46. Counties in the ACT River Basin Designated as Nonattainment or Maintenance Areas

State	Counties	Nonattainment pollutant
Georgia	Cherokee, Forsyth, Paulding	O_3 (Maintenance)
	Bartow, Cobb, Fulton	O_3 (Nonattainment)
Alabama	Jefferson, Shelby	$PM_{2.5}$ (Maintenance)

Source: (USEPA, 2019d).

USEPA, ADEM, and GADNR have established general conformity rules specifically to ensure that the actions taken by federal agencies in nonattainment areas do not affect a region's ability to meet the NAAQS. The conformity regulations play an important role in helping states and tribal regions improve air quality in those areas that do not meet the NAAQS and in federally supported activities that occur in the eight nonattainment and maintenance counties in the ACT River Basin.

E.1.10 Noise

Noise is defined as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, or is otherwise intrusive. Human response to noise varies according to the type and characteristics of the noise, distance between the noise source and the receptor, receptor sensitivity, and time of day. Noise is often generated by activities that are part of everyday life such as construction or vehicular traffic.

Sound varies by both intensity and frequency. Sound pressure level, described in decibels (dB), is used to quantify sound intensity. The dB is a logarithmic unit that expresses the ratio of a sound pressure level to a standard reference level. Hertz are used to quantify sound frequency. The human ear responds differently to different frequencies. *A-weighing*, described in a-weighted decibels (dBA), approximates that frequency response to express accurately the perception of sound by humans. Sounds encountered in daily life and their approximate levels in dBA are listed in Table E-47.

The dBA noise metric describes steady noise levels. Very few noises are, in fact, constant; therefore, a noise metric, Day-Night Sound Level (DNL), has been developed. DNL is defined as the average sound energy in a 24-hour period with a 10-dB penalty added to the nighttime levels (from 10 p.m. to 7 a.m.). DNL is a useful descriptor for noise because it (1) averages ongoing, yet intermittent noise, and (2) measures total sound energy over a 24-hour period. In addition, Equivalent Sound Level (L_{eq}) is often used to describe the overall noise environment. L_{eq} is the average sound level in dB.

Table E-47. Common Sounds and Levels

Outdoor	Sound level (dBA)	Indoor
Snowmobile	100	Subway train
Tractor	90	Garbage disposal
Noisy restaurant	85	Blender
Downtown (large city)	80	Ringing telephone
Freeway traffic	70	TV audio
Normal conversation	60	Sewing machine
Rainfall	50	Refrigerator
Quiet residential area	40	Library

Source: (Harris, 1998).

The Noise Control Act of 1972 (Public Li 92-574) directs federal agencies to comply with applicable federal, state, and local noise control regulations. In 1974 USEPA provided information suggesting that continuous and long-term noise levels in excess of DNL 65 dBA are normally unacceptable for noise-sensitive land uses such as residences, schools, churches, and hospitals. Alabama and Georgia have not implemented noise regulations at the state level. Many counties in the ACT River Basin maintain nuisance noise regulations; however, most of them do

not outline specific, not-to-exceed noise levels. Most county- and city-based noise ordinances exempt construction noise during daytime hours.

Estimates of existing noise levels (L_{eq} and DNL) in areas internal to, and on the perimeter of, the ACT River Basin are provided in Table E-48, based upon the techniques specified in the *American National Standard Quantities and Procedures for Description and Measurement of Environmental Sound Part 3: Short-term measurements with an observer present* (ANSI, 2013). Individuals residing in urban areas in the ACT River Basin have outdoor DNL values ranging from 45 to 65 dBA. The levels shown are the lowest provided by the American National Standards Institute standard, and noise levels in remote areas could be substantially less. Very rural and remote areas are estimated to have DNL values ranging from 20 to 45 dBA.

Table E-48. Estimated Noise Levels for Varying Land Use Intensities

Example land use category	Average residential intensity (people per ac)	DNL (dBa)	L_{eq} (dBa)	
			Daytime	Nighttime
Noisy urban residential	80	65	64	57
Quiet commercial, industrial, and normal urban residential	25	60	58	52
Quiet urban residential	8	55	53	47
Quiet suburban residential	3	50	48	42
Rural residential	1	45	43	37

Source: (ANSI, 2013)

E.1.11 Traffic and Transportation

The ROI for the proposed actions addressed in this Draft FR/SEIS is the Coosa River Basin within the larger ACT River Basin. Major transportation facilities within the general vicinity of the mainstem rivers in the Coosa River Basin include interstate highways, U.S. highways, and railroad corridors. Interstate (I-) 59 and U.S. Highway 11 runs along the west side of the Coosa River between Birmingham and Gadsden, AL. I-20 and U.S. Highway 78 cross the Coosa River (upper end of Logan Martin Lake) near Pell City, AL. I-75 and U.S. Highway 41 crosses the Etowah River near Cartersville, Georgia and the Oostanaula River near Calhoun, Georgia. US Highway 411 runs along the Etowah and Coosa rivers between Cartersville, GA, and Centre, AL (near Weiss Lake). Numerous railroad lines run along and cross the Coosa, Etowah, and Oostanaula rivers, connecting cities that include Childersburg, Birmingham, Anniston, and Gadsden, AL, and Rome, Cartersville, and Dalton, GA. In addition, numerous state and county roads lie in the immediate vicinity of the USACE and APC reservoirs in the Coosa River Basin and provide direct access to the reservoirs in many instances. These state and local road systems support transportations needs around these reservoirs, including the operation and maintenance (O&M) of facilities managed by USACE and APC, personal operating vehicles for residents, RVs, and tourists. There are no major airport facilities in the Coosa River Basin, but numerous small airport facilities are found in small towns across the basin.

Transportation aspects of water-based recreational activities are discussed in Section E.1.7.5, and commercial navigation activities are discussed in E.1.7.2.

E.1.12 Cultural Resources

Section 106 of the National Historic Preservation Act and its implementing regulations, 36 CFR Part 800, requires an assessment of the potential impact of an undertaking on historic properties that are within the proposed project's Area of Potential Effect (APE). The APE is defined as the geographic area(s) "within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist." Pursuant to 36 CFR 800.16 (l)(1), historic properties are defined as any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP) maintained by the Secretary of the Interior. Historic properties can include artifacts, records, and remains that are related to and located within historic properties.

Prior to the construction of the Allatoona Dam and Lake in the 1950s, the now inundated corridors of the Etowah River and its tributaries were surveyed for cultural resources. This initial survey (Caldwell, 1957), along with subsequent survey's (Ledbetter, Wood, Wood, Ethridge, & Braley, 1987), identified over 1,000 archaeological sites within what is now Allatoona Lake. These include both sites that have been inundated by the reservoir and sites situated above the maximum gross pool of the reservoir. Rivers have always been focal points of human subsistence, travel, and settlement and given the large number of known archaeological sites within the land and waters of the Allatoona project, it is reasonable to assume that high frequencies of cultural resources exist throughout the ACT River Basin. Since the proposed water supply storage reallocation at Allatoona Lake and proposed modified flood operations at Weiss and Logan Martin lakes will result in changes in water levels within each reservoir, there is potential that the operational changes could affect cultural resources. The following discussion regarding the existing conditions of cultural resources within the APE will describe the delineation the APE, how historic properties can be affected by reservoir operations, and the expected archaeological and historic site types within the APE.

E.1.12.1 Area of Potential Effect Delineation

The project area encompasses the Etowah River from its confluence with Hickory Log Creek at Canton, GA, and extends 79 mi downstream to its confluence with the Oostanaula River at Rome, GA, including Allatoona Lake. The project area also includes a 280-mile portion of the Coosa River extending from Rome, GA, downstream to its confluence with the Tallapoosa River near Montgomery, AL, including the Weiss and Logan Martin lakes. Within the reservoirs, the changes in elevation contours mark the boundaries of the APE and specifically define where project related impacts could occur. Portions of the APE below the dams include areas along the rivers where release patterns from the dams may change and could potentially cause channel widening and increased erosion. The proposed actions consist of operational changes that would utilize existing facilities and no new construction or earthmoving activities will be required.

E.1.12.2 Potential Effects to Historic Properties

During the mid-1970s, the effects of inundation upon archaeological sites within reservoirs were not clearly understood and there was considerable debate on whether the effects of inundation were beneficial or damaging. In 1975 the *National Reservoir Inundation Study* was initiated to address this debate and concluded that: a) the effects of inundation are overwhelmingly detrimental, b) some resources are more susceptible to negative effects than others, c) *in situ* preservation is a viable mitigation alternative in limited circumstances, and d) mitigation procedures should be incorporated into reservoir construction planning as soon as possible (Lenihan, et al., 1981).

The *National Reservoir Inundation Study* also identified four impact categories of reservoir processes that adversely affect archaeological sites. These consist of mechanical, biochemical, human, and other miscellaneous categories. Mechanical impacts are erosion and the deposition sediments from wave action along vertically fluctuating shorelines, the saturation and slumping sediments along the shoreline, and siltation from backshore runoff. Biochemical impacts include the increased degradation of archaeological artifacts, materials, and cultural deposit soils from periodic inundation. Human impacts consist of the consequence of reservoir construction, wave action from boat traffic, and problems stemming from increased site access. Miscellaneous factors encompass a host of other impacts including changes in the composition of flora and fauna and loss of access to an impacted cultural resource's data (Lenihan, et al., 1981). The *National Reservoir Inundation Study* was followed by additional work and in the late 1980s the USACE Environmental Laboratory arranged an interdisciplinary workshop to better understand processes that contribute to the degradation of archaeological sites within reservoirs (Mathewson, 1989). This in turn led to another USACE study that was intended to develop a means of designing effective ways to protect archaeological resources by burying them (Mathewson, Gonzalez, & Eblen, 1992).

Impacts to Historic Properties in Drawdown Zones at Corps of Engineer Reservoirs (Dunn, 1996) describes reservoirs as highly modified fluvial systems. As such, these systems can be understood through geomorphic analyses and erosional problems can be anticipated and one can plan ahead for the mitigation of adverse effects to Historic Properties. Unlike natural lakes where water levels are comparatively stable, and where inundated archaeological sites are less common, cultural resources located within the drawdown zone of a reservoir pool are subject to considerable impacts, largely as a result of lake level fluctuations. The 1996 study also explains the two primary drivers of these impacts which primarily include the effects of wave action in shallow water and wetting and drying of cultural deposits (Dunn, 1996).

Mechanical processes, especially wave action, can expose, displace, and bury artifacts. Wave action along the shoreline can also wash or erode away cultural deposits and features. In a natural lake, waves erode the shoreline, depositing silty materials in deeper water, gradually developing an off-shore shoal. As this shoal grows towards the water surface, it tempers wave energy, gradually slowing down the continued erosion until an equilibrium beach profile is created. In a reservoir where water levels rise and fall across a much wider range of elevation, an equilibrium profile is not created, and wave action continues to erode sediments unabated (Dunn, 1996).

Although wave action is the primary driver of reservoir pool impacts, frequent wetting and drying cycles are also damaging to a wide range of materials that exist in archaeological sites and other cultural resources (Dunn, 1996) (Mathewson, 1989) (Mathewson, Gonzalez, & Eblen, 1992). Increased frequencies of wetting/drying cycles can cause materials such as bone, charcoal, and other plant remains to deteriorate at accelerated rates. Wetting and drying can also change the physical properties of such materials rendering them unsuitable for specialized analyses such as radiocarbon dating. Some of these components include animal bones, shell, plant remains, charcoal, chipped stone, pottery, and midden soils (Mathewson, 1989).

Human activities tend to be focused on, or are more pronounced along, a reservoir's shoreline. Therefore, changes in water elevations could increase frequencies of exposure at some sites and lead to increased human traffic on or access to otherwise inundated resources. With more human traffic, increases in site vandalism and artifact collection could also occur, which could destroy the contextual integrity of a historic property.

E.1.12.3 Historical Properties in the APE

To understand potential effects of the proposed changes to project operations based on the information above, it is necessary to understand the existing conditions of the cultural and historical landscape in the APE. Although the project covers a vast area, a reasonable estimate of site types and probable project related effects can be illustrated from a subsample of previously recorded cultural resources. By the end of the 1980s, the Allatoona Lake portion of the APE has been subjected to numerous archaeological inventory efforts resulting in the identification of over 1,000 cultural resource sites. Approximately 250 of these sites have been determined to be eligible, or potentially eligible historic properties (Ledbetter, Wood, Wood, Ethridge, & Braley, 1987). These include properties representing every Native American period of occupation in the region, from 12,000 years ago until European contact. Historic Period properties include sites related to the industrial production of iron and textiles and grist mills dating to the mid-1800s and early 1900s and more recent resources related to flood risk management, hydropower generation, and navigation projects enacted by congressional legislation.

As described in Section E.1.12.1, the APE for the actions considered in this study is expansive, encompassing three reservoirs and over 300 mi of river and stream channels. Given the extent of the APE, even preliminary inventory efforts to list Historic Properties within the overall APE would require an extensive records search, which is beyond the scope of the present document. As an alternative, the following discussion relies upon data on known resources within the land and waters of the Allatoona project. It is assumed that sites similar to those within the land and waters of the Allatoona project will be present throughout the rest of the APE. It is also expected that sites within the Weiss and Logan Martin portions of the APE will be similarly affected by the reservoir processes, as those within the Allatoona Lake. Therefore, Allatoona Lake's historic properties represent an appropriate subsample from which current conditions can be described and expected affects from implementation of the proposed project can be determined.

Of the previously recorded sites within the Allatoona Lake portion of the APE, 14 have components located within the normal operating range of pool elevations for the reservoir. Based on the location of these resources, each of the properties could be impacted through increased wetting and drying, increased exposure to wave action, and increased human access. Adverse effects to these sites from mechanical, biochemical, or miscellaneous impacts will depend upon their geomorphological characteristics, wind exposure, and the extent of surrounding development. Information on these 14 representative cultural properties has been compiled from site descriptions prepared during previous studies and site inspections conducted under Section 110 compliance and is summarized on Table E-49. In some cases, data specifically regarding the effects of reservoir processes was recorded and provides helpful information regarding impacts that have resulted from current reservoir operations (i.e., its integrity, observed ongoing effects, and indications of past effects).

Nearly all the historic properties summarized in Table E-49 have been subjected to at least 1 or more processes of reservoir operation. Based on data related to site elevations, site descriptions recorded during previous surveys, and site maps with topographic information, at least 12 of the historic properties have been subjected to mechanical erosion, two have been impacted by development for recreational purposes, and vandalism has been documented at one site.

1 **Table E-49. Summary of Historic Properties within Allatoona Lake**

Site (name/no.)	Elevation (ft)	Cultural affiliation	Site type	Adverse reservoir impacts	NRHP status
9BR145	Maximum Gross Pool – 843	Late Archaic–Middle Woodland and historic	Artifact and shell scatters	Cultivated; possible shoreline erosion; <50% disturbed	Unknown
Coopers Furnace Community/9BR240, 253, 245, 247	Maximum Gross Pool – 859	Pre-Contact and historic	Historic structures and artifacts and Native American artifact scatter	Development for recreation; erosion	Potentially Eligible
9BR605	840	Unknown Pre-Contact occupation	Pre-Contact artifact and shell scatter	Unknown	Unknown
9CK23	840	Historic and Archaic to historic period Native American occupation	Historic artifacts and Native American village	Cultivated; possible shoreline erosion; <50% disturbed	Unknown
9CK32	Maximum Gross Pool – 850	Middle Archaic to historic period Native American occupation	Artifact and shell scatter	Cultivated; possible shoreline erosion; <50% disturbed	Unknown
9CK33	840	Historic and Archaic to Woodland period Native American occupation	Historic artifacts and Pre-Contact artifact and shell scatter	Development for recreation; cultivation; shoreline erosion	Unknown
9CK61	Maximum Gross Pool – 850	Historic and Early Woodland to Historic period Native American occupation	Historic artifacts and Pre-Contact artifact and shell scatter	Possible shoreline erosion	Unknown
9CK104	840	Early Paleo-Indian to Historic Period Native American occupation	Pre-Contact village and artifact and shell scatter	Possible shoreline erosion	Potentially Eligible; high data potential
9CK174	840	Late Archaic Period occupation	Quarry and artifact and shell scatter	Cultivated; possible shoreline erosion; <50% disturbed	Potentially Eligible; high data potential
9CK192	Maximum Gross Pool – 850	Pre-Contact Native American occupation	Quarry	Cultivated; possible shoreline erosion; <50% disturbed	Unknown
9CK265	840	Unknown Pre-Contact Native American occupation	Fish weir/rock dam	Exposure to wet/dry cycles	Potentially Eligible; high data potential
9CK359	840	Historic and Unknown Pre-Contact Native American occupation	Historic artifacts and Pre-Contact artifact and shell scatter	Cultivated; possible shoreline erosion	Unknown
9CK410	At or near Maximum Gross Pool	Historic, 1900s	Dam and mill	Vandalism; exposure to wet/dry cycles; shoreline erosion	Recommended eligible
9CK527	Maximum Gross Pool – 846	Historic and Archaic to Historic period Native American occupation	Historic artifacts and Pre-Contact artifact and shell scatter	Cultivated; possible shoreline erosion; <50% disturbed	Unknown

2

E.1.13 Hazardous and Toxic Materials

Operating and maintaining the USACE Allatoona Dam and Lake and the APC Weiss and Logan Martin dams and lakes typically require the use of hazardous and toxic materials. The use of materials such as pesticides, paints, solvents, and petroleum products would be expected during the O&M of facilities, lake shoreline, vehicles, and equipment. The use of petroleum products would also be expected from the operation of marinas and from RV use.

Additionally, APC's operational requirements on their reservoir projects include acquisition of flowage easements, when necessary, for lands that would be directly affected by any future changes to flood operations, including such lands downstream of Weiss and Logan Martin dams. Downstream of Weiss Dam is predominately agricultural and forested land with some residential areas near Gadsden, AL. Some industrial sites are present along the river in the Gadsden area. Downstream of Logan Martin Dam is predominately agricultural and forested land with some residential areas near Childersburg, AL; however, industrial, commercial and recreational uses are more apparent in this area than along other reaches of the Coosa River. Refer to Figure E-19 for a map of the general area. Situated between 7 to 10 mi downstream of the Logan Martin Dam, on the eastern side of the river, is Coosa Industrial Park, a golf course and a large industrial facility consisting of the Coosa Pines Mill and other facilities. The land area including Coosa Industrial Park, the Coosa Pines Mill and golf course were once part of the former Alabama Army Ammunition Plant. Site conditions at the former plant have been investigated by the Army with USEPA and ADEM oversight. Remedies to clean up soil and groundwater contamination have been taken or are ongoing (USEPA, 2018). Across from Coosa Pines Mill on the western bank of the river is a water treatment facility, and a short distance further downstream is the APC Gaston Power Plant.

E.2 Future Without Project Conditions

Environmental conditions within the ROI for proposed actions addressed in this Draft FR/SEIS are likely to change in the future, regardless of whether the proposed actions are implemented or not. These changes may over time compound the expected effects of the proposed actions, offset the effects, or result in no discernable differences between present and future environmental conditions. This section describes future environmental conditions without the proposed changes to USACE and APC reservoir project operations in comparison to existing conditions.

Table E-50 presents the expected or likely future conditions of the environmental resources (by topic or area of concerns) presented in Section E.1 over the period of analysis for the project (through 2050). The future conditions are presented as a comparison to existing conditions as presented in Section E.1. The contents of the table are based on reasoned estimates of future conditions based on past changes, recent and current trends, and existing plans and projections for the future. For each environmental resource area, the table identifies the potential implications for water management activities on USACE and APC reservoir projects in the ACT River Basin.

Table E-50. Future Without Project Condition for Allatoona-Coosa Reallocation Study

Environmental Resource Area or Issue	Current Conditions	Future Without Project Conditions Compared to Current Conditions
Water quantity	See Section E.1.1	Population growth and associated land development are expected to continue in the ACT River Basin, particularly in the upper portion of the basin (in the Etowah River, including the Allatoona Lake area) with the continued expansion of Metro Atlanta to the northwest. Withdrawals for public water supply and other purposes are likely to increase, but the rate of increase is expected to slow as a result of water conservation and efficiency measures being implemented. Land-use changes are likely to increase the amount of impervious surfaces and runoff during storm events and to decrease base flows in streams. Climate change over time could affect precipitation, evapotranspiration, and streamflow conditions in the ACT River Basin. Those future changes could indirectly affect future water management activities on the ACT Basin reservoirs.
Water quality	See Section E.1.2	Population growth and associated land development are expected to continue in the ACT River Basin, particularly in the upper portion of the basin (in the Etowah River, including the Allatoona Lake area) with the continued expansion of Metro Atlanta to the northwest. Associated land-use changes are likely to cause some water quality degradation, although the extent to which that might occur is unknown. Potential water quality degradation in USACE and APC reservoirs in the basin could have some indirect effects on future water management activities on the ACT Basin reservoirs.
Geology and soils	See Section E.1.3	As land-use change becomes more dramatic and land development continues to expand in the ACT River Basin, soil erosion in tributaries of USACE and APC reservoirs could increase sedimentation and further reduce available storage in those reservoirs. Specifically, Allatoona, Weiss, and Logan Martin lakes could be vulnerable to increased erosion driven by accelerated land-use change and development. Future management of the ACT River Basin reservoirs could potentially be affected by increased sedimentation over time.
Climate	See Section E.1.4	Climate change over time could affect precipitation, evapotranspiration, and streamflow conditions in the ACT River Basin. The climate change analysis in Section 7.5 of the main report suggests a strong likelihood that the upper ACT Basin could experience slightly wetter conditions in the future as a result of climate change. Those hydrologic changes could potentially affect future water management activities for USACE and APC reservoir projects in the basin.
Land use	See Section E.1.5	Land use in the ACT River Basin is likely to change dramatically in the future, particularly in the upper portion of the basin (in the Etowah River, including the Allatoona Lake area). Land use will transition over time from predominately forested and agriculture to urban/suburban. Compared to current conditions, those changes are likely to increase the amount of impervious surfaces and runoff during storm events, decrease base flows in streams, degrade water quality; degrade or destroy fish and wildlife habitat, and pose further risk to imperiled aquatic species. Dependent on the extent to which land uses change in the basin, those changes could potentially have an indirect effect on future management of ACT River Basin reservoirs.

Environmental Resource Area or Issue	Current Conditions	Future Without Project Conditions Compared to Current Conditions
Biological resources	See Section E.1.6	Future land-use change in the ACT River Basin, particularly in the upper portion of the basin (in the Etowah River, including the Allatoona Lake area), could potentially decrease base flows in streams, degrade water quality; degrade or destroy fish and wildlife habitat, and increase the number of imperiled aquatic species. The extent of those impacts will depend on the level of water and related land resource planning, management, and regulation by AL and GA. Future conditions for biological resources in the basin, particularly aquatic resources, could potentially have a limited indirect effect on future management of ACT River Basin reservoirs.
Socioeconomic resources	See Section E.1.7	Specific socioeconomic resource areas are addressed individually below.
M&I water supply	See Section E.1.7.1	Population growth and associated development will increase demand for public water supply in the ACT River Basin. Water supply withdrawals are expected to increase, but the rate of increase in the basin is expected to slow appreciably as a result of water conservation and efficiency measures being implemented. Georgia's pending water supply request would specifically address expected water supply demands for the City of Cartersville and CCMWA through 2050 in a substantial portion of the lower Etowah River Basin, including Allatoona Lake.
Navigation	See Section E.1.7.2	Commercial navigation in the Alabama River is likely to remain the same or continue to decline as a mode of transportation for commodities. The navigation plan in the 2015 ACT River Basin Master Manual update will continue to provide flow support from upstream reservoirs to sustain adequate navigation channel depths in the Alabama River when adequate basin inflows are available. Those releases are collaterally beneficial for downstream water supply and water quality purposes. The future status of commercial navigation on the Alabama River might have limited effects on management of ACT River Basin reservoirs.
Hydropower	See Section E.1.7.3	Demand for hydropower as a sustainable, renewable source of energy is expected to remain high in the future. Construction of new hydropower projects in the future will likely be rare because of extensive environmental concerns at most dam sites. There is potential for nonfederal hydropower development at USACE's Claiborne L&D and Carters Reregulation Dam, and possibly at nonfederal dams. Continued hydropower generation at current or higher levels in the future would not affect ongoing or expected future water management activities at USACE and APC reservoirs.
Flood risk management	See Section E.1.7.4	Over time, reduced flood risk provided by USACE and APC reservoir projects could inadvertently encourage development in flood-prone areas downstream of reservoirs, potentially increasing future flood damages. Development in those areas could be curtailed through proactive efforts by local officials to regulate and discourage it. The potential for development in the floodplain downstream of those reservoirs could have limited effects on future flood operations if property owners are at risk.

Environmental Resource Area or Issue	Current Conditions	Future Without Project Conditions Compared to Current Conditions
Recreation	See Section E.1.7.5	The demand for public access to water-based recreation facilities is likely to substantially increase in the future, especially in populated areas near USACE and APC reservoirs. Increased recreational use in the future could have a direct effect on routine water management activities at USACE and APC reservoirs in the basin.
Agricultural water supply	See Section E.1.7.6	Agricultural water supply demand in the ACT River Basin is likely to increase in the future, but that increase is likely to be modest compared to the increased demand for public water supply and other water uses and represents only a small share of total water use in the basin. Future agricultural water supply demand would not be expected to have a direct effect on management of ACT River Basin reservoirs.
Environmental justice	See Section E.1.7.11	The demographic composition of the ACT River Basin is not expected to change dramatically in the foreseeable future, including the relative share and general distribution of minority and economically disadvantaged residents. No new environmental justice issues are expected regarding the management of ACT River Basin reservoirs.
Protection of children	See Section E.1.7.12	River and reservoir management activities that currently may pose health and safety risks to children are expected to be the same in the future. Management activities at USACE and APC reservoir projects aimed at reducing those risks are expected to continue in the future and to be improved, where possible.
Aesthetic resources	See Section E.1.8	Continued population growth and associated development in the ACT River Basin will likely increase adverse effects on scenic areas in the ACT River Basin, including along the primary rivers, streams, and reservoirs. Those effects would likely create greater public pressure to preserve existing aesthetic values around USACE and APC lakes but not be expected to have a direct effect on management of ACT River Basin reservoirs in general.
Air quality	See Section E.1.9	Despite the expected increases in population, air quality in the ACT River Basin is likely to improve over time. Transition from coal-fired to natural gas-fired power generation, increased use of renewable energy, increased electric vehicle use, and other changes will likely sustain or improve conditions. Future air quality conditions would not be expected to have a direct effect on management of ACT River Basin reservoirs.
Noise	See Section E.1.10	Continued population growth and associated development in the ACT River Basin will likely increase noise levels in more urbanized areas and on the lakes as a result of increased recreational use. Future changes would not be expected to have a direct effect on management of ACT River Basin reservoirs.
Traffic and transportation	See Section E.1.11	Continued population growth and associated development in the ACT River Basin will likely increase congestion and pressure to further develop and improve the ground transportation infrastructure, especially in populated areas in the basin, some of which are close to USACE and APC reservoirs.

Environmental Resource Area or Issue	Current Conditions	Future Without Project Conditions Compared to Current Conditions
Cultural resources	See Section E.1.12	Continued population growth and associated development in the ACT River Basin will likely increase the risk of human interaction with significant cultural resources and historic sites on both public and private lands. Those potential future conditions would not be expected to have a direct effect on water management activities at ACT River Basin reservoirs. Additional future changes in water management practices at Allatoona Lake could result in additional effects on cultural resources at the project.
Hazardous and toxic waste	See Section E.1.13	Continued population growth and associated development could increase the risk of accidental releases of hazardous and toxic materials or waste into rivers, streams, and reservoirs or poor waste management practices near water bodies. Risks can be minimized through proactive planning, risk avoidance measures, and emergency response preparedness. The likelihood of such occurrences is considered low, any potential effects are likely to be localized, and the risks would not be expected to have a direct effect on water management activities for ACT River Basin reservoirs.

E.3 Environmental Consequences

This section describes the environmental and socioeconomic effects of Georgia's water supply storage reallocation request at Allatoona Lake and the APC-proposed modifications to flood operations at Weiss and Logan Martin lakes. The affected environment described in Section E.1 serves as a baseline from which potential environmental and socioeconomic effects likely to result from the proposed changes were determined.

For each natural and socioeconomic resource area discussed in this section, an impact matrix table (Table E-51) summarizes the expected environmental consequences for each of the 11 alternatives that were carried forward for detailed analysis in the plan formulation process, including the No Action Alternative (NAA). Note on the table that Alternatives 5 and 6 were screened from the original list of 13. The impact matrix includes relevant parameters and/or indicators for each resource area upon which the general assessment of effects is based. The following terms characterize or define the various levels of impact presented in each impact matrix:

- *Negligible/no change*—Any positive or negative impacts would be negligible, amounting to no effective change.
- *Slightly adverse/slightly beneficial*—Any impact would be perceptible and measurable but would not have an appreciable effect.
- *Adverse/beneficial*—Any impact would be clearly detectable and would have an appreciable effect.
- *Substantially adverse/substantially beneficial*—Any impact would result in a highly noticeable effect.

The characterization of environmental consequences for each natural and socioeconomic resource area in the impact matrix is intended to provide only a general overview or summary of the nature and relative intensity of the effects with respect to the specific resource area. The generalized summary of environmental consequences covers all 11 alternatives that were considered for more detailed analysis in the plan formulation process. Detailed descriptions of these alternatives are provided in Section 4. Three alternatives (in addition to the NAA) were selected for detailed analysis of impacts in accordance with NEPA: Alternative 11 (the Tentatively Selected Plan [TSP]), Alternative 10, and Alternative 3. The other alternatives in Table E-51 are variations of these three alternatives, and they would likely involve similar impacts to one of these three. The text for each resource area in this section provides more detailed information and analysis (both qualitative and quantitative) on the NAA and Alternatives 11, 10, and 3 to support the general characterization of environmental effects in the matrix. In some cases, pertinent appendices include additional details for reference by the reader. Compliance with federal laws and EOs for the TSP is summarized in Section 7.3 of the main report.

E.3.1 Model Simulations

The model simulations described in this section were used to evaluate and compare the expected impacts of the alternatives considered in detail.

E.3.1.1 HEC-ResSim Modeling

The HEC-ResSim model was used to simulate the alternatives for the proposed water supply storage request and proposed modifications to flood operations in the ACT River Basin. HEC-ResSim is a state-of-the-art tool for simulating flow operations in managed systems. The USACE Hydrologic Engineering Center (HEC) developed this software, which has become the standard for USACE reservoir operations modeling. The analysis for this Draft FR/SEIS was performed using HEC-ResSim Version 3.4.1, Build 32 (May 2018). HEC-ResSim replaced its predecessor, HEC-5, as the next generation graphical user interface-based reservoir operations simulation software.

Table E-51. Allatoona-Coosa Reallocation Study—Summary of Environmental Consequences of Alternatives

Resource Area \ Alternative No. Name	1	2	3	4	5	8	9	10	11	12	13
	NAA	FWOP	WS01	WS02	WS03	WS06	FWOP_MF	WS02_MF	WS06_MF	WS01_MF	WS03_MF
Water Quantity											
Lake level conditions											
Allatoona Lake	Baseline	Negligible/ No change	Slightly adverse	Slightly adverse	Beneficial	Beneficial	Negligible/ No change	Slightly adverse	Beneficial	Slightly adverse	Beneficial
Weiss Lake	Baseline	Negligible/ No change	Negligible/ No change	Negligible/ No change	Negligible/ No change	Negligible/ No change	Beneficial	Beneficial	Beneficial	Beneficial	Beneficial
H. Neely Henry Lake	Baseline	Negligible/ No change	Negligible/ No change	Negligible/ No change	Negligible/ No change	Negligible/ No change	Negligible/ No change	Negligible/ No change	Negligible/ No change	Negligible/ No change	Negligible/ No change
Logan Martin Lake	Baseline	Negligible/ No change	Negligible/ No change	Negligible/ No change	Negligible/ No change	Negligible/ No change	Beneficial	Beneficial	Beneficial	Beneficial	Beneficial
R.E. "Bob" Woodruff Lake	Baseline	Negligible/ No change	Negligible/ No change	Negligible/ No change	Negligible/ No change	Negligible/ No change	Negligible/ No change	Negligible/ No change	Negligible/ No change	Negligible/ No change	Negligible/ No change
Stream flow conditions											
Etowah River - Allatoona Dam to Rome, GA	Baseline	Slightly beneficial	Negligible/ No Change	Slightly adverse	Slightly adverse	Slightly adverse	Slightly beneficial	Slightly adverse	Slightly adverse	Negligible/ No Change	Slightly adverse
Coosa River - Rome, GA, to Weiss Lake	Baseline	Negligible/ No Change	Negligible/ No Change	Negligible/ No Change	Negligible/ No Change	Negligible/ No Change	Negligible/ No Change	Negligible/ No Change	Negligible/ No Change	Negligible/ No Change	Negligible/ No Change
Coosa River - Logan Martin Dam Discharge	Baseline	Negligible/ No Change	Negligible/ No Change	Negligible/ No Change	Negligible/ No Change	Negligible/ No Change	Slightly beneficial	Slightly beneficial	Slightly beneficial	Slightly beneficial	Slightly beneficial
Alabama River near Montgomery, AL	Baseline	Negligible/ No Change	Negligible/ No Change	Negligible/ No Change	Negligible/ No Change	Negligible/ No Change	Negligible/ No Change	Negligible/ No Change	Negligible/ No Change	Negligible/ No Change	Negligible/ No Change
Drought operations	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Releases to support navigation	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Water Quality											
Water temperature											
Etowah River - Canton, GA, to Allatoona Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Allatoona Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Etowah River - Allatoona Dam to Rome, GA	Baseline	Slightly adverse	Negligible/ no change	Slightly beneficial	Slightly beneficial	Slightly beneficial	Negligible/ no change	Slightly beneficial	Slightly beneficial	Negligible/ no change	Slightly beneficial

Alternative No. / Name / Resource Area	1	2	3	4	5	8	9	10	11	12	13
	NAA	FWOP	WS01	WS02	WS03	WS06	FWOP_MF	WS02_MF	WS06_MF	WS01_MF	WS03_MF
Coosa River - Rome, GA, to Weiss Lake	Baseline	Slightly adverse	Negligible/ no change	Slightly beneficial	Slightly adverse	Slightly adverse	Negligible/ no change	Slightly beneficial	Slightly adverse	Negligible/ no change	Slightly adverse
Weiss Lake	Baseline	Slightly adverse	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Slightly beneficial	Slightly beneficial	Negligible/ no change	Slightly beneficial	Slightly beneficial
H. Neely Henry Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Logan Martin Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Slightly adverse	Slightly adverse	Slightly adverse	Slightly adverse	Slightly adverse
Dissolved oxygen											
Etowah River - Canton, GA, to Allatoona Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Allatoona Lake	Baseline	Slightly adverse	Slightly adverse	Slightly beneficial	Slightly beneficial	Slightly beneficial	Slightly beneficial	Slightly beneficial	Slightly beneficial	Slightly adverse	Slightly beneficial
Etowah River - Allatoona Dam to Rome, GA	Baseline	Slightly adverse	Negligible/ no change	Slightly beneficial	Slightly beneficial	Slightly beneficial	Slightly adverse	Slightly beneficial	Slightly beneficial	Negligible/ no change	Slightly beneficial
Coosa River - Rome, GA, to Weiss Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Weiss Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
H. Neely Henry Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Logan Martin Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Phosphorus											
Etowah River - Canton, GA, to Allatoona Lake	Baseline	Negligible/ no change	Slightly adverse	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Allatoona Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Etowah River - Allatoona Dam to Rome, GA	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Coosa River - Rome, GA, to Weiss Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Weiss Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
H. Neely Henry Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Logan Martin Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change

Resource Area \ Alternative No. Name	1	2	3	4	5	8	9	10	11	12	13
	NAA	FWOP	WS01	WS02	WS03	WS06	FWOP_MF	WS02_MF	WS06_MF	WS01_MF	WS03_MF
Nitrogen											
Etowah River - Canton, GA, to Allatoona Lake	Baseline	Negligible/ no change	Slightly beneficial	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Slightly beneficial	Negligible/ no change
Allatoona Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Etowah River - Allatoona Dam to Rome, GA	Baseline	Negligible/ no change	Negligible/ no change	Slightly beneficial	Negligible/ no change	Negligible/ no change	Slightly adverse	Slightly beneficial	Negligible/ no change	Negligible/ no change	Negligible/ no change
Coosa River - Rome, GA, to Weiss Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Slightly adverse	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Weiss Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Slightly adverse	Slightly adverse	Slightly adverse	Negligible/ no change	Negligible/ no change
H. Neely Henry Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Slightly adverse	Slightly adverse	Slightly adverse	Negligible/ no change	Negligible/ no change
Logan Martin Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Slightly adverse	Slightly adverse	Slightly adverse	Negligible/ no change	Negligible/ no change
Chlorophyll a											
Etowah River - Canton, GA, to Allatoona Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Allatoona Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Etowah River - Allatoona Dam to Rome, GA	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Coosa River - Rome, GA, to Weiss Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Weiss Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Slightly adverse	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
H. Neely Henry Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Logan Martin Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Geology and Soils											
Allatoona Dam and Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Weiss Dam and Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
H. Neely Henry Dam and Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change

Alternative No. / Name / Resource Area	1	2	3	4	5	8	9	10	11	12	13
	NAA	FWOP	WS01	WS02	WS03	WS06	FWOP_MF	WS02_MF	WS06_MF	WS01_MF	WS03_MF
Logan Martin Dam and Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Climate Conditions	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Land Use											
Allatoona Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Weiss Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
H. Neely Henry Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Logan Martin Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Lay Lake (flowage easements for modified flood operations at Logan Martin Dam)	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Slightly adverse	Slightly adverse	Slightly adverse	Slightly adverse	Slightly adverse
Biological Resources											
Vegetation – terrestrial communities											
Etowah River	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Coosa River	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Vegetation – wetlands											
Etowah River - Canton, GA, to Allatoona Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Allatoona Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Slightly beneficial	Slightly beneficial	Negligible/ no change	Negligible/ no change	Slightly beneficial	Negligible/ no change	Slightly beneficial
Etowah River - Allatoona Dam to Rome, GA	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Coosa River - Rome, GA, to Weiss Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Weiss Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Slightly beneficial	Slightly beneficial	Slightly beneficial	Slightly beneficial	Slightly beneficial
H. Neely Henry Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change

Alternative No. / Name / Resource Area	1	2	3	4	5	8	9	10	11	12	13
	NAA	FWOP	WS01	WS02	WS03	WS06	FWOP_MF	WS02_MF	WS06_MF	WS01_MF	WS03_MF
Logan Martin Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Slightly beneficial	Slightly beneficial	Slightly beneficial	Slightly beneficial	Slightly beneficial
Wildlife											
Etowah River	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Coosa River	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Riverine fish and aquatic resources											
Etowah River - Canton, GA, (HLC) to Allatoona Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Etowah River - Allatoona Dam to Rome, GA	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Coosa River - Rome, GA, to Weiss Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Coosa River - Weiss Lake to H. Neely Henry Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Coosa River - H. Neely Henry Dam to Logan Martin Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Coosa River – Logan Martin Dam to Lay Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Reservoir fish and aquatic resources											
Allatoona Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Slightly beneficial	Slightly beneficial	Negligible/ no change	Negligible/ no change	Slightly beneficial	Negligible/ no change	Slightly beneficial
Weiss Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Slightly beneficial	Slightly beneficial	Slightly beneficial	Slightly beneficial	Slightly beneficial
H. Neely Henry Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Logan Martin Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Slightly beneficial	Slightly beneficial	Slightly beneficial	Slightly beneficial	Slightly beneficial
Lay, Mitchell, Jordan lakes	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
R.E. "Bob" Woodruff Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change

Alternative No. / Name / Resource Area	1	2	3	4	5	8	9	10	11	12	13
	NAA	FWOP	WS01	WS02	WS03	WS06	FWOP_MF	WS02_MF	WS06_MF	WS01_MF	WS03_MF
Estuarine fish and aquatic resources											
Essential Fish Habitat [a]	Baseline	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect	No effect
Protected species											
Mammals	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Birds	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Reptiles	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Amphibians	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Freshwater fishes	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Mussels	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Snails	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Plants	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Fish and wildlife management facilities	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Socioeconomic Resources											
Municipal and industrial water supply											
Etowah River (including Allatoona Lake)	Baseline	Adverse	Substantially beneficial	Substantially beneficial	Substantially beneficial	Substantially beneficial	Adverse	Substantially beneficial	Substantially beneficial	Substantially beneficial	Substantially beneficial
Coosa River	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Navigation channel (channel availability in the Alabama River downstream of Montgomery, AL)											
7.5-ft depth	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
9-ft depth	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Hydropower	Baseline	Slightly adverse	Slightly adverse	Slightly adverse	Slightly beneficial	Slightly beneficial	Slightly adverse	Slightly adverse	Slightly adverse	Slightly adverse	Slightly adverse
Agricultural water supply	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change

Resource Area \ Alternative No. Name	1	2	3	4	5	8	9	10	11	12	13
	NAA	FWOP	WS01	WS02	WS03	WS06	FWOP_MF	WS02_MF	WS06_MF	WS01_MF	WS03_MF
Flood risk management											
Allatoona Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Etowah and Coosa Rivers - Allatoona Dam to Weiss Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Weiss Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Beneficial	Beneficial	Beneficial	Beneficial	Beneficial
Coosa River - Below Weiss Dam (H. Neely Henry Lake)	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Logan Martin Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Beneficial	Beneficial	Beneficial	Beneficial	Beneficial
Coosa River - Below Logan Martin Dam (Lay Lake)	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Recreation resources											
Allatoona Lake	Baseline	Slightly beneficial	Slightly adverse	Slightly adverse	Slightly beneficial	Slightly beneficial	Negligible/ no change	Slightly adverse	Slightly beneficial	Slightly adverse	Slightly beneficial
Weiss Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Beneficial	Beneficial	Beneficial	Beneficial	Beneficial
H. Neely Henry Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Logan Martin Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Beneficial	Beneficial	Beneficial	Beneficial	Beneficial
Environmental justice	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Protection of children	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Aesthetic Resources											
Allatoona Lake	Baseline	Slightly beneficial	Slightly adverse	Slightly adverse	Slightly beneficial	Slightly beneficial	Negligible/ no change	Slightly adverse	Slightly beneficial	Slightly adverse	Slightly beneficial
Weiss Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Beneficial	Beneficial	Beneficial	Beneficial	Beneficial
H. Neely Henry Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Logan Martin Lake	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Beneficial	Beneficial	Beneficial	Beneficial	Beneficial

Alternative No. / Name / Resource Area	1	2	3	4	5	8	9	10	11	12	13
	NAA	FWOP	WS01	WS02	WS03	WS06	FWOP_MF	WS02_MF	WS06_MF	WS01_MF	WS03_MF
Air Quality	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Noise	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Traffic and Transportation	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Cultural Resources [b]	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change
Hazardous and Toxic Waste	Baseline	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change	Negligible/ no change

a. Areas subject to the Magnuson-Stevens Fishery Conservation and Management Act (Essential Fish Habitat) are outside the ROI for the proposed actions considered in this study. Therefore, the effects are characterized as "No Effect."

b. The impacts depicted are based on preliminary assessment of effects to cultural resources. USACE is establishing a Programmatic Agreement with Georgia and Alabama State Historic Preservation Offices to further investigate potential cultural resource effects associated with the TSP (Alternative 11).

Note:

Impacts descriptions in the Alternatives Impacts Comparison Matrix are drawn from evaluations of the post-processing outcomes compared to the No Action Alternative simulation, which is the NEPA baseline. Conclusions in this matrix are based upon the best information available at the time of the matrix's preparation and are subject to change if new information becomes available.

HEC-ResSim provides a realistic view of the physical river/reservoir system using a map-based schematic. The program's user interface allows the user to draw the network schematic as a stick figure or as an overlay on one or more georeferenced maps of the watershed. HEC-ResSim represents a system of reservoirs as a network composed of four types of physical elements: junctions, routing reaches, diversions, and reservoirs. By combining those elements, the modeler can build a network capable of representing as simple a model as a single reservoir on a single stream or as complex a model as a highly developed and interconnected system like the ACT River Basin. A reservoir is the most complex element of the reservoir network and is composed of a pool and a dam. HEC-ResSim assumes that the pool is level (i.e., it has no routing behavior), and its hydraulic behavior is completely defined by an elevation-storage-area table. The real complexity of HEC-ResSim's reservoir network begins with the dam. The HEC-ResSim modeling report, which is provided in Appendix C to the Draft FR/SEIS, describes the model's development and its application to the proposed actions in ACT River Basin addressed in this Draft FR/SEIS.

USACE determined that the 73-year hydrologic period of record (1939–2011) would provide a reasonable range of future hydrologic conditions to use to simulate the effects of the alternative plans to current project operations and the NAA. For the NAA, net diversions for M&I water supply (withdrawals minus returns of treated wastewater) and agricultural diversions for irrigation (assuming no returns) throughout the ACT River Basin were simulated by using 2006 values and applying them over the entire hydrologic period of record. All water-use data to support this analysis were provided by the state agencies responsible for regulating and tracking water withdrawals and returns in the respective states. Net diversion values in the ACT River Basin in 2006 represent the greatest annual amount of net water diversion in the basin during the period of simulation and, consequently, the year of greatest stress on the system from water withdrawals. Starting with average monthly values for each diversion, average daily values were calculated for each month (by dividing by the number of days), resulting in a year of daily values. The HEC-ResSim simulation applied those 2006 diversion values to hydrologic conditions for each year in the period of record.

Withdrawals and returns for the alternatives that include future water supply storage reallocation at Allatoona Lake were simulated using the estimated 2050 demands consistent with the State of Georgia's updated 2018 request. For the balance of the ACT River Basin, exclusive of CCMWA and City of Cartersville, year 2006 M&I net withdrawals, as well as agricultural withdrawal estimates, were simulated in the same manner as described for the NAA. The HEC-ResSim modeling report in Appendix C to the Draft FR/SEIS provides more information on how diversions were addressed.

The HEC-ResSim model simulations over the 73-year hydrologic period of record include the following assumptions: (1) the current USACE and APC projects in the ACT River Basin would be in place and operational over the entire period of record, and (2) the USACE and APC projects in the basin would be operated over the entire period of record either as they are currently operated (for the NAA) or as they would be operated under each of the alternatives developed for detailed consideration.

Based on those assumptions, observed or historic values for parameters such as lake levels or flows during the hydrologic period of record would be expected to vary from computed values in the simulations for the NAA. While observed values might track closely with model results in some cases, there are likely to be many cases in which the differences are more substantial because the model is not intended to replicate historic operating conditions.

E.3.1.2 HEC-5Q Modeling

The water quality effects associated with the water management alternatives and water supply storage options in the ACT River Basin were analyzed using the HEC-5Q model developed by the USACE HEC. USACE selected HEC-5Q as the tool most capable of faithfully representing river-reservoir temperature and water quality at the

culmination of a 3-year model development and verification process. A principal benefit of the HEC-5Q model is its ability to simulate the entire riverine and reservoir system in a single model. It can perform a holistic examination of the basin from top to bottom and simulate the watershed inflows, reservoirs, and river segments. The modeled output allows for a clear, longitudinal presentation of conditions to facilitate comparisons between alternative operations scenarios. In accordance with Engineering and Construction Bulletin 2007-6, *Model Certification Issues for Engineering Software in Planning Studies*, issued April 10, 2007, HEC-5Q falls under the category of "engineering models used in planning studies," leaving certification to the Science & Engineering Technology initiative associated with the USACE's Technical Excellence Network (TEN). As of January 2010, the TEN guidance listed HEC-5Q as "allowed for use" for water quality modeling.

To simulate water quality conditions under the various alternatives, HEC-5Q inputs included in-stream flows, tributary flows, water quality data, withdrawals, reservoir operations, and other point and nonpoint source flows and quality loads to the system. The HEC-5Q model was linked with the HEC-ResSim model through an input of flows by reach. In addition to the BASINS (Better Assessment Science Integrating point and Nonpoint Sources) model loadings developed in previous modeling efforts, observed data were used to represent the nonpoint inputs to the HEC-5Q model for the period of record from 2001 through 2008. The model also included nontributary inflows, wastewater treatment discharges, and cooling water returns. Inputs for wastewater treatment discharges were based on discharge monitoring reports (DMRs). When DMRs were not available, permitted limits, concentrations representative of the type of discharge, or an average of DMRs was used. The point source inputs considered only dischargers that contributed more than 1 mgd.

The HEC-5Q modeling report, which is provided in Appendix C to the Draft FR/SEIS, includes model inputs, assumptions, and calibration for application of HEC-5Q to the proposed actions.

E.3.1.3 HEC-RAS and HEC-FIA Modeling

The Hydrologic Engineering Center-River Analysis System (HEC-RAS) and Hydrologic Engineering Center-Flood Impact Analysis (HEC-FIA) models were used to evaluate potential flood risk management impacts associated with the proposed APC modifications to flood operations at Weiss and Logan Martin lakes and the potential flood risk effects of reallocation of a portion of the flood storage at Allatoona Lake for water supply purposes. The details of the flood risk modeling are presented in Appendix C to the Draft FR/SEIS.

E.3.2 Water Quantity

This section describes the expected effects of the NAA, Alternative 11 (the TSP), Alternative 10, and Alternative 3 on water quantity. It focuses on the extent of physical change in water resource parameters in the ACT River Basin that would likely result from implementing those alternatives and provides the principal basis for assessing other natural and socioeconomic resource impacts presented in the subsequent sections. The water quantity-related parameters evaluated include lake-level and reservoir storage conditions, streamflow conditions, drought operation occurrences, and navigation flows/channel depth availability. The evaluation includes multiple plots from the HEC-ResSim simulation over the hydrologic period of record. Table E-52 summarizes the alternatives evaluated in this section, including cross-referencing the alternative numbers with the alternative names used on the model graphs presented in this section and a brief description of each alternative's key features.

Table E-52. Summary of Alternative Numbers and Model Names from HEC-ResSim

Alternative number	Alternative name in model	Description
1	A0-BASE2018	No Action Alternative (NAA)
3	A03_WS1	Allatoona storage reallocation to enable withdrawals up to 94 mgd from conservation storage only, using Georgia's proposed storage accounting methodology
10	A10_WS2MF	Allatoona storage reallocation to enable withdrawals up to 94 mgd from conservation storage only, using USACE current storage accounting methodology, and modified flood operations at APC Weiss and Logan Martin projects
11 (TSP)	A11_WS6MF	Allatoona storage reallocation to enable withdrawals up to 94 mgd from combination of flood storage and conservation storage, using USACE current storage accounting methodology, and modified flood operations at APC Weiss and Logan Martin projects

This section provides figures showing plotted model results to facilitate comparison of the effects of the NAA, the TSP, and the other alternatives. In numerous cases, plots for two or more alternatives were nearly identical for a portion of the plot (or curve) or over their entire range. The last curve plotted on each figure is the NAA to help distinguish the extent to which the other alternatives deviate from the NAA or produce identical, or nearly identical, results as the NAA. The text associated with each figure provides specific clarification as necessary.

E.3.2.1 Lake Levels and Reservoir Storage Conditions

This section summarizes the effects of Alternatives 11, 10, and 3 compared to the NAA (Table E-52) on stream flow conditions in USACE and APC reservoirs. Representative summaries of HEC-ResSim model outputs are presented based on simulation of project operations under the alternative plans over the modeled period of record (1939–2011). This section describes the likely impacts on lake levels and associated storage conditions at Allatoona Lake on the Etowah River and the APC reservoirs on the Coosa River. In addition, model results for R.F. Henry L&D (R.E. "Bob" Woodruff Lake) on the upper Alabama River are presented to demonstrate that the effects of the proposed action are not discernable downstream of the mouth of the Coosa River.

Figures depicting "median" lake-level conditions in the basin are included to provide a representative characterization of "typical" conditions for alternative evaluation and comparison. The median value represents the point at which 50 percent of the values are higher and 50 percent are lower over the modeled period of record. In addition, figures depicting the 90 percent exceedance level have been included, showing that the values presented for each day would be exceeded 90 percent of the time over the period of record. The 90-percent exceedance value would be representative of extremely dry conditions in the basin and low basin inflow to the reservoirs. Other figures depicting the 10 percent exceedance level are included, showing that the values presented are exceeded only 10 percent of the time over the period of record and representative of substantially wet conditions in the basin and high basin inflow to the reservoirs.

E.3.2.1.1 No Action Alternative

E.3.2.1.1.1 Allatoona Dam and Lake

Under the NAA, conditions in Allatoona Lake, including its seasonal variations, would be consistent with those described in Section E.1.1.4.2. Over the modeled period of record, median lake levels would generally align with the current project guide curve from January through mid-July, subsequently gradually declining from about 840 ft to 832 ft by the end of November, thereafter aligning with the guide curve down to elevation 823 ft by the end of December (Figure E-39). At the 90-percent exceedance level (dry conditions), the Allatoona Lake pool would not reach to the level of the project guide curve at any time of the year. Pool levels would be slightly below the winter guide curve elevation of 823 ft in January to a peak elevation of about 838 ft in May, thereafter gradually declining at a steady rate to an elevation around 823 ft by the end of December (Figure E-40). At the 10-percent exceedance level (wet conditions), pool levels would generally be fully aligned with the project guide curve throughout the year, except for periods brief periods from January through April, when they are likely to occasionally exceed the guide curve by up to 5 ft because of large late winter/early spring rainfall events (Figure E-41).

The annual duration curve for Allatoona Lake pool levels (Figure E-42) provides information on the percentage of the total number of days over the 73-year modeled period of record that lake levels would be expected to exceed a range of water surface elevations, including certain elevations that are key indicators of potential impact on resources or uses of the lake. USACE has identified specific pool levels at Allatoona Lake as incremental thresholds for increasingly severe impacts on recreational use of the lake. Allatoona Lake fluctuates significantly during the year, and the fluctuations can be even more extreme during drought periods. The USACE Mobile District considers recreational needs at the Allatoona Lake project in making water management decisions, particularly during peak recreation season, generally Memorial Day through Labor Day. The incremental threshold impact elevations serve as a guide to understanding the recreational effects of water management decisions (USACE Mobile District, 2014a). Those levels and definitions are as follows:

- Initial Impact Level (IIL)–837 ft. At this elevation, recreational usage and recreation-related economy would begin to experience effects. Swimming areas would be reduced in size. Private docks would need adjusting, and some boating hazards can become evident in remote areas of the reservoir. Marina concessionaires would begin to need to move docks and water related business would decline.
- Recreation Impact Level (RIL)–835 ft. At this elevation, recreation would be more severely affected. All regular swimming areas will be exposed. Two boat ramps will be closed. Almost half of the private docks would be affected. Marina business would be severely reduced.
- Water Access Level (WAL)–828 ft. At this elevation, recreation would be severely restricted. Only half of boat ramps would be usable. Private docks would be totally unusable. Hazards to navigation would be numerous. Marinas would have severe problems such as gas docks being grounded and some slips being unusable. There would be reduction in recreational business activity.

As delineated, the current guide curve for Allatoona Lake calls for the water surface elevation to be below the IIL about 50 percent of the time during the year, below the RIL about 44 percent of the time, and below the WAL level about 22 percent of the time. For the NAA modeled over the period of record, lake levels would be expected to decline below the IIL on 69 percent of the days, below the RIL on 58 percent of the days, and below the WAL level on 21 percent of the days. Monthly duration curves for February (Figure E-43) and June (Figure E-44) are presented as examples to depict Allatoona Lake pool level conditions under the NAA in selected months of the year to facilitate comparison to the other alternatives. Over the modeled period of record, the lowest water surface elevation the lake would be expected to reach would be elevation 818.4 ft, about 4.6 ft below the winter guide curve level of 823 ft.

Under current operations, the Allatoona Lake surface area decreases dramatically as the lake level drops because of low basin inflow and during seasonal drawdown. At the normal summer pool elevation of 840 ft, the surface area of the lake is 11,164 ac; and the surface area of the lake drops to 6,962 ac at the winter drawdown level of 823 ft, almost a 38-percent reduction in surface area.

E.3.2.1.1.2 Weiss Dam and Lake

Under the NAA, conditions in Weiss Lake, including its seasonal variations, would be consistent with those described in Section E.1.1.4.3. Over the modeled period of record, median lake levels would align with the current project guide curve from January through mid-July, decline slightly below the guide curve (up to 1 ft) from mid-July through mid-November, and align with the guide curve from mid-November through December (Figure E-45). At the 90-percent exceedance level, the Weiss Lake pool would align with the guide curve from January through mid-April, decline slightly below the guide curve to a peak level of 563.6 ft by the end of May, gradually decline to about 558.2 ft by the end of November, and remain between 558.0 ft and 558.7 ft through December (Figure E-46). At the 10-percent exceedance level, the pool would generally be higher than the guide curve by 0.5–3 ft from January through mid-April, aligned with the guide curve from mid-April through mid-December, and up to 1.5 ft higher than the guide curve in late December (Figure E-47).

The annual duration curve for Weiss Lake pool levels (Figure E-48) provides information on the percentage of the total number of days over the 73-year modeled period of record that lake levels would be expected to exceed a range of water surface elevations. The pool elevations under the NAA would equal or exceed the normal summer guide curve elevation of 564 ft on about 20 percent of the days and would drop below the minimum winter guide curve level of 558 ft on only about 2 percent of the days. Monthly duration curves for October (Figure E-49) and February (Figure E-50) are presented to depict Weiss Lake pool level conditions under the NAA in selected months of the year to enable comparison to the other alternatives. Over the modeled period of record, the lowest water surface elevation the lake would be expected to reach would be elevation 556 ft, about 2 ft below the current minimum winter guide curve level of 558 ft.

Under current operations, the Weiss Lake surface area decreases dramatically as the lake level drops because of low basin inflow and during seasonal drawdown. At the normal summer pool elevation of 564 ft, the surface area of the lake is 30,027 ac; and the surface area of the lake drops to 19,603 ac at the current winter drawdown level of 558 ft, almost a 35-percent reduction in surface area.

E.3.2.1.1.3 H. Neely Henry Dam and Lake

Under the NAA, conditions in H. Neely Henry Lake, including its seasonal variations, would be consistent with those described in Section E.1.1.4.4. Over the modeled period of record, median lake levels would align with the current project guide curve from January through June, decline slightly (up to 0.5 ft) below the guide curve from July through mid-November, and align with the guide curve from mid-November through December (Figure E-51). At the 90-percent exceedance level, the H. Neely Henry Lake pool would be 1–4 ft lower than the project guide curve from January through May and would remain consistently about 1 ft below the guide curve for the balance of the year (Figure E-52). At the 10-percent exceedance level, the pool would align closely with the guide curve throughout the year.

The annual duration curve for H. Neely Henry Lake pool levels (Figure E-53) provides information on the percentage of the total number of days over the 73-year modeled period of record that indicates lake levels would be expected to exceed a range of water surface elevations. The pool elevations under the NAA would equal the normal summer guide curve elevation of 508 ft on about 18 percent of the days and would drop below the minimum winter guide curve level of 507 ft on about 18 percent of the days. Monthly duration curves for October (Figure E-54) and December (Figure E-55) are presented to depict H. Neely Henry Lake pool level conditions under the NAA in selected months of the year to enable comparison to the other alternatives. Over the modeled period of

record, the lowest water surface elevation the lake would be expected to reach would be elevation 502.5 ft, about 4.5 ft below the winter guide curve level of 507 ft.

E.3.2.1.1.4 Logan Martin Dam and Lake

Under the NAA, conditions in Logan Martin Lake, including its seasonal variations, would be consistent with those described in Section E.1.1.4.5. Over the modeled period of record, median lake levels would align with the current project guide curve from January through June, decline slightly below the guide curve (up to 1 ft) from July through mid-November, and align with the guide curve from mid-November through December (Figure E-56). At the 90-percent exceedance level, the Logan Martin Lake pool would align with the guide curve from January through mid-April, decline slightly below the guide curve (0.7 ft below) to a peak level of 464.3 ft by mid-May, and then gradually decline to about elevation 460 ft by the end of December (Figure E-57). At the 10-percent exceedance level, the pool would align with the current guide curve in January and February, generally be higher than the guide curve (by 0–4 ft) from March to mid-April, then align with the guide curve from mid-April through December (Figure E-58).

The annual duration curve for Logan Martin Lake pool levels (Figure E-59) provides information on the percentage of the total number of days over the 73-year modeled period of record that indicates lake levels would be expected to exceed a range of water surface elevations. Under the NAA, the pool elevations would equal or exceed the normal summer guide curve elevation of 465 ft on about 19 percent of the days and would drop below the minimum winter guide curve level of 460 ft on about 4 percent of the days. Monthly duration curves for October (Figure E-60) and December (Figure E-61) are presented to depict Logan Martin Lake pool level conditions under the NAA in selected months of the year to enable comparison to the other alternatives. Over the modeled period of record, the lowest water surface elevation the lake would be expected to reach would be elevation 458 ft, about 2 ft below the current minimum winter guide curve level of 460 ft.

Under current operations, the Logan Martin Lake surface area decreases dramatically as the lake level drops during periods of low basin inflow and during seasonal drawdown. At the normal summer pool elevation of 465 ft, the surface area of the lake is 15,269 ac; and the surface area of the lake drops to 11,894 ac at the current winter drawdown level of 460 ft, almost a 22-percent reduction in surface area.

E.3.2.1.1.5 Lay Dam and Lake, Mitchell Dam and Lake, and Jordan Dam and Lake

The APC's Lay, Mitchell, and Jordan projects, in descending order (upstream to downstream), lie between Logan Martin Dam and the mouth of the Coosa River, just upstream from Montgomery, AL. APC would continue to operate the three reservoirs as run-of-river hydropower projects under the NAA as described in Section E.1.1.4.6, Section E.1.1.4.7, and Section E.1.1.4.8.

E.3.2.1.1.6 R. F. Henry L&D / R.E. "Bob" Woodruff Lake

The R.F. Henry L&D /R.E. "Bob" Woodruff Lake is the furthest upstream of the three USACE reservoirs on the Alabama River, with a stable pool elevation of 126 ft under normal conditions from the L&D upstream to the Montgomery, AL, area, near the confluence of the Coosa and Tallapoosa rivers. USACE would continue to operate the project for federally authorized purposes under the NAA as described in Section E.1.1.4.13.

E.3.2.1.2 Tentatively Selected Plan (Alternative 11)

E.3.2.1.2.1 Allatoona Dam and Lake

Under Alternative 11, USACE would reallocate to M&I water supply an additional 33,872 ac-ft of reservoir storage from a combination of flood storage (11,670 ac-ft) and conservation storage (22,202 ac-ft). To accomplish that reallocation, USACE would raise the summer guide curve elevation from 840 ft to 841 ft and the winter guide curve elevation from 823 ft to 824.5 ft. Thus, the pool level in Allatoona Lake would be maintained at a slightly higher level throughout the year compared to current operations under the NAA.

Over the simulated 73-year hydrologic period of record, median pool levels in Allatoona Lake under Alternative 11 would be between about 1–1.5 ft higher than under the NAA from January through July and about 0–1 ft higher from August through December (Figure E-39). At the 90-percent exceedance level (dry conditions), the pool levels would be about 1–1.5 ft higher than under the NAA from mid-December through May, about 0.5–1 ft higher from June through July, and about the same as the NAA from August to early December (Figure E-40). At the 10-percent exceedance level (wet conditions), the pool levels would be about 1–1.5 ft higher than under the NAA from mid-December through mid-September and about the same level as under the NAA from mid-September through mid-December (Figure E-41).

The annual duration curve for Allatoona Lake pool levels over the modeled period of record is shown in Figure E-42. For Alternative 11, pool levels would be expected to decline below the IIL on 65 percent of the days compared to 69 percent for the NAA, below the RIL on 56 percent of the days compared to 58 percent for the NAA, and below the WAL level on 19 percent of the days compared to 21 percent for the NAA. Over the modeled period of record, the lowest water surface elevation the lake would be expected to reach would be elevation 817.3 ft, about 1.1 ft lower than under the NAA and about 5.7 ft below the current winter guide curve level of 823 ft.

While the annual duration curve shows an increase of up to 1 ft on about 95 percent of the days over the period of record, the increases in selected months can be even more pronounced. For example, the duration curve for days in the month of February (Figure E-43) indicates that pool levels under Alternative 11 would likely be 1–1.4 ft higher than under the NAA on about 90 percent of the days in February over the period of record. During February, pool levels under Alternative 11 would decline below the WAL level on 30 percent of the days compared to 55 percent for the NAA. The duration curve for the month of June (Figure E-44) indicates that pool levels for Alternative 11 would likely be about 0.5–1.0 ft higher than for the NAA on about 91 percent of the days in June over the period of record. During the month of June, pool levels under Alternative 11 would likely decline below the IIL on 8 percent of the days compared to 12 percent for the NAA and below the RIL on 5 percent of the days compared to 6 percent for the NAA.

As discussed in Section E.1.1.4.2, four action zones have been established in the conservation pool of Allatoona Lake (see Figure E-17), each with an established set of operating criteria that are increasingly constrained to conserve storage as reservoir pool levels decline under extended dry conditions. Table E-53 presents HEC-ResSim model outputs for several conservation storage metrics for Allatoona Lake. Those metrics indicate that Alternative 11 would result in substantial improvement in conservation storage conditions, increasing the operational flexibility of the project to address authorized project purposes compared to the NAA.

