DRAFT
Environmental Impact Statement

Update of the Water Control Manual for the Apalachicola-Chattahoochee-Flint River Basin in Alabama, Florida, and Georgia and a Water Supply Storage Assessment

October 2015

US Army Corps of Engineers®
Mobile District

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Appendix A

Master Water Control Manual
and
Individual Project Water Control Manuals

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US Army Corps
of Engineers ®
Mobile District

MASTER WATER CONTROL MANUAL

APALACHICOLA-CHATTAHOOCHEE-FLINT (ACF) RIVER BASIN

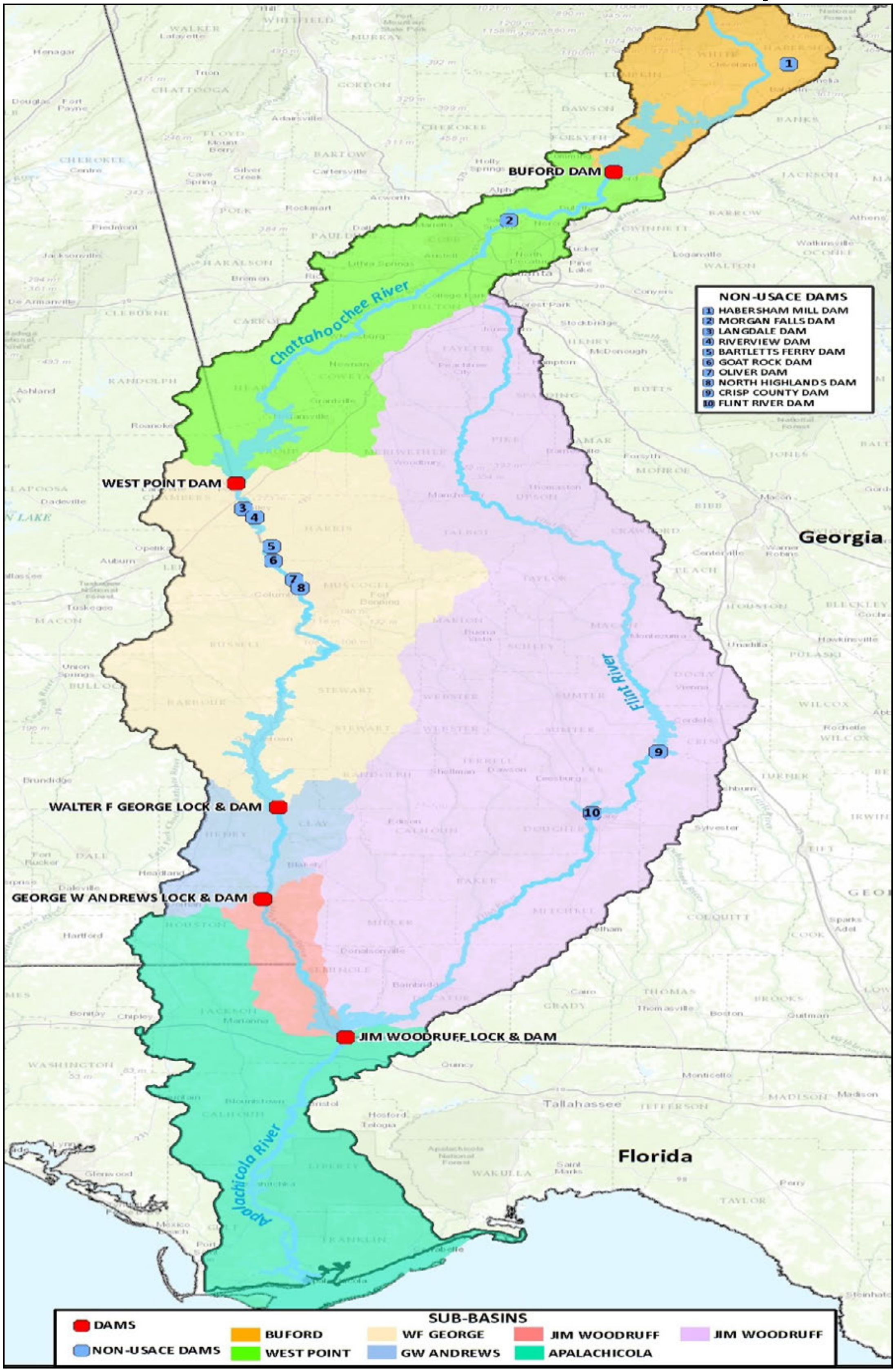
ALABAMA, FLORIDA, GEORGIA

U.S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT
MOBILE, ALABAMA

FEBRUARY 1958

REVISED XXX 2016

ACF River Basin with USACE and non-USACE Reservoir Projects



NOTICE TO USERS OF THIS MANUAL

Regulations specify that this Water Control Manual be published in a hard copy binder with loose-leaf form and only those sections, or parts thereof requiring changes, will be revised and printed. Therefore, this copy should be preserved in good condition so that inserts can be made to keep the manual current. Changes to individual pages must carry the date of revision, which is the Division's approval date.

REGULATION ASSISTANCE PROCEDURES

If unusual conditions arise, the following contact information can be used:

- Mobile District Water Management Section Chief (251) 690-2737 (office), (251) 509-5368 (cell)
- Mobile District Water Management Branch Chief (251) 690-2718 (office), (251) 459-3378 (cell)
- Mobile District Engineering Division Chief (251) 690-2709 (office), (251) 656-2178 (cell)
- Mobile District Operations Division Chief (251) 690-2576 (office), (251) 689-2394 (cell)
- South Atlantic Division Senior Water Manager (404) 562-5128 (office), (404) 242-1700 (cell)

Individual projects can be reached at the following telephone numbers during normal duty hours:

- Buford Dam and Lake Sidney Lanier (770) 945-9531
- West Point Dam and Lake (706) 645-2937
- Walter F. George Lock and Dam and Lake (229) 768-2516
- George W. Andrews Lock and Dam and Lake George W. Andrews (229) 768-2516
- Jim Woodruff Lock and Dam and Lake Seminole (229) 662-2001

UNIT CONVERSION

This manual uses the U.S. Customary System of Units (English units). Exhibit A contains a conversion table that can be used for common unit conversions and for unit conversion to the metric system of units.

VERTICAL DATUM

All vertical data presented in this manual are referenced to the project's historical vertical datum, National Geodetic Vertical Datum of 1929 (NGVD29 or NGVD). It is the U.S. Army Corps of Engineers (herein referred to as USACE or Corps) policy that the designed, constructed, and maintained elevation grades of projects be reliably and accurately referenced to a consistent nationwide framework, or vertical datum - i.e., the National Spatial Reference System (NSRS) or the National Water Level Observation Network (NWLON) maintained by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration. The current orthometric vertical reference datum within the NSRS in the continental United States is the North American Vertical Datum of 1988 (NAVD88). The current NWLON National Tidal Datum Epoch is 1983–2001. The relationships among existing, constructed, or maintained project grades that are referenced to local or superseded datums (e.g., NGVD29, MSL), the current NSRS, and/or hydraulic/tidal datums, have been established per the requirements of Engineering Regulation 1110-2-8160 and in accordance with the standards and procedures as outlined in Engineering Manual 1110-2-6056. A Primary Project Control Point has been established at each of the five federal projects and linked to the NSRS. Information on the Primary Project Control Point, for each project, and the relationship between current and legacy datums are in Exhibit B of each project water control manual appendix.

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PERTINENT DATA
APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

(NOTE: All drainage area values taken from latest USGS data)

GENERAL

ACF Drainage area – square miles	19,573
Apalachicola River – square miles	2,409
Flint River – square miles	8,456
Chattahoochee River –square miles	8,708
Area of federal reservoirs at static full pool – acres	148,627
Total volume of federal reservoirs at static full pool – acre-feet	5,215,020
Total volume of conservation storage at static full summer pool – acre-feet	1,638,131

PERTINENT DATA
FOR EXISTING RESERVOIR PROJECTS IN THE
APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

Buford Dam (Lake Sidney Lanier)

Structure type	Rolled-fill earth
Length	1,630 feet
Maximum height above streambed	192 feet
Lake elevation (full summer pool)	1,071 feet NGVD29
Lake elevation (full winter pool)	1,070 feet NGVD29
Lake area (elevation 1,071)	38,542 acres
Shoreline miles (elevation 1,071)	692 miles
Drainage area	1,034 square miles
Conservation Storage (elevation 1,071-1,035)	1,087,600 acre-feet
Generating capacity (declared*)	127 Megawatts

West Point Dam and Lake

Structure type	Concrete gravity and earth embankment
Length (earth embankments + concrete structure)	7,250 feet
Maximum height above streambed	96 feet
Lake elevation (full summer pool)	635 feet NGVD29
Lake elevation (full winter pool)	628 feet NGVD29
Lake area (elevation 635)	25,864 acres
Shoreline miles (elevation 635)	604 miles
Drainage area	3,440 square miles
Conservation Storage (elevation 635 - 620)	306,131 acre-feet
Generating capacity (declared*)	87 Megawatts

Pertinent Data
(Continued)

Walter F. George Lock and Dam and Lake

Structure type	Concrete gravity and earth embankment
Length (earth embankments + concrete structure)	12,128 feet
Maximum height above streambed	113 feet
Lake elevation (full summer pool)	190 feet NGVD29
Lake elevation (full winter pool)	188 feet NGVD29
Lake area (elevation 190)	45,181 acres
Shoreline miles (elevation 190)	640 miles
Drainage area	7,460 square miles
Conservation Storage (elevation 190-184)	244,400 acre feet
Generating capacity (declared*)	168 Megawatts
Static head limitation	88 feet

George W. Andrews Lock and Dam and Lake

Structure type	Concrete gravity and earth embankment
Length (earth embankments + concrete structure)	620 feet
Maximum height above streambed	72 feet
Lake elevation (normal pool)	102 feet NGVD29
Lake area (elevation 102)	1,540 acres
Shoreline miles (elevation 102)	65 miles
Drainage area	8,210 square miles
Usable Storage or Pondage (elevation 102-96)	8,200 acre feet
Generating capacity (declared*)	N/A
Static head limitation	25 feet

Jim Woodruff Lock and Dam (Lake Seminole)

Structure type	Concrete gravity and earth embankment
Length (earth embankments + concrete structure)	6,150 feet
Maximum height above streambed	68 feet
Lake elevation (normal pool)	77.0 feet NGVD29
Lake area acres (elevation 77.0)	37,500 acres
Shoreline miles (elevation 77.0)	532 miles
Drainage area	17,164 square miles
Usable Storage or Pondage (elevation 77.5-76.5)	38,000 acre feet
generating capacity (declared*)	43.35 Megawatts
Static head limitation	38.5 feet

Habersham Mill Dam

Structure type	Stone buttresses and timber
Length	207 feet
Maximum height	10 feet
Lake elevation	1,280 feet NAVD 88
Lake area (elevation 1280)	108 acres
Drainage area	82 square miles

Pertinent Data
(Continued)

Morgan Falls Dam (Bull Sluice Lake)

Structure type	Concrete gravity
Length	1,075 feet
Maximum height	56 feet
Lake elevation (Plant Datum)	866 ft PD (853.42 ft NGVD29)
Lake area (elevation 866)	580 acres
Shoreline miles (elevation 866)	12.6 miles
Drainage area	1,360 square miles
Generating capacity	16.8 Megawatts

Langdale Dam

Structure type	Rubble, Masonry
Length	1,360 feet
Maximum height	15 feet
Lake elevation	547.7 ft NGVD29
Lake area (elevation 547.7)	152 acres
Shoreline miles	N/A
Drainage area	3,640 square miles
Generating capacity	1.040 Megawatts

Riverview Dam

Structure type	Cyclopean Concrete
Length	1,200 feet
Maximum height	15 feet
Lake elevation	530.5 ft NGVD29
Lake area (elevation 530.5)	75 acres
Shoreline miles	N/A
Drainage area	3,661 square miles
Generating capacity	0.48 Megawatts

Bartletts Ferry Dam

Structure type	Concrete gravity
Length	2,052 feet
Maximum height	150 feet
Lake elevation (Plant Datum)	521 ft PD (520.14 ft NGVD29)
Lake area (elevation 521)	5,850 acres
Shoreline miles (elevation 521)	156 miles
Drainage area	4,240 square miles
Generating capacity	173 Megawatts

Goat Rock Dam

Structure type	Concrete Masonry
Length	1,320 feet
Maximum height	68 feet
Lake elevation (Plant Datum)	404 ft PD (403.1 ft NGVD29)
Lake area (elevation 404)	1,050 acres
Shoreline miles (elevation 404)	25.4 miles
Drainage area	4,510 square miles
Generating capacity	38.6 Megawatts

Pertinent Data
(Continued)

Oliver Dam	
Structure type	Gravity Masonry
Length	2,021 feet
Maximum height	70 feet
Lake elevation (Plant Datum)	337 ft PD (336.06 ft NGVD29)
Lake area (elevation 337)	2,150 acres
Shoreline miles (elevation 337)	40 miles
Drainage area	4,630 square miles
Generating capacity	60 Megawatts
North Highlands Dam	
Structure type	Cyclopean Concrete
Length	728 feet
Maximum height	15 feet
Lake elevation (Plant Datum)	269 ft PD (269.08 ft NGVD29)
Lake area (elevation 269)	131 acres
Shoreline miles	N/A
Drainage area	4,630 square miles
Generating capacity	29.6 Megawatts
Crisp County Dam (or Warwick Dam or Blackshear Dam)	
Structure type	Concrete Slab and Buttress with Earth Embankments
Length	4,612 feet
Maximum height	46 feet
Lake elevation	237 feet msl
Lake area (elevation 237)	8,700 acres
Shoreline miles (elevation 237)	77 miles
Drainage area	3,770 square miles
Generating capacity	15.2 Megawatts
Flint River Dam	
Structure type	Earth Dikes, Concrete Slab
Length	4,650 feet
Maximum height	60 feet
Lake elevation (Plant Datum)	182.3 PD
Lake area (elevation 182.3)	1,400 acres
Shoreline miles (elevation 182.3)	36 miles
Drainage area	5,310 square miles
Generating capacity	5.4 Megawatts

* Declared generating capacity is defined as the plant’s operational capacity declared on a weekly basis to the power marketing agency. 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.

Note: PD is “Plant Datum”

I - INTRODUCTION

1-01. Authorization. This water control manual is prepared in accordance with the following U.S. statutes and U.S. Army Corps of Engineers (referred to as USACE or Corps) Engineering Regulations (ER) and Engineering Manuals (EM):

- Section 7 of the Flood Control Act of 1944 (Public Law 78-534, 58 Stat. 890, 33 U.S.C. 709) directs the Secretary of the Army to prescribe regulations for the use of storage allocated for flood control (now termed flood risk management) or navigation at all reservoirs constructed wholly or in part with Federal funds.
- Section 310.(b) of the Water Resources Development Act of 1990 expanded the requirements for public meetings and public involvement in preparing water control plans.
- ER 1110-2-240, *Water Control Management* (8 October 1982). This regulation prescribes policies and procedures to be followed by the Corps in carrying out water control management activities, including establishment of water control plans for Corps and non-Corps projects, as required by federal laws and directives.
- ER 1110-2-241, *Use of Storage Allocated for Flood Control and Navigation at Non-Corps Projects* (24 May 1990). This regulation prescribes the responsibilities and general procedures for regulating reservoir projects for flood control (now termed flood risk management) or navigation and the use of storage allocated for such purposes. Excepted projects are those owned and operated by the Corps; the International Boundary and Water Commission, United States and Mexico; and those under the jurisdiction of the International Joint Commission, United States and Canada, and the Columbia River Treaty. The intent of this regulation is to establish an understanding among project owners, operating agencies, and the Corps.
- ER 1110-2-1150, *Engineering and Design for Civil Works Projects* (31 August 1999). This regulation defines engineering responsibilities, requirements, and procedures during the planning, design, construction, and operations phases of civil works projects. The regulation provides guidance for developing and documenting quality engineering analyses and designs for projects and products on time and in accordance with project management policy for civil works activities.
- ER 1110-2-1941, *Drought Contingency Plans* (15 September 1981). This regulation provides policy and guidance for preparing drought contingency plans as part of the Corps' overall water control management activities. This directive states the policy that water control managers will continually review and, when appropriate, adjust water control plans in response to changing public needs.
- ER 1110-2-8154, *Water Quality and Environmental Management for Corps Civil Works Projects* (31 May 1995). This regulation establishes a policy for the water quality management program at Corps civil works projects.
- ER 1110-2-8156, *Preparation of Water Control Manuals* (31 August 1995). This regulation standardizes the procedures to be followed when preparing Water Control Manuals (WCM).
- EM 1110-2-3600, *Management of Water Control Systems* (30 November 1987). This manual provides guidance to field offices for managing water control projects or systems authorized by Congress and constructed and operated by the Corps. It also applies to certain water control projects constructed by other agencies or entities.

1-02. Purpose and Scope. It is the policy of the Corps that water control plans be continually reviewed, updated, and adjusted as needed to ensure that the best use is made of available water resources. This revision to the basin master water control manual describes the system-wide water control plan for the Apalachicola-Chattahoochee-Flint (ACF) River Basin (referred to as the ACF River Basin or the ACF Basin). The descriptions of the ACF Basin, history of development, water control activities, and coordination with others are provided as supplemental information to enhance the knowledge and understanding of the ACF Basin water control plan. This manual provides a general reference source for ACF water control regulation. It is intended for use in day-to-day, real-time water management decision-making and for training new personnel. In conformance with the emphasis on water conservation as a national priority, the development and execution of the water control plan includes appropriate consideration for efficient water management.

1-03. Related Manuals and Reports. This master manual provides general information for the entire ACF River Basin. The following appendices have also been revised for individual federal reservoir projects within the ACF Basin:

Appendix A - Jim Woodruff Lock and Dam and Lake Seminole

Appendix B - Buford Dam and Lake Sidney Lanier

Appendix C - Walter F. George Lock and Dam and Lake

Appendix D - George W. Andrews Lock and Dam and Lake George W. Andrews

Appendix E - West Point Dam and Lake

The original ACF Master Manual was published in February of 1958 and titled *Apalachicola River Basin Reservoir Regulation Manual.* This manual supersedes that document and any of its revisions. Other pertinent information regarding the ACF River Basin development is contained in operation and maintenance manuals and emergency action plans for each project. Detailed project reports and design memoranda also contain useful information.

Prior to the issuance of this manual and the individual water control plans as appendices, the Corps considered the environmental impacts of its revised operations with the preparation of an Environmental Impact Statement (EIS). The EIS was published on (date) and a Record of Decision (ROD) for the action was signed on (date). The EIS was prepared in compliance with the National Environmental Policy Act (1969), Council on Environmental Quality guidelines, and Corps implementing regulations. Access to the final document is available by request from the Mobile District.

1-04. Project Owner. The Buford Dam; West Point Dam; Walter F. George Lock and Dam; George W. Andrews Lock and Dam; and Jim Woodruff Lock and Dam Projects and the ACF Rivers Navigation Project are federally owned projects entrusted to the Corps. There are 10 privately owned dams located on the main-stem rivers in the basin that were built by local mills (Habersham Mill) or hydropower interests (Georgia Power Company (GPC) and Crisp County Power Commission). The projects are listed in Table 1-1.

Table 1-1. Existing Dams in the ACF Basin

Basin/river/project name	Owner/year initially completed	Drainage area (sq mi)	Reservoir size (ac)	Total storage[a] (ac-ft)	Conservation storage[b] (ac-ft)	Declared Power capacity[c] (kW)	Normal summer lake elev (ft)	Authorized purposes for Corps-owned projects[d]
Chattahoochee River	*8,708 square miles drainage area*							
Habersham Mill Dam (Soque River)	Habersham Mills/1925		NA[d]	NA	0	0		Inoperative
Buford Dam/lake Lanier	Corps/1957	1,034	38,542	2,554,000	1,087,600	127,000	1,071	FRM, HP, NAV, FW, REC, WQ, WS
Morgan Falls Dam (Bull Sluice Lake)	GPC/1903	1,360	580	2,450	0	16,800	866	
West Point Dam and Lake	Corps/1975	3,440	25,864	774,798	306,131	87,000	635	FRM, HP, NAV, FW, REC, WQ, WS
Langdale Dam	GPC/1860	3,640	152	NA	0	1,040	547.7	
Riverview Dam	GPC/1902	3,661	75	NA	0	480	530.5	
Bartletts Ferry Dam	GPC/1926	4,240	5,850	181,000	0	173,000	521	
Goat Rock Dam	GPC/1912	4,510	1,050	11,000	0	38,600	404	
Oliver Dam	GPC/1959	4,630	2,150	32,000	0	60,000	337	
North Highlands Dam	GPC/1900	4,630	131	1,500	0	29,600	269	
Walter F. George Lock and Dam and Lake	Corps/1963	7,460	45,181	934,400	244,400	168,000	190	HP, NAV, FW, REC, WQ
George W. Andrews Lock and Dam/ Lake George W. Andrews	Corps/1963	8,210	1,540	18,180	0	None	102	NAV, FW, REC, WQ
Flint River	*8,456 square miles drainage area*							
Crisp County Dam (Blackshear Dam and Lake)	Crisp Co./1930	3,770	8,700	144,000	0	15,200	237	
Flint River Dam (Albany Dam, Lake Worth)	GPC/1920	5,290	1,400	NA	0	5,400	182.3	
Apalachicola River	*2,409 square miles drainage area (Total ACF Basin – 19,573 sq mi)*							
Jim Woodruff Lock and Dam/ Lake Seminole	Corps/1954	17,164	37,500	367,318	0	43,350	77	HP, NAV, FW, REC, WQ

a. Measured at top of storage for flood risk management.
b. Conservation storage is defined as that portion of the water stored in a reservoir that is impounded for later use. Conservation storage is the portion of a reservoir's storage that is normally conserved for beneficial use at-site or downstream but does not include any storage space reserved exclusively for flood control. Conservation storage serves a variety of purposes including: navigation, hydroelectric power, water supply, irrigation, fish and wildlife, recreation, and water quality.
c. Declared Power Capacity is defined as the plant's operational capacity declared on a weekly basis to the power marketing agency. 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.
d. As used in this table, the term *authorized purposes* includes purposes expressly identified in the project authorizing documents; incidental benefits recognized in project authorizations; and benefits that result from other authorities, such as general authorities contained in congressional legislation, for which the Corps operates. FRM = flood risk management; HP = hydroelectric power generation; NAV = navigation; FW = fish and wildlife conservation; REC = recreation; WQ = water quality; WS = water supply.
Note: Plant Datum is elevation for Morgan Falls, Bartletts Ferry, Goat Rock, Oliver, and North Highlands and msl for Crisp County Dam. All others are NGVD29.
e. NA = not available.

1-05. Operating Agency. The Corps, Mobile District operates the five federally owned projects within the ACF Basin. Operation and maintenance of dam and reservoir projects are under the supervision of the Operations Division. An Operations Project Manager and necessary staff members are assigned to each project to provide daily oversight and direction. The Buford and West Point Projects each have their own respective Operations Project Manager, while the Walter F. George, George W. Andrews, and Jim Woodruff Projects are all handled by the ACF

Operations Project Manager whose office is located at the Walter F. George Project. All non-federal projects on the Chattahoochee River are owned and operated by GPC.

1-06. Regulating Agencies. Authority for water control regulation of all federal projects within the ACF Basin has been delegated to the South Atlantic Division (SAD) Commander. Day-to-day water management activities are the responsibility of the Mobile District, Engineering Division, Water Management Section (Mobile District). Water control actions for each project are regulated in a system-wide, balanced approach to meet the federally authorized purposes. The regulating instructions presented in the basin water control plan are issued by the Mobile District with approval of the SAD. The Mobile District monitors the project for compliance with the approved water control plan and makes water control regulation decisions on the basis of that plan. The Mobile District advises project personnel on an as-needed basis regarding water control regulation procedures to perform during normal, as well as abnormal or emergency situations.

II - BASIN DESCRIPTION AND CHARACTERISTICS

2-01. General Characteristics. The ACF River Basin, made up of the Chattahoochee, Flint, and Apalachicola Rivers and their tributaries, drains an area of 19,573 square miles in Georgia, Alabama, and Florida. Plate 2-1 provides a map of the ACF Basin. The Chattahoochee River rises as springs in the Blue Ridge Mountains and flows in a southwesterly direction to the Alabama state line, then in a southerly direction for a total distance of 434 miles, draining an area of 8,708 square miles before joining the Flint River at the Florida border. The slope of the upper Chattahoochee River is steep, creating rapid runoff during storms. One of the most upstream tributaries is the Chestatee River, which flows into Lake Sidney Lanier.

The headwater of the Flint River is near the Hartsfield-Jackson Atlanta International Airport. Spring water is collected in pipes and directed off the airport property emerging as a free-flowing stream. The Flint River flows generally in a southerly, southeasterly, and then southwesterly direction, for a total distance of approximately 350 miles, draining a total area of 8,456 square miles, joining the Chattahoochee River at the Florida border. In contrast to the mainstem of the Chattahoochee River, many of the Flint River tributaries remain free flowing. Flows in forested tributary basins retain much of their natural runoff patterns. They have higher sustained flows during winter months and relatively quick responses to storm events throughout the year. However, sharper peaks in the hydrographs of urban streams such as Big Creek reflect the influence of impervious land cover in the urbanized parts of the basin. In addition, urban streams might not maintain their natural base flows during dry periods. The Flint River remains relatively undeveloped. For much of its length, the river is free flowing.

The Apalachicola River is formed at the confluence of the Chattahoochee and Flint Rivers and flows southerly for 108 miles to the mouth near Apalachicola, Florida, draining an area of 2,409 square miles. A profile of the river basins is shown on Plate 2-2. The ACF Basin is shown on Plate 2-3 including major drainage sub-basins and federal and private power company dams. Table 2-1 lists some selected streams considered and local drainage areas in the order of their locations.

Physiographic provinces, slopes and other basin characteristics are addressed in the following paragraphs.

1 **Table 2-1. Tributaries of the ACF Basin**

Chattahoochee River Basin (8,708 square miles drainage area)		
Stream	**Local drainage area (square miles)**	**Miles above mouth of confluent stream**
Soque River	166	402
Chestatee River	318	363
Peachtree Creek	122	301
Sweetwater Creek	287	289
Dog River	70	274
Cedar Creek	51	261
New River	172	228
Yellowjacket Creek	192	214
Flat Shoal Creek	200	190
Mulberry Creek	209	174
Upatoi Creek	560	151
Uchee Creek	340	143
Hannahatchee Creek	142	122
Cowikee Creek	480	105
Barbour Creek	101	93
Pataula Creek	40	85
Cemochechobee Creek	105	75
Colomokee Creek	103	67
Abbie Creek	204	59
Omusee Creek	144	48
Sowhatchee Creek	72	35
Bryans Creek	52	29
Flint River Basin (8,456 square miles drainage area)		
Line Creek	220	296
Whiteoak Creek	179	291
Redoak Creek	172	282
Liza Creek	185	256
Potato Creek	240	250
Swift Creek	114	244
Auchumpkee Creek	97	235
Patsiliga Creek	152	214
Whitewater Creek	236	186
Buck Creek	189	181
Turkey Creek	174	154
Muckafoonee Creek	1,000	104
Dry Creek	66	91
Racoon Creek	157	81
Cooleewahee Creek	157	70
Ichawaynochaway Creek	1,104	53
Spring Creek	789	3
Apalachicola River Basin (2,409 square miles drainage area)		
Chipola River	1,292	28

2-02. Topography

a. Chattahoochee River Basin. The upper reaches of the Chattahoochee River and its headwater streams are characterized by steep slopes and deep valleys. That combination contributes to significant flooding in the Atlanta, Georgia, area. Elevations in the basin range from near sea level at Apalachicola, Florida, to between 3,000 and 3,500 feet in the northern part of the Chattahoochee Basin. The slope of the Chattahoochee River from the headwaters to the upstream limit of Lake Sidney Lanier (about 25 miles) is approximately 9 feet per mile. From the upstream limit of Lake Sidney Lanier to Buford Dam (about 50 miles) the slope is approximately 4 feet per mile. Further downstream, near West Point, Georgia, the slope is fairly uniform and averages about 2.7 feet per mile. From West Point to Columbus, Georgia, the river flows over the Fall Line and drops 368 feet in elevation, averaging 10 feet per mile. The Fall Line extends across the ACF Basin and marks the boundary between the Piedmont and the Coastal Plain. From Columbus, Georgia, to the mouth of the Chattahoochee River at Jim Woodruff Lock and Dam and the Florida state line, the slope varies from 1.2 to 0.6 feet per mile.

b. Flint River Basin. Above the Fall Line, the Flint River's slope averages about 2 feet per mile. For about 55 miles across the Fall Line, the slope averages about 6.7 feet per mile, with as much as 48 feet per mile in one section. The lower portion of the Flint River, below Albany, Georgia, has an average slope of about 1.0 feet per mile. In the 73 mile reach between Albany and Bainbridge, Georgia, there are a number of rock shoals and rapids and the river flows between high, steep banks. Below Bainbridge, Georgia, the stream widens and passes through broad swamps.

c. Apalachicola River Basin. The Apalachicola River is formed by the confluence of the Chattahoochee and Flint Rivers at the southwest corner of Georgia. It is 108 miles long and varies in width from 600 to 800 feet. The floodplain is about 10 miles wide. The slope averages 0.5 to 0.7 feet per mile.

2-03. Geology. The ACF Basin consists of three distinct physiographic provinces. From north to south, the three regions are the Blue Ridge, the Piedmont, and the Coastal Plain. The Coastal Plain can be divided into the Southeastern Plains and the Southern Coastal Plain. The Fall Line forms the boundary between the Piedmont region and the Coastal Plain. The provinces are described in more detail in the following paragraphs. Plate 2-4 shows the physiographic provinces of the ACF Basin.

a. The Blue Ridge Province is a region of low- to high-grade metamorphic rocks. Many of the rocks of the Blue Ridge appear to be the metamorphosed equivalents of Proterozoic or Paleozoic (or both) sedimentary rocks. Others are metamorphosed igneous rocks, such as the Corbin Metagranite, the Fort Mountain Gneiss, various mafic and ultramafic rocks, and the metavolcanic rocks of the Gold Belt.

Geologic resources of the Blue Ridge include marble, much of which is mined. Talc has been mined in the western Blue Ridge just east of Chatsworth, Georgia. Gold was mined at Dahlonega, Georgia, in the early 1800's. The U.S. Mint produced gold coins there from 1830 to 1861. The North Georgia gold rush of the 1830's precipitated the eviction of the Cherokee Indians and their forced migration on the Trail of Tears.

Georgia houses the southwest end of the Blue Ridge, which extends northeast to Virginia through the Great Smoky Mountains. The southern boundary of the Blue Ridge in Georgia depends on one's perspective. A purely topographic approach would limit the Blue Ridge to just a few ridges extending southwestward from North Carolina, so that the Piedmont would extend all the way to the Georgia-Tennessee state line. Some geologists, in contrast, would extend the Blue Ridge region all the way to the Brevard Fault Zone, which runs through northwest Atlanta and Gainesville. One of the most commonly accepted boundaries, which are based on changes in rock types, would run just southeast of Canton, Dawsonville, Dahlonega, and Helen, Georgia.

b. The Piedmont Province is a region of moderate- to high-grade metamorphic rocks, such as schists, amphibolites, gneisses, and migmatites, and igneous rocks like granite.

Topographically, the Piedmont mostly consists of rolling hills, although faulting has produced the impressive ridge of Pine Mountain near Warm Springs, Georgia. Isolated granitic plutons also rise above the Piedmont landscape to give prominent features like Stone Mountain.

One major feature cutting across the Piedmont is the Brevard Fault Zone (the Brevard Zone). The Brevard Zone runs southwest to northeast and passes through Centralhatchee, Georgia, in Heard County, northwest Atlanta, Duluth, Buford, and Gainesville before leaving Georgia at the westernmost point on the Tugaloo River in northernmost Stephens County. The Chattahoochee River follows the Brevard Zone. The regional extent of the Brevard Zone is reflected by the fact that it is named after the Town of Brevard, North Carolina. The Brevard Zone has been interpreted as a variety of different kinds of faults or discontinuities, and its true nature remains enigmatic.

Piedmont soils are commonly a red color for which Georgia is famous. The soils consist of kaolinite and halloysite (aluminosilicate clay minerals) and of iron oxides. They result from the intense weathering of feldspar-rich igneous and metamorphic rocks. Such intense weathering dissolves or alters nearly all minerals and leaves behind a residue of aluminum-bearing clays and iron-bearing iron oxides because of the low solubilities of aluminum and iron at earth-surface conditions. Those iron oxides give the red color to the clay-rich soil that has come to be synonymous with central Georgia. The abundance of clay has contributed to a tradition of folk pottery in central and north Georgia.

Mineral resources of the Piedmont include hard, crushed stone. Granite has long been quarried for tombstones and other monuments in the eastern Piedmont near Elberton, Georgia. Granite was once quarried from Stone Mountain. Soapstone was mined by Native Americans in southwestern DeKalb County at Soapstone Ridge. One well-known kyanite mine in the Piedmont was at Grave’s Mountain. Groundwater in the Piedmont largely flows along faults and fractures, making it difficult to find but often locally abundant.

Athens and Atlanta are two cities in the Georgia Piedmont. The Piedmont extends a little bit westward into Alabama before it pinches out between the Valley and Ridge and the Coastal Plain. To the northeast, it cuts a broad swath across South Carolina, North Carolina, and Virginia. Spartanburg, South Carolina, and Greensboro and Winston-Salem, North Carolina, are Piedmont cities to the northeast of Georgia.

c. The Fall Line is the boundary between the Piedmont and the Coastal Plain. Its name arises from the occurrence of waterfalls and rapids that historically were the inland barriers to navigation on Georgia's major rivers. Thus, the Cities of Columbus, Macon, Milledgeville, and Augusta developed where boats had to be unloaded on the Chattahoochee, Ocmulgee, Oconee, and Savannah Rivers, respectively. Those waterfalls and rapids occur where the rivers drop off the hard crystalline rocks of the Piedmont onto the more readily eroded sedimentary rocks of the Coastal Plain.