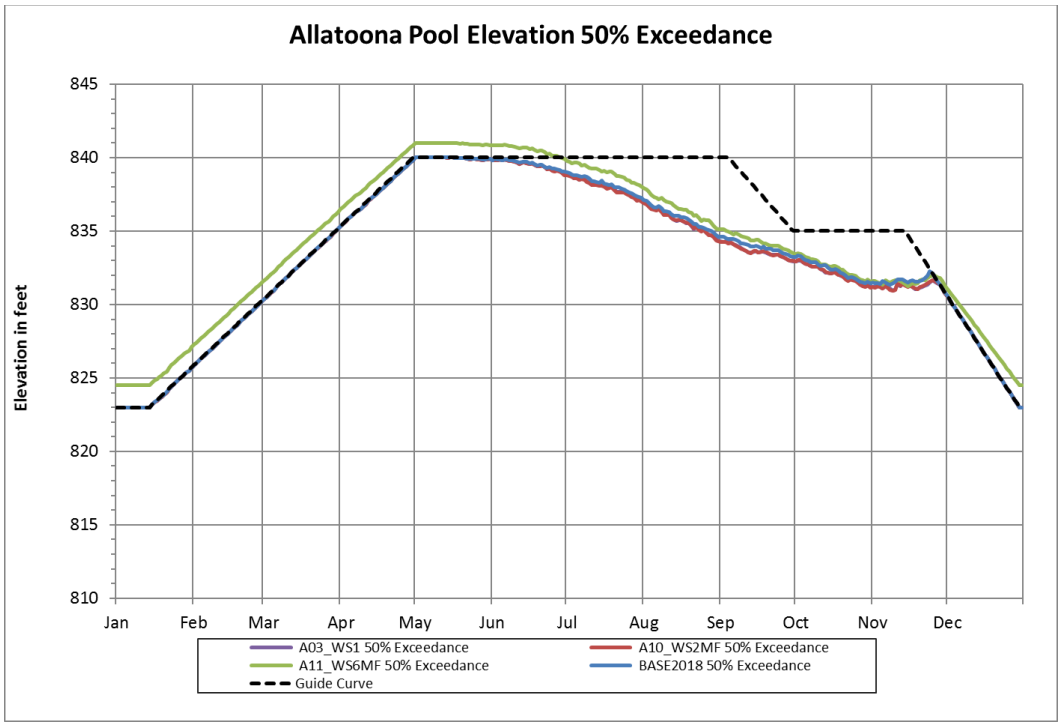


Figure E-39. Allatoona Lake—Median Daily Pool Elevation over the Modeled Period of Record.

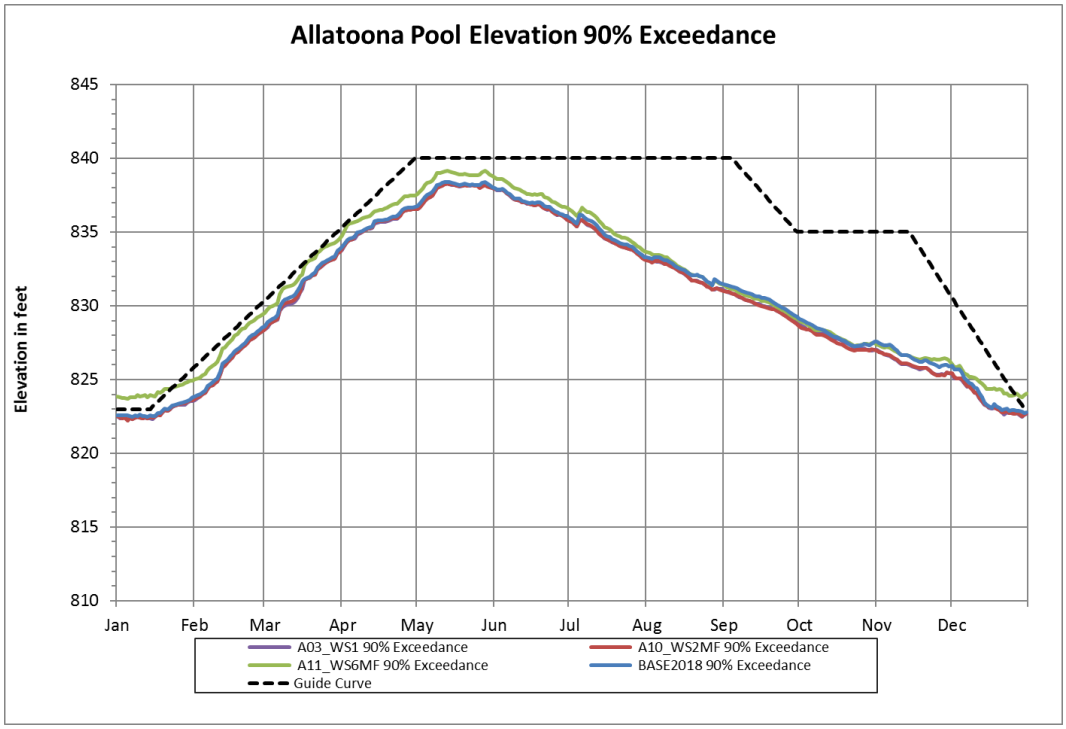


Figure E-40. Allatoona Lake—Daily Pool Elevations Exceeded 90 Percent of the Time over the Modeled Period of Record.

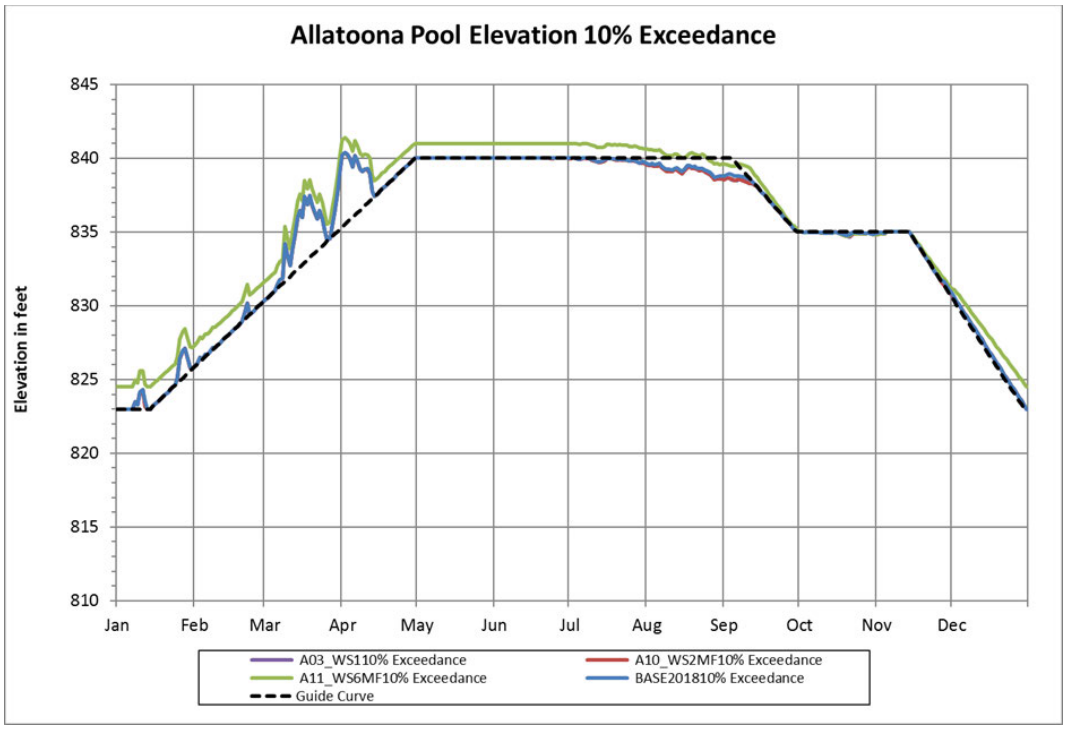


Figure E-41. Allatoona Lake—Daily Pool Levels Exceeded 10 Percent of the Time over the Modeled Period of Record.

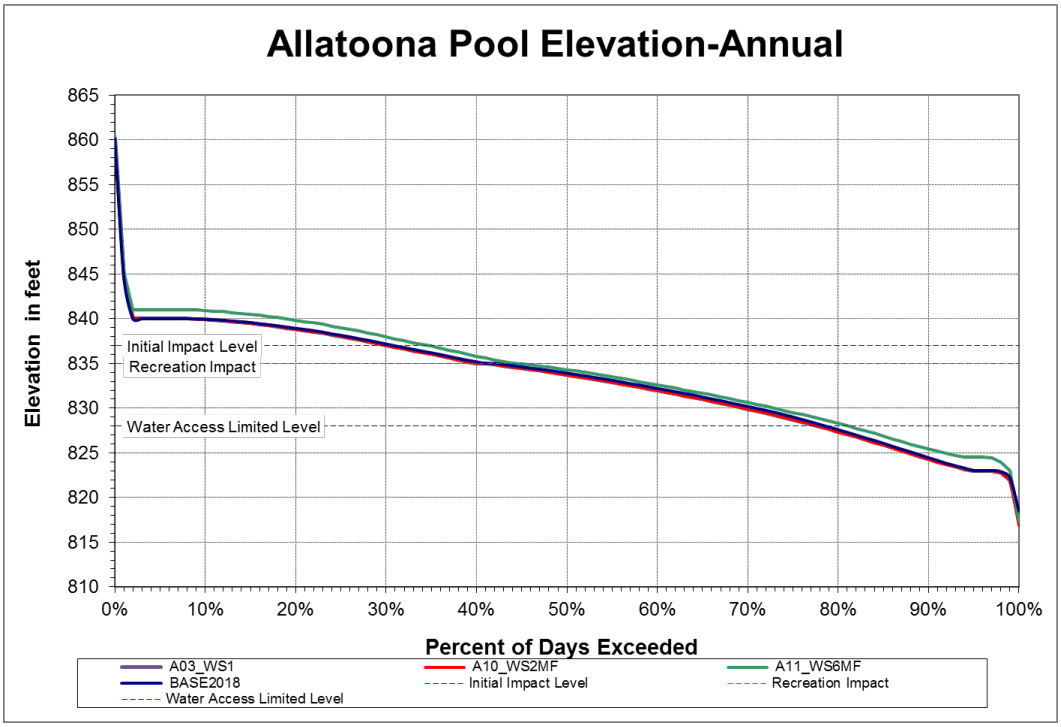


Figure E-42. Allatoona Lake—Annual Pool Level Duration Curve.

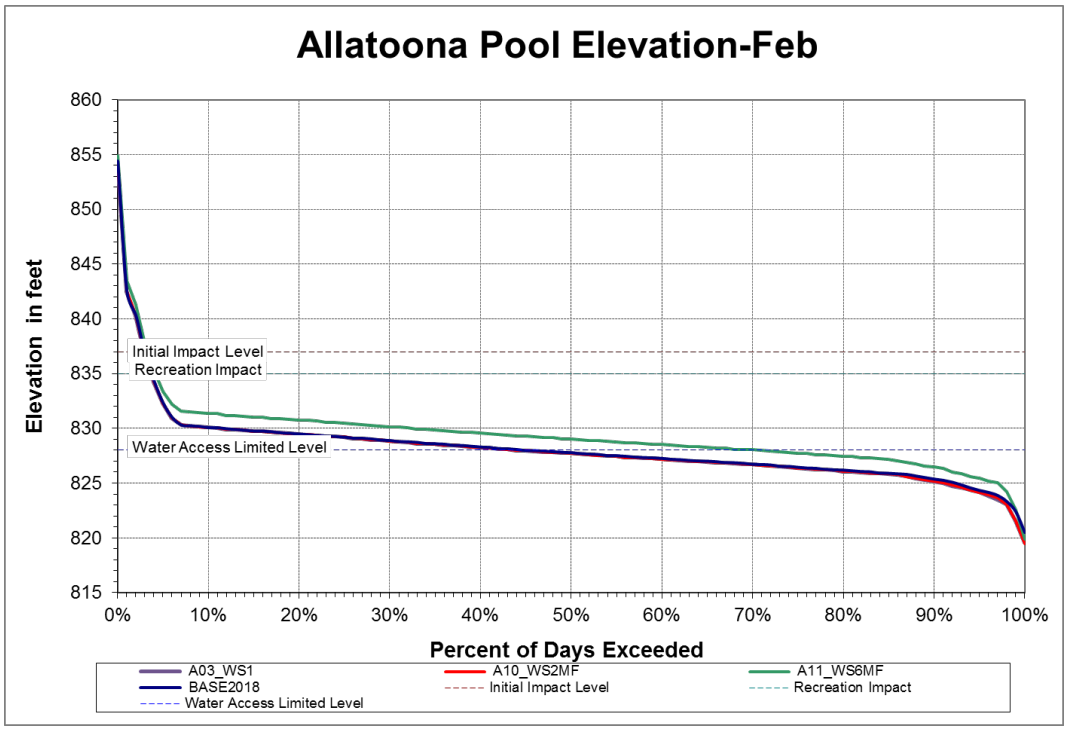


Figure E-43. Allatoona Lake—Pool Level Duration Curve for the Month of February over the Modeled Period of Record.

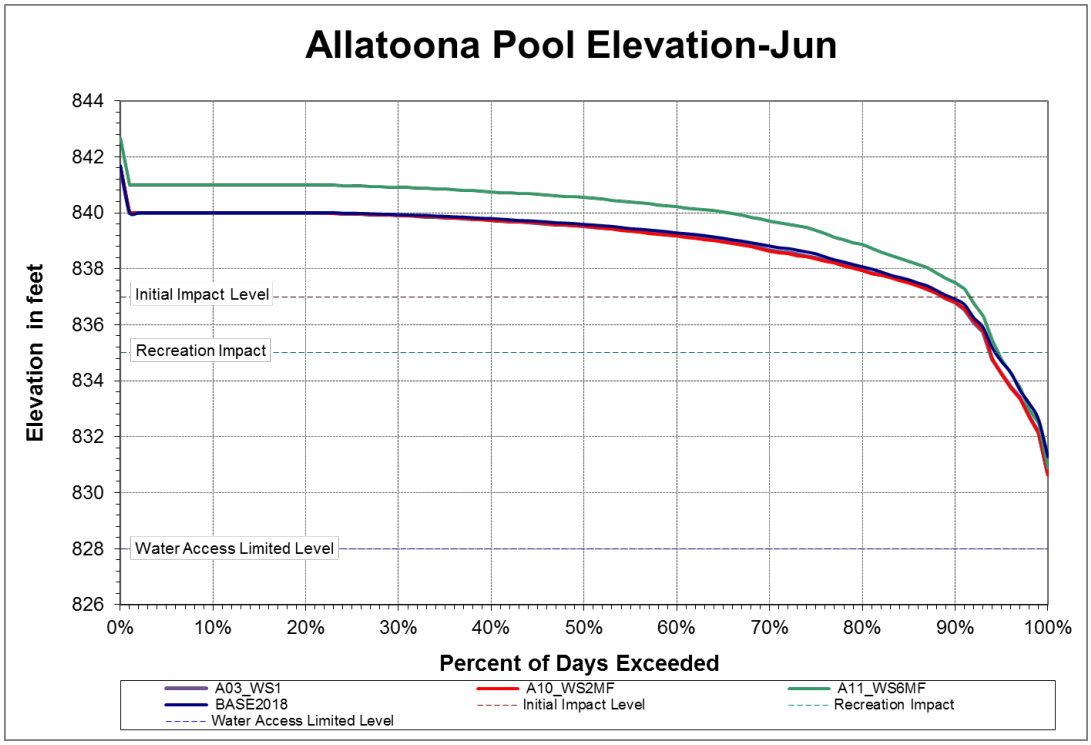


Figure E-44. Allatoona Lake—Pool Level Duration Curve for the Month of June over the Modeled Period of Record.

Table E-53. Allatoona Lake—Effects of Alternatives on Conservation Storage

Conservation storage metric	NAA	Alternative 11	Alternative 3	Alternative 10
Percentage of time in Zone 1	41%	73%	39%	39%
Percentage of time at full pool (840 ft) by May 1	64%	77%	62%	62%
Percentage of time refilled from Zone 3 to Zone 1 by May 1 of the next year	0%	33%	0%	0%
No. of years over 73-year modeled period of record pool would be in or below Zone 3 by Dec 1	5 years	3 years	6 years	6 years

E.3.2.1.2.2 Weiss Dam and Lake

Under Alternative 11, flood operations at Weiss Dam and Lake would be revised as described in Section 2.6.1 of the main report. The maximum surcharge level at the project would be lowered from 574 ft to 572 ft, and the winter guide curve level would be raised from 558 ft to 561 ft. Compared to the NAA, pool levels at Weiss Lake would be expected to be higher from September through February each year.

Over the simulated 73-year hydrologic period of record, median pool levels in Weiss Lake under Alternative 11 would range from a few inches up to about 3 ft higher than under the NAA from September through February and would be the same level from March through August (Figure E-45). At the 90-percent exceedance level (dry conditions), the pool levels would range from a few inches higher up to about 2 ft higher than the NAA from September through February and would be about the same level as the NAA from March through August (Figure E-46). At the 10-percent exceedance level (wet conditions), the pool levels would range from a few inches to about 2.5 ft higher than for the NAA between September and February and would be about the same from March through August (Figure E-47).

The annual duration curve for Weiss Lake pool levels over the modeled period of record is shown in Figure E-48. For Alternative 11, pool levels would range from a about 1 in to about 2.3 ft higher than for the NAA on about 68 percent of the days and the same as the NAA on the remaining 32 percent of the days. Weiss Lake pool levels would be higher than the proposed new winter guide curve level of 561 ft on 90 percent of the days under Alternative 11 compared to 64 percent for the NAA. Over the modeled period of record, the lowest water surface elevation the lake would be expected to reach would be 556 ft, about the same minimum level as under the NAA, and 2 ft below the current winter guide curve level.

While the annual duration curve shows an increase of up to 2.3 ft on about 68 percent of the days over the period of record, the increases occur during the months of September through February and are more pronounced during those months. For example, the duration curve for days in October (Figure E-49) indicates that pool levels under Alternative 11 would likely be 0.8–1.4 ft higher than under the NAA on about 93 percent of the days in that month over the period of record. Pool levels for the month of October would be equal to or higher than the new winter guide curve level on 81 percent of the days compared to 57 percent for the NAA. During February, pool levels under Alternative 11 would likely range from a few inches up to 1.3 ft higher than the NAA on about 83 percent of the days in that month (Figure E-50). Pool levels for the month of February would be equal to or higher than the new winter guide curve level of 561 ft on 95 percent of the days compared to 17 percent for the NAA.

Under Alternative 11, the Weiss Lake pool level would likely drop below the current winter pool level of 558 ft in 3 years over the 73-year period of record compared to 24 years for the NAA. The Weiss Lake surface area at the proposed winter guide curve level (561 ft) under Alternative 11 would be 24,693 ac compared to 19,603 ac at the current winter guide curve level under the NAA (558 ft).

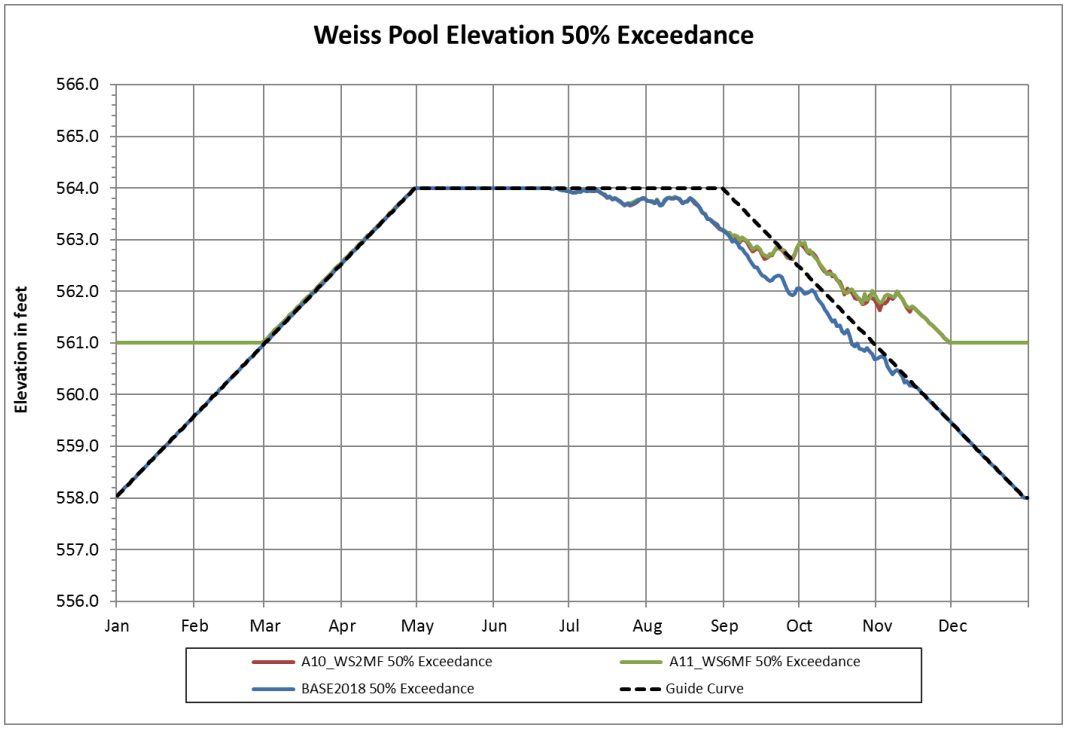


Figure E-45. Weiss Lake—Median Daily Pool Elevation over the Modeled Period of Record.

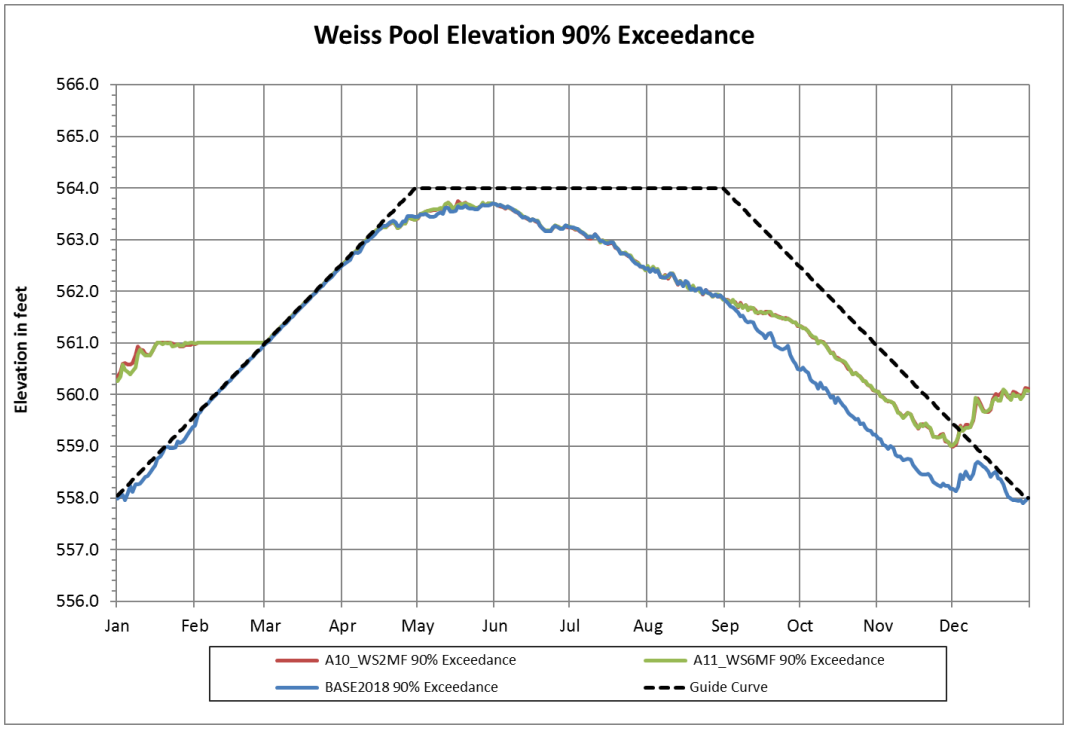


Figure E-46. Weiss Lake—Daily Pool Levels Exceeded 90 Percent of the Time over the Modeled Period of Record.

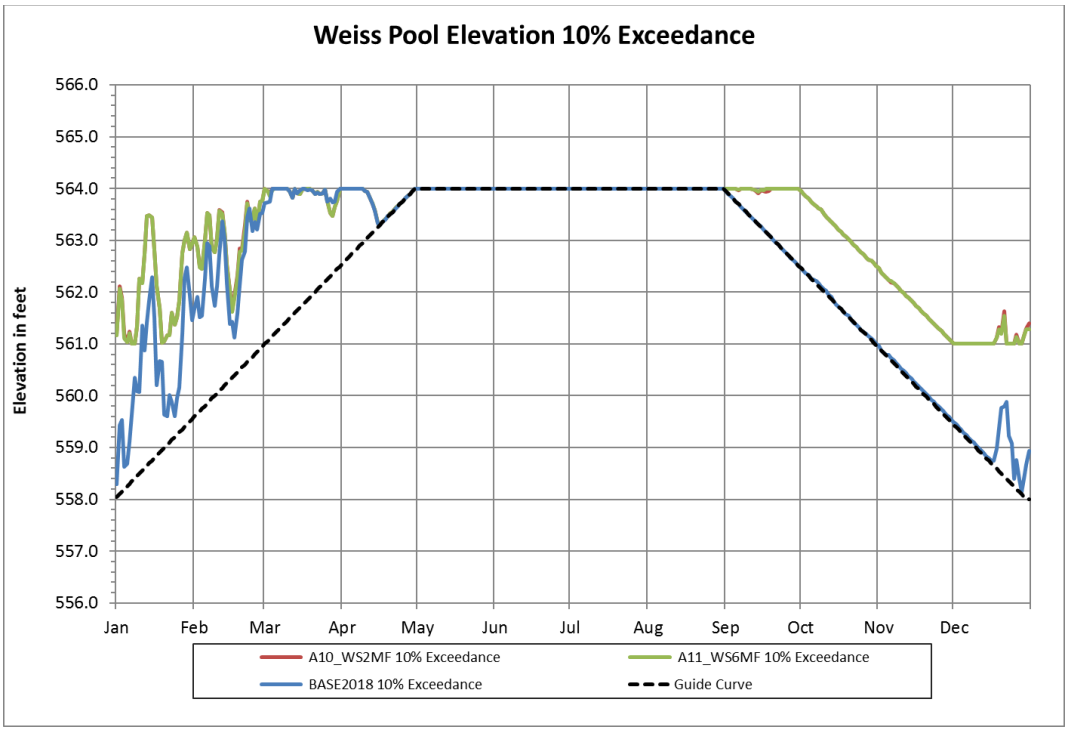


Figure E-47. Weiss Lake—Daily Pool Levels Exceeded 10 Percent of the Time over the Modeled Period of Record.

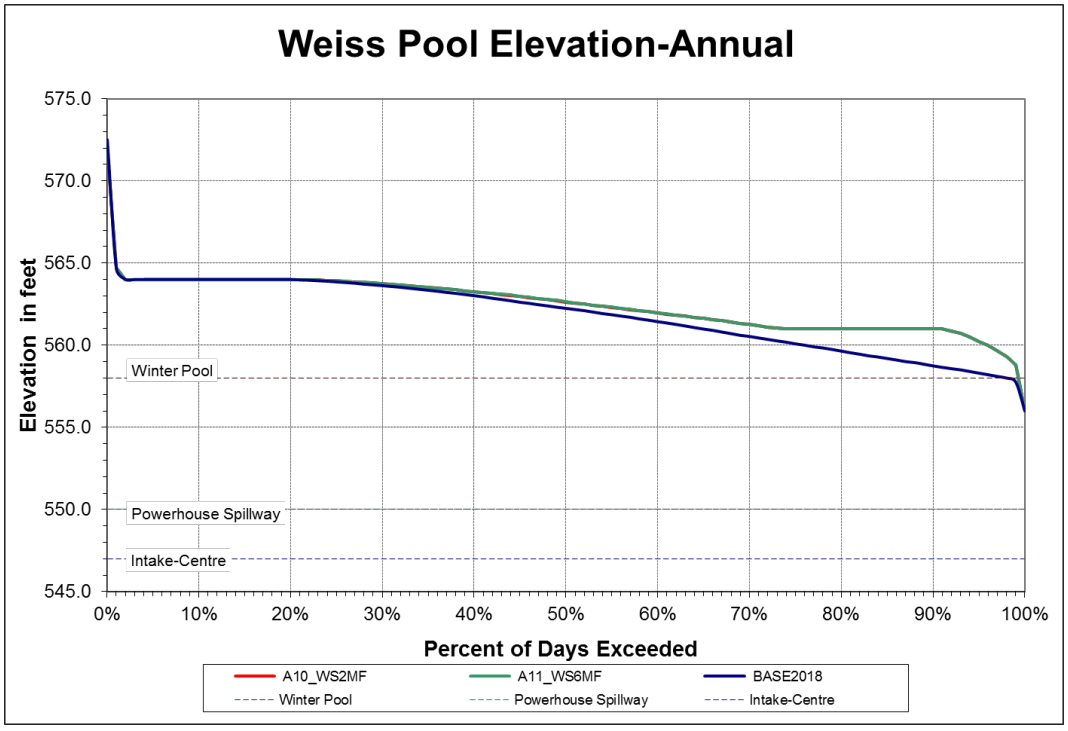


Figure E-48. Weiss Lake—Annual Pool Level Duration Curve.

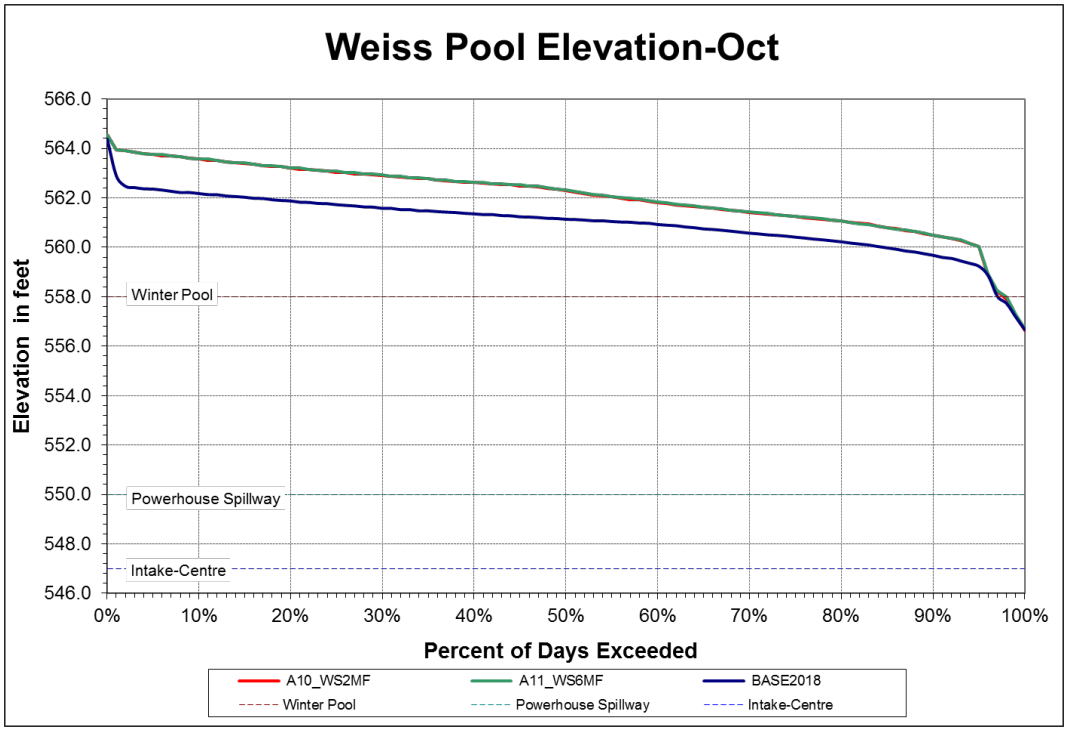


Figure E-49. Weiss Lake—Pool Level Duration Curve for the Month of October over the Modeled Period of Record.

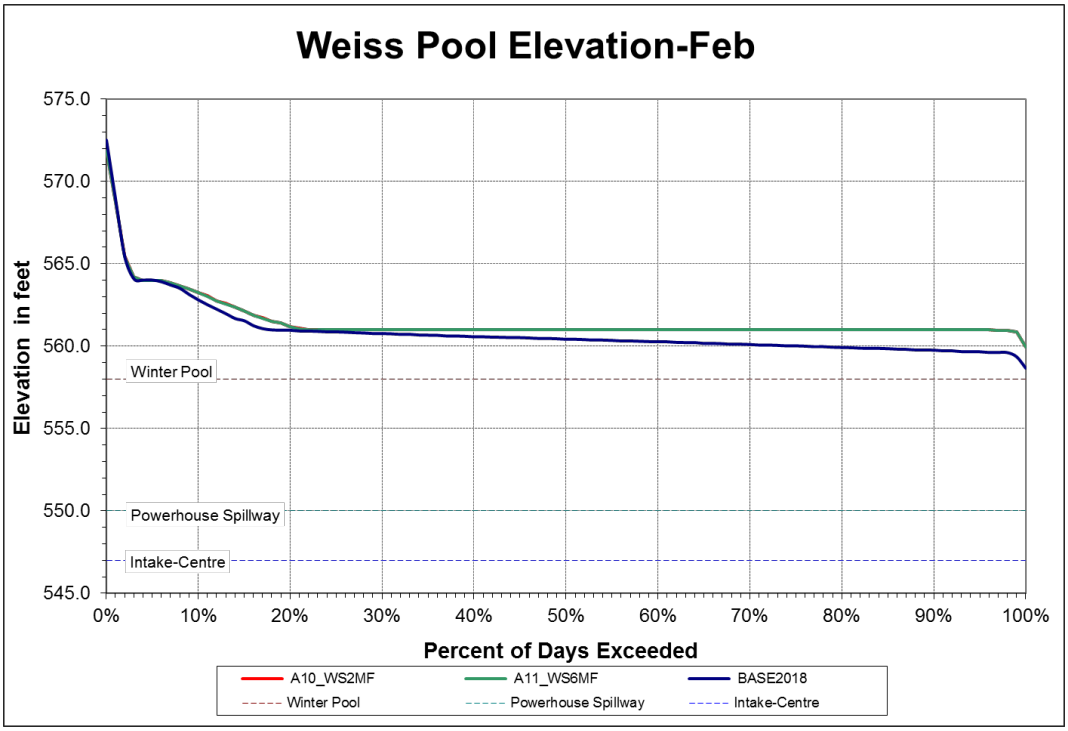


Figure E-50. Weiss Lake—Pool Level Duration Curve for the Month of February over the Modeled Period of Record.

E.3.2.1.2.3 H. Neely Henry Dam and Lake

No changes to project operations are proposed at H. Neely Henry Dam and Lake, but proposed changes in flood operations upstream at Weiss Dam and Lake under Alternative 11 might affect pools levels in H. Neely Henry Lake.

Over the simulated 73-year hydrologic period of record, median pool levels in H. Neely Henry under Alternative 11 would be about the same as under the NAA from mid-November through August and slightly lower (up to about 0.2 ft) than under the NAA from September through mid-November (Figure E-51). At the 90-percent exceedance level (dry conditions), there is little difference between the plotted values for Alternative 11 and the NAA (Figure E-52). At the 10-percent exceedance level (wet conditions), there would be no discernable difference between Alternative 11 and the NAA.

The annual duration curve for H. Neely Henry Lake pool levels over the modeled period of record is shown in Figure E-53. The annual duration curves for Alternative 11 and the NAA are nearly the same over the entire range of plotted values. H. Neely Henry Lake pool levels would be higher than the winter guide curve level of 507 ft on 78 percent of the days under Alternative 11 compared to 80 percent under the NAA. Over the modeled period of record, the lowest water surface elevation the lake would be expected to reach would be 502.5 ft, about the same minimum level as the NAA, and 4.5 ft below the current winter guide curve level.

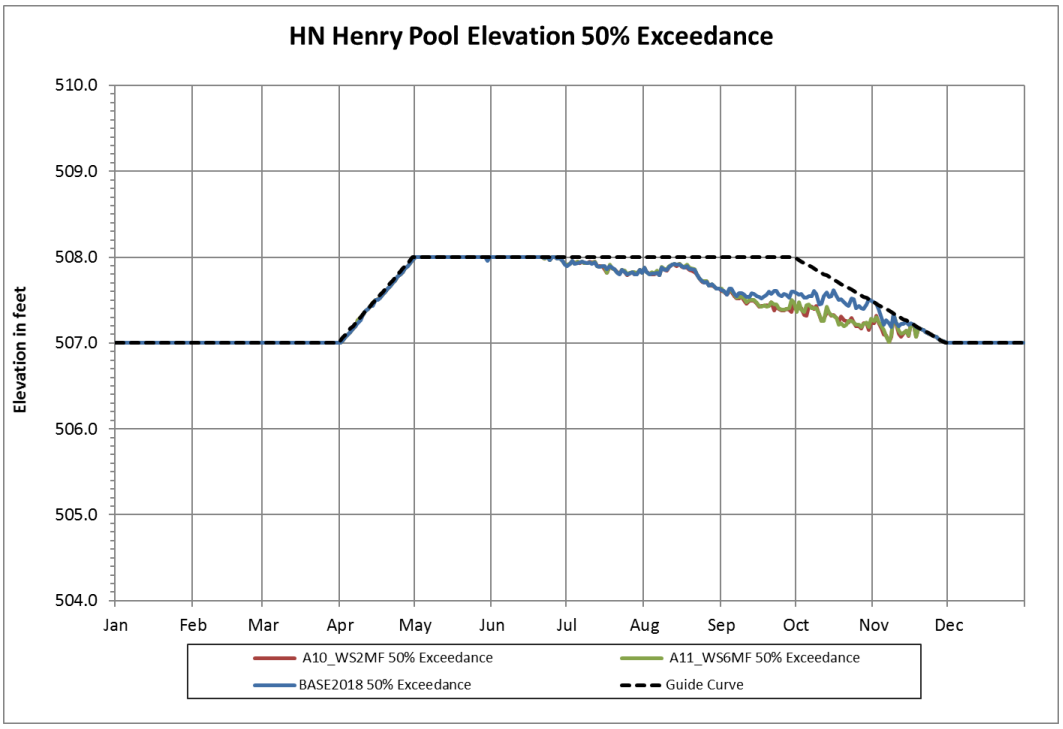


Figure E-51. H. Neely Henry Lake—Median Daily Pool Elevation over the Modeled Period of Record.

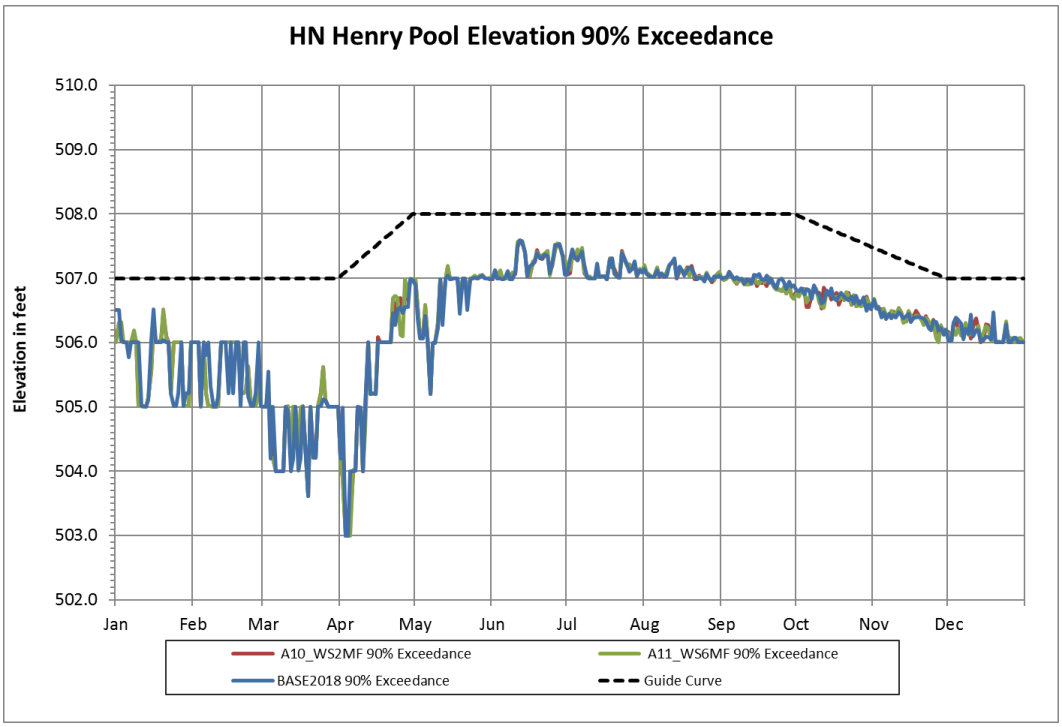


Figure E-52. H. Neely Henry Lake—Daily Pool Levels Exceeded 90 Percent of the Time over the Modeled Period of Record.

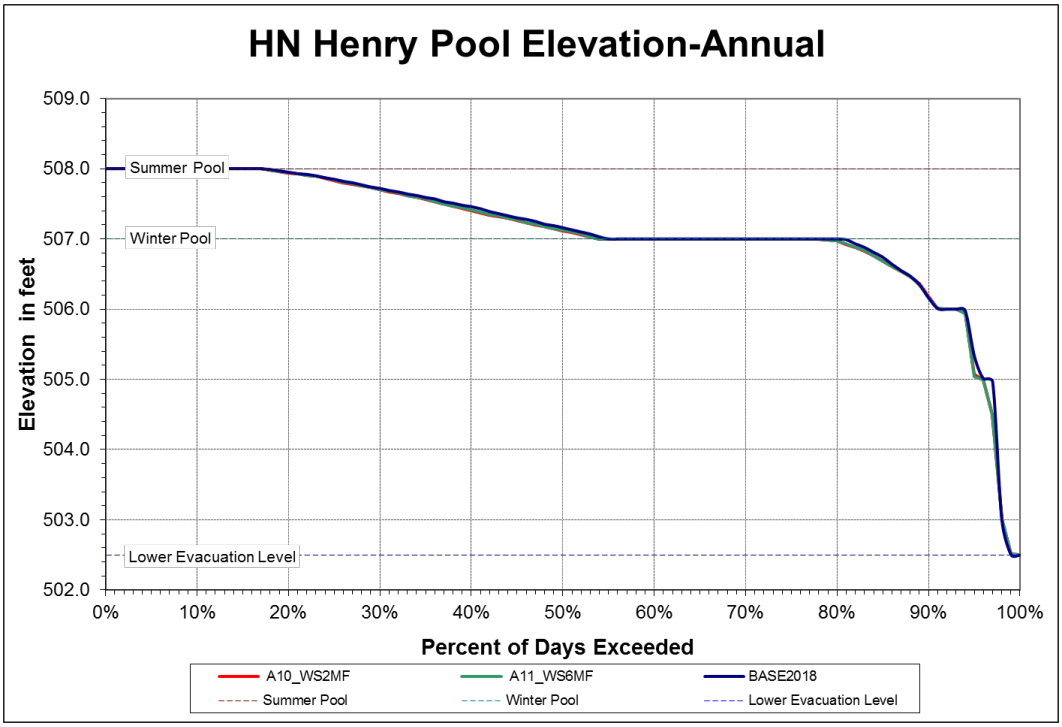


Figure E-53. H. Neely Henry Lake—Annual Pool Level Duration Curve.

Monthly duration curves for September through February all show very slight decreases in pool levels for Alternative 11 compared to the NAA. For example, the duration curve for days in October (Figure E-54) indicate that pool levels under Alternative 11 would likely be 0–0.2 ft lower than under the NAA on about 85 percent of the days in that month over the period of record. Pool levels for the month of October would be equal or higher than the winter guide curve level of 507 ft on 73 percent of the days compared to 78 percent for the NAA. For December, pool levels under Alternative 11 would likely range from 0 to about 0.5 ft lower than under the NAA on about 30 percent of the days in that month (Figure E-55). Pool levels for December would be equal to or higher than the winter guide curve level of 507 ft on 64 percent of the days compared to 70 percent for the NAA.

The H. Neely Henry Lake pool level would likely drop below the current winter pool level of 507 ft in all 73 years over the period of record for both Alternative 11 and the NAA.

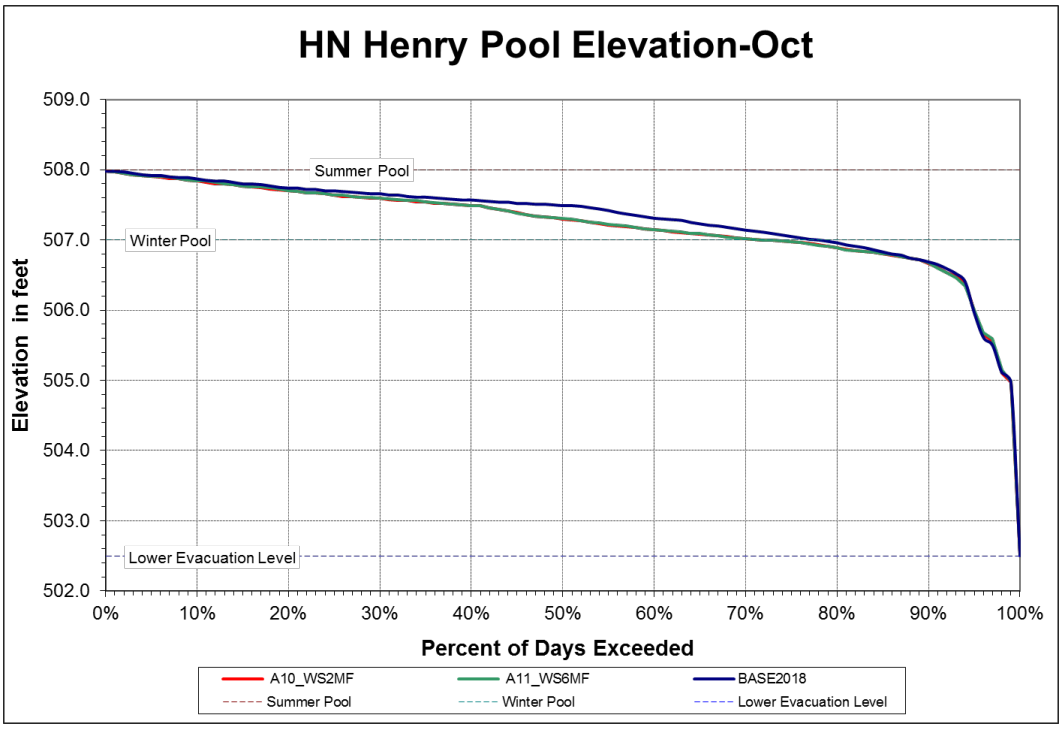


Figure E-54. H. Neely Henry Lake—Pool Level Duration Curve for the Month of October over the Modeled Period of Record.

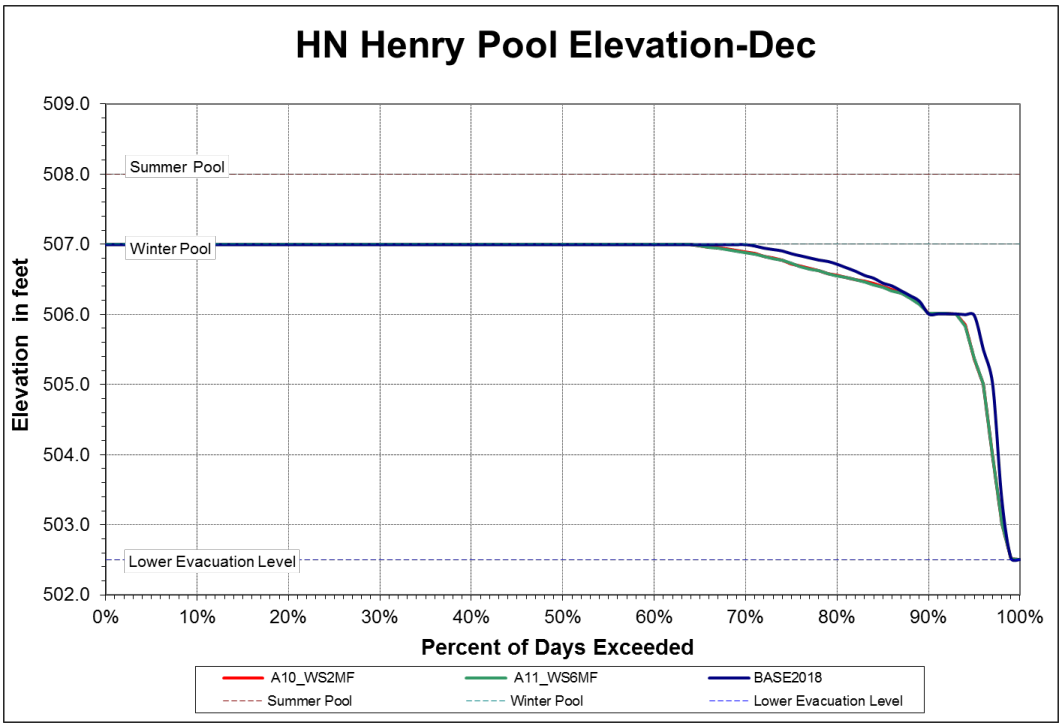


Figure E-55. H. Neely Henry Lake—Pool Level Duration Curve for the Month of December over the Modeled Period of Record.

E.3.2.1.2.4 Logan Martin Dam and Lake

Under Alternative 11, flood operations at Logan Martin Dam and Lake would be revised as described in Section 2.6.2 of the main report. The maximum surcharge level at the project would be lowered from 477 ft to 473.5 ft, and the winter guide curve level would be raised from 460 ft to 462 ft. Compared to the NAA, pool levels at Weiss Lake would be expected to be higher from October through April each year based on the guide curve change.

Over the simulated 73-year hydrologic period of record, median pool levels in Logan Martin Lake under Alternative 11 would range from a few inches up to about 2 ft higher than the NAA from mid-October through the first week of May, would be the same level as the NAA from the first week of May through August, and would be up to 0.5 ft lower than the NAA in September through mid-October (Figure E-56). At the 90-percent exceedance level (dry conditions), the pool levels would range from a few inches higher up to about 2 ft higher than the NAA from October through about mid-May and would be essentially the same level as the NAA from mid-May through September (Figure E-57). At the 10-percent exceedance level (wet conditions), the pool levels would range from a few inches to about 2 ft higher than the NAA between October and the first week of May, except for two occurrences in March and early April when the pool level for the NAA would briefly exceed the pool level for Alternative 11, and would be about the same as the NAA from the first week of May through September (Figure E-58).

The annual duration curve for Logan Martin Lake pool levels over the modeled period of record is shown in Figure E-59. For Alternative 11, pool levels would range from about 1 in to 2 ft higher than the NAA on about 57 percent of the days and 3–4 ft lower than the NAA during extreme flood events (2 percent of days exceeded). Pool levels would be the same as the NAA on the remaining 41 percent of days. Logan Martin Lake pool levels would be equal to or higher than the proposed new winter guide curve level of 462 ft on 89 percent of the days under Alternative 11 compared to 53 percent under the NAA. Over the modeled period of record, the lowest water surface elevation the lake would be expected to reach would be 458 ft, which would be the same minimum level as for the NAA and 2 ft below the current winter guide curve level.

While the annual duration curve shows an increase of up to 2 ft on about 52 percent of the days over the period of record, the increased levels occur during the months of October through the first week of May and are more pronounced during those months. For example, the duration curve for days in the month of October (Figure E-60) indicate that pool levels under Alternative 11 would likely increase in the range from a few inches up to 0.7 ft higher than for the NAA on about 94 percent of the days in that month over the period of record. Pool levels for the month of October would be equal or higher than the new winter guide curve level of 462 ft on 89 percent of the days compared to 79 percent for the NAA. During December, pool levels under Alternative 11 would likely range from a few inches up to 1.8 ft higher than for the NAA on about 95 percent of the days in that month (Figure E-61). Pool levels for the month of December would be equal to or higher than the new winter guide curve level of 462 ft on 70 percent of the days compared to 2 percent for the NAA.

Under Alternative 11, the Logan Martin Lake pool level would likely drop below the current winter pool level of 460 ft in 5 years over the 73-year period of record compared to 38 years for the NAA. The Logan Martin Lake surface area at the proposed winter guide curve level (462 ft) would be 13,157 ac compared to 11,894 ac at the current winter guide curve level under the NAA (460 ft).

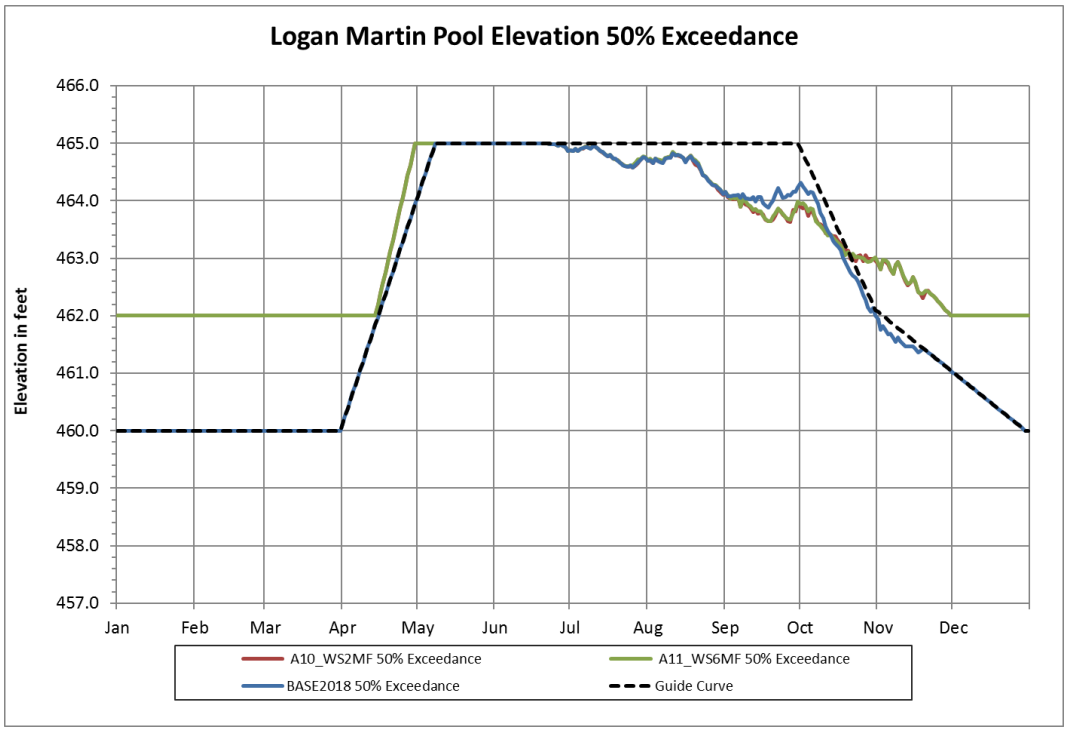


Figure E-56. Logan Martin Lake—Median Daily Pool Elevation over the Modeled Period of Record.

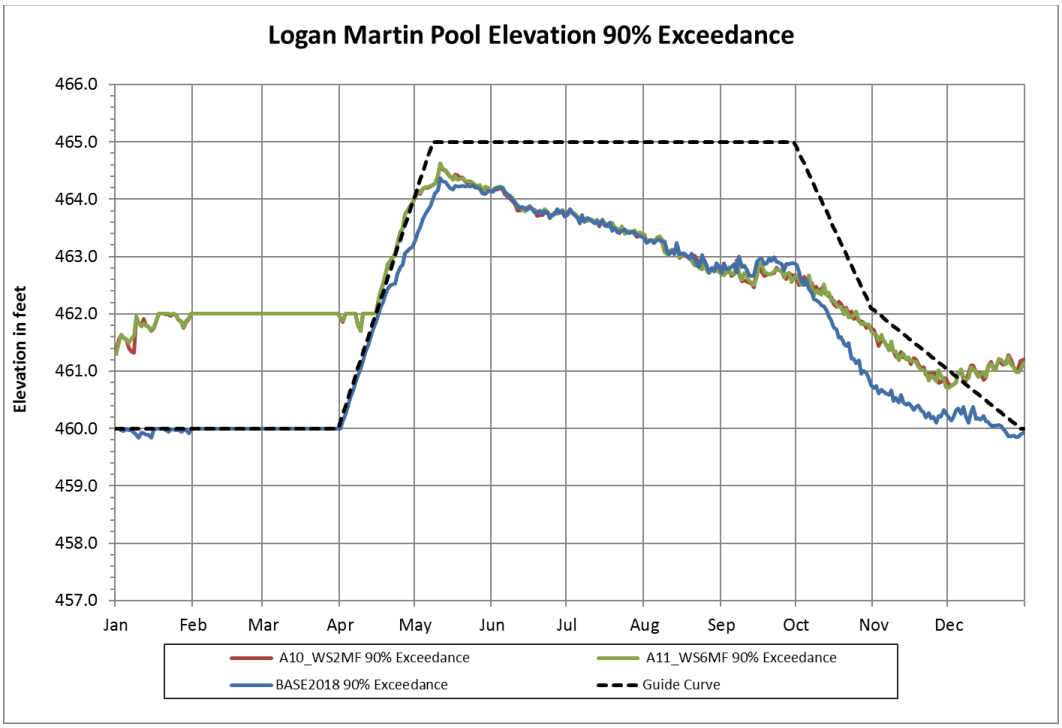


Figure E-57. Logan Martin Lake—Daily Pool Levels Exceeded 90 Percent of the Time over the Modeled Period of Record.

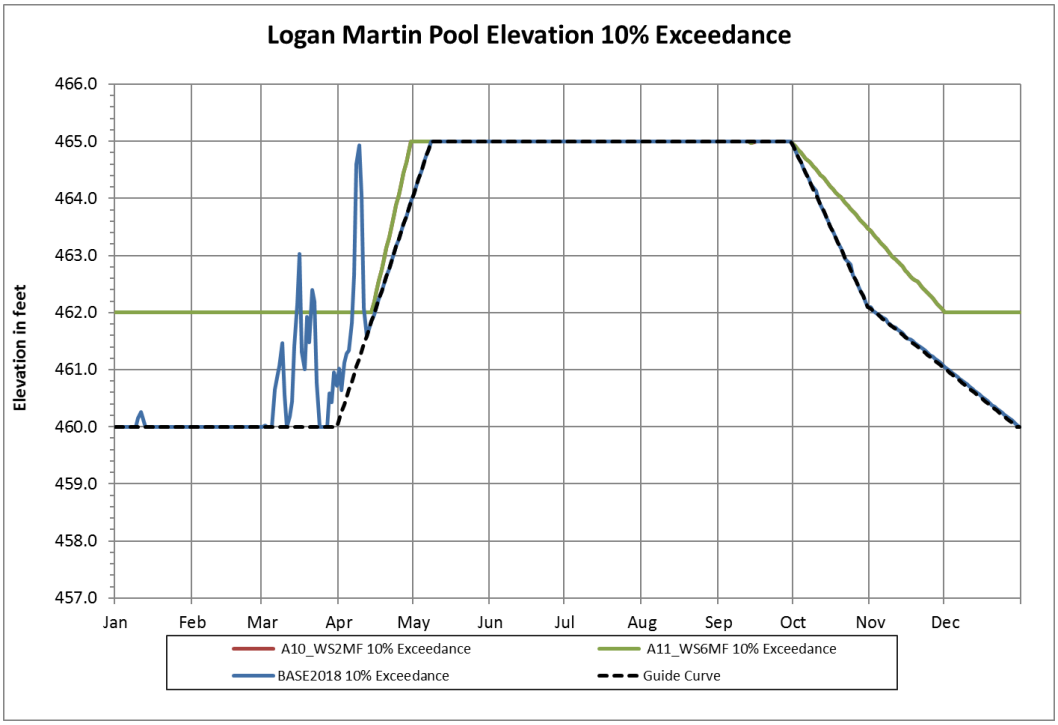


Figure E-58. Logan Martin Lake—Daily Pool Levels Exceeded 10 Percent of the Time over the Modeled Period of Record.

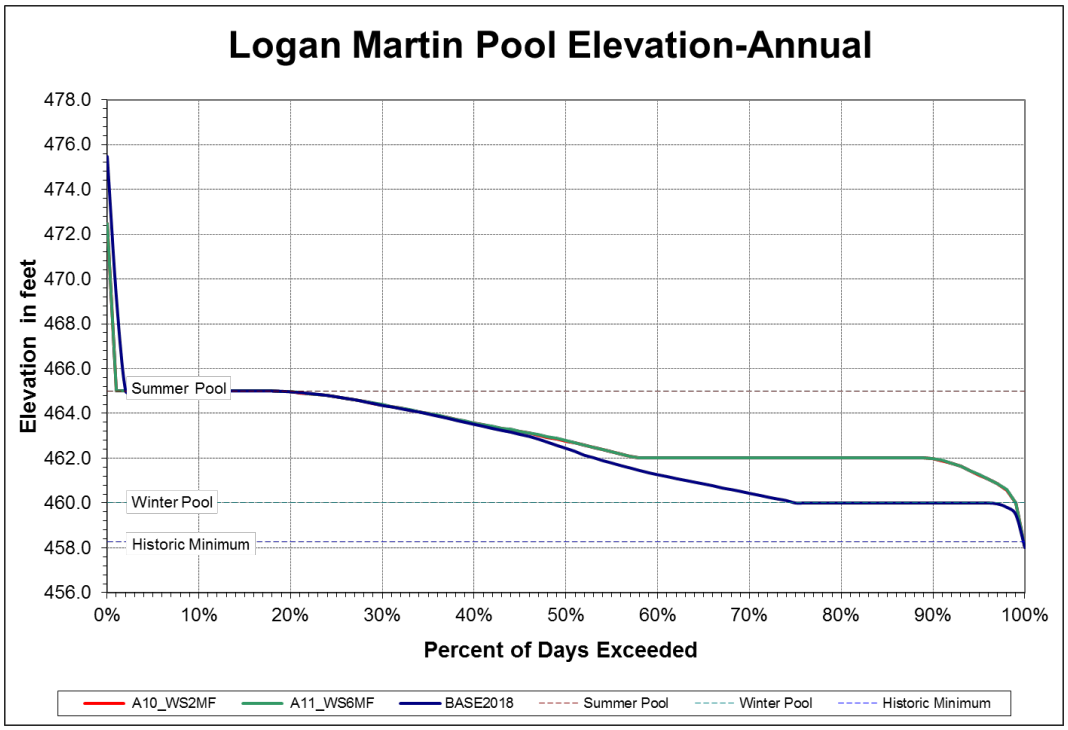


Figure E-59. Logan Martin Lake—Annual Pool Level Duration Curve.

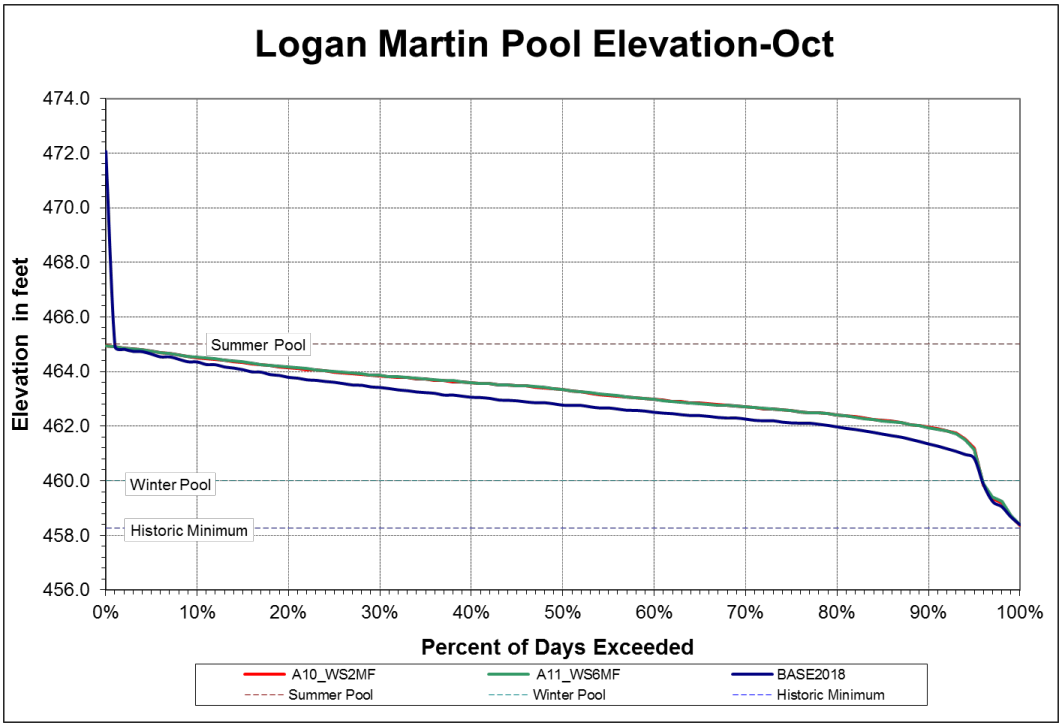


Figure E-60. Logan Martin Lake—Pool Level Duration Curve for the Month of October over the Modeled Period of Record.