The Fall Line is a boundary of bedrock geology, but it can also be recognized from stream geomorphology. Upstream from the Fall Line, rivers and streams typically have very small floodplains, if any at all, and they do not have well-developed meanders (curves that nearly or do reverse the direction of flow). Within a mile or so downstream from the Fall Line, rivers and streams typically have floodplains or marshes across which they flow, and within three or four miles they meander. That can be seen in the Flint River, Upatoi Creek, and the Chattahoochee River.

d. The Southeastern Plains and Southern Coastal Plain Province is a region of Cretaceous and Cenozoic sedimentary rocks and sediments. Those strata dip toward the southeast, and so they are younger nearer the coast. Near the Fall Line, they are underlain by igneous and metamorphic rocks like those of the Piedmont. The sedimentary rocks of the Coastal Plain partly consist of sediment eroded from the Piedmont over the last 100 million years, and partly of limestones generated by marine organisms and processes at sea.

The lower or Southern Coastal Plain consists of a series of Quaternary beach complexes that parallel the modern coast and are younger nearer the coast. Such beach complexes make subtle ridges. The modern beach consists largely of white quartz sand, but it also has dark-colored concentrations or placers of dense minerals. The same is true of the older beach ridges inland, and those dense minerals include titanium-rich minerals like rutile, ilmenite, and sphene.

Limestone is quarried in southwest Georgia. However, its quality as aggregate is not as high as that of the limestone in the Valley and Ridge. The reasons are largely due to the greater porosity of the Coastal Plain limestones, whereas the older limestones of the Valley and Ridge have lost nearly all their fine-scale porosity.

A major geologic resource in the Coastal Plain is groundwater. The less porous rocks of the northern regions provide less groundwater, but the aquifers of the Coastal Plain provide groundwater for domestic consumption, for industry, and for agricultural irrigation. The U.S. Geological Survey (USGS) South Atlantic Water Science Center – Georgia actively monitors groundwater conditions in Georgia.

Geologic hazards in the Coastal Plain are sinkholes and coastal erosion. Sinkholes can form in areas of limestone bedrock when subsurface dissolution of rock leads to collapse of the earth surface.

Soils in the Coastal Plain near the Jim Woodruff Lock and Dam are often porous permitting flow through the ground. There is some evidence that Lake Seminole contributes inflow to the groundwater and to downstream flows. Limestone caves were discovered during construction near the eastern side of the dam.

2-04. Sediment. The streams in the northern part of the basin, and especially metropolitan Atlanta area have been severely affected by past and present urban development. Urban development generally increases the peak and volume of runoff from rainfall events, which increases the velocity and erosion potential of rainfall runoff. Results are generally a down-cutting and widening of the stream, which creates bank-caving and further erosion.

Other significant sources of sediment within the ACF Basin are agricultural land erosion, unpaved roads, silviculture, and variation in land uses that result in conversion of forests to lawns or pastures.

Rivers and streams in the ACF Basin have always carried silt and other particles downstream. The Chattahoochee River is known for its muddy red color during high-flow periods, as shown in Figure 2-1.

Figure 2-1. Chattahoochee River High Flow

In the natural state before dams and other developments, the particulate matter was deposited along the floodplain or carried to Apalachicola Bay, where it would be subject to the movements of the Gulf of Mexico. The natural process continues but is altered to some degree by development in the basin.

Faster flowing streams can move suspended particles where slower streams will deposit that material. Where dams and reservoirs have been constructed, there is a tendency for the current to slow, causing particulates to settle on the lake bottom. Farming practices and urbanization have changed the conditions for nonpoint pollution. Both the volume and content of sediment material have changed over time.

Below Jim Woodruff Lock and Dam, the constantly moving siltation alters the navigation channel.

The Corps established sedimentation and retrogression ranges to monitor changes in reservoir volume and channel degradations. They serve as a baseline to measure changes in reservoir volume (sedimentation ranges) and channel degradation (retrogression ranges). Reservoirs tend to slow river flow and accelerate deposition. Irregular releases for peaking power often have an erosive effect downstream. The number of sedimentation ranges and the year they were surveyed for each project is summarized in Table 2-2. The number of retrogression ranges and the year they were surveyed for each project is summarized in Table 2-3. The locations of sedimentation and retrogression ranges are shown on plates within individual appendices.

Table 2-2. Sedimentation Ranges

Project	Year Surveyed	No. of Ranges Surveyed	Total No. of Ranges Established
Buford	1956	57	61
	1981	21	61
	1983	32	61
	1989-1990	59	61
	2009	Hydrographic bathymetric surface	N/A
West Point	1978	30	30
	1983	24	30
	1997	29	30
	2009	Hydrographic bathymetric surface	N/A
Walter F. George	1960-1962	44	44
	1988	44	44
	1999	44	44
	2009	Hydrographic bathymetric surface	N/A
George A. Andrews	1960	0	16
	1963	16	16
	1981	15	16
	2009	Hydrographic bathymetric surface	N/A
Jim Woodruff	1954	0	24
	1956-1957	40	42
	1963	16	42
	1976	39	42
	1988-1989	40	42
	2009	Hydrographic bathymetric surface	42

Table 2-3. Retrogression Ranges

Project	Year Surveyed	Number of Ranges Surveyed	Total Number of Ranges Established
BUFORD	1956	8	8
	1957	5	13
	1963	11	13
	1964	11	13
	1965	11	13
	1968	11	13
	1971	11	13
	1987	12	13
JIM WOODRUFF	1987	27	27
	1991	27	27

After ranges have been established, periodic re-surveys occur, and descriptive analyses are performed to determine the level of sedimentation occurring in the main body of the lake and to examine the erosion along the shoreline. The 2009 survey was a hydrographic bathymetric survey of the entire lake which allowed all previously established sedimentation ranges to be analyzed. Prior to 2009, surveys of sedimentation ranges were limited to specific range locations. Detailed reports are written after each re-survey to determine changes in reservoir geometry. That includes engineering analysis of the range cross-sections to estimate reservoir storage loss by comparing the earlier surveys of the existing ranges. The data provide the ability to compute new area/capacity curves for reservoirs. The area capacity curves generated using the 2009 data have been recommended for use and will be incorporated into this manual in the future upon completion of all reviews.

2-05. Climate. The chief factors that control the climate of the ACF Basin are its geographical position in the southern end of the temperate zone and its proximity to the Gulf of Mexico and the South Atlantic Ocean. Other factors are the length of the basin and the variation in altitude, ranging from sea level to higher than 3,000 feet in elevation. Tropical disturbances and hurricanes are major producers of floods in the basin during the summer and autumn months. Frontal systems are common and produce significant rainstorms. Average temperatures vary several degrees Fahrenheit from north to south but remain moderate. Severe, cold weather rarely lasts longer than a few days.

a. Temperature. Extreme temperatures vary from near 110 degrees Fahrenheit (°F) to values typically in the teens and occasionally below zero. Severe cold weather rarely lasts longer than a few days. The summers, while warm, are usually not oppressive. In the southern end of the basin, the average maximum January temperature is 60.1 °F, and the average minimum January temperature is 37.4 °F.

The maximum average July temperature is 90.3 °F in the southern end of the basin and the minimum average July value is 67.8 °F. Tables 2-4, 2-5, and 2-6 show the average monthly maximum and minimum temperatures for the period of record for various locations within the ACF Basin. The frost-free season varies in length from about 200 days in the northern valleys to about 250 days in the southern part of the basin. All tables compiled from online records of The Southeast Regional Climate Center.

b. Precipitation. The entire ACF Basin is in a region that ordinarily receives an abundance of precipitation with the average annual rainfall being heavy and well-distributed throughout the year. Winter and spring are the wettest periods and early fall is the driest. Light snow is not unusual in the northern part of the watershed, but it constitutes only a very small fraction of the annual precipitation and has little effect on runoff. Intense flood-producing storms occur mostly in the winter and spring. They are usually of the frontal-type, formed by the meeting of warm, moist air masses from the Gulf of Mexico with the cold, drier masses from the northern regions and can cause heavy precipitation over large areas. The storms that occur in summer or early fall are usually of the thunderstorm type with high intensities over smaller areas. Tropical disturbances and hurricanes can occur producing high intensities of rainfall over large areas. Tables 2-7, 2-8, and 2-9 show the average monthly and annual rainfall for the period of record for various locations within the ACF Basin. All tables were compiled from online records of The Southeast Regional Climate Center.

Table 2-4. Average Monthly Temperature (°F) for the Northern ACF Basin (max. and min.) for Period of Record (POR)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Blairsville Exp Sta, GA (090969) POR: 6/1892-4/2012	MAX	49.0	52.1	59.7	68.8	76.1	82.3	84.7	84.7	79.2	70.7	60.4	51.7	68.2
	MIN	25.0	27.2	33.7	41.1	49.3	57.4	61.3	60.6	54.4	42.1	33.2	27.3	42.7
Cedartown, GA (091732) POR 9/1896-4/2012	MAX	53.2	57.1	65.8	74.6	81.5	87.8	90.1	89.8	84.3	74.7	64.1	55.1	73.2
	MIN	31.4	33.1	39.8	47.0	55.4	63.6	67.5	66.6	60.1	47.6	38.2	32.7	48.6
Gainesville, GA (093621) POR 10/1891-4/2012	MAX	50.9	54.1	62.6	71.7	78.9	85.6	87.8	86.9	81.4	71.8	61.7	52.4	70.5
	MIN	31.8	33.1	39.8	47.5	55.7	63.6	67.1	66.5	60.9	49.3	39.9	33.3	49.0
Helen, GA (094230) POR 4/1956-4/2012	MAX	50.6	54.4	62.6	72.0	78.2	83.9	86.5	85.7	80.0	71.3	61.7	52.8	70.0
	MIN	29.3	30.7	37.0	43.8	52.0	59.8	63.7	63.3	57.4	45.8	37.2	31.2	45.9
Jasper 1 NNW, GA (094648) POR 6/1937-4/2012	MAX	49.3	53.0	61.2	70.4	77.7	84.2	86.7	86.2	80.6	71.1	60.7	51.5	69.4
	MIN	31.1	32.7	39.4	47.0	54.8	62.2	65.7	65.2	59.6	48.6	39.9	33.5	48.3
Average max		50.6	54.1	62.4	71.5	78.5	84.8	87.2	86.7	81.1	71.9	61.7	52.7	70.3
Average min		29.7	31.4	37.9	45.3	53.4	61.3	65.1	64.4	58.5	46.7	37.7	31.6	46.9

Table 2-5. Average Monthly Temperature (°F) for the Middle ACF Basin (max. and min.) for Period of Record (POR)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Carrollton, GA (091640)	MAX	53.2	57.1	65.5	74.2	81.1	86.8	88.8	88.2	82.8	73.7	64.1	55.1	72.5
POR 5/1904-4/2012	MIN	31.7	33.7	40.1	47.4	55.6	63.2	66.9	66.0	60.3	48.2	38.9	33.1	48.7
Columbus WSO Airport, GA	MAX	57.6	61.5	68.9	77.1	84.0	89.8	91.6	91.1	86.1	77.2	67.7	59.4	76.0
(092166) POR 7/1948-4/2012	MIN	36.5	38.9	45.1	52.2	61.1	68.7	71.9	71.3	66.2	54.3	44.2	38.1	54.0
Covington, GA (092318)	MAX	54.0	57.6	66.4	74.6	82.5	88.4	90.6	89.4	84.5	74.8	64.4	55.4	73.6
POR 7/1893-4/2012	MIN	33.0	34.8	41.7	48.5	57.3	65.1	68.4	67.7	61.9	50.1	40.4	34.1	50.2
Eufaula Wildlife Refuge, AL	MAX	57.4	61.9	69.8	77.2	83.3	89.7	91.6	90.9	87.0	78.1	68.9	61.2	76.4
(012730) POR 3/1967-4/2012	MIN	34.3	36.8	44.0	50.0	58.4	65.6	69.2	68.6	53.5	51.0	42.3	37.2	51.7
Lafayette, AL (014502)	MAX	55.9	60.4	67.8	76.4	82.7	88.9	90.4	90.1	85.0	76.0	66.0	57.6	74.8
POR 10/1944-4/2012	MIN	33.1	35.7	42.4	49.2	57.5	64.4	67.5	66.8	61.5	50.2	41.3	34.6	50.4
Opelika, AL (016129)	MAX	54.8	58.7	67.1	75.5	82.2	88.1	90.1	89.6	85.1	75.8	67.0	58.1	74.3
POR 3/1957-4/2012	MIN	31.3	33.2	40.3	47.6	55.8	63.6	67.3	67.0	62.0	49.1	40.7	34.1	49.3
Rockford 3 ESE, AL	MAX	53.7	58.6	67.0	75.8	82.0	87.9	89.8	89.6	85.1	75.9	65.7	56.8	74.0
(017020) POR 7/1954-3/2012	MIN	31.3	34.2	40.9	48.5	56.1	63.1	66.7	65.8	61.1	49.3	40.5	33.8	49.3
Rock Mills, AL (017025)	MAX	55.3	59.2	67.1	76.7	83.6	89.9	91.4	91.0	85.5	76.7	66.2	57.2	75.0
POR 6/1938-4/2012	MIN	31.3	33.2	39.5	46.7	55.1	62.8	66.6	65.7	60.1	46.9	37.6	32.1	48.1
Talbotton 1 NE, GA	MAX	58.0	60.9	68.8	76.3	83.4	88.9	90.2	89.8	85.7	76.9	67.2	58.8	75.4
(098535) POR 2/1893-4/2012	MIN	35.4	36.9	43.5	50.0	58.2	65.6	68.7	68.0	63.0	51.7	42.1	36.1	51.6
Average max		55.5	59.5	67.6	76.0	82.8	88.7	90.5	90.0	85.2	76.1	66.4	57.7	74.7
Average min		33.1	35.3	41.9	48.9	57.2	64.7	68.1	67.4	61.1	50.1	40.9	34.8	50.4

Table 2-6. Average Monthly Temperature (°F) for the Southern ACF Basin (max. and min.) for Period of Record (POR)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Albany 3 SE, GA (090140) POR 11/1891-4/2012	MAX	61.3	64.1	71.6	78.9	86.2	91.3	92.4	92.2	88.6	80.2	70.5	62.6	78.3
	MIN	38.5	40.5	46.8	53.5	61.6	68.7	71.4	71.0	66.8	55.3	45.0	39.4	54.9
Bainbridge Intl Paper Co, GA (090586) POR 10/1997-3/2012	MAX	61.9	65.9	72.9	79.4	86.4	90.5	92.5	92.0	88.6	81.1	73.3	64.6	79.1
	MIN	36.8	40.3	46.7	52.1	60.4	67.9	70.8	70.4	66.2	54.8	47.0	40.3	54.5
Blakely, GA (090979) POR 9/1889-4/2012	MAX	61.0	63.9	71.3	78.6	85.9	91.1	91.5	91.5	88.2	79.9	69.9	62.5	77.9
	MIN	39.3	41.0	47.1	53.5	61.2	68.0	70.3	70.0	65.9	55.3	45.5	40.0	54.8
Buena Vista, GA (091372) POR 1/1944-4/2012	MAX	57.2	60.7	68.4	78.1	84.2	89.1	90.0	89.9	86.0	77.6	67.9	60.3	75.8
	MIN	35.2	37.2	43.4	52.7	59.6	66.2	68.8	67.9	63.7	53.2	44.0	37.7	52.5
Camilla 3 SE, GA (091500) POR 10/1889-4/2012	MAX	62.5	65.9	72.9	79.9	86.7	91.2	92.3	91.9	88.4	80.8	71.6	63.9	79.0
	MIN	39.0	41.7	47.8	54.0	61.9	68.7	71.4	71.0	66.6	55.4	46.0	40.4	55.3
Headland, AL (013761) POR 4/1950-4/2012	MAX	58.3	62.7	70.0	78.2	85.1	90.2	91.3	91.0	87.3	78.7	69.3	61.3	77.0
	MIN	36.3	39.6	46.3	53.6	61.6	67.8	69.9	69.1	64.9	53.6	44.8	38.7	53.8
Plains SW, GA Exp Stn, GA (097087) POR 1/1956-4/2012	MAX	57.3	61.2	68.6	76.8	84.0	89.1	90.9	90.3	85.9	77.5	68.7	60.3	75.9
	MIN	34.7	37.3	44.2	51.5	59.7	66.7	69.5	68.8	63.9	52.6	43.9	37.0	52.5
Union Springs 4 S, AL (018438) POR 5/1892-3/2012	MAX	57.4	60.6	68.6	76.4	83.9	90.0	91.1	90.5	86.7	77.6	67.2	59.2	75.8
	MIN	36.6	38.7	45.5	51.8	60.3	67.6	70.2	70.2	65.4	53.8	44.0	38.0	53.5
Wewahitchka, FL (089566) POR 3/1901-4/2012	MAX	63.9	66.7	73.3	79.7	86.4	90.4	91.2	90.9	88.2	81.0	73.1	66.2	79.2
	MIN	40.0	42.4	48.8	54.2	61.9	68.5	71.0	71.0	67.5	56.7	47.8	41.8	56.0
Average max		60.1	63.5	70.8	78.4	85.4	90.3	91.5	91.1	87.5	79.4	70.2	62.3	77.6
Average min		37.4	39.9	46.3	53.0	60.9	67.8	70.4	69.9	65.7	54.5	45.3	39.3	54.2

Table 2-7. Average Monthly Rainfall for the Northern ACF Basin (inches) for Period of Record (POR)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Blairsville Exp Sta, GA	5.33	5.01	5.96	4.59	4.31	4.44	4.99	4.55	4.00	3.44	4.29	4.92	55.83
Cedartown, GA	4.79	4.73	6.02	4.76	3.87	4.22	4.75	3.60	3.73	2.95	3.78	4.30	51.51
Gainesville, GA	5.20	5.04	5.86	4.18	4.03	4.01	4.84	4.14	4.01	3.40	3.70	4.87	53.27
Helen, GA	6.65	5.85	7.16	5.43	5.47	5.38	6.02	6.10	5.92	4.84	5.72	6.27	70.82
Jasper 1 NNW, GA	5.59	5.09	6.29	5.05	4.29	4.27	5.38	4.31	3.96	3.38	4.40	5.07	57.08
Northern Area	5.51	5.14	6.26	4.80	4.39	4.46	5.20	4.54	4.32	3.60	4.38	5.09	57.70

Table 2-8. Average Monthly Rainfall for the Middle ACF Basin (inches) for Period of Record (POR)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Carrollton, GA	4.76	4.85	5.87	4.36	4.10	3.94	4.86	3.48	3.67	2.92	4.01	4.62	51.42
Columbus WSO Airport, GA	4.14	4.50	5.66	3.98	3.75	3.92	5.28	3.98	3.30	2.28	3.62	4.53	48.92
Covington, GA	4.66	4.76	5.34	3.81	3.59	3.94	4.86	4.23	3.20	2.90	3.29	4.30	48.93
Eufaula, AL	5.20	4.36	6.19	3.56	4.04	4.11	5.14	3.65	3.25	2.61	3.94	5.13	51.17
Lafayette, AL	5.21	5.55	6.69	5.09	4.29	3.60	5.52	3.60	4.18	2.88	4.07	5.21	55.91
Opelika, AL	5.18	5.08	6.99	4.75	3.80	4.11	5.64	3.82	4.17	3.32	4.10	5.27	56.23
Rockford 3 ESE, AL	5.60	5.63	6.90	5.23	4.32	4.02	5.82	3.94	4.22	3.09	4.19	5.17	58.11
Rock Mills, AL	5.39	5.21	6.42	4.83	3.95	3.95	5.12	3.98	3.74	2.47	4.18	5.21	54.46
Talbotton 1 NE, GA	4.51	5.10	6.01	4.12	3.52	4.17	5.24	4.13	3.45	2.66	3.20	4.77	50.88
Middle Area	4.96	5.00	6.23	4.41	3.93	3.97	5.28	3.87	3.69	2.79	3.84	4.91	52.88

Table 2-9. Average Monthly Rainfall for the Southern ACF Basin (inches) for Period of Record (POR)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Albany, GA 3 SE	4.49	4.68	5.15	3.89	3.75	4.66	5.92	5.05	3.65	2.30	2.76	3.85	50.15
Bainbridge Intl Paper Co, GA	5.00	4.76	5.88	4.09	3.56	5.75	5.61	5.25	4.29	2.89	3.24	3.42	53.74
Blakely, GA	4.95	5.27	5.64	4.43	3.87	4.53	6.48	5.47	3.95	2.40	3.03	4.60	54.62
Buena Vista, GA	4.58	4.58	5.60	3.64	3.25	4.12	5.69	4.14	3.37	2.60	3.77	4.48	49.81
Camilla 3 SE, GA	4.57	4.53	5.52	4.05	3.52	5.10	5.90	4.77	3.89	2.29	2.96	4.02	51.14
Headland, AL	5.55	5.06	5.60	4.03	4.00	4.57	6.08	4.79	3.87	2.78	3.37	4.60	54.28
Plains, GA SW	4.86	4.57	5.15	3.44	3.25	4.66	5.28	4.42	3.50	2.39	3.26	4.19	48.98
Union Springs 4 S, AL	4.77	5.18	6.20	4.45	3.83	4.33	5.62	4.55	3.44	2.63	3.53	4.81	53.33
Wewahitchka, FL	5.02	4.95	6.00	3.63	3.85	6.61	8.92	8.82	6.56	3.79	3.46	4.21	65.81
Southern Area	4.87	4.84	5.64	3.96	3.65	4.93	6.17	5.25	4.06	2.67	3.26	4.24	53.54

2-06. Storms and Floods

a. General. Major flood-producing storms over the ACF 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 frontal-type storms generally cut across the long, narrow basin. Frequently, a flood in the lower reaches is not accompanied by a flood in the upper reaches or vice versa. Occasionally, tropical storms or hurricanes, such as the storms of July 1916 and July 1994, will cause major floods over practically the entire basin. However, high intensity summer thunderstorms in the ACF Basin usually occur over small areas producing serious local flooding. With normal runoff conditions, from 5 to 6 inches of intense and general rainfall are required to produce widespread flooding, but on many of the minor tributaries, 3 to 4 inches are sufficient to produce local floods.

b. Principal Storms. During most years, one or more relatively small, localized flood events will occur somewhere within the ACF Basin. However, on occasion, significant storms produce widespread flooding or unusually high river stages. Generalized descriptions of seven historical storms are presented for reference. Those storms are July 1916, December 1919, March 1929, February 1961, March 1990, July 1994, May 2003, and September 2009.

1) July 1916. The storm of 5-10 July 1916 resulted from a hurricane that formed in the Caribbean Sea and moved northwest across the Gulf of Mexico to enter the United States east of the mouth of the Mississippi River on the evening of 5 July. The disturbance continued inland across western Mississippi, turned eastward on the 7th and from the 8th to the 10th moved northeastward across Alabama. The heavy precipitation covered a remarkably large area. The 6-inch isohyet on the total-storm isohyetal map, shown in Figure 2-2, includes practically all Alabama, the northwestern part of Florida, and large areas in Mississippi and Georgia.

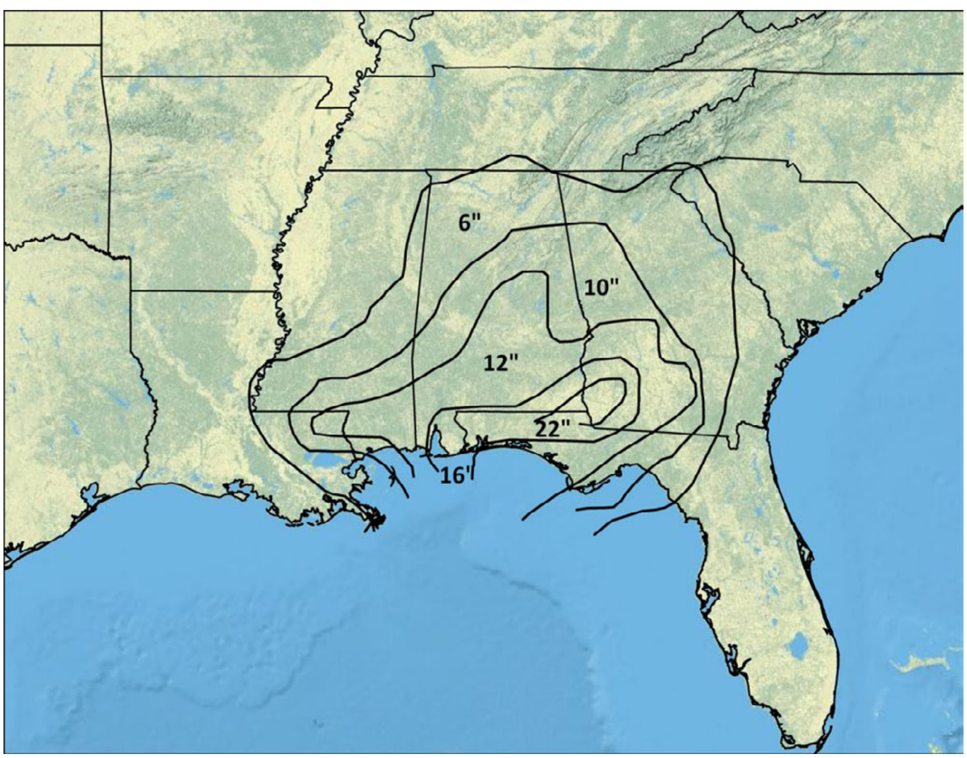


Figure 2-2. Storm of July 1916

At the center of greatest intensities, the following amounts of precipitation were recorded in 3 1/2 days of the 5-day storm: Bonifay, Florida, 24 inches; Robertsdale, Alabama, 22.6 inches; Merrill, Mississippi, 19.9 inches; and Clanton, Alabama, 18.6 inches. The storm produced general flood conditions throughout the southeastern states and, because it occurred during the middle of the growing season, caused enormous damage. The heaviest recorded rainfall in the ACF Basin was 23 inches at Blakeley, Georgia. A total of 22.7 inches fell at Alaga, Alabama, where 12.7 inches were recorded in one day. Flood stages were exceeded throughout the basin.

2) December 1919. According to U.S. Weather Bureau reports, the storm of 6-10 December 1919 was caused by meteorological conditions that were not particularly remarkable, but the sequence in which they developed was the controlling factor. A cyclonic system moved across California and centered over Utah, Oklahoma, and western New Mexico on successive days. A weak cold front was associated with it on the morning of the 7th and extended across Pennsylvania, Maryland, Virginia, and western North Carolina, then became quasi-stationary over northern Georgia, central Alabama, Mississippi, and Louisiana. The front lay in that position the evening of the 9th. An anti-cyclonic system persisted during the period just off the Atlantic Coast, and the circulation set up thereby brought a convergent flow of heavily moisture-laden air from the Gulf region directly over the area. Overrunning and wave development over the initially shallow front brought only moderate precipitation during 6-8 December, but a fresh mass of continental, polar air thrust southward on the afternoon of the 8th and on the 9th. The intense convergence about the new development changed the situation to one in which flood-producing rainfall was experienced on 8-9 December, diminishing on the 10th when the front passed eastward. The area of heaviest precipitation extended across southeastern Mississippi, central Alabama, and northern Georgia. The center of greatest rainfall was at Norcross, Georgia, with a total of 12.9 inches. The storm caused extreme flooding in the Chattahoochee River above Columbus and on the upper Flint River. Flooding was moderate in the lower part of the basin. An isohyetal map of the storm is shown in Figure 2-3.

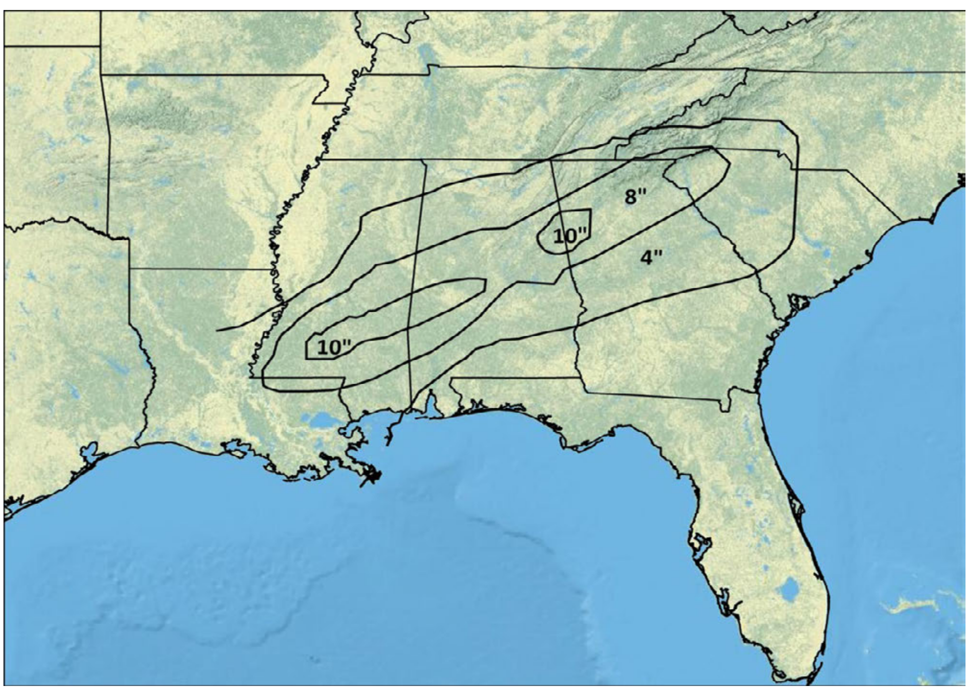


Figure 2-3. Storm of December 1919

3) <u>March 1929</u>. The storm of 11-16 March 1929 resulted from a widely extending low-pressure area that developed over eastern Colorado and moved rapidly eastward causing heavy rains, particularly in Alabama and parts of Mississippi, Georgia, and Tennessee. This was one of the greatest storms ever recorded in this country and is outstanding with regard to intensities of precipitation over large areas. The main center was at Elba, Alabama, with a total of 29.6 inches in three days, of which 20 inches were estimated to have fallen in 24 hours. In the ACF Basin, the most intense rainfall was recorded at Blakely, Georgia, which had a storm total of 12.9 inches and Goat Rock where 12.8 inches was recorded. The 4-inch isohyet encompassed the entire ACF Basin. Floods were moderate in the upper basin, becoming more severe downstream. An isohyetal map of the storm is shown in Figure 2-4.

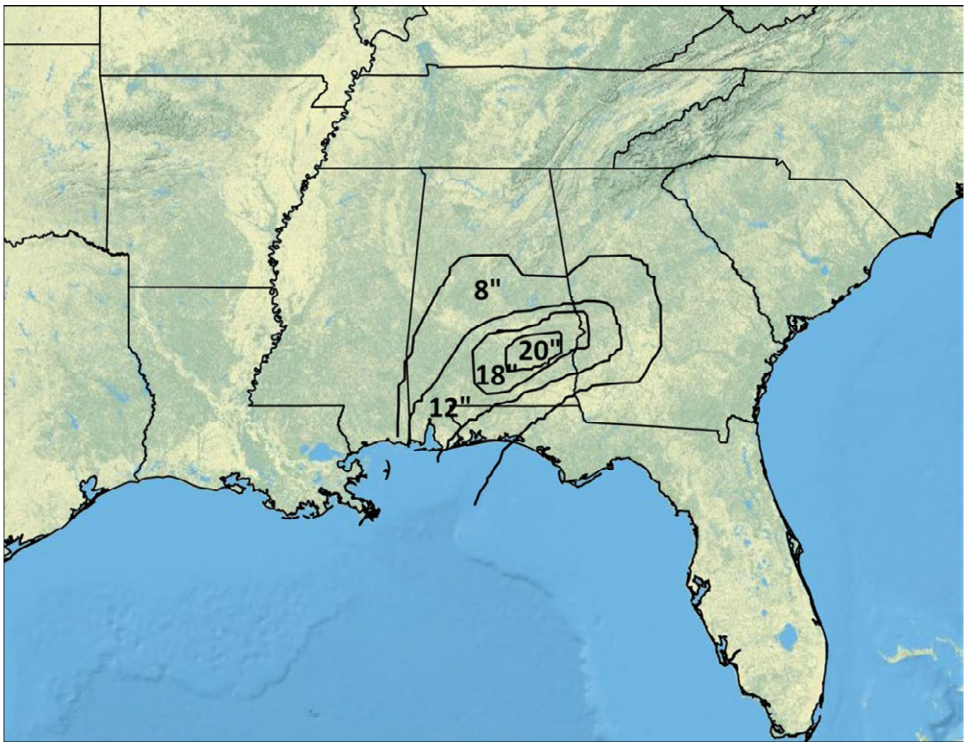


Figure 2-4. Storm of March 1929

4) <u>February 1961</u>. February 1961 was a month of extreme contrasts in the ACF Basin. The month began cold and dry, a continuation of the weather experienced over the area during most of December and January. Some scattered light rains occurred during the first week of February but not nearly enough to overcome the resulting moisture deficit. The drought condition was further intensified by a 9-day period beginning on the 9th that was almost completely devoid of rainfall. Beginning on the 18th the dry period was abruptly followed by the rainiest 8-day period experienced in Georgia since weather records began. The rains were heaviest in the west central part of the state were both LaGrange and West Point recorded more than 17 inches in 8 days. More than 7 inches fell in both places during a 24-hour period. Most locations northwest of Columbus reported more than 8 inches of rain during the 8 days. Several areas exceeded 12 inches. It was enough to make it the wettest February since 1929. The heavy rainfall caused flash flooding along many northern Georgia streams with major flooding developing on the Chattahoochee River in the West Point-Columbus area. An isohyetal map of the storm is shown in Figure 2-5.

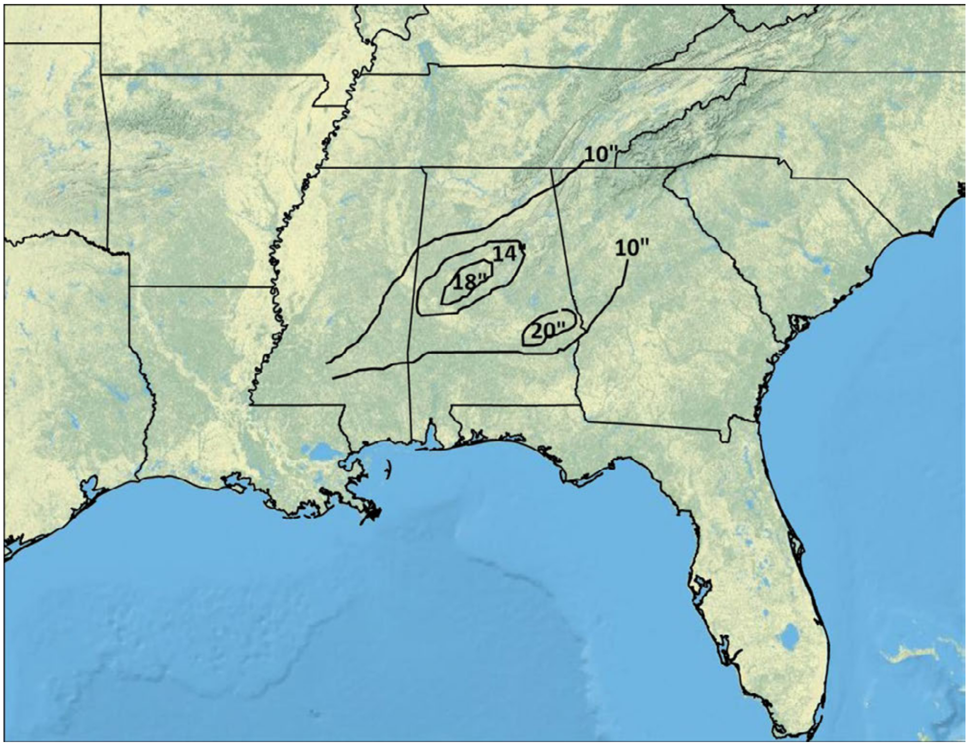


Figure 2-5. Storm of February 1961

5) March 1990. The March 1990 storm was a typical cyclonic storm which usually occurs in the winter and early spring months in the southeast. High pressure that had been sitting over the ACF in early March, weakened and moved eastward, allowing a low pressure system to move in over Alabama, Georgia and northwest Florida. The low pressure system became nearly stationary over the area, dumping extremely heavy amounts of rainfall in the basin.

The rainfall began on 15 March and has mostly ceased by the evening of 16 March. In that time, 8 to 13 inches had fallen over much of southwestern and south-central Alabama, with some localized rainfall totals reaching 17 inches. Soil conditions were very wet from a large event that had occurred in mid-February. The most severe flooding in the ACF occurred on the Upper Flint River and in the headwaters and tributaries of Walter F. George Lake on the Chattahoochee River.

The Culloden gage on the Flint River reported its second highest stage of 38.0 feet since records began in 1913 and Upatoi Creek near Columbus, Georgia, exceeded its previous record stage by 11 feet with a stage of 32.12 feet. This flood caused the highest recorded inflow into Walter F. George Lake since the project was built. An isohyetal map of the storm is shown in Figure 2-6.

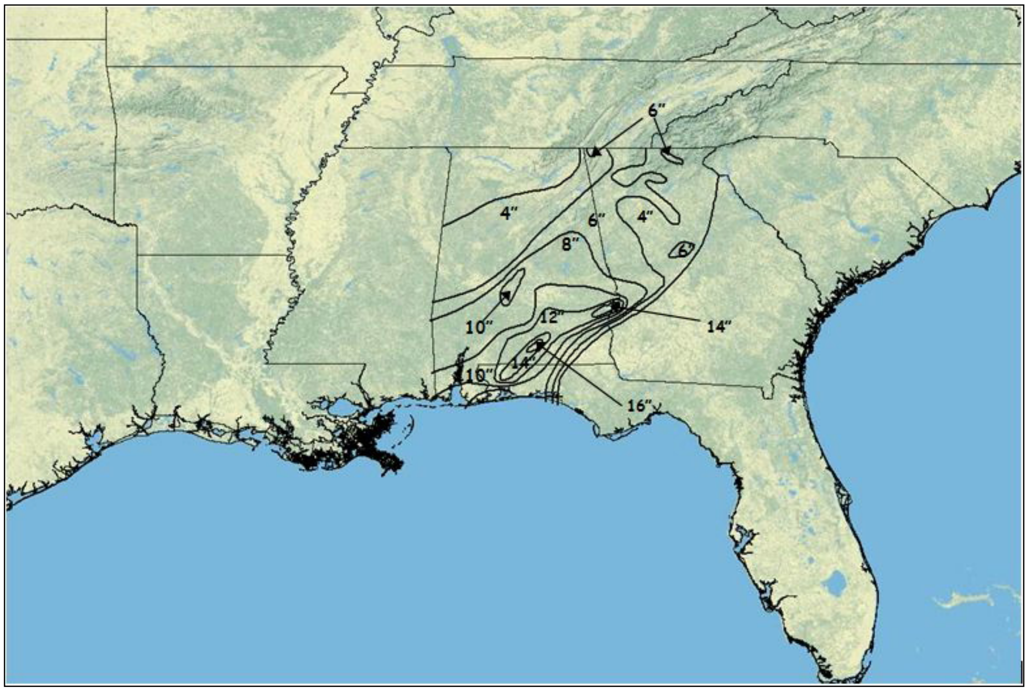


Figure 2-6. Storm of July 1990

<u>July 1994</u>. On the afternoon of 30 June 1994, Tropical Storm Alberto formed in the southeastern Gulf of Mexico between the Yucatan Peninsula and the western tip of Cuba. During the first 18 hours, the storm slowly drifted to the west, and then it began a more northwestward course. It continued that course until Saturday, July 2 when the storm began turning northerly. Alberto was near hurricane strength when it made landfall near Ft. Walton Beach, Florida, on Sunday, 3 July. The main threats over portions of Alabama, Florida, and Georgia were heavy rainfall and the possibility of tornados. The upper air patterns (which normally guide storms) were weak. Large areas of high pressure were to the west and the east of the storm. As a result, Tropical Storm Alberto became nearly stationary for several days as it moved over Georgia. Many places reported rainfall totals exceeding 10 inches. Atlanta received 12–15 inches, and other locations reported 20–26 inches of rainfall. Cuthbert, Georgia, in Randolph County reported 23.87 inches. The greatest flooding occurred in the Flint and Apalachicola Basins. An isohyetal map of the storm is shown in Figure 2-7.

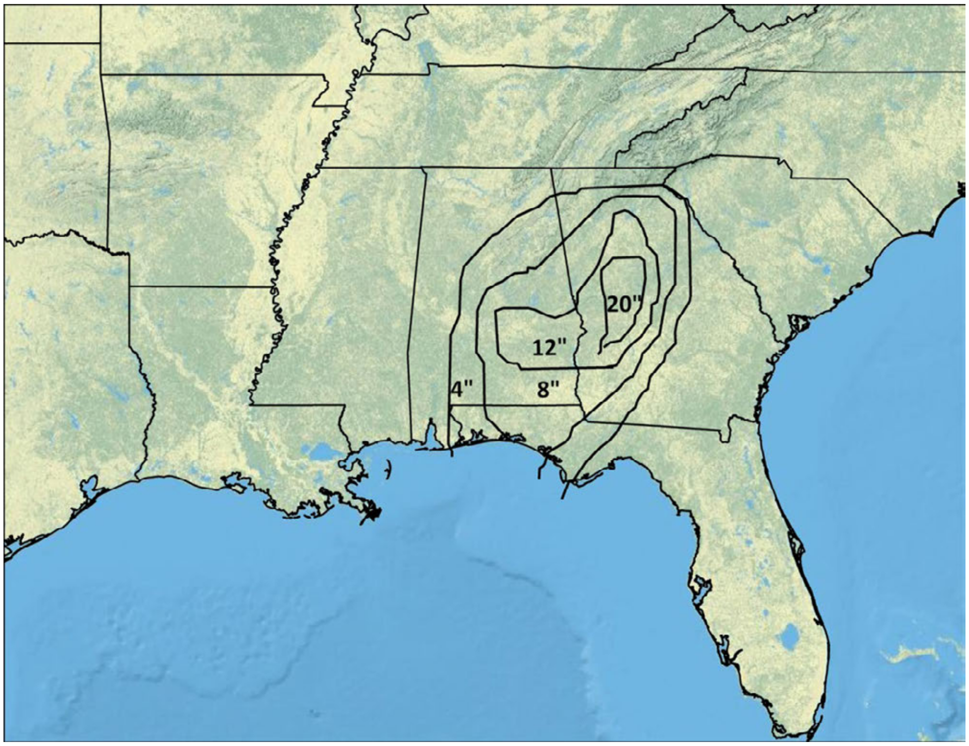


Figure 2-7. Storm of July 1994

6) May 2003. Several rounds of thunderstorms occurred over the Morristown, Tennessee, area from 30 April through 4 May. The thunderstorms significantly soaked the ground and raised the level of streams and lakes in the area. On 5 May, a warm front lay across extreme east Tennessee with a cold front over Arkansas. The warm sector of the frontal system with dew point temperatures in the lower 60s (resulting in high atmospheric moisture content) covered most of east Tennessee. A large atmospheric blocking pattern was across the United States, which caused the normal west-to-east progression of weather systems to become nearly stationary.

During a 3-day period of 5-7 May, heavy rain fell across north and central Georgia, especially in western and extreme northern counties. Some locations such as Troup and southern Meriwether Counties received almost a foot of rain.

Soils were already saturated from previous rainfall, resulting in rapid rises on many of the small streams in the western half of North and Central Georgia. Many streams overflowed their banks in Bartow and Whitfield Counties. Record flooding occurred on the Chickamauga Creek near the Tennessee border. Moderate flooding was noted on several other rivers and creeks including the Flint River near Culloden, the Conasauga River near Tilton, Sweetwater Creek near Austell, and the Chattahoochee River at West Point.

At the City of West Point, the Chattahoochee River crested at 23.2 feet, more than 4 feet above flood stage, shortly after midnight on 8 May. That is the highest level since 26 February 1961, when the river rose to 24.9 feet. The Corps calculated the peak flow at 170,000 cubic feet per second (cfs). Without West Point Dam, it is estimated that the Chattahoochee River at the City of West Point would have risen to around 34 feet. An isohyetal map of the storm is shown in Figure 2-8.

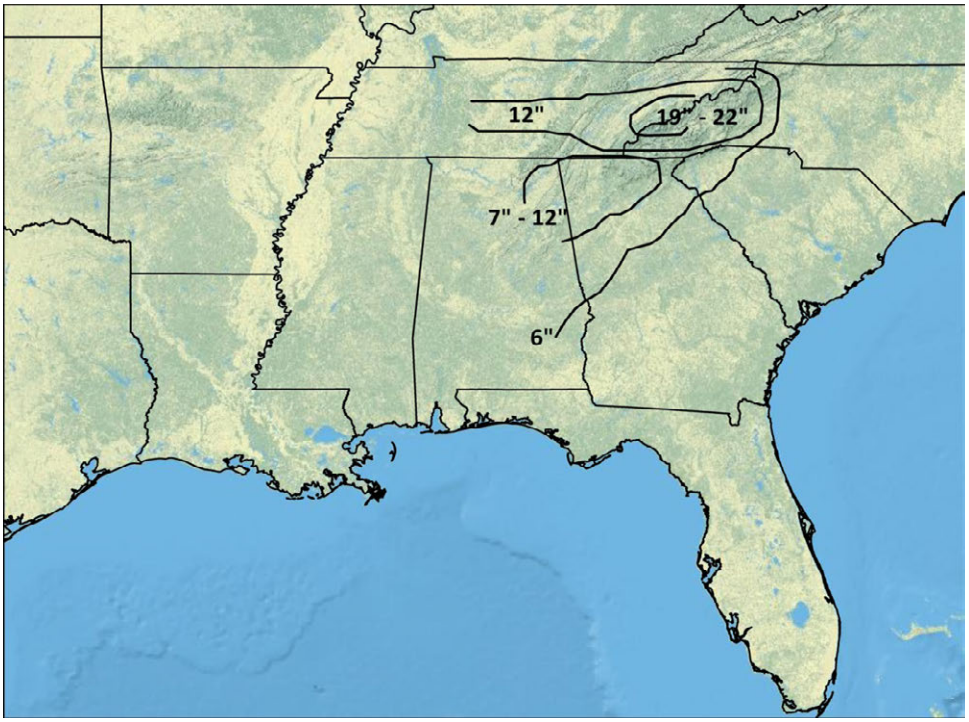


Figure 2-8. Storm of May 2003

7) September 2009. The floods of September 2009 resembled a tropical event but in reality were caused by steady rain for eight days.

During 15-18 September 2009, a constant rainfall fell but not in unusual amounts. Most areas had an inch or less on 15-16 September and very little on the 18th. By 19 September, the rainfall increased, resulting in 3-5 inches falling that day.

Rain began falling on the Atlanta area on the 15th, with the National Weather Service (NWS) reporting only 0.04 inch that day at the Hartsfield-Jackson Atlanta International Airport. Additional rain fell throughout the week, with only a trace amount recorded for 18 September. However, a large rain event began to inundate the area on 19 September. The NWS monitoring station at the Atlanta airport recorded 3.70 inches of rainfall from daybreak to 8 p.m. (more than doubling the previous record for rainfall on that date), while outlying monitoring stations recorded 5 inches of rainfall in a 13-hour period.

Inside the city limits of Atlanta, several neighborhoods were underwater, including Peachtree Hills. The Downtown Connector, a section where I-75 and I-85 run concurrent with each other and one of Georgia's busiest expressways, was submerged by the floodwaters.

The Governor of Georgia declared a state of emergency and requested a disaster declaration from the U.S. Government for 17 counties in Georgia. The counties were: Bartow, Carroll, Cherokee, Cobb, Coweta, DeKalb, Douglas, Fulton, Gwinnett, Heard, Newton, Paulding, and Rockdale around Metro Atlanta; Catoosa, Chattooga, and Walker in far northwest Georgia; and Stephens in northeast Georgia.

According to the USGS, the rivers and streams had magnitudes so great that the odds of it happening were less than 0.2 percent in any given year. In other words, there was less than a 1 in 500 chance that parts of Cobb and Douglas Counties would experience such flooding, commonly referred to as a 500-year storm. An isohyetal map of the storm is shown in Figure 2-9.

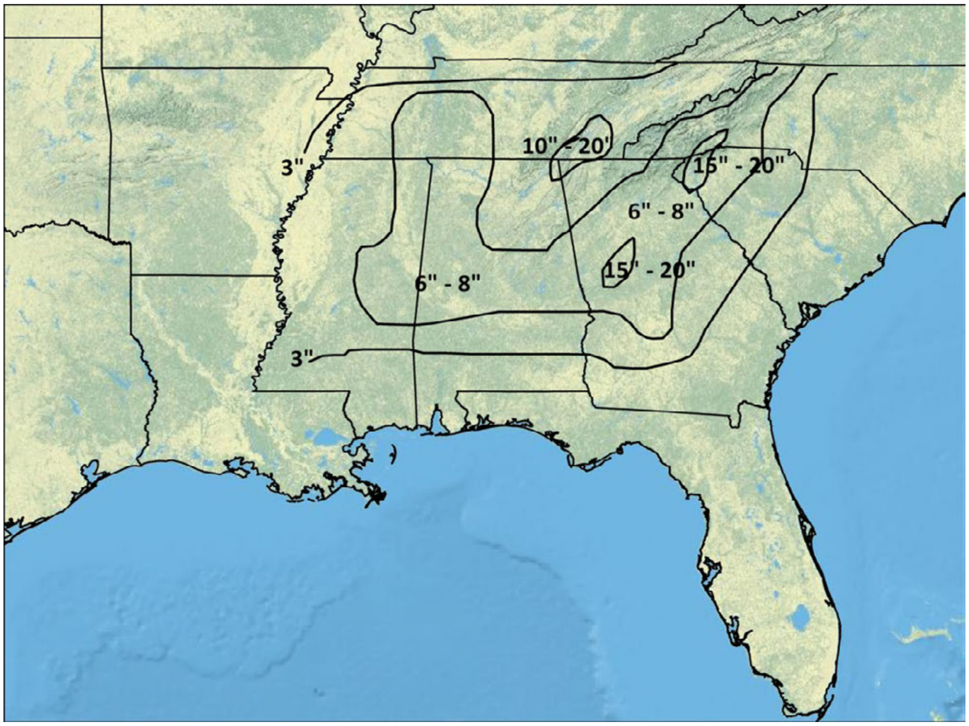


Figure 2-9. Storm of September 2009

A photo of the September 2009 flood in Mableton, Georgia, in the metropolitan Atlanta area is shown in Figure 2-10 below.

(Source:http://lollitop.blogspot.com/2009/10/flooding-in-southeast.html)

Figure 2-10. Flooding in Mableton, Georgia - September, 2009

2-07. Runoff Characteristics. Within the ACF Basin, rainfall occurs throughout the year but is less abundant during August through November. The amount of rainfall that actually contributes to streamflow varies much more than the rainfall. Several factors such as plant growth and seasonal rainfall patterns contribute to the volume of runoff. In severe droughts in the Upper Chattahoochee River Basin, the runoff from significant (3^+ inches) rain events can be as low as five percent of the rainfall.

While commonly referred to as observed data, reservoir inflows are actually calculated from pool elevations and project discharges. A reservoir elevation-storage relationship results in an inflow calculated for a given pool level change and outflow (total discharge) by using the continuity relationship. The reservoir continuity equation described below maintained the flow volume:

INFLOW = OUTFLOW + CHANGE IN STORAGE
where: INFLOW is in units of cfs/day
OUTFLOW is in units of cfs/day
CHANGE OF STORAGE is in units of cfs/day

The reservoir discharge value, OUTFLOW, is the total discharge from turbines, sluice gates, or spillway gates. Its associated value comes from rating tables for these structures. The CHANGE IN STORAGE comes from subtracting the daily storage on day two from day one as seen below.

$$\text{CHANGE IN STORAGE} = \text{STORAGE}_i - \text{STORAGE}_{i-1}$$

where: STORAGE_i = storage at midnight of the current day in units of cfs/day
STORAGE_{i-1} = storage at midnight of the previous day in units of cfs/day

The daily storage value comes from the storage-elevation tables using the adjusted midnight pool elevation for each day. Negative inflow calculations can occur when there is a decrease in storage which exceeds the project's outflow. Evaporative losses, direct reservoir withdrawals, wind affecting the lake level reading, and losses to groundwater are several causes of negative inflow calculations.

Figures 2-11, 2-12, and 2-13 present the average monthly runoff for the basin. The figures divide the basin at Atlanta and Columbus, Georgia, and Blountstown, Florida, to show the different percentages of runoff verses rainfall for the various sections. The mountainous areas exhibit flashier runoff characteristics and somewhat higher percentages of runoff. The source of the precipitation data for Figure 2-11 is the NOAA National Climatic Data Center, Georgia Climatic Division 2, monthly average Jan 1939 – Dec 2011. The source of the streamflow data for Figure 2-11 is the Atlanta monthly average unimpaired flow Jan 1939 – Dec 2011. The source of the precipitation data for Figure 2-12 is the NOAA National Climatic Data Center, Georgia Climatic Divisions 4 and 5, monthly average Jan 1939 – Dec 2011. The source of the streamflow data for Figure 2-12 is the monthly average unimpaired incremental flow between Columbus and Atlanta Jan 1939 – Dec 2011. The source of the precipitation data for Figure 2-13 is the NOAA National Climatic Data Center, Georgia Climatic Division 7 and Florida Climatic Division 1, monthly average Jan 1939 – Dec 2011. The source of the streamflow data for Figure 2-13 is the monthly average unimpaired incremental flow between Blountstown and Columbus Jan 1939 – Dec 2011.

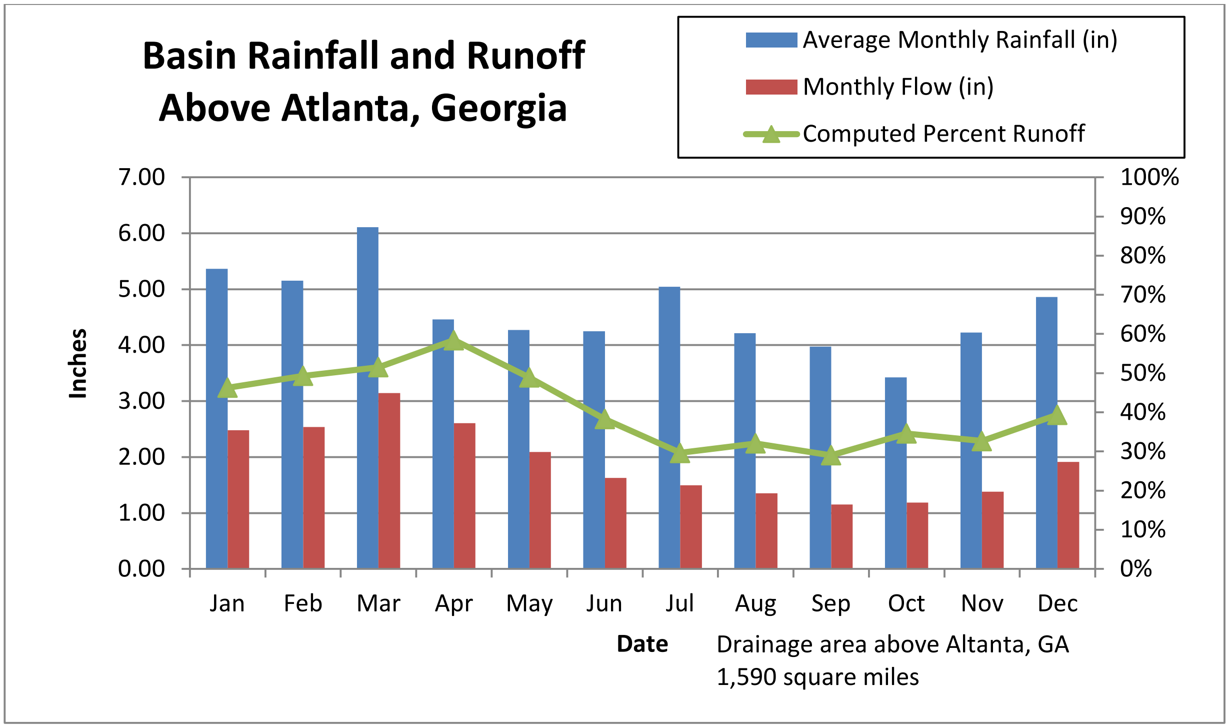


Figure 2-11. Basin rainfall and runoff above Atlanta, Georgia

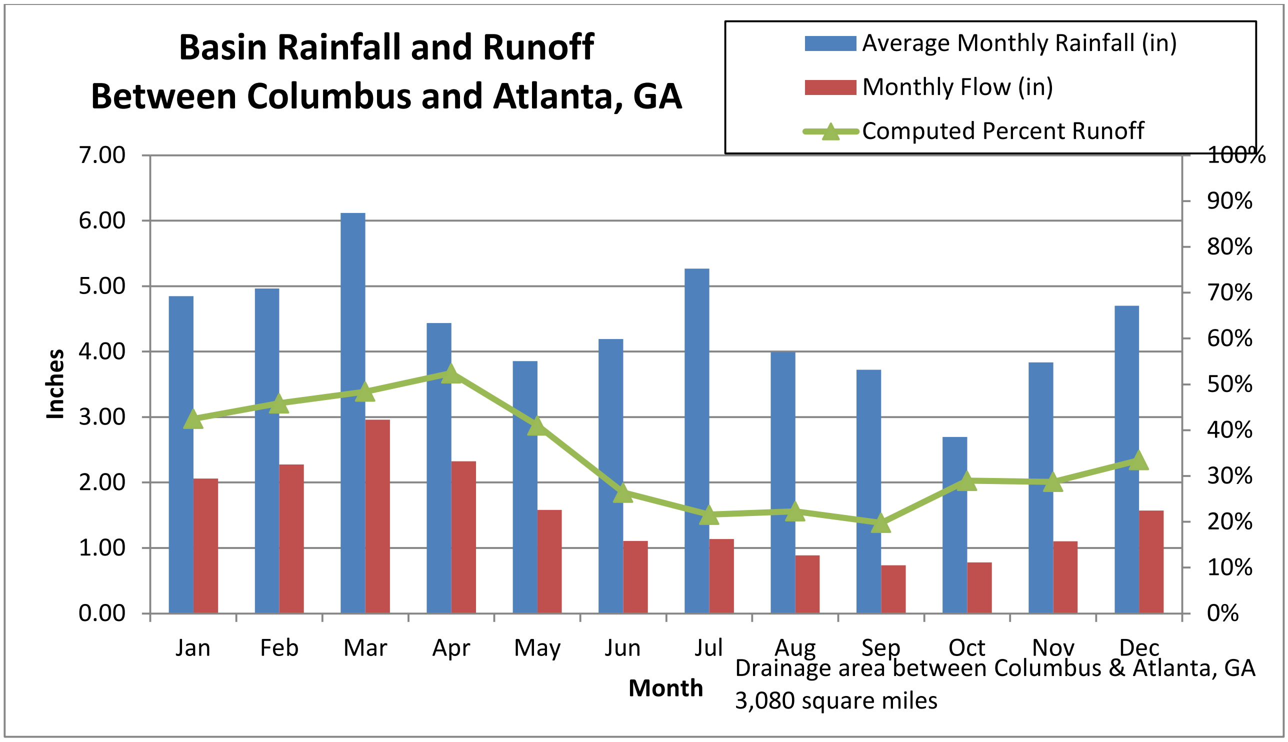


Figure 2-12. Basin Rainfall and Runoff between Columbus and Atlanta, Georgia

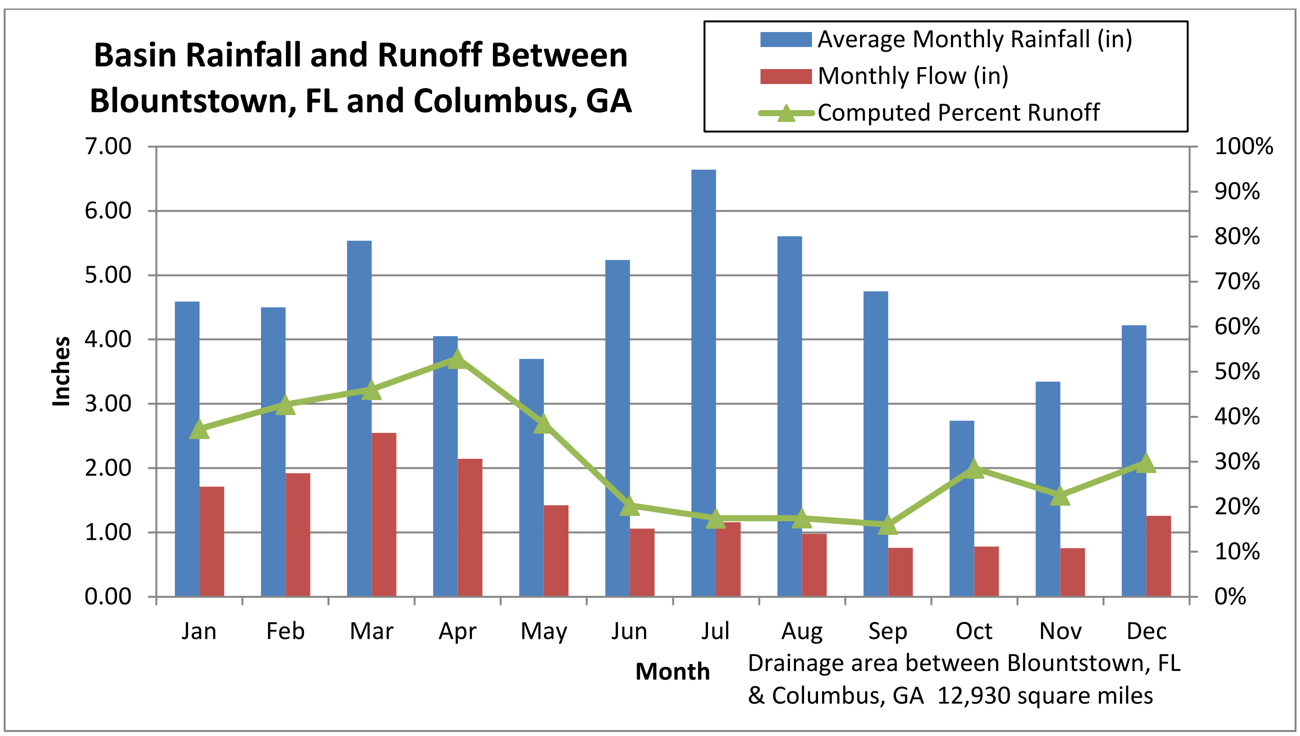


Figure 2-13. Basin Rainfall and Runoff between Blountstown, Florida, and Columbus, Georgia

2-08. Water Quality Trends in water quality since the passage of the Clean Water Act in 1972 show improvement. The reservoirs in the ACF Basin typically act as a sink, removing pollutant loads and sediment. Since the 1970's, significant decreases in the nutrient loads have occurred downstream of Lake Sidney Lanier, West Point Lake, and the Flint River arm of Lake Seminole. The decreases in nutrient and sediment concentrations in the reservoirs are caused by settling of sediments and associated phosphorus and detritus, inflow from tributaries with lower nutrient concentration, and by uptake of nutrients from phytoplankton in reservoirs. Nutrients concentrations are lower in the Chattahoochee River during the summer because of increased nutrient uptake in the reservoirs. The increased phytoplankton growth, along with aquatic plants, in the summer removes large amounts of nutrients.

The USGS described water quality trends in a report published in 2009, entitled *Trends in Water Quality in the Southeastern United States, 1973* – 2005. This report included several sampling sites located in the ACF Basin including: Chattahoochee River near Whitesburg, Georgia; Flint River at Newton, Georgia; and Flint River at Brownsboro. This investigation indicated an increasing trend in pH and specific conductance and a decreasing trend in nitrogen, phosphorus, and suspended sediments. Of course, these general trends may be different at specific site locations. Today, the focus of regulatory agencies is eutrophication in lakes and reservoirs, suspended sediment, nonpoint sources of pollution, and fecal coliform bacteria. Several total maximum daily loads (TMDLs) have been developed in the ACF Basin. TMDLs are developed for waterbodies to identify sources of impairment, the necessary reductions to sources, and methods to implement the reductions. The following paragraphs address water quality in the federal reservoir projects in the ACF Basin.

a. Lake Sidney Lanier Water quality in the forested headwaters of the ACF Basin was historically very good. After Buford Dam was built in the 1950s, water quality in the tailrace of the dam in the Chattahoochee River was diminished. Water released from the reservoir was high in iron and manganese because of the stagnation from the lake stratification and caused several large fish kills at the Georgia Lake Lanier Trout Hatchery. Several operational alternatives were considered in the late 1980s including the addition of hardening chemicals. Currently, the hatchery limits withdrawals from the Chattahoochee River during the fall destratification time period, when dissolved iron and manganese concentrations are at their highest levels.

Georgia's 2014 draft integrated 305(b)/303(d) list of impaired waters designates five of six reaches in Lake Sidney Lanier as supporting designated uses, including the area of the dam forebay. Water quality monitoring in Lake Sidney Lanier by the Georgia Environmental Protection Division (GAEPD) has shown that conditions exceeded the water quality standard for chlorophyll *a* at times since 2001. In the State's draft 2014 assessment, the reach near Browns Bridge Road (State Route 369) was identified as not supporting designated uses for chlorophyll *a*. Chlorophyll *a* standards for Lake Sidney Lanier are set as a growing season (April through October) average less than 5 micrograms per liter (µg/l) upstream of Buford Dam forebay, less than 5 µg/l upstream from Flowery Branch confluence, less than 5 µg/l at Browns Bridge Road, less than 10 µg/l at Boiling Bridge on the Chestatee River, and less than 10 µg/l at Lanier Bridge on the Chattahoochee River. The State collects profile data at compliance points in the reservoir for dissolved oxygen, pH, conductivity, and water temperature during the growing season. It also collects grab samples of nitrogen, phosphorus, chlorophyll *a*, and bacteria. Measured data at compliance points for dissolved oxygen, total nitrogen, and pH are consistent with Georgia's standards.

Georgia has begun efforts to identify sources contributing to high chlorophyll *a* by developing a total maximum daily load (TMDL). As part of the state's water planning effort, it is also modeling the Chattahoochee River downstream of Buford Dam.

The tailrace of Buford Dam is classified as a trout stream and GAEPD has established water quality standards; specifically, dissolved oxygen of 6.0 mg/l on a daily average and no less than 5.0 mg/l at all times. The water released from the dam is from the deeper levels of the lake where, although cool, often has dissolved oxygen levels of less than 3 mg/l from June to December when the lake is stratified. For this reason, auto-venting turbines were installed as part of the major rehabilitation project completed in 2005. Vented turbines increase dissolved oxygen levels in the releases by aspirating more air into the turbine and draft tube areas before the water is discharged downstream. Complete reaeration of the released waters typically occurs within five to six miles of the dam.