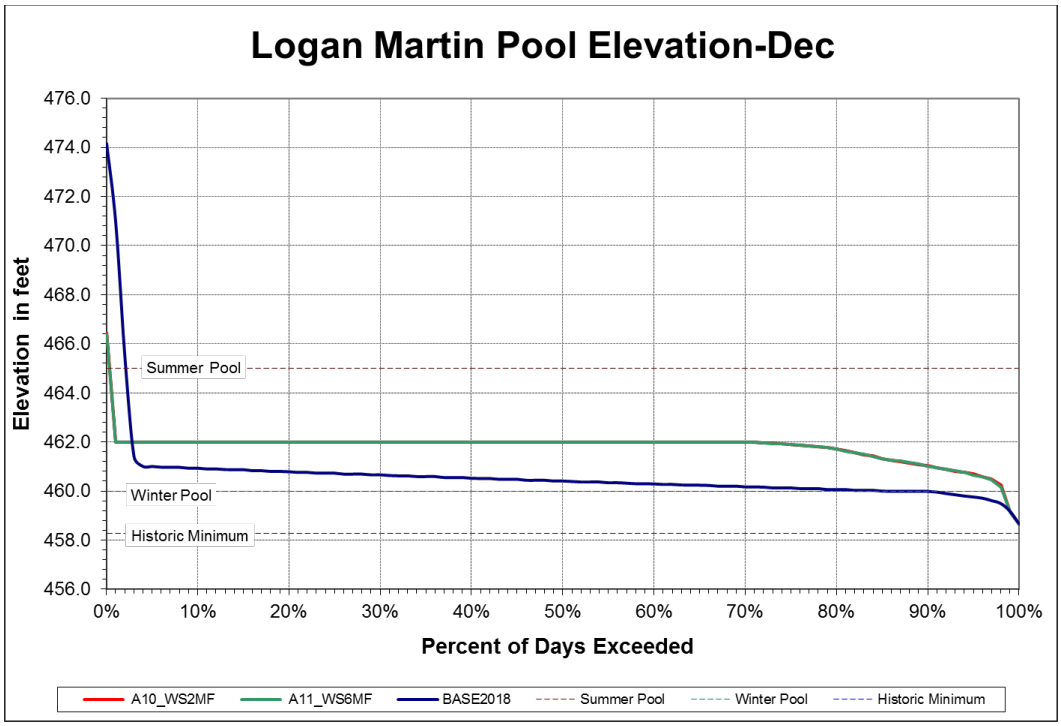


Figure E-61. Logan Martin Lake—Pool Level Duration Curve for the Month of December over the Modeled Period of Record.

E.3.2.1.2.5 Lay Dam and Lake, Mitchell Dam and Lake, and Jordan Dam and Lake

Since APC operates these reservoirs as run-of-river projects, the Alternative 11 would be expected to have a negligible incremental effect on lake levels compared to current operations under the NAA, even with the inclusion of modified flood operations at Weiss and Logan Martin dams. The upstream end of Lay Lake might experience slight and short-term increases in pool levels during flood events, when modified flood operations at Logan Martin Dam would be triggered.

E.3.2.1.2.6 R. F. Henry L&D / R.E. "Bob" Woodruff Lake

Based on review of HEC-ResSim model simulations over the 73-year hydrologic period of record, Alternative 11 would have no discernable effects on pool levels at R.E. "Bob" Woodruff Lake. The physical effects of the proposed actions at Allatoona, Weiss, and Logan Martin lakes included in Alternative 11 do not extend downstream of the mouth of the Coosa River.

E.3.2.1.3 Alternative 10

At Allatoona Lake, Alternative 10 includes reallocation of storage for water supply from the conservation pool only and application of the current USACE storage accounting practices. HEC-ResSim model outputs over the modeled period of record for Alternative 10 are presented in Figure E-39, Figure E-40, Figure E-41, Figure E-42, and Figure E-43. Median pool levels for Alternative 10 would be nearly identical to those for the NAA from late November through July and slightly lower than the NAA (from 0 to 0.5 ft lower) from August through late November. At the 90-percent exceedance level (dry conditions), pool levels for Alternative 10 would be nearly identical to those for the NAA from December through July and slightly below the NAA (from 0 to 0.7 ft lower) from August through November. At the-10 percent exceedance level, there is no discernable difference in pool levels for Alternative 10 and the NAA. The annual and monthly duration curves for Alternative 10 at Allatoona Lake depict pool levels that

are nearly the same as for the NAA except for slight deviations in the monthly duration curves in the fall months, as discussed.

For Alternative 10, pool levels at Weiss Lake compared to the NAA would be nearly identical to those described for Alternative 11 (see Figure E-45 through Figure E-50). Over the modeled period of record, the proposed storage reallocation options under consideration at Allatoona Lake would essentially have no effect on Weiss Lake pool levels. Any changes in pool levels at Weiss Lake under Alternative 10 would be solely attributable to features of the APC-proposed modifications to flood operations. Similarly, any effects on pool levels under Alternative 10 at H. Neely Henry Lake (see Figure E-51 through Figure E-55) and Logan Martin Lake (see Figure E-56 through Figure E-61) would be nearly identical to those described for Alternative 11.

Compared to the NAA, Alternative 10 would have the same effects on Lay Lake, Mitchell Lake, and Jordan Lake as those described for Alternative 11. Alternative 10 would have no effect on reservoir pool levels in the ACT River Basin downstream of Jordan Dam and Lake/Bouldin Dam.

E.3.2.1.4 Alternative 3

At Allatoona Lake, Alternative 3 includes reallocation of storage for water supply from the conservation pool only and application of the State of Georgia's proposed storage accounting method. The effects on pool levels at Allatoona Lake under Alternative 3 compared to the NAA are nearly identical to those described for Alternative 10 (see Figure E-39 through Figure E-44). Thus, based on the HEC-ResSim model simulation, the impact of the current USACE or proposed Georgia storage accounting method on Allatoona Lake pool levels is negligible.

The effects of Alternative 3 on pool levels in Weiss, H. Neely Henry, Logan Martin, Lay, Mitchell, and Jordan lakes on the Coosa River and R.E. "Bob" Woodruff Lake on the Alabama River would be identical to the NAA.

E.3.2.2 Streamflow Conditions

This section summarizes the effects of alternatives to proposed reallocation of reservoir storage for water supply in Allatoona Lake and APC-proposed flood storage and flood operations modifications at the Weiss and Logan Martin reservoir projects on stream flow conditions at strategic points throughout the ACT River Basin. It presents representative summaries of HEC-ResSim model outputs based on simulated project operations under the alternative plans over the modeled period of record (1939–2011). Based on the model results, this section describes the likely effects of the NAA, the TSP (Alternative 11), Alternative 10, and Alternative 3 on stream flow conditions at the following locations in the basin: (1) Etowah River immediately downstream of Allatoona Dam; (2) Coosa River near Rome, GA; (3) Coosa River downstream of Logan Martin Dam; and (4) Alabama River near Montgomery, AL.

Figures depicting median flow conditions in the basin are included to provide a representative characterization of "typical" conditions for alternative evaluation and comparison. The median value represents the point at which 50 percent of the values are higher and 50 percent are lower over the modeled period of record. In addition, figures depicting the 90-percent exceedance level have been included, showing that the values presented would be exceeded 90 percent of the time over the period of record and representative of substantially dry conditions in the basin and low basin inflow to the reservoirs. Other figures depicting the 10-percent exceedance level are included, showing that the values presented would be exceeded only 10 percent of the time over the period of record and representative of substantially wet conditions in the basin and high basin inflow to the reservoirs.

E.3.2.2.1 No Action Alternative

E.3.2.2.1.1 Etowah River at Allatoona Dam

Under the NAA, USACE would continue to operate Allatoona Dam and Lake in accordance with the updated ACT River Basin Master Manual (including the Allatoona project WCM) approved in May 2015, as summarized in Section E.1.1.4.2 and Appendix A to the Draft FR/SEIS. An important feature of project operations at the Allatoona Dam is the requirement to provide a continuous minimum release of 240 cfs to the Etowah River. Note that, in modeling the releases from Allatoona Dam, the minimum flow in the model includes continuous releases from the small service generator at the project plus an allowance for leakage at the dam. Thus, the minimum releases in the model outputs, as depicted in the figures following this section, are shown as 365 cfs.

Figure E-62 depicts median daily flow in the Etowah River downstream of Allatoona Dam for the NAA, analyzed over the 73-year period of record. Under the NAA, median daily flows would be 1,200–1,700 cfs from January through April; 1,500 cfs from May through July (except for one brief peak up to 1,900 cfs in early May); 800–1,200 cfs from August through November (except for a few daily peaks in August up to 1,500 cfs); and 2,000–2,300 cfs in December. The variations in flow conditions throughout the year are a direct function of the number of hydropower units operating and the number of hours they are in operation on any day during the year.

Figure E-63 presents the 90-percent exceedance daily flow values (dry conditions) over the modeled period of record. Daily flows for the NAA would likely be at 365–1,320 cfs from December through mid-January; 365–780 cfs from mid-January through mid-May; and stable at 365 cfs from mid-May through November. The 90-percent exceedance values for the NAA downstream of Allatoona Dam would be equal to the modeled minimum flow value of 365 cfs over a substantial portion of the year. Figure E-63 indicates that some hydropower generation consistently occurs from December through May, however, even during extremely dry conditions. Figure E-64 presents the 10-percent exceedance daily flow values (wet conditions) over the modeled period of record. Daily flows for the NAA from mid-November through May would be expected to vary widely between 2,000 cfs and 7,000 cfs, with most daily flow values in the 3,000–6,000 cfs range. From May through mid-November, daily flows would be in the range of 1,200–2,000 cfs.

Figure E-65 is the annual flow duration curve for the Etowah River downstream of Allatoona Lake that depicts the number of days over the modeled period of record (expressed as a percentage) that the range of potential flows would likely be exceeded. For the NAA, median daily flows would be expected to be about 1,200 cfs, with about 3,100 cfs being exceeded on 10 percent of the days and 570 cfs being exceeded on about 81 percent of the days over the period of record. Daily flows would be at the modeled minimum flow of 365 cfs on about 17 percent of the days.

Figure E-66 and Figure E-67 present flow duration curves for Etowah River below Allatoona Dam for the months of September and December, respectively. These months were selected because they represent periods when project operations and downstream flow conditions might be more susceptible to change as a result of proposed actions under consideration in this Draft FR/SEIS. For the NAA, median daily flows during the month of September would be about 965 cfs, with 1,750 cfs being exceeded on about 10 percent of the days and 570 cfs being exceeded on 76 percent of the days. Daily flows would be at the modeled minimum level of 365 cfs approximately 23 percent of the time in September. For the NAA, median daily flows during the month of December would be about 2,100 cfs, with 4,300 cfs being exceeded on about 10 percent of the days and 770 cfs being exceeded on 90 percent of the days. Daily flows would be at the modeled minimum level of about 365 cfs about 8 percent of the time in December.

E.3.2.2.1.2 Coosa River Near Rome

This section summarizes flow conditions in the Coosa River near Rome, GA, under the NAA. The specific location for evaluation of flow conditions for the NAA and other alternatives is the Coosa River at Mayo's Bar, about 7.5 mi downstream from the confluence of the Oostanaula and Etowah rivers and the location of USGS gage 02397000. Under the NAA, USACE project operations at Carters Dam and Lake/Carters Reregulation Dam and at Allatoona Dam and Lake would continue in accordance with the updated ACT River Basin Master Manual (including the Allatoona project WCM) approved in May 2015, as summarized in Section E.1.1.4.1, Section E.1.1.4.2, and Appendix A to the Draft FR/SEIS.

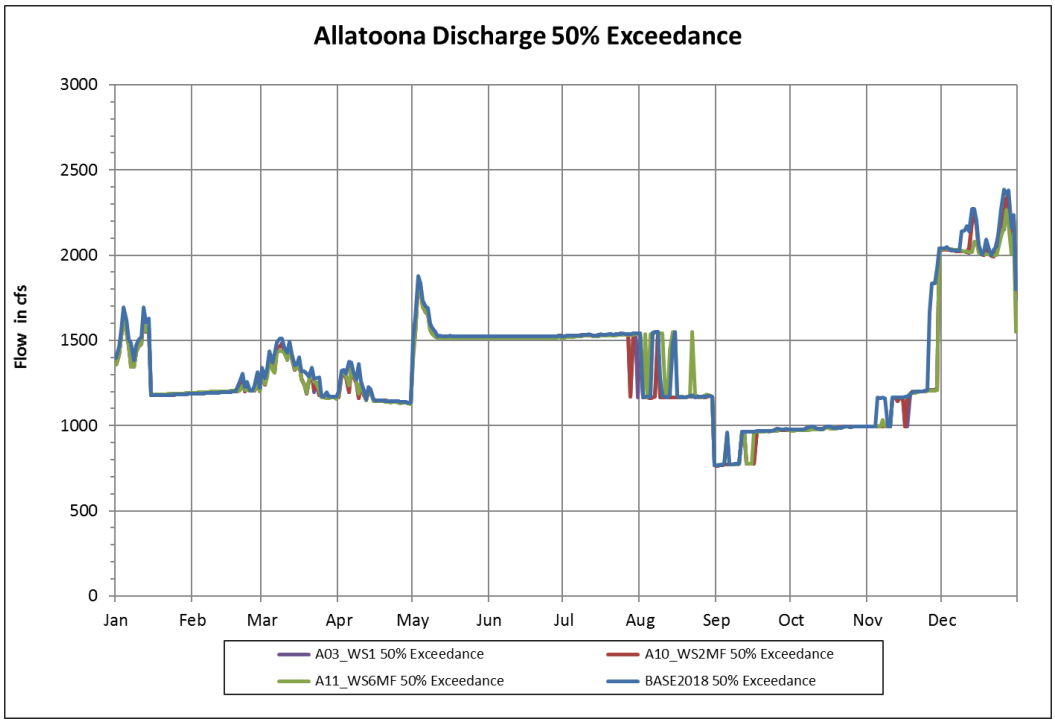


Figure E-62. Etowah River Downstream of Allatoona Dam—Median Daily Discharge over the Modeled Period of Record.

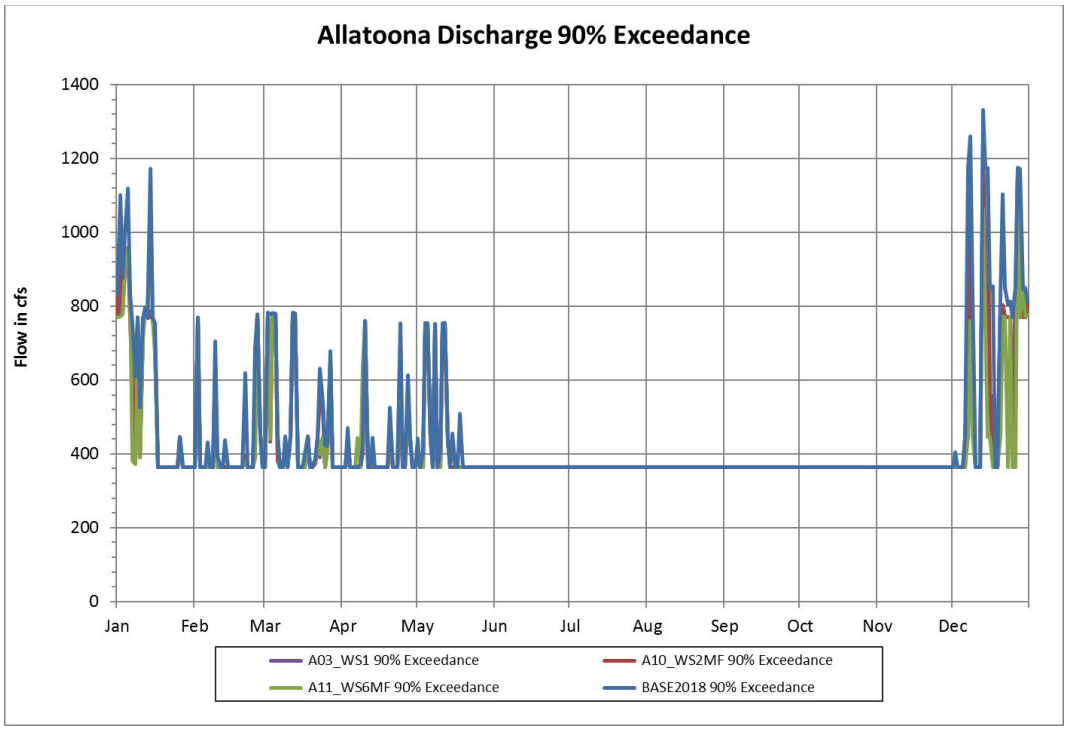


Figure E-63. Etowah River Downstream of Allatoona Dam—Daily Discharge Exceeded 90 Percent of the Time over the Modeled Period of Record.

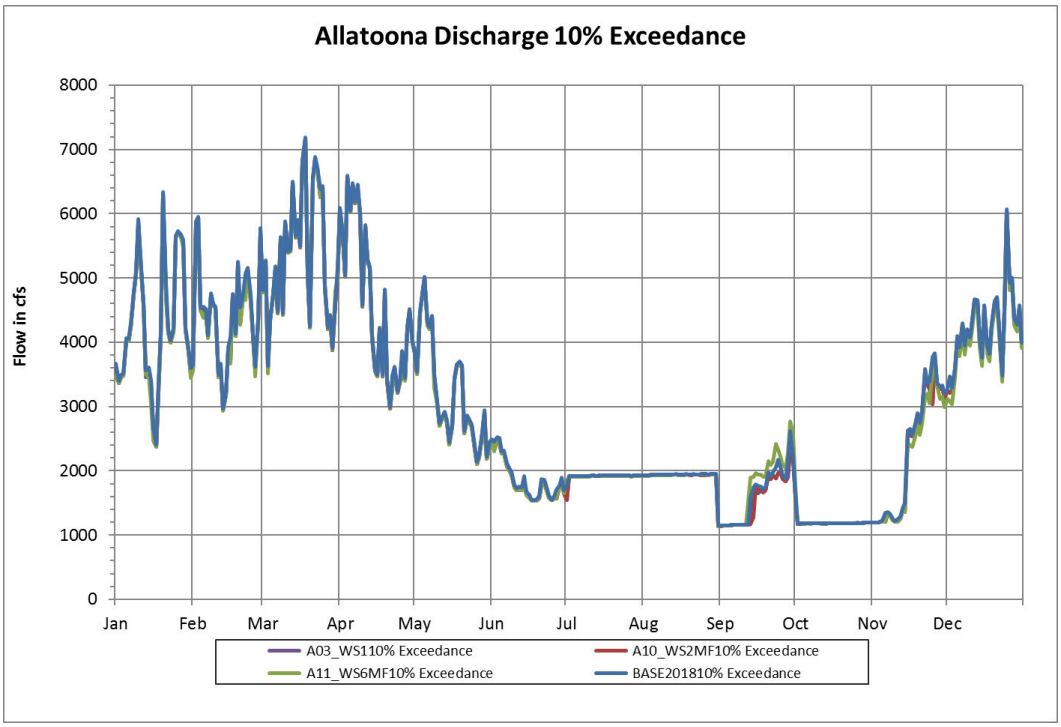


Figure E-64. Etowah River Downstream of Allatoona Dam—Daily Discharge Exceeded 10 Percent of the Time over the Modeled Period of Record.

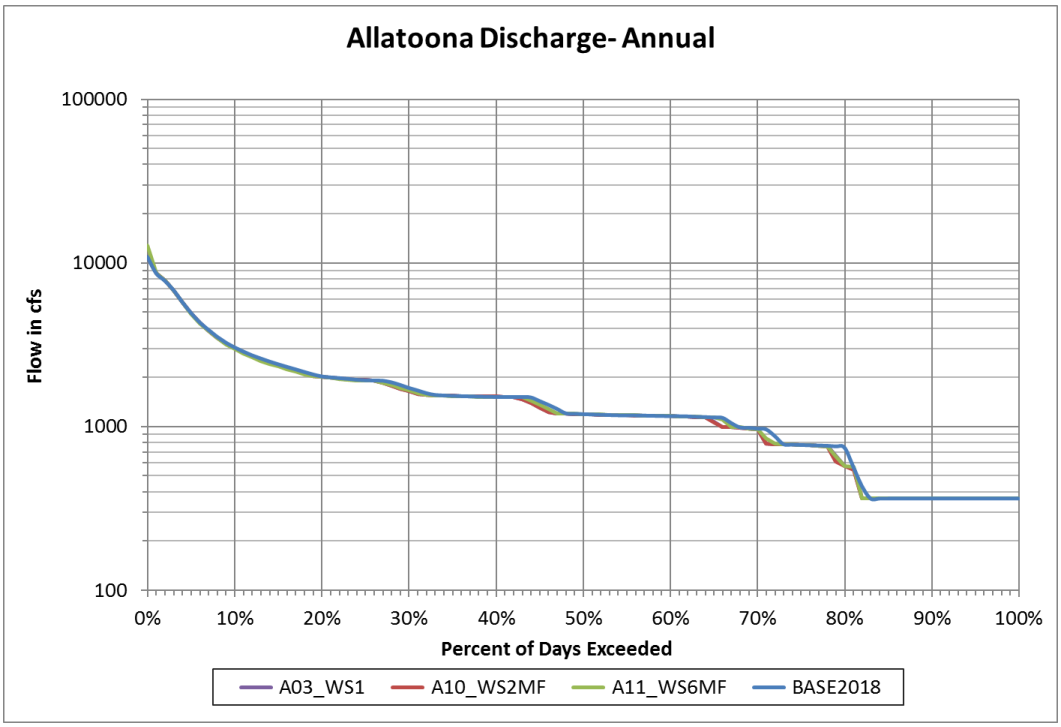


Figure E-65. Etowah River Downstream of Allatoona Dam—Annual Flow Duration Curve over the Modeled Period of Record.

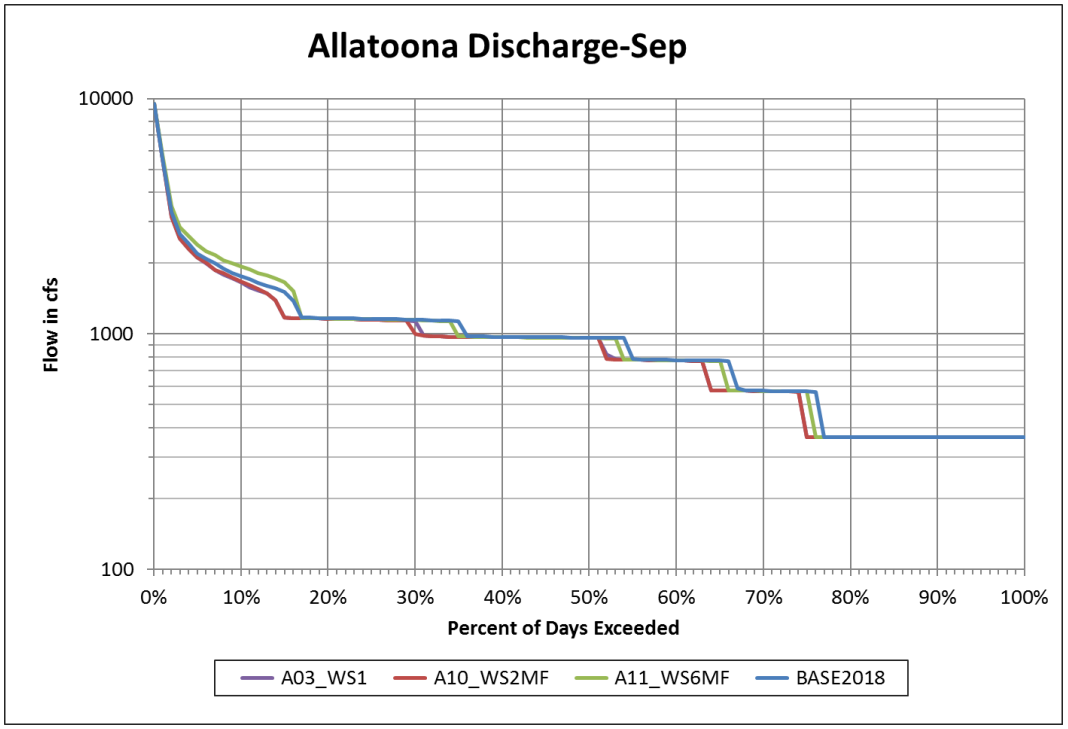


Figure E-66. Etowah River Downstream of Allatoona Dam—Flow Duration Curve for September over the Modeled Period of Record.

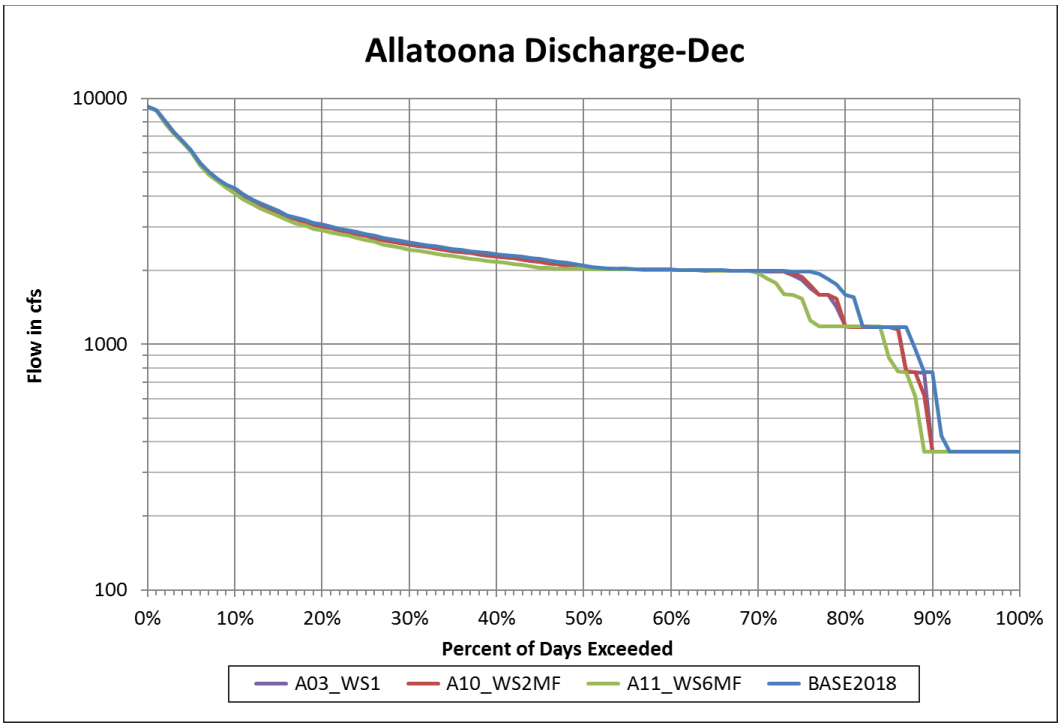


Figure E-67. Etowah River Downstream of Allatoona Dam—Flow Duration Curve for December over the Modeled Period of Record.

Figure E-68 depicts median daily flow in the Coosa River near Rome for the NAA, analyzed over the 73-year period of record. Under the NAA, median daily flows would range from about 6,000 cfs to 11,000 cfs from January through mid-April, from about 6,000 cfs to a low point of 2,000 cfs from May through mid-September, and gradually increasing back to around 6,000 cfs by the end of December.

Figure E-69 presents the 90-percent exceedance daily flow values (dry conditions) over the modeled period of record. Daily flows for the NAA would likely range from about 2,800 cfs in January to a peak around 4,800 cfs in mid-March, thereafter, gradually declining to a low point of about 1,200 cfs by the end of September, subsequently increasing to around 3,200 cfs by the end of December. Figure E-70 presents the 10-percent exceedance daily flow values (wet conditions) over the modeled period of record. Daily flows for the NAA would likely range from 13,000 cfs to 29,000 cfs between January and mid-May, gradually declining from around 15,000 cfs in mid-May to around 4,000 cfs in September and October, thereafter, gradually increasing to about 15,000 cfs by the end of December.

Figure E-71 is the annual flow duration curve for the Coosa River near Rome. For the NAA, median daily flows over the year would be about 4,100 cfs, with 14,000 cfs being exceeded on about 10 percent of the days and 1,800 cfs being exceeded on 90 percent of the days. Flows of 1,000 cfs would be exceeded on 99 percent of the days. Figure E-72 and Figure E-73 present flow duration curves in the Coosa River near Rome for the months of September and December, respectively. For the NAA, median daily flows during the month of September would be about 2,170 cfs, with 4,400 cfs being exceeded on about 10 percent of the days and 1,300 cfs being exceeded on 90 percent of the days. Flows of 1,000 cfs would be exceeded on 99 percent of days. Median daily flows during the month of December would be about 5,300 cfs, with 14,300 cfs being exceeded on about 10 percent of the days and 2,670 cfs being exceeded on 90 percent of the days. Flows of 1,500 cfs would be exceeded on 99 percent of days.

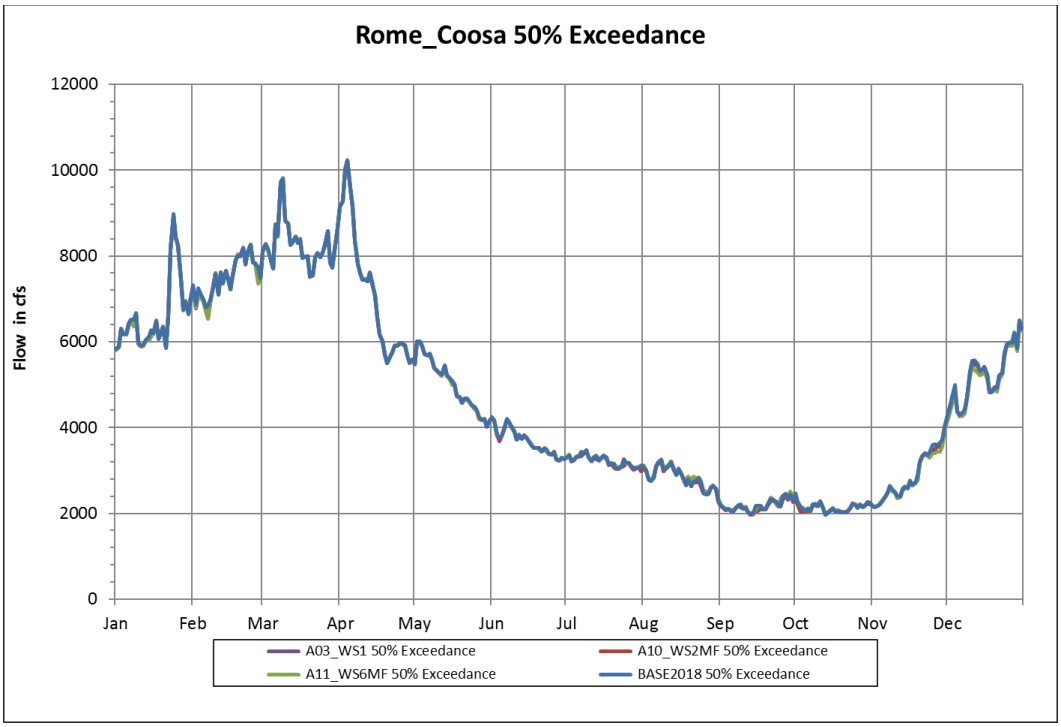


Figure E-68. Coosa River near Rome, GA—Median Daily Discharge over the Modeled Period of Record.

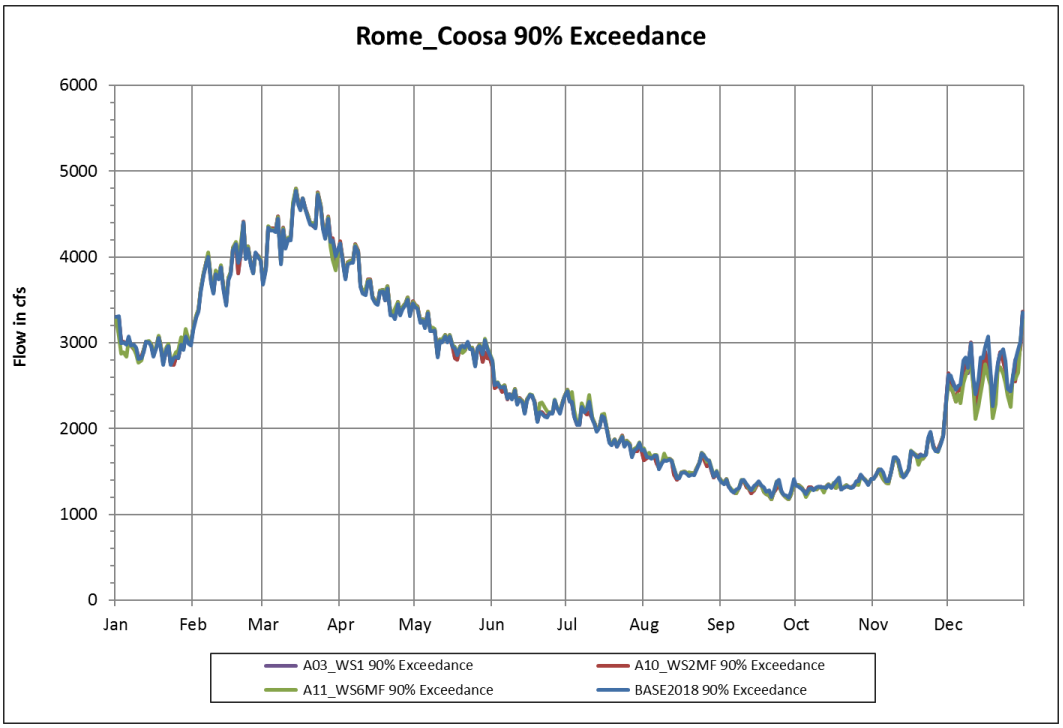


Figure E-69. Coosa River at Rome, GA—Daily Discharge Exceeded 90 Percent of the Time over the Modeled Period of Record.

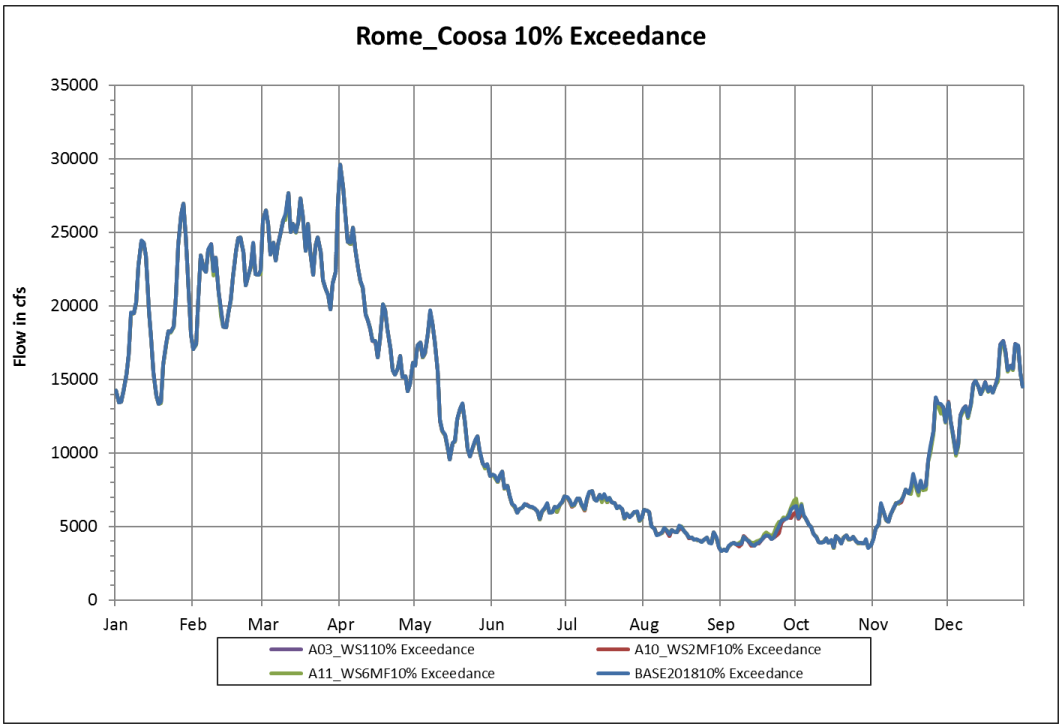


Figure E-70. Coosa River near Rome, GA—Daily Discharge Exceeded 10 Percent of the Time over the Modeled Period of Record.

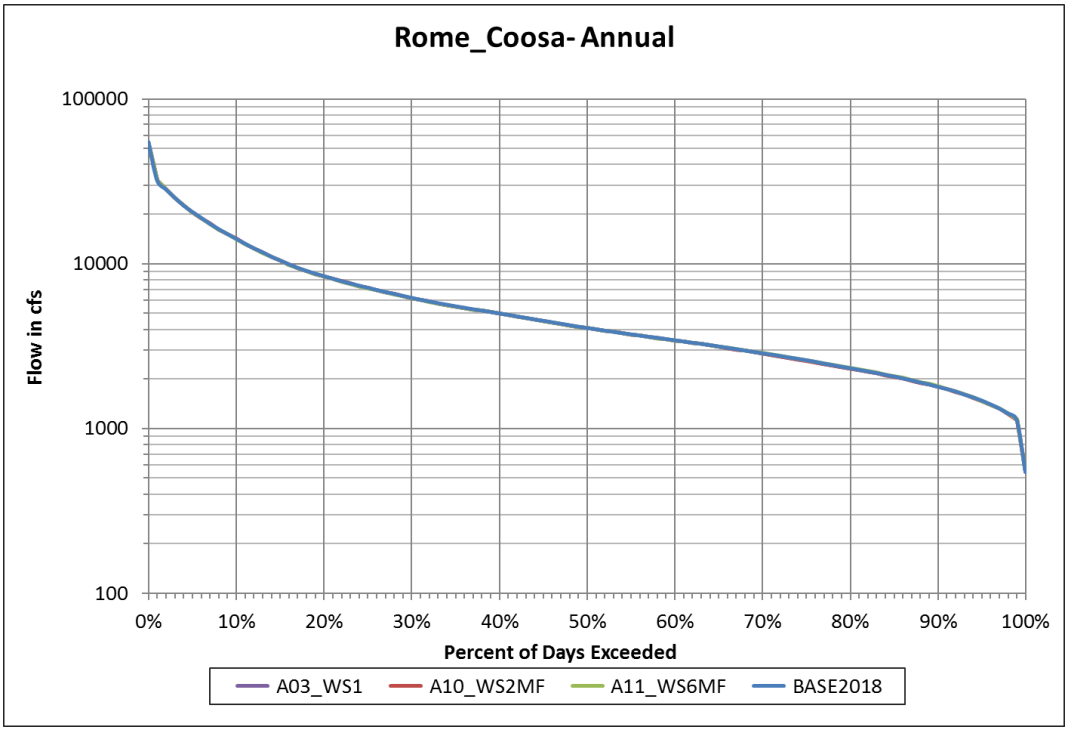


Figure E-71. Coosa River near Rome, GA—Annual Flow Duration Curve over the Modeled Period of Record.

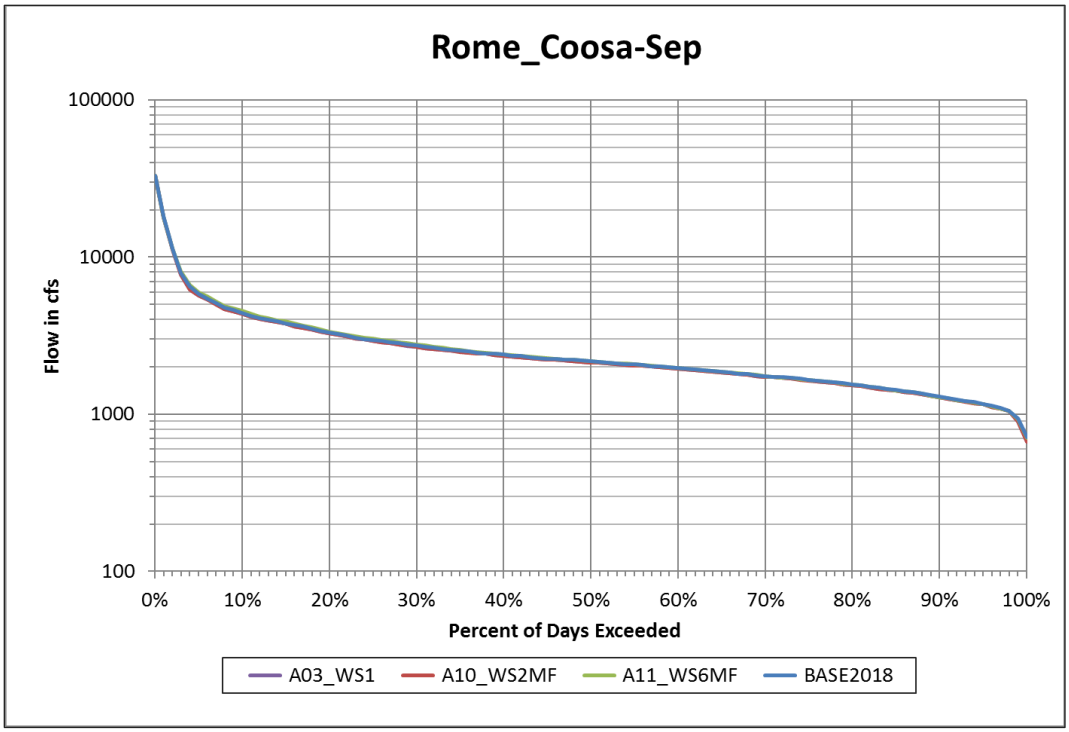


Figure E-72. Coosa River near Rome, GA—Flow Duration Curve for September over the Modeled Period of Record.

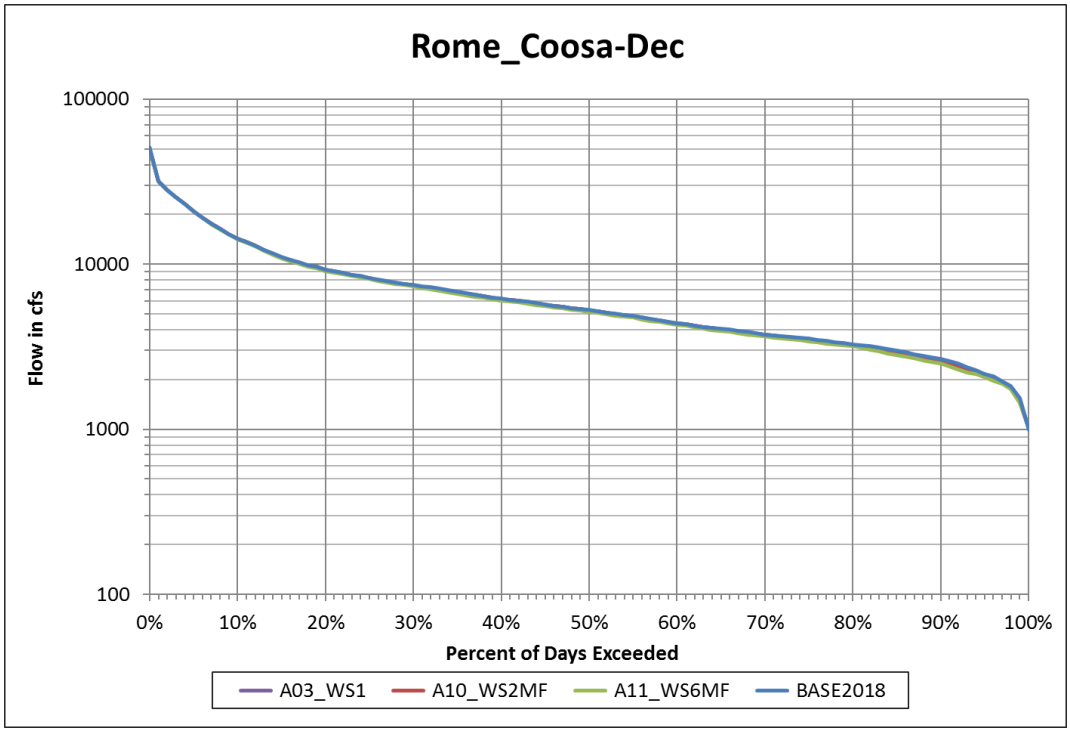


Figure E-73. Coosa River near Rome, GA—Flow Duration Curve for December over the Modeled Period of Record.

E.3.2.2.1.3 Coosa River at Logan Martin Dam

This section summarizes flow conditions in the Coosa River downstream of Logan Martin Dam under the NAA. APC project operations at Logan Martin Dam, H. Neely Henry Dam, Weiss Dam, and the three APC run-of-river projects on the Coosa River (Lay, Mitchell, and Jordan/Bouldin dams) would continue under their current FERC licenses. Specifically, flood operations at the Weiss and Logan Martin dams, as described in Section 2.5.2 of the main report, would continue in coordination with USACE as they have in the past. Project operations at USACE upstream reservoir projects in the basin, Carters Dam and Lake/Carters Reregulation Dam, would continue with no changes. APC reservoirs on the Tallapoosa River would continue to operate in accordance with their current FERC licenses.

Figure E-74 depicts median daily flow in the Coosa River below Logan Martin Dam for the NAA, analyzed over the 73-year period of record. Under the NAA, median daily flows would range from about 10,000 cfs to 20,000 cfs from mid-December through mid-April and 5,000–10,000 cfs from mid-April to mid-December (July through late November would be level at 5,000 cfs). Figure E-75 presents the 90-percent exceedance daily flow values (dry conditions) over the modeled period of record. Daily flows for the NAA would likely range from about 5,000 cfs to 9,400 cfs in December through May. From June through mid-November, daily flows would gradually decline from about 5,000 cfs to a low of 1,800–2,600 cfs during September and October, thereafter increasing to about 5,000 cfs by late November. Figure E-76 presents the 10-percent exceedance daily flow values (wet conditions) over the modeled period of record. Daily flows for the NAA would likely range from 25,000 cfs to 50,000 cfs from December through April, gradually declining from around 30,000 cfs in May to around 6,000 cfs in early September, thereafter, gradually increasing to about 25,000 cfs by the end of November.

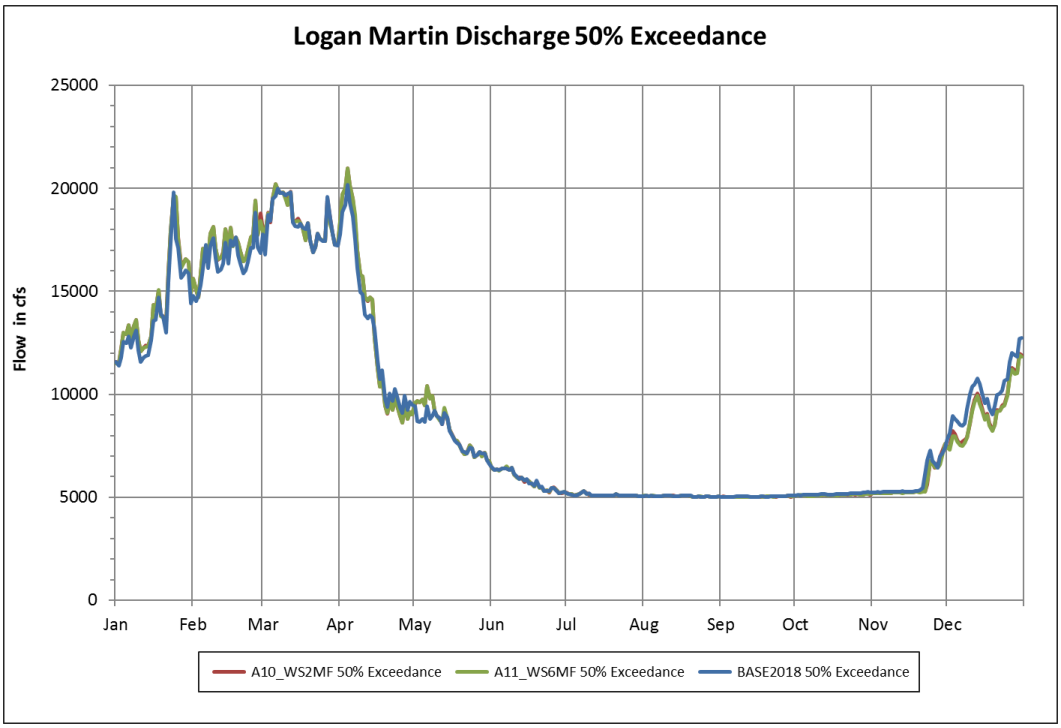


Figure E-74. Coosa River Downstream of Logan Martin Dam—Median Daily Discharge over the Modeled Period of Record.

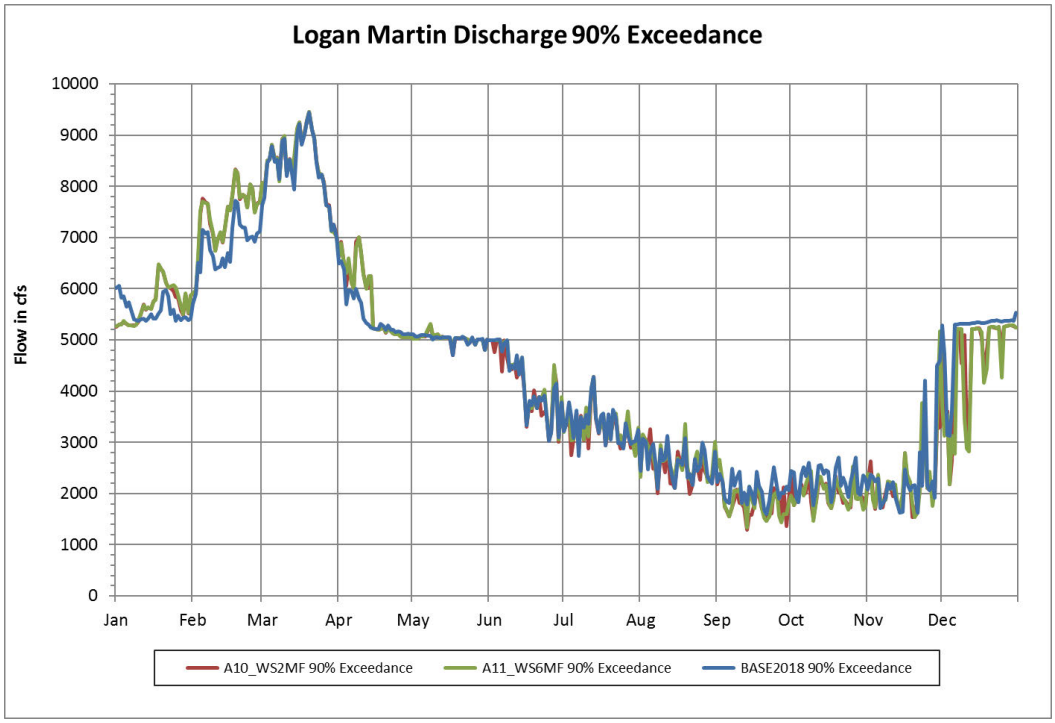


Figure E-75. Coosa River Downstream of Logan Martin Dam—Daily Discharge Exceeded 90 Percent of the Time over the Modeled Period of Record.

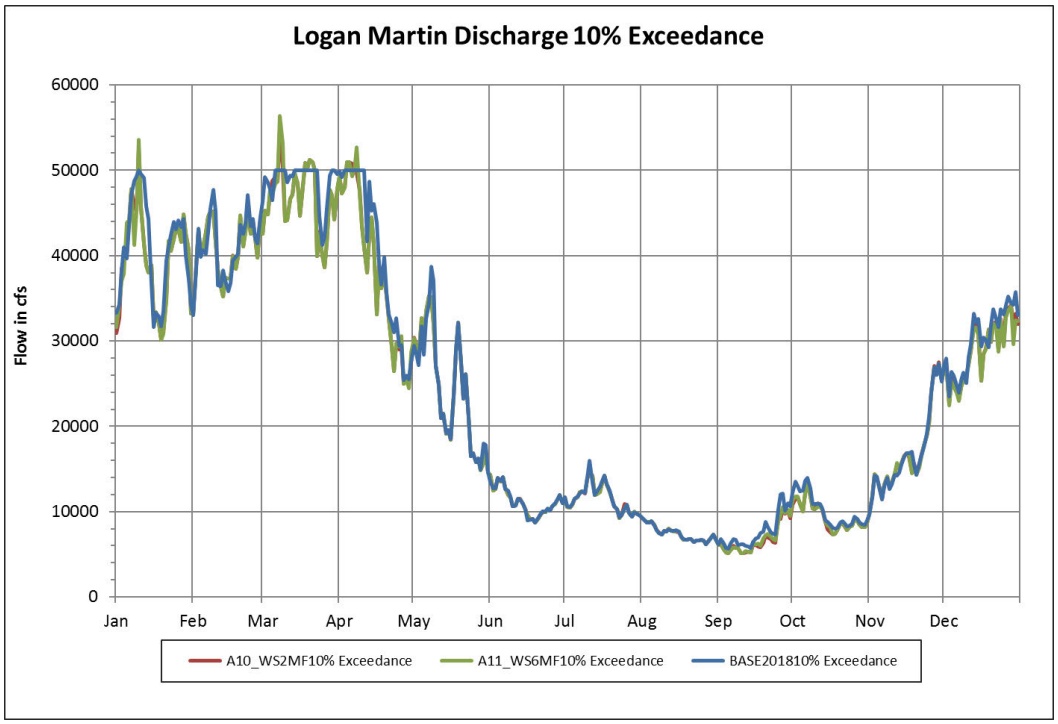


Figure E-76. Coosa River Downstream of Logan Martin Dam—Daily Discharge Exceeded 10 Percent of the Time over the Modeled Period of Record.

Figure E-77 is the annual flow duration curve for the Coosa River below Logan Martin Dam. For the NAA, median daily flows over the year would be about 7,000 cfs, with 29,840 cfs being exceeded on about 10 percent of the days and 3,470 cfs being exceeded on 90 percent of the days. Flows of 1,170 cfs would be exceeded on 99 percent of days. Figure E-78 and Figure E-79 present flow duration curves in the Coosa River below Logan Martin Dam for the months of March and September, respectively. For the NAA, median daily flows during the month of March would be about 18,290 cfs, with 50,000 cfs being equaled or exceeded on about 10 percent of the days and 8,070 cfs being exceeded on 90 percent of the days. Flows of 5,360 cfs would be exceeded on 99 percent of days in March. Median daily flows during the month of September would be about 5,040 cfs, with 7,860 cfs being exceeded on about 10 percent of the days and 2,020 cfs being exceeded on 90 percent of the days. Flows of 870 cfs would be exceeded on 99 percent of days.

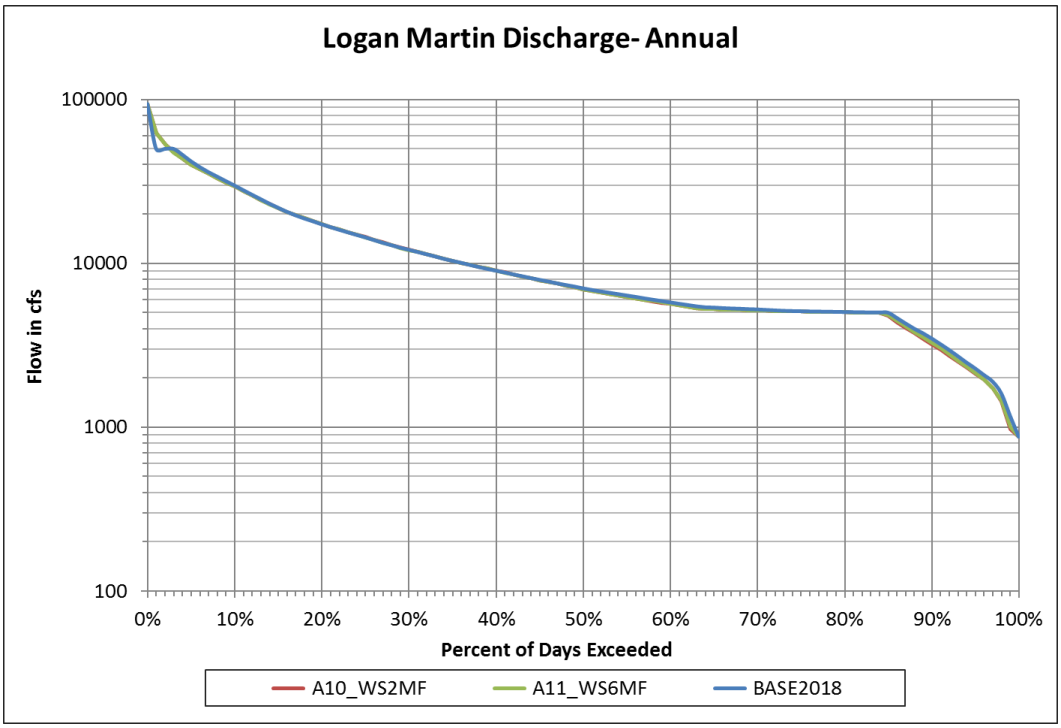


Figure E-77. Coosa River Downstream of Logan Martin Dam—Annual Flow Duration Curve over the Modeled Period of Record.

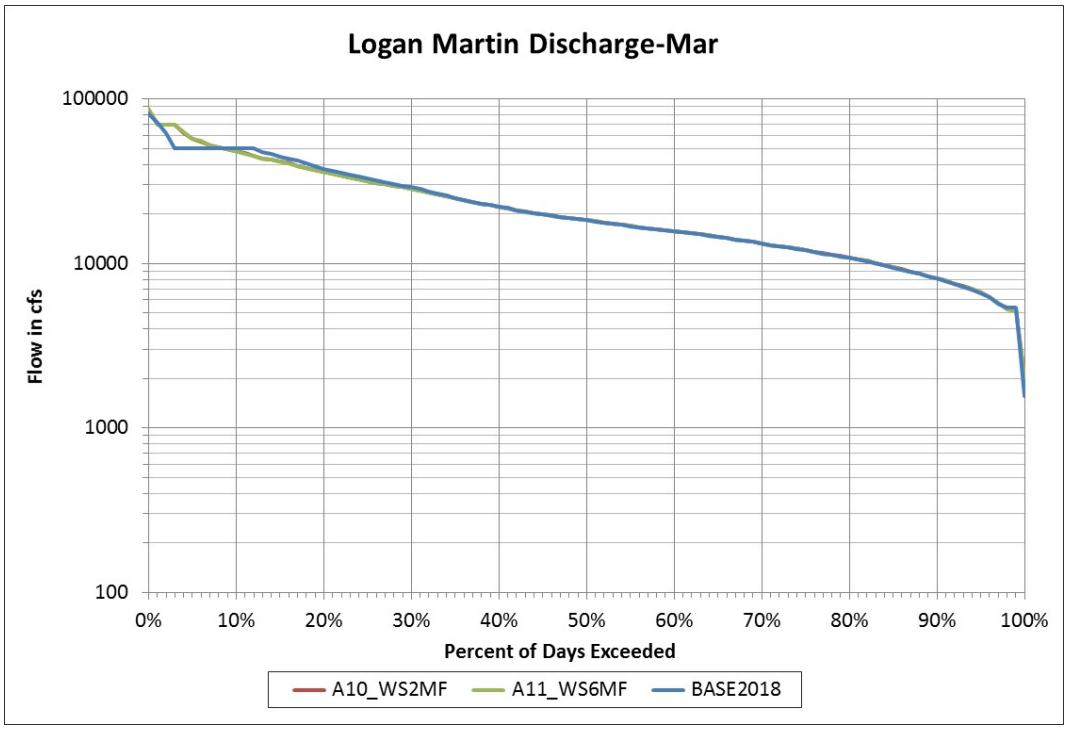


Figure E-78. Coosa River Downstream of Logan Martin Dam—Flow Duration Curve for March over the Modeled Period of Record.

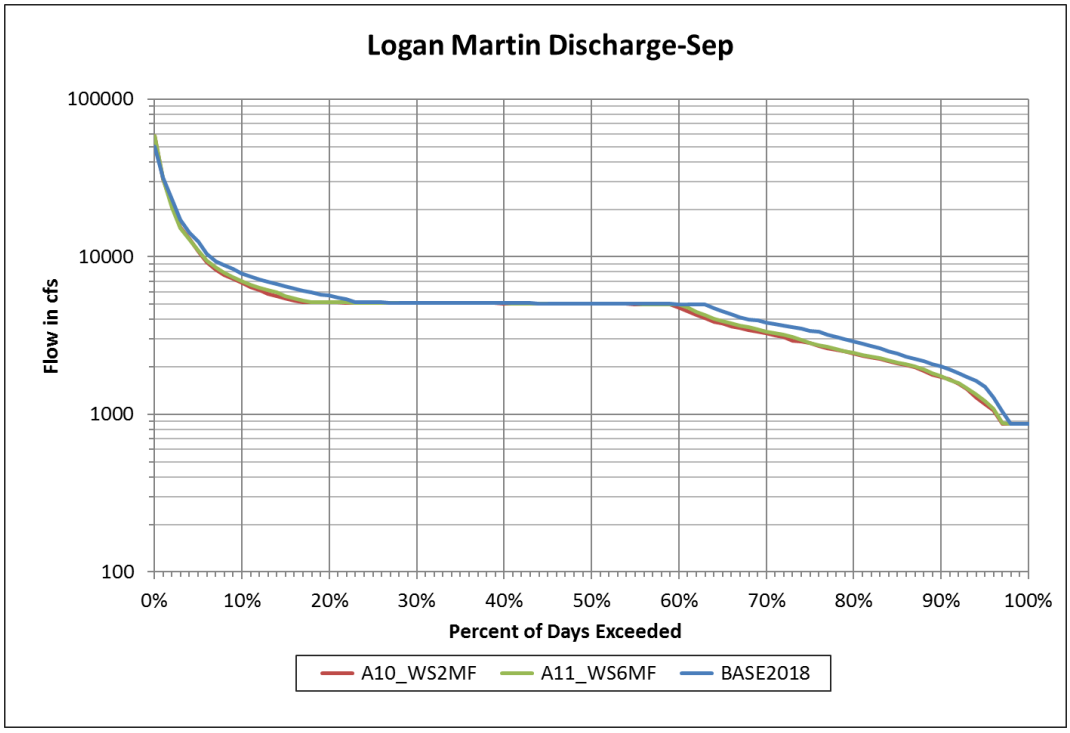


Figure E-79. Coosa River Downstream of Logan Martin Dam—Flow Duration Curve for September over the Modeled Period of Record.

E.3.2.2.1.4 Alabama River near Montgomery

This section summarizes flow conditions in the Alabama River at the confluence of the Coosa and Tallapoosa rivers for the NAA. APC project operations at Logan Martin Dam, H. Neely Henry Dam, Weiss Dam, and the three APC run-of-river projects on the Coosa River (Lay, Mitchell, and Jordan/Bouldin dams) would continue under their current FERC licenses. Specifically, flood operations at the Weiss and Logan Martin dams, as described in Section 2.5.2 of the main report, would continue in coordination with USACE as they have in the past. Project operations at USACE upstream reservoir projects in the basin, Carters Dam and Lake/Carters Reregulation Dam, would continue with no changes. APC reservoirs on the Tallapoosa River would continue to operate in accordance with their current FERC licenses.

The modeled discharges at this location are not based on or referenced to a specific USGS gage station on the Alabama River. Rather, the modeled discharges represent the sum of the releases over time from Jordan Dam, Bouldin Dam (two outlets from Jordan Lake on the Coosa River), and Thurlow Dam (the furthest downstream dam on the Tallapoosa River), or the JBT flow. The JBT flow is considered representative of the flow conditions in the Alabama River at the juncture of the Coosa and Tallapoosa rivers. The confluence of these rivers serves as one of the key locations in the ACT River Basin for comparing the physical effects (flow conditions) of the proposed actions considered in this Draft FR/SEIS.

Figure E-80 depicts median daily flow in the Alabama River at the confluence of the Coosa and Tallapoosa rivers for the NAA, analyzed over the 73-year period of record. For the NAA, median daily flows would range from about 20,000 cfs to 34,000 cfs from January through mid-April, gradually declining from 20,000 cfs to about 7,500 cfs in September, and gradually increasing to 20,000 cfs by the end of December. Figure E-81 presents the 90-percent exceedance daily flow values (dry conditions) over the modeled period of record. Daily flows for the NAA would likely range from about 8,000 cfs to 16,000 cfs from mid-December through May. From June through mid-December, the 90-percent exceedance daily flows would range between 8,000 cfs and 4,600 cfs, with flows from mid-June to mid-November at about 4,600 cfs. Figure E-82 presents the 10-percent exceedance daily flow values (wet conditions) over the modeled period of record. Daily flows for the NAA would likely range from about 40,000 cfs to 84,000 cfs from December through mid-May, gradually declining from about 40,000 cfs in mid-May to about 10,000 cfs in September, thereafter, gradually increasing to about 40,000 cfs by the end of November.

Figure E-83 is the annual flow duration curve for the Alabama River at the confluence of the Coosa and Tallapoosa rivers. For the NAA, median daily flows over the year would be about 12,050 cfs, with 49,030 cfs being exceeded on about 10 percent of the days and 4,990 cfs being exceeded on 90 percent of the days. Flows of 3,700 cfs would be exceeded on 99 percent of days. Figure E-84 and Figure E-85 present flow duration curves in the Alabama River at the confluence of the Coosa and Tallapoosa rivers for the months of September and December, respectively. For the NAA, median daily flows during the month of September would be about 7,600 cfs, with 12,520 cfs being exceeded on about 10 percent of the days and 4,610 cfs being exceeded on 90 percent of the days. Flows of 4,200 cfs would be exceeded on 99 percent of days in September. Median daily flows during the month of December would be about 15,860 cfs, with 50,840 cfs being exceeded on about 10 percent of the days and 8,330 cfs being exceeded on 90 percent of the days. Flows of 2,000 cfs would be exceeded on 99 percent of days.

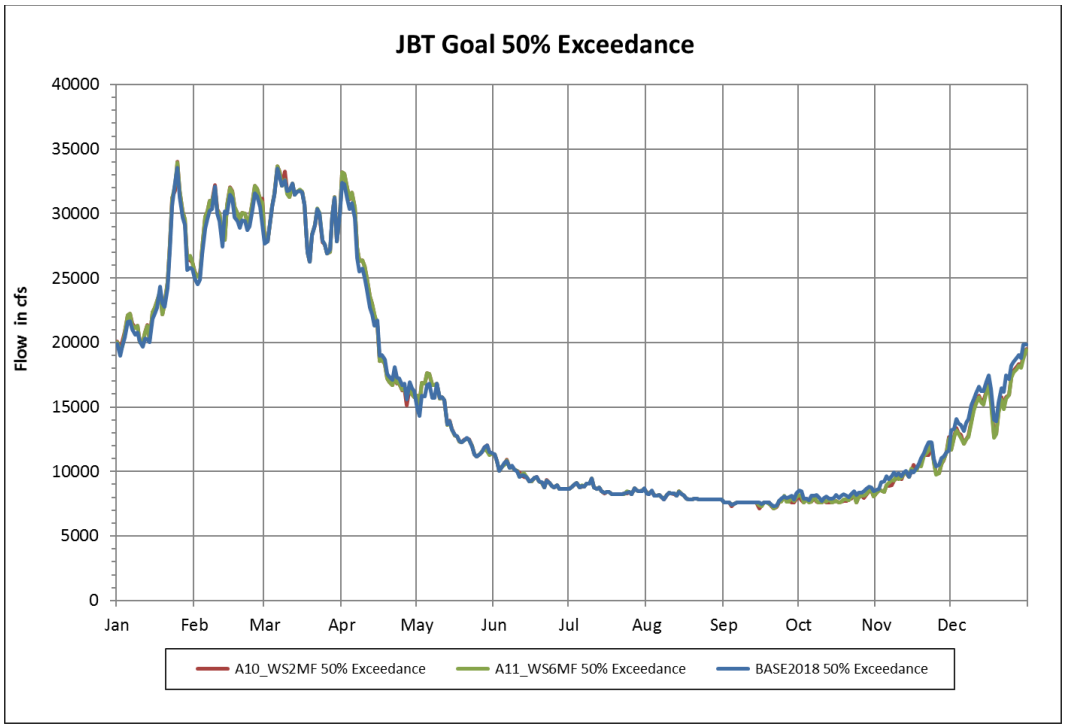


Figure E-80. Alabama River at Confluence of Coosa and Tallapoosa Rivers—Median Daily Discharge over the Modeled Period of Record.

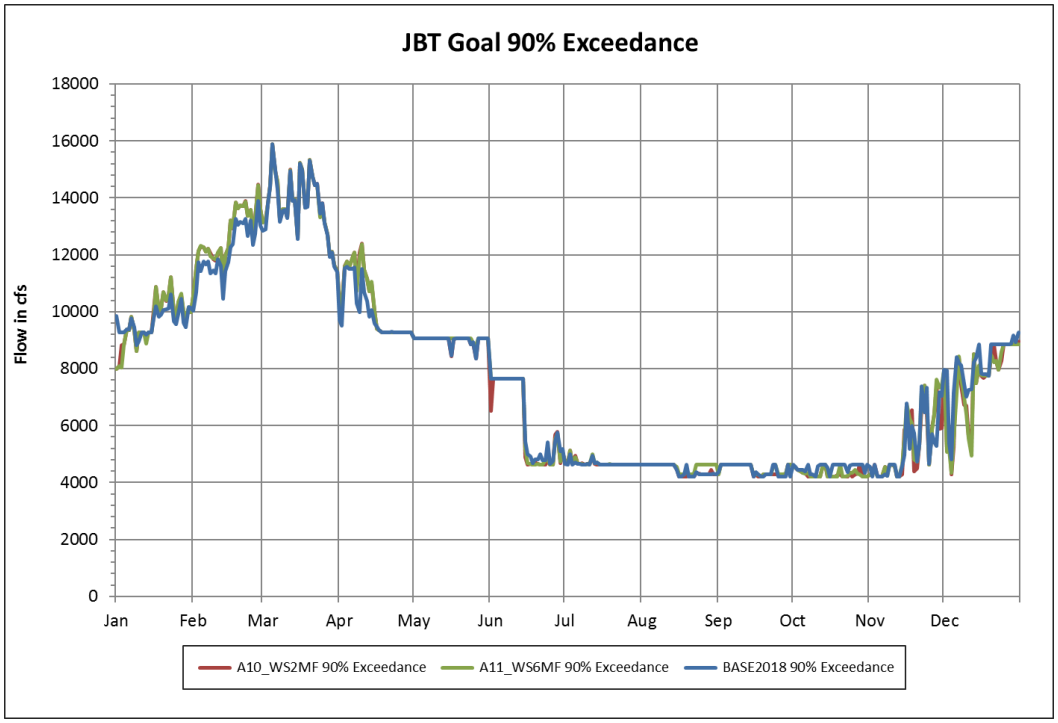


Figure E-81. Alabama River at Confluence of Coosa and Tallapoosa Rivers—Daily Discharge Exceeded 90 Percent of the Time over the Modeled Period of Record.

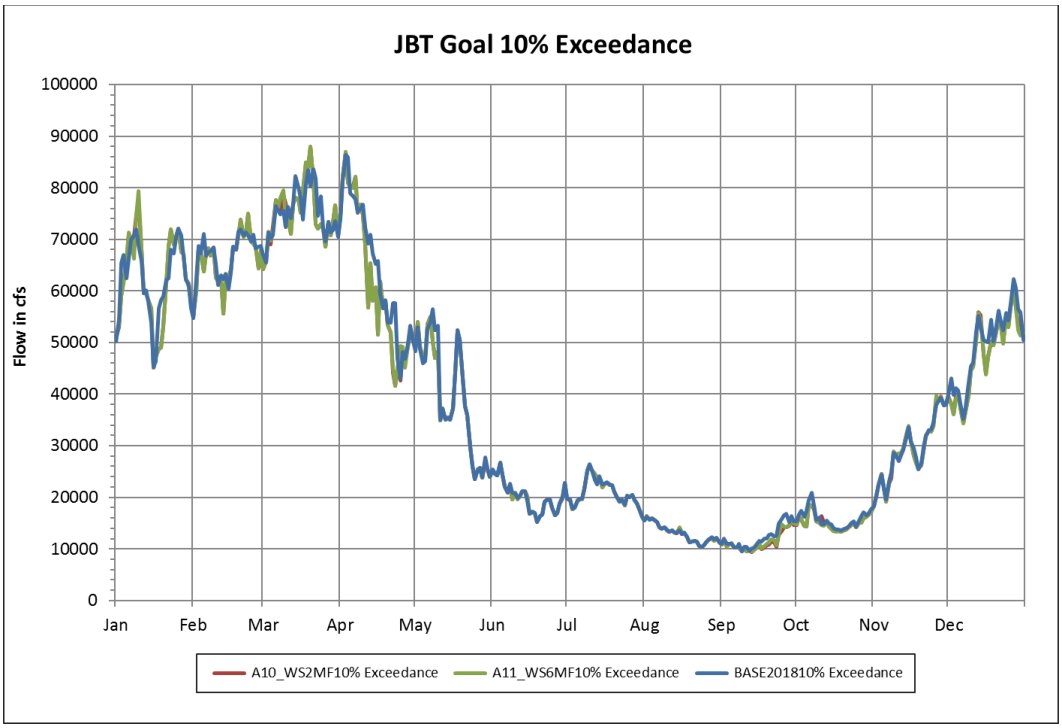


Figure E-82. Alabama River at Confluence of Coosa and Tallapoosa Rivers—Daily Discharge Exceeded 10 Percent of the Time over the Modeled Period of Record.

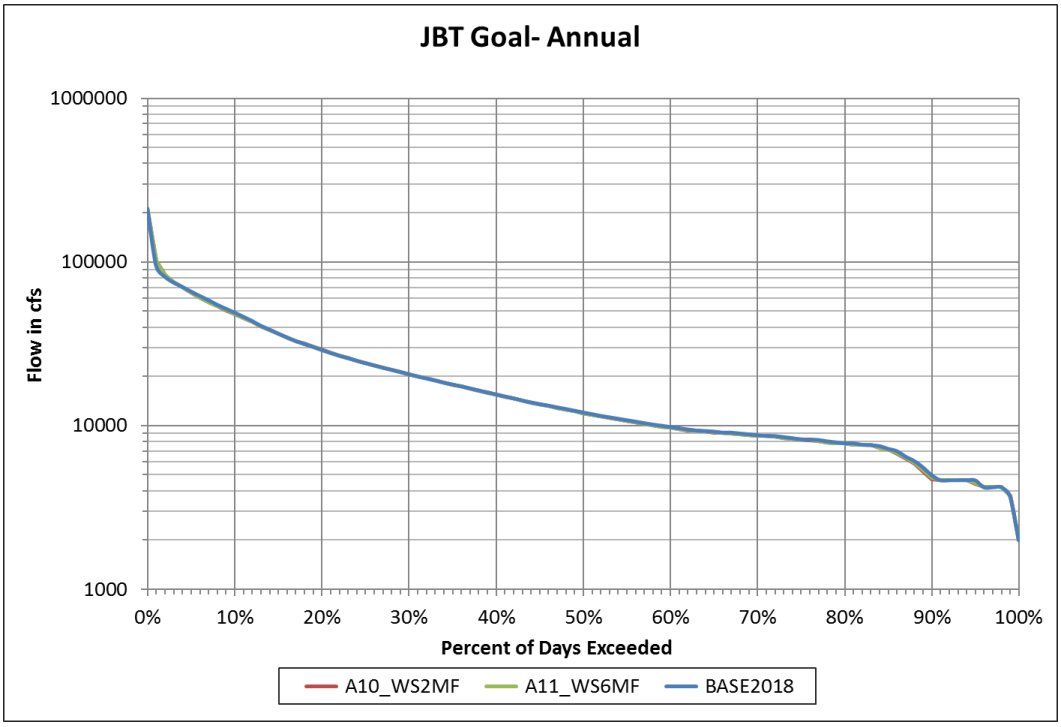


Figure E-83. Alabama River at Confluence of Coosa and Tallapoosa Rivers—Annual Flow Duration Curve over the Modeled Period of Record.

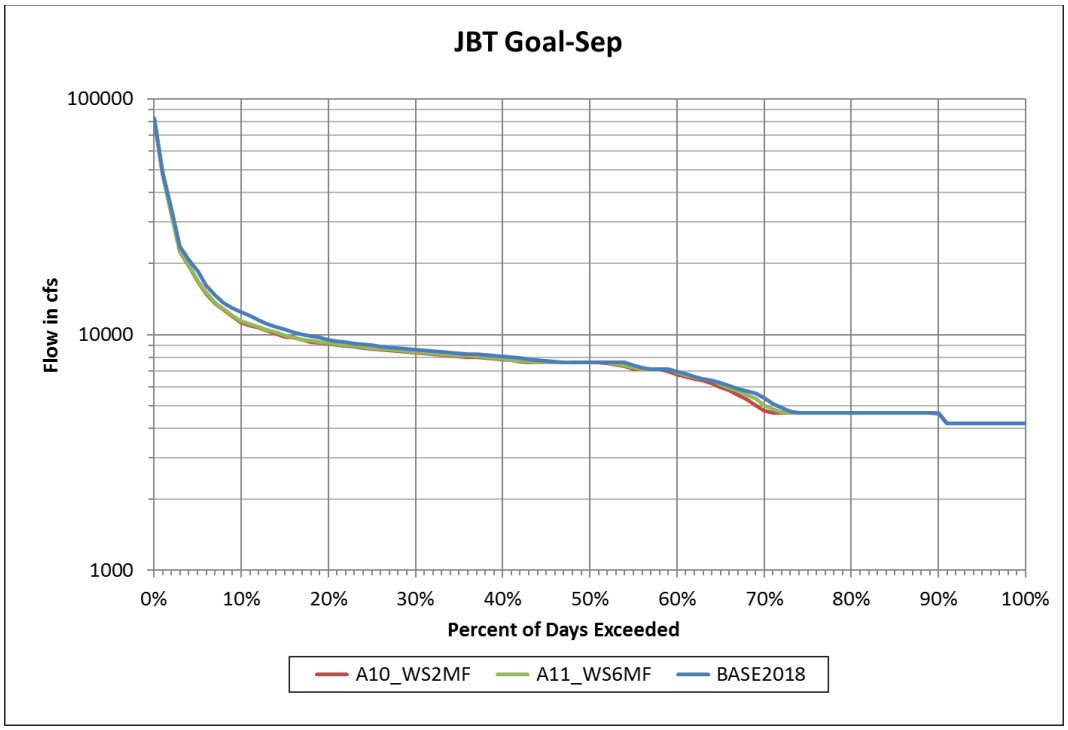


Figure E-84. Alabama River at Confluence of Coosa and Tallapoosa Rivers—Flow Duration Curve for September over the Modeled Period of Record.

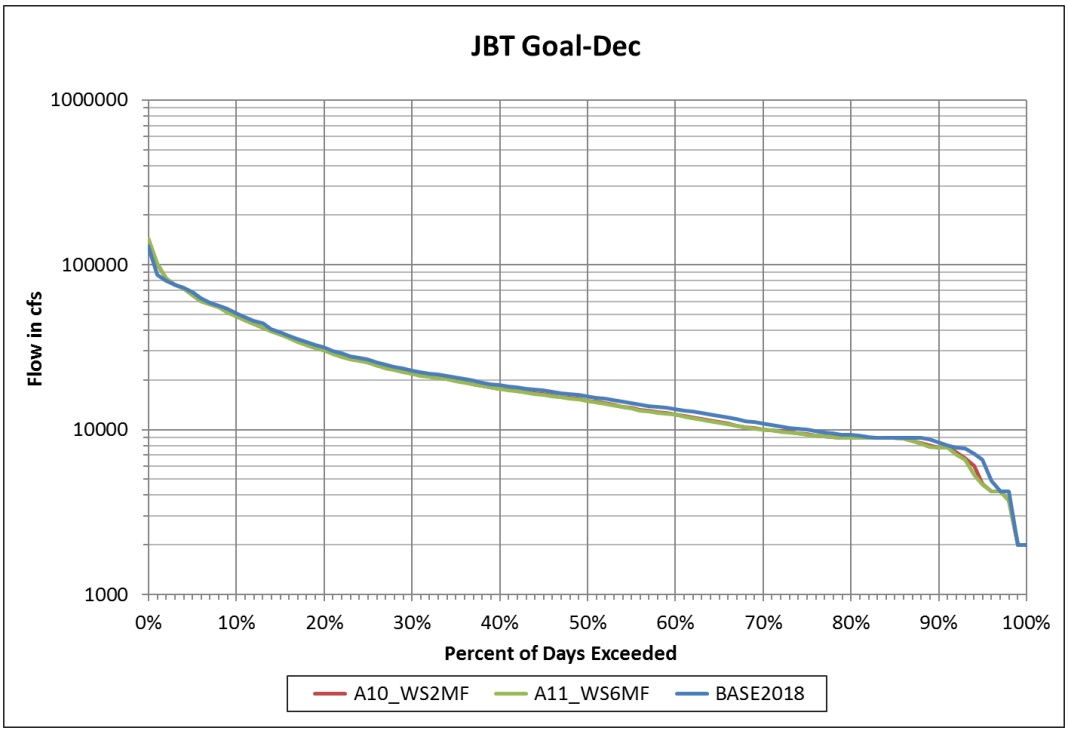


Figure E-85. Alabama River at Confluence of Coosa and Tallapoosa Rivers—Flow Duration Curve for December over the Modeled Period of Record.

E.3.2.2.2 Tentatively Selected Plan (Alternative 11)

E.3.2.2.2.1 Etowah River at Allatoona Dam

In the Etowah River immediately downstream from Allatoona Dam, Alternative 11 would likely result in minor changes to flow conditions compared to the NAA. The minor differences from flow conditions under the NAA are likely to be a direct result of some adjustments in the number of units generating and the number of hours they would be generating to maintain the pool at Allatoona Lake at a slightly higher level (about 1–1.5 ft) during the year under Alternative 11 compared to the NAA. Releases from Allatoona Dam under Alternative 11 would closely align with those under the NAA at the median, 90-percent exceedance, and 10-percent exceedance levels (Figure E-62, Figure E-63, and Figure E-64), but would be marginally lower, mostly from November through March. Little change in release from Allatoona Dam would likely occur in the late spring and summer months.

The annual duration curve for Alternative 11 (Figure E-65) also depicts the minor decreases in discharge over the year compared to the NAA, but most of the decreases appear at the 70–85-percent exceedance level. Monthly duration curves show marginally lower releases compared to the NAA during November through February associated with maintaining a slightly higher winter pool in November/December and beginning refill of the pool at a slightly higher rate in January/February. Monthly duration curves for September (Figure E-66) and December (Figure E-67) are provided as examples of months with more significant changes in releases from Allatoona Dam between Alternative 11 and the NAA. For September, under wetter conditions (3–16-percent exceedance), releases under Alternative 11 would be higher than for the NAA and, as conditions become progressively dryer, they would be slightly lower. For December, releases from Allatoona Dam would be slightly lower for Alternative 11 across most of the duration curve but most notably in the 70–92-percent exceedance range. This slight overall decrease in the month of December is associated with decreased releases under drier conditions to maintain a slightly higher pool level under Alternative 11.

Overall, Table E-54 provides some perspective on the degree or extent of change in releases that would occur between Alternative 11 and the NAA on an annual basis, the month of September, and the month of December at the 10-, 25-, 50-, 75-, and 90-percent exceedance levels. Generally, the differences are marginal to negligible. At the 90 percent exceedance level for the month of December, the modeled flow for the NAA appears to be notably larger than Alternative 11 (769 cfs compared to 365 cfs). On the duration curve for the month of December (Figure E-67) from which the values in Table E-54 were derived, the NAA and Alternative 11 values are very close. The 90 percent exceedance flow values for the NAA and Alternative 11 do not fully reflect how close their values actually are. For example, at the 91 percent exceedance level on the duration curve, the modeled NAA flow drops to 422 cfs. At 92 percent exceedance level on the duration curve, the modeled NAA flow is 365 cfs, the same as Alternative 11, reflecting a negligible shift in the duration curve for Alternative 11 compared to the NAA.

E.3.2.2.2.2 Coosa River Near Rome

This section addresses changes in flow conditions in the Coosa River near Rome, GA, associated with the proposed reservoir storage reallocation in Allatoona Lake included in Alternative 11. USGS gage 02397000 at Mayo's Bar on the Coosa River is an important location for measuring changes in flow conditions because it is a few miles upstream of the Georgia/Alabama state line and about 56 mi downstream of Allatoona Dam. The Oostanaula River joins the Etowah River at Rome, about 49 mi downstream of Allatoona Dam.

In the Coosa River near Rome, Alternative 11 would likely result in negligible changes to flow conditions compared to the NAA. Any detectible changes from flow conditions between Alternative 11 and the NAA would likely be related to minor adjustments in the number of generating units operating and the number of hours of operation necessary to maintain the pool level at Allatoona Lake slightly higher during the year under Alternative 11. Median flows in the Coosa River throughout the year under Alternative 11 would closely align with those for the NAA and show no appreciable differences, except for some limited occurrences in late November through February, when flows under Alternative 11 would be slightly lower than under the NAA (Figure E-68). At the 90-percent

exceedance level (dry conditions), flows under Alternative 11 would closely match those under the NAA, except they would likely be slightly lower than under the NAA (by 100–200 cfs) during December and early January (Figure E-69). At the 10-percent exceedance level (wet conditions), no distinguishable differences exist between flow conditions under Alternative 11 and those under the NAA (Figure E-70).

Table E-54. Etowah River Downstream of Allatoona Dam—Selected Flow Duration Data over the Modeled Period of Record

Period	Percentage of days exceeded	NAA (cfs)	Alternative 11 (cfs)	Alternative 10 (cfs)	Alternative 3 (cfs)
Annual (entire year)	10	3,063	2,963	3,007	3,005
	25	1,929	1,911	1,921	1,921
	50	1,197	1,192	1,187	1,187
	75	776	773	772	772
	90	365	365	365	365
September	10	1,762	1,935	1,673	1,661
	25	1,160	1,156	1,151	1,151
	50	965	961	962	962
	75	569	569	365	365
	90	365	365	365	365
December	10	4,295	4,108	4,218	4,218
	25	2,805	2,651	2,760	2,758
	50	2,091	2,025	2,038	2,036
	75	1,979	1,534	1,872	1,828
	90	769	365	365	365

The annual duration curve for Alternative 11 (Figure E-71) shows no discernable change in flow conditions in the Coosa River near Rome between Alternative 11 and the NAA. This conclusion is supported by data presented in Table E-55 that show negligible differences in flow values at the 10-, 25-, 50-, 75-, and 90-percent exceedance levels on an annual basis. Monthly duration curves for September (Figure E-72) and December (Figure E-73) are provided as examples of months that would most likely be susceptible to operational changes associated with the proposed reallocation of reservoir storage for water supply under Alternative 11. For the month of September, no discernable changes would be likely to occur between flow conditions for Alternative 11 and those for the NAA (see also Table E-55). For the month of December, flows in the Coosa River near Rome would be slightly lower for Alternative 11 across most of the duration curve but most notably between the 70-percent and 92-percent exceedance range (Figure E-73). Data for December in Table E-55 demonstrates that decreases in flow during that month under Alternative 11 were about 0.8 percent at the 10-percent exceedance level and 3.8 percent at the 90-percent exceedance level.

Table E-55. Coosa River Near Rome, GA—Selected Flow Duration Data over the Modeled Period of Record

Period	% of days exceeded	NAA (cfs)	Alternative 11 (cfs)	Alternative 10 (cfs)	Alternative 3 (cfs)
Annual (entire year)	10	14,148	14,099	14,136	14,136
	25	7,152	7,107	7,128	7,122
	50	4,078	4,068	4,069	4,070
	75	2,604	2,608	2,580	2,583
	90	1,798	1,805	1,791	1,792
September	10	4,422	4,541	4,360	4,364
	25	2,966	3,020	2,935	2,937
	50	2,173	2,179	2,135	2,131
	75	1,653	1,651	1,638	1,641
	90	1,291	1,280	1,279	1,278
December	10	14,281	14,172	14,246	14,247
	25	8,263	8,167	8,244	8,244
	50	5,276	5,135	5,255	5,259
	75	3,530	3,397	3,486	3,489
	90	2,669	2,575	2,575	2,568

Table E-56 presents the 7Q10 values by month at the Rome-Coosa gage and the percentage of the total number of days over the modeled period of record that 7Q10 flows would likely be exceeded for the NAA and Alternative 11. Flow conditions in the Coosa River near Rome have added importance in water management in the ACT River Basin. One of the three key triggers that activate the USACE drought management plan for the basin is based on 7Q10 flows at the Alabama/Georgia state line, a short distance downstream from the USGS gage 02397000, Coosa River (Mayo's Bar) near Rome. The drought management plan was approved in May 2015 as an integral part of the USACE update of the ACT River Basin Master Manual and project WCMs. See Section E.3.2.3 and Appendix A to the Draft FR/SEIS for more detailed discussion of the drought management plan. The 7Q10 flows for the drought trigger were derived from historic flow data at USGS gage 02397000. When flow levels decline below the 7Q10 value (established by month), drought operations (Drought Intensity Level (DIL) 1 or higher, depending on whether one or both of the other triggers have been exceeded) are activated for management of downstream APC reservoirs.

Since the Coosa River near Rome is a critical location in consideration of drought conditions and drought management activities, Figure E-86 plots the modeled flow values for Alternative 11 and the NAA for the period from January 2007 through December 2009, which includes the drought of record in the ACT River Basin, to determine how flow conditions under Alternative 11 would compare to the NAA during that period. The plot shows little to no difference between Alternative 11 and the NAA. Any deviations between Alternative 11 and the NAA over that 3-year period would are minor as shown in the figure. Therefore, the proposed reallocation of storage at Allatoona Lake would not be expected to worsen flow conditions in the Coosa River near Rome under a similar extreme drought event in the future.

Based on a review of model outputs over the modeled period of record, Alternative 11 would not be expected to result in an appreciable deviation in flow conditions in the Coosa River near Rome (Mayo's Bar) compared to the NAA.

Table E-56. Coosa River Near Rome, GA—Percentage of Number of Days over the Modeled Period of Record that Flows Would Likely Exceed the Monthly 7Q10 Value

Percentage of days flow would exceed 7Q10 values			
Month	Monthly 7Q10 value (cfs)	NAA (BASE2018)	Alternative 11 (WS6MF)
January	2,544	94.1%	94.2%
February	2,982	94.6%	94.7%
March	3,258	97.0%	97.1%
April	2,911	94.6%	94.7%
May	2,497	93.2%	93.4%
June	2,153	91.6%	92.0%
July	1,693	93.5%	93.6%
August	1,601	88.2%	88.6%
September	1,406	85.7%	85.4%
October	1,325	89.6%	89.4%
November	1,608	89.8%	88.8%
December	2,043	96.3%	95.2%

Note: Based on USGS gage 02397000 at Coosa River at Rome (Mayo's Bar) observed flow from 1949 to 2006.

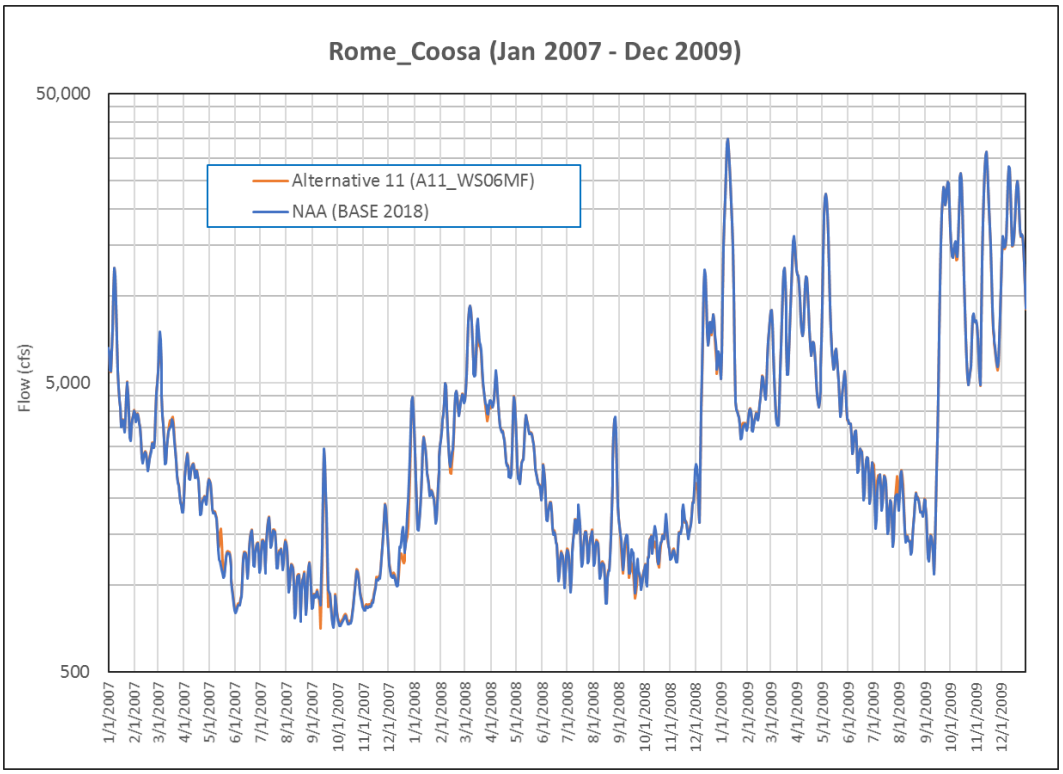


Figure E-86. Coosa River Near Rome, GA—Modeled Flows for the NAA and Alternative 11 for the Period from January 2007 through December 2009.

E.3.2.2.2.3 Coosa River at Logan Martin Dam

This section addresses changes in flow conditions in the Coosa River downstream of Logan Martin Dam associated with Alternative 11 compared to the NAA. The flow conditions at this location under Alternative 11 would principally be influenced by the APC-proposed modifications to flood operations and proposed changes to maximum surcharge levels and guide curves at the APC Weiss and Logan Martin projects. Reservoir storage reallocation at Allatoona Lake in Alternative 11 would have little to no influence on flow conditions downstream of Logan Martin Dam.

Alternative 11 would likely result in minor changes to flow conditions compared to the NAA. Median flows in the Coosa River throughout the year under Alternative 11 would closely align with those for the NAA but would be slightly lower in November and December as releases from Logan Martin Dam would decrease to maintain a higher winter pool level in Logan Martin Lake. Releases from the dam would be slightly higher than under the NAA during January through April in response to modified flood operations that would increase releases during flood events (Figure E-74). At the 90-percent exceedance level (dry conditions), flows under Alternative 11 would be notably lower than the NAA from September through early January (ranging from 200 cfs to 2,000 cfs lower) as releases would be reduced to maintain a higher winter pool level, but they would be higher from early January through February and in April associated with increased releases with the modified flood operations (Figure E-75). At the 10-percent exceedance level (wet conditions), releases would be slightly lower than under the NAA in September and October and in December through April, except for some intermittent periods in January through early April, when releases would likely be as much as 2,000–6,000 cfs higher (Figure E-76).

Compared to the NAA, the annual duration curve for Alternative 11 (Figure E-77) shows a slight increase in releases at the 2–3-percent-exceedance level, a slight reduction in releases at the 3–10-percent exceedance level, and a slight reduction in releases at the 85–99-percent exceedance level. This conclusion is supported by data presented in Table E-57. Review of monthly duration curves for flows downstream of Logan Martin Dam revealed that the curves for Alternative 11 during April through August and November are nearly identical to those for the NAA. Curves for September and October show that daily releases for Alternative 11 and the NAA are both at about 5,000 cfs for about 40 percent of the time during those months, while flows for Alternative 11 are slightly lower than for the NAA over the balance of those months, coinciding with reduced releases to maintain a higher winter pool level. Releases for January through March show that daily releases are slightly higher for Alternative 11 than for the NAA over most of the curve, associated with the effects of modified flood operations.

Monthly duration curves for March (Figure E-78) and September (Figure E-79) are provided as examples of months that would be susceptible to operational changes associated with the modified flood operations at the Weiss and Logan Martin projects. For the month of March, Alternative 11 would result in slightly increased releases from Logan Martin Dam over much of the month. For the month of September, releases from Logan Martin Dam would be slightly lower for Alternative 11 across most of the duration curve.

Based on a review of model outputs over the modeled period of record as described above, Alternative 11 would likely have a minor overall effect on flow conditions in the Coosa River below Logan Martin Dam between September and March each year and little effect on flow conditions between April and August each year.

Table E-57. Coosa River Downstream of Logan Martin Dam—Selected Flow Duration Data over the Modeled Period of Record

Period	% of days exceeded	NAA (cfs)	Alternative 11 (cfs)	Alternative 10 (cfs)	Alternative 3 (cfs)
Annual (entire year)	10	29,840	29,289	29,283	29,783
	25	14,414	14,414	14,440	14,384
	50	7,026	6,955	6,959	7,001
	75	5,094	5,081	5,080	5,094
	90	3,474	3,268	3,217	3,456
March	10	50,000	48,036	48,109	50,000
	25	33,028	31,625	31,620	32,994
	50	18,293	18,322	18,344	18,294
	75	12,007	12,015	12,005	11,948
	90	8,069	8,117	8,128	8,075
September	10	7,856	7,009	6,826	7,820
	25	5,120	5,108	5,105	5,117
	50	5,037	5,023	5,021	5,037
	75	3,398	2,826	2,820	3,377
	90	2,108	1,742	1,732	2,020

E.3.2.2.2.4 Alabama River near Montgomery

This section addresses changes in flow conditions in the Alabama River at the confluence of the Coosa River and Tallapoosa River under Alternative 11 compared to the NAA. As discussed in Section E.3.2.2.1.4, the modeled discharges for this location represent the sum of the releases over time from Jordan Dam, Bouldin Dam (two outlets from Jordan Lake on the Coosa River), and Thurlow Dam (the most downstream dam on the Tallapoosa River), or the JBT flow. Any changes in flow conditions at this location under Alternative 11 are principally influenced by the APC-proposed modifications to flood operations and proposed changes to maximum surcharge levels and guide curves at the APC Weiss and Logan Martin projects. Reservoir storage reallocation at Allatoona Lake in Alternative 11 would have no influence on flow conditions in the Alabama River at the confluence of the Coosa and Tallapoosa rivers.

In the Alabama River at the confluence of the Coosa and Tallapoosa rivers, median flows throughout the year under Alternative 11 over the modeled period of record would closely align with those for the NAA but, because of the residual effects of proposed modifications to flood operations at the APC Weiss and Logan Martin projects, flows would be marginally lower in October through December as a result of actions to maintain higher winter pool levels in Logan Martin and Weiss lakes. Further, median flows under Alternative 11 would be marginally higher from January through March associated with modified flood operations at the Logan Martin and Weiss projects (Figure E-80). At the 90-percent exceedance level (dry conditions), flows under Alternative 11 would be nearly the same as those under the NAA throughout the year, except for a slight decrease in December and slight intermittent increases in January and February (Figure E-81). At the 10-percent exceedance level (wet conditions), flows for Alternative 11 and the NAA align closely, and there are no appreciable differences in flow conditions throughout the year (Figure E-82).

The annual duration curve for Alternative 11 (Figure E-83) is nearly identical to the annual duration curve for the NAA. Review of monthly duration curves for flows in the Alabama River at the confluence of the Coosa and Tallapoosa rivers revealed that the curves for Alternative 11 would be nearly identical to those for the NAA in all months of the year except September, October, and December. In each of those 3 months, flows under Alternative 11 would be marginally lower on the portion of the curve that represents drier conditions at that location. This occurrence reflects the remaining residual effects of reduced releases at Weiss and Logan Martin dams in the fall to maintain a higher winter pool level. Monthly duration curves for September (Figure E-84) and December (Figure E-85) are provided as examples of months that might be susceptible to operational changes associated with the modified flood operations at the Weiss and Logan Martin projects. The slight reduction in flow conditions in the Alabama River at the confluence of the Coosa and Tallapoosa rivers during these months under Alternative 11 and the NAA is also supported by the data in Table E-58.

Alternative 11 is expected to have a negligible overall effect on flow conditions in the Alabama River at the confluence of the Coosa River and Tallapoosa River and further downstream below Montgomery, AL. HEC-ResSim outputs addressing conditions under Alternative 11 and the NAA for R.F. Henry L&D /Robert "Bob" Woodruff Lake were reviewed to confirm this conclusion.

Table E-58. Alabama River Near Montgomery (JBT Flow)—Selected Flow Duration Data over the Modeled Period of Record

Period	% of days exceeded	NAA (cfs)	Alternative 11 (cfs)	Alternative 10 (cfs)	Alternative 3 (cfs)
Annual (entire year)	10	49,025	47,971	47,970	48,981
	25	24,089	24,091	24,101	24,067
	50	12,047	11,931	11,931	12,038
	75	8,260	8,232	8,232	8,241
	90	4,989	4,771	4,682	4,949
September	10	12,519	11,436	11,281	12,491
	25	9,005	8,768	8,705	8,988
	50	7,600	7,600	7,600	7,600
	75	4,640	4,640	4,640	4,641
	90	4,614	4,638	4,638	4,639
December	10	50,837	48,781	48,872	50,836
	25	26,606	25,508	25,628	26,508
	50	15,862	14,864	14,994	15,855
	75	9,985	9,340	9,345	9,930
	90	8,332	7,752	7,752	8,298

E.3.2.2.3 Alternative 10

For Etowah River below Allatoona Dam and the Coosa River near Rome, GA, Alternative 10 would have nearly the same effects as Alternative 11 when compared to the NAA. Alternative 10 includes reallocation of reservoir storage in Allatoona Lake from the conservation pool only, whereas Alternative 11 includes reallocation of storage from a combination the conservation pool and the flood storage pool. In some limited instances in the fall and early winter months, releases from Allatoona Dam under Alternative 10 might be marginally lower than releases under Alternative 11. Those instances would be intermittent, however, and the release reductions for Alternative 10 would be small compared to Alternative 11. See Figure E-62, Figure E-63, Figure E-65, Figure E-66, Figure E-67, and Table E-54.

In the Coosa River near Rome, the effects of Alternative 10 compared to the NAA would be the same as those described for Alternative 11. Compared to the NAA, Alternative 10 would have the same effects on flow conditions in the Coosa River from Weiss Lake downstream to the confluence of the Coosa and Tallapoosa rivers as those described for Alternative 11.

E.3.2.2.4 Alternative 3

For Etowah River below Allatoona Dam and for the Coosa River near Rome, GA, Alternative 3 has the same effects on flow conditions as Alternative 10 in comparison to the NAA. The features of Alternatives 3 and 10 with respect to the proposed reservoir storage reallocation in Allatoona Lake are identical, except that Alternative 3 applies Georgia's proposed storage accounting method and Alternative 10 applies the current USACE storage accounting practice in the HEC-ResSim simulation over the modeled period of record (see Table E-52). No appreciable differences exist in flow conditions between Alternatives 3 and 10 in the Etowah River below Allatoona Dam or in the Coosa River near Rome. Thus, the storage accounting methodology has a negligible effect on flow conditions downstream of Allatoona Dam.

Alternative 3 includes no features that directly affect Weiss Lake or Logan Martin Lake. HEC-ResSim simulations demonstrate that the effects of reservoir storage reallocation at Allatoona Lake on downstream flow conditions have effectively dissipated in Weiss Lake and are equal to modeled conditions under the NAA. No incremental effects of Alternative 3 are discernable downstream of Weiss Dam.

E.3.2.3 Drought Operations

The ACT River Basin WCM Update completed in May 2015 includes a drought management plan for the basin, prepared in collaboration with the APC, that was incorporated into the ACT River Basin Master Manual and individual project WCMs. The plan basically calls for more conservative reservoir operations in the system with the onset and persistence of drought conditions in the basin based on established triggers, or thresholds, for three critical drought indicators: (1) low Coosa River flow conditions at the Alabama/Georgia state line; (2) low basin inflow; and (3) low composite conservation storage in the APC reservoirs in the basin. DIL1 drought operations actions are triggered when a drought threshold is met for any one of the three critical indicators. Drought operations become increasingly more conservative when two thresholds (DIL2) or three thresholds (DIL3) are met concurrently. DIL1 is referred to as *moderate drought*, DIL2 as *severe drought*, and DIL3 as *exceptional drought*. The currently approved ACT River Basin drought management plan is summarized in Appendix A to the Draft FR/SEIS.

This section discusses the effects of the NAA and Alternatives 11, 10, and 3 regarding the number of times drought operations would be activated and the length of time drought operations would be in effect, which could potentially have an impact on natural and socioeconomic resources. Generally, a more proactive approach to conserving reservoir storage as drier conditions develop in the basin is a beneficial effect of drought operations, while continuing to meet downstream commitments and needs. The drought management plan could trigger slightly

constrained operations more frequently and over slightly longer periods, and the extent of those constrained operations would gradually increase only as worsening drought conditions dictate over time. The currently approved drought management plan enables USACE and APC to operate their reservoir projects in the basin more effectively in response to drought conditions similar to those experienced several times over the modeled period of record and positions USACE to successfully address a more severe drought of record in the future.

E.3.2.3.1 No Action Alternative

Under the NAA, the drought management plan for the ACT River Basin would be administered as defined in the update of the Master Manual for the projects in the basin approved in May 2015. Based upon HEC-ResSim model simulation over the 73-year hydrologic period of record, the NAA would be expected to trigger DIL1 operations 124 times (Table E-59). DIL1 conditions could be encountered more than once in any year. DIL2 and DIL3 would likely be encountered much less frequently—32 and 3 occurrences, respectively, over the modeled period of record (Table E-59). The number of times a specific drought level is triggered does not indicate how long it might last. Based on established protocols by which the drought level is monitored and updated, the minimum duration for a drought level designation would be 14 days. The drought level duration could extend from 14 days to several weeks or months if the conditions that triggered drought operations in the ACT River Basin persisted.

Table E-59. Number of Times Drought Operations Would Be Triggered over the Modeled Period of Record

Operations level	NAA	Alternative 11	Alternative 10	Alternative 3
Drought Level 1	124	122	122	124
Drought Level 2	32	30	30	31
Drought Level 3	3	3	3	3

Table E-60 summarizes the percentage of time over the modeled period of record that operations would be considered *normal* versus various levels of drought operation. *Normal operations* in this context would include any period when drought operations have not been triggered. For the NAA, the ACT River Basin projects would be in normal operation about 82.3 percent of the time and in drought operations a total of about 17.7 percent of the time, with most of that time in DIL1 operations (12.9 percent). DIL3 operations (reflecting the most severe conditions) would be expected only about 1 percent of the time under the NAA.

Table E-60. Percentage of Time the ACT River Basin System Would Operate in Normal and Drought Mode over the Modeled Period of Record

Operations level	NAA	Alternative 11	Alternative 10	Alternative 3
Normal	82.3%	81.7%	81.7%	81.8%
Drought Level 1	12.9%	13.7%	13.7%	13.4%
Drought Level 2	3.8%	3.7%	3.7%	3.8%
Drought Level 3	1.0%	0.9%	0.9%	1.0%

The state line flow would be the drought threshold most often reached to trigger drought operations, followed closely by the basin inflow threshold. Table E-61 summarizes the percentage of time over the modeled period of record that drought operations would likely be activated and the individual drought thresholds met. For the NAA, the state line flow trigger would be in effect about 12.9 percent of the time, the basin inflow trigger about 9.3 percent of the time, and the composite conservation storage trigger about 1 percent of the time.

Table E-61. Percentage of Time Drought Operations Activated and Individual Drought Thresholds Met over the Modeled Period of Record

	NAA	Alternative 11	Alternative 10	Alternative 3
Drought Operations Activated	17.7%	18.3%	18.3%	18.2%
State Line Flow Threshold Met	12.7%	13.2%	13.2%	13.1%
Basin Inflow Threshold Met	9.3%	9.4%	9.4%	9.3%
Composite Conservation Storage Threshold Met	1.0%	1.0%	1.0%	1.0%

E.3.2.3.2 Tentatively Selected Plan (Alternative 11)

Alternative 11 would be expected to trigger drought operations slightly less often than the NAA (122 occurrences versus 124) (Table E-59). However, Alternative 11 would likely result in a slightly higher percentage of time in drought operations over the modeled period of record (18.3 percent versus 17.7 percent). The increased time spent in drought operations under Alternative 11 would be at DIL1, the least constrained level of drought operations (Table E-60). Alternative 11 would reach the state line flow drought threshold slightly more often over the period of record than the NAA (13.2 percent versus 12.7 percent) (Table E-61).

Overall, Alternative 11 would be expected to have a negligible effect on implementing the approved drought management plan for the ACT River Basin compared to the NAA.

E.3.2.3.3 Alternative 10

Based on review of data in Table E-59, Table E-60, and Table E-61, Alternative 10 would be expected to have the same effect on implementing the approved drought management plan for the ACT River Basin as Alternative 11 compared to the NAA.

E.3.2.3.4 Alternative 3

Based on review of data in Table E-59, Table E-60, and Table E-61, Alternative 3 would be expected to have the same effect on implementing the approved drought management plan for the ACT River Basin as Alternative 11 compared to the NAA.

E.3.2.4 Releases to Support Commercial Navigation

The ACT River Basin WCM Update completed in May 2015 includes a navigation plan with specific protocols for releases from upstream ACT River Basin reservoirs to support commercial navigation in the Alabama River when sufficient basin inflow is available and for specific reductions in reservoir releases when basin inflows are insufficient to support downstream navigation. This navigation plan, which is summarized in Appendix A to the Draft FR/SEIS, was incorporated into the ACT River Basin Master Manual and individual project WCMs. The plan provides for greater reliability and predictability in meeting the needs of commercial navigation operators and

beneficiaries in the Alabama River. This section addresses the potential effects of the NAA, Alternative 11, Alternative 10, and Alternative 3 on implementing the approved navigation plan.

The effects of the NAA and other alternatives considered in this Draft FR/SEIS on implementing the navigation plan were evaluated by comparing HEC-ResSim model results graphically to depict the percentage of the total number of days (also displayed for each month of the year) over the 73-year hydrologic period of record during which the flow targets for 7.5-ft and 9-ft channel depths would likely be met.

E.3.2.4.1 No Action Alternative

Under the NAA, the navigation plan for the ACT River Basin would be administered as defined in the Master Manual update for the projects in the basin that was approved in May 2015. Based upon HEC-ResSim model simulation over the 73-year hydrologic period of record, the NAA would be expected to provide adequate flows in the Alabama River to sustain a minimum 7.5-ft navigation depth for at least 90 percent of the time during 6 months of the year (December through May). For the remaining months of the year (June through November), generally the low-flow season, the percentage of time that flows would likely be adequate to support a 7.5-ft navigation depth varies from 89 percent in June to 62 percent in September (Figure E-87).

Over the modeled period of record, the NAA would be expected to provide adequate flows in the Alabama River to sustain a minimum 9-ft navigation depth for at least 90 percent of the time during 5 months of the year (January through May). For the remaining months of the year (June through December), the percentage of time that flows would likely be adequate to support a 9-ft navigation depth varies from 89 percent in December to 56 percent in September (Figure E-88).

E.3.2.4.2 Tentatively Selected Plan (Alternative 11)

Under Alternative 11, the percentage of time that adequate flows would be available in the Alabama River to sustain a 7.5-ft channel depth and 9-ft channel depth would be nearly the same as under the NAA. During the months of September through December, the percentage of time that adequate flows would be available (for both channel depths) would be 1–3 percent lower than for the NAA (Figure E-87 and Figure E-88). Those slight decreases during those months would have a negligible effect on navigation.

E.3.2.4.3 Alternative 10

The effects of Alternative 10 compared to the NAA are the same as presented for Alternative 11 (see Figure E-87 and Figure E-88).

E.3.2.4.4 Alternative 3

Even though not depicted in Figure E-87 and Figure E-88, the effects of Alternative 3 would be identical to those of the NAA based on review of the HEC-ResSim model outputs.

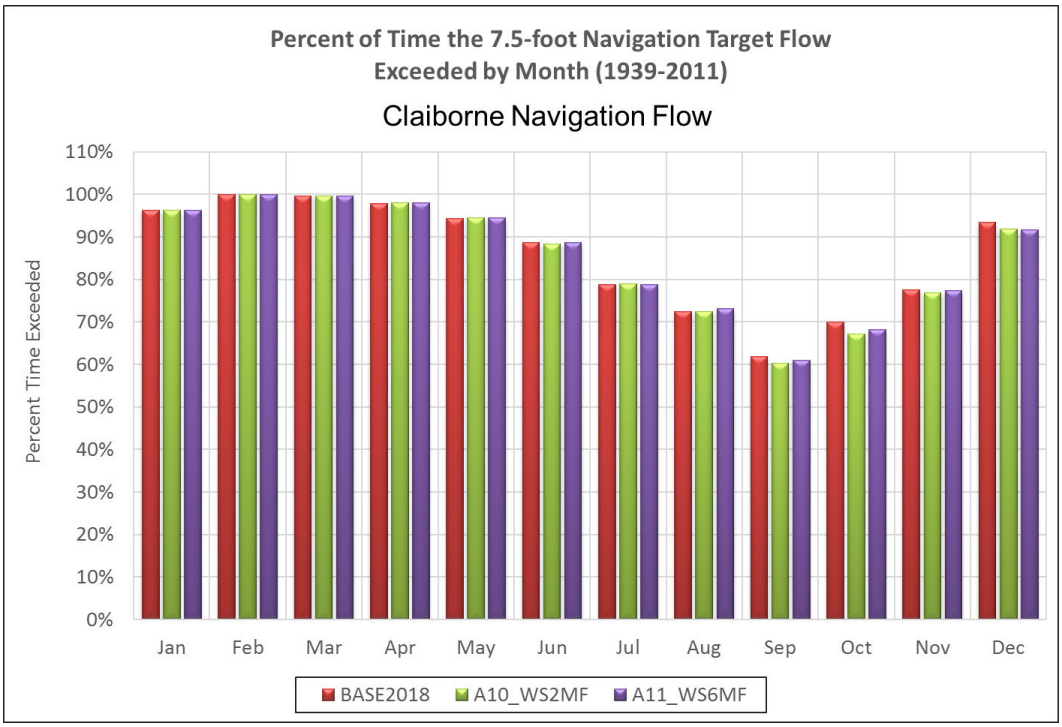


Figure E-87. Percentage of Time the 7.5-ft Navigation Target Flow Would Be Exceeded over the Modeled Period of Record.

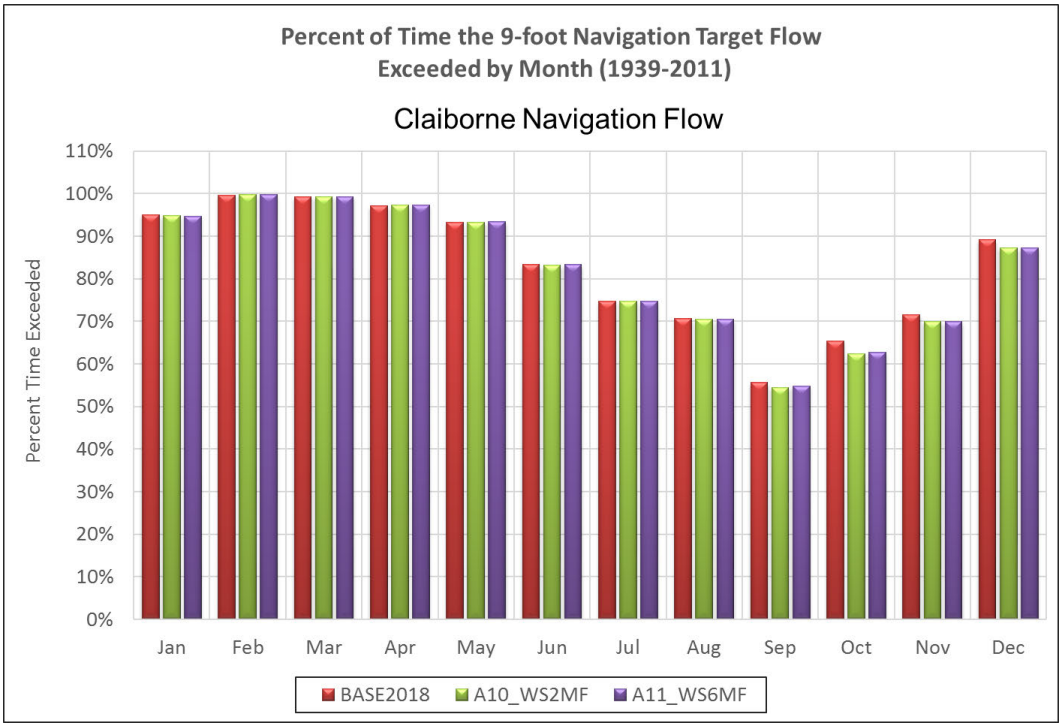


Figure E-88. Percentage of Time the 9-ft Navigation Target Flow Would Be Exceeded over the Modeled Period of Record.

E.3.3 Water Quality

The HEC-5Q model was used to evaluate the effects of ACT River Basin project operations on basin water quality. It was linked with the HEC-ResSim model through an input of flows by reach to examine the changes in water quality for the ACT River Basin mainstems. The proposed operations of USACE reservoirs would not be expected to affect tributaries in the basin. The benefit of using the HEC-5Q model is its ability to simulate the entire riverine and reservoir system in a single model. It can perform a holistic examination of the basin from top to bottom and simulate the watershed inflows, reservoirs, and river segments. The modeled output it produced allows a clear, longitudinal presentation of conditions for comparison between the various operations scenarios.

The HEC-5Q model includes both point source and nonpoint source loads, which consist of BOD, nitrogen, phosphorous, and DO. The M&I point sources are based on DMRs or, when values were not available, on concentrations representative of the type of discharge. The point source inputs are only from dischargers that contribute more than 1 mgd. The nonpoint source loads from tributaries were developed in previous modeling efforts and confirmed with measured data for the modeled period of 2001–2008 representing point and nonpoint contributions. The model inputs and assumptions are detailed in Appendix C to the Draft FR/SEIS.

This section details the results of modeling under the NAA, TSP (Alternative 11), Alternative 3, and Alternative 10. HEC-5Q results are presented for the modeled period (2001–2008). Loads from both point and nonpoint sources were not varied in modeling scenarios. Instead, the results presented illustrate how water quality is affected by hydrologic conditions and water management activities in the ACT River Basin.

Simulating conditions over the period of 2001–2008 was intended to capture the range of potential hydrologic conditions that influence water quality. The modeled period includes wet, dry, and normal flow conditions, which supports display of the water quality response to varying hydrologic conditions. Wet years are defined by the wettest 25th percentile rainfall, and dry years are defined by the driest 25th percentile rainfall. Normal years are represented by median rainfall. The wet, dry, and normal years are 2003, 2007, and 2002, respectively. Those years were selected to represent the range of hydrologic conditions that can occur, understanding that conditions can vary greatly over the entire basin.

The longitudinal occurrence profiles by river mile illustrate how water quality varies along the reach and how it might be affected by dams, other structures, or discharges from point and nonpoint sources. The data illustrate the amount of time a concentration is higher or lower than a given value. In those plots, the 5th, 50th (or median), and 95th percent occurrences are illustrated, showing the range of concentrations that would be likely to occur. These results are based on modeled output. The figures are not meant to present statistical ranges. The profiles illustrate the percentage of time a concentration of a pollutant occurs as a percent occurrence at stations in mainstem sections of the ACT River Basin. The HEC-5Q modeling report in Appendix C to the Draft FR/SEIS provides the locations of those stations.

The median values reflect the points at which 50 percent of the calculated values are higher and 50 percent are lower. The 95th percent occurrence and 5th percent occurrence bracket the range of high and low calculated values that rarely occur. For example, a DO plot showing a 5-percent occurrence level at 5 mg/L means that 5 percent of the observations were lower than that concentration. An occurrence level of 95 percent at 12 mg/L shows that 95 percent of modeled concentrations fell below 12 mg/L. Conversely, that would indicate that 5 percent of the model values were higher than 12 mg/L. Presenting modeled results that way should help the reader understand the response of the system without allowing the data from extreme events to skew the results.

Note: The percent *occurrence* is the inverse of the percent *exceedance*, a metric presented for many of the water quantity analyses presented earlier in this section.

The results from the alternatives were analyzed along reaches and reservoirs within the ROI addressed by this FR/SEIS (Coosa River and Etowah River upstream to Canton, GA) to determine the magnitude of any negative changes to water quality from the NAA and whether those changes would result in exceedances or additional exceedances of water quality standards. For this evaluation, the all-year model results that reflect average water quality values throughout the year were analyzed. Model results also were analyzed for specific time periods if water quality standards specify use of growing season averages (e.g., chlorophyll *a* and TN).

This section focuses on the NAA, Alternative 11 (TSP), Alternative 10, and Alternative 3. Table E-62 cross-references the alternative numbers with the alternative names included on the model graphs presented in this section.

Table E-62. Summary of Alternative Numbers and Model Names for HEC-5Q

Alternative number	Alternative name in model	Description
0	A0-BASE2018	No Action Alternative (NAA)
2	FWOP	Future Without Project
3	A03_WS1	Allatoona storage reallocation up to 94 mgd from conservation storage only and Georgia's proposed storage accounting methodology
9	A09_FWOPMF0	Modified flood operations at the APC projects only and no Allatoona storage reallocation
10	A10_WS2MF	Allatoona storage reallocation up to 94 mgd from conservation storage only, USACE current storage accounting methodology, and modified flood operations at APC projects
11	A11_WS6MF	Allatoona storage reallocation up to 94 mgd from combination of flood storage and conservation storage using USACE current storage accounting methodology

E.3.3.1 No Action Alternative

The NAA represents the current conditions with the current withdrawals at Allatoona Lake and the USACE storage accounting methodology. Water quality conditions under the NAA would generally be consistent with those described in Section E.1.2. Some existing water quality impairments within the ROI would remain under the NAA.

E.3.3.1.1 Water Temperature

The overall water quality standard for temperature in the system is a limit of 90 degrees Fahrenheit (°F) with no more than a 5-°F variation from discharge and no more than a 1.5-°F increase during June–September. As shown in Figure E-89 and Figure E-90, temperatures in the Etowah River and Coosa River, respectively, remain below that temperature limit for the NAA.

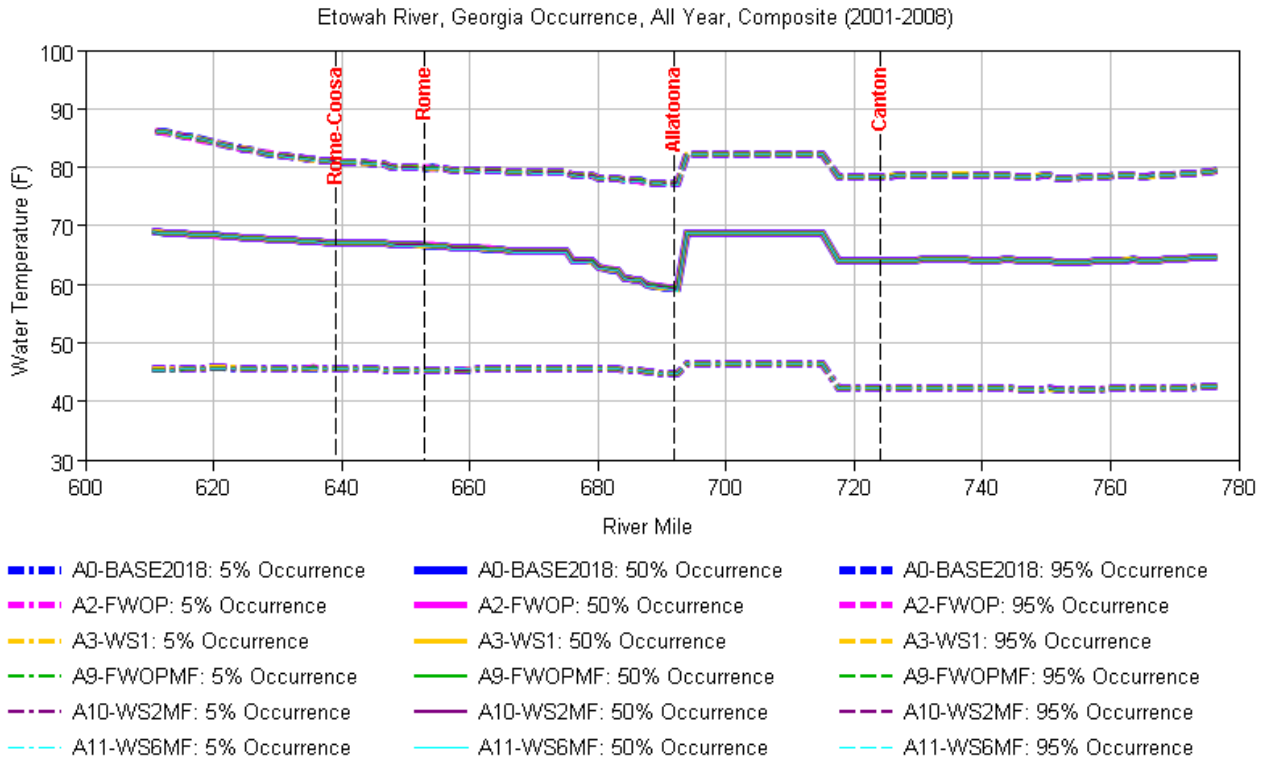


Figure E-89. Water Temperature Occurrence for the Etowah River (2001–2008).

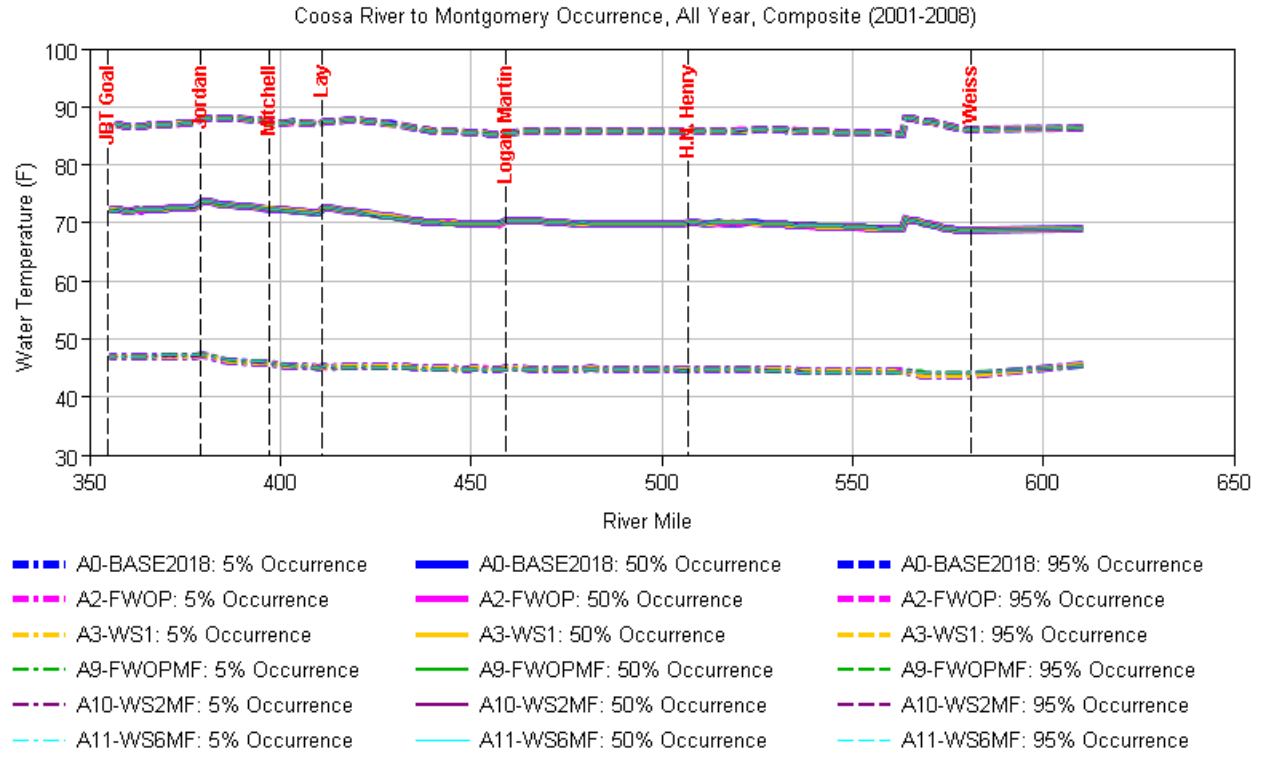


Figure E-90. Water Temperature Occurrence for the Coosa River (2001–2008).

E.3.3.1.2 Dissolved Oxygen

DO is required by all aquatic animals to survive and is measured as an indicator of water quality. Alabama and Georgia both enforce minimum DO concentrations in waterbodies designated for recreation. The standards are no less than 5 mg/L at all times in Alabama and no less than 4 mg/L at all times in Georgia. APC has added aeration blower systems to their projects at Logan Martin, Weiss, and H. Neely Henry. The blower systems are operated to achieve a DO concentration of 4 mg/L at the downstream compliance point for each facility. The operation of the blower systems to maintain the 4 mg/L DO concentration was included in the HEC-5Q model simulations.

On the Etowah River, upstream of Allatoona Lake, HEC-5Q simulations show that DO concentrations remain consistently high at all levels of occurrence. At the 5-percent occurrence, the lowest DO levels are modeled around 5.5 mg/L upstream of the lake but drop to almost 2 mg/L downstream of Allatoona Dam (Figure E-91). For APC Coosa River reservoir projects (including Weiss and Logan Martin lakes), DO concentrations remain above 5 mg/L upstream of all dams, even at the 5-percent occurrence, except for a drop to approximately 4 mg/L at Logan Martin Lake (Figure E-92).