There are two GAEPD permitted utilities for Gainesville's discharge treated wastewater into Lake Sidney Lanier; the Linwood Plant (3-mgd design flow) and the Flat Creek Plant (12-mgd design flow). GAEPD has also permitted a wastewater discharge for Gwinnett County's F. Wayne Hill Water Resources Center treatment plant (60-mgd design flow).

There are five GAEPD permitted water users from Lake Sidney Lanier (see Table 2-11); McCrae and Stolz, Inc., Forsyth and Gwinnett Counties, the Cities of Buford, Cumming, and Gainesville; and the Lake Lanier Island Management Company.

b. <u>Chattahoochee River between Buford Dam and West Point Lake</u>: Water quality in the metropolitan Atlanta area and the 70 miles immediately downstream was notoriously poor from the 1940s to the 1970s. Raw sewage was often directly discharged into the Chattahoochee River, along with industrial effluent. Wastewater from the R.M. Clayton Plant, the main wastewater treatment plant for Atlanta, received only primary treatment before being discharged into the Chattahoochee River. These discharges had elevated fecal coliform counts and high concentrations of total suspended solids, ammonia, and a high biochemical oxygen demand. Water quality was typically worse during the summer months due to lower river flows and higher water temperatures. Phosphorus levels were also very high in rivers because phosphates were still being used in laundry detergent. Before the 1970s, fish kills were fairly common due to the discharge of raw sewage directly to the river.

In the 1970s, several laws and regulations were established at federal and local levels, including the 1972 Clean Water Act (CWA) and the 1973 Atlanta Metropolitan River Protection Act. The CWA required that all wastewater undergo secondary treatment, and by 1974 the Atlanta area facilities had been upgraded to provide secondary treatment. This resulted in an increased level of dissolved oxygen and a significant reduction in ammonia and total suspended solids in the Chattahoochee and Flint Rivers. Phosphorus levels also decreased due to regulations on phosphate detergents. The highest concentrations of nutrients and pollutants in the ACF Basin still occur immediately downstream of Atlanta in both the Flint River and Chattahoochee River.

c. <u>West Point Lake:</u> General water quality conditions that have been well documented in West Point Lake are typical of water quality conditions and trends that exist in reservoirs throughout the ACF Basin. Nutrient concentrations are highest in the upper arms of the tributaries to West Point Lake, specifically the Chattahoochee River arm, because of the nutrient-rich riverine inflows. Sediment and phosphorus concentrations are also highest in the upper arms and decrease toward the main pool as velocity is lowered and sediment is removed from suspension. Currents and mixing regimes influence the concentrations of dissolved oxygen throughout the reservoir. Due to summer-time thermal stratification of West Point Lake, dissolved oxygen levels were highest in the top 15 feet of the reservoir, declining to anoxic or nearly anoxic conditions near the reservoir bottom, especially in the main pool area. During winter-time conditions, the reservoir is well-mixed, with dissolved oxygen levels near saturation throughout the water column. Additionally, chlorophyll *a* concentrations varied both seasonally and spatially and were highest from July to October during periods of low flow.

Before West Point Dam was constructed, there were concerns with water quality, and monitoring was put in place downstream of the West Point Dam. In 1964, the U.S. Public Health Service conducted a study of water quality and water quantity, which concluded that a minimum of 670 cfs be released from West Point Lake to ensure sufficient water levels for downstream intakes.

Georgia's 2014 draft integrated 305(b)/303(d) list of impaired waters designates West Point Lake as not supporting designated uses because of polychlorinated biphenyls (PCBs). A TMDL for West Point Lake was completed in 1998 for PCBs, but it lists reduction requirements at zero percent because PCBs are no longer being used in Georgia. The PCBs found in fish in West Point Lake are from historic contamination. A TMDL was also completed in 2000 for low dissolved oxygen below the West Point Dam.

Georgia collects profile data at compliance points in the lake for nutrients and additional water quality criteria. Site-specific nutrient standards have been developed for West Point Lake; chlorophyll *a* shall not exceed 24 µg/l more than once in a five-year period at the LaGrange water intake or 22 µg/ upstream from West Point Dam in the forebay during the growing season (April through October), total nitrogen shall not exceed 4.0 mg/l, and phosphorus loading shall not exceed 2.4 pounds per acre-foot (lbs/ac-ft) per volume of water per year. All water quality samples collected by GAEPD have been within those ranges. In accordance with the state water plan, GAEPD is developing a three-dimensional hydrodynamic and water quality model that will further examine nutrient criteria in West Point Lake.

The City of LaGrange, Georgia, also monitors the water quality at various locations in West Point Lake. The city's monitoring efforts are being conducted to document reservoir nutrients. The city's water supply intake is in West Point Lake and has intake ports located at elevations 628, 623, 618, and 600 feet NGVD29. Their GAEPD permit allows a daily maximum of 17.6 mgd, with a monthly average of 16 mgd

In 2008, the data effort identified several violations of the state's nitrogen standard in waters entering the reservoir. Samples collected in the lake pool during the same period did not experience violations. Since 2008, nitrogen concentrations entering the reservoir have not violated the state's water quality standard for nitrogen.

d. <u>Walter F. George Lake:</u> The pool and mid-lake areas of Walter F. George Lake are both supporting their designated water uses according to Georgia's 2014 draft integrated 305(b)/303(d) list. A TMDL was completed in 1998 for PCBs, and because PCBs are no longer used in Georgia, reduction of contaminants was listed at zero percent. GAEPD collected nutrient and water quality data at compliance points in the lake, and measurements have not exceeded the standards. Walter F. George Lake has site-specific nutrient criteria, and the chlorophyll *a* growing season average must be less than 18 µg/l. While the growing season average has been less than 18 µg/l, some individual chlorophyll *a* measurements have equaled 18 µg/l. In accordance with the state water plan, GAEPD is developing a three-dimensional hydrodynamic and water quality model that will further examine nutrient criteria in Walter F. George Lake.

Historically, low dissolved oxygen downstream of Walter F. George Lock and Dam into the headwaters of Lake George W. Andrews had caused fish kills. A new protocol was adopted for Walter F. George Lock and Dam that allowed for additional water release from the reservoir during periods of fish stress and low dissolved oxygen. Special releases are made when monitoring indicates low dissolved oxygen or if fish below the dam appear to be in distress.

The Corps operates a water quality monitoring station on the Chattahoochee River downstream from Walter F. George Lock and Dam. Dissolved oxygen levels immediately downstream from the Walter F. George Lock and Dam are routinely monitored and other water quality parameters, such as temperature, pH, and conductivity are monitored less frequently for project specific purposes. The water quality data are collected monthly by project personnel and submitted to the Mobile District, Planning Division, Inland Environment (PD-EI) team.

The MeadWestvaco Corporation withdraws water from the Chattahoochee River, near Pittsview, Russell County, Alabama, and is required to meet special water quality criteria with its discharge water. The plant's water intake is in the reservoir at elevation 178.8 feet NGVD29. When the Walter F. George pool elevation reaches 184.75 feet NGVD29, the pumping capacity reduces to 75 percent. MeadWestvaco has installed emergency pumps at the intake to operate at or below pool elevation 178.8 feet NGVD29 to maintain pumping capacity.

e. <u>Lake George W. Andrews:</u> Lake George W. Andrews is supporting its designated water quality use for fishing according to GAEPD. Because it is meeting all water quality standards, no TMDL studies have been conducted. GAEPD does not have regularly monitored compliance station in the lake as it does with other reservoirs in the ACF Basin. Georgia has not developed site-specific water quality criteria for the reservoir. The Corps monitors water quality in the headwaters of the lake (tailrace of Walter F. George Lake) and will use the data for future water quality planning purposes.

Two major industries withdraw water for plant process purposes and discharge wastewater back into the Chattahoochee River just downstream of the George W. Andrews Lock and Dam (headwaters of Lake Seminole). The Georgia Pacific Corporation plant is on the Chattahoochee River near Cedar Springs, in Early County, Georgia, in the upper reaches of the Lake Seminole pool, tailwaters of the George W. Andrews Lock and Dam. The plant uses six pumps with an intake elevation of 72.67 feet NGVD29. Pumping capacity is reduced at pool elevations below 75 feet NGVD29. The GAEPD permit specifies a daily maximum withdrawal of 144 mgd, with a monthly average of 115 mgd. The wastewater discharge from this plant is approximately 72 mgd. The Farley Nuclear Power Plant is on the west bank of the Chattahoochee River near Columbia, Houston County, Alabama, in the headwaters of Lake Seminole/tailwaters of George W. Andrews Lock and Dam. The plant becomes severely affected when the pool elevation at Lake Seminole drops below elevation 75.0 feet NGVD29, Southern Nuclear Company defines 2,000 cfs and 74.5 feet NGVD29 as minimum conditions for operation. The Alabama Department of Environmental Management permit specifies a withdrawal of 105.36 mgd for the Farley Plant.

f. <u>Lake Seminole</u>: The upper reaches of the lake maintain the characteristics of a river with relatively homogenous temperature and dissolved oxygen concentrations. The productive zone of the lake is not limited because of vertical stratification due to the homogenous dissolved oxygen concentrations and the relative shallowness of the lake. Although there is a small degree of vertical stratification, a thermocline does not exist. Interagency sampling over the 1993–1995 period does show significant areas of extremely low or zero dissolved oxygen in the aquatic plant beds in the lake. On the basis of those data, a significant portion of the lake probably has poor water quality conditions during the hot summer and early fall months when the hydrilla has formed large surface mats. For example, in the dense hydrilla beds, the dissolved oxygen levels were less than 5 mg/l at depths greater than 18 inches in most of the June - October, while stations in open water had significantly fewer dissolved oxygen measurements less than 5 mg/l. Average dissolved oxygen measurements on the bottom in the hydrilla beds were about 2.5 mg/l, compared with approximately 5.0 mg/l at the open-water sites.

By the time the Chattahoochee River enters Lake Seminole, nutrient concentrations are similar in concentrations to the Apalachicola River. The Flint River, which has no reservoirs between Albany and Lake Seminole, has much higher pollutant loads upon entering Lake Seminole due to point sources in Albany, Georgia and nonpoint sources from the surrounding agricultural land.

According to Georgia's 2014 draft integrated 305(b)/303(d) list of impaired waters, Lake Seminole is supporting its designated recreation usage except for a portion of the Flint River east of the confluence with Fish Pond Drain, which fails to support its designated use for pH. Two TMDLs were completed in 1998 for chlordane and PCBs. Reduction for both was zero percent because both are no longer used in Georgia. GAEPD regularly monitors water quality in Lake Seminole, and all water quality meets criteria. Georgia has not set site-specific nutrient criteria for Lake Seminole. The Corps has historically monitored water quality in the tailrace, and the data has shown that the water discharged from the dam generally has good water quality.

However, in the freshwater nutrient criteria drafted for Florida in January 2010, Florida's nutrient criteria will apply to Lake Seminole in the dam forebay, which is in Florida. The monitored concentration of phosphorus (0.1 µg/l in 2008 (GAEPD 2008)) exceeds the proposed Florida standard of 0.02 µg/l. The new standard for nitrogen is 0.67 mg/l. The implications of new standards might require nutrient reductions throughout the ACF Basin from both point and nonpoint sources.

GAEPD is developing a three-dimensional hydrodynamic and water quality model for the lake that will establish nutrient criteria. That tool will help the state understand how nutrients entering the reservoir assimilate. Understanding how nutrients in the lake assimilate will be a factor in determining the need for upstream reductions.

g. Apalachicola River: Apalachicola River is a large alluvial river with a broad floodplain that has a fairly flat slope and flows unimpaired to the ocean. The river supports its water quality designation of Class III – Recreation, Propagation and Maintenance of a Healthy Well Balanced Population of Fish and Wildlife by the state of Florida. The river is also offered special protection being designated as an "Outstanding Florida Waters, Outstanding Natural Resources Water". No TMDLs have been completed for the river. Florida has determined that a TMDL is needed for mercury due to the levels of mercury found in fish tissue with the most likely source being atmospheric deposition.

2-09. Channel and Floodway Characteristics. Channel characteristics vary greatly throughout the basin from the steep, narrow, clear, flashy Chattahoochee River in the rocky strata in the upper reaches of the Blue Ridge Mountains, to the 800 feet wide, meandering Apalachicola River near Apalachicola, Florida.

a. Chattahoochee River. The slope of the Chattahoochee River in the extreme upper reaches is extremely steep and varies rapidly. The slope of the Chattahoochee River from the headwaters to the upstream limit of Lake Sidney Lanier (about 25 miles) is approximately 9 feet per mile. From the upstream limit of Lake Sidney Lanier to Buford Dam (about 50 miles) the slope is approximately 4 feet per mile (see Plate 2-2). The channel width just below Buford Dam is 300 feet. The Chattahoochee River below Buford Dam is shown in Figure 2-14.

Near West Point, the slope of the river is approximately 2.7 feet per mile, and the river varies in width from 350 to 460 feet.

From West Point to Columbus, Georgia, the river flows over the Fall Line and drops 368 feet in elevation, averaging 10 feet per mile. The width of the river varies from 400 to 600 feet and is affected by the backwater from the dams in this reach.

From Columbus, Georgia, to the mouth of the Chattahoochee River at the Florida state line, the slope varies from 1.2 to 0.6 feet per mile. River widths are approximately 400 to 500 feet unless affected by reservoirs.

Figure 2-14. Chattahoochee River below Buford Dam

b. Flint River. Above the Fall Line, the Flint River's slope averages about 2 feet per mile. For about 55 miles across the Fall Line, the slope averages about 6.7 feet per mile, with as much as 48 feet per mile in one section. The lower portion of the Flint River, below Albany, Georgia, has an average slope of about 1.0 feet per mile. In the 73-mile reach between Albany and Bainbridge, Georgia, there are a number of rock shoals and rapids and the river flows between high, steep banks. Below Bainbridge, Georgia, the stream widens and passes through broad swamps. The Flint River is shown in Figure 2-15.

Source: Beth Young

Figure 2-15. Flint River

c. Apalachicola River. The Apalachicola River is formed by the confluence of the Chattahoochee and Flint Rivers at the southwest corner of Georgia. It is 108 miles long and varies in width from 600 to 800 feet. The floodplain is about 10 miles wide. The slope averages 0.5 to 0.7 feet per mile. A photo of the river is shown in Figure 2-16.

Figure 2-16. Apalachicola River near Bristol, Florida

2-10. Economic Data. The ACF Basin drains approximately 19,573 square miles in parts of Georgia, Alabama, and Florida and covers 60 counties in Georgia, 10 counties in Alabama, and 8 counties in Florida. Water resources in the ACF Basin have been managed to serve a variety of purposes, including navigation, hydroelectric power, flood risk management, water supply, water quality, and recreation. Such water resources also provide important habitat for fish and wildlife.

Population in the southern states has increased dramatically since the 1940s. Figures 2-17 and 2-18 show the increase in housing density in the ACF Basin.

According to the U.S. Census Bureau, the population in the ACF Basin is 6,848,411 (2012). The population has more than doubled in the region over the past 50 years. About 75 percent of the population in the ACF Basin resides in Chattahoochee River Basin, 20 percent in the Flint River Basin, and 5 percent in the Apalachicola River Basin.

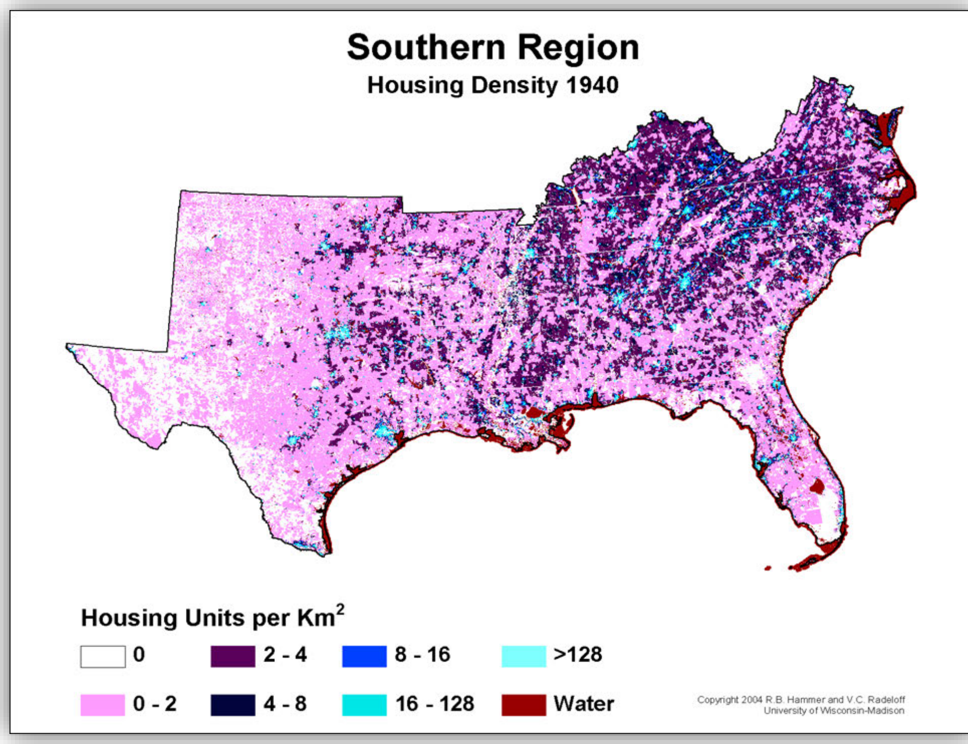


Figure 2-17. Houses per Kilometer in 1940

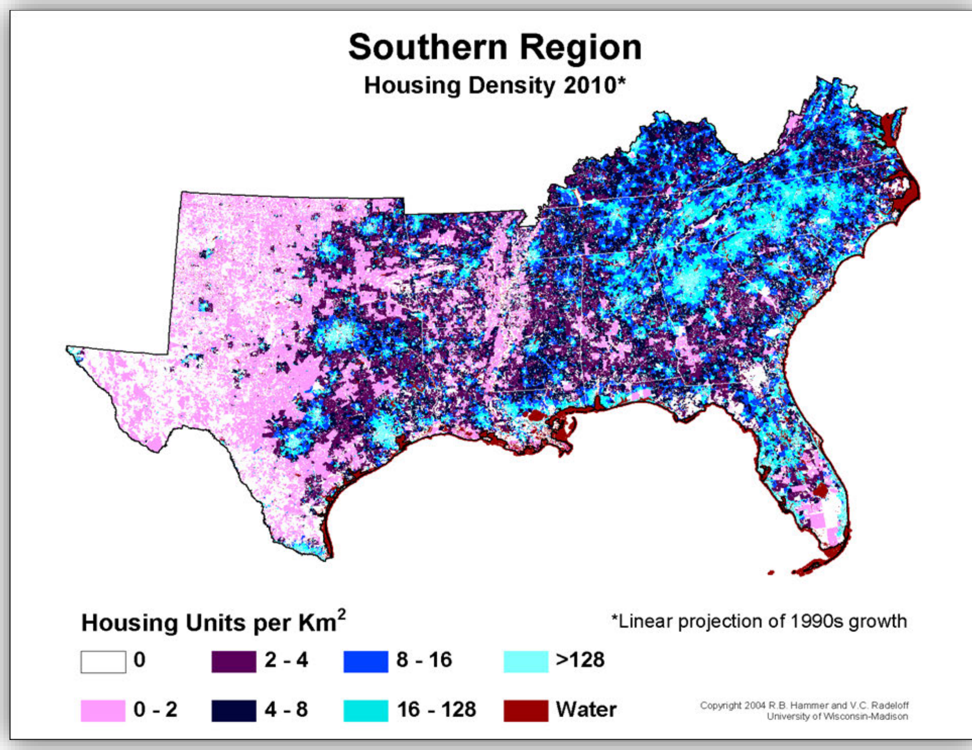


Figure 2-18. Houses per Kilometer in 2010

2-11. Land Use. Basin-wide land use was compiled from the Georgia Land Use Trends 2008 data. The Georgia Land Use Trends 2008 data set addresses the entire ACF Basin, including those areas in Alabama and Florida. The major land cover uses are categorized as beaches/dunes/mud, water, developed land, barren land, forested land, golf courses, pasture and row crops (i.e., agricultural), and wetlands. The overall proportions of these land cover categories in the ACF Basin are illustrated in Figure 2-19, and the acreages associated with the land cover categories are listed in Table 2-10.

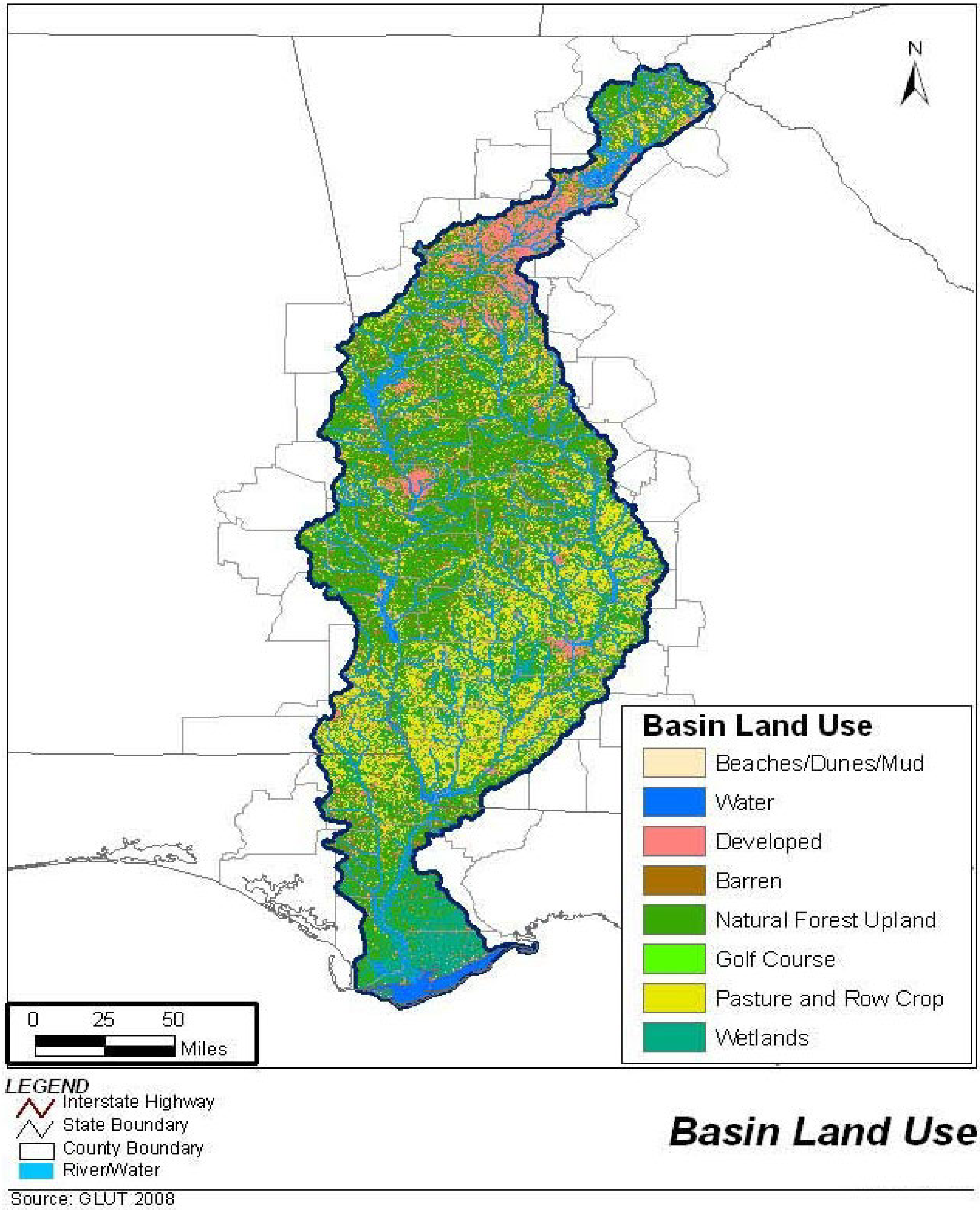


Figure 2-19. Land Use in the ACF Basin

Table 2-10. ACF Basin Land Use

Land use	Acres	Percent of total acreage
Beaches/Dunes/Mud	30,595	0.2%
Water	372,427	3%
Developed (urban or built-up land)	1,423,097	11%
Barren	571,492	4%
Natural forested upland (forested lands)	6,229,860	48%
Golf Courses	2,067	0.02%
Pasture and Row Crop	2,753,559	21%
Wetlands	1,712,139	13%
Total basin	13,095,236	100%

Beaches, dunes, and mud are less than one percent of the ACF Basin. Roughly 30,600 acres of the basin includes open sand, sandbars, sand dunes, mud - natural environmental, and exposed sand from dredging and other activities.

Water includes lakes, rivers, ponds, ocean, industrial water, and aquaculture. As shown in Table 2-10, water covers 372,427 acres or almost three percent of the ACF Basin.

Developed land is urban or built-up land, which includes residential, commercial, institutional, industrial, transportation (e.g., roads, railways, airports), and recreational land uses. Developed land accounts for more than 1.4 million acres or almost 11 percent of the ACF Basin. The largest developed areas in the basin are the metropolitan area of Atlanta, Georgia, near the Chattahoochee River in the northern portion of the ACF Basin; Columbus, Georgia (the third largest city in Georgia) along the Chattahoochee River in the central portion of the basin; and Albany, Georgia, the largest city on the Flint River in the southeastern portion of the basin.

Barren lands include areas of exposed rock and soil from industrial uses, gravel pits, landfills, rock outcrops, and mountain tops. Barren lands cover approximately 571,500 acres and account for about four percent of land use in the ACF Basin.

Forested land includes deciduous forest (tree species that shed foliage in response to seasonal change), evergreen forest (tree species that maintain their foliage all year), and mixed forest. Forested land is the predominant land use in the ACF Basin, accounting for more than 6.2 million acres or about 48 percent of land use.

Golf courses make up 2,067 acres and only account for 0.02% of the land use in the ACF Basin.

Pasture and row crops is the second most predominant land use in the ACF Basin, accounting for about 2.8 million acres or 21 percent of land use. This land use category includes row crops, orchards, vineyards, groves, horticultural businesses, pasture, and non-tilled grasses.

Wetlands include forested, salt marsh, brackish, and freshwater marsh wetlands. Wetlands account for more than 1.7 million acres or about 13 percent of ACF Basin land use.

2-12. Water Use. The ACF Basin rivers and lakes are a major source of water supply used in the region. Most of the population in the metropolitan Atlanta, Georgia, area is dependent upon surface water from the Chattahoochee River for their drinking water supply. Municipal and Industrial (M&I) use is the primary water demand along the middle and lower Chattahoochee River. Agricultural use is the primary demand for water along the Flint River. Other water use demands in the basin include wastewater dilution, fish and wildlife propagation, hydropower generation, and recreational boating and fishing. Table 2-11, found on pages T-1 to T-3, lists the water users in the ACF Basin.

III - GENERAL HISTORY OF BASIN

3-01. Authorization for Federal Development. Federal expenditures for improvements in the ACF Basin were first made during the period 1828 to 1831. Although there was no definite project at that time, $13,000 was spent to remove obstructions in the Apalachicola River and lower Chipola River. In 1835 and 1836, appropriations totaling $9,000 were made for work on the upper Chipola River. The first reports on surveys for river improvements were submitted in 1853 for the Chattahoochee River below Columbus, Georgia, and in 1872 for the Apalachicola River and the Flint River below Albany, Georgia.

The Rivers and Harbors Act of 23 June 1874 provided the original project authorization for navigation improvements in the ACF Basin. The act authorized the following improvements:

- A 6-foot deep by 100-foot wide channel in the Apalachicola River by removing snags and overhanging trees
- Widening and straightening Moccasin Slough
- A 4-foot deep by 100-foot wide channel on the Chattahoochee River from the mouth to Columbus, Georgia, a distance of 161 miles
- A 3-foot deep by 100-foot wide channel on the Flint River from the mouth to Albany, Georgia, a distance of 102 miles

The Rivers and Harbors Act of 14 June 1880 authorized a navigation channel for light-draft steamers at moderate stages from Albany, Georgia, to Montezuma, Georgia, a distance of 79 miles.

The Rivers and Harbors Act of 13 January 1902 modified the project to include a channel 5-foot deep by 60-foot wide through the Cut-off, Lee Slough, and Lower Chipola River.

The Rivers and Harbors Act of 1925 authorized a preliminary examination and survey of an “inland waterway” to include the Apalachicola and Chattahoochee Rivers “suitable to the economical operation of self-propelled barges.”

The Rivers and Harbors Act of 6 January 1934 included snagging and dredging in the lower 2,500 feet of the Styx River.

The Emergency Relief Appropriation Act of 8 April 1935 authorized and funded a flood control project near the vicinity of West Point, Georgia, on the upper Chattahoochee River. That project provided for increasing the channel section at critical points between the Town of West Point and Langdale Dam, clearing a floodway on both banks, constructing a 1,500-foot-long levee, and constructing an additional span in a highway bridge.

The Rivers and Harbors Act of 1945 approved the general plan presented in House Document No. 342, 76th Congress, First Session (1939 Report of the Chief of Engineers), for the full development of navigation and power in the Apalachicola, Chattahoochee, and Flint Rivers. It also authorized the initiation and partial accomplishment of that plan by construction of two locks and dams for a 9-foot project depth; one lock was authorized at the junction of the Chattahoochee and Flint Rivers and the other at Fort Benning, Georgia. A 6-foot navigation channel would be accomplished by dredging, and construction works to Columbus, Georgia, and Bainbridge, Georgia. The remaining elements of the approved plan included four navigation-power dams on the Chattahoochee River between the Junction and Fort Benning

Dams, near Florence, Fort Gaines, Columbia, and Paramore Landing. Storage-power reservoirs were authorized on the upper Chattahoochee River at Roswell, Cedar Creek, and Lanier sites. On the Flint River storage-power reservoirs were authorized at Woodbury No. 2, Potato Creek, and Auchumpkee Creek sites. Also authorized were dredging, cut-offs, contraction works and other methods to provide (with the aforementioned dams and flow regulation) channels 9 feet deep and 100 feet wide from the mouth of the Apalachicola River to Columbus, 7 feet deep and 100 feet wide in the Flint River to Bainbridge and 5 feet deep and 100 feet wide to Albany, Georgia. The three reservoir projects on the Flint River were deauthorized in the Water Resources Development Act of 1986.

In a report dated 20 March 1946 ("Newman Report") the South Atlantic Division Engineer, Brigadier General James B. Newman, Jr., recommended a number of modifications to the plan authorized in the previous year, reducing the number of separate locks and dams and reservoirs from twelve to four: one "navigation-power" and two "storage-power" facilities with a combined hydropower capacity of 144,700 kilowatts (kW), and one lock and dam project without storage or hydropower. The Newman Report anticipated that the federal hydropower installations would be operated "as units of an integrated power system" with the existing, non-federal projects in the ACF Basin, adding 97,800 kW dependable capacity to the system and contributing system power benefits estimated at $3,377,000 annually.

The Rivers and Harbors Act of 24 July 1946 authorized project modifications in accordance with the general plan presented in House Document No. 300, 8th Congress, First Session. The Act provided for the initiation and partial accomplishment of the modified plan by constructing the Buford multiple-purpose reservoir, the Fort Benning Lock and Dam, and the Upper Columbia and Jim Woodruff multiple-purpose developments. Supplemental channel works were also included to provide a 9-foot deep by 100-foot wide channel from the Gulf Intracoastal Waterway in the Apalachicola River to Columbus, Georgia, on the Chattahoochee River and to Bainbridge, Georgia, on the Flint River. A resolution of the Committee on Public Works of the House of Representatives, adopted on 19 May 1953 approved the modification of the plan for a low dam at the Columbia site and a high dam at Fort Gaines site in lieu of a high dam at the Upper Columbia site and a high dam at the Fort Benning site.

The Flood Control Act of 23 October 1962 (P.L. 87-874) authorized the construction of West Point Dam in accordance with House Document 570, 87th Congress, Second Session. The original purposes contained in the project authorization were flood control (now termed flood risk management), hydropower, recreation, fish and wildlife conservation, and navigation.

Section 311 of the Water Resources Development Act of 1990 directed the Secretary of the Army to review and report upon the authorized and operating purposes of reservoirs under his control. The Corps report, *Authorized and Operating Purposes of Corps of Engineers Reservoirs* dated July 1992, identifies the authorized and operating purposes of 541 federally owned reservoirs. On page 2 of that report, it states, "The purposes that a reservoir is to serve are given in laws that may be grouped into three categories: (1) laws initially authorizing construction of the project; (2) laws specific to the project passed subsequent to construction; and (3) laws that apply generally to all Corps reservoirs. In the latter category, the following laws have the greatest relevance to Corps reservoirs:

- P.L. 78-534, Flood Control Act of 1944 (provides authority to add recreation as a purpose and to contract for use of surplus water for domestic purposes);
- P.L. 85-500, Title III, Water Supply Act of 1958 (provides authority to include storage for municipal and industrial water supply);

- P.L. 85-624, Fish and Wildlife Coordination Act of 1958 (provides authority to modify projects to conserve fish and wildlife);
- P.L. 92-500, Federal Water Pollution Control Act Amendments of 1972 (establishes goal to restore and maintain the quality of the Nation's waters);
- P.L. 93-205, Endangered Species Act of 1973 (provides authority for operating projects to protect federally listed threatened and endangered species and their designated critical habitat.)"