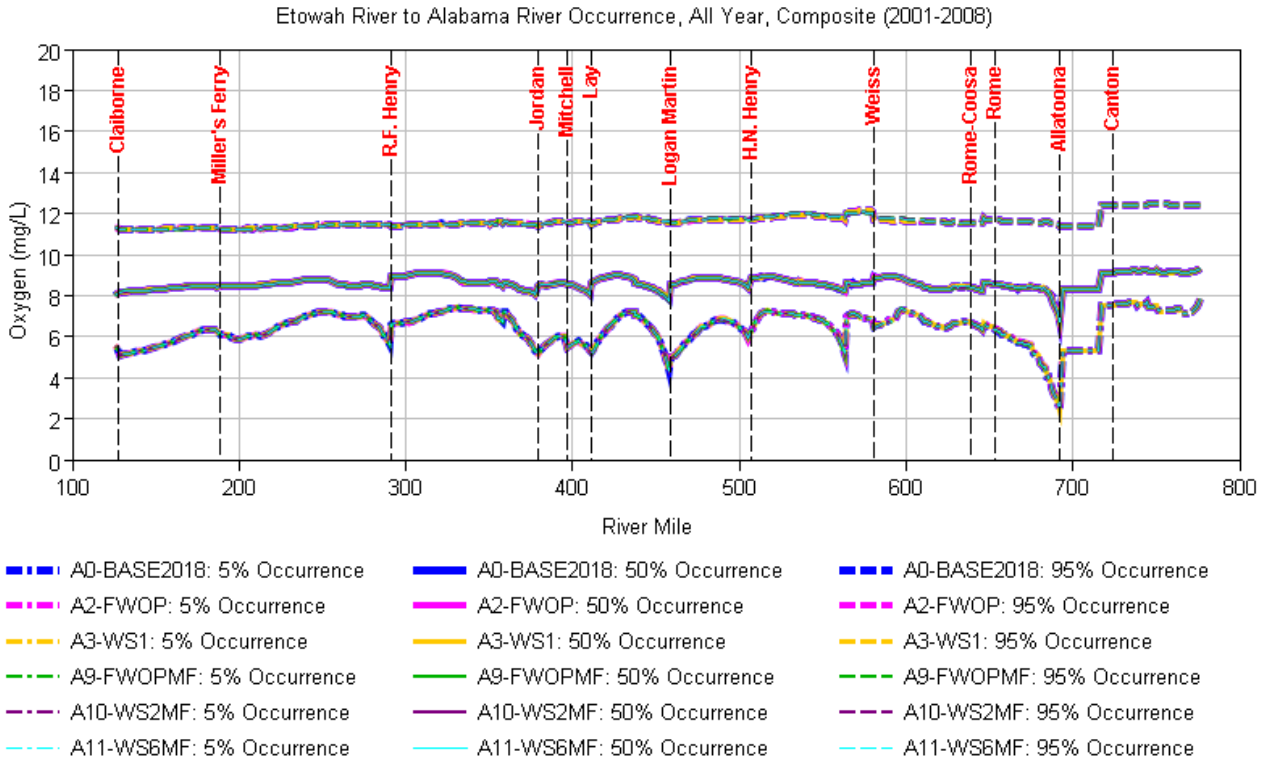


Figure E-91. DO Occurrence for the Etowah River (2001–2008).

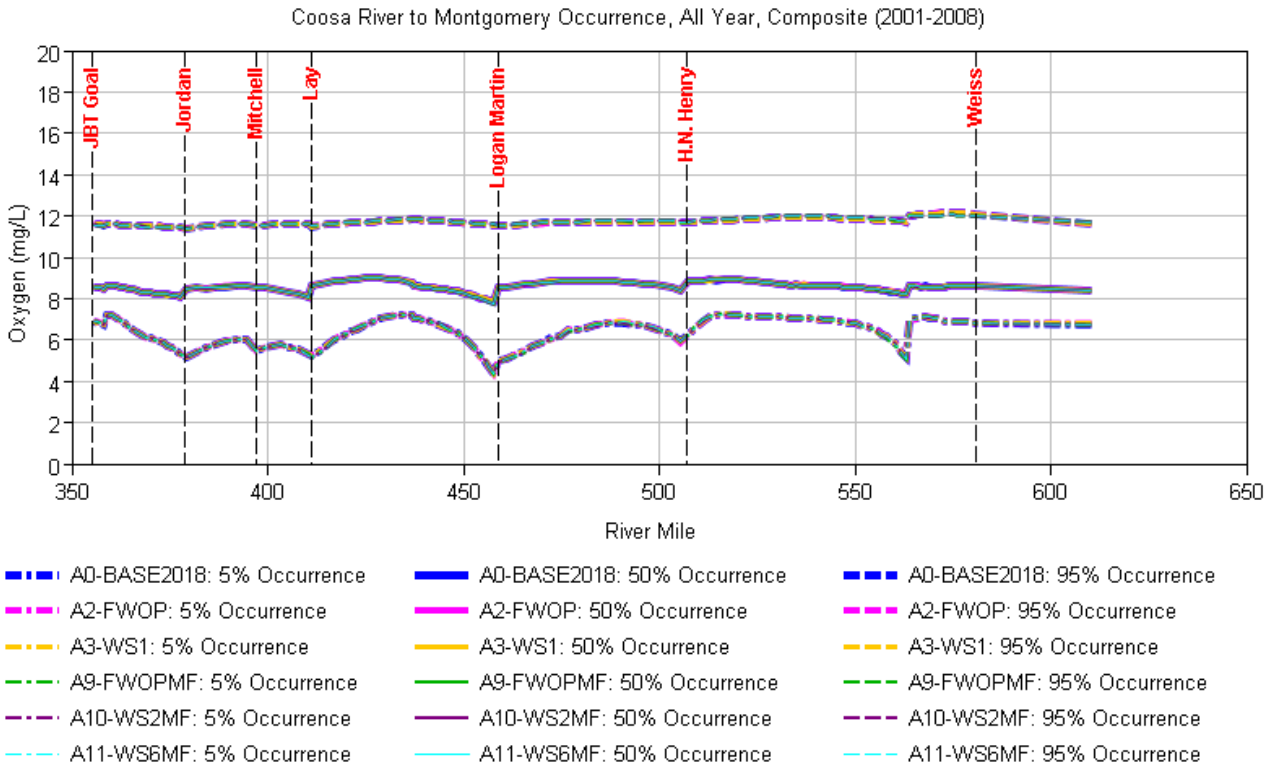


Figure E-92. DO Occurrence for the Coosa River (2001–2008).

E.3.3.1.3 Phosphorus

Total phosphorous (TP) is a required nutrient for plants and animals; however, excessive concentrations in aquatic environments can lead to algal blooms, accelerated plant growth, and decreased DO, which are all indicators of poor water quality. USEPA suggests an acceptable range of 10 µg/L to 40 µg/L in waterbodies (USEPA, 2015b).

Upstream of Allatoona Lake, the HEC-5Q model displays a TP concentration of approximately 0.15 mg/L (150 µg/L) at the 95-percent occurrence, which then steadily increases to approximately 0.26 mg/L (260 µg/L) downstream of Rome-Coosa (Figure E-93). Downstream of Allatoona Lake, TP concentrations remain at or above approximately 0.075 mg/L (75 µg/L) at the 5-percent occurrence. Most reaches of the Etowah River fail to meet USEPA's recommended 10 µg/L to 40 µg/L range at any occurrence level.

Along the Coosa River, TP concentrations are about 0.25 mg/L (250 µg/L) at the 95-percent occurrence upstream of Weiss Lake, but then decreases to approximately 0.13 mg/L (130 µg/L) downstream of H. Neely Henry Lake (Figure E-94). At the 5-percent occurrence, the model predicts the Weiss Lake TP concentration to be approximately 0.06 mg/L (60 µg/L) and the concentration downstream of Logan Martin Dam to be approximately 0.04 mg/L (40 µg/L). While the 5-percent occurrence level meets the site-specific water quality standard at Weiss Lake as well as the USEPA recommended TP concentrations downstream of Logan Martin Lake, any higher occurrence level fails to meet the standard and recommended range.

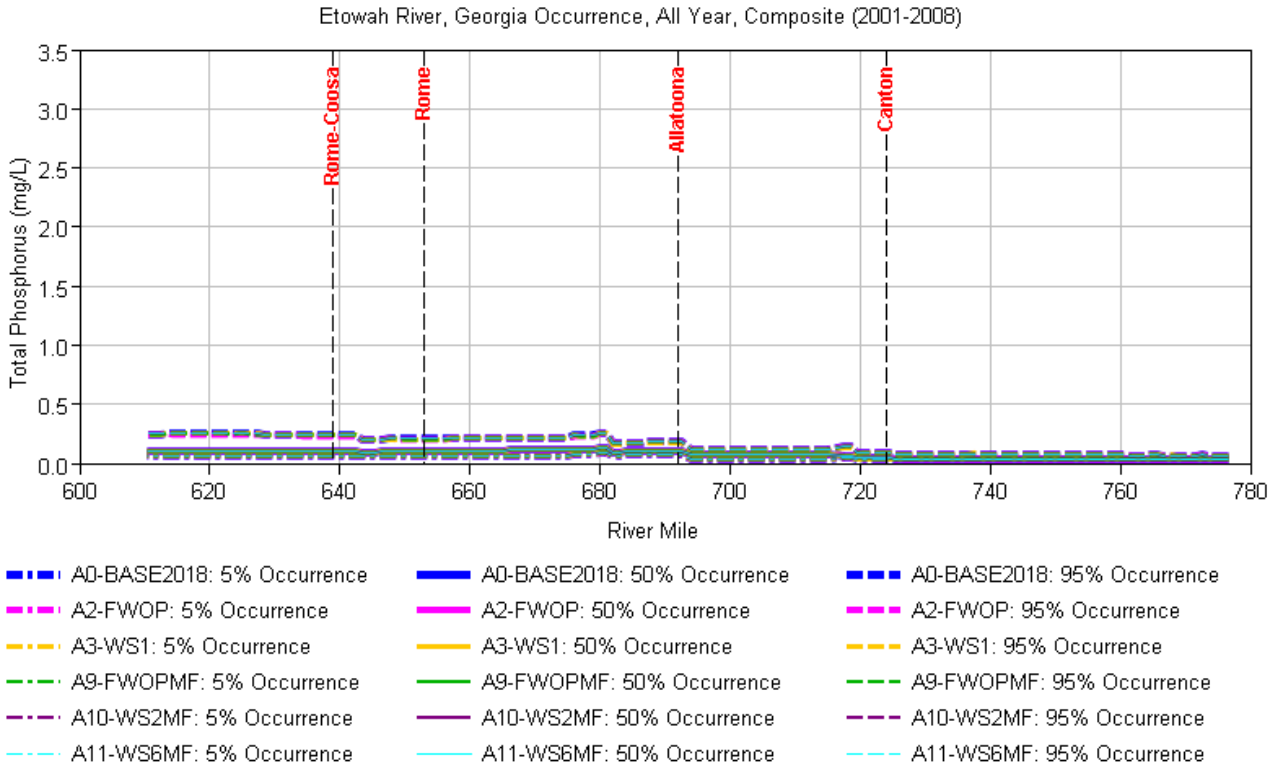


Figure E-93. TP Occurrence for the Etowah River (2001–2008).

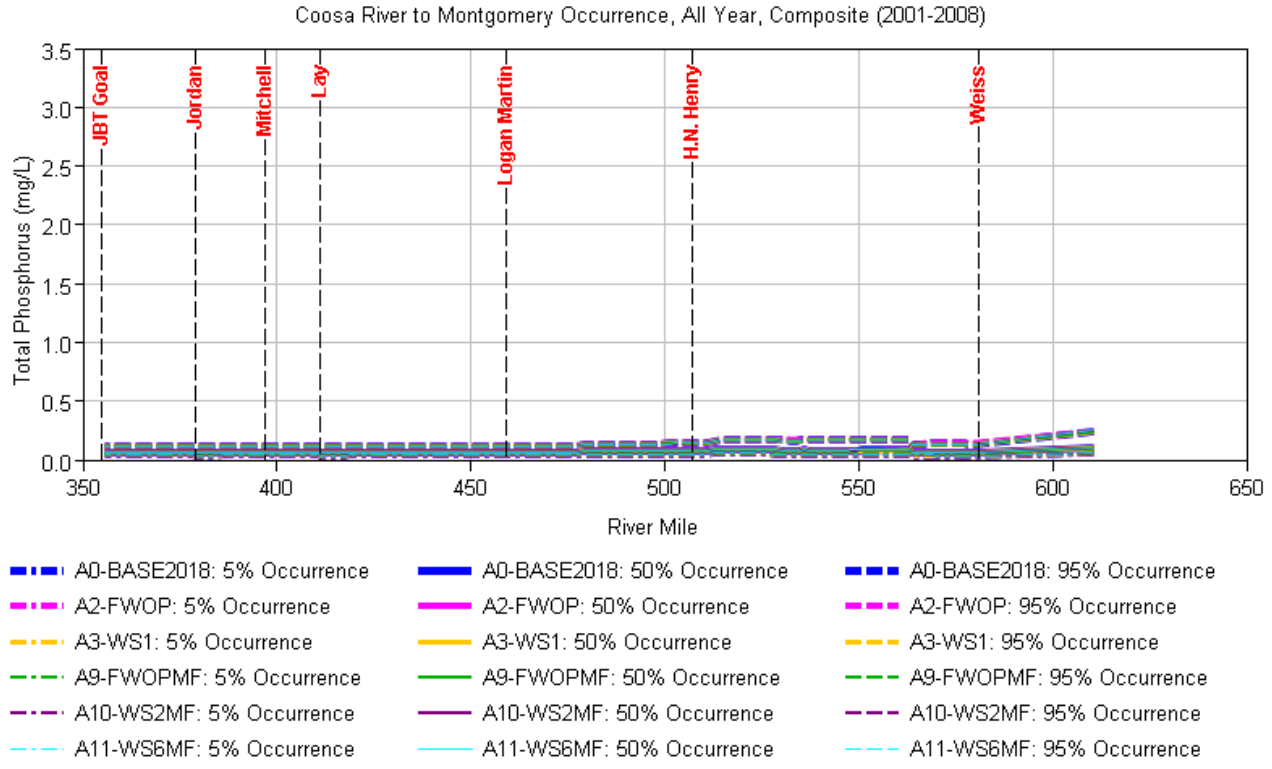


Figure E-94. TP Occurrence for the Coosa River (2001–2008).

E.3.3.1.4 Nitrogen

Total nitrogen (TN) is also a requirement for plants and animals and can be detrimental to water quality if waterbodies contain elevated concentrations. Sources include wastewater treatment plants, animal manure, fertilized lawns and crops, failing septic systems, and other industrial discharges. Allatoona Lake has a site-specific water quality standard set at a growing season average of less than 4 mg/L in the photic zone. USEPA recommends maintaining a range of 2–6 mg/L of TN in waterbodies (USEPA, 2015a).

Along the Etowah River, TN concentrations simulated in the HEC-5Q model fall well below the 4 mg/L site-specific standard and even below the acceptable range suggested by USEPA, with peak TN concentrations of about 1.2 mg/L at the 95-percent occurrence downstream of Rome-Coosa (Figure E-95). Similar to concentrations on the Etowah River, the Coosa River TN concentrations in the HEC-5Q simulations fall below the acceptable range suggested by USEPA, with peak TN concentrations of about 1.2 mg/L at the 95-percent occurrence upstream of Weiss Lake (Figure E-96).

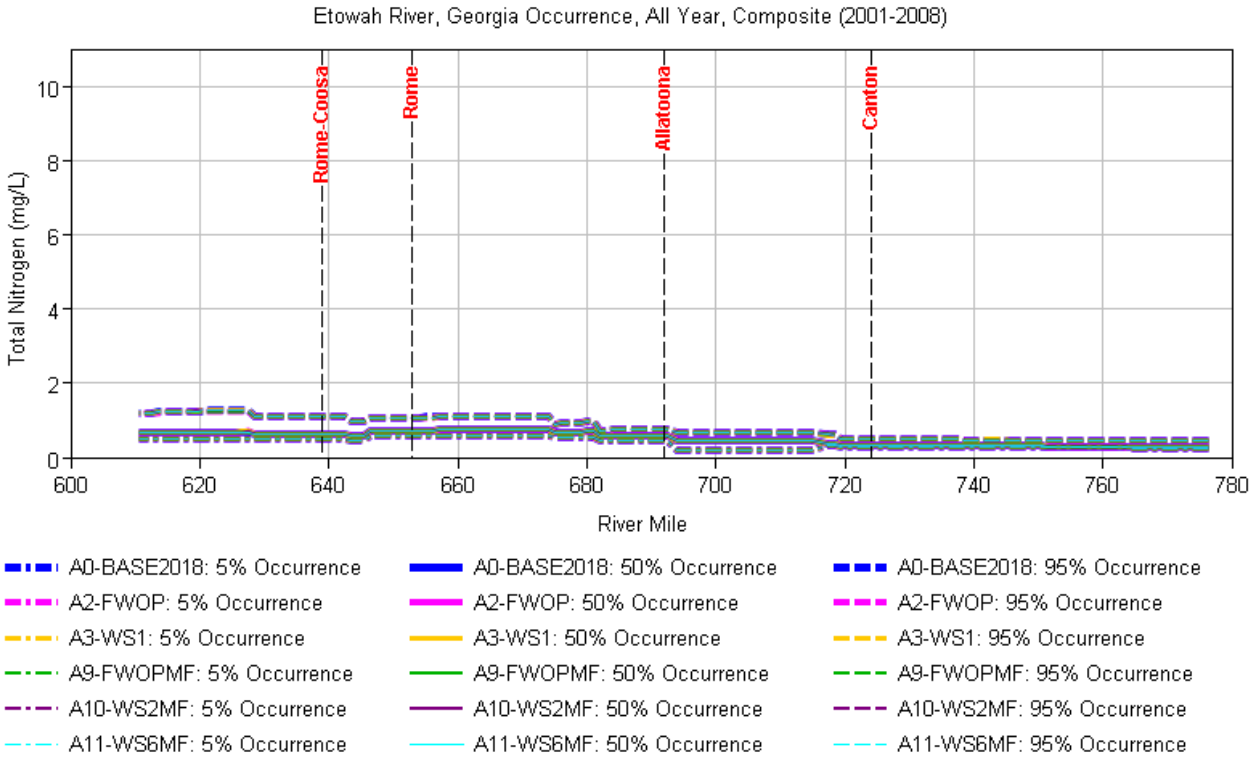


Figure E-95. TN Occurrence for the Etowah River (2001–2008).

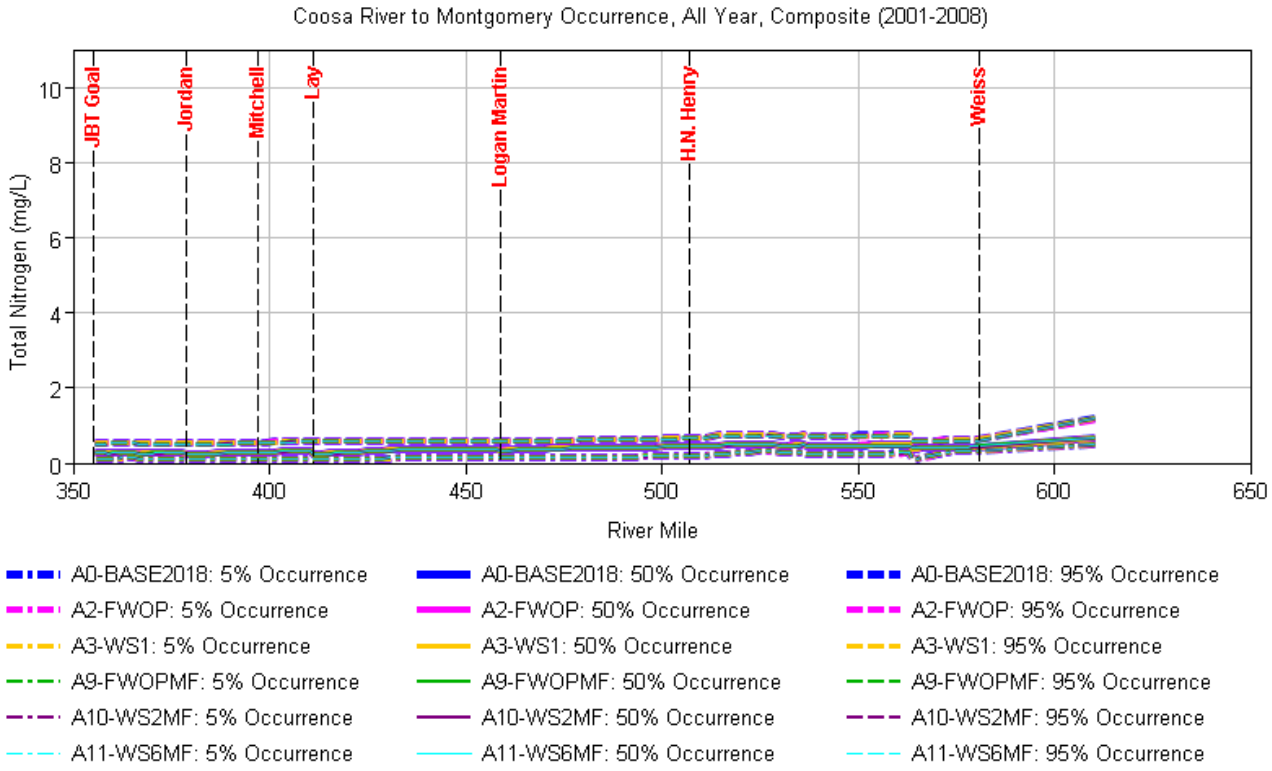


Figure E-96. TN Occurrence for the Coosa River (2001–2008).

E.3.3.1.5 Chlorophyll *a*

Concentrations of chlorophyll *a* can be measured to identify the trophic condition of a waterbody. Increased chlorophyll *a* levels represent increased algal biomass, which signifies degraded water quality conditions. In Georgia, Allatoona Lake has a site-specific standard that requires an upstream concentration below 10 µg/L from April to October. In Alabama, site-specific standards include chlorophyll *a* exceedance limits from April to October of 20 µg/L at Weiss Lake, 18 µg/L at H. Neely Henry Lake, 17 µg/L at Logan Martin Lake and Lay Lake, and 14 µg/L at Mitchell Lake and Jordan Lake.

Results from the HEC-5Q simulations indicate that, on the Etowah River in Allatoona Lake, the 50-percent occurrence falls significantly below the 10 µg/L limit; however, the 95-percent occurrence exceeds 20 µg/L upstream of the lake (Figure E-97). Along the Coosa River, chlorophyll *a* concentrations would be expected to exceed their respective site-specific standards at the 95-percent occurrence level (Figure E-98).

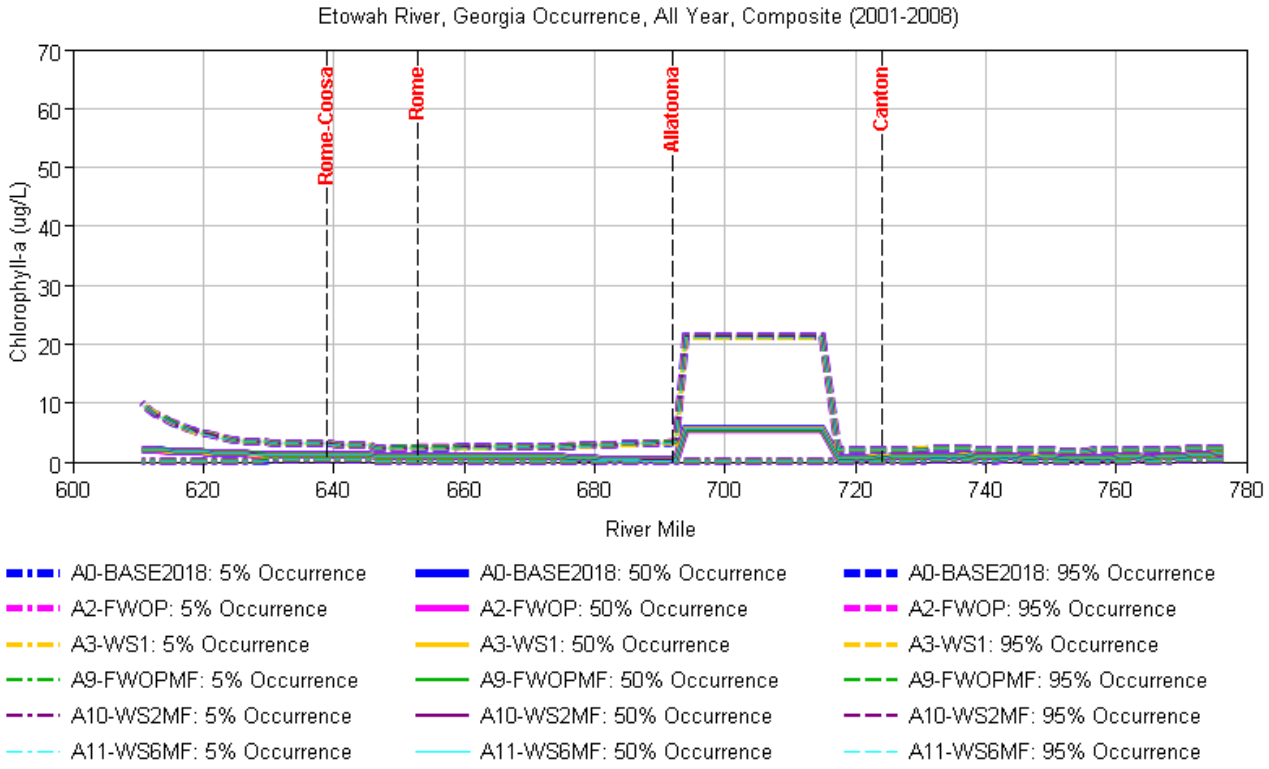


Figure E-97. Chlorophyll *a* Occurrence for April–November for the Etowah River (2001–2008).

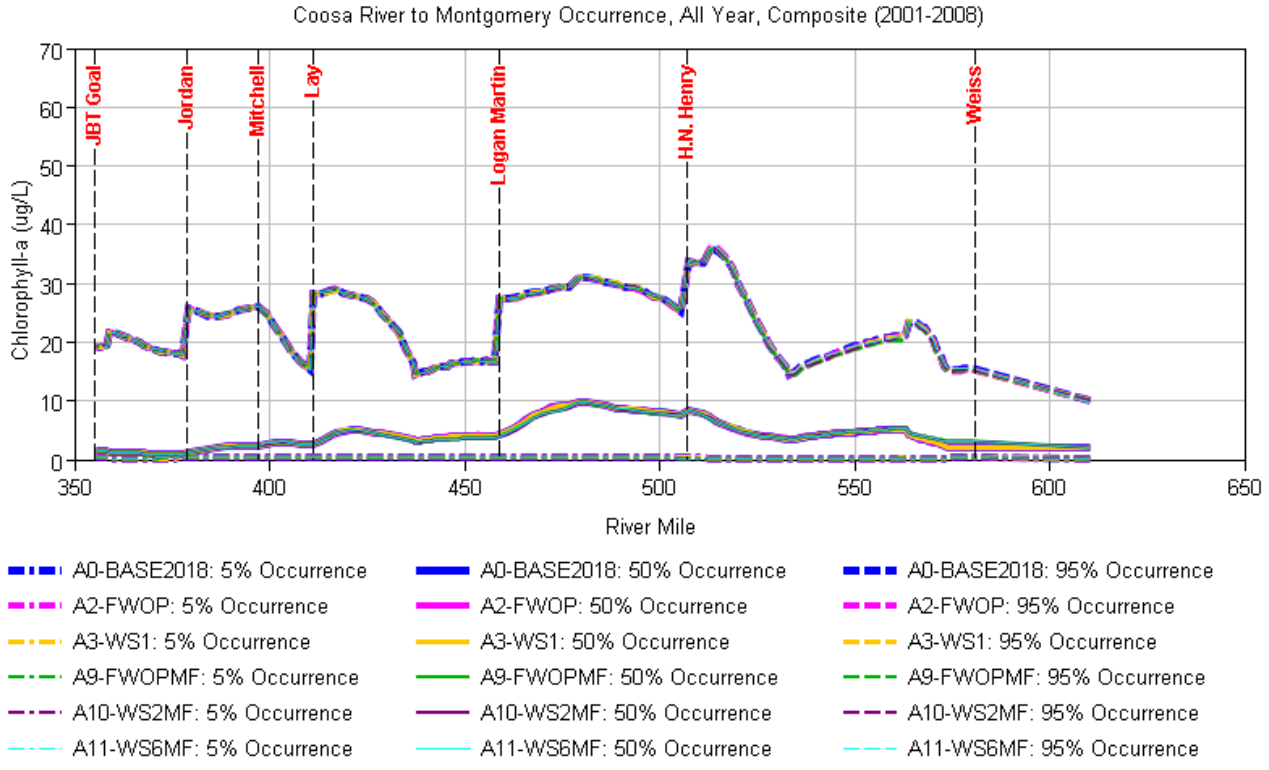


Figure E-98. Chlorophyll *a* Occurrence for April–November for the Coosa River (2001–2008).

E.3.3.2 Tentatively Selected Plan (Alternative 11)

The TSP (Alternative 11) includes the Allatoona Lake storage reallocation up to 94 mgd from a combination of flood storage and conservation storage. The TSP uses the USACE current storage accounting methodology.

E.3.3.2.1 Water Temperature

As noted in Section E.3.3.1.1, water temperature is not allowed to increase more than 1.5 °F during June–September. As shown in Figure E-99 for the Etowah River, there is no discernible difference between the TSP and NAA water temperatures. For the Coosa River, the simulated temperatures for the TSP have only small deviations from the NAA between H. Neely Henry and Weiss lakes and downstream of Weiss Lake, none of which are more than 1.5 °F (Figure E-100).

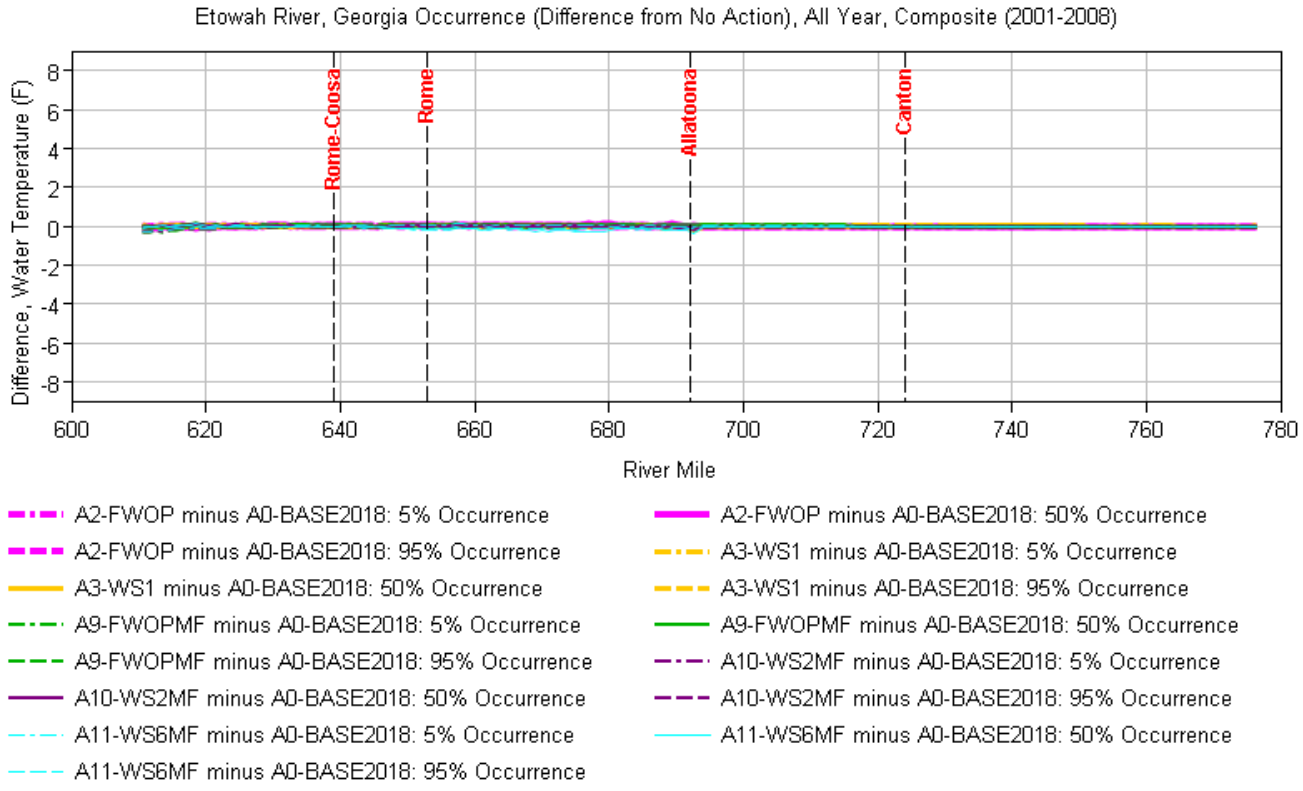


Figure E-99. Water Temperature Occurrence Difference from the NAA for the Etowah River (2001–2008).

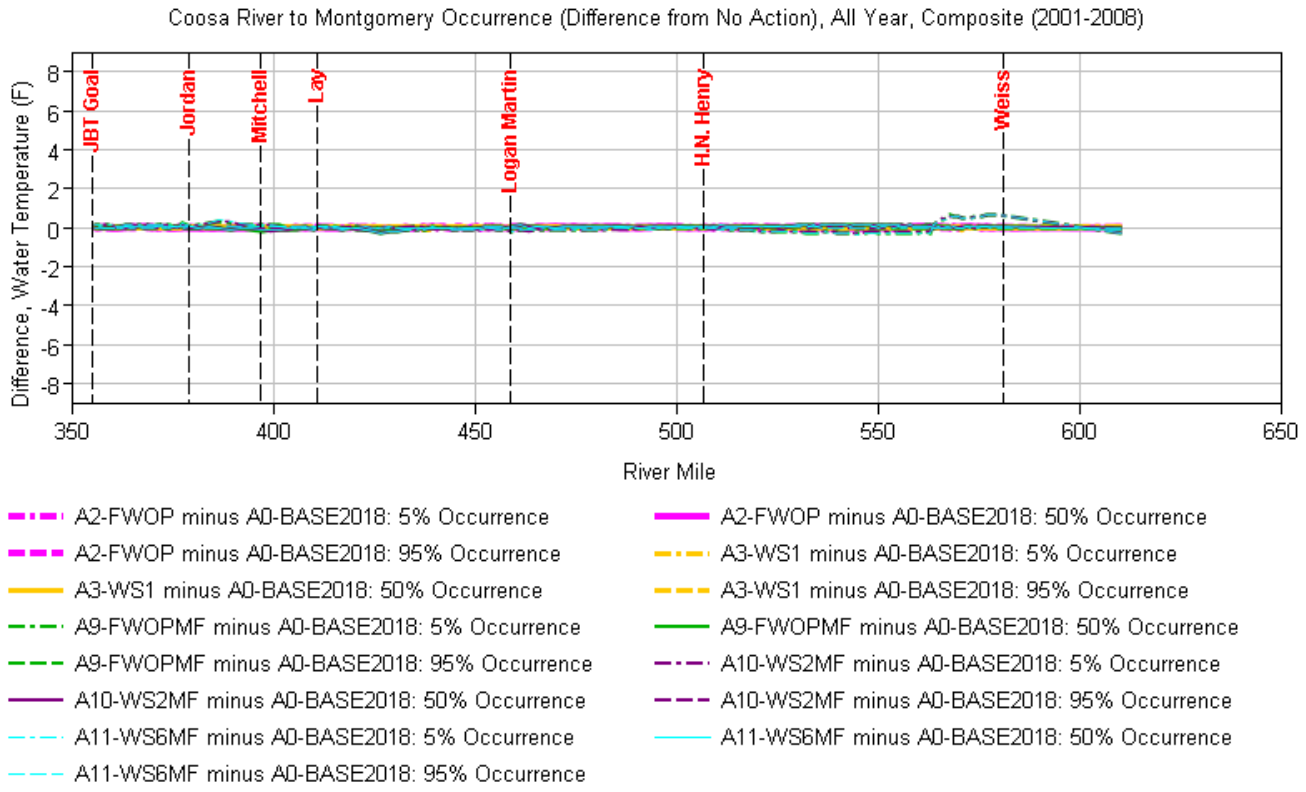


Figure E-100. Water Temperature Occurrence Difference from the NAA for the Coosa River (2001–2008).

E.3.3.2.2 Dissolved Oxygen

The model results demonstrate that the TSP would not be expected to have a detectable effect on the DO concentrations upstream of Allatoona Lake compared to the NAA (Figure E-101). There is no distinguishable difference in the modeled DO levels in the Etowah River downstream of Allatoona Dam between the NAA and Alternative 11. For the Coosa River, the TSP would have a minimal effect on the DO concentrations. The TSP model results show a minor decrease in DO from the NAA of 0.16 mg/L downstream of Weiss Lake at the 95-percent occurrence; however, that change is not expected to have a significant impact on water quality (Figure E-102).

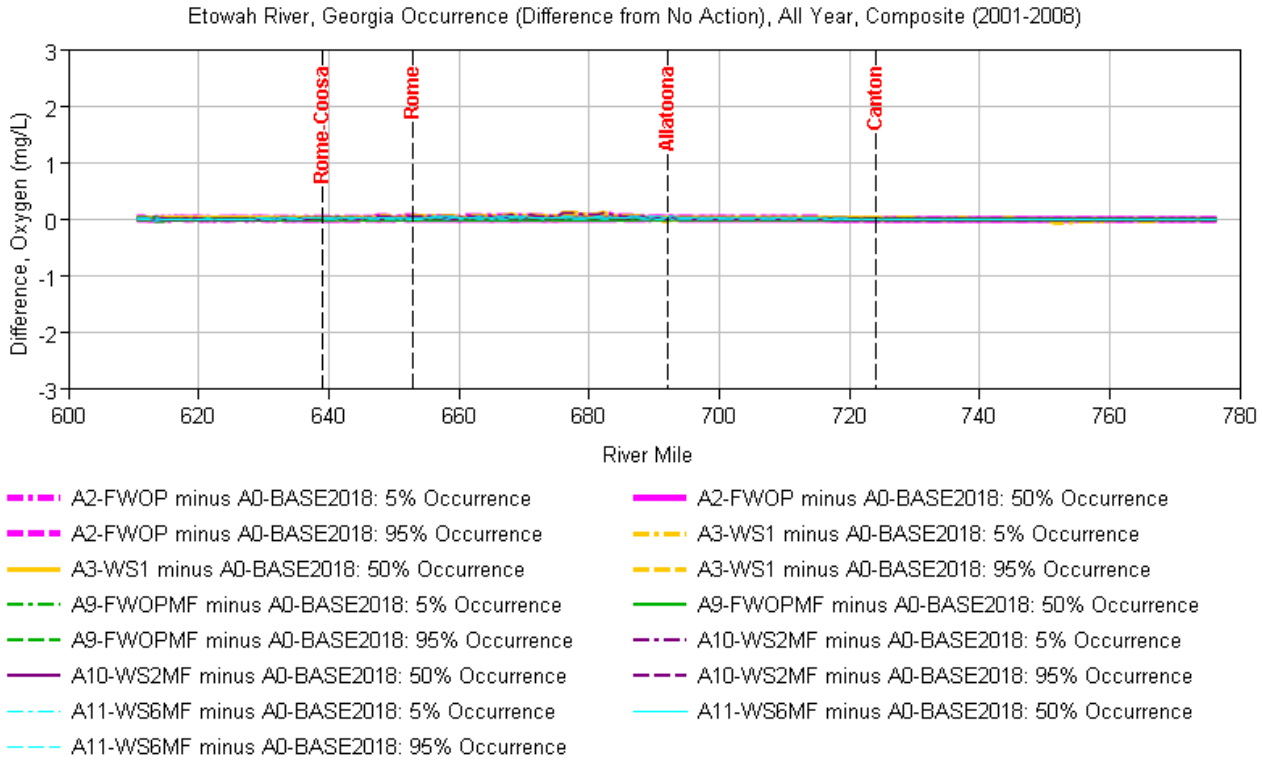


Figure E-101. DO Occurrence Difference from the NAA for the Etowah River (2001–2008).

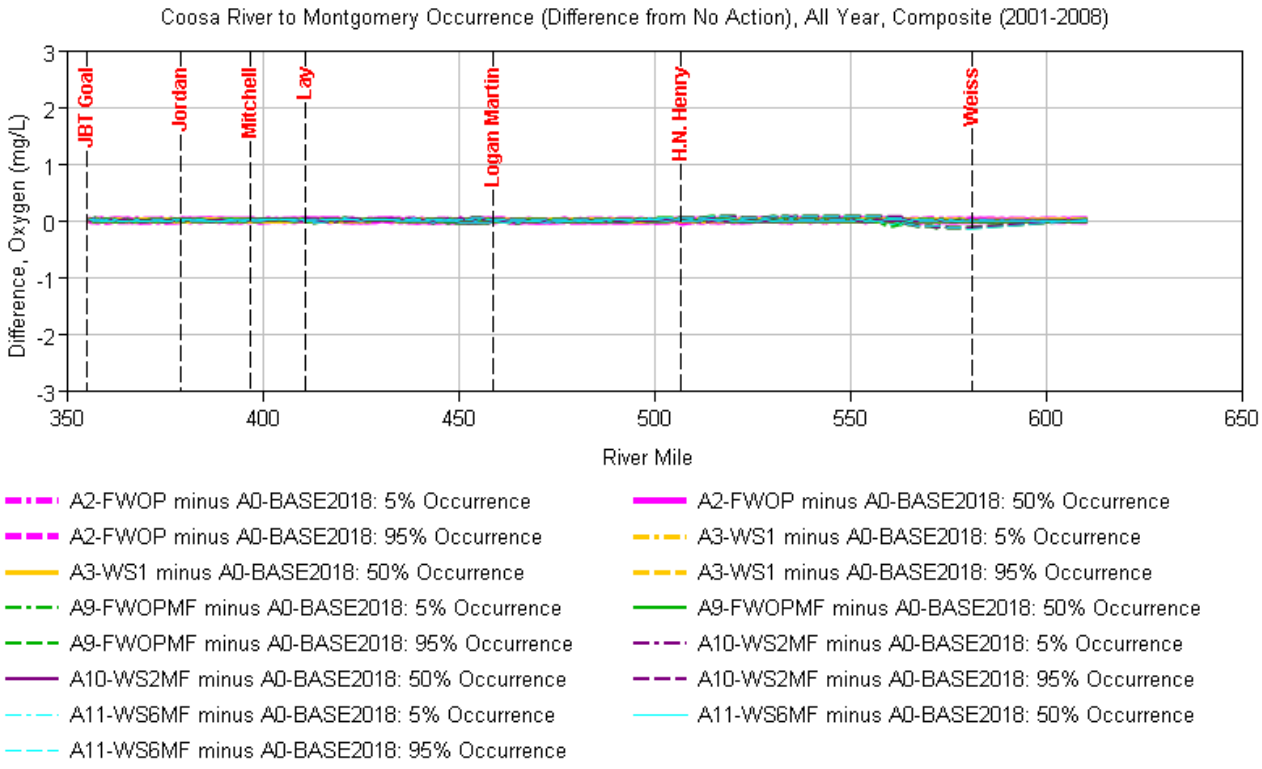


Figure E-102. DO Occurrence Difference from the NAA for the Coosa River (2001–2008).

E.3.3.2.3 Phosphorus

Downstream of Canton, GA, the model predicts a peak difference in TP at the 95-percent occurrence between the TSP and NAA of approximately 0.01 mg/L (10 µg/L). There are no other discernible changes in TP concentrations on the Etowah River (Figure E-103). The difference in TP near Canton is expected to amplify during a dry year to approximately 0.02 mg/L (20 µg/L) (Figure E-104). The Coosa River responds to the TSP with very little change from the NAA (Figure E-105). A peak increase of less than 0.01 mg/L (10 µg/L) is modeled at 95-percent occurrence near Weiss Lake, but no other significant changes can be discerned.

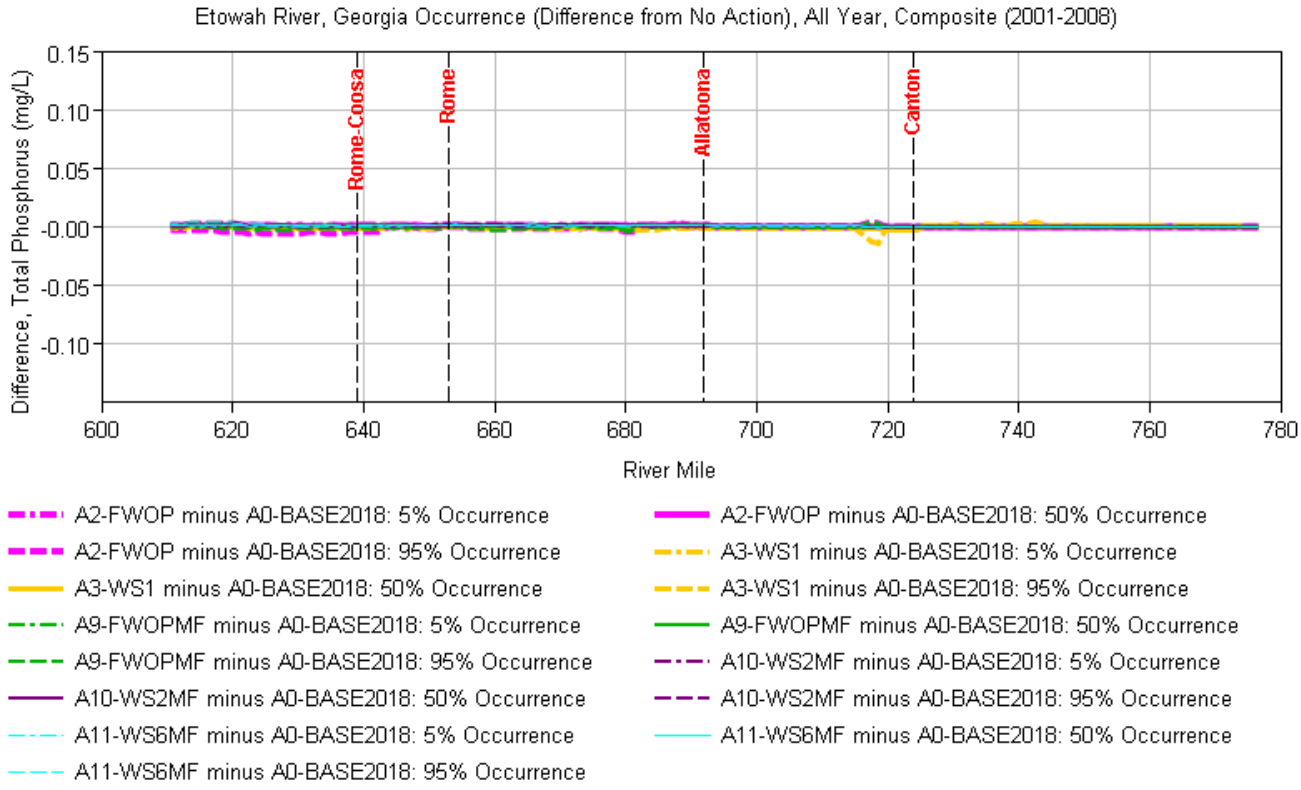


Figure E-103. TP Occurrence Difference from the NAA for the Etowah River (2001–2008).

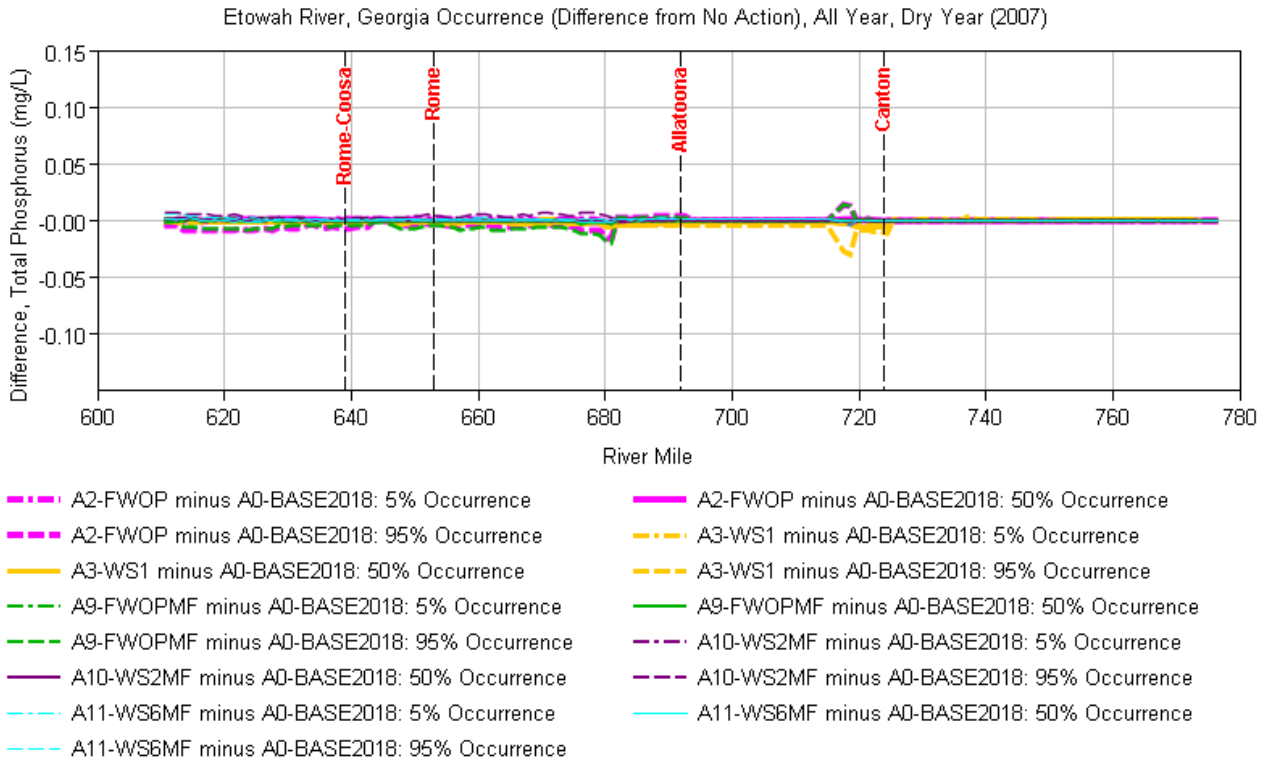


Figure E-104. TP Occurrence Difference from the NAA for the Etowah River (dry year [2007]).

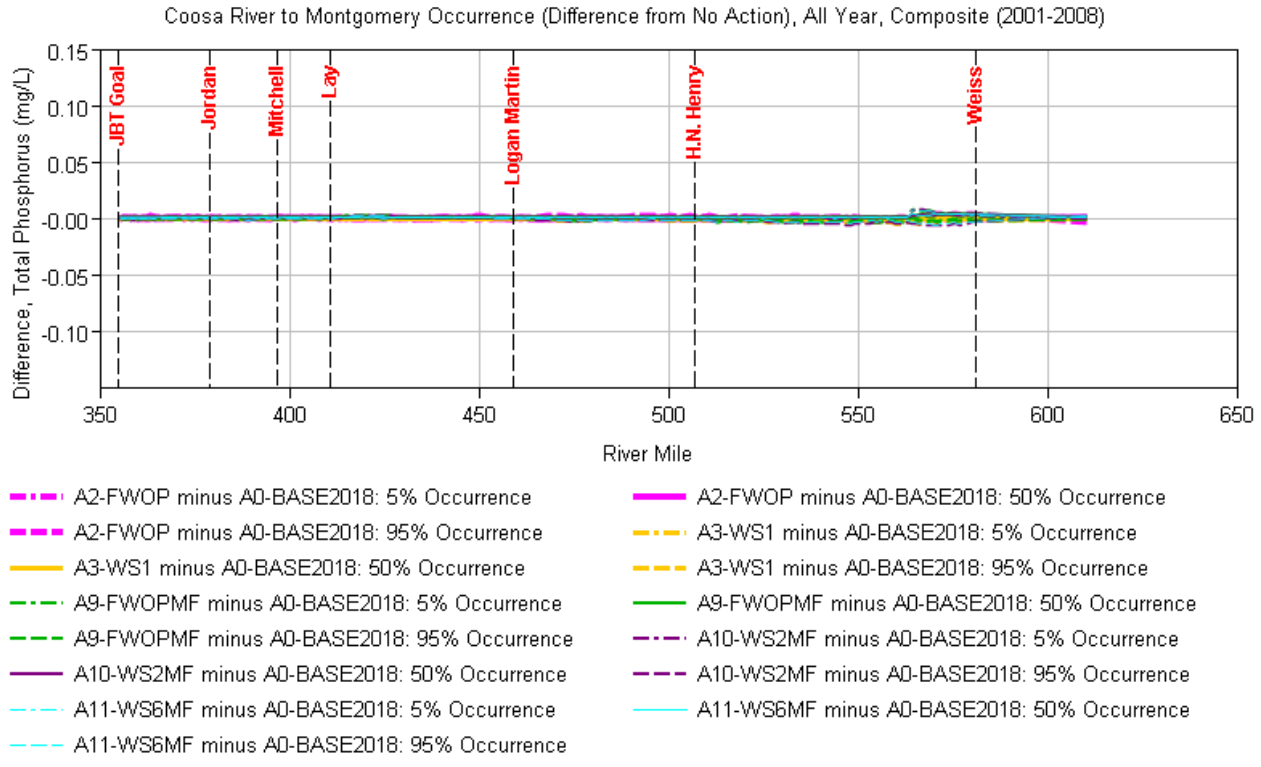


Figure E-105. TP Occurrence Difference from the NAA for the Coosa River (2001–2008).

E.3.3.2.4 Nitrogen

For the Etowah River, modeled results show no discernible change between TSP operations and the NAA (Figure E-106). The HEC-5Q model simulations show a potential increase in TN concentrations of 0.03 mg/L immediately downstream of Weiss Lake at the 50-percent occurrence for the TSP, but a decrease in TN concentrations of approximately 0.14 mg/L at the 95-percent occurrence upstream of Weiss Lake (Figure E-96). Other less significant decreases in TN concentration can be noted farther downstream where concentrations are modeled about 0.04 mg/L lower at the 95-percent occurrence between Weiss Lake and H. Neely Henry Lake and by about 0.03 mg/L at the 95-percent occurrence upstream of Mitchell Lake (Figure E-107).

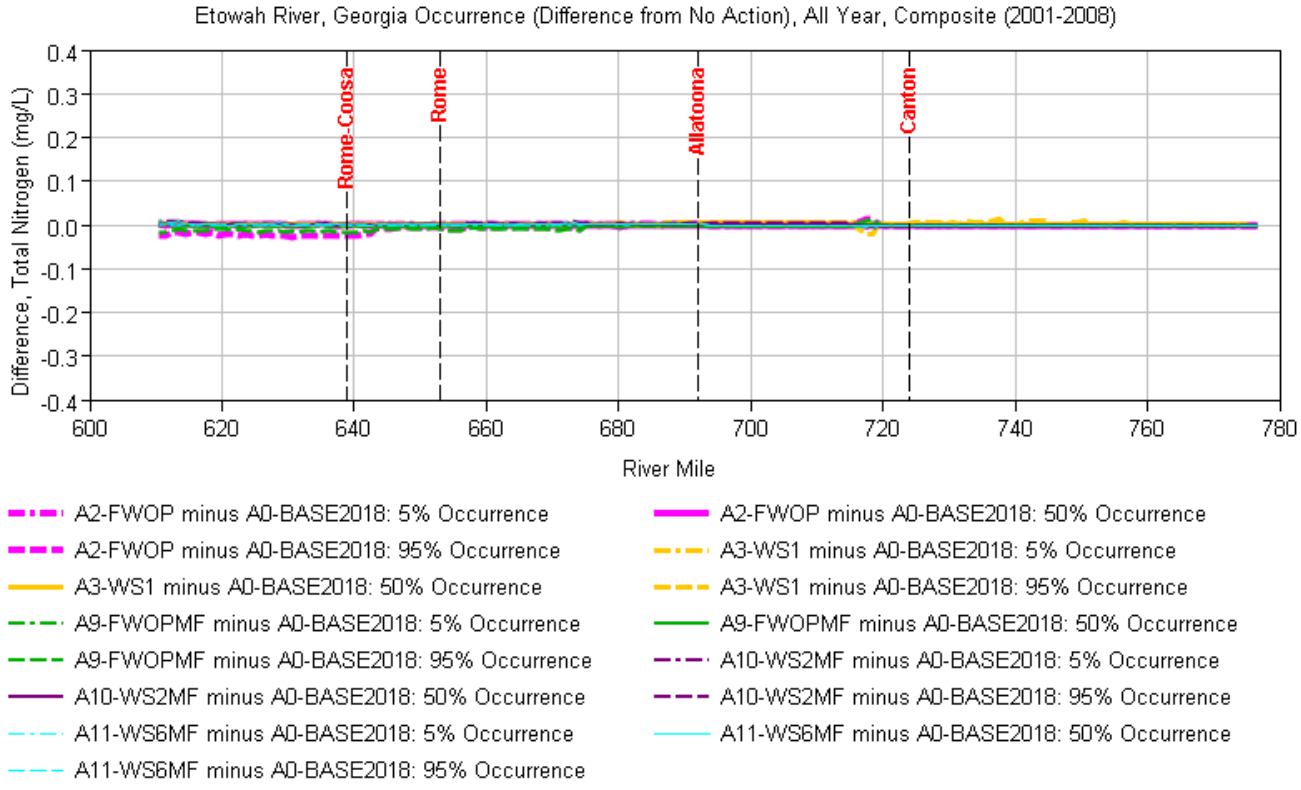


Figure E-106. TN Occurrence Difference from the NAA for the Etowah River (2001–2008).

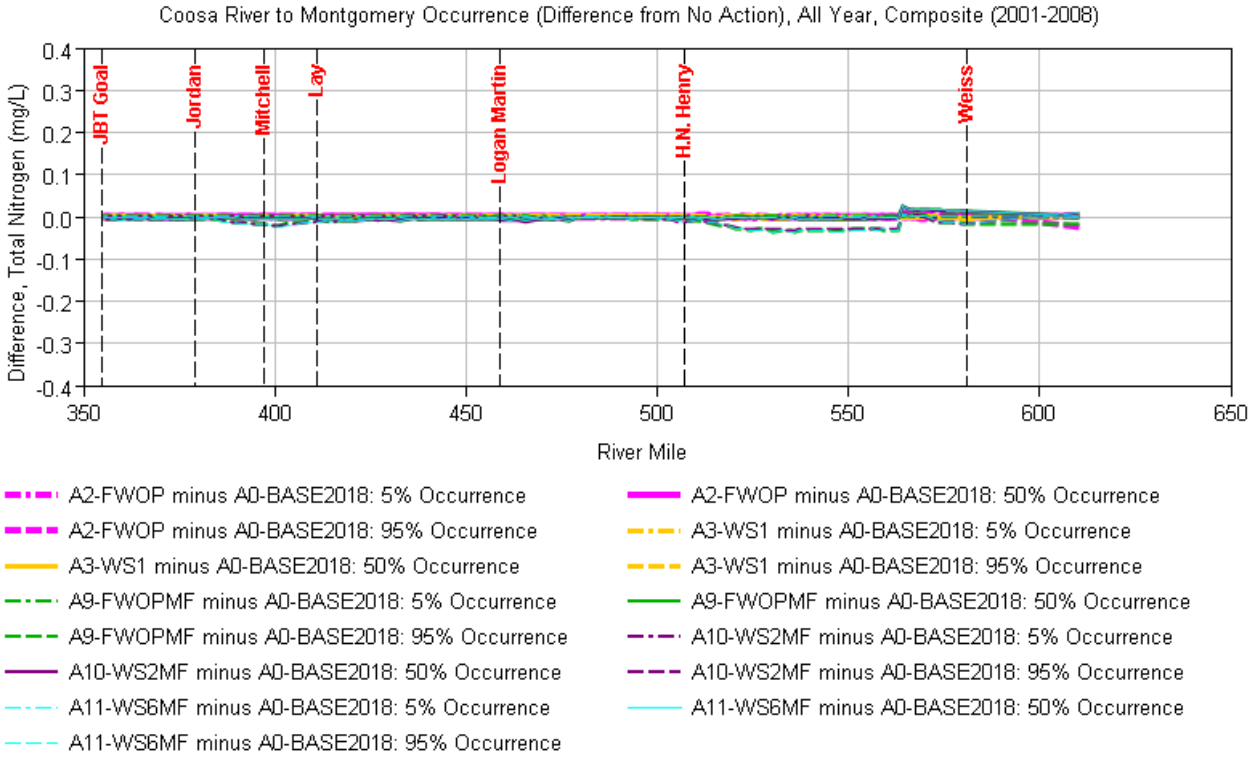


Figure E-107. TN Occurrence Difference from the NAA for the Coosa River (2001–2008).

E.3.3.2.5 Chlorophyll *a*

The model results demonstrate that the TSP would not be expected to have an incremental effect on chlorophyll *a* concentration in Allatoona Lake compared to the NAA. Some temporary exceedances of standards at equivalent concentrations for both the NAA and the TSP would occur (Figure E-108). For the Coosa River, the TSP would have no discernible incremental effect on chlorophyll *a* concentration compared to the NAA (Figure E-109).



Figure E-108. Chlorophyll *a* Occurrence Difference from the NAA for the Etowah River (2001–2008).

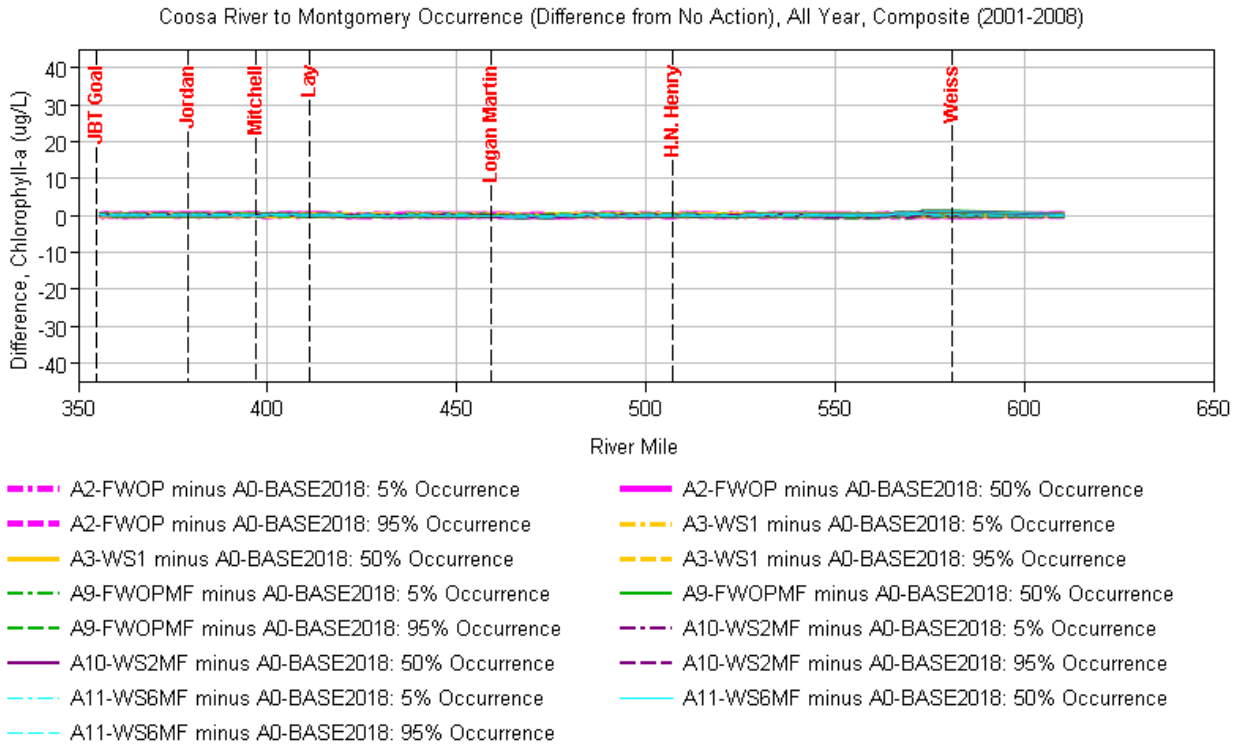


Figure E-109. Chlorophyll *a* Occurrence Difference from the NAA for April–November for the Coosa River (2001–2008).

E.3.3.3 Alternative 10

Alternative 10 includes the Allatoona Lake storage reallocation up to 94 mgd from conservation storage only. This alternative uses the current USACE storage accounting methodology and includes the modified flood operations at APC projects.

E.3.3.3.1 Water Temperature

As noted in Section E.3.3.1.1, water temperature is not allowed to increase more than 1.5 °F during June–September. As shown in Figure E-99 for the Etowah River, there would be no discernible difference between Alternative 10 and NAA water temperatures. For the Coosa River, the simulated temperatures for Alternative 10 would have only small deviations from the NAA between H. Neely Henry and Weiss lakes and upstream of Weiss Lake, none of which are more than 1.5 °F (Figure E-100).

E.3.3.3.2 Dissolved Oxygen

The model results demonstrate that Alternative 10 would have a slight benefit to the DO concentrations downstream of Allatoona Lake compared to the NAA (Figure E-101). Along the Coosa River, Alternative 10 would have a minimal effect on the DO concentrations with a minor decrease of 0.16 mg/L in DO from the NAA downstream of Weiss Lake at the 95-percent occurrence and a small increase of about 0.01 mg/L upstream of Weiss Lake Figure E-102).

E.3.3.3.3 Phosphorus

Downstream of Canton, GA, there would be a decrease in TP at the 95-percent occurrence between Alternative 10 and NAA of approximately 0.01 mg/L (10 µg/L). There are no other discernible changes in TP concentrations on the Etowah River (Figure E-103). The difference in TP near Canton is expected to amplify during a dry year to approximately 0.02 mg/L (20 µg/L) with a slight decrease in TP of about 0.01 downstream of Rome-Coosa (Figure E-104). Along the Coosa River, there would be little change from Alternative 10 to the NAA (Figure E-105).

E.3.3.3.4 Nitrogen

For the Etowah River, Alternative 10 would be expected to have a slight decrease in TN concentrations upstream of Allatoona Lake compared to the NAA for the 95-percent occurrence (Figure E-106). Alternative 10 would be expected to have a potential decrease in TN concentrations of 0.02 mg/L between H. Neely Henry and Weiss lakes and a decrease of about 0.11 mg/L upstream of Weiss Lake at the 95-percent occurrence (Figure E-107).

E.3.3.3.5 Chlorophyll *a*

The model results demonstrate that Alternative 10 would have no discernable differences in chlorophyll *a* from the NAA along the Etowah River (Figure E-108). The same is true along the Coosa River (Figure E-109).

E.3.3.4 Alternative 3

Alternative 3 includes the Allatoona Lake storage reallocation up to 94 mgd from conservation storage only. The alternative also uses the proposed storage accounting methodology from the State of Georgia.

E.3.3.4.1 Water Temperature

As noted in Section E.3.3.1.1, water temperature is not allowed to increase more than 1.5 °F during June–September. As shown in Figure E-99 and Figure E-100 for the Etowah River and Coosa River, respectively, the simulated temperatures for Alternative 3 have only small deviations from the NAA, none of which are more than 1.5 °F.

E.3.3.4.2 Dissolved Oxygen

The model results demonstrate that Alternative 3 would have a slight benefit to the DO concentrations downstream of Allatoona Lake compared to the NAA (Figure E-101). For the Coosa River, Alternative 3 would have a minimal effect on the DO concentrations with a very minor decrease in DO from the NAA downstream of Weiss Lake at the 95-percent occurrence; however, that change is not expected to have a significant impact on water quality (Figure E-102).

E.3.3.4.3 Phosphorus

Downstream of Canton, GA, the model predicts a peak difference in TP at the 95-percent occurrence between Alternative 3 and NAA of approximately 0.01 mg/L (10 µg/L). There are no other discernible changes in TP concentrations on the Etowah River (Figure E-103). The difference in TP near Canton is expected to amplify during a dry year to approximately 0.02 mg/L (20 µg/L) (Figure E-104). The Coosa River responds to Alternative 3 with very little change from the NAA (Figure E-105).

E.3.3.4.4 Nitrogen

For the Etowah River, modeled results show a slight decrease in TN concentrations downstream of Canton for Alternative 3 compared to the NAA for the 95-percent occurrence (Figure E-106). The HEC-5Q model simulations show a potential increase in TN concentrations of 0.01 mg/L downstream of Weiss Lake followed by a decrease immediately upstream of Weiss Lake at the 95-percent occurrence for Alternative 3 (Figure E-107).

E.3.3.4.5 Chlorophyll *a*

The model results demonstrate that Alternative 3 would have some very minor increases in chlorophyll *a* upstream of Canton compared to the NAA (Figure E-108). For the Coosa River, Alternative 3 would have no discernible incremental effect on chlorophyll *a* concentration compared to the NAA (Figure E-109).

E.3.4 Geology and Soils

Effects on geology and soils that can be influenced by USACE and APC water management activities are limited to sedimentation and erosion of the river and lake beds and shorelines. USACE and APC have no control over the management of soils and underlying geology on land outside their respective jurisdictions; thus, sources of sediment related to agricultural practices, land development, and activities along tributaries are considered a background condition in which the management measures must function.

Prime and unique farmland resources within the ACT River Basin would not be appreciably affected under the NAA or any of the other alternatives.

Sedimentation and erosion activity in river networks modified by locks and dams and hydropower facilities such as the ACT River Basin projects can be divided into two general types: (1) river bed shoaling and bank erosion, (2) and lake bed sedimentation and shoreline erosion. In general, riverine sedimentation and bank erosion processes are active only during floods. Studies of rivers throughout the world indicate that high flows, with recurrence intervals of about 1.5 years, are dominant in shaping the channel (Dunne & Leopold, 1978). Flows of such magnitude are termed *channel-forming discharge*. As a general rule, the typical channel-forming discharges can be thought of as the annual peak flood. Additionally, sediments eroded from landscapes during intense rainfalls and from stream and river banks during high-flow events are transported in the greatest quantities and over the greatest distances during floods. The sediment becomes deposited as shoals where the rivers and tributaries enter the lakes.

Important channel-forming processes related to the ACT River Basin include tailwater degradation downstream of projects (Section E.1.3.2.5) and bank erosion within the river portions above the project pools and downstream of

Claiborne L&D. Similarly, lake bed sedimentation is dominated by flood events, when the erosive forces throughout the watershed are most severe and the most sediment is delivered to the lakes and lower Alabama River.

Lake shoreline erosion activity is not limited to times of high water and can occur at all water levels and flow conditions. The shoreline erosion rate is a balance between the erosive forces and the stabilizing forces: waves driven by wind and boat traffic versus the density of shoreline vegetation and durability of shoreline soils. Thus, management measures within control of USACE and APC that influence shoreline erosion include lake elevation and duration at any given elevation. This section discusses those management measures as appropriate in relation to the NAA and the other alternatives.

E.3.4.1 No Action Alternative

Geology and soils conditions under the NAA would be consistent with those described in Section E.1.3 and the introduction to this section.

Figure E-110 shows a typical cross section of Allatoona Lake and detail of the shoreline. The elevations bounding the winter and summer pools at 823 ft and 840 ft, respectively, show retreating shorelines on both right and left banks. In general, the shoreline erosion trends on Allatoona Lake indicate that the highest rates occurred during the first 30 years since impoundment and have slowed since that time. The change in rate is due to the winnowing of fine soil particles by wave action over the first several years since impoundment. Left behind are more robust gravel, cobble, and bedrock shorelines that have become more erosion resistant as time passed (USACE Mobile District, 2011).

Under the NAA, it is likely that both Allatoona Lake shoreline erosion and lake sedimentation would continue at their present rates. Comparisons of sedimentation range surveys over time was not available for Weiss Lake, H. Neely Henry Lake, or Logan Martin Lake.

At Weiss Lake, shoreline erosion over time is likely similar to that shown in Figure E-110, with the exception of a smaller vertical range caused by the 6-ft difference between summer and winter pool elevations at Weiss Lake and the 17-ft difference at Allatoona Lake. The highest shoreline erosion rates occurred during the first few years following impoundment; present erosion rates have slowed down along shorelines with soil and are negligible along shores scoured to bedrock.

At H. Neely Henry Lake, shoreline erosion over time is likely very mildly impacted by lake-level management due to the 1-ft range between summer and winter pool elevations. Power boats and wind-driven waves are likely the forces generating the erosion. Sedimentation of the main body of H. Neely Henry Lake likely progresses slowly because of a large portion of Coosa River sediment becoming trapped in Weiss Lake.

At Logan Martin Lake, shoreline erosion over time is likely similar to that shown in Figure E-110, with the exception of a smaller vertical range caused by the 5-ft difference between summer and winter pool elevations at Logan Martin Lake and the 17-ft difference at Allatoona Lake. The highest shoreline erosion rates occurred during the first few years following impoundment; present erosion rates have slowed down along shorelines with soil and are negligible along shores scoured to bedrock.

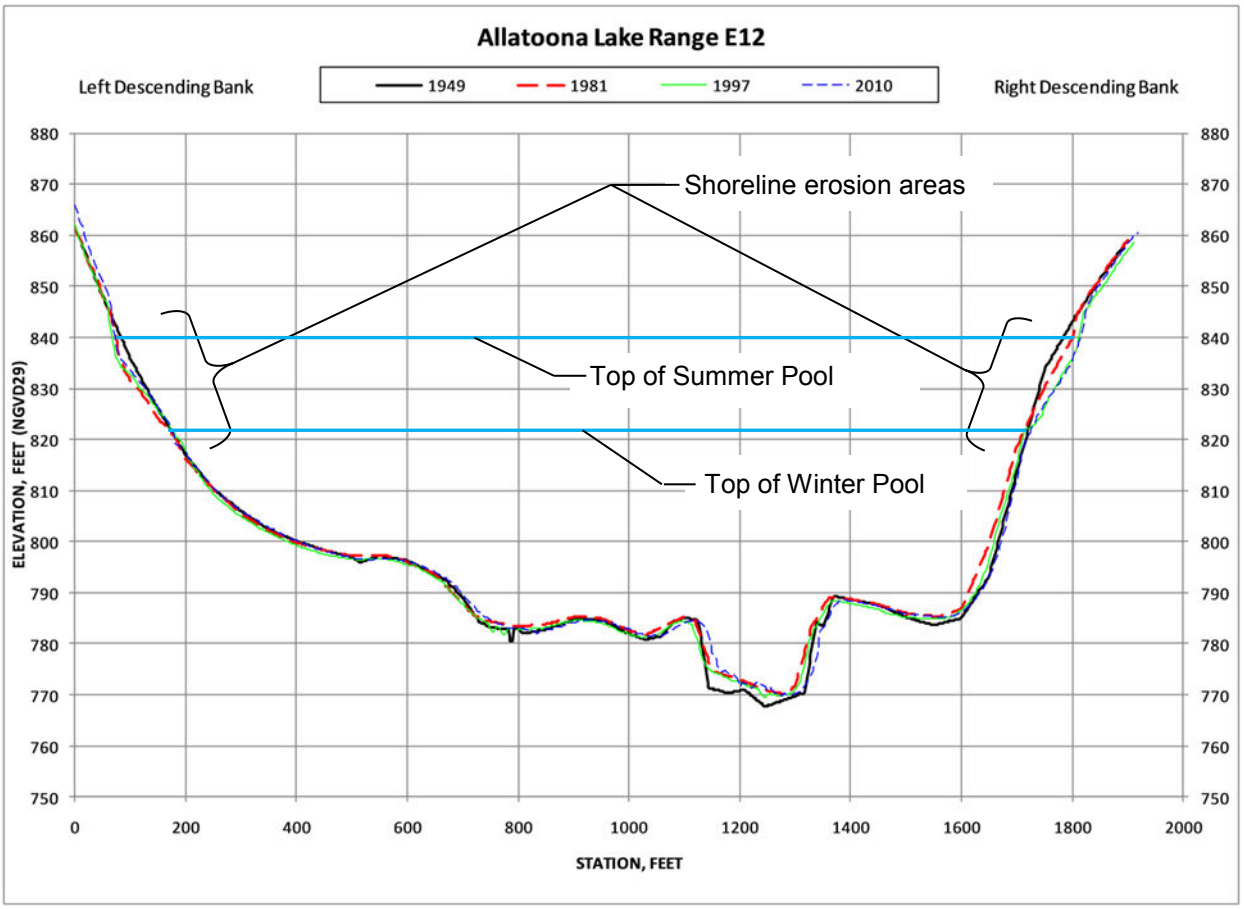


Figure E-110. Typical Allatoona Lake Sedimentation Range Cross Section.

E.3.4.2 Tentatively Selected Plan (Alternative 11)

The management measures for Alternative 11 include an increase to the Allatoona Lake pool elevation of about 1 ft throughout much of the year. The impact to shoreline erosion would be most significant during the spring and summer months, during which the HEC-ResSim model simulation indicates that the median summer pool level would be at 841 ft for several weeks to several months compared to 840 ft for about 4 weeks under the NAA (Figure E-39). Shoreline erosion would increase in the zone above 840 ft for several years, as described in Section E.3.4.1, until the erodible soils have been washed from the banks, leaving the more robust underlying bedrock or coarser gravel and cobble particles. Most sediment eroded from the shorelines would be deposited within the lake below the winter pool elevation, thus the upper elevation of shoaling would increase from about 823 ft to 824 ft. A small portion of the sediment, clay-size particles fine enough to remain in suspension, might be transported over the dam downstream to the Etowah River.

The simulated daily discharges at Allatoona Dam under Alternative 11 closely match those under the NAA. Thus, any changes in channel erosion and sedimentation of the Etowah and Coosa rivers between Allatoona Dam and Weiss Lake would likely be negligible.

Water management measures at Weiss Dam and Lake under Alternative 11 include extending the summer guide curve elevation at 564 ft for an additional 4 weeks until the end of September each year and increasing the winter pool elevation from 558 ft to 561 ft from December through February (Figure E-111). Most sediment eroded from the shorelines would be deposited within the lake below the winter pool elevation, thus the upper elevation of

shoaling would increase from about 558 ft to 561 ft. A small portion of the sediment, clay-size particles fine enough to remain in suspension, might be transported over the dam downstream to the Coosa River and downstream impoundments.

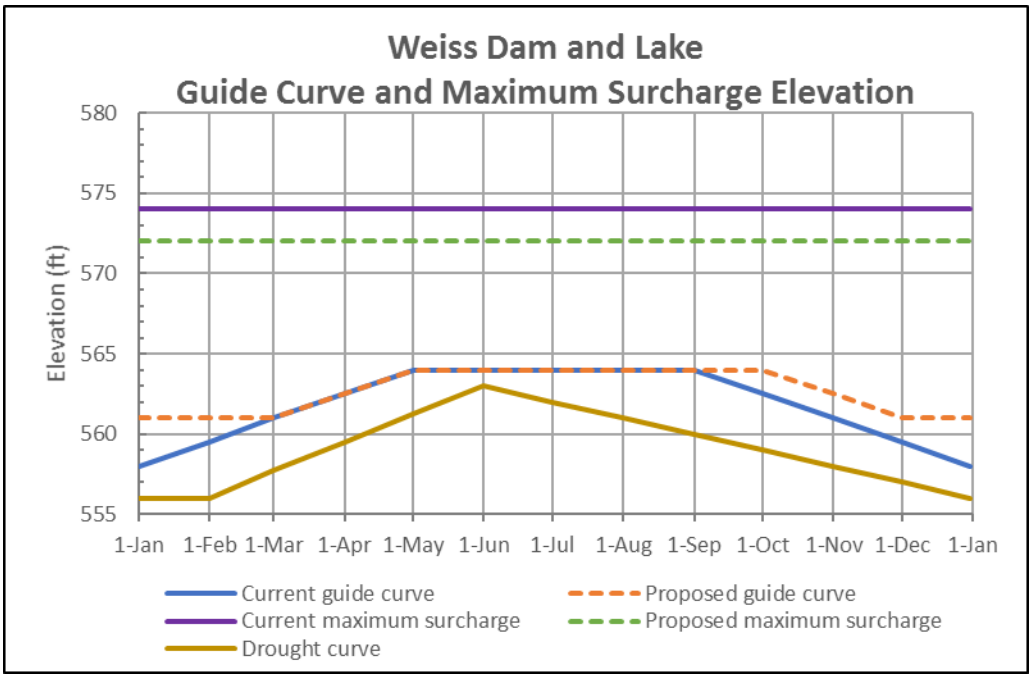


Figure E-111. Weiss Lake—Proposed Changes to Guide Curve and Maximum Surcharge Elevation.

Proposed modifications to flood operations at Weiss Dam and Lake in Alternative 11 would result in some minor changes in quantity and timing of releases into the upper reaches of H. Neely Henry Lake. However, those changes are well within the range of releases that have occurred over time at the project under the NAA. Any changes in channel erosion and sedimentation of the Coosa River below Weiss Dam would likely be negligible.

Current water management operations at H. Neely Henry Dam and Lake would not change under Alternative 11. Discharges from Weiss Dam under the proposed modified flood operations in Alternative 11 would have negligible effects on H. Neely Henry Lake compared to the NAA, as HEC-ResSim results indicate pool level variations of 0.1 ft or less. Any changes to shoreline erosion or shoaling rates would be expected to be negligible. The discharges at H. Neely Henry Dam under Alternative 11 are essentially identical to the NAA, thus any changes in channel erosion and sedimentation of the Coosa River below H. Neely Henry Lake would likely be negligible.

Water management measures at Logan Martin Dam and Lake under Alternative 11 include an increase to the Logan Martin Lake winter guide curve elevation by 2 ft (from elevation 460 ft to 462 ft). The summer guide curve elevation of 465 ft would not be changed, but the guide curve would be adjusted to reach elevation 465 ft by May 1, one week earlier than the current guide curve (see Figure E-56). Most sediment eroded from the shorelines would be deposited within the lake below the winter pool elevation, thus the upper elevation of shoaling would increase from about 460 ft to 462 ft. A small portion of the sediment, clay-size particles fine enough to remain in suspension, might be transported over the dam downstream to the Coosa River and downstream impoundments.

The discharges at Logan Martin Dam under Alternative 11 would be increased from 50,000 cfs to a range of 50,000–65,000 cfs for about the 1–3-percent exceedance range (see Figure E-59). Since the mid-1960s, the Coosa River impoundments have effectively reduced the annual peak flows below Logan Martin Dam by about 20,000 cfs on average. That range of flows was compared to the historic channel-forming discharge for the preimpoundment

Coosa River. Based on the annual peak flow record from 1916 to 1966 at the USGS Childersburg, AL, gage, the 1.5-year recurrence interval flow (channel-forming discharge) was estimated at 71,000 cfs. Because the Coosa River was primarily formed by flows greater than the proposed flow increases under Alternative 11, and since flood peaks have been reduced by flood management operations, any changes in the present channel erosion and sedimentation rates of the Coosa River below Logan Martin Dam would likely be negligible compared to the NAA.

E.3.4.3 Alternative 10

Compared to the NAA, Alternative 10 would essentially have the same effects on geology and soil resources in the basin as those described for Alternative 11.

E.3.4.4 Alternative 3

Alternative 3 would have the same effects on geology and soil resources at Allatoona Lake as Alternative 10. I the Coosa River from Weiss Lake to its confluence with the Tallapoosa River, Alternative 3 would likely have the same effects on geology and soil resources as the NAA.

E.3.5 Climate Conditions

This section addresses the extent to which proposed reallocation of storage in Allatoona Lake for water supply and proposed modifications to flood operations at the APC Weiss and Logan Martin projects may affect GHG emissions and climate conditions. Also included is a discussion of both direct and indirect effects. Although not strictly an environmental effect, the extent to which future climate variability may affect the operation of the reservoir projects are also discussed. Notably, USACE would continually review the WCM as needed to ensure that the best use is made of available water resources. At a minimum, the district will review the manual every 5 years to determine whether updates are needed (USACE South Atlantic Division, 2010). Effects from all alternatives would be primarily confined to the northern portions of the ACT basin and would be negligible as far south as Mobile Bay; therefore, sea level rise was not carried forward for detail discussion in this Draft FR/SEIS.

E.3.5.1 No Action Alternative

The NAA would have minor indirect adverse effects to climate. Effects would be due to an incremental increase GHG emissions from regional fossil-fuel power plants required to offset a small reduction in hydropower when compared to existing conditions. The NAA would not have any direct impact on the climate and would not directly introduce changes in emissions or contribute to global warming.

E.3.5.1.1 Direct Effects

The NAA would not directly generate any GHG, have any effect on the climate, or contribute to global warming. The overall emissions associated with vehicle and equipment use to conduct routine O&M activities around the reservoir projects would remain unchanged when compared to existing conditions or conditions as outlined in the Final EIS for the ACT River Basin WCM update (USACE Mobile District, 2014d). These effects would be negligible.

E.3.5.1.2 Indirect Effects

The NAA would have minor adverse indirect effects on GHG emission and climate. These effects would be due to decreases in hydropower production and subsequent increases in GHG emissions produced by regional fossil fuel powered power plants. Indirect GHG emissions would increase by 0.001 million metric tons (MMT) (or 1,000 metric tons) per year when compared to existing conditions. These changes would have no discernible or

measurable effects on the climate but would constitute and incremental increase in global GHG emissions. These effects would be minor.

E.3.5.2 Tentatively Selected Plan (Alternative 11)

Alternative 11 would have no direct effects and minor indirect effects on GHG emissions and climate change. As with the NAA, emissions from the projects would remain unchanged when compared to existing conditions, or the conditions as outlined in the Final EIS for the ACT River Basin WCM update (USACE Mobile District, 2014d). There would be indirect beneficial effects from increase in hydropower production and subsequent reductions in GHG emissions otherwise produced by regional fossil fuel powered power plants. Long-term minor beneficial effects would be expected water management and resiliency under future climate scenarios. Although there would be no direct effects and limited indirect effects, Alternative 11 would constitute a more effective approach to water management under all future conditions when compared to the NAA.

E.3.5.2.1 Direct Effects

Alternative 11 would not directly generate any GHG, have any effect on the climate, or contribute to global warming. The overall emissions associated with vehicle and equipment use to conduct routine O&M activities around the reservoir projects would remain unchanged when compared to existing conditions, the NAA, or conditions as outlined in the Final EIS for the ACT River Basin WCM update. These effects would be negligible.

E.3.5.2.2 Indirect Effects

Alternative 11 would have minor beneficial indirect effects on GHG emission and climate. These effects would be due to increases in hydropower production and subsequent decrease in GHG emissions produced by regional fossil fuel powered power plants. Table E-63 provides a summary of changes in annual GHG emissions that would be caused by changes in hydropower production for each alternative. Further details of this analysis can be found in the Hydropower Analysis Report in Appendix D to the Draft FR/SEIS. Modeling in support of the hydropower analysis indicates that Alternative 11 (TSP) would indirectly reduce CO2e emission by 0.009 MMT when compared to the No Action Alternative. This reduction is comparable to eliminating approximately 2,000 passenger vehicles from the roads. These changes would have no discernible or measurable effects on the climate but would constitute and incremental decrease in global GHG emissions. These effects would be minor.

Table E-63. Indirect Greenhouse Gas Emissions for Each Alternative

Alternative	Carbon Dioxide Equivalent (Million Metric Tons)		
	Overall	Change From Existing	Change from Future No Action Conditions
Existing	3.683	-	0.001
No Action	3.682	- 0.001	-
Alternative 11 (TSP)	3.672	- 0.009	- 0.009
Alternative 3	3.678	- 0.004	- 0.004
Alternative 10	3.671	- 0.010	- 0.010

E.3.5.3 Alternative 10

As with Alternative 11, and for similar reasons, Alternative 10 would have no direct effects and minor indirect effects on GHG emissions and climate change. Direct emissions from the projects would remain unchanged when compared to existing conditions, the NAA, or the conditions as outlined in the Final EIS for the ACT River Basin WCM update. There would be minor indirect beneficial effects from increase in hydropower production and subsequent reductions in GHG emissions otherwise produced by regional fossil fuel powered power plants. Alternative 10 would indirectly reduce CO_2e emission by 0.010 MMT when compared to the NAA. This reduction is comparable to eliminating approximately 2,200 passenger vehicles from the roads. As with Alternative 11, and for similar reasons, Alternative 10 would constitute a more effective approach to water management under all future conditions when compared to the No Action Alternative. These effects would be minor.

E.3.5.4 Alternative 3

As with Alternative 11, and for similar reasons, Alternative 3 would have no direct effects and minor indirect effects on GHG emissions and climate change. Direct emissions from the projects would remain unchanged when compared to existing conditions, the NAA, or the conditions as outlined in the Final EIS for the ACT River Basin WCM update. There would be minor indirect beneficial effects from increase in hydropower production and subsequent reductions in GHG emissions otherwise produced by regional fossil fuel powered power plants. Alternative 3 would indirectly reduce CO_2e emission by 0.004 MMT when compared to the No Action Alternative. This reduction is comparable to eliminating approximately 500 passenger vehicles from the roads. As with Alternative 11, and for similar reasons, Alternative 3 would constitute a more effective approach to water management under all future conditions when compared to the No Action Alternative. These effects would be minor.

E.3.6 Land Use

An adverse effect on land use would be the result of a land-use change that would be incompatible with adjacent land uses. The degree to which the NAA, Alternative 11 (TSP), Alternative 10, and Alternative 3 conflict with established land uses in the area, disrupt or divide established land-use configurations, represent a substantial change in existing land uses, or are inconsistent with adopted land use plans will determine the severity of adverse effects.

E.3.6.1 No Action Alternative

No effects would be expected. Under the NAA, current water control operations at Allatoona, Weiss, and Logan Martin lakes in the ACT River Basin would continue; therefore, effects on land use would be expected to be the same as in the past, with deviations in lake elevations caused by seasonal and yearly variations in flow and climatic conditions.

E.3.6.2 Tentatively Selected Plan (Alternative 11)

E.3.6.2.1 Allatoona Dam and Lake

Long-term, minor beneficial effects would be expected. Under Alternative 11, USACE would maintain the lake at a slightly higher (about 1 ft) pool elevation throughout the year.

Allatoona Lake's normal pool elevation is 840 ft. The elevation of 837 ft marks the IIL, below which minor adverse effects on shoreline land use would occur. The IIL is generally characterized by minimal effects on USACE boat ramps, minimal effects on private marina and dock owners, and marginal effects on designated public swimming areas. If the lake elevation fell to the IIL, it would not change the shoreline land-use designation but would make the land use less desirable, resulting in minor adverse effects. The scenic appeal of protected shoreline land use

would be affected by exposed shoreline and lake bed. Shoreline land use designated for public recreation—such as public boat docks, marinas, and swimming areas as well as limited development areas with private boat docks—would be adversely affected in a similar manner, with the exposed shoreline and lower water level reducing the appeal of the areas for their intended shoreline land use.

Under Alternative 11, Allatoona Lake's pool elevation would be about 1 ft above the current pool elevations throughout the year (assuming sufficient water basin inflow from rainfall). That change would be beneficial for land use, as the HEC-ResSim model shows that the lake elevation would have fewer weeks below the IIL. Accordingly, there would be less time with exposed shoreline and lower water levels and more time for the shoreline to fulfill its intended land use, such as public recreation for boating, fishing, and swimming and limited development for shoreline and lake access from docks.

The HEC-ResSim model showed that flow downstream of Allatoona Dam would experience little change under Alternative 11 compared to the NAA. No land-use impacts downstream would be expected.

Implementing Alternative 11 would not change Allatoona Lake's shoreline land-use allocations around or downstream of the lake and, therefore, would not affect land-use compatibility.

E.3.6.2.2 Weiss Dam and Lake

Long-term, minor beneficial effects would be expected under Alternative 11. The proposed change to lower the lake's maximum surcharge elevation (top of flood storage) would not affect land use around Weiss Lake; however, the proposed change to raise the winter pool elevation from 558 ft to 561 ft would be expected to have long-term beneficial effects. The HEC-ResSim model shows a substantial improvement in pool levels from early September through February, as the number of years the lake pool would drop below important levels (i.e., where shoreline land use would be adversely impacted) would be much lower than under the NAA (only 3 years out of the HEC-ResSim 73-year study period for Alternative 11 compared to 24 years under the NAA). Maintaining a higher lake level during the fall and winter months (assuming sufficient rainfall) would provide residents and visitors with improved conditions for use of recreational facilities around the lake shoreline and for boating on the lake. Prior to implementation of the modified flood operations feature of the TSP at the Weiss project, it may be incumbent on APC to purchase any additional identified real interests downstream of Weiss Dam affected by the modified flood operations. USACE will conduct additional analysis of impacts to private property both upstream and downstream of Weiss and Logan Martin dams. This analysis will provide the decision maker a comprehensive impact assessment of the effects for APC's current and proposed operations. This analysis and findings will be available for review in the Final FR/SEIS. Modified flood operations at Weiss Dam would be expected to have little effect on current land use downstream of the dam but may include some specific restrictions on future land use options on those lands.

E.3.6.2.3 H. Neely Henry Lake

No effects would be expected. Alternative 11 would not change operation of H. Neely Henry Lake. The HEC-ResSim model shows that raising Weiss Lake's winter pool (from September to February) would have a negligible (0.2 ft) decrease in H. Neely Henry Lake's pool elevation during the same time period, but it would not be expected to impact land use.

E.3.6.2.4 Logan Martin Dam

Long-term, minor beneficial effects would be expected. Logan Martin Lake's maximum surcharge elevation would be lowered by 3.5 ft and the winter pool elevation would be raised by 2 ft. Raising the winter pool would have long-term beneficial effects. The HEC-ResSim model shows a substantial improvement in Logan Martin Lake's pool levels from early September through February, as the number of years the lake pool would drop below important levels (where shoreline land use would be adversely impacted) would be much lower than under the NAA baseline conditions (only 5 years out of the 73-year HEC-ResSim study period for Alternative 11 compared to 38

years under the NAA baseline). Maintaining a higher lake level during the fall and winter months (assuming sufficient rainfall) would provide residents and visitors with improved conditions for use of recreational facilities around the lake shoreline and for boating on the lake. Downstream of Logan Martin Dam, modeling showed a negligible decrease in flow from September through December as a result of maintaining a higher winter pool in Logan Martin Lake. The slight decrease during those months would not be expected to impact downstream land use.

As with Weiss Lake, the proposed change to Logan Martin Lake's maximum surcharge elevation would not affect land use around the lake. To offset the reduction in the lake's flood storage under the modified flood operations proposal, APC would purchase flowage easements downstream of the Logan Martin Dam. USACE will conduct additional analysis of impacts to private property both upstream and downstream of Weiss and Logan Martin dams. This analysis will provide the decision maker a comprehensive impact assessment of the effects for APC's current and proposed flood operations. Prior to implementation, it may be incumbent on APC to purchase any additional identified real interests as part of this proposed plan. This analysis and findings will be available for review in the Final FR/SEIS. APC's acquisition of flowage easements would not be expected to change the current land use on the easement lands but may include some specific restrictions on future land use options on those lands.

E.3.6.2.5 Lay Dam and Lake

No effects would be expected. Lay Dam and Lake is a run-of-river project, so lake levels are typically stable with minimal fluctuation. Implementing Alternative 11 would not change the operation of Lay Dam and Lake, and the changes in upstream operations at Allatoona, Weiss, and Logan Martin lakes would not change Lay Lake's operation. The dam would continue to be operated as a run-of-river project with the lake's normal pool elevation maintained at about 396 ft; therefore, there would be no effect on land use. Some deviation in reservoir elevation would continue due to seasonal and yearly variations in flow and climatic conditions.

E.3.6.2.6 Mitchell Dam and Lake

No effects would be expected. Mitchell Dam and Lake is a run-of-river project. Lake levels are typically stable with minimal fluctuation. Implementing Alternative 11 would not change the operation of Mitchell Dam and Lake, and the changes in upstream operations at Allatoona, Weiss, and Logan Martin lakes would not change Mitchell Lake's operating conditions. The dam would continue to be operated as a run-of-river project with the lake's normal pool elevation maintained at about 312 ft; therefore, there would be no effect on land use. Some deviation in reservoir elevation would continue due to seasonal and yearly variations in flow and climatic conditions.

E.3.6.2.7 Jordan Dam and Lake/Bouldin Dam

No effects would be expected. Alternative 11 would not change operation of Jordan Dam and Lake or Bouldin Dam. The HEC-ResSim model shows that the changes in upstream operations at Allatoona, Weiss, and Logan Martin lakes would not change Jordan Dam and Lake's or Bouldin Dam's baseline conditions. The dam would continue to be operated as a run-of-river project with the lake's normal pool elevation maintained at about 252 ft; therefore, there would be no effect on land use. Some deviation in reservoir elevation would continue due to seasonal and yearly variations in flow and climatic conditions.

E.3.6.3 Alternative 10

Under Alternative 10, the effects on land use at Allatoona Lake would likely be the same as those described for the NAA. At the APC lakes on the Coosa River, the effects of Alternative 10 compared to the NAA would likely be the same as those described for Alternative 11.

E.3.6.4 Alternative 3

Under Alternative 3, the effects on land use at Allatoona Lake and the APC reservoir projects on the Coosa River would likely be the same as those described for the NAA.

E.3.7 Biological Resources

The following sections describe the environmental consequences of the NAA and the TSP (Alternative 11) on biological resources in the ROI, including vegetation, wildlife, fish and aquatic resources, protected species, and fish and wildlife management facilities. Coordination and consultation with the USFWS and state fish and wildlife agencies regarding the effects of the TSP and alternatives on fish and wildlife resources and protected species are discussed in Section 7.3.1 of the main report, and all pertinent documentation of those efforts is provided in Appendix F to the Draft FR/SEIS.

E.3.7.1 Vegetation Resources

E.3.7.1.1 No Action Alternative

There would be no change in the degree of floodplain (lateral) connectivity under the NAA, and thus, no adverse effects on riparian, wetland, or SAV would be expected. Under the NAA, vegetation resources will continue to be exposed to a hydrologic regime influenced by current water control operations at USACE and APC reservoirs.

Water quality conditions under the NAA would generally be consistent with those described in Section E.1.2 for the affected environment. There are some water quality impairments within the ROI that would remain under the NAA, including chlorophyll *a* concentrations that fail to meet water quality standards throughout the ROI at the 95-percent occurrence interval and TP concentrations that fail to meet water quality standards throughout the ROI under most conditions. However, the effect of these impairments on existing vegetation should be negligible.

E.3.7.1.2 Tentatively Selected Plan (Alternative 11)

Effects on vegetation resources are generally expected to be negligible under the TSP and would be limited to the ROI, including the Etowah River, the Coosa River, and reservoirs along those rivers. The annual duration curve for Allatoona Lake shows that there will be a 1-ft increase in the range of lake elevation over much of the year. Also, at the 90-percent exceedance level during the year, lake levels will be 1–2 ft higher from December to June, and at 50- and 10-percent exceedance levels during the year, lake levels will be 1–2 ft higher from December to August. This change will create a slightly greater area of deep-water habitat and a slightly greater area of shallow-water habitat and wetland habitat during the times of higher lake levels. This slight, seasonal increase in pool elevation is expected to have slightly beneficial effects on the plant communities in Allatoona Lake.

Flows immediately below Allatoona Dam demonstrate minor changes from NAA to the TSP. The months when flows may be slightly lower than the NAA (late fall/winter) are periods of relatively low biological productivity. Little change is shown during the more active months (spring/early summer). Minor changes in flow are expected to have a negligible effect on vegetation resources in the Etowah River below Allatoona Lake because the vegetation community currently withstands an altered hydrology based on water control operations at Allatoona Dam and does not depend on natural stream hydrology. Slight seasonal changes in flow should continue to support the current vegetation community. In the Coosa River near Rome, GA, the only changes in flow for the TSP compared to the NAA are very slight increases in flow during December in the 80–95 percent of days exceeded range (dry conditions). That slight change is not expected to have a notable influence on vegetation communities.

Changes in the flood storage and flood operations at Weiss and Logan Martin lakes result in generally higher pool levels in both of the reservoirs under most conditions and slight seasonal changes in flows in the Coosa River

downstream of these reservoirs. The changes in pool levels and flows are expected to have slightly beneficial effects on vegetation communities in these reservoirs.

Changes to reservoir operations might be expected to affect nutrients, which are critical to vegetation health and growth. Excess nutrients can cause rapid population increases in certain species, which can reduce community diversity as these species outcompete other species. Effects of the TSP on TP and TN are negligible compared to the NAA, with the most notable effect being a decrease in TN concentrations of approximately 0.14 mg/L at the 95-percent occurrence upstream of Weiss Lake. TP concentrations would continue to exceed standards under most conditions. Some temporary exceedances of chlorophyll *a* standards would occur at equivalent concentrations for both the NAA and the TSP. Those slight changes in nutrients are expected to have a negligible effect on vegetation.

E.3.7.1.3 Alternative 10

The effects of Alternative 10 are nearly the same as those described for Alternative 11, except that Allatoona Lake would not have the benefit of a slightly higher pool level year-round because the reallocation of reservoir storage for water supply would come for conservation storage only. Even with this slight difference, Alternative 10 is expected to have negligible effects on vegetation resources in the Etowah River and Coosa River basins compared to the NAA.

E.3.7.1.4 Alternative 3

The proposed reservoir storage reallocation at Allatoona Lake would have negligible effects on vegetation resources in the Etowah River Basin, including Allatoona Lake. Alternative 3 does not include any proposed changes to operations of APC's Weiss and Logan Martin projects, and the storage reallocation in Allatoona Lake has minimal effects on flow conditions in the Coosa River near Rome, GA and no discernable effects further downstream. Thus, Alternative 10 would not affect vegetation resources in the Coosa River Basin.

E.3.7.2 Wildlife Resources

In this Draft FR/SEIS, *wildlife* refers to nonaquatic animals, including birds, mammals, reptiles, amphibians, and insects. Those animals use lakes and rivers to some extent, but they are generally not as sensitive to flow and water quality as aquatic animals. Because flows and lake levels would be minimally affected by the alternatives throughout the ACT River Basin, the primary mechanism by which wildlife resources could be affected by implementing the alternative WCM revisions is through an effect on water quality. The analyses of effects on wildlife resources in this section, therefore, rely primarily on the analysis of water quality, and adverse effects would not be expected from minor changes in water quality.

E.3.7.2.1 No Action Alternative

There would be negligible change in flow and water quality conditions under the NAA, and thus, any effects on wildlife resources in the ROI would be negligible. Wildlife resources in riparian or wetland areas will continue to be influenced by current water control operations at USACE and APC reservoirs.

E.3.7.2.2 Tentatively Selected Plan (Alternative 11)

Effects on wildlife resources are expected to be negligible under the TSP. The overall increase in pool elevations on Allatoona, Weiss, and Logan Martin lakes and slight changes in flows downstream of the reservoirs would not result in the permanent conversion of one habitat type into another compared to the NAA but will result in changes to the duration of inundation along the margins of lakes and slight seasonal differences in flow of the downstream river segments. Considering the degree to which hydrology and flow are altered from natural conditions under the NAA, the effects of hydrologic changes under the TSP should be negligible on wildlife that inhabits riparian and

wetland areas in the ROI. Effects on bird species that are protected under the Migratory Bird Treaty Act are also expected to be negligible.

Changes to reservoir operations could result in slight changes in water temperature, DO, and nutrients, but the effects of such changes on nonaquatic wildlife would be negligible.

E.3.7.2.3 Alternative 10

The effects of Alternative 10 are nearly the same as those described for Alternative 11, except that Allatoona Lake would not have the benefit of a slightly higher pool level year-round because the reallocation of reservoir storage for water supply would come for conservation storage only. Even with this slight difference, Alternative 10 is expected to have negligible effects on wildlife resources in the Etowah River and Coosa River basins compared to the NAA.

E.3.7.2.4 Alternative 3

The proposed reservoir storage reallocation at Allatoona Lake would have negligible effects on wildlife resources in the Etowah River Basin, including Allatoona Lake. Alternative 3 does not include any proposed changes to operations of APC's Weiss and Logan Martin projects, and the storage reallocation in Allatoona Lake has minimal effects on flow conditions in the Coosa River near Rome, GA and no discernable effects further downstream. Thus, Alternative 10 would not affect wildlife resources in the Coosa River Basin.

E.3.7.3 Fish and Aquatic Resources

In this Draft FR/SEIS, fish and aquatic resources include fish, mussels, aquatic snails, and other animals that are heavily dependent on aquatic resources. Those animals would, in general, be more sensitive than other wildlife to changes in flow, water quality, and lake levels.

E.3.7.3.1 No Action Alternative

Effects on fish and aquatic resources are expected to be negligible under the NAA. Fish and aquatic resources will continue to be influenced by current water control operations at USACE and APC reservoirs. The current management of pool elevations and discharges at the reservoirs provides stable deepwater lake habitat within each of the waterbodies and shallow-water lake habitat that shifts up and down-slope along the margins of the lakes as lake levels are raised and lowered. Allatoona Lake has the most drastic annual change in the ACT River Basin system, commonly experiencing a change of 20 ft in water surface elevation throughout an average year. Flow in the rivers downstream of the reservoirs is influenced more by discharges from the reservoirs than by storm events and seasonal changes in precipitation.

Water quality conditions under the NAA would generally be consistent with those described in Section E.1.2 for the affected environment. There are some water quality impairments within the ROI that would remain under the NAA, but their effect on fish and aquatic resources should be negligible.

E.3.7.3.2 Tentatively Selected Plan (Alternative 11)

Effects on fish and aquatic resources are generally expected to be negligible under the TSP. Slightly higher pool elevations in Allatoona Lake, Weiss Lake, and Logan Martin Lake will provide some additional deep-water and shallow-water habitat and may therefore have slightly beneficial effects on fish and aquatic resources in these reservoirs. In the Etowah River just downstream of Allatoona Dam, the months when flows may be slightly lower than the NAA (late fall/winter) are periods of relatively low biological productivity. Little change is shown during the more active months (spring/early summer). In the Coosa River at Rome, GA, there are slight decreases in flow

under certain conditions and, in the Coosa River at Logan Martin Dam, there are slight increases and slight decreases in flow under certain conditions. Studies of ecological response to altered flow regimes indicate that fishes show consistent negative responses to alteration of flow magnitude. However, most studies examine higher values of flow alteration. There are few studies on the response of fishes to more moderate ranges of flow alteration (Poff & Zimmerman, 2010). The slight alterations of flow that will result from changes in reservoir operations are not expected to create notable changes in the presence or abundance of specific habitat types (such as riffle habitat with moderate flow) or to have notable effects on population dynamics of aquatic species.

Changes to reservoir operations could result in slight changes in water temperature and DO, environmental parameters important to aquatic resources. For the Coosa River, the simulated temperatures for the TSP have only small deviations from the NAA between H. Neely Henry and Weiss lakes and downstream of Weiss, none of which are more than 1.5 °F. The TSP would have a minimal effect on the DO concentrations for the Coosa River. TSP model results show a minor decrease in DO from the NAA of 0.16 mg/L downstream of Weiss Lake at the 95-percent occurrence; however, this change is not expected to have a significant impact on water quality. These slight water quality changes should not impact aquatic resources.

E.3.7.3.3 Alternative 10

Compared to the NAA, the effects of Alternative 10 on fish and aquatic resources, in general, would be nearly identical to those described for Alternative 11. Those effects overall would be negligible. Seasonally higher pool levels may provide a slight benefit to fishery resources in the reservoirs.

E.3.7.3.4 Alternative 3

Alternative 3 is limited to proposed reservoir storage reallocation in Allatoona Lake. The effects of Alternative 3 on fish and aquatic resources in the Etowah River and Coosa River basins would be negligible.

E.3.7.4 Protected Species (Federal and State)

Reservoir operations can influence two types of direct or indirect actions that could affect the habitats of federally and state-protected species:

- Alteration of flow regimes in reservoirs and downstream of dams
- Water quality degradation

USACE is responsible for determining project-specific effects on protected species because the effects depend largely on where and how the actions occur. USACE also is responsible for pursuing consultation with USFWS in accordance with Section 7 of the ESA regarding any expected effects on those species.

Little information is available on linkages between flow regime characteristics and the life histories of protected species occurring in the basin. While that is beyond the scope of the current effort, it might be possible to quantify optimal flow regimes for some of or all the riverine-dependent species or even minimum flow regimes that would ensure each species' survival and persistence in the basin. Such an effort would show that some species do best in wet years and others do best in dry years. However, overall biological diversity and ecosystem function benefit from interannual variations in species success (Tilman, Downing, & Wedin, 1994). Previous efforts at riverine ecosystem restoration have demonstrated that it is impossible to simultaneously optimize conditions for all species (Sparks, 1992) (Sparks, 1995) (Toth, 1995). Therefore, the best strategy for protecting the ecology and biodiversity of the basin, including its protected species, is to maintain or restore to some extent the natural patterns of variability of flow regimes throughout the basin.

Riverine communities generally require clean water with sufficiently high DO concentration and appropriate temperatures. Although water quality has improved in the ACT River Basin since the 1970s because of controls on point source pollutant discharges under the CWA, water quality problems related largely to nonpoint source sedimentation and other contaminants continue in many river reaches. Biological conditions in the ACT River Basin are most severely degraded in the urbanized reaches of the basin (Frick, et al., 1998). Water quality degradation is a frequently cited concern for the riverine-dependent species included in the *Comprehensive Study's Protected Species Report* (Ziewitz, Luprek, & Kasbohm, 1997). It is quite likely that water quality is a limiting factor for several of the species, including many of the 12 federally listed mussels listed in Table E-35. Any actions that could alter water quality must address effects on the protected species.

E.3.7.4.1 No Action Alternative

The NAA is not expected to adversely affect protected species in the ROI. Conditions under the NAA are generally consistent with the environmental baseline condition. There are some water quality impairments within the ROI that would remain under the NAA, but their effect on protected species that currently inhabit rivers and reservoirs in the ROI should be negligible.

E.3.7.4.2 Tentatively Selected Plan (Alternative 11)

Effects on federally listed endangered or threatened species in the ROI are expected to be negligible under the TSP. The only areas that show any water quality or water quantity effect under this alternative are the main stem of the Etowah River downstream of its confluence with Hickory Log Creek at Canton, GA; the main stem of the Coosa River downstream to its confluence with the Tallapoosa River near Montgomery, AL; and the reservoirs along those rivers. Those water quality and quantity changes are negligible to minor and tend to occur primarily in the winter and early spring months. Terrestrial wildlife, including birds, mammals, and reptiles that may be present in the action area will have some dependency on the water resources in that area. However, those species are unlikely to be measurably affected by the very slight changes in flow and lake level conditions in the primary rivers that result from the currently proposed action. While it is conceivable that they could be affected by the proposed action, the likelihood that these species would be adversely affected by the proposed action is negligible. Upland vegetation will not be affected by proposed water management actions and wetlands will be minimally influenced. The proposed actions will not result in the permanent conversion of one habitat type into another but will result in changes to the duration of inundation along the margins of lakes and slight seasonal differences in flow of the downstream river segments. Considering the degree to which hydrology and flow are altered from natural conditions under baseline conditions, the effects of hydrologic changes under the TSP should be negligible on wildlife that inhabits riparian and wetland areas in the ROI.

Table E-35 lists 11 federally protected fish species within the Coosa River and Etowah River basins; however, just three of the species inhabit the main stem of the rivers and their associated reservoirs: the blue shiner, which occurs in the Coosa River near Weiss Lake; and the Cherokee darter and the Etowah darter, which inhabit the Etowah River and Allatoona Lake (USFWS, 2019b) (USFWS, 2019c). Additionally, the state-protected lake sturgeon inhabits both the Coosa and Etowah rivers.

Table E-35 lists 12 federally protected mussel species within the Coosa and Etowah river basins; however, just 10 of those species inhabit the main stem of the rivers and their associated reservoirs: the Alabama moccasinshell, Coosa moccasinshell, finelined pocketbook, Georgia pigtoe, ovate clubshell, southern acornshell, triangular kidneyshell, and upland combshell inhabit parts of the Coosa River; and the southern clubshell and southern pigtoe inhabit parts of both the Coosa and Etowah rivers. Table E-35 lists seven federally protected snail species within the Coosa River and Etowah River basins; however, just five of those species inhabit the main stem of thee rivers and their associated reservoirs: the cylindrical lioplax, interrupted rocksnail, painted rocksnail, rough hornsnail, and tulotoma snail inhabit parts of the Coosa River. Critical habitat is not designated for any species along the Coosa River, the Etowah River, or the reservoirs along those rivers.

In the Etowah River just downstream of Allatoona Dam, the months when flows might be slightly lower than the NAA (late fall/winter) are periods of relatively low biological productivity. Little change is shown during the more active months (spring/early summer). In the Coosa River at Rome there are slight decreases in flow under certain conditions, and in the Coosa River at Logan Martin Dam, there are slight increases and slight decreases in flow under certain conditions. These slight changes in flow are not expected to create notable changes in the presence or abundance of specific habitat types (such as riffle habitat with moderate flow), and, therefore, are not expected to have notable effects on population dynamics of protected species.

Changes to reservoir operations might result in slight changes in water temperature and DO, environmental parameters that are important to aquatic resources. Protected fish, mussel, and snail species would be the most susceptible to changes in water quality. For the Coosa River, the simulated temperatures for the TSP have only small deviations from the NAA between H. Neely Henry and Weiss lakes and downstream of Weiss, none of which are more than 1.5 °F. The TSP would have a minimal effect on the DO concentrations for the Coosa River. The TSP model results show a minor decrease in DO from the NAA of 0.16 mg/L downstream of Weiss Lake at the 95-percent occurrence; however, this change is not expected to have an appreciable impact on water quality. These slight water quality changes should not impact aquatic resources, including protected species that might be sensitive to changes in water quality.

E.3.7.4.3 Alternative 10

Compared to the NAA, Alternative 10 is expected to have negligible effects on protected terrestrial and avian species and protected upland plant species. Effects on protected aquatic species (fish, mussels, and snails) and protected wetland/aquatic plant species are expected to be minimal and not likely to adversely affect those species or their critical habitats.

E.3.7.4.4 Alternative 3

Compared to the NAA, Alternative 3 is expected to have negligible effects on protected terrestrial and avian animal species and protected upland plant species. Effects on protected aquatic species (fish, mussels, and snails) and protected wetland/aquatic plant species are expected to be minimal and not likely to adversely affect those species or their critical habitats.

E.3.7.5 Fish and Wildlife Management Facilities

E.3.7.5.1 No Action Alternative

Changes in water surface elevations under the NAA would be negligible and would not be expected to affect wildlife management operations or hunting opportunities at Coosa WMA in Alabama, would not be expected to affect wildlife management operations or hunting opportunities at Allatoona WMA, a federal property in Georgia, and would not be expected to affect wildlife management operations or boating and fishing opportunities at Red Top Mountain State Park in Georgia.

There are some water quality impairments within the ROI that would remain under the NAA, but their effect on fish and wildlife management facilities should be negligible.

E.3.7.5.2 Tentatively Selected Plan (Alternative 11)

Changes in water surface elevations under the TSP would be minor and would not be expected to affect wildlife management operations or hunting opportunities at Coosa WMA in Alabama, would not be expected to affect wildlife management operations or hunting opportunities at Allatoona WMA and would not be expected to affect wildlife management operations or boating and fishing opportunities at Red Top Mountain State Park.

The minor changes in water quality that are expected as a result of changes to reservoir operations should not affect fish and wildlife management facilities in the ROI.

E.3.7.5.3 Alternative 10

The effects of Alternative 10 on fish and wildlife management facilities would be the same as described for Alternative 11. No effects would be expected.

E.3.7.5.4 Alternative 3

The effects of Alternative 3 on fish and wildlife management facilities would be the same as described for Alternative 11. No effects would be expected.

E.3.8 Socioeconomic Resources

The following subsections briefly describe the expected changes to M&I water supply, navigation, hydropower generation, flood risk management, recreation, agricultural water supply, environmental justice, and the protection of children. Additional details can be found in the Plan Formulation and Economics appendices.

E.3.8.1 Municipal and Industrial Water Supply

This section provides a summary of the effects of M&I water supply as resulting from an increase in demand due to future projections and the ability of alternatives to meet those demands. Additional information can be found in Section D.4 of Appendix D to the Draft FR/SEIS. The forecasted demand by CCMWA and the City of Cartersville is presented in Table E-64.

Table E-64. Forecasted 2050 Water Supply Demands for Withdrawal from Allatoona Lake

Water Provider	Average Annual Day – Million Gallons per Day (aad-mgd)
Cobb County-Marietta Water Authority	57
City of Cartersville / Bartow County	37
Total Demand	94

E.3.8.1.1 No Action Alternative

Under the NAA, no additional water would be allocated to meet the year 2050 projected demand of 94 average annual day-million gallons per day (aad-mgd). The lack of additional water supply could lead to water shortages in the future if the water supply is not attained through alternative means such as new reservoir construction.

E.3.8.1.2 Tentatively Selected Plan (Alternative 11)

Under Alternative 11, the year 2050 M&I water supply demand of 94 aad-mgd would be met through reallocation of water supply storage out of the conservation and flood control pool at Allatoona Lake.

E.3.8.1.3 Alternative 10

Under Alternative 10, the year 2050 M&I water supply demand of 94 aad-mgd would be met through reallocation of water supply storage out of the conservation pool at Allatoona Lake.

E.3.8.1.4 Alternative 3

Under Alternative 3, the year 2050 M&I water supply demand of 94 aad-mgd would be through reallocation of water supply storage out of the conservation pool at Allatoona Lake. Alternative 3 is equal to alternative 10 for the M&I water supply, however the alternatives differ in proposed operational changes of the APC projects on the Coosa River in Alabama.

E.3.8.2 Navigation

Navigation is an authorized purpose in the ACT River Basin. Channel availability was modeled for both a 7.5-ft and 9-ft channel. The percentage of time the navigation channel depths would likely be available differs slightly among alternatives (see Table E-65). However, navigation on the ACT River Basin is currently underutilized with less than 1 million total tons being transported between years 1999 and 2017 as shown in Table E-39.

Table E-65. ACT River Basin - Alabama River Navigation Channel Depth Availability

Alternative	Storage Accounting Method	Percentage of Time 9-ft Navigation Depth Channel Available	Percentage of Time 7.5-ft Navigation Depth Channel Available
NAA	USACE	82.9%	85.9%
3	GA	82.9%	85.4%
10	USACE	80.7%	85.0%
11	USACE	80.7%	85.1%

E.3.8.2.1 No Action Alternative

Under the NAA, the percentage of time that project operations would provide for 9-ft and 7.5-ft navigation channel depth would be 82.9 percent and 85.9 percent, respectively. Due to the underutilization of the navigation channel, the current availability percentages are not expected to impact navigation on the Alabama River.

E.3.8.2.2 Tentatively Selected Plan (Alternative 11)

For Alternative 11, the percentage of time that project operations would provide for 9-ft and 7.5-ft navigation channel depth would be 80.7 percent and 85.1 percent, respectively. These slightly reduced percentages compared to the NAA are associated with APC-proposed changes to flood operations at Weiss and Logan Martin Dams. The reductions to a negligible effect on navigation channel availability. Due to the current and expected future underutilization of the navigation channel, these slightly reduced availability percentages are not expected to impact navigation on the Alabama River.

E.3.8.2.3 Alternative 10

For Alternative 10, the percentage of time that project operations would provide for 9-ft and 7.5-ft navigation channel depth would be 80.7 percent and 85.0 percent, respectively. These slightly reduced percentages compared to the NAA are associated with APC-proposed changes to flood operations at Weiss and Logan Martin Dams. The

reductions to a negligible effect on navigation channel availability. Due to the underutilization of the navigation channel, these slightly reduced availability percentages are not expected to impact navigation on the Alabama River

E.3.8.2.4 Alternative 3

For Alternative 3, the percentage of time that project operations would provide for 9-ft and 7.5-ft navigation channel depth would be 82.9 percent and 85.4 percent, respectively. These percentages are nearly identical to those for the NAA. Due to the underutilization of the navigation channel, these availability percentages are not expected to impact navigation on the Alabama River.

E.3.8.3 Hydropower Generation

The hydropower analysis was performed by the USACE Hydropower Analysis Center over the entire ACT River Basin system, including both federal and private generation plants. Table E-66 presents the current value of hydropower generation dependable capacity the all the hydropower projects (USACE and APC) in the ACT River Basin for the NAA and Alternatives 11, 10, and 3. For a more details on the hydropower analysis, refer to Section 6 of Appendix D to the Draft FR/SEIS.

Table E-66. ACT River Basin Hydropower Projects - Value of Dependable Capacity

Alternatives > Projects V		NAA (Base2018)	Alternative 11 (A11_WS6MF)	Alternative 10 (A10_WS2MF)	Alternative 3 (A03_WS1)
Allatoona	Federal	$12,171,439	$12,176,229	$11,987,283	$11,998,932
Carters	Federal	$91,676,016	$91,675,768	$91,675,768	$91,675,768
Millers Ferry	Federal	$18,809,672	$18,780,560	$18,774,159	$18,808,806
R.F. Henry	Federal	$16,024,183	$15,997,727	$15,990,752	$16,020,930
Federal	**Subtotal**	**$138,681,310**	**$138,630,285**	**$138,427,961**	**$135,777,856**
Harris	Non-Federal	$20,324,064	$20,327,674	$20,331,070	$20,329,455
H. Neely Henry	Non-Federal	$11,820,078	$11,781,911	$11,773,542	$11,809,549
Jordan	Non-Federal	$19,669,654	$19,622,064	$19,618,577	$19,664,794
Lay	Non-Federal	$34,972,575	$34,851,512	$34,849,221	$34,950,076
Logan Martin	Non-Federal	$25,835,264	$25,833,682	$25,830,823	$25,814,232
Martin	Non-Federal	$32,741,963	$33,116,607	$33,115,689	$32,126,943
Mitchell	Non-Federal	$32,680,019	$32,593,482	$32,572,045	$32,659,957
Thurlow	Non-Federal	$16,156,554	$16,157,729	$16,155,558	$16,161,523
Bouldin	Non-Federal	$45,440,193	$45,280,651	$45,222,219	$45,400,221
Weiss	Non-Federal	$13,758,229	$13,777,245	$13,756,217	$13,742,600
Yates	Non-Federal	$9,549,558	$9,439,622	$9,437,603	$9,441,726
Non-Federal	**Subtotal**	**$262,948,149**	**$262,782,180**	**$262,662,563**	**$263,101,075**
System	**Total**	**$401,629,460**	**$401,412,465**	**$401,090,524**	**$398,878,931**

E.3.8.3.1 No Action Alternative

Under the NAA, the current value of hydropower generation dependable capacity in the ACT River Basin is $401,629,460 annually.

E.3.8.3.2 Tentatively Selected Plan (Alternative 11)

For Alternative 11, changes in operations are forecasted to create a decrease in total system dependable capacity (Federal and non-Federal projects) from $401,629,460 to $401,412,465 annually, or a decrease of 0.05 percent.

E.3.8.3.3 Alternative 10

For Alternative 10, changes in operations are forecasted to create a decrease in total system dependable capacity (Federal and non-Federal projects) from $401,629,460 to $401,090,524 annually, or a decrease of 0.12 percent.

E.3.8.3.4 Alternative 3

For Alternative 3, changes in operations are forecasted to create a decrease in total system dependable capacity (Federal and non-Federal projects) from $401,629,460 to $398,878,931 annually, or a decrease of 0.69 percent.

E.3.8.4 Flood Risk Management

E.3.8.4.1 No Action Alternative

Under the NAA, water surface elevations and flows are not expected to change from the existing level of flood risk, which is beyond that of an unregulated system.

E.3.8.4.2 Tentatively Selected Plan (Alternative 11)

Under Alternative 11, water surface elevations and flows are slightly increased causing small amounts of induced flooding. Overall, an acceptable level of flood risk would be maintained, and areas that may have never developed under unregulated Oostanaula, Etowah, or Coosa rivers would continue to receive flood risk management (FRM) benefits provided by the USACE Allatoona project and the APC projects along the Coosa River. Any increases in water surface elevations seen downstream are in fractions of a ft and, except for in events above the 1.0 percent annual chance exceedance, do not appear to expand the extent of flooding to previously unimpacted structures beyond marginal amounts.

E.3.8.4.3 Alternative 10

Under Alternative 10, water surface elevations and flows are not expected to change from the existing level of flood risk below Allatoona Dam, which is beyond that of an unregulated system. In the areas affected by the APC projects, the affects from Alternative 10 would be the same as those under Alternative 11.

E.3.8.4.4 Alternative 3

Under Alternative 3, water surface elevations and flows are not expected to change from the existing level of flood risk below Allatoona Dam, and areas affected by the APC projects would remain in the same state as the NAA.

E.3.8.5 Recreation

National economic development recreation benefits were used as the basis of comparing alternatives. The Unit Day Value (UDV) analysis methodology was used for computing benefits associated with the alternatives considered in

detail, and a summary of the results is provided in Table E-67. More detail on the UDV analysis methodology and its application to this project is included in Section 5 of Appendix D to the Draft FR/SEIS.

Table E-67. Recreation Benefits at Allatoona, Weiss, and Logan Martin Lakes Associated with Proposed Alternatives

Project and Scenario	Annualized Recreation Value ($)	Present Value ($)	Annualized Change vs. Without Project	Percent Change
Allatoona				
No Change Scenario	$73,784,300	$1,944,349,000	$0	0%
With Change Scenario [1]	$74,481,000	$1,962,708,000	$696,700	0.9%
Weiss				
No Change Scenario	$15,881,400	$418,503,000	$0	0%
With Change Scenario [2]	$16,208,700	$427,127,000	$327,300	2.1%
Logan Martin				
No Change Scenario	$16,167,000	$426,030,000	$0	0%
With Change Scenario [2]	$16,666,000	$439,180,000	$499,000	3.1%

[1] Allatoona WCS alternatives: 5, 8, 11, 13
[2] Weiss and Logan Martin WCS alternatives: 9, 10, 11, 12, 13

E.3.8.5.1 No Action Alternative

The NAA is the current level of recreation benefits generated annually at Allatoona, Weiss, and Logan Martin lakes (locations where there are proposed changes to operations).

E.3.8.5.2 Tentatively Selected Plan (Alternative 11)

Under Alternative 11, estimated annual recreation benefits increase by $1,523,000 from $105,832,700 to $107,355,700 across the 3 projects.

Raising the summer guide curve at Allatoona Lake to 841 ft would result extended periods during the summer months (May–August) when the pool level would be 1 ft higher than current operational practices, except during flood events. Based on model simulation over the period of record, pool levels would be expected to be greater than 840 ft and up to, or equal to, 841 ft on 75 percent of days in May, 64 percent of days in June, 30 percent of days in July, and 12 percent of days in August. The slightly higher pool levels at Allatoona under Alternative 11 could require some extension of existing rip rap/bulkheads, relocation of aids to navigation, modifications to public boat ramps, and modifications to public beaches on the lake, and an update to the project's shoreline management plan. These effects are not expected to have substantial effects on public recreation at Allatoona Lake. Estimated costs for the modifications discussed above have been included as a specific cost to the cost of storage to the water supply user. These costs are presented in Section 7.6.4 of the Draft FR/SEIS main report.

E.3.8.5.3 Alternative 10

Under Alternative 10, estimated annual recreation benefits increase by $826,300 from $32,048,400 to $32,874,700. These benefits are the result of changes in lake levels at Weiss and Logan Martin lakes.

E.3.8.5.4 Alternative 3

Under Alternative 3, no changes to recreation are expected due to no lake elevation changes at any of the affected projects.

E.3.8.6 Agricultural Water Supply

Agricultural water supply withdrawals in the Alabama and Georgia portions of the ACT River Basin are summarized in Section E.1.7.6. Generally, surface water withdrawals for agricultural water supply in the basin are less than 5 percent of the total surface water withdrawals.

E.3.8.6.1 No Action Alternative

Under the NAA, agricultural water supply withdrawals would occur as described in Section E.1.7.6.

E.3.8.6.2 Tentatively Selected Plan (Alternative 11)

Alternative 11 would have a negligible effect on agricultural water supply in the ACT River Basin.

E.3.8.6.3 Alternative 10

Alternative 10 would have a negligible effect on agricultural water supply in the ACT River Basin.

E.3.8.6.4 Alternative 3

Alternative 3 would have a negligible effect on agricultural water supply in the ACT River Basin.

E.3.8.7 Environmental Justice

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,* requires that federal agencies identify and address disproportionately high and adverse human health or environmental effects on minority and low-income populations that might result from their programs, policies, and activities. Under the EO, USEPA was directed to ensure that agencies analyze environmental effects on minority and low-income communities, including human-health, social, and economic effects. Table E-45 provides information on the demographic characteristics of the ACT River Basin with a specific focus on the minority, low-income, and disadvantaged communities.

During the scoping process for this EIS, no significant environmental justice concerns relative to water management operations in the ACT Basin reservoirs were identified. Access and use of the USACE reservoirs in the basin by minority and low-income populations would most likely focus on shoreline access activities like picnicking, wading/swimming, and recreational and subsistence fishing, primarily from the bank or public docks/piers, rather than on boating-related activities that would tend to be somewhat less dependent on high lake levels. Low water levels in the lakes tend to affect those shoreline access activities slightly more than boating-related activities. Access and usability of lake resources for all visitors could be adversely affected by extended periods with low lake levels, but effects could be marginally higher for low-income and minority visitors who may depend on shoreline access for activities such as recreational and subsistence fishing.