3-02. Planning and Design. The authorizations for developing the federal projects in the ACF Basin provided for the specific multiple purposes of flood risk management, hydropower, navigation, and, in the case of the West Point Dam Project, recreation and fish and wildlife conservation. During the planning stages, each project was designed to fulfill its authorized purposes and to complement total basin development.

a. Jim Woodruff Lock and Dam. The Corps first considered a dam with a navigation lock on the Apalachicola River near Chattahoochee, Florida, in the early 1930s in preparing a report on the Apalachicola River System in accordance with House Document No. 308, 69th Congress, First Session. Definite Project Report, Junction Project, Apalachicola River, Florida, was completed by the Mobile District on 1 October 1946 and transmitted to higher headquarters on 4 October 1946. The plan consisted of a dam with its axis about normal to the river channel, providing at extreme low flow a 33-foot pool differential between elevations 77.0 and 44.0 feet NGVD29; an 82- by 450-foot single-lift lock; a 30,000-kilowatt (kW) power plant and appurtenances; and a reservoir extending up the Chattahoochee River to the vicinity of Columbia, Alabama, and up the Flint River to a point about 18 river miles above Bainbridge, Georgia. A revised report entitled *Definite Project Report on Jim Woodruff Dam* was issued on 15 March 1948. The change in name of the project from Junction Project to Jim Woodruff Dam was done in accordance with Public Law 525, dated 24 July 1946.

b. Buford Dam. Congress authorized Buford Dam for construction in 1946 as part of the overall development of the Nation's waterways after World War II.

Figure 3-1. Foundation work at Buford Dam (Circa 1950-51)

The Buford Dam site was investigated and its possibilities considered by the Corps in the early 1930s when a report on the Apalachicola River Basin was being prepared in accordance with House Document No. 308, 69th Congress, First Session. It was first recommended for construction in a report by the District Engineer dated 20 November 1945 that modified a previously approved comprehensive plan for basin-wide development.

Studies made in 1949 for a definite project report showed that the Buford site was especially favorable for an earth dam and that considerable savings (more than $2 million) could be affected by constructing an earth dam instead of a concrete dam. Figure 3-1 shows an early stage in construction.

The Definite Project Report prepared by the Corps' Mobile District proposed an earth dam supplemented by saddle dikes and an unpaved chute spillway, an 86 megawatt (mw) power plant and appurtenances and a reservoir at elevation 1,075 feet NGVD29, the top of primary flood control storage pool. The Definite Project Report dated 1 December 1949 was approved by the Chief of Engineers on 3 February 1950 subject to certain modifications and considerations proposed by that office and the SAD.

As a result of recommendations of additional studies by the Mobile District during construction, on 11 September 1953, the Chief of Engineers approved raising the top of power pool from elevation 1,065 to 1,070 feet NGVD29. At the same time, the top of flood control pool was raised from elevation 1,080 to 1,085 feet NGVD29. In February 1976, the Division Engineer approved raising the top of conservation pool to elevation 1,071 feet NGVD29 from May through September with transitions starting 15 April and ending 30 November for the benefit of navigation on the Apalachicola River. The change was consonant with National policy, statutes, and administrative directions; and that the total public interest was best served by modification of the reservoir regulation procedures for the benefit of downstream navigation.

c. Walter F. George and George W. Andrews Locks and Dams. The Rivers and Harbors Act of 1945 approved the general plan for the overall development of the Apalachicola River Basin, authorizing construction of two dams. The Rivers and Harbors Act of 1946 modified that plan to include improvements of Buford Dam, Fort Benning Lock and Dam, and upper Columbia and Jim Woodruff multiple-purpose developments. On 19 May 1953 the House of Representatives Committee on Public Works approved a plan consisting of a low navigation dam near Columbia, Alabama, and a high navigation and power dam near Fort Gaines, in lieu of the Fort Benning Lock and Dam and the upper Columbia projects. In March 1958, the 85th Congress, Second Session, enacted Public Law 85-363 officially designating Fort Gaines Lock and Dam as the Walter F. George Lock and Dam in honor of the Senator Walter F. George of Georgia. The President signed the bill into law on 28 March 1958.

In February 1972, the 92nd Congress enacted Public Law 92-229, which provided that the Columbia Lock and Dam on the Chattahoochee River, Alabama, would be known and designated as the George W. Andrews Lock and Dam, and the reservoir formed by the dam would be known and designated as Lake George W. Andrews.

Figure 3-2. Construction at Walter F. George Lock and Dam (Circa 1962)

Design Memorandum No. 1. *Basic Hydrology* was submitted on 14 August 1953 and approved by the Chief of Engineers on 12 November 1953. Design Memorandum No. 2 was submitted on 9 October 1953 and approved 10 November 1953. Figure 3-2 shows construction at Walter F. George Lock and Dam.

d. West Point Dam. A survey report of the Chattahoochee River at and in the vicinity of West Point, Georgia, was authorized in resolutions by the Committee on Public Works of the House of Representatives adopted 29 July 1955 and 31 July 1957 with a view to determining whether it was advisable to authorize construction of a multiple-purpose reservoir on the Chattahoochee River at and in the vicinity of West Point, Georgia. That report was published as House Document No. 570, 87th Congress, Second Session. Construction of the West Point Dam Project was authorized by the Flood Control Act of 23 October 1962. In view of the unbalanced civil works load between districts in SAD, the Division Engineer by letter dated 16 November 1962 assigned responsibility for design, construction, and real estate acquisition of the West Point Project to the Savannah District.

e. Navigation Channel. The original project for stream improvement in the Apalachicola River Basin was authorized by the Rivers and Harbors Act of 23 June 1874. That Act authorized the improvement of the Apalachicola River, the Chattahoochee River to Columbus, and the Flint River to Albany for navigation by snagging, dredging, and related works. Since construction of Jim Woodruff Lock and Dam, several modifications to improve navigability in the Apalachicola River have been done. Seasonal dredging along with training dikes were methods used to maintain the 9-foot by 100-foot channel.

3-03. Construction of Federal Projects. Jim Woodruff Lock and Dam (Lake Seminole) was the first project to be constructed in the basin. Project construction began in the summer of 1947. The lock was open to navigation in May 1954, and the power plant was placed in operation in February 1957.

Buford Dam (Lake Sidney Lanier) was the second federal project to be constructed in the basin. The Buford Dam Project construction began in March 1950. Storing of water in the reservoir was initiated in February 1956. Power generation began on a limited schedule in June 1957 and the reservoir reached full conservation pool in 1959.

Construction of the Walter F. George began in 1955 and was completed in 1963. A major rehabilitation project at Walter F. George Lock and Dam, consisting of a concrete cutoff wall in the earth embankments to correct under-seepage problems, was completed in March 1985. A second cutoff wall in front of the Walter F. George powerhouse, lock and dam was completed in 2004.

Construction of the George W. Andrews Project began in 1959 and was completed in 1963.

West Point Dam Project construction began in 1965 and was completed in 1975. Beginning in the late 1990s and continuing through 2011, major rehabilitations of the Buford, Walter F. George, and Jim Woodruff powerhouses were completed. The rehabilitations included replacing the major power train components of the generators because they had surpassed their life expectancy and for efficiency gains. The rehabilitation resulted in greater generation capacity and increased reliability. The revised capacities at those powerhouses are reflected in description of the projects presented in this manual.

3-04. Related Projects. In addition to the five Corps projects in the basin, eight privately owned dams are on the Chattahoochee River, and two privately owned dams are on the Flint River (Table 1-1.). The privately owned reservoirs on the Chattahoochee River are primarily run-of-the-river projects containing very little storage capacity and, consequently, do not significantly influence flows in the river or the operation of the Corps projects.

3-05. Modifications to Regulations. The first *Master Reservoir Regulation Manual for the ACF Basin* was published in February 1958. A draft ACF Basin Water Control Plan update was developed in October 1989 but was never finalized. Appendices for Jim Woodruff Lock and Dam (Appendix A) and Buford Dam (Appendix B) were also prepared in 1958. Appendices A and B were revised in August 1972 and February 1991, respectively. Appendices for the remaining projects were completed as follows: Walter F. George Lock and Dam (Appendix C) April 1965, revised February 1993; George W. Andrews Lock and Dam (Appendix D) April 1965, revised February 1978 and November 1996; West Point Dam (Appendix E) June 1975, revised August 1984.

Over the span of years since 1955 that the Corps reservoirs in the ACF Basin began to become operational, changes in needs and conditions in the basin have influenced certain modifications to the regulation of the projects. The following describe the major factors influencing modifications to project regulation that have occurred in the basin.

a. Metropolitan Atlanta Population Growth. The significant population growth and resulting increase demand for M&I water supply in metropolitan Atlanta has resulted in increased water demands for M&I water supply, for additional flows in the river to better maintain water quality and aquatic life, and for higher pool levels to support recreational needs. Concerns associated with flooding also increased with increases in population.

The project authorization required minimum releases of up to 600 cfs from Buford Dam, when combined with local inflow to the river, to provide at least 650 cfs at Atlanta for water supply purposes. Over time, demand for M&I water supply downstream of the project increased. Additionally, higher flows were needed at Peachtree Creek for waste assimilation. These increased demands led to the development of interim plans in 1975 and 1979 to accommodate increased downstream water withdrawals. The 1979 agreement between the Corps, Atlanta, and the GPC agreed to an operating procedure under which the GPC would schedule a portion of weekly power generation on the weekend. The Corps also committed to make available certain minimum summer weekly flows from Buford Dam. The two commitments allowed for increased downstream water supply withdrawals while providing for the 750 cfs in-stream flow requirement at Peachtree Creek.

The Corps recognized that withdrawals beyond the peak amount of 327 mgd provided under the 1975 and 1979 interim plans might exceed the amount available incidental to operations under the project authority, and could require a contract under a separate authority. Accordingly, to meet additional water supply demands of the Atlanta region in 1986, the Corps entered into a contract with the Atlanta Regional Commission (ARC) under the Independent Offices Appropriation Act, providing for withdrawals by ARC of up to 377 mgd from the Chattahoochee River, with payment required for withdrawals exceeding 327 mgd (Contract No. DACW01-9-86-145). The contract incorporated the Corps' determination that downstream withdrawals of up to 327 mgd were available, apart from that contract, "from normal operation of the Buford Project for non-water supply purposes," and "can be provided year-round with no impact on the [Lake Sidney Lanier] Project." That 1986 contract was an interim arrangement pending either construction of a new reregulation facility that would further alter flow regimes, or execution of a contract for permanent storage space, which has expired.

b. Tri-State Water Rights Litigation. The ACF litigation was divided into two phases to address separate distinct legal issues. Phase I addressed the Corps' authority to operate Lanier for water supply and reallocate storage under the Water Supply Act (WSA), as well as claims raised under NEPA and other statutes. The Phase I summary judgment hearing was held on 11 May 2009. On 17 July 2009, Judge Magnuson issued a ruling that found that the Corps' operations in support of water supply had “seriously affected the project purposes for which the Buford Project was originally authorized” and that “the Corps is therefore in violation of the WSA.”

On 3 May 2010, the Solicitor General authorized appeal of the Phase I ruling. On 28 June 2011, the Eleventh Circuit Court issued a ruling that reversed the findings of the District Court. The court found that water supply was an authorized project purpose of Buford Dam under the Rivers and Harbors Act of 1946 (RHA) and the Water Supply Act (WSA). The case was remanded to the district court with instructions to remand to the USACE for further proceedings. As to the merits, the court held that the majority of Plaintiffs’ claims in the ACF were not final agency actions and therefore not subject to judicial review.

Phase II of the ACF litigation concerns the Corps’ compliance with the Endangered Species Act (ESA), as well as claims raised under NEPA. The Phase II summary judgment hearing was held on 8 June 2010. Judge Magnuson issued a ruling on Phase II in the summer of 2010. In his ruling, he determined that the Corps and the FWS had complied with the ESA, but that the Corps had not properly complied with its NEPA requirements. The appropriate remedy would be for the Corps to conduct new NEPA on the WCM; however, because the Corps had already agreed to develop an EIS as part of the WCM update, Judge Magnuson determined Florida’s claims were moot. Florida appealed the Phase II ruling to the Eleventh Circuit. After the appeal was filed, new information on the endangered species caused the FWS to request the Corps reinitiate consultation. All parties agreed to stay the appeal while the Corps and the FWS conduct additional studies. On 24 January 2013 the district court vacated its Phase II ruling on the grounds that the USACE and the USFWS reinitiated consultation while the appeal was pending, thus rendering the appeal moot and making it proper to vacate the underlying order. Accordingly, there is no active litigation regarding the USACE operation of the ACF Basin.

In October 2013, the State of Florida filed a motion seeking leave to file a complaint in an original action in the United States Supreme Court against the State of Georgia to equitably apportion the waters of the ACF Basin, and to limit Georgia's overall depletive water uses at 1992 levels. The motion was granted in November 2014 and a Special Master was appointed to the case. Presently, the United States is not a party to that litigation and intends to proceed with update to the water control manuals.

c. Revised Interim Operating Plan. The Revised Interim Operating Plan (RIOP) was implemented in June 2008 and modified in May 2012 to support endangered or threatened species and their critical habitat in the Apalachicola River and to avoid or minimize potential adverse effects associated with discretionary operations at Jim Woodruff Lock and Dam. The RIOP directly affected flows, and fall rates, in the Apalachicola River and prescribed the minimum flow releases to be made from Jim Woodruff Dam under specific conditions. However, the releases to be made from Jim Woodruff Dam in accordance with the RIOP used the composite conservation storage of all the upstream reservoirs in the ACF System. The Corps operates five federal reservoirs on the ACF as a system, and releases made from Jim Woodruff Dam under the RIOP reflected the downstream end result for system-wide operations measured by daily releases from Jim Woodruff Dam into the Apalachicola River. The RIOP did not describe operational specifics at any of the four federal reservoirs upstream of Jim Woodruff Lock and Dam or other operational parameters at those reservoirs. Instead, the RIOP described the use of the composite reservoir storage of the system and releases from the upstream reservoirs as necessary to assure that the releases made from Jim Woodruff Dam would minimize adverse effects on endangered or threatened species and their critical habitats. Future management actions in support of endangered or threatened species and their critical habitat in the Apalachicola River are described in Section 7-07 c.

d. Navigation. A major factor influencing reservoir regulation was the additional flow required to maintain the authorized 9.0-foot navigation depth on the Apalachicola River. At the time the ACF system of projects was constructed, a discharge from Jim Woodruff Dam of 9,300 cfs, together with dredging, provided a 9.0-foot deep navigation channel in the Apalachicola River. A discharge of 20,600 cfs from Jim Woodruff Dam is currently required for a 9.0-foot channel without dredging. The increase of 11,300 cfs to support a 9.0-foot channel is equivalent to 4.1 feet of storage at Lanier, 5.6 feet of storage from West Point, or 3.6 feet of storage from Walter F. George over a one week period. In practice any use of storage to support navigation would be distributed between the three ACF storage projects with consideration to the current action zone of each reservoir. The increasing flow requirements to achieve suitable navigation channel depth in the Apalachicola River are attributable to (1) channel degradation and (2) escalating flow diversion through Chipola Cutoff. In response to those changing conditions, it became necessary to periodically schedule the release of increased flows over the minimum 9,300 cfs from Jim Woodruff Dam for periods of a few days to as long as two weeks to accommodate commercial river traffic. Those periods were known as navigation windows. During navigation windows, water was released in varying amounts from the upstream reservoirs, stored in the downstream reservoirs, and then released through Jim Woodruff Lock and Dam to provide sufficient flow in the Apalachicola River to achieve suitable navigation depths. In preparation for navigation windows, releases were made from Buford Dam to help supply sufficient water in storage downstream to successfully implement the navigation window.

Increased flow requirements when there is no dredging plus the denial of water quality certification from the state of Florida, which prevents the Corps from dredging the Apalachicola River, significantly reduced commercial navigation on the Apalachicola River. Those conditions limit navigation to periodic, special commercial shipments. Coordination with waterway users identified the need for changes in the Corps' water control operations to provide a more reliable flow regime, without dredging, to support at least a 7.0-foot navigation channel in the Apalachicola River. At the print of this manual, a discharge of 16,200 cfs from Jim Woodruff Dam is required for a 7.0-foot channel without dredging. Through an iterative hydrologic modeling process, it was determined that a 4-month navigation season, January through April with an extension through May if conditions allow (i.e., basin composite storage in zones 1 or 2), could improve navigation reliability without significantly affecting other project purposes. The 5-month navigation season on the ACF waterway, in the absence of maintenance dredging, will improve the total reliability of a 7.0-foot navigation channel in the Apalachicola River from 21 percent to as much as 42 percent. For a 7.0-foot channel that is at least 90 percent reliable for any single navigation season, the total reliability over the period of record would improve from the present 36 percent to 54 percent during the navigation season. Releases made from Buford Dam, West Point Dam, Walter F. George Lock and Dam, and to a limited extent, Jim Woodruff Lock and Dam during hydropower operations contribute to the needed downstream navigation flows.

e. Hydropower. The Southeastern Power Administration (SEPA) negotiates contracts for the sale of power from the Corps hydropower projects in accordance with the Flood Control Act of 1944. Under the provisions of the Act, the Corps determines the amount of energy available at the ACF projects each week and advises SEPA of the amount available. SEPA schedules when Corps facilities will generate and arranges the sale. In the early years, power generation was conducted at each hydropower project for a set number of hours per day as long as sufficient water was in conservation storage to accommodate the hydropower operation. In dry years, conservation storage was depleted at some projects to the point that release requirements for other project purposes could not be met. Under current operations, power generation demands are balanced between the projects weekly to enhance long-term generating capability of the entire system and to provide for the needs of other project purposes in the system.

f. Fish Spawn Operations. The Corps' South Atlantic Division Regulation DR 1130-2-16 (31 May 2010) and Mobile District Draft Standard Operating Procedure (SOP) 1130-2-9 (February 2005) were developed to address lake regulation and coordination for fish management purposes. The SOP addresses procedures necessary to gather and disseminate water temperature data and manage lake levels during the annual fish spawning period between March and June, primarily targeted at largemouth bass. The major goal of the operation is to not lower the lake level more than six inches in elevation during the reproduction period to prevent stranding or exposing fish eggs. The lake elevation that exists at the time spawning begins becomes the datum point for the downward fluctuation. The beginning and ending of the spawning season is determined by the Mobile District biologists in cooperation with the fish and game personnel of the states concerned. Table 3-1 presents the expected timing for fish spawning at each of the Corps lakes and the Apalachicola River.

Table 3-1. Expected Spawning Dates

Project	Fish spawn period
Lake Sidney Lanier	1 April–1 June
West Point Lake	1 April–1 June
Walter F. George Lake	15 March–15 May
Lake Seminole	1 March–1 May
Apalachicola River	1 April–1 June

3-06. Principal Regulation Problems

a. Buford Dam. The main problem affecting regulation at Buford Dam is encroachment within the floodplain downstream of the project. Residential and other developments in the floodplain have necessitated a change in how stored flood waters are evacuated from the reservoir. Before encroachments, waters stored in the flood risk management pool during major flood events were evacuated by running the turbines 24 hours a day until the reservoir returned to its normal conservation pool elevation. Presently, to avoid inducing flooding of downstream development, flood waters are released through the turbines at a lower rate by generating less than 24 hours at full plant capacity each day. However, conditions might indicate that it is necessary to run all or fewer units 24 hours a day at full or reduced loads.

b. Head Limitations. To maintain structural integrity of the structures on the lower ACF, each of these projects has a maximum head differential criteria, as follows:

Walter F. George Project - The head differential at this structure is limited to 88 feet. At no time shall the headwater elevation minus the tailwater elevation be allowed to exceed 88 feet. If it becomes apparent that this criteria could be violated, then additional releases shall be made from the project to ensure this 88 foot criteria is not violated.

George W. Andrews Project - The allowable head differential at this project is a function of the elevation of the upper pool. If the upper pool elevation is less than 102 feet NGVD29, then the criteria is 26 feet. If the upper pool elevation is greater than 102 feet NGVD29, then the criteria is 25 feet. Again, if becomes apparent that the criteria could be violated, an action must be taken to prevent this and the typical action will be to increase releases. Of course, any increase in releases from the George W. Andrews Project must be closely coordinated with the Walter F. George Project operation as releases from Andrews will impact the tailwater below Walter F. George Dam.

Jim Woodruff Project - The head limitation at Woodruff is a function of both the pool elevation of Lake Seminole and the tailwater elevation below Woodruff Dam and varies between 38.5 and 33.0 feet. Furthermore, whenever the tailwater elevation drops below 44.5 feet NGVD29, static head can control project operation. See Appendix A for a detailed explanation of the head limitation at Woodruff.

IV - DESCRIPTION OF PROJECTS

4-01. Location. Streams that form the Chattahoochee River begin as springs in the Blue Ridge Mountains of north Georgia. From that beginning, they flow for 434 miles until the Chattahoochee River combines with the Flint River, forming the Apalachicola River at the Georgia-Florida border. From there, the Apalachicola flows an additional 108 miles to the Gulf of Mexico. The Flint River begins as a spring or groundwater seep underneath the runways of Hartsfield-Jackson International Airport near Atlanta, Georgia. From the airport, the Flint River meanders 350 miles until it merges with the Chattahoochee River. The geographical location of the federal and non-federal reservoir projects are shown on Plate 2-1.

4-02. Purpose. Federal interest in the ACF River Basin dates back to the 1800s. Navigation improvements were authorized under the Rivers and Harbors Act of 1874. Later, flood control and hydropower interests were addressed. The Rivers and Harbors Acts of 1945 and 1946 provided for the construction of a series of locks, dams, and reservoirs within the ACF Basin as part of a general plan to provide system-wide benefits for multiple purposes including navigation, flood control (flood risk management), hydropower generation, water supply, water quality, recreation, and fish and wildlife conservation. Modifications of those plans and subsequent legislation have resulted in the completion of five federal dams, four on the Chattahoochee River and one at the confluence of the Chattahoochee and Flint Rivers. Operations of the ACF System and of the individual projects within it are governed by the original authorizing legislation, as amended, and by other general authorities and applicable law.

4-03. Physical Components. Plate 2-1 presents the locations of the major dam projects in the ACF River Basin, and Plate 2-2 presents a profile view of the river and reservoir developments. A brief summary of the key features of each project are provided below. Details of the physical components of each federal project are provided in the individual project appendices.

4-04. Overview. The ACF Basin extends approximately 385 miles from northeast Georgia to the Gulf of Mexico. The total drainage area of the ACF Basin is 19,573 square miles. The Corps operates four projects on the Chattahoochee River: Buford Dam and Lake Sidney Lanier, West Point Dam and West Point Lake, Walter F. George Lock and Dam and Walter F. George Lake, and George W. Andrews Lock and Dam and Lake George W. Andrews; and one project at the confluence of the Chattahoochee and Flint Rivers: Jim Woodruff Lock and Dam and Lake Seminole.

a. <u>Chattahoochee River</u>. The Chattahoochee River has a drainage area of 8,708 square miles. The headwaters rise as a cold-water mountain stream in the Blue Ridge Province at altitudes above 3,000 feet. From its beginning, the river meanders 434 miles to its confluence with the Flint River. The Chattahoochee River is one of the most heavily used water resources in Georgia.

Through most of its length, flows in the Chattahoochee River are controlled by hydroelectric plants releasing water for production of hydropower. The hydroelectric plants use peaking operations to augment power supply during peak periods of energy demand. Daily fluctuations below some reservoirs can be dramatic. Fluctuations are usually more pronounced during low-flow periods when hydropower releases often cause daily fluctuations of several feet.

The GPC operates seven projects on the Chattahoochee River. Morgan Falls is north of Atlanta, and the remaining six are along the Fall Line near Columbus, Georgia. Those projects are Langdale Dam, Riverview Dam, Bartletts Ferry Dam, Goat Rock Dam, Oliver Dam and North Highlands Dam. The GPC Projects are primarily run-of-river projects containing very little storage capacity and, consequently, do not significantly influence flows in the river or the operation of the Corps projects.

The Eagle and Phenix Dam and the City Mills Dam both located on the Chattahoochee River just upstream of Columbus, Georgia, were demolished and removed in 2012 and 2013, respectively. Habersham Mill Dam, in the headwaters above Buford Dam, is still present but inoperative.

Lake Sidney Lanier, West Point Lake, and Walter F. George Lake provide most of the water storage available to regulate flows in the basin. Lake Sidney Lanier alone provides 66 percent of conservation storage, although only 12 percent of the Chattahoochee Basin drains into the lake. Drainage area above Buford Dam represents five percent of the ACF Basin. In addition, West Point Lake and Walter F. George Lake provide 19 and 15 percent, respectively, of the basin's conservation storage. Lake Seminole is a run-of-the-river reservoir, meaning that it does not store inflows except to reregulate them over a short period. This limited storage is typically called pondage. The reservoir conservation storage in acre-feet is shown below in Figure 4-1.

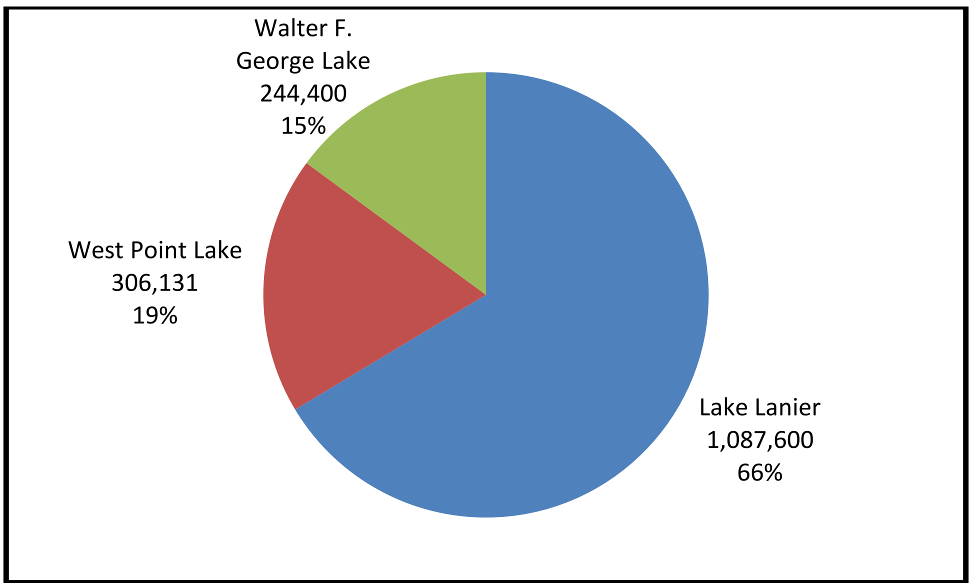


Figure 4-1. Reservoir Conservation Storage Percent by Acre-Feet

b. <u>Flint River</u>. The Flint River drainage area (8,456 square miles) includes Crisp County Dam and Lake (also known as Warwick, or Blackshear Lake), and Flint River Dam (also known as Albany Dam), which impounds Lake Worth. The river begins as a spring or groundwater seep underneath the runways of Hartsfield-Jackson International Airport. The flow is channeled off the airport by large drainage pipes.

From the airport, the Flint River meanders 350 miles in a basin that is about 212 miles long. It has 220 miles of unimpeded flow between the headwaters and the Crisp County Dam, making it one of only 40 rivers in the United States with unrestricted flows of 200 miles or more of near natural stream. Groundwater uses in the basin influence flows in the stream.

The Flint River empties into Lake Seminole near Bainbridge, Georgia, where it joins the Chattahoochee River. At the Florida state line, the water flows through Jim Woodruff Lock and Dam to form the Apalachicola River.

c. Apalachicola River. The Apalachicola River drainage area (2,409 square miles) includes Jim Woodruff Lock and Dam (Lake Seminole), which the Corps operates. The river is completely within the Coastal Plain and is 108 miles long. The Apalachicola River flows south unimpeded across northwest Florida from the Georgia border to Apalachicola Bay in Florida.

4-05. Federal Dams

a. Buford Dam. Buford Dam is 50 miles northeast of central Atlanta, Georgia, on the Chattahoochee River at river mile 348.3 (above mouth of Chattahoochee River). The drainage area above the dam is 1,034 square miles. Buford Dam is a multiple-purpose project with the project purposes of flood risk management, hydroelectric power, water supply, recreation, fish and wildlife conservation, water quality, and navigation. The project consists of a rolled earth fill dam 1,630 feet long that rises approximately 192 feet above the streambed. Power installation consists of two, 60-megawatt (MW) generators and a 7-MW service unit. Buford Dam is further described in Appendix B. The project is shown in Figure 4-2.

Figure 4-2. Buford Dam

b. West Point Dam. West Point Dam is located on the Chattahoochee River at river mile 201.4 (above mouth of Chattahoochee River), approximately three miles north of West Point, Georgia, 147 river miles below Buford Dam, and 126 miles above Walter F. George Lock and Dam. The drainage area above the dam is 3,440 square miles. West Point Dam is a multiple-purpose project with the project purposes of flood risk management, hydroelectric power, recreation, fish and wildlife conservation, water quality, water supply, and navigation. The project consists of a gravity type concrete dam 896 feet long with earth embankments at either end. The embankment on the east end is 1,111 feet long, and the west embankment is 5,243 feet long. Power installation consists of two, 42-MW generators and a 3-MW service unit. West Point Dam is further described in Appendix E. The project is shown in Figure 4-3.

Figure 4-3. West Point Dam

c. Walter F. George Lock and Dam. Walter F. George Lock and Dam is a multi-purpose project for navigation, hydroelectric power, recreation, water quality, and fish and wildlife conservation. The project is on the Chattahoochee River at river mile 75.0 (above mouth of Chattahoochee River), approximately one mile north of Fort Gaines, Georgia, and approximately 1.6 miles upstream from the Georgia State Highway 37 Bridge. The dam crosses the Alabama-Georgia state line with the earth dike on the west bank entirely in Henry County, Alabama. The earth dike on the east is entirely in Clay County, Georgia. The drainage area above Walter F. George Lock and Dam is 7,460 square miles. The project consists of a concrete dam, gated spillway, and a single-lift lock. Earth dikes extend approximately 6,000 feet from each end. Power installation consists of four, 42-MW generators. Walter F. George Lock and Dam is further described in Appendix C. The project is shown in Figure 4-4.

Figure 4-4. Walter F. George Lock and Dam

d. George W. Andrews Lock and Dam. The west abutment of the Andrews Lock and Dam is in Houston County, Alabama, and the east abutment is in Early County, Georgia, on the Chattahoochee River at river mile 46.5 (above mouth of Chattahoochee River), two miles south of Columbia, Alabama, and about 17 miles east of Dothan, Alabama. The drainage area above the dam is 8,210 square miles. George W. Andrews Lock and Dam was originally authorized as a single-purpose project designed to aid navigation by providing a 9-foot navigation channel and by maintaining a more uniform downstream flow. The original congressional authorization has been modified and expanded by later legislation. The project consists of a concrete fixed-crest spillway 340 feet long extending into the right bank with a crest elevation of 102.0 feet NGVD29, a concrete gated spillway and a single-lift lock. George W. Andrews Lock and Dam is further described in Appendix D. The project is shown in Figure 4-5.

Figure 4-5. George W. Andrews Lock and Dam

e. Jim Woodruff Lock and Dam. Jim Woodruff Lock and Dam is about 1,000 feet downstream from the point where the Chattahoochee and Flint Rivers meet to form the Apalachicola River. It is about 3,200 feet upstream from the U.S. Highway 90 Bridge and 1.6 miles northwest of the town of Chattahoochee, Florida. The dam crosses the Georgia-Florida state line on the left bank. About 1,500 feet of the overflow dike is in Decatur County, Georgia. The remainder of the structure is in Gadsden County, Florida, on the left bank and Jackson County, Florida, on the right bank. The drainage area above Jim Woodruff Lock and Dam, 17,164 square miles, is about equally divided between the Chattahoochee and Flint Rivers. The project is at mile 106.3 on the Apalachicola River. Jim Woodruff Lock and Dam is a multipurpose project created primarily to aid navigation in the Apalachicola River below the dam and in the Chattahoochee and Flint Rivers above the dam and to generate hydroelectric power. Other purposes are recreation, water quality, navigation, and fish and wildlife conservation. The project consists of a concrete open-crested spillway 1,634 feet long, a single-lift lock, a gated spillway 766 feet long, a powerhouse, an overflow dike 2,130 feet long extending from the left abutment to a 690 feet long transition section which connects the dike with the switchyard and parking area at elevation 107.0 feet NGVD29. Power installation consists of three 14.45-MW generators. Jim Woodruff Lock and Dam is further described in Appendix A. The project is shown in Figure 4-6.

Figure 4-6. Jim Woodruff Lock and Dam

4-06. Non-Federal Dams. There are 10 privately owned dams in the ACF Basin that were built by local mills or hydropower interest. All the reservoir projects are briefly described in the following paragraphs. They are listed in Table 1-1, and their locations are shown on Plate 2-1. One of the structures (Crow Hop Dam) is actually part of the Riverview Dam Project and is not numbered as a separate project.

a. Habersham Mill Dam. The Habersham Mill Dam is owned by Habersham Mills and is located in Habersham, Georgia. The dam is on the Soque River, a headwater tributary of the Chattahoochee River. The dam was constructed in 1925 with a lake covering about 100 acres. By 1837, Habersham Iron Works and Manufacturing Company began operation on the large shoals, where the mill now stands. In 1914, the lower power plant was installed. In 1925, the upper power plant was built along with a dam and tunnel. In 1977, the mill was modernized and round-the-clock operation begun. In 1999, the mill closed; therefore, the Habersham Mill Dam no longer generates hydropower. The project is shown in Figure 4-7.