E.3.8.7.1 No Action Alternative

Seasonal fluctuations in the water surface elevations under the NAA, even with relatively normal rainfall conditions in the basin, could create minor inconveniences for local residents, including low-income and minority populations, who use USACE reservoirs for fishing and other forms of recreation. Those uses might be more constrained during

extreme drought years, but those constraints and their associated effects are not likely to be disproportionately higher for low-income and minority populations. All lake users could be affected under those conditions, which might last for months at a time but are temporary. USACE resource managers at the lakes work closely with the public under such circumstances and pursue reasonable temporary measures to maintain at least a minimum level of access to the lakes until the extreme conditions improve.

The Master Manual and the individual project WCMs outline current communication measures to promote and maintain public safety at USACE projects, both in the reservoirs and the tailrace areas below the dams, including automated warning systems associated with rapid changes in flow and stage conditions downstream of the dams when hydropower generation is initiated and/or spillway gates are opened.

E.3.8.7.2 Tentatively Selected Plan (Alternative 11)

Alternative 11 would have essentially the same effects as described for NAA in Section E.3.8.7.1 with respect to minority and low-income populations.

E.3.8.7.3 Alternative 10

Alternative 10 would have essentially the same effects as described for NAA in Section E.3.8.7.1 with respect to minority and low-income populations.

E.3.8.7.4 Alternative 3

Alternative 3 would have essentially the same effects as described for NAA in Section E.3.8.7.1 with respect to minority and low-income populations.

E.3.8.8 Protection of Children

EO 13045 requires federal agencies to consider and address the impacts of their activities on children with respect to environmental health and safety risks (see Section E.1.7.12 for more details). Table E-45 provides information on the number and general characteristics of children residing in the ACT River Basin. Operation of large reservoir projects provide increased opportunities for public access and use, particularly in the form of water-based recreation. Public use of the projects inherently includes a level of health and safety risk to both adults and children. USACE pursues extensive measures at operating projects to minimize such risks by implementing water safety and other education programs, providing clear signage, marking designated uses areas, removing hazards where appropriate, restricting public access to certain areas designated for authorized personnel only, and other activities designed to promote safe use, many of which are directly focused on children who visit the projects.

E.3.8.8.1 No Action Alternative

The environmental health and safety activities at USACE projects as described in Section E.3.8.8 would be expected to continue and would be adjusted over time as needs might change. Existing water management activities at the reservoirs do not impose any undue risks to children that are not effectively addressed by the current activities.

E.3.8.8.2 Tentatively Selected Plan (Alternative 11)

Alternative 11 would have the same effects relative to protection of children as described for the NAA in Section E.3.8.8.1. No additional risks would be imposed by the proposed updates to water management practices or increased water supply.

E.3.8.8.3 Alternative 10

Alternative 10 would have the same effects relative to protection of children as described for the NAA in Section E.3.8.8.1. No additional risks would be imposed by the proposed updates to water management practices or increased water supply.

E.3.8.8.4 Alternative 3

Alternative 3 would have the same effects relative to protection of children as described for the NAA in Section E.3.8.8.1. No additional risks would be imposed by the proposed updates to water management practices or increased water supply.

E.3.9 Aesthetic Resources

E.3.9.1 No Action Alternative

Under the NAA, both USACE and APC reservoirs serve as valuable aesthetic assets in the ACT River Basin. The periods of winter drawdown for Allatoona Lake, Weiss Lake, and Logan Martin Lake under the NAA would continue to decrease their aesthetic value during the winter months, as described in Section E.1.8. The free-flowing reaches of rivers and streams, wetlands, and upland areas (Piedmont to Southern Appalachian Mountainous) across the basin are important visual assets, as presented in Section E.1.8. These visual assets in the ACT River Basin are generally expected to remain unchanged under the NAA.

E.3.9.2 Tentatively Selected Plan (Alternative 11)

Alternative 11 would raise the winter pool levels in Weiss Lake and Logan Martin Lake by 3 ft and 2 ft, respectively. Those changes would result in about 5,100 ac less of exposed lake bed at Weiss Lake and about 1,300 ac less of exposed lake bed at Logan Martin Lake compared to the current winter drawdown levels at those lakes. The water supply storage reallocation proposal for Allatoona Lake would increase the level of the lake by up to 1 ft throughout the year compared to current operations. At any given time of year, this change would likely result in 200–300 ac less of exposed lake bottom. Implementing the TSP would have a beneficial aesthetic effect on the three reservoirs.

E.3.9.3 Alternative 10

Compared to the NAA, Alternative 10 would have the same effects on aesthetic resources in the basin as described for Alternative 11.

E.3.9.4 Alternative 3

Alternative 3 would have the same effects on aesthetic resources in the basin as the NAA.

E.3.10 Air Quality and General Conformity

E.3.10.1 No Action Alternative

Under the NAA, air quality and air emissions along the Coosa River and Etowah River (including the Allatoona, Weiss, H. Neeley Henry, and Logan Martin project areas) would continue generally as described in Section E.1.9. Future changes in population and land use may occur in the project area under the NAA, potentially resulting in some minor changes to regional air quality and air emissions in the project area.

E.3.10.2 Tentatively Selected Plan (Alternative 11)

Alternative 11 is not expected to result in any reasonably foreseeable direct or indirect emissions. Such types of federal activities are specifically exempt from the general conformity regulations. The requirements of the general conformity rule would not apply to the TSP because the proposed activities would result in no emissions increase (40 CFR 93.153(c)(2)). A Record of Non-Applicability to the general conformity rule has been prepared and is provided as an attachment to this appendix. Future changes in population and land use, independent of the TSP, could potentially cause minor changes to regional air quality and air emissions in the project area.

E.3.10.3 Alternative 10

Compared to the NAA, the effects of Alternative 10 for air quality and general conformity would be the same as those described for Alternative 11.

E.3.10.4 Alternative 3

The effects of Alternative 3 for air quality and general conformity would be essentially the same as those described for Alternative 11 at Allatoona Lake and the same as the NAA for the Coosa River from Weiss Lake to its confluence with the Tallapoosa River.

E.3.11 Noise

E.3.11.1 No Action Alternative

Under the NAA, noise levels along the Coosa River and Etowah River (including the Allatoona, Weiss, H. Neeley Henry, and Logan Martin project areas) would continue generally as described in Section E.1.10. In most areas along this corridor, noise levels typically do not present major challenges or concerns. Small changes in the natural soundscape associated with water movement, and animal movement and vocalizations in and around the projects could occur. Localized higher noise levels would tend to occur in more urbanized areas around the reservoirs or during periods of more concentrated boating/jet ski activity on the reservoirs.

E.3.11.2 Tentatively Selected Plan (Alternative 11)

Alternative 11 would not be expected to cause increased noise levels along the Coosa River and Etowah River (including the Allatoona, Weiss, H. Neeley Henry, and Logan Martin project areas). No new noise from man-made sources would be introduced by implementing the TSP. Although noise is partially a function of population and land use throughout the basin, no major changes in current noise level conditions are expected in the foreseeable future.

E.3.11.3 Alternative 10

Compared to the NAA, the effects of Alternative 10 for noise levels would be the same as those described for Alternative 11.

E.3.11.4 Alternative 3

The effects of Alternative 3 for noise levels would be essentially the same as those described for Alternative 11 at Allatoona Lake and the same as the NAA for the Coosa River from Weiss Lake to its confluence with the Tallapoosa River.

E.3.12 Traffic and Transportation

E.3.12.1 No Action Alternative

Under the NAA, traffic and transportation resources in the general vicinity of the Coosa River and tributaries (including the USACE and APC reservoirs) would continue to exist as generally described in Section E.1.11 and serve local and regional transportation needs as they currently do. No major expansion of transportation resources in the vicinity of the Coosa or Etowah River that would potentially affect the continued operations of USACE and APC reservoirs is expected in the foreseeable future. Commercial navigation and recreational boating activities would continue as discussed in Section E.1.7.2 and Section E.1.7.5, respectively.

E.3.12.2 Tentatively Selected Plan (Alternative 11)

Alternative 11 would not be expected to result in effects to major traffic and transportation resources in the general project area, nor would the TSP have a discernable effect on traffic and transportation resources immediately adjacent to the dams and lakes as needed for project operations, access by local residents, and access by visitors to the shoreline, lake, public use facilities (marinas, parks, and picnic areas). Railroad, Interstate highways, and U.S. highways that cross or run along the Coosa and Etowah rivers (including the USACE and APC reservoirs) would not be affected by the TSP. The effects of the TSP on commercial navigation and recreational boating activities are discussed in Section E.3.8.

E.3.12.3 Alternative 10

Compared to the NAA, the effects of Alternative 10 for traffic and transportation would be essentially the same as those described for Alternative 11.

E.3.12.4 Alternative 3

The effects of Alternative 3 for traffic and transportation would be essentially the same as those described for Alternative 11 at Allatoona Lake and the same as the NAA for the Coosa River from Weiss Lake to its confluence with the Tallapoosa River.

E.3.13 Cultural Resources

E.3.13.1 No Action Alternative

Under the NAA, cultural resources present at Allatoona Lake, Weiss Lake, Logan Martin Lake, and downstream of those three projects are expected to remain in place and be exposed to the normal range of current operating practices at those projects, as described in Section E.1.12. The APE is expansive and has high potential for cultural resources, including pre-Contact Native American and historic period sites. Some portions of the APE have been surveyed for cultural resources and data, particularly from work previously conducted at USACE's Allatoona Lake, indicate that some sites have been impacted by normal reservoir operations.

E.3.13.2 Tentatively Selected Plan (Alternative 11)

Alternative 11 would include actions at Allatoona, Weiss, and Logan Martin lakes that would result in changes to seasonal water levels and minor changes in the volume of water released from the dams that fall within the full range of pool elevation and downstream releases that already occur at the projects under current operations. To determine

if sites within the Weiss and Logan Martin lakes within the APE are being affected by current operations and could be affected by the proposed modified flood operations will necessitate background research and record searches.

Because the changes to pool levels and downstream releases that would occur under Alternative 11 would be well within the range of conditions already being experienced under current operations, it is likely that any adverse effects would be minimal. Nonetheless, Alternative 11 does have some potential to cause adverse effects upon cultural resources within the APE. Differentiating these effects from those caused by normal operations will be difficult. Comparing the frequency of wet/dry cycles associated with lake-level fluctuations under current operations to the frequency of wet/dry cycles under Alternative 11 will be required to determine whether the cycles might occur more frequently under Alternative 11. A *wet/dry cycle* is defined as an instance of a given water surface elevation that becomes inundated, then dries for at least 1 week. Section 106 coordination and consultation with the State Historic Preservation Offices from Alabama and Georgia and the Mobile District's Tribal partners will be necessary. Furthermore, as the impacts to listed, eligible, or potentially eligible cultural resources cannot be currently understood, a Programmatic Agreement is currently being developed to address adverse effects to historic properties.

E.3.13.3 Alternative 10

Compared to the NAA, the effects of Alternative 10 with respect to cultural resources would be essentially the same as those described for Alternative 11.

E.3.13.4 Alternative 3

The effects of Alternative 3 for cultural resources would be essentially the same as those described for Alternative 11 at Allatoona Lake and the same as the NAA for the Coosa River from Weiss Lake to its confluence with the Tallapoosa River.

E.3.14 Hazardous and Toxic Materials

E.3.14.1 No Action Alternative

Under the NAA, conditions with respect to management, use, and disposal of hazardous and toxic materials and potential exposure to previously disposed hazardous and toxic wastes in the vicinity of USACE and APC projects along the Coosa and Etowah rivers would be expected to continue as described in Section E.1.13. Routine project operations activities at USACE and APC reservoirs in the project area would continue to use hazardous and toxic materials. The handling, use, storage, and disposal of such materials from those operations would be conducted accordance with label recommendations and local, state, and federal regulatory guidelines. No increased risk of exposure to or release of hazardous or toxic materials along the Coosa River to an extent greater than currently exists would be expected from implementing the NAA.

E.3.14.2 Tentatively Selected Plan (Alternative 11)

Under Alternative 11, no change would be expected relative to the management, use, and disposal of hazardous materials associated with routine O&M activities on USACE and APC projects. The handling, use, storage, and disposal of such materials would continue in accordance with label recommendations and local, state, and federal regulatory guidelines.

Implementing the proposed modified flood operations at Weiss and Logan Martin dams and lakes would not be likely to pose an increased risk of release of hazardous and toxic materials from industrial and commercial sites as identified in Section E.1.13. Using data from the 1979 Coosa River flood–the largest on record–and select locations downstream

of Logan Martin Dam, USACE considered modified flood operations that would be expected to increase the depth of downstream flooding. Based on the 1979 flood data and a cut back of water releases, a similar flood event would likely increase downstream flooding depths by about 1.2 ft approximately 0.25 mi downstream of the dam with flood depths decreasing to about 0.42 ft above 1979 levels approximately 22 mi downstream of the dam. Flood levels up to 7 mi downstream of the dam would likely range between 1.2 ft and 1.0 ft and would occur in areas that are predominately forested or used for agriculture. Beyond 7 mi downstream, where industrial and commercial activities occur along the river, flood levels decrease to less than 1 ft above 1979 levels. Below Weiss Dam, similar flood levels would be expected along the river where forested and agricultural land dominate. Overall, inundation risks to industrial and commercial facilities where hazardous materials and waste are used or generated are minimized because such facilities along the river are typically on topographic highs or high ground to avoid inundation from such flood events.

E.3.14.3 Alternative 10

Compared to the NAA, the effects of Alternative 10 relative to hazardous and toxic materials/waste considerations would be the same as those described for Alternative 11.

E.3.14.4 Alternative 3

The effects of Alternative 10 relative to hazardous and toxic materials/waste considerations at Allatoona Lake would likely be the same as those described for the NAA. Alternative 3 does not include proposed modifications to flood operations at the Weiss and Logan Martin projects. Therefore, the effects of Alternative 3 would likely be the same as those described for the NAA.

E.3.15 Cumulative Effects

Cumulative effect is "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative effects can result from actions that may be individually minor but collectively significant actions over time.

USACE operates five multipurpose reservoir projects and APC operates 11 reservoir projects in the ACT River Basin. The baseline condition for continued operation of those projects is defined by the USACE ACT River Basin Master Manual and individual WCMs that were updated and approved in May 2015 and by the current FERC licenses for the APC projects. The TSP includes proposed changes to operations at USACE's Allatoona Dam and Lake (the water supply reallocation request) and at APC's Weiss Dam and Lake and Logan Martin Dam and Lake (the APC-requested modifications to federally-authorized flood operations). The proposed changes in operations at these projects might have effects on environmental and socioeconomic conditions in the basin. This analysis addresses the cumulative effects of the proposed actions and other ongoing or reasonably foreseeable actions in the ACT River Basin.

E.3.15.1 Past, Present, and Reasonably Foreseeable Future Actions

Table E-68 identifies and summaries those reasonably foreseeable actions by private sector entities, local governments and water utilities, state agencies, and federal agencies that have cumulative effects on the water and related land resources of the ACT River Basin. The table includes activities that may already be ongoing or recurring, newly initiated, and/or expected to occur in the future. In consideration of these reasonably foreseeable actions, this section discusses the potential incremental cumulative effects of the TSP on ACT River Basin resources.

Table E-68. Past, Present, and Reasonably Foreseeable Future Activities in the ACT River Basin with Cumulative Effects on Water and Related Land Resources

Performing Entity/ Activity	Location of Activity in ACT River Basin	Environmental Effects
Private sector		
Commercial and residential development	Basin-wide (with specific focus on rapid development northwest of Metro Atlanta in Etowah River Basin).	Ongoing and future changes in land use from forested and agriculture to urban/suburban; more impervious surfaces will increase runoff during storm events; decreased base flows in streams; potential water quality degradation; potential loss of fish and wildlife habitat and more imperiled aquatic species.
Nonfederal hydropower development	Carters Reregulation Dam and Claiborne L&D.	Between 1982 and 2019, multiple private-sector hydropower interests pursued FERC licenses to develop nonfederal hydropower facilities at USACE's Carters Reregulation Dam (Coosawattee River) and Claiborne L&D (Alabama River). To date, none have been successful. Additional efforts are likely in the future. Effects include potential for additional hydropower generation and for alteration to flow regimes that could affect aquatic habitat.
APC reservoir management for Coosa River and Tallapoosa River hydropower projects	Coosa and Tallapoosa rivers, AL.	Effects of these established and ongoing activities are addressed in current FERC licenses and their supporting NEPA documents.
APC routine O&M activities at Coosa River and Tallapoosa River hydropower projects;	Coosa and Tallapoosa rivers, AL.	Activities include: facility maintenance; natural resource stewardship; shoreline management; and operation of limited recreation facilities. Effects of these established and ongoing activities are generally minor and are addressed in current FERC licenses and their supporting NEPA documents.
Local governments and water utilities		
Regional water supply reservoirs	Richland Creek Reservoir (Paulding Co., GA) under construction; Russell Creek Reservoir (Dawson Co., GA) permitted and construction pending; Indian Creek Reservoir (Carroll Co. GA) permit pending.	Direct and localized habitat loss in Richland Creek; potential direct and localized habitat loss in Russell Creek and Indian Creek; potential reduced flows in Etowah River and Tallapoosa River. Would provide additional water supply sources to meet increased demands.
Water and wastewater infrastructure	Basin-wide but occurring more rapidly in developing areas in the Etowah River Basin (in Cobb, Paulding, and Cherokee counties and other northwest GA counties).	In rapidly developing areas, direct construction impacts on landscape; conversion of land use from primarily forested and agricultural to urban/suburban; more impervious surfaces will increase runoff during storm events and potentially impact base flows in streams; potential loss of fish and wildlife habitat.

Performing Entity/ Activity	Location of Activity in ACT River Basin	Environmental Effects
Other public service infra-structure (roads, public safety facilities, schools, and so forth)	Basin-wide but occurring more rapidly in developing areas in the Etowah River Basin (in Cobb, Paulding, and Cherokee counties and other northwest GA counties).	In rapidly developing areas, direct construction impacts on landscape; conversion of land use from primarily forested and agricultural to urban/suburban; more impervious surfaces will increase runoff during storm events and potentially impact base flows in streams; potential loss of fish and wildlife habitat.
Interbasin transfer of water	Upper Coosa River and Etowah River basins (principally in vicinity of Metro Atlanta).	Typically involves M&I water withdrawal in one river basin and water use, wastewater treatment, and return in an adjacent basin. Potential effects on stream flow (losses or gains in affected streams) and water quality.
State government		
State water planning	Basin-wide (GA, AL, and TN).	Water plans facilitate implementing improved water conservation and efficiency measures and support developing long-range estimates of future demands, technical tools and models to facilitate water planning, and regional plans to meet projected demands. State water planning processes are highly likely to result in reduced impacts to environmental resources compared to a more fragmented, reactive approach.
State water quality regulation	Basin-wide (GA, AL, and TN).	The states have effective water quality programs in place. The adverse effects of increased development and land-use change in the future is likely to be partially offset with improved tools and models to assess water quality conditions and implementation of improved wastewater treatment and non-point source management measures.
Federal government		
USACE ACT River Basin reservoir management	Basin-wide.	USACE will continue water management activities for existing reservoir projects consistent with the updated ACT River Basin Master Manual approved May 2015; the EIS for the updated Master Manual addressed minor alterations in the flow regime, minor water quality impacts, a drought operations plan, and navigation maintenance plan.
USACE routine O&M activities at ACT River Basin projects.	Basin-wide.	Activities include: facility maintenance, natural resource stewardship, shoreline management, and operation of recreation areas. USACE will continue routine O&M activities at its reservoir projects in the ACT River Basin. The effects of those activities are generally minor and have been addressed in a series of EISs in the 1970s for each ACT River Basin project and a 1987 supplemental EIS for the Alabama-Coosa Rivers project. The ACT River Basin Master Manual Update and EIS, approved in May 2015, included some updates regarding routine O&M practices. Those documents describe the effects of these established and ongoing activities.

Performing Entity/ Activity	Location of Activity in ACT River Basin	Environmental Effects
FERC licensing for existing APC projects in ACT River Basin	Coosa and Tallapoosa rivers, AL.	Under the Federal Power Act, as amended, FERC licenses nonfederal hydropower production, subject to NEPA and other relevant environmental laws and EOs. In the licensing process, FERC addresses environmental impacts and requires appropriate mitigation measures through public and agency reviews. The environmental effects of the established APC project operations in the ACT River Basin are documented in their respective FERC licenses. Any change in operation by APC would require environmental review and a modification to the FERC licenses.
FERC licensing of new nonfederal hydropower projects	Carters Reregulation Dam; Claiborne L&D; other potential sites in the basin.	Proposals for nonfederal development at these projects have been active almost since the USACE projects were completed in the 1960s and 1970s. A licensing request for nonfederal hydropower development at the Carters Reregulation Dam is active at the present time. Other proposals are likely in the future. FERC, in coordination with USACE, would evaluate all new nonfederal proposals with respect to impacts on the environment and on USACE project operations including mitigation of any adverse effects.

The ACT River Basin has been permanently altered by construction of the USACE, APC, and other nonfederal reservoir projects (see Section E.1.1.4). One effect of the conversion of flowing water habitat to still water by constructing dams along the mainstem rivers of the ACT River Basin and tributaries has been the decline or loss of river-dependent species of freshwater fishes, mussels, and snails. The habitat fragmentation effects of dams in the basin have resulted in declines in habitat for anadromous fishes. USACE, APC, and other reservoirs in the ACT River Basin have changed the frequency of floodplain inundation in some areas and altered the ecology of the river.

Human-induced inputs of various stressors into aquatic and terrestrial ecosystems can further compromise the ability of an ecological system to support a healthy biota. As growth (i.e., increased density of human habitation) continues, terrestrial ecosystems and wetlands adjacent to waterbodies in the basin are expected to become more degraded despite regulation and/or conservation efforts (e.g., adding stream buffers and implementing wetland mitigation requirements). If, however, additional attention is given to protecting the integrity of floodplains and restrictions are placed on land-cover conversions from urban and suburban development, those areas could retain their function in fluvial processes. Those factors are expected to influence conditions in tributaries, but they are expected to have little, if any, effect on the inundation of floodplains and wetlands in the Alabama, Coosa, and Tallapoosa river corridors. Those systems are largely influenced by reservoir operations.

E.3.15.1.1 Private Sector

Commercial and residential development. Ongoing and future changes in land use from forested and agriculture to urban/suburban, especially in the Etowah River Basin, will result in increased impervious surfaces, likely causing peak flows in the basin to increase and base flows in the basin to decrease. Urban land cover would generally increase stormwater runoff and decrease interception of rainfall and infiltration, resulting in less assimilative capacity during periods of low flow because base flow would decrease. These changes may also result in potential loss of fish and wildlife habitat and an increase in the number of imperiled aquatic species.

Nonfederal hydropower development at USACE dams. Between 1982 and 2019, multiple private sector hydropower interests pursued licenses from FERC to develop nonfederal hydropower facilities at USACE's Carters Reregulation Dam on the Coosawattee River and Claiborne L&D on the Alabama River. Previous efforts have been unsuccessful. A licensing request for nonfederal hydropower development at the Carters Reregulation Dam is active at the present time. There are no known current studies or related activities underway to pursue nonfederal hydropower development at Claiborne L&D. It is highly likely that such development will be reconsidered in the future when economic circumstances dictate. Nonfederal hydropower development at these projects would add additional hydropower generation capability and would likely affect existing flow regimes at these projects, potentially affecting downstream aquatic habitat.

APC Coosa River and Tallapoosa River hydropower projects reservoir management. Water management activities at the APC Coosa River and Tallapoosa River projects will continue as they have been conducted in the past, except for changes included in the TSP. The environmental effects associated with these ongoing activities are fully described in current FERC licenses and their supporting NEPA documents. Accordingly, they are part of the baseline condition for comparison of the cumulative effects of the TSP.

APC Coosa River and Tallapoosa River hydropower projects routine O&M activities. Routine O&M activities will continue at these projects in the future generally as they have been conducted in the past. Accordingly, they are part of the baseline condition for comparison of the effects of the TSP. These activities include: facility maintenance; natural resource stewardship; shoreline management; and operation of limited recreation facilities. The effects of these established and ongoing activities are addressed in current FERC licenses and their supporting NEPA documents.

E.3.15.1.2 Local governments and water utilities

Regional water supply reservoirs. Regional water supply reservoirs in north Georgia that have been constructed, under construction, permitted, or pending permits since 1988 are discussed in Section E.1.1.4.16. The Richland Creek Reservoir in Paulding County, GA is currently under construction and scheduled for completion by the end of 2019. The Russell Creek Reservoir in Dawson County, GA received a DA permit in July 2017 and is scheduled to be completed by 2023. The Richland Creek and Russell Creek reservoir projects are located on tributaries to the Etowah River. The Indian Creek Reservoir in Carroll County, GA is located on a tributary to the Tallapoosa River has a DA permit pending. No similar projects have been identified in the ACT River Basin in Alabama, and none are contemplated in the foreseeable future.

New dams in the ACT Basin would replicate many of those impacts elsewhere in the tributary streams and add to the cumulative alteration of natural flow regimes and habitat fragmentation. Depending on location, size, operating modes, amid other factors, new dams to meet water supply demands could adversely affect some protected aquatic species. These projects will generally involve direct, localized habitat loss and/or degradation in the project footprints. As their primary source for filling the Richland Creek and Russell Creek reservoirs will be pumping from the Etowah River, withdrawals to fill the reservoirs have potential to impact flows in Etowah River, which may become an important issue during a future drought scenario. These projects add additional water supply sources to the basin to meet increased demands, and they were at least partially justified as drought contingency projects. During the DA permit processes for both Richland Creek and Russell Creek reservoirs, the effects of withdrawals from the Etowah River to fill the reservoirs was modeled during the DA permit process and determined to have minimal impacts on the Etowah River and Allatoona Lake. The HEC-ResSim model for the ACT River Basin, which was used to assess the actions proposed in this Draft FR/SEIS, was modified to include Richland Creek Reservoir operations in the simulation over the modeled period of record.

Water and wastewater infrastructure. As population and associated land development increases in the basin, particularly in the Etowah River Basin northwest of metro Atlanta, demand for continued improvement and expansion of water and wastewater infrastructure in the developing areas will increase. The infrastructure requirements will include facilities for water treatment and distribution systems and for wastewater collection, treatment, and discharge (return) to the basin. Such infrastructure projects will involve direct construction impacts on the landscape, conversion of land from primarily forested and agricultural to urban/suburban, increase impervious surfaces that will increase runoff during storm events and potentially adversely impact base flows in streams, and potentially cause loss of fish and wildlife habitat.

Other public service infrastructure. As population and associated land development increases in the basin, particularly in the Etowah River Basin northwest of metro Atlanta, demand for continued improvement and expansion of public service infrastructure (roads, public safety facilities, schools, etc.) in the developing areas will increase. Such infrastructure projects will involve direct construction impacts on the landscape, conversion of land from primarily forested and agricultural to urban/suburban, increase impervious surfaces that will increase runoff during storm events and potentially adversely impact base flows in streams, and potentially cause loss of fish and wildlife habitat.

Interbasin transfers. In the portion of the ACT River Basin within the metro Atlanta area, interbasin transfers are likely to continue for the foreseeable future, reflecting a minor net loss of water from the Coosa River Basin to the Chattahoochee River Basin. Existing laws and regulatory mechanisms limiting interbasin transfers in Georgia would likely have to be modified to enable this option to be implemented on a larger scale. The 2009 MNGWPD *Water Supply and Water Conservation Management Plan* projected that 32 mgd would be transferred from the ACT River Basin into the Chattahoochee River Basin within the District by the year 2035 (MNGWPD, 2009).

Additional interbasin transfers from the Tennessee River into the ACT River Basin will likely be considered and evaluated as areas in the ACT River Basin continue to grow and water demands increase. Blount County and Birmingham, AL, a large metropolitan area on a relatively small river, are already outgrowing available water supplies. A substantial portion of the Birmingham service area is in the ACT River Basin. The distance from Birmingham to Decatur or Guntersville, AL, on the Tennessee River is less than 80 mi, a reasonable piping distance by current standards. Water demand for Metro Atlanta will continue to grow; while in-state water resources might be sufficient for the near future, the Tennessee River is the nearest waterbody with enough volume to meet a major portion of Atlanta's future water demand. The entire northwest Georgia area above Atlanta is growing rapidly and exceeding the capacity of existing groundwater and surface water supplies. The likelihood of any future withdrawals from the Tennessee River to meet those needs is highly speculative; nonetheless, any transfers in the future would represent net gains to water resources in the ACT River Basin (TVA, 2007).

E.3.15.1.3 State government

State Water Planning and Management. The state of Georgia specifically has a proactive state-wide water planning program, which is implemented via preparation of a series of RWPs orchestrated by 11 regional water councils. These RWPs establish the "road map" for water resource infrastructure development in each planning region. Most of the ACT River Basin in Georgia affected by the proposed action falls into two water planning regions, the MNGWPD and the CNG region. Future shortfalls in water supply will likely be incorporated into the RWPs developed by the regional water councils established under the ongoing Georgia SWP process.

The state of Alabama has moved in the direction of establishing a more formal statewide water planning process, as evidenced by the efforts of the AWAWG in 2012-2014 (see Section E.1.1.8.2.5) and the completion of a comprehensive Assessment of the Surface Water Resources of Alabama in 2017. The 2017 surface water resources assessment developed state-wide estimates of 2040 surface water demands for all water use sectors (ALOWR, 2017). Additional steps toward a formalized state water planning process are likely in the future.

Demands for public water supply and, to a lesser extent, agricultural water supply in the upper portion of the ACT River Basin increased steadily increased from 1950 until about 2006, decreased in 2007, and thereafter has held at decreased levels, largely due to water efficiency/conservation measures undertaken during the 2007-2009 drought period and the effects of the economic recession around 2009. As of 2019 water withdrawals have not yet returned to 2006 levels, although they are expected increase in the future as population continues to grow in both states. Agricultural water supply currently represents less than 5 percent of surface water withdrawals in the ACT Basin. As water efficiency and conservation measures associated with public water supply (particularly in those portions of the ACT River Basin in the metro Atlanta area) become more institutionalized through education, incentives, and enforceable laws/regulations, the rate of increase in water demand has declined and is likely to continue that trend. More aggressive water conservation and water efficiency measures would likely further reduce or curtail the growth of current water demands, as would the implementation of any feasible water reuse projects.

Industrial water use in the basin has decreased appreciably in the past 40 years with the decline of the manufacturing sector increased water efficiency in manufacturing processes. Overall, the decrease in industrial water use in the basin, which is expected to continue in the future, tends to offset increased demands for public water supply and agricultural water supply. Water requirements for thermoelectric power production in the basin have declined as more efficient methods for cooling units in older plants have been employed and as power production with natural gas has increased, and that trend is expected to continue for the foreseeable future.

For purposes of this cumulative effect analysis, it is not appropriate to speculate on what specific actions the states of Alabama and Georgia, the MNGWPD, other regional water councils in GA, and/or local water providers in both states might elect to pursue in the future in response to water resource related litigation or water allocation formulas that may be developed by the states. Interstate disagreements and litigation over water rights and use create a high degree of uncertainty relative to future water resource management in the ACT River Basin.

Water quality regulation. The states of Alabama and Georgia have effective water quality management and permitting programs in place. The adverse effects of increased population growth and associated development and land use changes in the ACT River Basin in the future are likely to be partially offset with (1) improved tools and models to assess water quality conditions, (2) implementation of improved wastewater treatment and nonpoint source management measures, and (3) proactive permitting and enforcement processes.

E.3.15.1.4 Federal government

USACE ACT River Basin reservoir management. Water management activities for the USACE ACT River Basin projects to achieve authorized project purposes will continue as described in the updated ACT River Basin Master Manual and EIS, approved May 2015. The effects of those ongoing water management activities are addressed in the EIS. Accordingly, those ongoing effects are part of the baseline condition for comparison of the cumulative effects of the TSP. The EIS for the updated Master Manual addressed minor alterations in the flow regime, minor water quality impacts, a drought operations plan, and navigation maintenance plan.

USACE ACT River Basin routine O&M activities. Routine O&M activities will continue at these projects in the future generally as they have been conducted in the past. Accordingly, they are part of the baseline condition for comparison of the effects of the TSP. These activities include: facility maintenance; natural resource stewardship; shoreline management; and operation of limited recreation facilities. The effects of these established and ongoing routine O&M activities were addressed in a series of EISs in the 1970s for each USACE project in the basin and a 1987 supplemental EIS for the Alabama-Coosa Rivers project (USACE Mobile District, 1987). The subsequent ACT River Basin Master Manual Update and EIS, approved in May 2015, included some updated information regarding routine O&M practices. These documents describe the effects of these established and ongoing O&M activities.

FERC licensing of APC projects in ACT River Basin. Under the Federal Power Act, as amended, FERC licenses nonfederal hydropower production, subject to NEPA and all other relevant environmental laws and EOs. In the licensing process, FERC addresses environmental impacts and requires appropriate mitigation measures through the public and agency review process. The environmental effects of these established APC project operations in the ACT River Basin are documented in the licensing process and appropriate measures to mitigation those effects are included in their respective FERC licenses. Any change in operation by APC would require environmental review and a modification to the pertinent FERC license.

FERC new nonfederal hydropower project licensing. Proposals for nonfederal development at USACE's Carters Lake Reregulation Dam and Claiborne L&D have been active almost since the USACE projects were completed in the 1960s and 1970s. A new licensing request for nonfederal hydropower development at the Carters Reregulation Dam was initiated in April 2019 and is active at the present time. No nonfederal proposals are presently active at Claiborne L&D. New proposals in the future are likely. Nonfederal hydropower proposals are possible at other nonfederal reservoirs in the basin. FERC, in coordination with USACE, would evaluate all new nonfederal proposals with respect to impacts on the environment and on USACE project operations including mitigation of any adverse effects.

E.3.15.2 Contribution of the TSP to Cumulative Effects

E.3.15.2.1 Water Quantity

Overall, the TSP would have a minor positive cumulative effect on lake level and streamflow conditions in the ACT River Basin. Winter pool levels would substantially increase at Weiss and Logan Martin lakes and year-round pool level conditions at Allatoona Lake would slightly improve. The TSP would likely result in minimal incremental effects on streamflow conditions throughout the basin.

E.3.15.2.2 Water Quality

Water quality is influenced by multiple factors, including pollutant loads and in-stream flows (water quantity). Pollutant loads include both point and nonpoint sources of pollution. Point sources of pollution are regulated by USEPA through the NPDES program under the CWA. Nonpoint sources of pollution are also targeted to reduce pollutant loads under the CWA through TMDLs. Enforcement of reductions varies because of limited resources. As land uses in the ACT River Basin change from forested to urban land-cover, especially in the headwaters areas of the Etowah River Basin, peak flows in the system are likely to increase and base flows in the system are likely to decrease. Urban land cover would generally increase stormwater runoff and decrease interception of rainfall and infiltration, resulting in less assimilative capacity during periods of low flow because base flow would decrease.

Implementing the operational changes included in the 2015 ACT River Basin Master Manual update was expected to result in minor cumulative effects on water quality in the basin. The combination of minor changes to the flow regime and continued discharges during low-flow conditions by some entities holding NPDES permits were expected to affect water temperature, nitrogen, phosphorus, and chlorophyll a. For the most part, those effects would be uneven throughout the course of the affected project area and would be expected to occur only during low-flow periods. A waterbody's ability to assimilate pollutants is dependent on the amount of water in-stream, especially during low-flow periods. For that reason, the HEC models were used during the Master Manual update process to ascertain the relationship between quantity and quality in the ACT River Basin. Agencies regulating water quality in rivers and reservoirs will continue to monitor them for impairment and improvement and enforce reductions until standards are met. That balance of what is allowable and what is discharged is an ongoing cycle of monitoring, assessment, and implementation. It was assumed during the Master Manual update process that, over time, violations of the water quality standards would decrease because of reductions achieved through the CWA.

The operational changes in the TSP would have negligible incremental effects on water quality in comparison to the effects of all the other reasonably foreseeable activities identified in the basin (see Section E.3.3.2).

E.3.15.2.3 Geology and Soils

The TSP would have a negligible cumulative effect on geology and soils resources in the ACT River Basin compared to the effects of other identified activities in the basin.

E.3.15.2.4 Climate

The TSP would have a negligible cumulative effect on climate in the ACT River Basin compared to the effects of other identified activities in the basin.

E.3.15.2.5 Land Use

Changes in land use in the basin are expected and will likely be more accelerated in areas northwest of Metro Atlanta, particularly in the Etowah River Basin. The changes will likely result in a loss of forested and agricultural lands in exchange for more urban and suburban types of development. That development is likely to increase runoff during storm events because of an increase in the extent of impervious surfaces.

The ROI for land use for proposed actions in the TSP is the reservoir project land, the adjacent shorelines, and lands immediately downstream of the Allatoona, Weiss, and Logan Martin dams. The TSP would not change land-use allocations or zoning. It would not have effects that would cause substantial change in established land uses, disrupt or divide established land-use configurations, or be inconsistent with adopted land-use plans. USACE typically considers requests for a variety of real estate easements, leases, and shoreline management permits at its projects. Such actions are not expected to affect water management decisions or project purposes nor would they be impacted by the TSP. Therefore, no cumulative effects on land use would be expected because of the TSP.

E.3.15.2.6 Biological Resources

Since the USACE and APC projects are already constructed and operating in the basin, most of the major changes to the biological resources of the basin have already occurred. Further changes in flow regime and water quality driven by additional population growth and urban/suburban development in the basin may have additional effects on fish and wildlife habitat and imperiled aquatic species. New infrastructure to support population growth (including water supply, wastewater, and other public service infrastructure) will likely contribute to effects on habitat and aquatic species. New regional water supply reservoirs, beyond those already constructed or permitted for construction, would likely add to habitat fragmentation and loss and increased risk to species that are already imperiled. Potential new nonfederal hydropower development may result in further localized effects on the current flow regimes and water quality. Proactive water supply planning and water quality management/regulation by the states will likely offset some of those potential adverse ecological effects. The TSP would generally have minor effects on biological resources and would have a minimal incremental effect on the cumulative effects of these other activities in the basin.

E.3.15.2.7 Socioeconomic Resources

The TSP would have a negligible cumulative effect on socioeconomic resources in the ACT River Basin compared to the effects of other identified activities in the basin.

E.3.15.2.8 Aesthetic Resources

Overall, aesthetic conditions in the natural areas of the ACT River Basin are likely to be adversely affected by the land-use changes associated with the expected population growth and infrastructure development. The TSP would result in a slight overall improvement in ACT River Basin aesthetic conditions during the winter months at Weiss and Logan Martin lakes and year-round at Allatoona Lake (see Section E.3.9.2) as the winter drawdown in reservoir pool levels is reduced.

E.3.15.2.9 Air Quality and General Conformity

The TSP would have negligible cumulative effects with respect to air quality and general conformity considerations in the basin.

E.3.15.2.10 Noise

The TSP would have negligible cumulative effects with respect to noise considerations in the basin.

E.3.15.2.11 Traffic and Transportation

The TSP would have negligible cumulative effects with respect to traffic and transportation considerations in the basin.

E.3.15.2.12 Hazardous and Toxic Waste

The TSP would have negligible cumulative effects with respect to hazardous and toxic water concerns in the basin.

E.3.15.2.13 Cultural Resources

Regardless of changes in reservoir operations addressed in the TSP, populations and associated land use changes in the ACT River Basin are expected to increase in the future, thus increasing the potential for impact on known and undiscovered archaeological sites in the basin. Increased human interaction along the affected lakeshores and waterways is likely to increase the impact of access as a result of vandalism or artifact collection. The cumulative effects of the TSP on cultural resources are expected to be minor compared to the other changes in the ACT River Basin driven by population growth and land-use changes.

E.4 References

ACWP [Alabama Clean Water Partnership]. (2003). *Mid-Coosa River Basin Management Plan.* Alabama Clean Water Partnership.

ACWP. (2004). *Upper Coosa Basin Watershed Management Plan.* ACWP.

ACWP. (2005). *Lower Coosa River Basin Management Plan.* ACWP.

ADCNR. (2014a). *Blue Shiner*. Retrieved April 2019, from Outdoor Alabama: https://www.outdooralabama.com/shiners/blue.

ADCNR. (2014b). *Plicate Rocksnail*. Retrieved March 2014, from Outdoor Alabama: http://www.outdooralabama.com/watchable-wildlife/what/inverts/mollusks/aquaticsnails/horn/leptoxis/plicate/.

ADCNR. (2014c). *Red-Cockaded Woodpecker*. Retrieved February 2014, from Outdoor Alabama: http://www.outdooralabama.com/watchable-wildlife/what/birds/ woodpeckers/rcw.cfm.

ADCNR. (2018). *Coosa River*. Retrieved October 2018, from Outdoor Alabama: https://www.outdooralabama.com/rivers-and-mobile-delta/coosa-river.

ADCNR. (2019a). *Black Warrior Waterdog*. Retrieved April 2019, from Outdoor Alabama: https://www.outdooralabama.com/salamanders/black-warrior-waterdog.

ADCNR. (2019b). *Boating, Fishing, and Fish in the Coosa River and its Impoundments*. Retrieved August 26, 2019, from Outdoor Alabama: https://www.outdooralabama.com/rivers-and-mobile-delta/coosa-river .

ADCNR. (2019c). *Flattened Musk Turtle*. Retrieved April 2019, from Outdoor Alabama: https://www.outdooralabama.com/turtles/flattened-musk-turtle.

ADCNR. (2019d). *Logan Martin Lake*. Retrieved September 11, 2019, from Outdoor Alabama: https://www.outdooralabama.com/reservoirs/logan-martin-lake.

ADCNR. (2019e). *Watchable Wildlife*. Retrieved September 13, 2019, from Outdoor Alabama: https://www.outdooralabama.com/wildlife/watchable-wildlife.

ADCNR. (2019f). *Wood Stork*. Retrieved August 26, 2019, from Outdoor Alabama: https://www.outdooralabama.com/herons/wood-stork.

ADEM. (2014). *Alabama Nonpoint Source Management Program.* Montgomery: ADEM.

ADEM. (2016). *2016 Integrated Water Quality Monitoring and Assessment Report.* Montgomery: ADEM.

ADEM. (2018a). *ADEM Admin. Code r. 335-6.* Montgomery: ADEM.

ADEM. (2018b). *Alabama 303(d) List - 2018.* Montgomery, AL: ADEM. Retrieved April 1, 2019, from http://www.adem.state.al.us/programs/water/wquality/2018AL303dList.pdf.

ADEM. (2018c). *Approved TMDLs in Alabama.* Montgomery, AL: Alabama Department of Environmental Management. Retrieved August 26, 2019, from http://www.adem.state.al.us/programs/water/approvedTMDLs.htm.

Alabama Scenic River Trail. (2019). *District 3/Northeast (AL) District Paddling*. Retrieved April 10, 2019, from Alabama Scenic River Trail: https://www.alabamascenicrivertrail.com/district-3northeast-district-paddling/.

AL-GAP. (2010). *Alabama Gap Analysis Project*. Retrieved May 1, 2010, from Auburn University, School of Forestry and Wildlife Sciences: http://www.auburn.edu/academic/forestry_wildlife/alabama_gap_analysis_project/.

ALOWR. (2013). *Alabama Drought Management Plan.* Montgomery, Alabama: Alabama Office of Water Resources.

ALOWR. (2017). *2017 Surface Water Assessment Report Fact Sheet (Alabama).* Montgomery, Alabama: Alabama Office of Water Resources. Retrieved September 12, 2018, from http://adeca.alabama.gov/Divisions/owr/watermanagement/2017%20OWR%20Surface%20Water%20Assessment/OWR%20Surface%20Water%20Assessment%20Report%20Fact%20Sheet.pdf.

ALOWR. (2018a). *Alabama Drought Management Plan (Final).* Montgomery, Alabama: Alabama Office of Water Resources. Retrieved April 30, 2019, from http://adeca.alabama.gov/Divisions/owr/Documents/Drought%20Plan%20Revision_Final.pdf.

ALOWR. (2018b). *Office of Water Resources*. Retrieved December 13, 2018, from ADECA (Alabama Department of Economic and Community Affairs): http://adeca.alabama.gov/Divisions/owr/Pages/default.aspx.

Anderson, B. (2019). General Manager, Etowah Water and Sewer Authority (March 28, 2019). (D. Barnett, Interviewer).

ANHP. (2017). *Alabama Inventory List, The Rare, Threatened, & Endangered Plants and Animals of Alabama.* Alabama Natural Heritage Program.

ANSI. (2013). *American National Standard Quantities and Procedures for Description and Measurement of Environmental Sound. Part 3: Short-term measurements with an observer present.* Acoustical Society of America. New York: American National Standards Institute.

APC. (2008). *Martin Dam Project, FERC Project No. 349, Pre-Application Document (PAD).* Birmingham, Alabama: Alabama Power Company.

APC. (2016). *Dissolved Oxygen Enhancement Plan, Coosa River Project, FERC No. 2146.* Birmingham, Alabama: Alabama Power Company. Retrieved April 9, 2019.

APC. (2018). *Aquatic Plant Management*. Retrieved October 2018, from Alabama Power Company Shorelines: https://apcshorelines.com/aquatic/.

APC. (2019). *Alabama Power Company*. Retrieved September 6, 2019, from Alabama Power Company Recreation - Parks: https://apcshorelines.com/recreation/parks/.

AWAWG. (2012). *Water Management Issues in Alabama.* Montgomery, Alabama: Alabama Water Agencies Working Group.

AWAWG. (2013). *Mapping the Future of Alabama Water Resources Management: Policy Options and Recommendations.* Montgomery, Alabama: Alabama Water Agencies Working Group. Retrieved December 13, 2018, from http://adeca.alabama.gov/Divisions/owr/watermanagement/awawg/Documents/AWAWG-Report-FINAL-2-Side-Print.pdf.

Caldwell, J. R. (1957). *Survey and Excavations in the Allatoona Reservoir, Northern Georgia.* Athens, Georgia: Dpartment of Anthropology, University of Georgia.

CARB. (2017). *Regulation for the Mandatory Reporting of Greenhouse Gas Emissions (Subchapter 10).* Sacremento, CA: California Air Resources Board. Retrieved from https://www.arb.ca.gov/regact/2016/ghg2016/ghg2016.htm.

Carroll County Water Authority. (2018). *CCWA Water Supply Project*. Retrieved November 29, 2018, from Carroll County Water Authority: http://www.ccwageorgia.com/water-supply-project.html.

Centers for Disease Control and Prevention. (2019). *CDC's Social Vulnerability Index (SVI)*. Retrieved April 24, 2019, from Agency for Toxic Substances and Disease Registry: https://svi.cdc.gov/index.html.

City of Canton. (2019). *Hickory Log Creek Reservoir*. Retrieved September 13, 2019, from Canton, GA: https://www.cantonga.gov/gov/departments/reservoir.htm.

City-Data. (2019a). *Climate - Alabama*. Retrieved March 12, 2019, from City-Data.com: http://www.city-data.com/states/Alabama-Climate.html.

City-Data. (2019b). *Climate - Georgia*. Retrieved March 12, 2019, from City-Data.com: http://www.city-data.com/states/Georgia-Climate.html.

Code of Alabama. (2016). *Code of Alabama: Title 9-Conservation and Natural Resources. Chapter 10C-Alabama Drought Planning and Response Act*. Retrieved December 13, 2018, from Justia US Law: https://law.justia.com/codes/alabama/2016/title-9/chapter-10c/.

Couch, C. A., Hopkins, E. H., & Hardy, P. S. (1996). *Influences of Environmental Settings on Aquatic Ecosystems in the Apalachicola-Chattahoochee-Flint River Basin (Water Resources Investigations Report 95-4278).* Reston, VA: U.S. Geological Survey. Retrieved April 23, 2019, from https://pubs.usgs.gov/wri/1995/4278/report.pdf.

Day, K. (2010). Natural Resources Management Section, U.S. Army Corps of Engineers, Mobile District (October 22, 2010). (D. Barnett, Interviewer).

DeVries, D., Armstrong, D., Topolski, M., Pine, III, W., Johnson, J., Dunham, R., . . . Cook, S. (2003). Distribution, habitat use, and genetics of Tulotoma magnifica (Gastropoda:Viviparidae). *Southeastern Naturalist 2(1): 35-58.*

Dickson, J., & Warren, J. M. (1993). Wildlife and fish communities of eastern riparian forests. *Procedings of the Riparian Ecosystems in the Humid U.S.: Functions, Values and Management*.

Dunn, R. A. (1996). *Impacts to Historic Properties in Drawdown Zones at Corps of Engineers Reservoirs.* Vicksburg, Mississippi: USACE Waterways Experiment Station.

Dunne, T., & Leopold, L. B. (1978). *Water in Environmental Planning.* New York, New York: W.H. Freeman and Company.

Fanning, J. L. (2003). *Water Use in Georgia by County for 2000 and Water Use Trends for 1980-2000 - Information Circular 106.* Reston, Virginia: U.S. Geological Survey. Retrieved April 2, 2019, from http://epd.georgia.gov/sites/epd.georgia.gov/files/related_files/site_page/IC-106.pdf.

Fanning, J. L., & Trent, V. P. (2009). *Water Use in Georgia by County for 2005; and Water-Use Trends, 1980–2005: U.S. Geological Survey Scientific Investigations Report 2009–5002.* Reston, Virginia: U.S. Geological Survey. Retrieved from http://pubs.usgs.gov/sir/2009/5002/.

FERC. (2009). *Final Environmental Assessment for Hydropower License, Coosa River Hydroelectric Project - FERC Project No. 2146-111.* Washington, DC: Federal Energy Regulatory Commission.

FERC. (2013). *Carters Reregulation Dam, Docket P-13598-001, Accession Number 20110302-3058, Notice of Surrender of Preliminary Permit* . (Federal Energy Regulatory Commission) Retrieved August 24, 2013, from FERC elibrary: http://elibrary.ferc.gov/idmws/search/fercgensearch.asp.

FERC. (2015a). *Final Environmental Impact Statement for Hydropower License, Martin Dam Hydroelectric Project, FERC Project No. 349-173, Alabama.* Washington, D.C.: Federal Energy Regulatory Commission. Retrieved January 29, 2019, from https://www.ferc.gov/industries/hydropower/enviro/eis/2015.asp?csrt=534280742277750248.

FERC. (2015b). Order Issuing New License to Alabama Power Company, Martin Dam Hydroelectric Project No. 349, Alabama (December 17, 2015). Washington, D.C., USA: Federal Energy Regulatory Commission.

FERC. (2016). *Order on Rehearing and Clarification and Dismissing Request for Stay, Alabama Power Company, Project No. 2146-141 (April 16, 2016)*. Retrieved April 9, 2019, from FERC online library: https://elibrary.ferc.gov/idmws/search/fercgensearch.asp.

FERC. (2017). *Claiborne Lock and Dam, Docket P-13519-004, Accession Number 20170328-3015 - Lock + Hydro Friends Fund XIX, LLC, Rejection of License Application (March 28, 2017).* Retrieved September 17, 2018, from FERC online elibrary: https://elibrary.ferc.gov/idmws/search/fercgensearch.asp.

Freeman, M., & Wenger, S. (2000). *Prioritizing Streams for Buffer Preservation and Restoration in the Etowah River Basin.* Prepared for the U.S. Fish and Wildlife Service. University of Georgia, Athens, Georgia.

Frick, E., Hippe, D., Buell, G., Couch, C., Hopkins, E., & et al. (1998). Water quality in the Apalachicola-Chattahoochee-Flint River Basin, Georgia, Alabama, and Florida, 1992–1995. *Circular 1164*.

GADNR. (2007). *Swamp-pink*. Retrieved 2019 April, from Georgia Biodiversity Portal: https://georgiabiodiversity.org/natels/profile.html?es_id=21147&fus_tab_id=1HsRRHkW2qqMS1MunY5KMrvThVR_5C8sAX2-pFapk&group=plant.

GADNR. (2008a). *Large-flowered Skullcap*. Retrieved April 2019, from Georgia Biodiversity Portal: https://georgiabiodiversity.org/natels/profile.html?es_id=20397&fus_tab_id=1HsRRHkW2qqMS1MunY5KMrvThVR_5C8sAX2-pFapk&group=plant.

GADNR. (2008b). *Virginea Spiraea*. Retrieved April 2019, from Georgia Biodiversity Portal: https://georgiabiodiversity.org/natels/profile.html?es_id=22147&fus_tab_id=1HsRRHkW2qqMS1MunY5KMrvThVR_5C8sAX2-pFapk&group=plant.

GADNR. (2009a). *Gray bat*. Retrieved April 2019, from Georgia Wildlife: https://georgiawildlife.com/sites/default/files/wrd/pdf/fact-sheets/2009_gray_bat.pdf.

GADNR. (2009b). *Indiana Bat*. Retrieved April 2014, from Georgia Wildlife: https://georgiawildlife.com/sites/default/files/wrd/pdf/fact-sheets/2009_indiana_bat.pdf.

GADNR. (2011). *Bog Turtle*. Retrieved April 2019, from Georgia Biodiversity Portal: https://georgiabiodiversity.org/natels/profile.html?es_id=16848&fus_tab_id=1DtMrydpUQzrrujEgjM1wecIbIxmIkscINdFCwx89&group=rep-amp.

GADNR. (2015). *Northern Long-eared bat*. Retrieved April 2019, from Georgia Wildlife: https://georgiawildlife.com/sites/default/files/wrd/pdf/fact-sheets/2015_northern_long-eared-bat.pdf.

GADNR. (2016a). *Amber Darter*. Retrieved April 2019, from Georgia Wildlife: https://georgiawildlife.com/sites/default/files/wrd/pdf/fact-sheets/amber_darter_2016.pdf.

GADNR. (2016b). *Snail Darter*. Retrieved April 2019, from Georgia Wildlife: https://georgiawildlife.com/sites/default/files/wrd/pdf/fact-sheets/snail_darter_2016.pdf.

GADNR. (2016c). *Trispot Darter*. Retrieved April 2019, from Georgia Wildlife: https://georgiawildlife.com/sites/default/files/wrd/pdf/fact-sheets/trispot_darter_2016.pdf.

GADNR. (2018a). *Fishing Forecasts*. Retrieved October 2018, from Georgia Department of Natural Resources: https://georgiawildlife.com/fishing-prospects.

GADNR. (2018b). *Guide to Fishing the Lower Etowah River*. Retrieved October 2018, from Georgia Department of Natural Resources, Wildlife Resources Division: https://georgiawildlife.com/sites/default/files/wrd/pdf/river-prospects/etowah_guide.pdf.

GADNR. (2018c). *Lake Sturgeon Reintroduction to the Coosa River Basin*. Retrieved October 2018, from Georgia Department of Natural Resources, Wildlife Resources Division: https://georgiawildlife.com/lake-sturgeon-reintroduction-program.

GADNR. (2019a). *General Information about Rare Natural Elements*. Retrieved March 1, 2019, from Georgia Biodiversity Portal: https://georgiabiodiversity.org/natels/general-info.html.

GADNR. (2019b). *The Bald Eagle in Georgia*. Retrieved March 2019, from Georgia Department of Natural Resources Wildlife Resources Division: https://georgiawildlife.com/bald-eagle.

GAEPD. (1998). *Coosa River Basin Management Plan 1998.* Atlanta: GAEPD.

GAEPD. (2000). *1998-2000 Georgia Drought Report.* Atlanta, Georgia: Georgia Environmental Protection Division.

GAEPD. (2003). *Georgia Drought Management Plan.* Atlanta, GA: Georgia Environmental Protection Division. Retrieved April 30, 2019, from https://drought.unl.edu/archive/plans/Drought/state/GA_2003.pdf.

GAEPD. (2008, January 8). *State Water Plan.* Retrieved December 6, 2018, from Georgia Water Planning: https://waterplanning.georgia.gov/sites/waterplanning.georgia.gov/files/related_files/water_plan_20080109.pdf.

GAEPD. (2010a). *Georgia's Water Conservation Implementation Plan.* Atlanta, Georgia: Georgia Environmental Protection Division. Retrieved December 12, 2018, from https://epd.georgia.gov/sites/epd.georgia.gov/files/related_files/site_page/WCIP%20March%202010%20FINAL.pdf.

GAEPD. (2010b). *Review Draft Synopsis Report Current Assimilative Capacity Assessment, Georgia State-wide Water Management Plan .* GAEPD.

GAEPD. (2011). *List of Stream Reaches with TMDLs and TMDL Implementation Plans.* GAEPD.

GAEPD. (2015a). *Georgia Administrative Rule 391-3-6-.03 Water Use Classifications and Water Quality Standards.* GAEPD.

GAEPD. (2015b). *Georgia Surface Water and Groundwater Quality Monitoring and Assessment Strategy.* Atlanta: GAEPD.

GAEPD. (2018a). *Draft 2018 Integrated 305(b)/303(d) List - Streams.* GAEPD.

GAEPD. (2018b). *List of Georgia EPD Non-Farm Groundwater Withdrawal Permits (Revised April 1, 2018).* Retrieved November 28, 2018, from Georgia Environmental Protection Division Watershed Protection Branch: https://epd.georgia.gov/watershed-protection-branch-lists.

GAEPD. (2018c). *List of Georgia EPD Non-Farm Surface Water Withdrawal Permits (Revised April 1, 2018).* Retrieved November 28, 2018, from Georgia Environmental Protection Division Watershed Protection Branch: https://epd.georgia.gov/watershed-protection-branch-lists.

GAEPD. (2018d). *State of Georgia's Updated Allatoona Lake Water Supply Request.* Atlanta, Georgia: Georgia Environmental Protection Division. Retrieved December 6, 2018, from https://www.sam.usace.army.mil/Portals/46/docs/planning_environmental/docs/2018_Georgia_ACT%20Water%20Supply%20Request.pdf?ver=2018-08-07-163848-187.

GAEPD. (2018e). *Water Planning Regions*. Retrieved December 6, 2018, from Georgia State Water Plan: https://waterplanning.georgia.gov/water-planning-regions.

GAEPD. (2019a). *Georgia's Statewide Nonpoint Source Management Plan.* Atlanta: GAEPD.

GAEPD. (2019b). *Water Conservation*. Retrieved July 15, 2019, from Georgia Environmental Protection Division: https://epd.georgia.gov/water-conservation.

GAEPD. (2019c). *Water Planning Regions*. Retrieved September 13, 2019, from Georgia Water Planning: https://waterplanning.georgia.gov/water-planning-regions.

GEFA. (2008). *Georgia Inventory and Survey of Feasible Sites for Water Supply Reservoirs (October 31, 2008).* Atlanta, Georgia: Georgia Environmental Facilities Authority.

GEFA. (2011). *GEFA Water System Interconnection, Redundancy and Reliability Act, Emergency Supply Plan.* Atlanta, Georgia: Georgia Environmental Finance Authority. Retrieved December 12, 2018, from https://gefa.georgia.gov/sites/gefa.georgia.gov/files/related_files/document/GEFA-Water-System-Interconnection-Supply-Plan.pdf.

GEFA. (2018). *Governor's Water Supply Program makes major water supply projects reality (August 10, 2018)*. Retrieved December 12, 2018, from Georgia Environmental Finance Authority: https://gefa.georgia.gov/blog/2018-08-10/governor%E2%80%99s-water-supply-program-makes-major-water-supply-projects-reality.

GEFA. (2019). *Georgia Reservoir Fund*. Retrieved May 1, 2019, from Georgia Environmental Finance Authority: https://gefa.georgia.gov/georgia-reservoir-fund.

Georgia General Assembly. (2010a). *2009-2010 Regular Session - SB 370: Water; examine practices, programs, policies; develop programs for voluntary water conservation; reports of measurable progress (June 1, 2010).* Retrieved December 12, 2018, from Georgia General Assembly - Legislation: http://www.legis.ga.gov/Legislation/en-US/display/20092010/SB/370.

Georgia General Assembly. (2010b). *2009-2010 Regular Session - SB 442; "Water System Interconnection Redundancy and Reliability Act"; achieve district-wide interconnection within Metro. North Georgia Water Planning District (April 20, 2010).* Retrieved December 12, 2018, from Georgia General Assembly - Legislation: http://www.legis.ga.gov/Legislation/en-US/display/20092010/SB/442.

Griffith, G., Omernik, J., Comstock, J., Lawrence, S., Martin, G., Goddard, A., . . . Foster, T. (2001). *Ecoregions of Alabama and Georgia.* U.S. Geological Survey, Reston, Virginia.

Harper, M. J., & Turner, B. G. (2015). *Estimated Use of Water in Alabama in 2010.* Montgomery, Alabama: Alabama Department of Economic and Community Affairs, Office of Water Resources and Troy State University Center for Water Resource Economics.

Harris, C. M. (1998). *Handbook of Acoustical Measurement and Noise Control.* New York,, New York: Acoustical Society of America.

Hazen and Sawyer, Inc. (2018). *Allatoona Lake Reallocation - Evaluation of Potential Alternatives.* Atlanta, GA: (Prepared for the Georgia Water Supply Providers; transmitted to USACE on 09/01/2018 by John Fortuna, King and Spaulding LLP).

Hook, D. J. (2009). *Agricultural Irrigation Water Demand, Georgia's Major Crops, 2011-2050 (July 14, 2009).* Retrieved March 16, 2010, from Georgia Water Planning Regions - Ag Water Demand - All Crops: http://www.nespal.org/sirp/waterinfo/State/awd/AgWaterDemand.htm.

Hutson, S. S., Barber, N. L., Kenny, K. S., Linsey, K. S., Lumia, D. S., & Maupin, M. A. (2004). *Estimated Use of Water in the United States in 2000 - U.S. Geological Survey Circular 1268.* Reston, Virginia: U.S. Geological Survey.

Hutson, S. S., Littlepage, T. M., Harper, M. J., & Tinney, J. O. (2009). *Estimated use of water in Alabama in 2005: U.S. Geological Survey Scientific Investigations Report 2009–5163.* Reston, Virginia: U.S Geological Survey.

IPCC. (2007). *Climate Change 2007 - Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Fourth Assessment.* New York, NY: Cambridge University Pree.

IPCC. (2014). *Climate Change 2014 - Impacts, Adaptation, and Vulnerability; Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment.* Intergovernmental Panel on Climate Change. New York, NY: Cambridge University Press.

Jackson, M. (2019). Ranger, Allatoona Lake Project Management Office (March 27, 2019). (M. Cannella, Interviewer).

Journey, C. A., & Atkins, J. B. (1997). *Ground-Water Resources of the Lower-Middle Chattahoochee River Basin in Georgia and Alabama, and Middle Flint River Basin in Georgia—Subarea 5 of the Apalachicola-Chattahoochee-Flint and Alabama-Coosa-Tallapoosa River Basin (Open file report 96-433).* Montgomery, AL: U.S. Geological Survey. Retrieved April 23, 2019, from https://doi.org/10.3133/ofr96433.

Kidd, R. E., Atkins, J. B., & Scott, J. C. (1997). *Gound-Water Resources of the Alabama River Basin in Alabama-Subarea 8 of the Apalachicola-Chattahoochee-Flint and Alabama-Coosa-Tallapoosa River Basins (USGS Open-File Report 96-473).* Montgomery, Alabama: U.S. Geological Survey.

Landers, J. (2017, September). Georgia County Completes First Component of Major Supply Program. *Civil Engineering*, p. 3.

LAUE. (2009). *Watershed Assessment for the Lake Allatoona/Upper Etowah River Basin.* Lake Allatoona/Upper Etowah River Watershed Partnership. Prepared by Tetra Tech, Inc., Owings Mills, Maryland and Malcolm Pirnie, Inc., Mobile, Alabama for the Lake Allatoona/Upper Etowah River Watershed Partnership, Canton, Georgia.

Lawrence, S. J. (2016). *Water use in Georgia by county for 2010 and water-use trends, 1985 –2010 (ver. 1.1, January 2016): U.S. Geological Survey Open-File Report 2015 –1230.* Reston, Virginia: U.S. Geological Survey. Retrieved from http://dx.doi.org/10.3133/ofr20151230.

Ledbetter, J. R., Wood, D. W., Wood, K. G., Ethridge, R. F., & Braley, C. O. (1987). *Cultural Resources Survey of Allatoona Lake Area.* Athens, Georgia: Southeastern Archaeological Services, Inc. (Prepared for USACE Mobile District).

Lenihan, D. J., Carrell, T. L., Fosberg, S., Murphy, L., Rayl, S. L., & Ware, J. A. (1981). *The Final Report Resulting from the National Reservoir Inundation Study (funded by the Bureau of Reclamation, USACE, National Park Service, Soil Conservation Service).* Santa Fe, New Mexico: U.S. Department of the Interior, National Park Service, Cultural Resources Center.

Lovell, R. G. (2011). *Field Guide to Aquatic Plants of Alabama.* Alabama Department of Conservation and Natural Resources.

Lyon, E. I. (2010, October 22). Site Manager, Alabama River Lakes, U.S. Army Corps of Engineers, Mobile District. (D. W. Barnett, Interviewer).

Maddaus Water Management, Inc. and CH2M Hill. (2011). *National Water Use Per Capita Survey, 2005-2007 Period.* Danville, California: Maddaus Water Management, Inc.

Mathewson, C. C. (1989). Interdisciplinary Workshop on the Physical, Chemical, and Biological Processes Affecting Archaeological Sites. Vicksburg, MS: USACE Environmental Laboratory.

Mathewson, C. C., Gonzalez, T., & Eblen, J. S. (1992). *Burial as a Method of Archaeological Site Protection - Environmental Impact Research Program (Contract Report EL-92-1).* Vicksburg, MS: USACE Waterways Experiment Station.