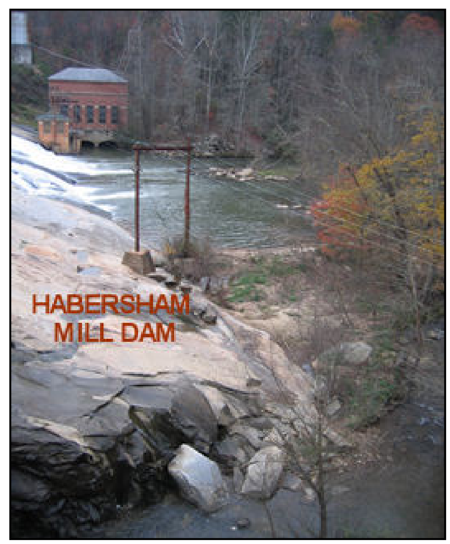


Figure 4-7. Habersham Mill Dam

b. Morgan Falls Dam. Morgan Falls Dam is located on the Chattahoochee River, 36 river miles downstream from Buford Dam. GPC constructed the dam in 1904 for the primary purpose of power generation. The State of Georgia and the GPC have agreements to reregulate power releases from Buford Dam to provide a more dependable flow below Morgan Falls Dam. Morgan Falls Dam maintains a continuous minimum outflow of 750 cfs by reregulating releases from Buford Dam. The project is shown in Figure 4-8. Impoundment of the Chattahoochee River by Morgan Falls Dam resulted in the formation of Bull Sluice Lake, a 580-acre reservoir just north of Atlanta. The reservoir has experienced a significant amount of sediment deposition, which has created a shallow pool, and wetland areas that are conducive for fishing and lake recreation. Consequently, the storage capacity of Bull Sluice Lake has diminished.

Figure 4-8. Morgan Falls Dam (Photograph courtesy of GPC)

c. Langdale Dam. The West Point Manufacturing Company built Langdale Dam on the Chattahoochee River in 1908 and the dam provided electrical power for the company's textile plant. Today, GPC owns the dam and produces approximately one megawatt of hydroelectric power annually. The dam is four miles south of West Point, Georgia. The project is shown in Figure 4-9.

Figure 4-9. Langdale Dam (Photograph courtesy of Google Earth)

d. Riverview Dam. Riverview Dam was built on the Chattahoochee River in 1918 and originally powered several West Point textile mills. Today, it produces hydroelectric power for GPC with a capacity of 0.48 megawatts. The dam is located approximately two river miles downstream from Langdale Dam, directly behind Riverview Mill. The project is shown in Figure 4-10.

Figure 4-10. Riverview Dam (Photograph courtesy of Google Earth)

Figure 4-11. Crow Hop Dam (Photograph courtesy of Google Earth)

Crow Hop Dam was constructed on the Chattahoochee River sometime after Riverview Dam was completed to push the river water toward the western side of the channel and provide more water for Riverview Dam generators. The small dam, owned by GPC, is right above Riverview Dam. The project is shown in Figure 4-11.

e. <u>Bartletts Ferry Dam</u>. Bartletts Ferry Dam was built on the Chattahoochee River in 1926 with two hydropower units to provide hydroelectric power for Columbus, Georgia. Hydropower capacity was increased in 1928 with the addition of a third unit, again in 1951 with the addition of a fourth unit, and again in the 1970's with the construction of a new powerhouse for turbine units number 5 and 6 which were added in 1985. Total hydropower capacity is currently 173 megawatts. Owned by GPC, it impounds Lake Harding. The dam is about 17 miles north of Columbus. The project is shown in Figure 4-12.

Figure 4-12. Bartletts Ferry Dam (Photograph courtesy of GPC)

f. Goat Rock Dam. Goat Rock Dam was built on the Chattahoochee River in 1912. Goat Rock Dam has changed very little since it was first constructed. GPC owns the project. The dam produces hydroelectric power with a capacity of 38.6 megawatts and impounds Goat Rock Lake. It is located about nine miles north of Columbus, Georgia. The project is shown in Figure 4-13.

Figure 4-13. Goat Rock Dam (Photograph courtesy of GPC)

g. Oliver Dam. GPC completed Oliver Dam on the Chattahoochee River in 1959. This project produces hydroelectric power at a capacity of 60 megawatts and impounds Lake Oliver. The dam is located in northern Columbus, Georgia, on the site of a 19th century textile mill. The project is shown in Figure 4-14.

Figure 4-14. Oliver Dam (Photograph courtesy of GPC)

h. North Highlands Dam. North Highlands Dam was built on the Chattahoochee River in 1899 and was the first large dam in the South. The dam provided hydroelectric power to the Bibb Cotton Mill in Columbus, Georgia. Today, the project is owned by the GPC and produces hydropower with a capacity of 29.6 megawatts. The dam impounds Bibb Pond and crosses the Chattahoochee River in the Bibb City area of Columbus, one mile south of Oliver Dam. The project is shown in Figure 4-15.

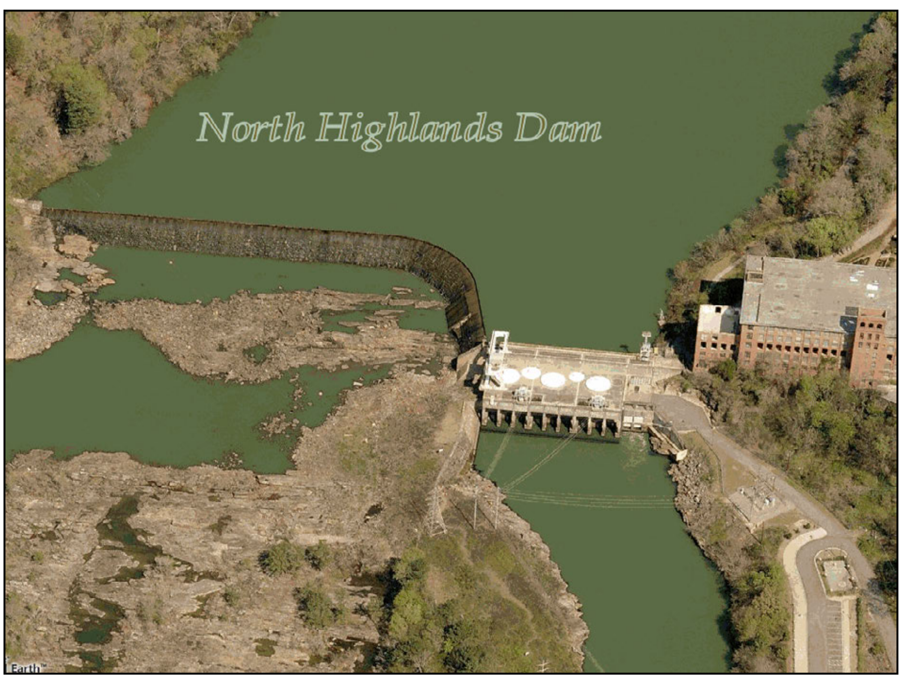


Figure 4-15. North Highlands Dam (Photograph courtesy of GPC)

i. City Mills Dam. City Mills Dam was built by the City Mills Company in 1907. The dam crossed the Chattahoochee River at 18th Street in downtown Columbus, Georgia. The dam was breeched and removed in 2013 as part of a Section 206, Ecosystem Restoration Program project, for the purpose of restoring unimpounded riverine habitat and providing additional shoal habitat between North Highlands Dam and the headwaters of Walter F. George Lake. The project as it existed prior to removal is shown in Figure 4-16.

Figure 4-16. City Mills Dam (Photograph courtesy of GPC)

j. Eagle and Phenix Dam. Eagle and Phenix Dam was built in 1866 or earlier. The dam once powered a textile mill. The dam was located on the Chattahoochee River near the 13th Street Bridge in downtown Columbus, Georgia. The dam was breeched and removed in 2012 as part of a Section 206, Ecosystem Restoration Program project, for the purpose of restoring unimpounded riverine habitat and providing additional shoal habitat between North Highlands Dam and the headwaters of Walter F. George Lake. The project as it existed prior to demolition is shown in Figure 4-17 and the project after breeching is shown in Figure 4-18.

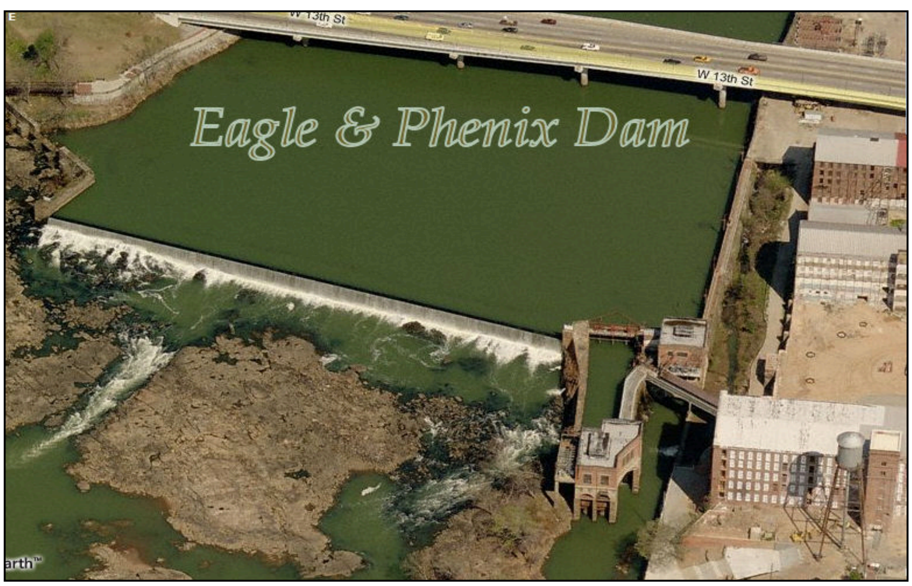


Figure 4-17. Eagle and Phenix Dam (Photograph courtesy of GPC)

Figure 4-18. Eagle and Phenix Dam after Breech (Photograph courtesy of Google Earth)

k. <u>Crisp County Dam</u>. Crisp County Dam (also known as Warwick Dam or Blackshear Dam) on the Flint River at river mile 129 was the first county-owned and operated hydroelectric power project in the United States. When the dam began generating electricity in August 1930, a secondary benefit was the formation of the 8,700-acre Lake Blackshear. Current hydropower capacity is 15.2 megawatts. The project is shown in Figure 4-19.

Figure 4-19. Crisp County Dam

l. <u>Flint River Dam</u>. The GPC owns Flint River Dam, also known as the Flint River Development or Albany Dam. The dam is located on the Flint River above Muckafoonee Creek, about two miles above Albany, Georgia. The dam was constructed in 1905 and includes an earth dike, a spillway section, and a powerhouse. The hydropower capacity is 5.4 megawatts. The project is shown in Figure 4-20.

Figure 4-20. Flint River Dam

4-07. Real Estate Acquisition. Land acquisitions and flowage easements were established for each federal project. A more complete real estate acquisition description is included in the individual appendices for each project.

4-08. Public Facilities. The Corps has developed and maintains public use recreation areas along the shoreline of each project it owns. The public use areas include overlook sites, campgrounds, boat launch facilities, day use parks, and rest rooms. Some areas have been leased to other agencies and local communities. Detailed information regarding the Corps public use areas is available at the Operations Project Management Offices for each project. A summary of public facilities is included in the individual appendices for each project.

4-09. Economic Data. The ACF River Basin drains areas of northern, western, and middle Georgia; southeastern Alabama; and northwest Florida. The basin includes a total of 78 counties: 60 in Georgia, 10 in Alabama and 8 in Florida. The 60 Georgia counties are almost evenly split between the Flint River Basin and the Chattahoochee River Basin: 33 in the Flint River Basin and 27 in the Chattahoochee River Basin. The Alabama counties are primarily in the Chattahoochee River Basin. The Florida counties are primarily in the Apalachicola River Basin below Jim Woodruff Lock and Dam.

a. Population. The 2012 population of the 78 counties composing the ACF River Basin totaled 6,848,411 persons. Table 4-1 shows the total 2012 population and the 2012 per capita income for each of the three ACF sub-basins.

Table 4-1. Population and per Capita Income

River Basin	2012 Population	2012 Per Capita Income
Apalachicola River Basin	340,381	$ 18,615
Chattahoochee River Basin	5,161,346	22,301
Flint River Basin	1,346,684	19,407
Total	6,848,411	
Source: U.S. Census Bureau, American Community Survey 2008-2012		

There are 15 cities with populations greater than 25,000 persons in the ACF River Basin. Table 4-2 lists the major cities in the basin and the 2012 population for each.

Table 4-2. Major Cities (from south to north)

City	2012 Population
Albany, GA	77,280
Peachtree City, GA	34,655
Dothan, AL	67,407
Columbus, GA	198,701
Phenix City, AL	36,250
LaGrange, GA	30,301
East Point, GA	35,506
Atlanta, GA	443,505
Smyrna, GA	52,662
Marietta, GA	58,407
Roswell, GA	93,649
Alpharetta, GA	61,965
Gainesville, GA	34,813
Source: U.S. Census Bureau, 2012 estimate from 2010 base	

b. Agriculture. The ACF River Basin contains approximately 35,000 farms averaging 272 acres per farm. According to the National Agricultural Statistics Service, in 2012, the area produced $11 billion in farm products sold. Agriculture in the ACF River Basin consists primarily of row crops, which account for 42.1 percent of the value of farm products sold. Cotton, peanuts, soybeans, corn, and vegetables are the principle row crops. Livestock operations consist primarily of beef cattle in the lower counties of the basin and poultry production in the upper basin. Pork production and dairy farms are also important livestock operations in the basin.

c. Industry. The leading industrial sectors in the ACF River Basin that provide non-farm employment are wholesale and retail trade, services, and manufacturing. Those sectors account for a combined 66.1 percent of the non-farm employment. The remaining non-farm employment is provided by construction, finance, insurance, real estate, transportation, and public utilities. In 2005 the basin contained 5,519 manufacturing establishments that provided almost 270,000 jobs with total earnings of more than $16.6 billion. Additionally, the value added by the area manufactures totaled almost $33.5 billion. Table 4-3 contains information on the manufacturing activity for each of the river sub-basins in the ACF Basin.

Table 4-3. Manufacturing Activity

River Basin	No. of Manufacturing Establishments	Total Manufacturing Employees	Total Earnings ($1,000)	Value Added by Manufactures ($1,000)
Apalachicola	193	7,306	$ 348,708	$ 552,666
Chattahoochee	4,497	206,473	13,640,719	25,501,600
Flint	829	54,577	2,625,557	7,437,447
Totals	5,519	268,356	$ 16,614,984	$ 33,491,713
Source: U.S. Census Bureau, County and City Data Book: 2007				

d. Employment. According to the 2012 American Community Survey, more than 90 percent of all jobs in the ACF Basin are provided by the private sector. The primary sources of employment are management and professional occupations and sales and office occupations; together, they account for over 50 percent of the total employment in the ACF Basin. Government employment makes up more than 13.6 percent of total employment in the Florida portion of the ACF Basin. Table 4-4 provides a breakdown of employment in percentages by general occupations for the ACF Basin as a whole and with the State portions broken out.

Table 4-4. Employment

		ACF (Alabama)	ACF (Florida)	ACF (Georgia)	ACF Basin
Percent distribution by occupation	Management, professional, and related occupations	26.7	26.5	29.2	27.5
	Service occupations	17.3	24.1	17.3	19.6
	Sales and office occupations	24.3	24.5	24.3	24.4
	Construction, extraction, and maintenance occupations	12.7	14.6	12.0	13.1
	Production, transportation, and material moving occupations	19.1	10.3	17.1	15.5
Percent in selected industries	Agriculture, forestry, fishing and hunting	3.6	4.3	3.5	3.8
	Manufacturing	16.2	5.7	13.5	11.8
Percent of government workers (local, state, or federal)		5.7	13.6	6.8	8.7
Source: U.S. Census Bureau, American Community Survey, 2012					

e. Flood Damages. Two of the federal projects in the ACF Basin, Buford Dam and West Point Dam, provide flood risk management benefits for existing development in the Chattahoochee River floodplain. The floodplain below Buford Dam consists of 5,108 residential structures, 16 public structures, and 218 commercial structures totaling almost $1.9 billion in total value. The tax assessor appraised values of residential structures and contents total more than $1.5 billion, public structures more than $56 million, and commercial structures $352 million. The values for each category of structures in the Chattahoochee River floodplain below Buford Dam are shown in Table 4-5 (USACE 1998 data).

Table 4-5. Buford Dam Floodplain Value Data

Category	Structure Value	Contents Value	Inventory Value	Equipment Value	Totals
Residential	$ 1,048,486,000	$ 466,014,000	$ -	$ -	$ 1,514,500,000
Public	30,642,000	-	19,723,000	5,653,000	56,018,000
Commercial	109,238,000	-	34,000,000	208,647,000	351,885,000
Totals	$ 1,188,366,000	$ 466,014,000	$ 53,723,000	$ 214,300,000	$ 1,922,403,000

The floodplain south of West Point Lake Dam consists of 171 residential structures, 18 public structures and 220 commercial structures. The appraised values of residential structure and contents total more than $7.7 million, public structures more than $5.5 million, and commercial structures about $177.5 million. The values for each category of structures in the Chattahoochee River floodplain below West Point Dam are shown in Table 4-6 (USACE 1998 data).

Table 4-6. West Point Dam Floodplain Value Data

Category	Structure Value	Contents Value	Inventory Value	Equipment Value	Totals
Residential	$ 5,361,000	$ 2,363,000	$ -	$ -	$ 7,724,000
Public	2,643,000	-	893,000	2,024,000	5,560,000
Commercial	28,453,000	-	60,153,000	88,819,000	177,425,000
Totals	$ 36,457,000	$ 2,363,000	$ 61,046,000	$ 90,843,000	$ 190,709,000

The Corps' Water Management Office has developed an Annual Flood Risk Management Summary that estimates the flood damages prevented by the two flood risk management projects in the ACF Basin - Buford Dam and West Point Dam. Table 4-7 shows the Buford Dam and West Point Dam combined flood damages prevented by year from 1989 through 2013.

Table 4-7. Combined Flood Damages Prevented
Buford Dam and West Point Dam

Year	Flood Damages Prevented* ($)
1989	$0
1990	$21,410,000
1991	$11,000
1992	$264,318
1993	$302,500
1994	$476,539
1995	$1,775,200
1996	$11,486,730
1997	$232,615
1998	$8,326,632
1999	$2,225,409
2000	$0
2001	$0
2002	$0
2003	$55,442,000
2004	$12,418,000
2005	$11,554,000
2006	$0
2007	$0
2008	$0
2009	$128,047,000
2010	$1,230,000
2011	$238,346
2012	$0
2013	$811,600

*Dollar values are indexed to each FY using Consumer Price Index
Note: Years with zero values are for drought years in ACF

Walter F. George Lake does not contain any flood risk management storage; however, water control guidelines are followed during high-flow periods that provide some flood risk management benefits for downstream areas. The floodplain of the Chattahoochee River downstream of Walter F. George Lake is largely undeveloped and consists primarily of forest and agricultural lands.

George W. Andrews Lock and Dam is a run-of-the-river navigation project; therefore, it does not contain any flood risk management storage. The floodplain of the Chattahoochee River downstream of George W. Andrews Lock and Dam is largely undeveloped and primarily consists of agricultural lands and forested areas in the natural floodplain of the river. The Corps provides flood alerts to the local emergency management officials for areas downstream of George W. Andrews Lock and Dam.

Lake Seminole does not contain any flood risk management storage nor in any other way does it provide flood risk management for downstream areas. The floodplain of the Apalachicola River downstream of Jim Woodruff Lock and Dam is largely undeveloped and primarily consists of natural wildlife areas. Releases from the lake provide periodic flooding in the floodplain which is considered to be desirable and beneficial for the ecosystem. Some minor flooding issues exist along the Apalachicola River at Blountstown, Florida, and directly across the river at Bristol, Florida.

V - DATA COLLECTION AND COMMUNICATION NETWORKS

5-01. Hydrometeorological Stations

a. Facilities. Management of water resources requires continuous, real-time knowledge of hydrologic conditions. The Mobile District contracts out the majority of basin data collection and maintenance to the USGS and NWS through cooperative stream gaging and precipitation network programs. The USGS, in cooperation with other federal and state agencies, maintains a network of real-time gaging stations throughout the ACF Basin. Those stations continuously collect various types of data including stage, flow, and precipitation. The data are stored at the gage location and are transmitted to orbiting satellites. Figure 5-1 shows a typical encoder with wheel tape housed in a stilling well used for measuring river stage or lake elevation. Figure 5-2 shows a typical precipitation station, with rain gage, solar panel, and Geostationary Operational Environmental Satellite (GOES) antenna for transmission of data. The gage locations are discussed further in Chapter VI related to hydrologic forecasting.

Reservoir project data are obtained through each project's Supervisory Control and Data Acquisition (SCADA) system and provided to the Mobile District both daily and in real-time.

Figure 5-1. Encoder with Wheel Tape for Measuring the River Stage or Lake Elevation in a Stilling Well

Figure 5-2. Typical Field Installation of a Precipitation Gage

Through the Corps-USGS Cooperative stream gage program, the Mobile District and the USGS operate and maintain stream gages throughout the ACF Basin. The Mobile District also partners with the USGS and the NWS for the majority of basin data collection and gage maintenance.

Plate 5-1 shows the location of rainfall and stream gage stations used to monitor conditions in the ACF Basin. Table 5-1 lists the rainfall only reporting network for the ACF Basin. Table 5-2 list the river stage and rainfall reporting network for the ACF Basin.

Table 5-1. ACF Basin Rainfall Only Reporting Network

Station	Agency Station ID	Latitude	Longitude	Elev. Ft. NGVD29
Helen, GA	94230	34° 42′	83° 43′	1,440
Cleveland, GA	92006	34° 35′	83° 46′	1,590
Cornelia, GA	92283	34° 31′	83° 31′	1,470
Gainesville, GA	93621	34° 18′	83° 51′	1,170
Buford Dam, GA	CMMG1	34° 10′′	84° 05′	1,150
Cumming 2N, GA	92408	34° 11′	84° 10′	1,295
Atlanta 9NW, GA	90444	33° 50′	84° 29′	885
Atlanta Hartsfield AP, GA	90451	33° 38′	84° 25′	1,010
Rock Mills, AL	17025	33° 09′	85° 17′	745
Newnan 5N, GA	96335	33° 26′	84° 47′	920
LaGrange 1N, GA	94949	33° 03′	85° 01′	715
Lafayette 2W, AL	14502	32° 54′	85° 26′	740
West Point Dam	WETG1	32° 55′	85° 11′	652
West Point, GA	99291	32° 52′	85° 11′	575
Hurtsboro, AL	14080	32° 15′	85° 24′	400
Columbus Metro AP, GA	92166	32° 30′	84° 56′	392
Opelika, AL	16129	32° 39′	85° 26′	640
W.F. George L&D	FOGGI	31°38′	85°05′	162
Clayton, AL	11725	31° 53′	85° 28′	500
Eufaula Wildlife Refuge, AL	12730	32° 00′	85° 05′	215
Cuthbert, GA	92450	31° 46′	84° 47′	461
Abbeville , AL	10008	31°34′	85°15′	456
Headland, AL	13761	31°21′	85°20′	370
Andrews L&D	COLA1	31°15′	85°07′	176
Woodbury, GA	99506	32°59′	84°35′	800
Talbotton, GA	98535	32°41′	84°31′	686
Montezuma, GA	95979	32°17′	84°01′	327
Americus, GA	90253	32°03′	84°16′	490
Crisp County Power Dam, GA	92361	31°51′	83°57′	245
Preston, GA	97201	32°03′	84°31′	405
Albany 3SE, GA	90140	31°32′	84°08′	180
Dawson, GA	92570	31°46′	84°27′	355
Camilla 3SE, GA	91500	31°11′;	84°12′	175
Jim Woodruff L&D	WRDF1	30°43′	84°52′	118
Apalachicola AP, FL	80211	29°43′	85°01′	20

Table 5-2. ACF River Stage and Rainfall Reporting Network

Stream	Station	Station number	River miles above mouth	Drainage area (sq. mi.)	Gage zero (ft. NGVD29)	Flood stage (ft.)	Operating agency	Rain Gage
Chattahoochee River	Helen	2330450	421.58	44.7	1404.04	6	USGS	Y
Chattahoochee River	Leaf	2331000	405.64	150	1219.47		USGS	Y
Soque River	Clarkesville	23312495	402.5	93.9	1300	12	USGS	Y
Chattahoochee River	Cornelia	2331600	401.43	315	1128.53	14	USGS	Y
Chestatee River	Dahlonega	2333500	29.2	153	1128.6	19	USGS	Y
Chattahoochee River	Lake Sidney Lanier	02334400	348.3	1,034	0		USGS	Y
Chattahoochee River	Buford tailwater	2334401	347.9	1,034	0		USGS	N
Chattahoochee River	Buford	2334430	348.1	1,040	912.04	12	USGS	N
Chattahoochee River	Norcross	2335000	330.77	1,170	878.14	12	USGS	Y
Chattahoochee River	Roswell	2335450	320.6	1,220	858.6	9	USGS	N
Big Creek	Roswell	2335757	2.11	103	940	10	USGS	N
Chattahoochee River	Morgan Falls	2335810	312.62	1,370	-12.52		USGS	Y
Chattahoochee River	Morgan Falls TW	2335815	312.62	1,370	-12.52	821	USGS	N
Chattahoochee River	Atlanta (Vinings)	2336000	302.97	1,450	750.1	14	USGS	N
Peachtree Creek	Atlanta	2336300	4	86.8	763.96	17	USGS	Y
Chattahoochee River	GA 280	2336490	298.77	1,590	736.35	24	USGS	N
Sweetwater Creek	Austell	2337000	5.5	246	857.01	10	USGS	Y
Chattahoochee River	Fairburn	2337170	281.79	2,060	718.3	20	USGS	Y
Snake Creek	Whitesburg	2337500	7	35.5	832.75	10	USGS	Y
Chattahoochee River	Whitesburg	2338000	259.85	2,430	682.06	15	USGS	Y
Chattahoochee River	Franklin	2338500	253.46	2,680	623.86	23	USGS	Y
Yellowjacket Creek	Hogansville	2338840	6.9	91	640.93	8	USGS	Y
Chattahoochee River	West Point Lake	2339400	201.4	3,440	0		USGS	Y
Chattahoochee River	West Point TW	2339402	201.6	3,443	0		USGS	N
Chattahoochee River	West Point	2339500	198.9	3,550	551.67	17	USGS	Y
Chattahoochee River	Columbus, 14th St.	2341460	160.64	4,630	224	27	USGS	Y
Chattahoochee River	Columbus (removed 30 Sep 2014)	2341505	159.9	4,670	183.14	34	USGS	N

Table 5-2 Cont: ACF River Stage and Rainfall Reporting Network

Stream	Station	Station number	River miles above mouth	Drainage area (sq. mi.)	Gage zero (ft. NGVD29)	Flood stage (ft.)	Operating agency	Rain Gage
Chattahoochee River	W. F. George Lake	2343240	75.17	7,460	0.0		USGS	Y
Chattahoochee River	W. F. George TW	2343241	75.1	7,460	0	134	USGS	N
Chattahoochee River	Ft. Gaines	23432415	73.38	7,460	0		USGS	N
Chattahoochee River	Lake G. Andrews and tailwater	02343801	46.53	8,210	0.0	106	USGS	Y
Sawhatchee Creek	Cedar Springs	2343940	35.27	64.2	109.9		USGS	Y
Chattahoochee River	Columbia	2343805	46.5	8,213	0		USGS	N
Flint River	Griffin	2344500	304.4	272	711.4	12	USGS	N
Flint River	Culloden	2347500	238.3	1,850	334.54	18	USGS	Y
Flint River	Montezuma	2349605	180.6	2,920	255.83	20	USGS	Y
Turkey Creek	Byromville	2349900	11	45	286	10	USGS	Y
Kinchafoonee Creek	Preston	2350600	51.8	197	337.7	7	USGS	Y
Flint River	Oakfield	2350512	125	3,860	193.3	23	USGS	Y
Flint River	Albany	2352500	102.2	5,310	150.03	20	USGS	Y
Flint River	Newton	2353000	69.5	5,740	110.2	24	USGS	Y
Pachitla Creek	Edison	2353400	8.5	188	212.64	7.8	USGS	Y
Ichawaynochaway Cr	Milford	2353500	19.8	620	150.3	11	USGS	Y
Ichawaynochaway Cr	Newton	2355350	69.5	1,040	98.67	17	USGS	Y
Flint River	Hopeful	2355662	48.3	7,080	62	30	USGS	Y
Flint River	Bainbridge	2356000	29	7,570	57.7	25	USGS	Y
Spring Creek	Iron City	2357000	27	527	85.7	16	USGS	Y
Spring Creek	Reynoldsville	2357150	10.8	623	0		USGS	N
Apalachicola River	Lake Seminole	2357500	106.3	17,164	0 .0		USGS	Y
Apalachicola River	Jim Woodruff tailwater	2357700	106.3	17,164	0	66	USGS	N
Apalachicola River	Chattahoochee	2358000	105.7	17,200	0		USGS	Y
Apalachicola River	Blountstown	2358700	78.85	17,530	27	15	USGS	N
Apalachicola River	Wewahitchka	2358754	43.82	17,800	0		USACE	N
Apalachicola River	Sumatra	2359170	20.3	19,200	0		USGS	N

b. Reporting. The Mobile District operates and maintains a Water Control Data System (WCDS) that integrates large volumes of hydrometeorological and project data so the basin can be regulated to meet the operational objectives of the system. The WCDS, in combination with the new Corps Water Management System (CWMS), together automate and integrate data acquisition and retrieval to best meet all Corps water management activities. Much of the historic and current project hydrologic data are available to the public via the Mobile District website.

Data are collected at Corps sites and throughout the ACF Basin through a variety of sources and integrated into one verified and validated central database. The basis for automated data collection at a gage location is the data collection platform. The data collection platform is a computer microprocessor at the gage site. The data collection platform has the capability to interrogate sensors at regular intervals to obtain real-time information (e.g., river stage, reservoir elevation, water and air temperature, precipitation). The data collection platform then saves the information, performs simple analysis of it, and then transmits the information to a fixed geostationary satellite. Data collection platforms transmit real-time data at regular intervals to the Geostationary Operational Environmental Satellite (GOES) System operated by the National Oceanic and Atmospheric Administration (NOAA). The GOES Data Collection System (DCS) sends the data directly down to the NOAA Satellite and Information Service in Wallops Island, Virginia. The data are then rebroadcast over a domestic communications satellite (DOMSAT). The Mobile District operates and maintains a Local Readout Ground Station (LRGS), which collects the data collection platform-transmitted, real-time data from the DOMSAT. Figure 5-3 depicts a typical schematic of how the system operates.

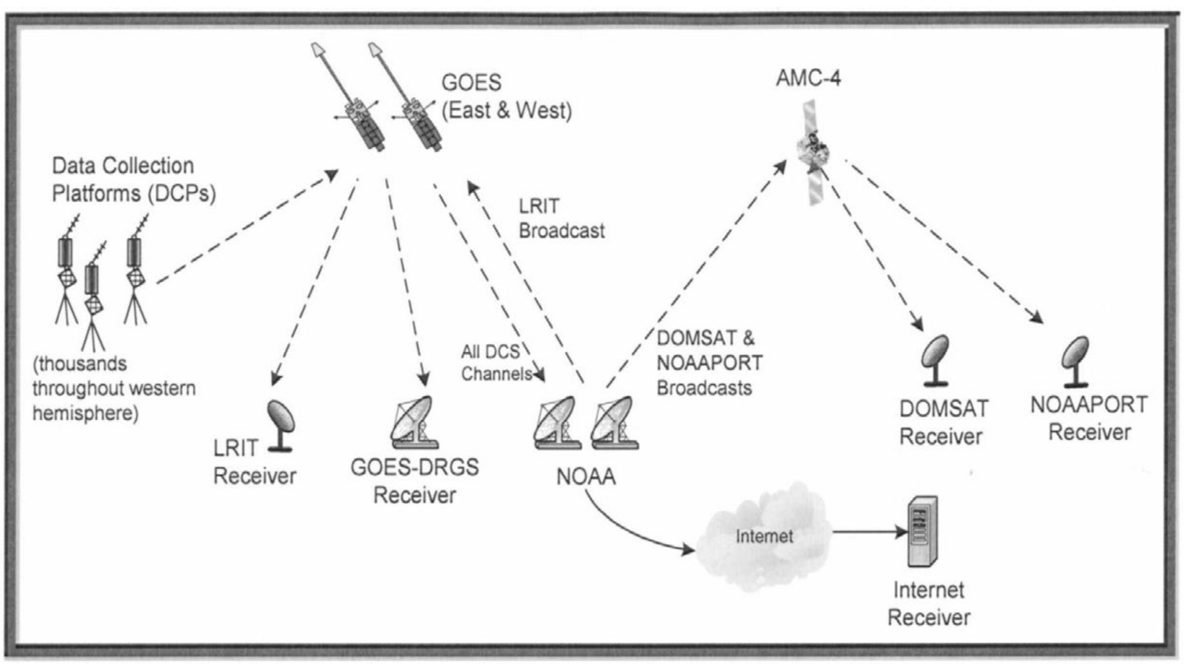


Figure 5-3. Typical Configuration of the GOES System

Typically, reporting stations log 15-minute data that are transmitted hourly. A few remaining gages report every four hours, but they are being transitioned to the hourly increment. All river stage and precipitation gages equipped with a data collection platform and GOES antenna are capable of being part of the reporting network.

Other reservoir project data are obtained directly at a project are collected through each project's SCADA system. The Mobile District downloads the data both daily and hourly through the Corps server network.

c. Maintenance. Maintenance of data reporting equipment is a cooperative effort among the Corps, the USGS, and the NWS. The USGS, in cooperation with other federal and state agencies, maintains a network of real-time data collection platform stream gaging stations throughout the ACF Basin. The USGS is responsible for the supervision and maintenance of the real-time data collection platform gaging stations and the collection and distribution of streamflow data. In addition, the USGS maintains a systematic measurement program at the stations so the stage-discharge relationship for each station is current. Through cooperative arrangements with the USGS, discharge measurements at key ACF Basin locations are made to maintain the most current stage-discharge relationships at the stations. The NWS also maintains precipitation data for the flood control precipitation (FC-1) network. For Corps-maintained facilities in the ACF, gages are typically visited six to eight times a year to validate stage, flow, and accuracy of gage equipment.