MBRC. (2005). *Internet Archive Wayback Machine*. Retrieved from Mobile River Basin Coallition, Focus on Snails: 3 Snails Rediscovery: https://web.archive.org/web/20070928103058/http:/www.mobileriverbasin.org/snails.htm.

Mettee, M., O'Neil, P., & Pierson, J. (1996). *Fishes of Alabama and the Mobile Basin.* Oxmoor House, Birmingham, Alabama.

Millard, C., Stribling, J., Jokay, N., & Davie, S. (2008). *Ecological assessment of the Lake Allatoona/Upper Etowah River Watershed. Year 2 of the Long-Term Monitoring Program, 2007–08.* Prepared by Tetra Tech, Inc., Owings Mills, Maryland, and Atlanta, Georgia, for the Lake Allatoona/Upper Etowah River Watershed Partnership, Canton, Georgia.

Millard, C., Stribling, J., Jokay, N., Moiz, K., & Davie, S. (2007). *Ecological Assessment of the Lake Allatoona/Upper Etowah River Watershed. Year 2 of the Long-Term Monitoring Program, 2006–07.* Prepared by Tetra Tech, Inc., Owings Mills, Maryland, and Atlanta, Georgia, for the Lake Allatoona/Upper Etowah River Watershed Partnership, Canton, Georgia.

MNGWPD. (2009). *Water Supply and Water Conservation Plan.* Atlanta, Georgia: Metropolitan North Georgia Water Planning District.

MNGWPD. (2017). *Water Resource Management Plan.* Atlanta, Georgia: Metropolitan North Georgia Water Planning District. Retrieved August 5, 2018, from http://northgeorgiawater.org/wp-content/uploads/2018/03/Water-Resource-Management-Plan_REVISED.pdf.

Mooty, W. S., & Kidd, R. E. (1997). *Ground-Water Resources of the Lower-Middle Chattahoochee River Basin in Georgia and Alabama, and Middle Flint River Basin in Georgia—Subarea 7 of the Apalachicola-Chattahoochee-Flint and Alabama-Coosa-Tallapoosa River Basin (Open file report 96-470).* Montgomery, AL: U.S. Geological Survey. Retrieved April 23, 2019, from https://pubs.usgs.gov/of/1996/ofr96-470/pdf/ofr96-470.pdf.

NatureServe. (2014a). *Michaux's Sumac*. Retrieved March 2014, from NatureServe Explorer: http://explorer.natureserve.org/servlet/ NatureServe?searchSciOrCommonName=Rhus%20michauxii.

NatureServe. (2014b). *White Fringeless Orchid*. Retrieved March 2014, from NatureServe Explorer: http://explorer.natureserve.org/servlet/NatureServe?searchSciOrCommonName=white%20fringeless%20orchid.

NatureServe. (2014c). *Whorled Sunflower*. Retrieved March 2014, from NatureServe Explorer: http://explorer.natureserve.org/servlet/ NatureServe?searchSciOrCommonName=Whorled%20sunflower.

NatureServe. (2019a). *Dark Pigtoe*. Retrieved April 2019, from NatureServe Explorer: http://explorer.natureserve.org/servlet/NatureServe?sourceTemplate=tabular_report.wmt&loadTemplate=species_RptComprehensive.wmt&selectedReport=RptComprehensive.wmt&summaryView=tabular_report.wmt&elKey=112471&paging=home&save=true&startIndex=1&nextStartInd.

NatureServe. (2019b). *Etowah Darter*. Retrieved June 2019, from NatureServe Explorer: http://explorer.natureserve.org/servlet/NatureServe?sourceTemplate=tabular_report.wmt&loadTemplate=species_RptComprehensive.wmt&selectedReport=RptComprehensive.wmt&summaryView=tabular_report.wmt&elKey=103687&paging=home&save=true&startIndex=1&nextStartInd.

NatureServe. (2019c). *Finelined Pocketbook*. Retrieved June 2019, from NatureServe Explorer: http://explorer.natureserve.org/servlet/NatureServe?sourceTemplate=tabular_report.wmt&loadTemplate=species_RptComprehensive.wmt&selectedReport=RptComprehensive.wmt&summaryView=tabular_report.wmt&elKey=117227&paging=home&save=true&startIndex=1&nextStartInd.

NatureServe. (2019d). *Interrupted Rocksnail*. Retrieved June 2019, from NatureServe Explorer: http://explorer.natureserve.org/.

NatureServe. (2019e). *Lake Sturgeon*. Retrieved June 2019, from NatureServe Explorer: http://explorer.natureserve.org.

NatureServe. (2019f). *Ovate Clubshell*. Retrieved June 2019, from NatureServe Explorer: http://explorer.natureserve.org/.

NatureServe. (2019g). *Painted Rocksnail*. Retrieved June 2019, from NatureServe Explorer: http://explorer.natureserve.org/.

NatureServe. (2019h). *Rush Darter*. Retrieved April 2019, from NatureServe Explorer: http://explorer.natureserve.org/servlet/NatureServe?searchName=Etheostoma+phytophilum.

NatureServe. (2019i). *Southern Acornshell*. Retrieved June 2019, from NatureServe Explorer: http://explorer.natureserve.org/.

NatureServe. (2019j). *Southern Clubshell*. Retrieved June 2019, from NatureServe Explorer: http://explorer.natureserve.org/.

NatureServe. (2019k). *Triangular Kidneyshell*. Retrieved June 2019, from NatureServe Explorer: http://explorer.natureserve.org/.

NatureServe. (2019l). *Tulotoma*. Retrieved June 2019, from NatureServe Explorer: http://explorer.natureserve.org/.

NatureServe. (2019m). *Upland Combshell*. Retrieved June 2019, from NatureServe Explorer: http://explorer.natureserve.org/.

NatureServe. (2019n). *Vermilion Darter*. Retrieved April 2019, from NatureServe Explorer: http://explorer.natureserve.org/servlet/NatureServe?searchName=Etheostoma+chermocki.

Nix, C. M. (2018). Update to ACT ResSim Model, Martin and Weiss (email to James E Hathorn, Jr., USACE Mobile District, et al.) (June 20, 2018). Birmingham, AL.

NLCD. (1992). *National Land Cover Database 1992 Land Cover.* Retrieved May 2010, from http://landcover.usgs.gov/natllandcover.php.

NLCD. (2009). Retrieved March 2010, from National Land Cover Database Frequently Asked Questions.: http://www.mrlc.gov/faq.php.

NLCD. (2011). *2011 Land Cover Layer for the Conterminous United States. Multi-Resolution Land Cover Characteristics (MRLC) Consortium.* Retrieved March 2019, from https://www.mrlc.gov/.

NRCS. (2009). *Part 630 Hydrology, National Engineering Handbook. Chapter 7, Hydrologic Soil Groups.* U.S. Department of Agriculture, Natural Resource Conservation Service (210-VI-NEH, January, 2009).

NRCS. (2010a). *U.S. Department of Agriculture, National Agricultural Statistics Service (NASS),.* Research and Development Division (RDD), Geospatial information Branch (GIB), Spatial Ag Research Section (SARS).

NRCS. (2010b). *U.S. Department of Agriculture, National Agricultural Statistics Service (NASS). Alabama Cropland Data Layer (CDL).* Washington, D.C.: USDA NASS Marketing and Information Services Office.

NRCS. (2011). *NLCD 2011 Land Cover (2011 Edition), Frequently Anticipated Questions.* Retrieved March 2019, from https://www.wcc.nrcs.usda.gov/ftpref/wntsc/H&H/HecRAS/NEDC/workshops/workshopGIS/GIS/land_use_land_cover/nlcd_2011_faq.html#what.7.

O.C.G.A. § 12-5-31. (2018). Regulated riparian rights to surface waters for general or farm use; permits for withdrawal, diversion, or impoundment; coordination with water plans; metering of farm use; interbasin transfers; appeal procedures. *Official Code of Georgia Annotated*.

O.C.G.A. § 12-5-470. (2018). Georgia Water Supply Act of 2008. *Offical Code of Georgia Annotated*. Georgia General Assembly. Retrieved December 12, 2018, from

https://advance.lexis.com/documentpage/?pdmfid=1000516&crid=ea989346-4968-4659-a7b2-838bd7f9d385&title=%C2%A7+12-5-470.+Short+title&populated=false&haschildren=&level=4&nodepath=%2FROOT%2FAAM%2FAAMAAG%2FAAMAAGAAH%2FAAMAAGAAHAAC&nodeid=AAMAAGAAHAAC&config=.

O.C.G.A. §§ 12-5-520 et seq. (2018). Comprehensive State-wide Water Management Planning Act. *Official Code of Georgia Annotated*. Atlanta, Georgia. Retrieved December 6, 2018, from https://advance.lexis.com/documentprint/documentprintclick/?pdmfid=1000516&crid=a4bbef74-cb43-4850-b766-3a76f7ca9de5&ecomp=vs6fkkk&prid=65c09128-aef6-4edf-97e8-cf116107509f.

O.C.G.A. §§ 12-5-570 et seq. (2019). Metropolitan North Georgia Water Planning District Act. Atlanta, Georgia. Retrieved January 28, 2019, from https://advance.lexis.com/documentpage/?pdmfid=1000516&crid=f4e1dab3-da12-4dd0-b5d2-e6839957407c&title=%C2%A7+12-5-570.+Short+title&populated=false&haschildren=&level=4&nodepath=%2FROOT%2FAAM%2FAAMAAG%2FAAMAAGAAL%2FAAMAAGAALAAC&nodeid=AAMAAGAALAAC&config=.

O.C.G.A. §§ 12-5-90 et seq. (2018). Ground-water Use Act of 1972. *Offical Code of Georgia Annotated*.

Office of the Governor. (2013). *Lake Allatoona - Request for Final Agency Action.* Atlanta, Georgia: State of Georgia, Office of the Governor.

Parmalee, P., & Bogan, A. (1998). *The Freshwater Mussels of Tennessee.* University of Tennessee Press, Knoxville.

Paulding County Water System. (2018). *Richland Creek Reservoir Schedule*. Retrieved November 20, 2018, from Richland Creek Reservoir: http://www.rcrwater.com/project-information/schedule/.

Peel, M., Finlayson, B., & McMahon, T. (2007). Updated World Map of Köppen-Geiger Climate Classification. *Hydrology and Earth System Sciences*, 11:1633-1644. Retrieved March 12, 2019, from https://www.hydrol-earth-syst-sci.net/11/1633/2007/.

Poff, N. L., & Zimmerman, J. (2010). Ecological responses to altered flow regimes: a literature review to inform the science and management of environmental flows. *Freshwater Biology 55, 194-205.*

Robinson, J. L., Journey, C. A., & Atkins, J. (1997). *Ground-Water Resources of the Coosa River Basin in Georgia and Alabama - Subarea 6 of the Aplachicola-Chattahoochee-Flint and Alabama-Coosa-Tallapoosa River Basins (USGS Open-File Report 96-177).* Montgomery, Alabama: U.S. Geological Survey.

Seager, R., Tzanova, A., & Nakamura, J. (2009). Drought In the Southeastern United States, Variability over the Last Millennium, and the Potential for Future Hydroclimate Change. *American Meteorological Society*, 25. Retrieved January 17, 2019, from https://pdfs.semanticscholar.org/e0ef/1f909448bf4abcb2ec3cdb12772b9a34a72f.pdf.

SERCC. (2016). *The Southeast U.S. Drought of 2016: Evolution, Climate Perspectives, and Impacts (Southeast U.S. Drought Report - October 2016).* Chapel Hill, North Carolina: Southeast Regional Climate Center.

SERCC. (2019a). *Cartersville #2, Georgia - Climate summary*. (Southeast Regional Climate Center) Retrieved January 14, 2019, from Southeast Regional Climate Center - Monthly and Seasonal Climate Information: http://www.sercc.com/cgi-bin/sercc/cliMAIN.pl?ga1670.

SERCC. (2019b). *Gadsden Steam Plant, Alabama - Climate Summary*. (Southeast Regional Climate Center) Retrieved January 14, 2019, from Southeast Regional Climate Center - Monthly and Seasonal Climate Information: http://www.sercc.com/cgi-bin/sercc/cliMAIN.pl?al3154.

SERCC. (2019c). *Rome, Georgia - Climate Summary*. (Southeast Regional Climate Center) Retrieved January 14, 2019, from Southeast Regional Climate Center - Monthly and Seasonal Climate Information: http://www.sercc.com/cgi-bin/sercc/cliMAIN.pl?ga7600.

Sparks, R. (1992). Risks of altering the hydrologic regime of large rivers. (B. N. J. Cairns, Ed.) *Predicting Ecosystem Risk, Volume XX: Advances in Modern Environmental Toxicology*, 119-152.

Sparks, R. (1995). Need for ecosystem management of large rivers and their floodplains. *BioScience 45:168-182.*

St. John, T. (2019). APC Corporate Real Estate Manager (April 12, 2019). (M. Cannella, Interviewer).

Stribling, J., Hill, C., Davie, S., Jokay, N., & Miller, J. (2006). *Ecological Assessment of the Lake Allatoona/Upper Etowah River Watershed. Year 1 of the Long-term Monitoring Program, 2005–2006. .* Prepared by Tetra Tech, Inc., Owings Mills, Maryland, and Atlanta, Georgia, for the U.S. Army Corps of Engineers, Mobile District, Mobile, Alabama, and the Lake Allatoona/Upper Etowah River Watershed Partnership, Canton, Georgia.

Tennessee Department of State. (2016). Proclamation 1660-01-32, Endangered and Threatened Species (June 2016). Retrieved August 26, 2019, from Watchable Wildlife in Tennessee: https://www.tn.gov/content/dam/tn/twra/documents/1660-01-32%20threatened-endangered-species-rule.pdf.

Tetra Tech, Inc. (2012). Memorandum to USACE Mobile District - Allatoona Lake, Georgia, Area-Capacity Curves (April 12, 2012). Atlanta, Georgia.

Tilman, D., Downing, J., & Wedin, D. (1994). Does diversity beget stability? *Nature 371:257-264.*

Toth, L. (1995). Need for ecosystem management of large rivers and their floodplains. (J. Cairns, Ed.) *Rehabilitating Damaged Ecosystems, 2nd edition*, 49-73.

Turney, L. (2019). North Branch Chief, Regulatory Division, USACE Mobile District - Birmingham Field Office. *Email (March 25, 2019) - Subject: Update on Alabama and Coosa River Basin Large Reservoirs*. Homewood, Alabama.

TVA. (2007). *Frequently Asked Questions About Water Supply.* Retrieved October 27, 2010, from Tennessee Valley Authority: Water Supply: http://www.tva.gov/river/watersupply/faq.htm

TVA. (2018). *Water Use in the Tennessee Valley for 2015 and Projected Use in 2040.* Knoxville, Tennessee: Tennessee Valley Authority. Retrieved November 27, 2018, from https://www.tva.gov/file_source/TVA/Site%20Content/Environment/Managing%20the%20River/2015%20Water%20Use%20Report_2040%20Projections.pdf.

TWRA. (2019). *Watchable Wildlife in Tennessee*. Retrieved March 2019, from Tennessee Wildlife Resources Agency: www.tn.gov/content/tn/twra/wildlife.html.

U.S. Census Bureau. (2019). *Decennial Census of Population and Housing*. Retrieved April 24, 2019, from U.S. Census Bureau: https://www.census.gov/programs-surveys/decennial-census/decade.2010.html.

UGA CAES. (2014, April 24). *The 2010 Georgia Water Stewardship Act (Circular 995).* Athens, Georgia: University of Georgia College of Agricultural and Environmental Sciences. Retrieved December 12, 2018, from The University of Georgia Extension: http://extension.uga.edu/publications/detail.html?number=C995&title=The%202010%20Georgia%20Water%20Stewardship%20Act.

UNFCCC. (2008). *Kyoto Protocol Reference Manual on Accounting of Emissions and Assigned Amount.* New York: United Nations Framework Convention on Climate Change.

USACE ERDC. (2007). *Assessment of the Population Status of the Gray Bat (Myotis grisescens), Environmental Laboratory Technical Report 07-22.* Vicksburg, MS: United States Army Corps of Engineers Engineer Research and Development Center.

USACE Institute for Water Resources. (2018a). *Public Lock Commodity Report, Calendar Years 1999-2017 (xlsx) (Updated 1 August 2018).* Navigation Data Center, Fort Belvoir, VA. Retrieved April 1, 2019, from https://iwrlibrary.planusace.us/#/home.

USACE Institute for Water Resources. (2018b). *Public Lock Usage Report files, Calendar Years 1993-2017 (xlsx) (Updated 1 August 2018).* Navigation Data Center, Fort Belvoir, VA. Retrieved April 1, 2019, from https://iwrlibrary.planusace.us/#/home.

USACE Mobile District. (1951). *Alabama-Coosa River Basin - Reservoir Regulation Manual.* Mobile, Alabama: U. S. Army Corps of Engineers, Mobile District.

USACE Mobile District. (1965). *Alabama-Coosa River Basin Reservoir Regulation Manual, Appendix B, Weiss Reservoir (Alabama Power Company), Coosa River, Alabama.* Mobile, Alabama: U.S. Army Corps of Engineers, Mobile District.

USACE Mobile District. (1968). *Alabama-Coosa River Basin Reservoir Regulation Manual, Appendix C - Logan Martin Reservoir (Alabama Power Company), Coosa River, AL.* Mobile, AL: U.S. Army Corps of Engineers, Mobile District.

USACE Mobile District. (1987). *Final Supplement to the Environmental Impact Statement, Alabama-Coosa Rivers, Alabama and Georgia (Operation and Maintenence).* U.S. Army Corps of Engineers, Mobile District. Mobile, AL.

USACE Mobile District. (1997). *ACT/ACF Comprehensive Water Resources Study, Surface Water Availability, Volume I, Unimpaired Flow.* Mobile, Alabama: U.S. Army Corps of Engineers, Mobile District.

USACE Mobile District. (1998a). *Allatoona Lake Shoreline Management Plan.* Mobile, AL: USACE Mobile District.

USACE Mobile District. (1998b). *Water Allocation for the Alabama-Coosa-Tallapoosa (ACT) River Basin, Alabama and Georgia, Draft Environmental Impact Statement.* Mobile, Alabama: US Army Corps of Engineers, Mobile District.

USACE Mobile District. (2003). *Biological Assessment: Species Identification Interim Report for the Alabama–Coosa–Tallapoosa (ACT) River Basin.* U.S. Army Corps of Engineers, Mobile District, Mobile, Alabama.

USACE Mobile District. (2004a). *Alabama-Coosa River Basin Reservoir Regulation Manual, Appendix B (Administrative Update), Weiss Reservoir (Alabama Power Company), Coosa River, Alabama and Georgia.* Mobile, Alabama: U.S. Army Corps of Engineers, Mobile District.

USACE Mobile District. (2004b). *Alabama-Coosa River Basin Reservoir Regulation Manual, Appendix C (Administrative Update), Logan Martin Reservoir (Alabama Power Company), Coosa River, Alabama.* Mobile, Alabama: U.S. Army Corps of Engineers, Mobile District.

USACE Mobile District. (2010). *Federal Storage Reservoir Critical Yield Analyses, Alabama-Coosa-Tallapoosa (ACT) and Apalachicola-Chattahoochee-Flint (ACF) River Basins.* Mobile, Alabama: U.S. Army Corps of Engineers, Mobile Distroct.

USACE Mobile District. (2011). *Sedimentation and Erosion Analysis for Allatoona Dam and Lake.* Mobile, AL.

USACE Mobile District. (2014a). *Alabama-Coosa-Tallapoosa River Basin Water Control Manual, Appendix A: Allatoona Dam and Lake Etowah River, Georgia.* Mobile, AL: USACE Mobile District.

USACE Mobile District. (2014b). *Alabama-Coosa-Tallapoosa River Basin Water Control Manual, Appendix D, H. Neely Henry Dam and Lake (Alabama Power Company), Coosa River, Alabama.* Mobile, Alabama: U.S. Army Corps of Engineers, Mobile District.

USACE Mobile District. (2014c). *Alabama-Coosa-Tallapoosa River Basin Water Control Manual, Appendix I, R. L. Harris Dam and Lake (Alabama Power Company), Tallapoosa River, Alabama.* Mobile, Alabama: U.S. Army Corps of Engineers, Mobile District.

USACE Mobile District. (2014d). *Final Environmental Impact Statement Update of the Water Control Manual for the Alabama-Coosa-Tallapoosa River Basin in Georgia and Alabama.* Mobile, Alabama.

USACE Mobile District. (2017). *Allatoona Lake Project Master Plan.* Mobile, AL: U.S. Army Corpos of Engineers Mobile District.

USACE Mobile District. (2018). *Osprey Platform Project*. Retrieved October 2018, from U.S. Army Corps of Engineers Mobile District: http://www.sam.usace.army.mil/Missions/Civil-Works/Recreation/Allatoona-Lake/Wildlife-and-Forestry/Osprey-Platform-Project/.

USACE Mobile District. (2019a). *Allatoona Lake - Hunting*. Retrieved May 09, 2019, from U.S. Army Corps of Engineers, Mobile District - Civil Works, Recreation: https://www.sam.usace.army.mil/Missions/Civil-Works/Recreation/Allatoona-Lake/Hunting/.

USACE Mobile District. (2019b). *Allatoona Lake Website*. Retrieved March 1, 2019, from https://www.sam.usace.army.mil/Missions/Civil-Works/Recreation/Allatoona-Lake/.

USACE Savannah District. (2004). Department of the Army Permit, Permit No. 200006560, Hickory Log Creek Reservoir. Savannah, GA: U.S. Army Corps of Engineers, Savannah District.

USACE Savannah District. (2015). *Department of the Army Permit, Richland Creek Reservoir, Permit # SAS-2007-01410.* Savannah, GA: USACE Savannah District.

USACE Savannah District. (2017). Department of the Army Permit No. SAS-2007-00907 (July 21, 2017) - Etowah Water and Sewer Authority (Russell Creek Reservoir). Savannah, GA.

USACE South Atlantic Division. (2010). *SAD Regulation RBT-2 -Water Control Management in the South Atlantic Division .* Atlanta, GA: U.S. Army Corps of Engineers, South Atlantic Division.

USDA. (2019). *Agricultural Statistics by State*. Retrieved June 24, 2019, from U.S. Department of Agriculture, National Agricultural Statistics Service: https://www.nass.usda.gov/Statistics_by_State/.

USEPA. (2015). *Total Nitrogen*. Retrieved from https://www.epa.gov/sites/production/files/2015-09/documents/totalnitrogen.pdf.

USEPA. (2015). *Total Phosphorus*. Retrieved from https://www.epa.gov/sites/production/files/2015-09/documents/totalphosphorus.pdf.

USEPA. (2016). *Climate Change Indicators in the United States (4th edition).* Washington, D.C.: U.S. Environmental Protection Agency. Retrieved March 7, 2019, from www.epa.gov/climate-indicators.

USEPA. (2018). *USEPA Superfund*. Retrieved October 23, 2018, from Alabama Army Ammunition Plant - Superfund Site Profile: https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.Cleanup&id=0400449#bkground.

USEPA. (2019a). *Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2017 - Executive Summary.* Washington, D.C.: USEPA. Retrieved March 12, 2019, from https://www.epa.gov/ghgemissions/draft-inventory-us-greenhouse-gas-emissions-and-sinks-1990-2017.

USEPA. (2019b). *Ecoregions*. Retrieved September 13, 2019, from United States Environmental Protection Agency: https://www.epa.gov/eco-research/ecoregions.

USEPA. (2019c). *Global Greenhousehouse Emissions Data*. (USEPA) Retrieved March 12, 2019, from Greenhouse Gas Emissions: https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data.

USEPA. (2019d). *Green Book National Area and County_Level Multi-Pollutant Information*. Retrieved March 12, 2019, from USEPA Green Book: https://www.epa.gov/green-book/green-book-national-area-and-county-level-multi-pollutant-information.

USEPA Region 4. (2008). *Final Total Maximum Daily Load for Nutrient Impairment in Weiss Lake.* Atlanta, Georgia: U.S. Environmental Protection Agency, Region 4.

USFWS. (1989). *Alabama Leather Flower Recovery Plan.* U.S. Fish and Wildlife Service, Jackson, Mississippi.

USFWS. (1990). *Harperella (Ptilimnium nodosum) Recovery Plan.* Newton Corner, Massachusetts.

USFWS. (1991a). *Kral's Water-plantain Recovery Plan.* Jackson, Mississippi.

USFWS. (1991b). *Recovery Plan for Mohr's Barbara's Buttons.* U.S. Fish and Wildlife Service, Jackson, Mississippi.

USFWS. (1992a). *Alabama Canebrake Pitcher Plant Recovery Plan.* Jackson, Mississippi.

USFWS. (1992b). *Endangered and Threatened Wildlife and Plants; Endangered Status for Schwalbea americana (American Chaffseed).* Federal Register, September 29, 1992, 57:44703–8.

USFWS. (1993). *Recovery Plan for pondberry (Lindera melissifolia).* U.S. Fish and Wildlife Service, Jackson, Mississippi.

USFWS. (1994). *Green Pitcher Plant Recovery Plan.* U.S. Fish and Wildlife Service, Jackson, Mississippi.

USFWS. (1995). *Recovery Plan for the Blue Shiner.* Jackson, MS.: U.S. Fish and Wildlife Service.

USFWS. (1997). *Revised Recovery Plan for the U.S. Breeding Population of the Wood Stork.* U.S. Fish and Wildlife Service. Atlanta, Georgia.

USFWS. (1998). *Appendix E: Working Draft Fish and Wildlife Coordination Act Report for the ACF River Basin Water Allocation Formula. In Water Allocation for the Apalachicola-Chattahoochee-Flint (ACF) River Basin, Alabama, Florida, and Georgia, Volume 2. Draft. .* U.S. Army Corps of Engineers, Mobile District, Mobile, Alabama.

USFWS. (2000). *Recovery Plan for Mobile River Basin Aquatic Ecosystem.* Atlanta, GA: U.F. Fish and Wildlife Service, Southeast Region.

USFWS. (2001). *ESA Basics: Over 25 Years of Protecting Endangered Species*. Retrieved April 2009, from http://endangered.fws.gov/pubs/esa%20basics.pdf.

USFWS. (2004). *Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Three Threatened Mussels and Eight Endangered Mussels in the Mobile River Basin; Final Rule.* Federal Register 69(126):40083-40171.

USFWS. (2005a). *Endangered and Threatened Wildlife and Plants; 5-Year Review of 25 Southeastern Species. Notices.* Federal Register 70(113):34492-34494.

USFWS. (2005b). *Recovery Plan for 6 Mobile River Basin Aquatic Snails.* U.S. Fish and Wildlife Service, Jackson, Mississippi.

USFWS. (2006). *5-year review of Cylindrical Lioplax (Lioplax cyclostomatiformis), Flat Pebblesnail (Lepyrium showalteri), Plicate Rocksnail (Leptoxis plicata), Painted Rocksnail, (Leptoxis taeniata), Round Rocksnail*

(Leptoxis ampla) and Lacy Elimnia (Elima crenatella). . U.S. Fish and Wildlife Service, Jackson, Mississippi.

USFWS. (2007). *The Alabama, Coosa, and Tallapoosa River Watershed Critical Habitat for Protected Mussel Species.* U.S. Fish and Wildlife Service, Alabama Field Office, Daphne, Alabama.

USFWS. (2008a). *Endangered and Threatened Wildlife and Plants; 5-Year Status Review of 20 Southeastern Species. Notices.* Federal Register 73(146):43947-43948.

USFWS. (2008b). *Endangered and Threatened Wildlife and Plants; 5-Year Review of 14 Southeastern Species. Notices.* Federal Register 71(174):53127-53129.

USFWS. (2008c). *Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Reviews of 10 Listed Species. Notices.* Federal Register 73(15):3991-3993.

USFWS. (2009). *Spigelia gentianoides, Gentian pinkroot, 5-Year Review Summary and Evaluation.* Panama City: U.S. Fish and Wildlife Service, Southeast Region, Panama City Field Office.

USFWS. (2010a). *Endangered and threatened wildlife and plants; determination of endangered status for the Georgia pigtoe mussel, interrupted rocksnail, and rough hornsnail and designation of critical habitat; Final Rule.* Federal Register. November 2, 2010, 75(211):67512-67550.

USFWS. (2010b). *Fish and Wildlife Service Conducts Five-year Status Reviews of 10 Southeastern Species*. Retrieved June 2010, from http://www.fws.gov/southeast/news/2010/r10-031.html.

USFWS. (2010c). *Planning Aid Letter regarding the Alabama-Coosa-Tallapoosa Water Control Manual Updates.* USFWS.

USFWS. (2016). *Small whorled pogonia.* Retrieved April 2019, from Endangered Species: https://www.fws.gov/midwest/endangered/plants/smallwhorledpogoniafs.html.

USFWS. (2017). *2017 Indiana Bat (Myotis sodalis) Population Status Update.* U.S. Fish and Wildlife Service, Indiana Ecological Services Field Office. Revised November 13, 2018.

USFWS. (2018). *IPaC Official Species List - Coosa and Etowah Basins, Georgia.*

USFWS. (2019a). *ECOS Environmental Conservation Online System*. Retrieved May 1, 2019, from U.S. Fish and Wildlife Service: https://ecos.fws.gov/ecp/.

USFWS. (2019b). *Official Species List- Coosa and Etowah Basins_Alabama.*

USFWS. (2019c). *Official Species List- Coosa and Etowah Basins_Georgia.*

USFWS. (2019d). Threatened & Endangered Species Active Critical Habitat Report. Critical habitat shapefiles ("crithab_all_layers.zip"). Shapefiles updated March 19, 2019. U.S. Fish & Wildlife Service. Retrieved March 20, 2019, from https://ecos.fws.gov/ecp/report/table/critical-habitat.html.

USFWS NWI. (2018). National Wetland Inventory shapefiles for Alabama, Georgia, and Tennessee ("AL_shapefile_wetlands.zip," "GA_shapefile_wetlands.zip," "TN_shapefile_wetlands.zip"). Shapefiles updated April 2018. U.S. Fish and Wildlife Service, National Wetlands Inventory. Retrieved March 21, 2019, from http://www.fws.gov/wetlands/Data/Data-Download.html.

USGS. (1991). *National water summary 1988-89 - Hydrologic events and floods and droughts: USGS Water-Supply Paper 2375.* Reston, Virginia: U.S. Geological Survey.

USGS. (2000). *Droughts in Georgia, U.S. Geological Survey Open-File Report 00-380.* Reston, Virginia: U.S. Geological Survey.

USGS. (2003a). *A GAP Analysis of Georgia.* Athens, Georgia: Natural Resources Spacial Analysis Laboratory, University of Georgia.

USGS. (2003b). *Principal Aquifers.* Reston: USGS.

USGS. (2006). *Classifications of Wetlands and Deepwater Habitats of the United States: Palustrine System*. Retrieved April 2009, from Northern Prairie Wildlife Research Center: hppt://www.npwrc.usgs.gov/resource/wetlands/classwet/palustri.htm.

USGS. (2017). *USGS Water-Year Summary for Site USGS 02397000 (Water-Year 2016)*. (U. S. Geological Survey) Retrieved December 7, 2018, from National Water Information System data available on the World Wide Web (USGS Water Data for the Nation): https://nwis.waterdata.usgs.gov/nwis/wys_rpt?dv_ts_ids=&37872&adr_begin_date=2015-10-01&adr_end_date=2016-09-30&site_no=02397000&agency_cd=USGS.

USGS. (2018a). *USGS Water-Year Summary for Site USGS 02397000 (Water-Year 2017)*. (U.S. Geological Survey) Retrieved December 7, 2018, from National Water Information System data available on the World Wide Web: https://nwis.waterdata.usgs.gov/nwis/wys_rpt?dv_ts_ids=&37872&adr_begin_date=2016-10-01&adr_end_date=2017-09-30&site_no=02397000&agency_cd=USGS.

USGS. (2018b). *USGS Water-Year Summary for Site USGS 02414500 (Water-Year 2017)*. (U.S. Geological Survey) Retrieved December 19, 2018, from National Water Information System data available on the World Wide Web (USGS Water Data for the Nation): https://nwis.waterdata.usgs.gov/nwis/wys_rpt?dv_ts_ids=&2160&adr_begin_date=2016-10-01&adr_end_date=2017-09-30&site_no=02414500&agency_cd=USGS.

USGS. (2018c). *USGS Water-Year Summary for Site USGS 02420000 (Water-Year 2017)*. (U.S. Geological Survey) Retrieved December 19, 2018, from National Water Information System data available on the World Wide Web (USGS Water Data for the Nation): https://waterdata.usgs.gov/nwis/wys_rpt?dv_ts_ids=2194&wys_water_yr=2017&site_no=02420000&agency_cd=USGS&adr_water_years=2006%2C2007%2C2008%2C2009%2C2010%2C2011%2C2012%2C2013%2C2014%2C2015%2C2016%2C2017&referred_module=.

USGS. (2018d). *USGS Water-Year Summary for Site USGS 02428400 (Water-Year 2017)*. Retrieved December 19, 2018, from National Water Information System data available on the World Wide Web (USGS Water Data for the Nation): https://nwis.waterdata.usgs.gov/nwis/wys_rpt?dv_ts_ids=&2323&adr_begin_date=2016-10-01&adr_end_date=2017-09-30&site_no=02428400&agency_cd=USGS.

USGS. (2019a). *USGS 02382500 Coosawattee River at Carters, GA*. (U.S. Geological Suvey) Retrieved January 30, 2019, from USGS National Water Information System: Web Interface: https://waterdata.usgs.gov/ga/nwis/dv/?site_no=02382500&PARAmeter_cd=00060.

USGS. (2019b). *USGS 02394000 Etowah River at Allatoona Dam, above Cartersville, GA*. (U.S. Geological Survey) Retrieved January 30, 2019, from National Water Information System: Web Interface: https://waterdata.usgs.gov/ga/nwis/dv/?site_no=02394000&PARAmeter_cd=00060.

USGS. (2019c). *USGS 02397000 Coosa River (Mayo's Bar) Near Rome, GA*. (U.S. Geological Survey) Retrieved January 30, 2019, from National Water Information System: Web Interface: https://waterdata.usgs.gov/ga/nwis/dv/?site_no=02397000&PARAmeter_cd=00060.

USGS. (2019d). *USGS 02414500 Tallapoosa River at Wadley, AL*. (U.S. Geological Survey) Retrieved January 30, 2019, from National Water Information System: Web Interface: https://waterdata.usgs.gov/al/nwis/uv/?site_no=02414500&PARAmeter_cd=00065,00060.

USGS. (2019e). *USGS 02420000 Alabama River near Montgomery, AL*. (U.S. Geological Survey) Retrieved January 30, 2019, from National Water Information System: Web Interface: https://waterdata.usgs.gov/al/nwis/uv/?site_no=02414500&PARAmeter_cd=00065,00060.

USGS. (2019f). *USGS 02428400 Alabama R at Claiborne Lock and Dam*. (U.S. Geological Survey) Retrieved January 30, 2019, from National Water Information System: Web Interface: https://waterdata.usgs.gov/al/nwis/uv/?site_no=02428400&PARAmeter_cd=00065,00060.

Williams, J., & Hughes, M. (1998). *Freshwater Mussels (Unionidae) of Selected Reaches of the Main Channel Rivers of the Coosa Drainage of Georgia.* U.S. Geological Survey, Florida Caribbean Science Center, Gainsville, Florida.

Windom, M. (2019). Executive Director, Carroll County Water Authority (March 29, 2019). (D. Barnett, Interviewer).

Ziewitz, J., Luprek, B., & Kasbohm, J. (1997). *Comprehensive Study's Protected Species Inventory and Identification in the ACT and ACF River Basins. Volume I.* Fish and Wildlife Service, Panama City, Florida.

Zitsch, K. (2018a). Director, Metropolitan Noth Georgia Atlanta Water Planning District (August 31, 2018). (D. Barnett, Interviewer).

Zitsch, K. (2018b). Projected Future Water Supply Demands and Returns for the Allatoona Lake System. *March 30, 2018 Memorandum to Richard E. Dunn, Director, Georgia Environmental Protection Division)*, 42. Atlanta, Georgia: Metropolitan North Georgia Water Planning District. Retrieved December 6, 2018, from https://www.sam.usace.army.mil/Portals/46/docs/planning_environmental/docs/2018_Georgia_ACT%20Water%20Supply%20Request.pdf?ver=2018-08-07-163848-187.

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Attachment 1. Record of Non-Applicability

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RECORD OF NON-APPLICABILITY

In Accordance with the Clean Air Act—General Conformity Rule
Master Water Control Manual Updates for the Alabama–Coosa–Tallapoosa River Basin

The U.S. Army Corps of Engineers proposes to reallocate storage in Allatoona Lake for municipal and industrial water supply and to modify federally-authorized flood operations at Alabama Power Company's Weiss and Logan Martin Dams in the Alabama–Coosa–Tallapoosa River Basin (ACT River Basin) and to update the pertinent project water control manuals (WCMs) to reflect these changes. WCMs outline the regulation schedules for each project and specifications for storage and releases from each reservoir. WCMs outline policies and data protocols for flood control operations and drought contingency operations. The updates to the WCMs for these projects are not expected to result in any reasonably foreseeable direct or indirect emissions. Such types of federal activities are specifically exempt from the general conformity regulations.

General Conformity under the Clean Air Act, section 176 has been evaluated according to the requirements of Title 40 of the *Code of Federal Regulations* Part 93, Subpart B. The requirements of that rule are not applicable to the proposed action or the alternatives because the proposed activities would result would result in no emissions increase [40 CFR 93.153(c) (2)], and/or the emissions are not reasonably foreseeable, such as electric power marketing activities that involve the acquisition, sale, and transmission of electric energy [40 CFR 93.153(c)(3)(ii)].

Supported documentation and emission estimates
( ) Are Attached
( ) Appear in the NEPA Documentation
(X) Other (Not Necessary)

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Attachment 2. Draft Cultural Resources Programmatic Agreement

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PROGRAMMATIC AGREEMENT
AMONG
THE U.S. ARMY CORPS OF ENGINEERS,
THE ALABAMA STATE HISTORIC PRESERVATION OFFICER, THE GEORGIA STATE HISTORIC PRESERVATION OFFICER, AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION REGARDING THE ALLATOONA LAKE WATTER SUPPLY STORAGE REALLOCATION STUDY AND WEISS AND LOGAN MARTIN RESERVOIRS PROJECTS WATER CONTROL MANUALS

WHEREAS, the U.S. Army Corps of Engineers, Mobile District (Corps), is conducting water supply reallocation study of Allatoona Reservoir and updates to Weiss and Logan and Martin Water Control Manuals (WCM) (Project) as authorized in the in Section 201(a) of the Water Resources Development Act (WRDA) of 1986, as amended by Section 302 of the WRDA of 1996; and

WHEREAS, the Project is being developed to reduce the risk of water supply shortage for Allatoona Reservoir users through the year 2050 and maintain acceptable levels of flood risk Alabama - Coosa – Tallapoosa (ACT) River Basin Projects; and

WHEREAS, the Corps proposes to raise water levels during the summer in Allatoona Reservoir and reduce top of flood control levels in the summer and raise winter water levels in Weiss and Logan and Martin reservoirs; and

WHEREAS, the Project comprises both the reallocation study and updates of the WCMs, the Corps will be the Lead Federal Agency for compliance with 54 U.S.C. § 306108 (NHPA Section 106) for the WCM update; and

WHEREAS, the Corps, the Alabama State Historic Preservation Officer (SHPO), and the Georgia SHPO have determined that the Reallocation Study and WCM updates constitutes an Undertaking, as defined in 36 C.F.R. § 800.16(y), and therefore is subject to Section 106 of the National Historic Preservation Act of 1966, 54 U.S.C. § 306108 (NHPA); and

WHEREAS, the Corps has determined that the reallocation study and WCM updates have the potential to affect properties that are either listed or eligible for listing in the National Register of Historic Places (NRHP) and have consulted with the Alabama and Georgia State SHPOs pursuant to the NHPA; and

WHEREAS, the Corps has determined that the Project's Area of Potential Effects (APE) includes discontinuous areas within the Allatoona, Weiss, and Logan and Martin reservoirs determined by comparing the frequency of wet/dry cycles under existing operations to frequencies of wet/dry cycles during hypothetical operations conducted under water supply storage reallocation and

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proposed revisions to flood operations and areas below reservoir dams that could be subjected to higher flow rates from releases under the proposed reallocation and WCM updates; and

WHEREAS, the Corps has identified potential historic properties in the reservoir and riverine portions the APE; and

WHEREAS, the Corps as lead federal agency, with the concurrence of the Signatories, has decided to comply with Section 106 of the NHPA for the Undertaking through the execution and implementation of a Programmatic Agreement (Agreement), following § 800.14(b); and

WHEREAS, the Alabama Power Company (APC) will implement the WCM updates for Weiss and Logan and Martin reservoirs and has been invited to be a Concurring Party to this Agreement; and

WHEREAS, in accordance with 36 C.F.R. §§ 800.2(c)(2)(ii)(A), 800.3(f)(2), and 800.14(b)(2)(i), the Corps has contacted federally recognized Native American Tribes, via letter(s), phone call(s), and meetings, to invite them to consult on the reallocation study, WCM updates, and this Agreement, including the Absentee-Shawnee Tribe of Oklahoma, the Alabama-Coushatta Tribes of Texas, the Alabama-Quassarte Tribal Town, the Caddo Nation of Oklahoma, the Catawba Indian Nation, the Cherokee Nation, the Chickasaw Nation, the Chitimacha Tribe of Louisiana, the Choctaw Nation of Oklahoma, The Coushatta Tribe of Louisiana, Eastern Band of the Cherokee Nation, the Eastern Shawnee Tribe of Oklahoma, the Jena Band of Choctaw Indians of Louisiana, the Kialegee Tribal Town of Oklahoma, the Miccosukee Tribe of Indians of Florida, the Mississippi Band of Choctaw Indians, Muscogee (Creek) Nation, the Poarch Band of Creek Indians, the Quapaw Tribe of Indians of Oklahoma, Shawnee Tribe of Oklahoma, the Seminole Nation of Oklahoma, the Seminole Tribe of Florida, the Thlopthlocco Tribal Town, Tunica-Biloxi Indian Tribe of Louisiana, and the United Keetoowah Band of Cherokee Indians in Oklahoma; and

WHEREAS, in accordance with 36 C.F.R. § 800.2(c)(5), the Corps has contacted additional interested parties via letter(s), phone call(s), email(s), and meetings, to invite them to consult on the reallocation study, WCM updates, and this Agreement, including other non-Federally listed Tribes and Native American individuals and other interested parties; and

WHEREAS, in accordance with 36 C.F.R. § 800.14(b)(3), the Corps, will invite the Advisory Council on Historic Preservation (ACHP) per 36 C.F.R. § 800.6(a)(1)(C) to participate in consultation to resolve potential adverse effects of the WCM update, including development of this Agreement; and

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WHEREAS, in accordance with 36 C.F.R. § 800.6(a)(4) and 36 C.F.R. § 800.14(b)(2)(ii), the Corps held a series of public meetings to notify the public of the WCM update and provide an opportunity for members of the public to comment on the Project and the Section 106 process as outlined in this Agreement; and

NOW, THEREFORE, the signatories agree that the Undertaking shall be implemented in accordance with the following stipulations in order to take into account the effects of the undertaking on Historic Properties.

STIPULATIONS

The Corps shall ensure that the following measures are carried out:

I. TIME FRAMES AND REVIEW PROCEDURES

A. Document and Deliverable Review. For all documents and deliverables produced in compliance with this Agreement, the Corps will have thirty (30) calendar days to review. After completing its review, the Corps shall provide a hard copy draft document via mail to the appropriate SHPOs, Concurring Parties, and Native American interested parties and Tribes for review. Any written comments provided by the SHPOs, Concurring Parties, and additional consulting parties including non-federally recognized Native American Tribes, and Federally Recognized Tribes within thirty (30) calendar days from the date of receipt shall be considered in the revision of the document or deliverable. The Corps shall document and report the written comments received for the document or deliverable and how comments were addressed. The Corps shall provide a revised final document or deliverable to the SHPOs for concurrence. The SHPOs shall have thirty (30) calendar days to respond. Failure of the SHPOs, Concurring Parties, and Native American interested parties and Tribes to respond within thirty (30) calendar days of any submittal shall not preclude Corps from moving to the next step in this Agreement. A copy of the final document shall be provided to the Signatories and to any consulting parties who request it, as appropriate per **Stipulation IX (Confidentiality)**.

B. Disagreement. Should the any of the SHPOs, Concurring Parties, Tribes, or interested parties object to the findings of National Register of Historic Places eligibility and/or findings of effect within the final document or deliverable submitted for concurrence, the Corps, SHPOs, Concurring Parties, Tribes, and interested parties shall consult for a period not to exceed fifteen (15) calendar days following the receipt of a SHPO's, a tribe's, a Concurring Party's, or an interested party's written objection in an effort to come to agreement on the issues to which the SHPOs, Concurring Parties, Tribes, or interested parties has objected. Should the SHPOs, Concurring Parties, a Tribe, or interested party be unable to agree on the issues to which the SHPOs, a Concurring Party, a Tribe,

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or an interested party has objected, the SHPOs and the Corps shall proceed in accordance with **Stipulation X (Dispute Resolution)**, below. The timeframe to consult to resolve a disagreement or objection may be extended by mutual consent of the Signatories.

II. AREA OF POTENTIAL EFFECTS

A. DETERMINATION OF THE AREA OF POTENTIAL EFFECTS. The APE for Project activities has been determined by the Corps as Lead Federal Agency. It includes the portions of the Etowah River from its confluence with Hickory Log Creek at Canton, Georgia, and extends 79 miles downstream to its confluence with the Oostanaula River at Rome, Georgia, including portions of Allatoona Reservoir. The APE also includes parts of the Etowah and Coosa rivers below Weiss and Logan and Martin reservoir dams. This encompasses a 280-mile portion of the Coosa River extending from Rome, Georgia, downstream to its confluence with the Tallapoosa River near Montgomery, Alabama, including Weiss and Logan and Martin reservoirs. If the APE is revised, the Corps shall consult on that revision in accordance with **Stipulation I (Timeframes and Review Procedures),** and the Corps shall determine the potential for Project activities in a revised APE to affect potential Historic Properties.

III. TREATMENT OF HISTORIC PROPERTIES

A. SITE CONDITION ASSESSMENT AND MONITORING PLAN. In consultation with the Signatories and consulting parties, the Corps shall conduct a Site Condition Assessment (SCA) and prepare a Monitoring Plan (MP). Templates for the SAC report and MP are provided in Appendices B and C. As specified in the SCA template, the SCA report will provide a detailed description of the project, present site assessment methods and results, describe the objectives and methods of the site condition assessment work and provide contextual information on environmental and cultural parameters related to the APE. As specified in the MP template, a list and description of sites recommended for monitoring in the SCA report will be provided and the methods and objectives of site monitoring will be outlined. This will allow for the complete consideration of effects of the undertaking by considering previously recorded potential historic properties that exist within the project APE, and, if needed, providing for a program of monitoring their condition over time.

1. REVIEW. The Corps will submit the SCA and the MP to all consulting parties for review pursuant to **Stipulation I (Timeframes and Review Procedures)**. The Corps shall ensure the SCA and the MP is completed no later than 90 days from the execution of this agreement, or within 30 days of the implementation of the undertaking.

B. SITE CONDITION ASSESSMENT. The Site Condition Assessment will be conducted concurrently with the preparation of the MP. The rational of the site

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condition assessment, the scope of the background research and records search for the site condition assessment, and a description of the contents of the site condition assessment report are listed below:

1. Rationale: The proposed APE was identified based upon a theoretical model of current operations the three subject reservoirs. Presently, the extent to which the proposed reallocation and WCM updates would impact historic properties and whether these impacts would be discernable from normal operations of the dams is unclear. Based on these factors and the significantly large APE, assessment efforts for the project will focus on archival research and tribal consultation regarding know sites and potential site visits to previously recorded properties.

2. Site Condition Assessment: The site condition assessment will include background research and a records search regarding known NRHP eligible properties within the APE. The background research will focus on existing site conditions, information related to site integrity, and investigating the potential effects to resources by the implementation of the Allatoona reallocation study and Weiss Logan and Martin WCM updates, following the methods described in the SCA template. As the degree to which sites will be impacted by the undertaking is currently unknown, the site condition assessment will also focus on determining if future archaeological monitoring of specific sites is required. The purpose of the site condition assessment research is to obtain baseline data on the potential historic properties within the APE, in order to assess their changing site conditions following implementation of the reallocation and WMC updates.

3. Report Content: A SCA report will be prepared within 90 days following the completion of the background research and records search or 30 prior to the implementation of the undertaking. The report will include the results of the fieldwork with descriptions of the condition of each site. Descriptions will include photographs (if feasible), maps (if needed), any findings of integrity and eligibility, and if possible, a finding of effect. Specific sites requiring monitoring will also be identified in this report. Monitoring will be recommended for NRHP eligible sites where effects of the undertaking may not be readily determined or where they are determined to be adverse during the site condition assessment. Specific methods guiding the site condition assessment work, including assessments of NRHP eligibility, determinations of the effect of the undertaking on potential historic properties, and expected deliverables will be described in the SCA report. Timeframes for all documents and deliverables produced in compliance with this Agreement will be distributed in accordance with **Stipulation I (Timeframes and Review Procedures).**

C. REPORT ON MONITORING RESULTS. The Corps shall prepare a technical report that documents results of any site monitoring conducted within 90 days of

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the initial implementation of the Allatoona Reservoir reallocation study and WCM updates for Weiss and Logan and Martin reservoirs. The monitoring report shall include updated updated sites forms for each property where monitoring occurred with maps, photographs, and descriptive narratives that document the changing conditions at each site. The monitoring results report shall assess whether and how the undertaking affected each individual property by comparing actual results to pre-project modeling. The Corps will submit the monitoring results report to all consulting parties for review pursuant to **Stipulation I.**

D. RESOLUTION OF ADVERSE EFFECTS. The adverse effects of the reallocation study and WCM updates will be resolved through the completion of the SCA study, finalization of the SCA report, the completion of any site monitoring, or other actions identified during the SCA study or site monitoring to mitigate adverse effects to any historic properties.

1. SCA study and report: The SCA study and report will identify and record the physical conditions of known sites within the APE, assess the potential for the undertaking to effect these sites, document new information, provide recommendations for site monitoring or other potential types of site mitigation, and provide the framework for preparation of the MP. The Corps will submit the SCA report to all consulting parties for review pursuant to **Stipulation I.**

2. Site Monitoring and monitoring report: If site monitoring is conducted for any historic properties within the APE, the results of the monitoring will be documented in a monitoring report. This report will also document any adverse effects to properties and provide any updated information regarding changes in site conditions from previous descriptions. The Corps will submit the monitoring results report to all consulting parties for review pursuant to **Stipulation I.**

3. Other Mitigation Measures: Depending upon the results of the SCA and site monitoring, other forms of site mitigation could be recommended to resolve any adverse effects of the undertaking. This could include, but are not limited to Phase I inventory surveys, Phase II testing and data recovery, the preparation of interpretive and/or educational materials, artifact curation, or the preparation of an article for publication in a peer-review journal.

IV. QUALIFICATIONS

A. Professional Qualifications: All technical work required for historic preservation activities implemented pursuant to this Agreement shall be carried out by or under the direct supervision of a person or persons meeting, at a minimum, the *Secretary of Interior's Professional Qualifications Standards* for archeology or history, as appropriate (48 FR 44739). "Technical

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work" here means all efforts to inventory, evaluate, and perform subsequent treatment such as data recovery excavation or recordation of potential Historic Properties that is required under this Agreement. This stipulation shall not be construed to limit peer review, guidance, or editing of documents by SHPO and associated Project consultants.

B. Historic Preservation Standards: Historic preservation activities carried out pursuant to this Agreement shall meet the *Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation* (48 FR 44716-44740), as well as standards and guidelines for historic preservation activities established by the Alabama and Georgia SHPOs. The Corps shall ensure that all reports prepared pursuant to this Agreement will be provided to the Signatories, Concurring Parties, and Native American interested parties and Tribes and are distributed in accordance with **Stipulation IX (Confidentiality),** and meet published standards of the California Office of Historic Preservation, specifically, *Preservation Planning Bulletin* Number 4(a), "Archaeological Resources Management Reports (ARMR): Recommended Contents and Format" (December 1989).

C. Archeological Monitor Standards: Archeological monitoring activities required for evaluating project effects upon resources pursuant to this Agreement shall be carried out by a person meeting, at a minimum, the *Secretary of Interior's Professional Qualifications Standards* for prehistoric or historic archaeology, as appropriate (48 FR 44739).

V. TRIBAL CONSULTATION

A. In consultation with other interested parties that include non-federally recognized tribes and federally recognized tribes, the Corps will make a reasonable and good-faith effort to identify Historic Properties of traditional religious and cultural importance. As the Lead Federal Agency, the Corps shall ensure that consultation regarding site condition assessment and monitoring efforts and determinations of eligibility and effects with Native American Tribes continues throughout the implementation of the Agreement. The Corps shall be responsible for transmitting all relevant documents and deliverables to Native American interested parties or tribes as part of their tribal consultation responsibility.

B. Native American Tribes may choose not to sign this Agreement as a Concurring Party. However, the Corps will make a good faith effort to contact Native American Tribes and individuals, not acting as Concurring Parties to the Agreement, with potential interest in consulting on site condition assessment efforts and on the proposed treatment of Historic Properties or potential Historic Properties. Efforts to identify these individuals or groups may include using the Corps' list of Consulting Tribes, online databases, and using personal and professional knowledge. The Corps will then contact each

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identified organization and individual by mail, inviting them to consult about inventory and site condition assessment efforts and proposed treatments of Historic Properties or potential Historic Properties. If the contacted parties wish to consult, the Corps will proceed in accordance with **Stipulation V.A. (Tribal Involvement)**. Consultations may be carried out through either letters of notification, public meetings, environmental assessments/environmental impact statements, site visits, and/or other methods requested by a Native American interested parties and Tribe. Failure of any contacted group to comment within thirty (30) calendar days shall not preclude the Corps from proceeding with the Project.

C. The Corps shall make a reasonable and good-faith effort to ensure that Native American Tribes, acting as either Concurring Parties or those expressing interest in the project, will be invited to participate in the implementation of the terms of this Agreement, including, but not limited to, , the development of the SCA report, MP, and monitoring report. Review periods shall be consistent with **Stipulation I (Timeframes and Review Procedures)** The Corps shall ensure that all interested Native American reviewers shall receive copies of all reports.

VI. TREATMENT OF HUMAN REMAINS

A. FEDERAL LAND. The Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. § 3001 et seq.) applies to this Project only on Federal lands within the APE, i.e. those owned by the Corps. In the event that Native American human remains, as well as Native American funerary objects, sacred objects, or objects of cultural patrimony are encountered during the site condition assessment or monitoring efforts on Federal lands, those remains and objects are subject to the Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. 3001 *et seq.*) and treatment under NAGPRA's implementing regulations at 43 CFR Part 10. When NAGPRA items are discovered inadvertently on Corps land, an appropriate Corps official (Corps Regional Archaeologist) must be notified immediately upon the discovery. The Corps shall follow the requirements of 43 CFR §10.3 for consultation; notification; development of excavation, treatment, and disposition plans as needed; and the requirements of 43 CFR §10.6 for NAGPRA item disposition.

B. NON-FEDERAL LAND. Native American human remains and grave goods encountered during the Undertaking that are located on state or private land would be treated in accordance with the requirements in established Alabama or Georgia state codes.

VII. PUBLIC CONSULTATION AND PUBLIC NOTICE

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A. The interested public will be invited to provide input during the implementation of this document. The Corps shall carry this out through letters of notification, public meetings, environmental assessment/environmental impact statements, and/or site visits. The Corps shall ensure that any comments received from members of the public are taken under consideration and incorporated where appropriate. Review periods shall be consistent with **Stipulation I (Timeframes and Review Procedures)**. In seeking input from the interested public, locations of Historic Properties will be handled in accordance with **Stipulation IX (Confidentiality)**. In cases where the release of location information may cause harm to the Historic Property, this information will be withheld from the public in accordance with Section 304 of the NHPA (54 U.S.C. § 307103).

VIII. NEW DISCOVERIES

The SCA report shall provide direction for management of the discovery of new properties that occur during the site condition assessment work or site monitoring of known properties. Any new discoveries shall be recorded on appropriate State forms and treated the same as the known sites within the APE. If any new discoveries are made prior to finalizing the SCA report, the Corps will incorporate the new sites into the MP.

IX. CONFIDENTIALITY

Confidentiality regarding the specific nature and location of the archaeological sites and any other cultural resources discussed in this Agreement shall be maintained to the extent allowable by law. Dissemination of such information shall be limited to appropriate personnel with the Corps, SHPOs, contractors, Native American tribes, and those parties involved in planning, reviewing and implementing this Agreement and in accordance with Section 304 of the NHPA (54 U.S.C. § 307103). When information is provided to the Corps by Native American tribes or others who wish to control the dissemination of that information more than described above, the Corps will make a good faith effort to do so, to the extent permissible by law.

X. DISPUTE RESOLUTION

A. Should any signatory or concurring party to this Agreement object at any time to any actions proposed or the manner in which the terms of this agreement are implemented, the Corps shall consult with such party to resolve the objection. If the Corps determines that such objection cannot be resolved, the Corps will:

1. Forward all documentation relevant to the dispute, including the District's proposed resolution, to the ACHP. The ACHP shall provide the Corps with its advice on the resolution of the objection within thirty (30) days of

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receiving adequate documentation. Prior to reaching a final decision on the dispute, the Corps shall prepare a written response that takes into account any timely advice or comments regarding the dispute from the ACHP, signatories and concurring parties, and provide them with a copy of this written response. The District will then proceed according to its final decision.

2. If the ACHP does not provide its advice regarding the dispute within the thirty (30) day time period, the Corps may make a final decision on the dispute and proceed accordingly. Prior to reaching such a final decision, the Corps shall prepare a written response that takes into account any timely comments regarding the dispute from the signatories and concurring parties to the Agreement, and provide them and the ACHP with a copy of such written response.

3. The Corps' responsibility to carry out all other actions subject to the terms of this Agreement that are not the subject of the dispute remain unchanged.

B. At any time during implementation of the measures stipulated in this Agreement should an objection pertaining to the Agreement be raised by a Native American Tribe, or a member of the public, the Corps shall notify the Signatory and Concurring Parties and take the objection under consideration, consulting with the objecting party and should the objecting party request, any of the Signatory and Concurring Parties to this Agreement, for no longer than fifteen (15) calendar days. The Corps shall consider the objection, and in reaching its decision, will consider all comments provided by the other signatories and concurring parties. Within fifteen (15) calendar days following closure of the comment period, the Corps will render a decision regarding the objection and respond to the objecting party. The Corps will promptly notify the other signatories and concurring parties of its decision in writing, including a copy of the response to the objecting party. The Corps' decision regarding resolution of the objection will be final. Following issuance of its final decision, the Corps may authorize the action that was the subject of the dispute to proceed in accordance with the terms of that decision. The Corps' responsibility to carry out all other actions under this Agreement shall remain unchanged.

C. Should any Signatory Party to this Agreement object in writing to the determination of National Register eligibility, the objection will be addressed pursuant to 36 C.F.R. § 800.4(c) (2).

XI. NOTICES

A. All notices, demands, requests, consents, approvals or communications from all parties to this Agreement to other parties to this Agreement shall be either

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personally delivered, sent by United States Mail, or emailed, and all parties shall be considered in receipt of the materials five (5) calendar days after deposit in the United States mail or the on the day after being emailed.

B. If Signatory and Concurring Parties agree in advance in writing or by email, facsimiles, emails, or copies of signed documents may be used as if they bore original signatures.

C. If Signatory Parties agree, hard copies and/or electronic communications may be used for formal communication amongst themselves for activities in support of **Stipulation I (Time Frames and Review Procedures).**

XII. AMENDMENTS, NONCOMPLIANCE, AND TERMINATION

A. Amendement: Any Signatory Party to this Agreement may propose that the Agreement be amended, whereupon the Corps shall consult with the Signatories to consider such amendment. This Agreement may be amended when such an amendment is agreed to in writing by all signatories. The amendment will be effective on the date a copy signed by all of the signatories is filed with the ACHP.

All attachments to this Agreement, and other instruments prepared pursuant to this agreement including, but not limited to, the maps of the APE, the SCA report, the MP, and the MP report may be individually revised or updated through consultation consistent with **Stipulation I (Timeframes and Review Procedures)** and agreement in writing of the Signatories without requiring amendment of this Agreement, unless the Signatories through such consultation decide otherwise. In accordance with **Stipulation V (Tribal Involvement)** and **Stipulation VII (Public Consultation and Public Notice)**, the Concurring Parties, interested Native American Tribes, and interested members of the public, will receive amendments to the Project's SCA and MP as appropriate, and copies of any amendment(s) to the Agreement.

B. Termination: Any signatory to this Agreement, including Invited Signatories, may terminate this Agreement. If this Agreement is not amended as provided for in **Stipulation XI.A. (Amendment)**, or if any Signatory proposes termination of this Agreement for other reasons, the Signatory proposing termination shall notify the other Signatories in writing, explain the reasons for proposing termination, and consult with the other Signatories to seek alternatives to termination, within thirty (30) calendar days of the notification.

1. Should such consultation result in an agreement on an alternative to termination, the Signatories shall proceed in accordance with that agreement and amend the Agreement as required.

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2. Should such consultation fail, the Signatory proposing termination may terminate this Agreement by promptly notifying the other Signatories and Concurring Parties in writing.

3. Beginning with the date of termination, the Corps shall ensure that until and unless a new agreement is executed for the actions covered by this Agreement, such undertakings shall be reviewed individually in accordance with 36 C.F.R. § 800.4-800.6.

C. Duration: This Agreement shall remain in effect for a period of five (5) years after the date it takes effect and shall automatically expire and have no further force or effect at the end of this five-year period unless it is terminated prior to that time. No later than ninety (90) calendar days prior to the expiration date of the Agreement, the Corps shall initiate consultation to determine if the Agreement should be allowed to expire automatically or whether it should be extended, with or without amendments, as the Signatories may determine. Unless the Signatories unanimously agree through such consultation on an alternative to automatic expiration of this Agreement, this Agreement shall automatically expire and have no further force or effect in accordance with the timetable stipulated herein.

XIII. ANNUAL REPORTING

At the end of every calendar year following the execution of this Agreement, the Corps shall provide the SHPOs, concurring parties, and any participating tribes or interested parties a summary report detailing work carried out pursuant to its terms, if any. Such report shall describe progress made implementing the terms of the Agreement as well as include any scheduling changes proposed, any problems encountered, and any disputes and objections received in the course of efforts to carry out the terms of this Agreement. Any Signatory, concurring party, or participant tribe may request to meet with the other Signatories to discuss implementation of this Agreement.

XIV. EFFECTIVE DATE

This Agreement shall take effect on the date that it has been fully executed by the Corps, the Alabama SHPO, the Georgia SHPO, and the ACHP.

EXECUTION of this Agreement by the Corps, the Alabama SHPO, the Georgia SHPO, and the ACHP and the implementation of its terms evidence that the Corps has taken into account the effects of this undertaking on historic properties and afforded the ACHP an opportunity to comment.

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PROGRAMMATIC AGREEMENT
AMONG
THE U.S. ARMY CORPS OF ENGINEERS,
THE ALABAMA STATE HISTORIC PRESERVATION OFFICER, THE GEORGIA STATE HISTORIC PRESERVATION OFFICER, AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION REGARDING THE ALLATOONA LAKE WATTER SUPPLY STORAGE REALLOCATION STUDY AND WEISS AND LOGAN MARTIN RESERVOIRS PROJECTS WATER CONTROL MANUALS

SIGNATORIES TO THIS AGREEMENT:

U.S. ARMY CORPS OF ENGINEERS, MOBILE DISTRICT

BY:_____DATE :_____
Sebastien P. Joly, Colonel, U.S. Army Corps of Engineers, District Commander

ALABAMA STATE HISTORIC PRESERVATION OFFICER

BY:_____DATE:_____
, State Historic Preservation Officer

GEORGIA STATE HISTORIC PRESERVATION OFFICER

BY:_____DATE:_____
, State Historic Preservation Officer

ADVISORY COUNCIL ON HISTORIC PRESERVATION

BY:_____DATE:_____
John M. Fowler, Executive Director

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PROGRAMMATIC AGREEMENT
AMONG
THE U.S. ARMY CORPS OF ENGINEERS,
THE ALABAMA STATE HISTORIC PRESERVATION OFFICER, THE GEORGIA STATE HISTORIC PRESERVATION OFFICER, AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION REGARDING THE ALLATOONA LAKE WATTER SUPPLY STORAGE REALLOCATION STUDY AND WEISS AND LOGAN MARTIN RESERVOIRS PROJECTS WATER CONTROL MANUALS

CONCURRING PARTIES:

ALABAMA POWER COMPANY

BY:_____DATE: _____

TRIBES

BY:_____DATE: _____

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