If gages appear to be out of service, the following agencies can be contacted for repair:

U.S. Army Corps of Engineers, Mobile District, 109 Saint Joseph Street, Mobile, AL 36602-3630
Phone: (251) 690-2737 Web: http://water.sam.usace.army.mil

USGS South Atlantic Water Science Center - Georgia, 1770 Corporate Dr., Suite 500,
Norcross, GA 30093; Phone: (678) 924-6700 Web: http://ga.water.usgs.gov

USGS Lower Mississippi-Gulf Water Science Center - Alabama, 75 TechnaCenter Drive,
Montgomery, Alabama 36117 Phone: (334) 395-4120 Web: http://al.water.usgs.gov

USGS Florida Water Science Center, 4446 Pet Lane, Suite 108, Lutz, FL 33559,
Phone: (813) 498-5000 Web: http://fl.water.usgs.gov

NWS Southern Region, 819 Taylor Street, Room 10E09, Fort Worth, TX 76102
Phone: (817) 978-1100 Web: http://www.srh.noaa.gov/

5-02. Water Quality Stations. Water quality monitoring by the Corps is limited in the ACF Basin. However, other federal and state agencies including the USGS, Georgia Department of Natural Resources, Alabama Department of Environmental Management, and the Florida Department of Environmental Management maintain an extensive network of water quality stations for general water quality monitoring throughout the ACF Basin.

5-03. Sediment Stations. The Corps does not maintain sediment stations per se, for the ACF Basin. A network of sediment ranges were established for each Corps project in the basin and have been resurveyed periodically in order to compute storage depletion rates as well as monitoring bank sloughing. Specific details on sediment data can be found in the project appendices.

5-04. Recording Hydrologic Data. The WCDS/CWMS is an integrated system of computer hardware and software packages readily usable by water managers and operators as an aid for making and implementing decisions. An effective decision support system requires efficient data input, storage, retrieval, and capable information processing. Corps-wide standard software and database structure are used for real-time water control. Time series hydrometeorological data are stored and retrieved using the CWMS Oracle database. In the event this database is unavailable, data can alternately be stored in the Hydrologic Engineering Center Data Storage System (HEC-DSS).

To provide stream gage and precipitation data needed to support proper analysis, a DOMSAT Receive Station (DRS) is used to retrieve data collection platform data from gages throughout the ACF Basin. The DRS equipment and software then receives the DOMSAT data stream, decodes the data collection platforms of interest and reformats the data for direct ingest into a HEC-DSS database. Reservoir data is received through a link with the SCADA system which monitors and records reservoir conditions and operations in real time.

Most reservoir data are transmitted in hourly increments for inclusion in daily log sheets that are retained indefinitely. Gage data are transmitted in increments of 15 minutes, 1 hour, or other time intervals. Reservoir data are examined and recorded in water control models every morning (or other times when needed). The data are automatically transferred to forecast models.

Automated timed processes also provide provisional real-time data needed for supporting real-time operational decisions. Interagency data exchange has been implemented with the USGS and NWS Southeast River Forecast Center (SERFC). A direct link to SERFC is maintained to provide real-time products generated by NWS offices. Information includes weather and flood forecasts and warnings, tropical storm information, NEXRAD radar rainfall, graphical weather maps and more. Likewise, a direct link to USGS gages in the field allows for direct downloading of USGS data to Corps databases.

5-05. Communication Network. The global network of the Corps consists of Voice over IP (VoIP) connections between every Division and District office worldwide. The VoIP allows all data and voice communications to transverse through the Corps' internet connection. The reliability of the Corps' network is considered a command priority and, as such, supports a dedicated 24 hours-per-day Network Operations Center. Additionally, the use of satellite data acquisition makes for a very reliable water control network infrastructure.

The Mobile District has a critical demand for emergency standby for operation of the ACF Basin and to ensure that data acquisition and storage remain functional. Water Management must be able to function in cases of flooding or other disasters, which typically are followed by the loss of commercial electricity. The WCDS/CWMS servers and LRGS each have individual uninterruptable power supply (UPS) and a large UPS unit specifically for the portion of Mobile District Office in which Water Management resides to maintain power for operational needs.

In the event of a catastrophic incident that causes loss of communication or complete loss of access to the Mobile District Office and the WCDS and CWMS servers located on site, a Continuity of Operations Program (COOP) site is being set up as a backup to these systems. This site will have servers that mirror the WCDS and CWMS servers located at the Mobile District Office allowing Water Managers to continue operating with no interruption or loss of data. It is currently planned that the COOP site will be located at the South Atlantic Division Office in Atlanta, Georgia.

5-06. Communication with Project

a. Regulating Office with Project Office. The Mobile District is the regulating office for the Corps' projects in the ACF Basin. Daily routine communication between the Mobile District and project offices occur thru electronic mail, telephone, and facsimile. Daily hydropower generation schedules are issued by SEPA. During normal conditions on weekends, hydropower generation schedules can be sent out on Friday to cover the weekend period of project regulation, but those can change if deemed appropriate. If loss of network communications occurs, orders can be given via telephone.

During critical reservoir regulation periods and to assure timely response, significant coordination is often conducted by telephone between the project office and the Mobile District. That direct contact assures that issues are completely coordinated and concerns by both offices are presented and considered before final release decisions are made. The Chief of the Water Management Section is generally available by cell phone during critical reservoir operation periods.

b. Between Project Office and Others. Each reservoir project office is generally responsible for local notification and for maintaining lists of those individuals who require notification under various project regulation changes. In addition, the project office is responsible for notifying the public using project recreation areas, campsites, and other facilities that could be affected by various project conditions.

5-07. Project Reporting Instructions. In addition to automated data, project operators maintain record logs of gate position, water elevation, and other relevant hydrological information including inflow and discharge. That information is stored and available to the Mobile District through the Corps' network. Operators have access to Mobile District Water Managers via email, land line and cell phone and notify the Mobile District if changes in conditions occur. Unforeseen or emergency conditions at the project that require unscheduled manipulations of the reservoir should be reported to the Mobile District as soon as possible.

If the automatic data collection and transfer are not working, projects are required to fax or email daily or hourly project data to the Mobile District. Water Management staff will manually input the information into the database. In addition, Mobile District Power Projects must verify pool level gage readings each week, in accordance with *Standard Operating Procedure, Weekly Verification of Gauge Readings, Mobile District Power Projects* dated 19 February 2008, and CESAD SOP 1130-2-6 dated 21 July 2006. Those procedures require that powerhouse operators check the accuracy of pool monitoring equipment by verifying readings of the equipment against gage readings at each plant. That information is logged into the Official Log when completed and furnished to the master plant. A Trouble Report to management communicates any discrepancies with the readings. Operations Division, Hydropower Section will be notified by e-mail when verification is complete. The e-mail notification will include findings of the verification.

Project personnel or the Hydropower Section with Operations Division, or both, are responsible for requesting any scheduled system hydropower unit outages in excess of two hours. The out-of-service times for the hydropower units are reported back to Water Management upon completion of outages. Forced outages are also reported with an estimated return time, if possible. Any forced or scheduled outages causing the project to miss scheduled water release targets must be immediately reported to the Mobile District and to SEPA. In such cases, minimum flow requirements can be met through spill or sluicing or both.

5-08. Warnings. During floods, dangerous flow conditions or other emergencies, the proper authorities and the public must be informed. In general flood warnings are coupled with river forecasting. The NWS has the legal responsibility for issuing flood forecast to the public and that agency will have the lead role for disseminating the information. For emergencies involving the project, the operator on duty should notify the Mobile District, Operations Division, and the Operations Project Manager at the project. A coordinated effort among those offices and the District's Emergency Management Office will develop notifications for local law enforcement, government officials, and emergency management agencies.

VI - SYSTEM HYDROLOGIC FORECASTS

6-01. General. Reservoir operations are scheduled by the Mobile District in accordance with forecasts of reservoir inflow and pool stages. The NWS's River Forecast Center prepares river forecasts for the general public and for use by the Corps. In addition, the Mobile District maintains the capability to prepare forecasts for internal use only. Because the five federally owned reservoirs in the ACF Basin are operated as a system for all authorized project purposes, knowledge of total basin inflow is required.

ACF Basin inflow is computed by summing the daily local flow into the four federal reservoirs: Lake Sidney Lanier, West Point Lake, Walter F. George Lake, and Lake Seminole. Basin inflow is not the natural flow into the ACF Basin because basin inflow incorporates influences of reservoir evaporative losses, inter-basin water transfers, and consumptive water uses, such as municipal water supply and agricultural irrigation.

Expressed as a mathematical formula, the ACF Basin Inflow = Buford Local Flow + West Point Local Flow + Walter F. George Local Flow + Jim Woodruff Local Flow

"Local Flow" = Computed Inflow – Upstream Dam Discharge (with appropriate time lag)
"Computed Inflow" = Dam Discharge + Change in Reservoir Storage

Buford Local Flow $_i$ = Buford Computed Inflow $_i$
West Point Local Flow $_i$ = West Point Computed Inflow $_i$ – Buford Discharge $_{i-3}$
Walter F. George Local Flow $_i$ = Walter F. George Computed Inflow $_i$ – West Point Discharge $_{i-2}$
Jim Woodruff Local Flow $_i$ = Jim Woodruff Computed Inflow $_i$ – Walter F. George Discharge $_{i-1}$

where i is the current daily time step.

Flow requirements at the lower end of the basin, below Jim Woodruff Lock and Dam, are determined by conditions in the basin. On the Chattahoochee River, the observed inflows and outflows of upstream projects provide an estimate of future flows and requirements in the Apalachicola River. The Flint River is less developed, and a continuous monitoring of river gages and rainfall is necessary to predict total flow for that river. Authorized navigation functions require knowledge of river depths (or stages) at Blountstown, Florida. During stable flow conditions, accurate forecasts permit relatively uniform releases into the Apalachicola River. In addition, rapid decreases in river stages are to be avoided to prevent stranding endangered species. That requires forecasting the recession of high-flow events.

The Corps has developed techniques to conduct forecasting in support of the regulation of the ACF Basin. In addition, the Corps has a strong reliance on other federal agencies such as the NWS and the USGS to help maintain accurate data and forecast products to aid in making the most prudent water management decisions. The regulation of multipurpose projects requires scheduling releases and storage on the basis of both observed and forecasted hydrologic events throughout the basin. The existing conditions include current inflows to the project, current lake elevation and current releases. The forecasted future conditions include future inflows from water which is already on the ground, future operations of upstream projects, and future expected releases all of which contribute to the future expected lake elevation. Meteorological and hydrologic forecasts can influence the projected release forecasts that are adjusted based on actual observed conditions.

During both normal and below-normal runoff conditions, releases through the power plants are scheduled on the basis of water availability, to the extent reasonably possible, during peak periods to generate electricity during periods of greatest demand. These schedules are prepared on a weekly basis and modified as appropriate. The release level and schedules are dependent on current and anticipated hydrologic events. The most efficient use of water is always a goal, especially during the course of a hydrologic cycle when below-normal streamflow is occurring. Reliable forecasts of reservoir inflow and other hydrologic events that influence streamflow are critical to efficiently regulate the ACF Basin.

a. Role of Corps. The Water Management Section maintains real-time observation of reservoir, river, and weather conditions data in the Mobile District. The Mobile District makes reservoir level, outflow, inflow, and hydropower forecasts for all the federal projects and river stage forecasts at Blountstown. Observation of real-time stream conditions provides guidance of the accuracy of the forecasts. The Corps maintains contact with the SERFC to receive forecast and other data as needed. Daily operation of the ACF Basin during normal, flood risk management, and drought conservation regulation requires accurate, continual short-range and long-range elevation, streamflow, and river-stage forecasting. Those short-range inflow forecasts are used as input in computer model simulations so that project forecast release determinations can be optimized to achieve the regulation objectives. Actual release determinations are made based on observed pool elevation, inflow, and river stage data. The Mobile District continuously monitors the weather conditions occurring throughout the ACF Basin and the forecasts issued by the NWS. Whenever possible, the NWS weather and hydrologic forecasts are used for planning purposes. The Mobile District develops forecasts that are used to meet the regulation objectives of the Corps reservoirs. Daily, the Mobile District develops 7-day forecasts for inflow, project releases, pool elevation, and hydropower generation. The Mobile District prepares five-week inflow and reservoir elevation forecasts weekly on the basis of rainfall estimates and historical observed data in the basin. Those projections assist in making water management decisions and providing project staff and the public trends based on the current hydrology and operational goals of the period. In addition, the Mobile District provides weekly hydropower generation forecasts based on current power plant capacity, latest hydrological conditions, and system water availability.

b. Role of Other Agencies. The NWS is responsible for all preparation and public dissemination of forecasts relating to precipitation, temperatures, and other meteorological elements related to weather and weather-related forecasting in the ACF Basin. The Mobile District uses the NWS as a key source of information for weather forecasts. The meteorological forecasting provided by the NWS is considered critical to the Corps' water resources management mission. The 24- and 48-hour Quantitative Precipitation Forecasts (QPFs) are invaluable in providing guidance for basin release determinations. The use of precipitation forecasts and subsequent runoff directly relates to project release decisions.

The SERFC is responsible for the supervision and coordination of streamflow and river-stage forecasting services provided by the NWS Weather Service Forecast Office in Peachtree City, Georgia, and Tallahassee, Florida. The SERFC routinely prepares and distributes 5-day streamflow and river-stage forecasts at key gaging stations along the Chattahoochee, Flint, and Apalachicola Rivers. Streamflow forecasts are available at additional forecast points during periods above normal rainfall. In addition, the SERFC provides a revised regional QPF on the basis of local expertise beyond the NWS Hydrologic Prediction Center QPF. The SERFC also provides the Mobile District with flow forecasts for selected locations on request.

The SERFC prepares 5-day and longer forecasts for Montezuma, Albany and Bainbridge, Georgia, on the Flint River and for Atlanta, Georgia, and George Andrews on the Chattahoochee River and for Blountstown, Florida, and the Jim Woodruff Dam tailrace on the Apalachicola River. These forecasts can be compared to those prepared by the Mobile District.

The Corps and SERFC have a cyclical procedure for providing forecast data between federal agencies. As soon as reservoir release decisions have been planned and scheduled for the proceeding days, the release decision data are sent to the SERFC. Taking release decision data coupled with local inflow forecasts at forecast points along the ACF Basin, the SERFC can provide inflow forecasts into Corps projects. Having revised inflow forecasts from the SERFC, the Corps has up-to-date forecast data to make the following day's release decisions. The Mobile District monitors observed conditions and routinely adjusts release decisions based on observed data.

The USGS is responsible for maintaining and operating the network of river based gages that measure stage, flow, rainfall and often other parameters essential for the operation and monitoring of the ACF River Basin. This includes the critical gages at all flood risk management locations as well as all gages located at the federal projects on the ACF. The gage data is provided by the USGS through their website which updates each gage hourly. The Corps also retrieves USGS gage data directly from the gage data collection platform through the GOES system discussed in Chapter V of this manual. The Corps uses this near real-time data to make decisions on operations ranging from flood releases to daily hydropower releases during normal conditions. This data is also used by the Corps and SERFC in model calibration for forecasting flood releases and river stages.

USGS offices in Norcross, Georgia, Montgomery, Alabama, and Tallahassee, Florida are responsible for the maintenance of the gages located in the ACF River Basin. In the event that a gage becomes inoperable, the Corps will inform the USGS office of responsibility by phone or email. The USGS will then deploy a team to perform maintenance on the gage, if they have not already done so. When any gage associated with flood risk management operations or a critical gage at a federal storage project malfunctions, the USGS will usually send a team to perform maintenance immediately upon becoming aware of the malfunction.

6-02. Flood Condition Forecasts. The NWS has the primary responsibility to issue flood forecasts to the public. The Mobile District uses the forecasts as much as possible for regulating the system. The Mobile District monitors observed conditions and adjusts release decisions based on observed data. The Corps also provides a link to the NWS website so that the Mobile District and the public can obtain this vital information in a timely fashion. The information is relayed to affected county emergency management officials. When hydrologic conditions exist so that all or portions of the ACF Basin are considered to be flooding, existing Corps streamflow and short- and long-range forecasting runoff models are run on a more frequent, as-needed basis. Experience demonstrates that the sooner a significant flood event can be recognized and the appropriate release of flows scheduled, an improvement in overall flood risk management can be achieved. Consequently, the Corps and the SERFC constantly run models and examine data to include QPF's, "water on the ground", rainfall/runoff relationships, timing of peaks, and other appropriate data. When flooding is occurring or forecast to occur, Water Management has also begun utilizing the Corps Water Management System (CWMS) models developed to perform short term forecasts for the ACF Basin. The CWMS model suite includes hydrologic modeling system (HEC-HMS) and reservoir simulation (HEC-ResSim) models to determine the anticipated reservoir operations based on the QPF provided by the SERFC. It also includes the capability to estimate inundation at downstream flood damage reduction locations using HEC-RAS (River Analysis System) and the ability to estimate damages at those locations using HEC-FIA (Flood Impact Analysis).

A selected operation is then made based on all data available including observed data, model results, and the perceived quality of such data. System storage that has accumulated from significant rainfall events must be evacuated following the event and as downstream conditions permit to provide effective flood risk management. Flood risk management carries the highest priority during significant runoff events that pose a threat to human health and safety. The accumulation and evacuation of storage for the authorized purpose of flood risk management is accomplished in a manner that will prevent, as much as possible, flows exceeding those that will cause flood damage downstream. During periods of significant basin flooding, the frequency of contacts between the Mobile District and SERFC staff are increased to allow a complete interchange of available data on which the most reliable forecasts and subsequent project regulation can be based.

6-03. Conservation Purpose Forecasts. The ACF Basin is typically regulated for normal or below normal runoff conditions. Therefore, the majority of the forecasting and runoff modeling simulation is for conservation regulation decisions. Whenever possible, the NWS weather and hydrologic forecasts are used. Because the NWS is the federal agency responsible for the preparing and issuing streamflow and river-stage forecasts, the Mobile District frequently uses SERFC forecasted inflows for general conservation forecasts. The Mobile District Water Management Section has also begun testing CWMS for short term forecasts in normal conditions. These forecasts are typically no longer than five days and assist in the planning of reservoir releases for the coming week. In addition, the Mobile District provides weekly hydropower generation forecasts on the basis of current power plant capacity, latest hydrological conditions, and system water availability. Property owners, fishermen, recreation enthusiasts, and developers use weekly elevation forecasts for a variety of purposes.

6-04. Long-Range Forecasts. During normal conditions, the current long-range outlook produced by the Corps is a 5-week forecast. For normal operating conditions, a forecast longer than that incorporates a greater level of uncertainty and less reliability. In extreme conditions, 3-month and 6-month forecasts can be produced on the basis of observed hydrology and comparative percentage hydrology inflows into the ACF Basin. One-month and three-month outlooks for temperature and precipitation produced by the NWS Climate Prediction Center (CPC) are used in long-range planning for prudent water management of the ACF Basin.

6-05. Drought Forecasts. Various products are used to detect the extent and severity of basin drought conditions. One key indicator is the U.S. Drought Monitor. The Palmer Drought Severity Index is also used as a regional drought indicator. The index is a soil moisture algorithm calibrated for relatively homogeneous regions and may lag emerging droughts by several months. The State Climatologists also produce a Lawn and Garden Index, which gives a basin-wide ability to determine the extent and severity of drought. The runoff forecasts developed for both short- and long-range periods reflect drought conditions when appropriate. There is also a heavy reliance on latest El Nino Southern Oscillation (ENSO) forecast modeling to represent the potential effects of La Nina on drought conditions and spring inflows. Long-range models are used with greater frequency during drought conditions to forecast potential effects on reservoir elevations, ability to meet minimum flows, and water supply availability. A long-term, numerical model, Extended Streamflow Prediction developed by the NWS provides probabilistic forecasts of streamflow and reservoir stages on the basis of historical rainfall, streamflow, and soil moisture. Extended Streamflow Prediction results are used in projecting possible future drought conditions. Other parameters and models can indicate a lack of rainfall and runoff and the degree of severity and continuance of a drought. Models using data of previous droughts or a percent of current to mean monthly flows with several operational schemes have proven helpful in planning. Other parameters are the ability of the various lakes to meet the demands placed on storage, the probability that lake elevations will return to normal seasonal levels, basin streamflows, basin groundwater table levels, and the total available storage to meet hydropower marketing system demands.

VII - SYSTEM WATER CONTROL PLAN

7-01. General Objectives. The general objective of water control management is to accomplish the authorized purposes of the federal ACF System of improvements. Many factors must be evaluated in determining project or system reservoir regulation procedures, including project requirements, time of year, climate conditions and trends, downstream needs, and the amount of water remaining in storage. Various interests and project conditions must be continually considered and balanced when making water control decisions for the basin and individual projects. The water control plan seeks to equitably meet the needs of all project purposes of the ACF Basin. Project purposes and basic parameters guiding water management activities at each of the Corps projects in the ACF Basin are discussed below. This master water control plan summarizes general project water control regulation and management objectives at Corps projects in the basin from the perspective of the authorized project purposes. Individual project appendices to this master manual provide specific guidance and instructions for each project.

7-02. Constraints. Individual project physical constraints and limitations are addressed in each project specific appendix. Head limitations are one of the physical project constraints that exist at several projects. Walter F. George Lock and Dam, George W. Andrews Lock and Dam, and Jim Woodruff Lock and Dam have head limitations that must be maintained to ensure the structural integrity of the dam and powerhouse. The head limit is the maximum head differential between the headwater and the tailwater at each dam; the head differential must not be exceeded (Plate 7-1).

The head limit at Walter F. George Dam is 88 feet, and at George W. Andrews Dam it is 25 feet unless the George W. Andrews pool falls below 102 feet NGVD29, then the head limit is 26 feet. There is a variable head limit at Jim Woodruff Dam (Appendix A, Jim Woodruff Lock and Dam and Lake Seminole Water Control Manual, Plate 7-1, Limitation on Maximum Head) that ranges from 38.5 feet to 33.0 feet.

The time required to physically make a spillway gate change at the Woodruff Project can take up to 1½ hours if the gate change is required outside the normal working hours of 8:00 am to 4:00 pm. During normal working hours, the time required is approximately 30 minutes.

It is critical that the lake levels at Lake Seminole and Lake George W. Andrews be maintained at the highest practicable levels before any extended shutdown at the Walter F. George power plant, especially during low-flow periods. During low-flow periods at Jim Woodruff Lock and Dam, there could be times when the management of the system to meet the low-flow criteria might require release of additional water from Jim Woodruff Dam. Typically, the water release will be for a short period to raise the tailwater to not exceed the head limitation. In those situations, operations to ensure that head limitation requirements are met will supersede any low-flow operations guidance.

7-03. Overall Plan for Water Control. The Corps operates five projects in the ACF Basin: (in downstream order) Buford Dam and Lake Sidney Lanier, West Point Dam and Lake, Walter F. George Lock and Dam and Lake, George W. Andrews Lock and Dam and Lake George W. Andrews, and Jim Woodruff Lock and Dam and Lake Seminole. Those are all on the Chattahoochee River arm of the basin except Jim Woodruff, the most downstream project, which is immediately below the confluence of the Chattahoochee and Flint Rivers and marks the upstream extent of the Apalachicola River. Lanier, West Point, and Walter F. George are storage reservoirs. Andrews Lock and Dam is a run-of-river project without any appreciable storage. Jim Woodruff Lock and Dam is operated as a run-of-river project with only very limited storage pondage available to support project purposes.

Authorized purposes for operation of the federal ACF System of projects include flood risk management, hydropower, navigation, fish and wildlife conservation, recreation, water supply, and water quality, pursuant to the specific ACF project authorizing legislation and other, more generally applicable statutory authorities (e.g., the Flood Control Act of 1944, P.L. 89-72, and P.L. 85-624). Each of the legally authorized project purposes is considered when making water control regulation decisions, and the decisions affect how water is stored and released from the projects.

ACF Basin water control regulation considers all project functions and accounts for the full range of hydrologic conditions, from flood to drought. In general, to provide for the authorized project purposes, flow must be stored during wetter times of each year and released from storage during drier periods of each year. Traditionally, that means that water is stored in the upstream storage lakes during the spring and released for authorized project purposes in the summer and fall months. Some authorized project purposes such as lakeside recreation, water supply, and lake fish spawn are achieved by retaining water in the lakes, either throughout the year or during specified periods of each year. The flood risk management purposes at certain reservoirs require drawing down reservoirs in the fall through winter months to store possible flood waters.

Because actions taken at the upstream portion of the basin affect conditions downstream, the ACF projects are operated in a coordinated manner to the maximum extent possible rather than as a series of individual, independent projects. Balancing water control actions to meet each of the project purposes varies between the individual projects and time of year. Water Management considers the often-competing purposes and makes water control decisions accordingly. When possible, the Corps manages reservoir water control regulation to complement and accommodate those purposes. For example, flood waters are evacuated to the greatest extent practicable through the powerhouse turbines to produce electricity. In addition to specific authorized purposes for which the projects are operated, over the years a variety of activities (industrial and municipal water supply, in-stream recreation, water quality, and the like) have become dependent on the operational patterns of the projects. The Corps considers these needs when regulating the federal projects in an attempt to meet all authorized purposes, while continuously monitoring the total system water availability to ensure that project purposes can at least be minimally satisfied during critical drought periods. This water management strategy does not prioritize any project function, but seeks to balance all project authorized purposes. The intent is to maintain a balanced use of conservation storage rather than to maintain the pools at or above certain predetermined elevations. However, in times of high-flow conditions, flood risk management regulation will supersede all other project functions. At all times, the Corps seeks to conserve the water resources entrusted to its regulation authority.

This manual, including the project specific manuals included as appendices, prescribe guide curves to facilitate the water control regulation of the three major storage projects in the ACF Basin, Buford/Lake Sidney Lanier, West Point, and Walter F. George (Figures 7-1 through 7-3). The guide curve for each project defines the top of conservation storage water surface elevation. The water control plan also establishes action zones within the conservation storage for each project. The zones are used to manage the lakes at the highest level possible while balancing the needs of all the authorized purposes. Zone 1, the highest in each lake, defines a reservoir condition where all authorized project purposes can be met. As lake levels decline, Zones 2 through 4 define increasingly critical system status where purposes can no longer fully be met. The action zones also provide guidance on meeting minimum hydroelectric power needs at each project. Typical peaking hours of hydropower operation according to action zones for each project are discussed in paragraph 7-09b, Hydroelectric Power, below.

The zones were derived considering numerous factors to include the ability of the reservoirs to refill (considering hydrology, watershed size, and physical constraints of each reservoir), recreation effects and hazard levels, and the proportionality of zone drawdown between projects. Other factors or activities might cause the lakes to operate differently than the action zones described. Examples of the factors or activities include; exceptional flood risk management measures, fish spawn operations, approved deviations, maintenance and repair of turbines, emergency situations such as a drowning and chemical spills, draw-downs because of shoreline maintenance, releases made to free grounded barges, and other circumstances.

The storage projects are operated to maintain their lake level in the same zones concurrently. However, because of the hydrologic and physical characteristics of the river system and factors mentioned above, there might be periods when one lake is in a higher or lower zone than another. When that occurs, the Corps makes an effort to bring the lakes back into balance with each other as soon as conditions allow. By doing so, effects on the river basin are shared equitably among the projects.

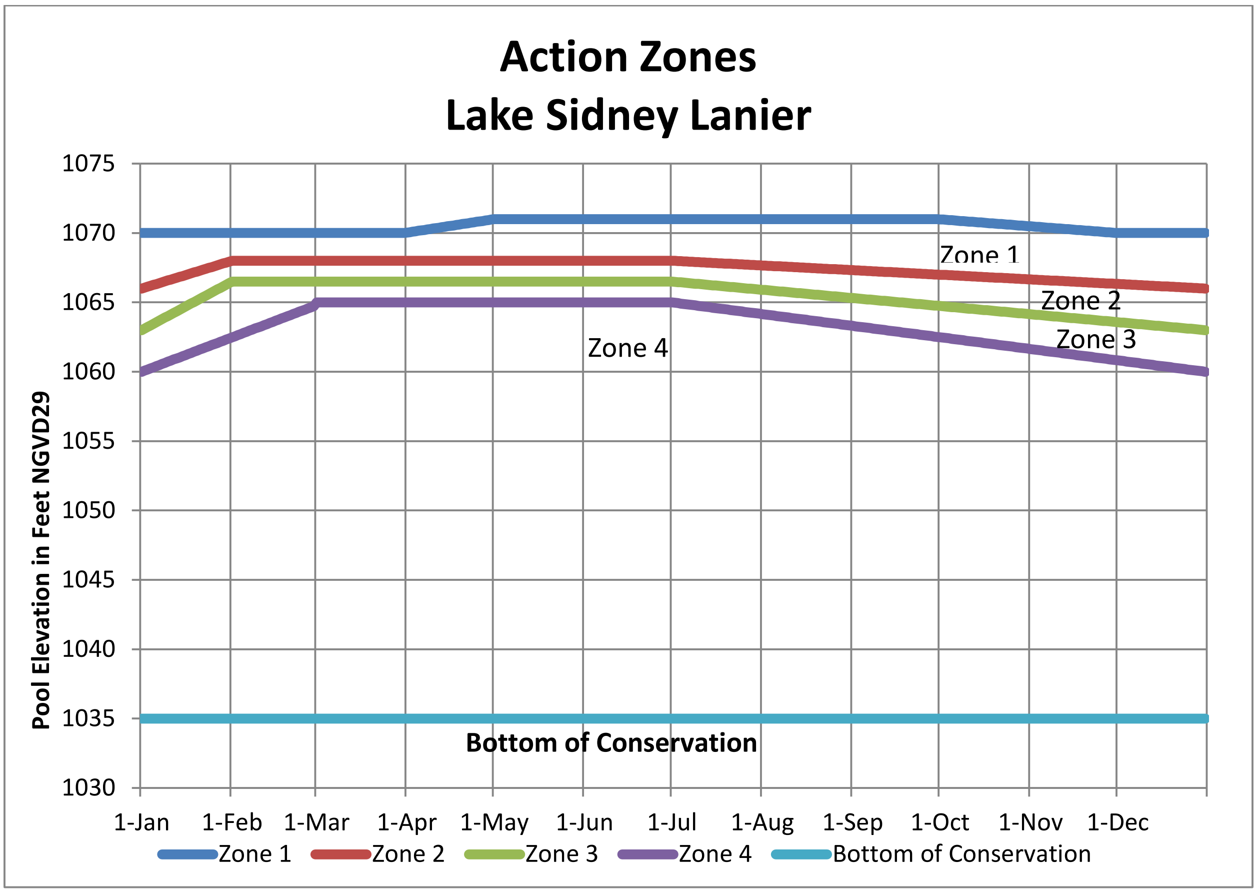


Figure 7-1. Action Zones for Lake Sidney Lanier

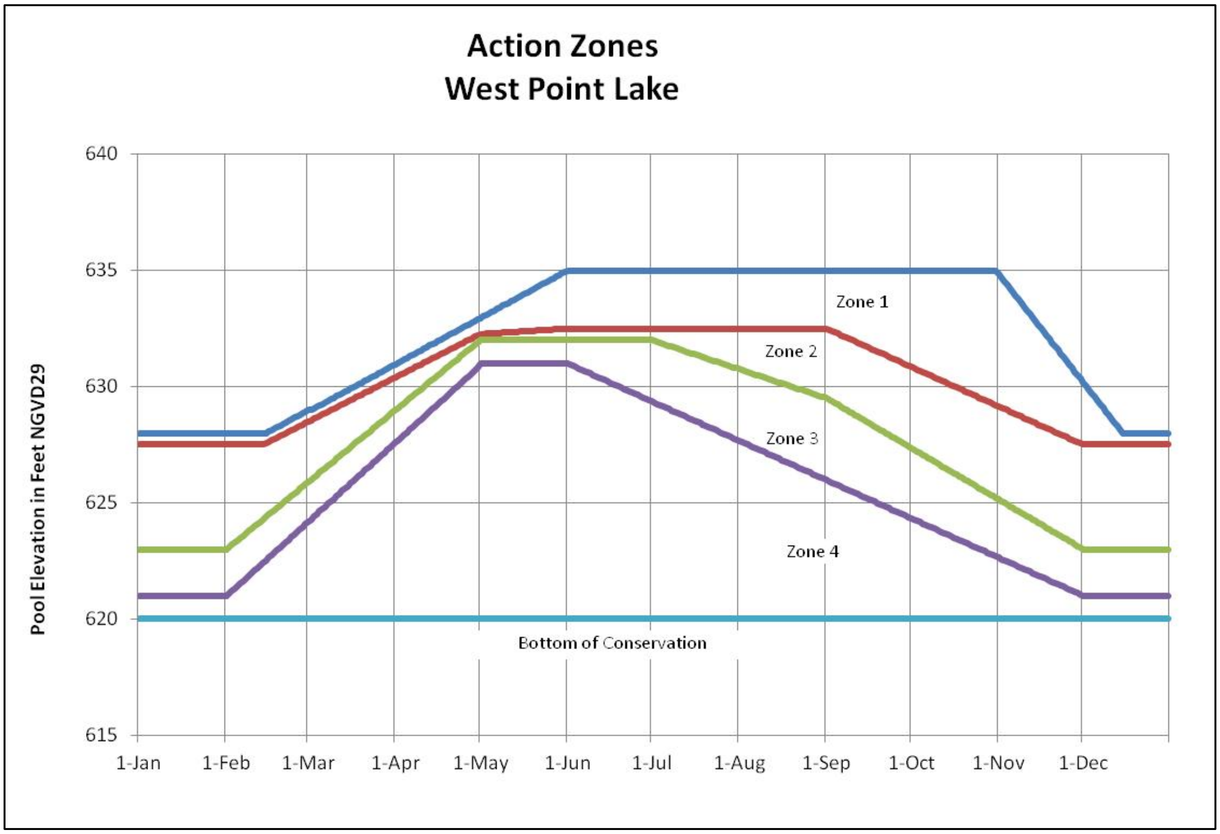


Figure 7-2. Action Zones for West Point Lake

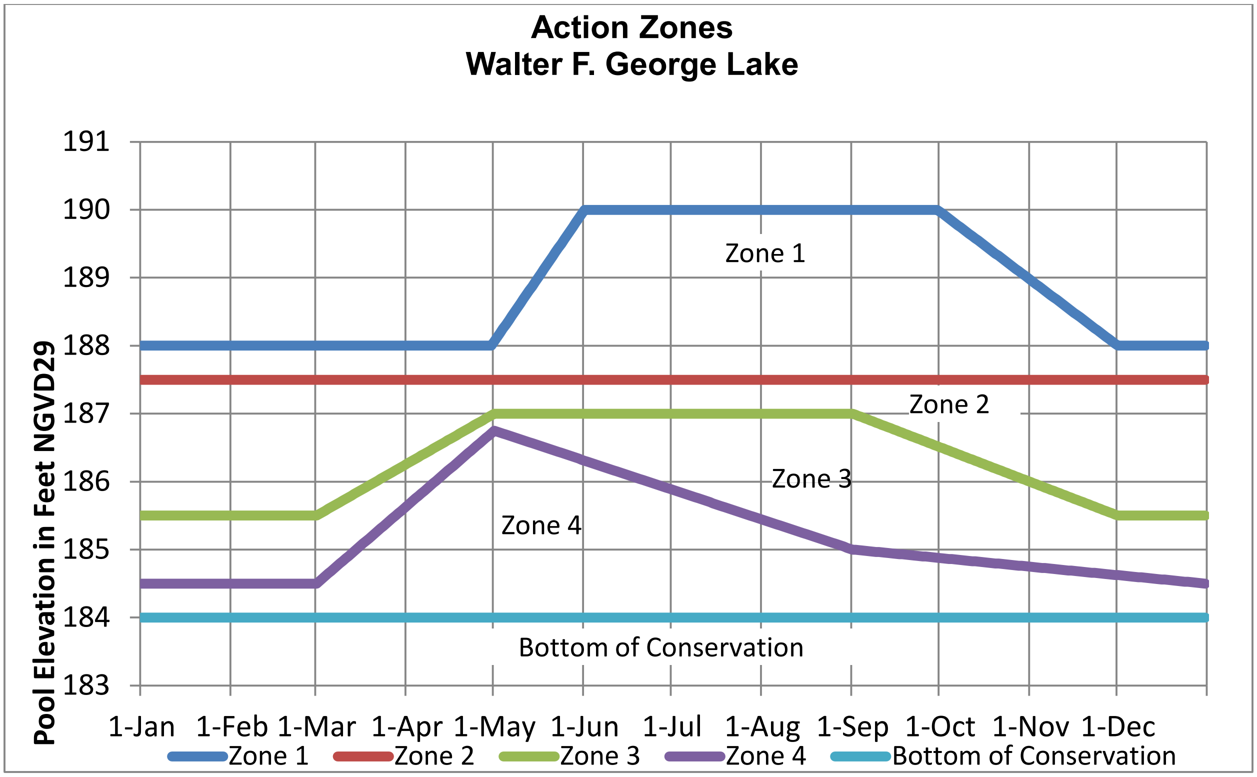


Figure 7-3. Action Zones for Walter F. George Lake

The action zones are integral to the system-wide regulation of the ACF Basin through the concept of composite conservation storage. Composite conservation storage is calculated by combining the conservation storage of Lake Sidney Lanier, West Point Lake, and Walter F. George Lake. Composite conservation storage is shown in Figure 7-4. Each of the individual storage reservoirs consists of four action zones. The composite conservation storage uses the four zone concepts as well; i.e., Zone 1 of the composite conservation storage represents the combined storage available in Zone 1 for each of the three storage reservoirs. When composite conservation storage is in Zones 1 and 2, a less conservative operation is in place. When composite conservation storage is in Zone 3, drought contingency operations are triggered, hydropower is supported at a reduced level, and water supply and water quality releases are met. When composite conservation storage is in Zone 4, severe drought conditions exist, navigation is not supported, and hydropower is likely to be generated only during concurrent uses.

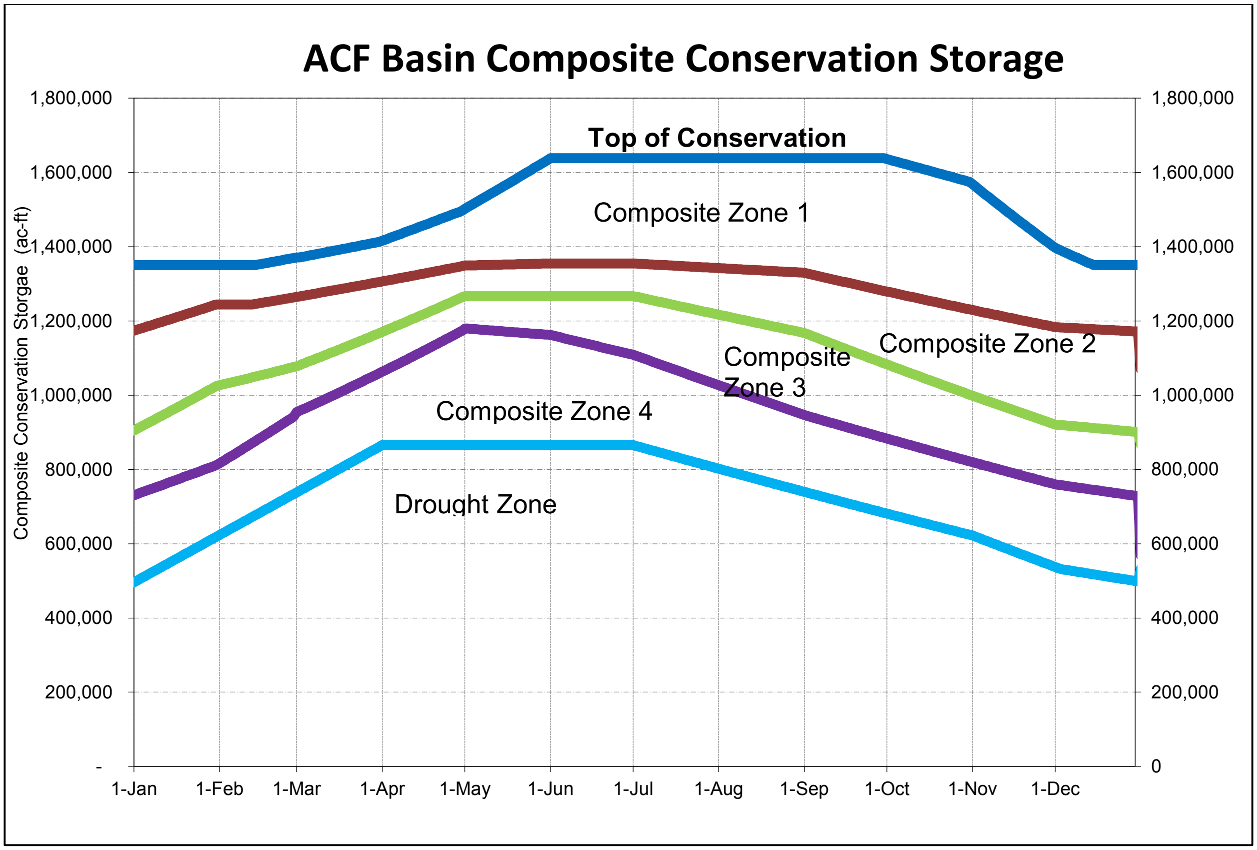


Figure 7-4. ACF Basin Composite Conservation and Flood Storage

The following definitions apply to the composite action zones:

Zone 1: If all the lakes are in Zone 1 or above, the river system would operate in a fairly normal manner. Releases can be made for hydroelectric power, water supply, and water quality. If system composite conservation storage is in Zone 1, releases can be made in support of a navigation season (January to April or May). Drought contingency operations cease when levels return to composite action Zone 1 in accordance with the Drought Contingency Plan.

Zone 2: Hydroelectric power generation is supported at the same or a reduced level. Water supply and water quality releases are met. Minimum flow targets are met. If system composite conservation storage is in Zone 2, releases can be made in support of a navigation season (January to April or May).

Zone 3: Hydroelectric power generation is supported at a reduced level. Water supply and water quality releases are met. Minimum flow targets are met. If system composite conservation storage is in Zone 3, navigation is not supported. Drought contingency operations are triggered when levels drop to Zone 3.

Zone 4: Hydroelectric power demands will be met at a minimum level and might occur for concurrent uses only. Water supply and water quality releases are met. Minimum flow targets are met. If system composite conservation storage is in Zone 4, navigation is not supported.

Drought Zone: Hydroelectric power will only be met as a result of meeting other project purposes. Water supply and water quality releases are met. Minimum flow targets are met but are reduced to their lowest level. If system composite conservation storage is in the Drought Zone, navigation is not supported and the emergency drought operations are triggered. This reduces the minimum discharge from Jim Woodruff Dam to 4,500 cfs.

7-04. Standing Instructions to Damtender. During normal operations, the powerhouse operators will operate the Corps Projects in accordance with the daily hydropower schedule. Any deviation from the schedule must come through the Mobile District. Normally, flood control instructions are issued by the Water Management Section in the Mobile District Office. However, if a storm of flood-producing magnitude occurs and all communications are disrupted between the Mobile District and the powerhouse operators, the operators will follow detailed instructions provided in the “Standing Instructions to the Damtender for Water Control” exhibit found in the individual project manuals.

7-05. Flood Risk Management. The objective of flood risk management operations on the ACF System is to store excess flows thereby reducing downstream river levels below flood stage and producing no higher stages than would otherwise occur naturally. Whenever flood conditions occur, operation to reduce flood damage takes precedence over all other project functions. Of the five Corps reservoirs, only Lake Sidney Lanier and West Point Lake were designed with space to store flood waters. Flood risk management operations for those projects are described in Appendices B and E, respectively. Annual drawdown of reservoir storage is one foot at Lake Sidney Lanier, seven feet at West Point Lake, and two feet at Walter F. George Lake in the fall through winter to provide additional capacity to protect life and property in the basin. The George W. Andrews and Jim Woodruff Dams operate to pass inflows, while the Walter F. George Dam operates according to specified schedules for flood risk management. Flood risk management operations for the Walter F. George are described in Appendix C.

The timing of flood peaks in the ACF System is of considerable importance in determining the effectiveness of reservoir flood risk management operations and the degree to which such operations can be coordinated. During a flood event, excess water above normal pool elevation, or guide curve, should be evacuated through the use of the turbines and spillways in a manner consistent with other project needs as soon as downstream waters have receded sufficiently so that releases from the reservoirs do not cause flows to exceed bankfull capacity or maximum, non-damaging, channel capacities. Stored floodwater can be released up to the maximum, non-damaging, downstream channel capacities, consistent with regulation procedures, provided the releases do not exceed peak inflow of that event into the reservoir(s). Under certain instances, induced surcharge operations might be required to ensure project integrity, which could result in flows that exceed bankfull capacity.

7-06. Recreation. All the Corps lakes have become important recreational resources. The five Corps projects include many facilities, both public and private, that have been developed around the lakeshore. The water control plan for each project considers the recreation effects and impact levels associated with lake levels. Recreation benefits are maximized at the lakes by maintaining full or nearly full pools during the primary recreation season which are the warm summer months. In response to meeting other authorized project purposes, lake levels can and do decline during the primary recreation period, particularly during drier than normal years. Recreation impact levels have been identified for various lake elevations at each of the reservoir projects (Table 7-1). Recreational impact levels are not applicable to the George W. Andrews Project due to the lack of conservation storage and the run-of-river operation at the project.

Table 7-1. Water Levels Affecting Federal Project Recreation

Corps project	Initial impact level (ft NGVD29)	Recreation impact level (ft NGVD29)	Water access limited level (ft NGVD29)
Lake Sidney Lanier	1,066	1,063	1,060
West Point Lake	632.5	629	627
Walter F. George Lake	187	185	184
Lake Seminole	76	NA	NA

The first impact level is generally characterized by marginal effects on designated swimming areas, increased safety awareness regarding navigation hazards, minimal effects on Corps boat ramps, and minimal effects on private marina and dock owners. More substantial impacts begin to occur at the second and third impact levels.

When pool levels must be lowered, the rates at which the draw-downs occur are as steady as possible. The action zones at Lake Sidney Lanier and West Point Lake are drawn down to correlate the line between Zone 2 and Zone 3 near the Initial Impact Level at the beginning of the recreation season (May through early September). This is an attempt to maximize the time these projects are above the Initial Impact Level during the recreation season.

7-07. Water Quality. Buford, West Point, and Jim Woodruff Dams provide continuous minimum flow releases. Those releases benefit the water quality immediately downstream of the dams. There are no minimum flow provisions downstream of Walter F. George Dam. However, when low dissolved oxygen values are observed below the dam, spillway gates are opened until the dissolved oxygen readings return to an acceptable level. Occasional special releases are also made at Buford Dam to ensure adequate dissolved oxygen and water temperature at the Buford Fish Hatchery downstream of the dam.

Additionally, self-aspirating turbines were installed at Buford Dam to improve dissolved oxygen levels downstream. At Buford Dam, the small turbine generator runs continuously to provide a minimum flow from the dam, which ranges from approximately 550 to 6600 cfs, depending on head conditions. This minimum flow from Buford Dam helps to meet the minimum flow requirement of 750 cfs at Atlanta, Georgia, in the Chattahoochee River just upstream of the confluence with Peachtree Creek. At West Point Dam, the minimum flow requirement is 670 cfs and a similar small generating unit provides a continuous release of approximately 675 cfs. A varying minimum flow from 4,500 to 25,000 cfs, dependent upon basin conditions, is maintained as a release from the Jim Woodruff Dam to the Apalachicola River which assures an adequate water supply for downstream industrial use and water quality. Walter F. George Dam has two siphons on each spillway gate. The siphon discharge can range from about 15 cfs up to 200 cfs when all 12 are in use. Typically, the siphon tubes are opened continuously from May through the end of September and all 12 are used at full capacity. The siphons provide a gravity-fed, typically continuous, minimum flow that benefits dissolved oxygen levels below the dam. No water quality problems below Jim Woodruff Dam have been identified in association with project operations.

Although there is no Corps requirement to maintain minimum flows for assimilative capacity at Columbus, Georgia, the Georgia Power projects above Columbus are required in their FERC licenses to provide 1,850 cfs weekly average, 1,350 cfs daily average, and 800 cfs instantaneous, or inflow if less, minimum flow at Columbus. Releases from the Georgia Power projects are dependent on upstream releases from West Point Dam and, to a limited extent, those requirements are recognized when making release decisions for West Point Dam. There is a desired flow for 2,000 cfs below George W. Andrews Lock and Dam for cooling at Farley Nuclear Plant and for assimilative capacity needs downstream. Although those are not Corps authorized project purposes, to the extent practicable, the needs are considered in operations at Walter F. George Dam and Jim Woodruff Dam. Those needs are met only if they can be met incidentally and for concurrent use toward the authorized project purposes of the basin.

7-08. Fish and Wildlife

Fish and wildlife conservation is an authorized purpose of the reservoirs in the ACF Basin in accordance with P.L. 85-624 (Fish and Wildlife Coordination Act of 1958). All the Corps reservoirs in the ACF Basin support important fisheries and are operated accordingly, consistent with other project purposes. In addition to fishery management, such operations include aquatic plant control and waterfowl management activities. Fish and wildlife conservation operations specific to each project in the ACF Basin are described in its individual reservoir regulation manual.

a. Fish Spawning. In addition to providing for minimum flow and water quality releases, the Corps operates the system to provide favorable conditions for annual fish spawning, both in the reservoirs and the Apalachicola River. In most water years (October 1 to September 30) it is not possible to hold both lake levels and river stages at a steady or rising level for the entire spawning period, especially when upstream lakes or the Apalachicola River spawning periods overlap. During the fish spawning period for each water body (Table 7-2), the Corps' goal is to operate for a generally stable or rising lake level and a generally stable or gradually declining river stage on the Apalachicola River for approximately 4 to 6 weeks during the designated spawning period. When climatic conditions preclude a favorable operation for fish spawn, the Operations Division or Planning Division of the Corps consults with the state fishery agencies and the U.S. Fish and Wildlife Service (USFWS) on balancing needs in the system and minimizing the effects of fluctuating lake or river levels. Those operations are described in Division Regulation SADR PDS-O-1, *Lake Regulation and Coordination for Fish Management Purpose* dated 31 May 2010, and the Mobile District's draft Standard Operating Procedure 1130-2-9, *Lake Reservoir Regulation and Coordination for Fish Management Purposes* dated February 2005.

During spawning period (March to May), the Corps operates Jim Woodruff Dam to avoid potential Gulf sturgeon take. Potential Gulf sturgeon take is defined as an 8-foot or greater drop in Apalachicola River stage over the last 14-day period (i.e., is today's stage greater than 8 feet lower than the stage of any of the previous 14 days) when flows are less than 40,000 cfs.

During the non-spawning period(June to November), one set of four basin inflow thresholds and corresponding releases exists according to composite conservation storage in Zones 1 - 3. When composite conservation storage falls below the bottom of Zone 2 into Zone 3, the drought contingency operations are triggered (see Figure 7-6). When composite conservation storage falls below the bottom of Zone 2 into Zone 3, the drought contingency operations are triggered (see Figure 7-6).

Table 7-2. Project-Specific Principal Fish Spawning Period

Project	Fish spawn period
Lake Sidney Lanier	1 April – 1 June
West Point Lake	1 April – 1 June
Walter F. George Lake	15 March – 15 May
Lake Seminole	1 March - 1 May
Apalachicola River	1 April – 1 June

b. Endangered Species. The Corps manages releases from Jim Woodruff Dam to support the federally protected Gulf sturgeon and mussel species (fat threeridge, purple bankclimber, and Chipola slabshell) in the Apalachicola River. Daily releases to provide support for fish and wildlife conservation from Jim Woodruff Dam are dictated by two parameters: a minimum discharge (measured in cfs) and a maximum fall rate (measured in feet per day [ft/day]).

c. Fish Passage. The Corps, as conditions allow, operates the lock at Jim Woodruff Lock and Dam during the March through May time frame to facilitate downstream to upstream passage of Alabama shad (*Alosa alabamae*) and other anadromous fishes (those that return from the sea to rivers where they were born to spawn). There could be slight differences in the locking technique each year. However, when possible, two fish locking cycles are performed each day between 8 a.m. and 4 p.m. on each day the lock operators are scheduled to be present - one in the morning and one in the afternoon. The operation consists of opening the lower lock gates and getting fish into the lock in one of three ways; transporting them into the lock by boat, using attraction flows to entice the fish into the lock, or leaving the lower gate open for a period before a lockage and allowing the fish to move in without an attraction flow. Once the fish are in the lock (or assumed to be in the lock), the downstream doors are closed. The lock is filled to the lake elevation, and the upper gates are opened. Studies are ongoing to determine the most appropriate technique and timing for the locks, but the number of lock cycles per day will not change. The lock schedule and techniques will be closely coordinated with the Planning Division and the interagency fish passage partnership.

d. Minimum Discharge. Minimum discharges from Jim Woodruff Dam vary according to composite conservation storage, basin inflow per the 7-day moving average and by month. Table 7-3 shows these minimum releases, which are measured as a daily average flow in cfs at the USGS Chattahoochee, Florida, gage (#02358000). During normal and above normal hydrological conditions within the basin, releases greater than the minimum release provisions can occur consistent with the maximum fall rate schedule described herein, or as needed to achieve other project purposes; such as hydroelectric power generation or flood risk management.

Table 7-3. Flow Releases from Jim Woodruff Dam

Months	Composite Storage Zone	Basin Inflow (BI) (cfs)[a]	Minimum Outflows from JWLD (cfs)[b]
March - May	Zones 1 and 2	>= 34,000 >= 16,000 and < 34,000 >= 5,000 and < 16,000 < 5,000	= 25,000 = 16,000 + 50% BI > 16,000 = BI = 5,000
	Zone 3	>= 39,000 >= 11,000 and < 39,000 >= 5,000 and < 11,000 < 5,000	= 25,000 = 11,000 + 50% BI > 11,000 = BI = 5,000
June - November	Zones 1,2, and 3	>= 22,000 >= 10,000 and < 22,000 >= 5,000 and < 10,000 < 5,000	= 16,000 = 10,000 + 50% BI > 10,000 = BI = 5,000
December - February	Zones 1,2, and 3	>= 5,000 < 5,000	= 5,000 = 5,000
IF Drought Triggered[c]	Zone 3	NA	= 5,000[d]
At all times	Zone 4	NA	=5,000
At all times	Corps Extreme Drought Zone	NA	= 4,500[e]

Footnotes:

a. Basin inflow for composite conservation storage in Zones 1, 2, and 3 are calculated on the basis of the 7-day moving average basin inflow. Basin inflow for composite conservation storage in Drought Operations, Zones 3 and 4 or lower (Drought Zone) is calculated on the basis of the one-day basin inflow.

b. Consistent with safety requirements, flood risk management purposes, and equipment capabilities.

c. Drought plan is triggered when the composite conservation storage falls into Zone 3, the first day of each month represents a decision point.

d. Once drought operation triggered, reduce minimum flow to 5,000 cfs following the maximum ramp rate schedule.

e. Once composite storage falls below the top of the Corps Extreme Drought Zone ramp down to a minimum release of 4,500 cfs at rate of 0.25 ft/day based on the USGS gage at Chattahoochee, Florida (#02358000).

Minimum releases are dictated according to basin inflow threshold levels that vary by three seasons - spawning season (March to May) depicted on Figure 7-5; non-spawning season (June to November) depicted on Figure 7-6; and winter (December to February) depicted on Figure 7-7. Composite conservation storage threshold factors are also incorporated into minimum release decisions. Any minimum release that falls above the “Basin Inflow” line on the charts indicates water must be used from storage to meet the requirement, while any release requirement that falls below that line indicates that basin inflow in excess of the minimum flow requirement can be stored in the conservation storage. Composite conservation storage is calculated by combining the conservation storage of Lake Sidney Lanier, West Point Lake, and Walter F. George Lake. Flood storage is not included in the calculation of composite conservation storage, with the exception of temporary deviations (an example being temporarily storing water within West Point’s flood zone due to head limits at Walter F. George). Composite conservation storage is shown in Figure 7-4. Each of the individual storage reservoirs consist of four action zones. The composite conservation storage uses the same four action zone concepts. Zone 1 of the composite conservation storage represents the combined storage available in Zone 1 for each of the three storage reservoirs. During the spawning season, two sets of four basin inflow thresholds and corresponding releases exist according to composite conservation storage. When composite conservation storage is in Zones 1 and 2, a less conservative operation is in place. When composite conservation storage is in Zone 3, a more conservative operation is in place while still avoiding or minimizing effects on listed species and critical habitat in the river. When composite conservation storage falls below the bottom of Zone 2 into Zone 3, the drought contingency operations are triggered. Within Zone 4, the minimum flow is the same as in zone 3. When the composite conservation storage drops further into the Drought Zone, Extreme Drought Operations (EDO) begin and the minimum flow from Jim Woodruff Dam is reduced to 4,500 cfs. A detailed description of the drought contingency operations is provided in Paragraph 7-11. During the spawning season, a daily monitoring plan that tracks composite conservation storage and basin inflow will be implemented to determine water management operations.

(1) Spawning Period (March to May). During this period, the Corps operates Jim Woodruff Dam to avoid potential Gulf sturgeon take. Potential Gulf sturgeon take is defined as an 8-foot or greater drop in Apalachicola River stage over the last 14-day period (i.e., is today's stage greater than 8 feet lower than the stage of any of the previous 14 days) when flows are less than 40,000 cfs. When composite conservation storage falls below the bottom of Zone 2 into Zone 3, the drought contingency operations are triggered (see Figure 7-6).

(2) Non-Spawning Period (June to November). During the non-spawning period, one set of four basin inflow thresholds and corresponding releases exists according to composite conservation storage in Zones 1 - 3. When composite conservation storage falls below the bottom of Zone 2 into Zone 3, the drought contingency operations are triggered (see Figure 7-6).

(3) During the winter season (December to February), only one basin inflow threshold and corresponding minimum release (5,000 cfs) exists while in composite conservation storage Zones 1 - 4. That provides the greatest opportunity to refill the storage reservoirs. No basin inflow storage restrictions are in effect as long as this minimum flow is met under such conditions.

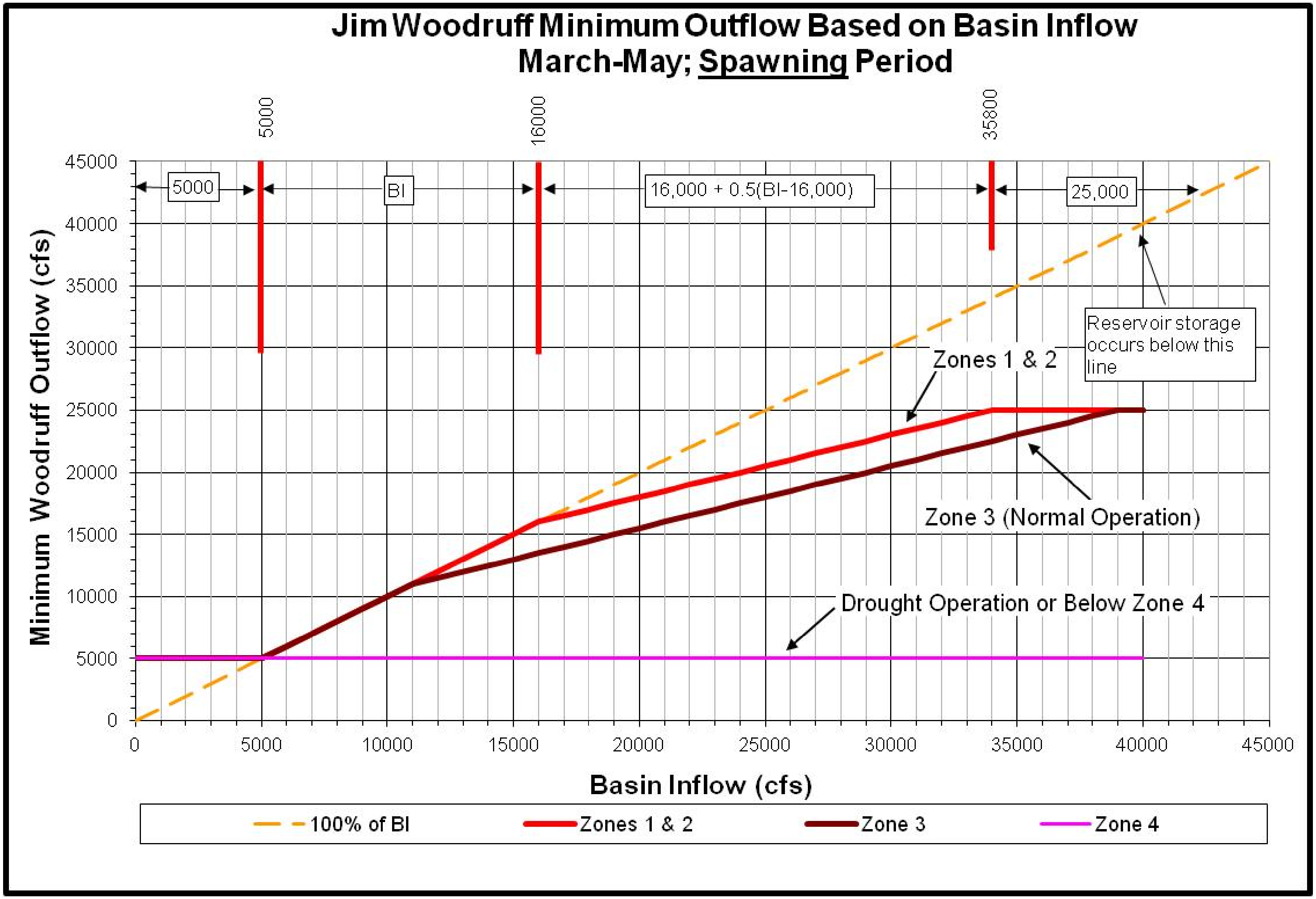
f. Maximum Fall Rate. Fall rate, also called down-ramping rate, is the vertical drop in river stage (water surface elevation) that occurs over a given period of time. The fall rates are expressed in units of ft/day and are measured at the USGS Apalachicola River gage (#02358000) near Chattahoochee, Florida, as the difference between the daily average river stage on consecutive calendar days. Rise rates (e.g., today's average river stage is higher than yesterday's) are not addressed. The maximum fall rate schedule is provided in Table 7-4. When composite conservation storage falls into Zone 3, and the drought contingency operation described below is implemented, the maximum fall rate schedule is suspended and more conservative drought contingency operations begin (see Drought Contingency Operations, paragraph 7-11). Down-ramping rates are also suspended during periods of prolonged low flow (flows less than 7,000 cfs for a period of more than 30 consecutive days). A prolonged low flow period is considered over and down-ramping rates would be reinstated when flows are greater than 10,000 cfs for 30 consecutive days. Unless extreme drought operations are triggered, fall rates under drought contingency and prolonged low flow operations would be managed to match the fall rate of the basin inflow.

Table 7-4. Maximum Down-Ramping Rate

Release Range (cfs)	Maximum Fall Rate (ft/day), measured at Chattahoochee gage
> 30,000*	No ramping restriction**
> 20,000 and <= 30,000*	1.0 to 2.0
Exceeds Powerhouse Capacity (~ 16,000) and <= 20,000*	0.5 to 1.0
Within Powerhouse Capacity and > 10,000*	0.25 to 0.5
Within Powerhouse Capacity and <= 10,000*	0.25 or less

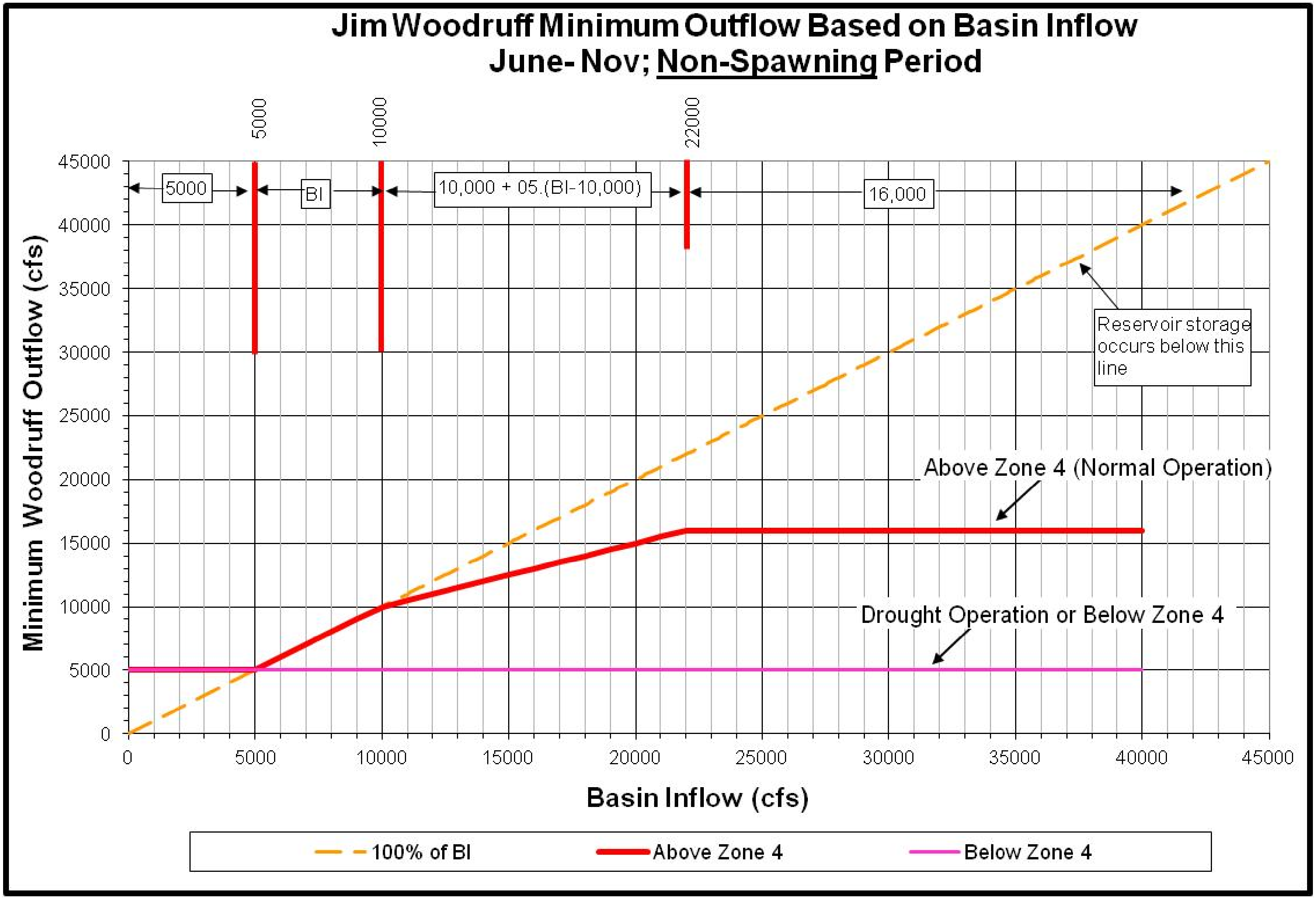
*Consistent with safety requirements, flood risk management purposes, and equipment capabilities.

**For flows greater than 30,000 cfs, it is not reasonable and prudent to attempt to control down ramping rate, and no ramping rate is required.



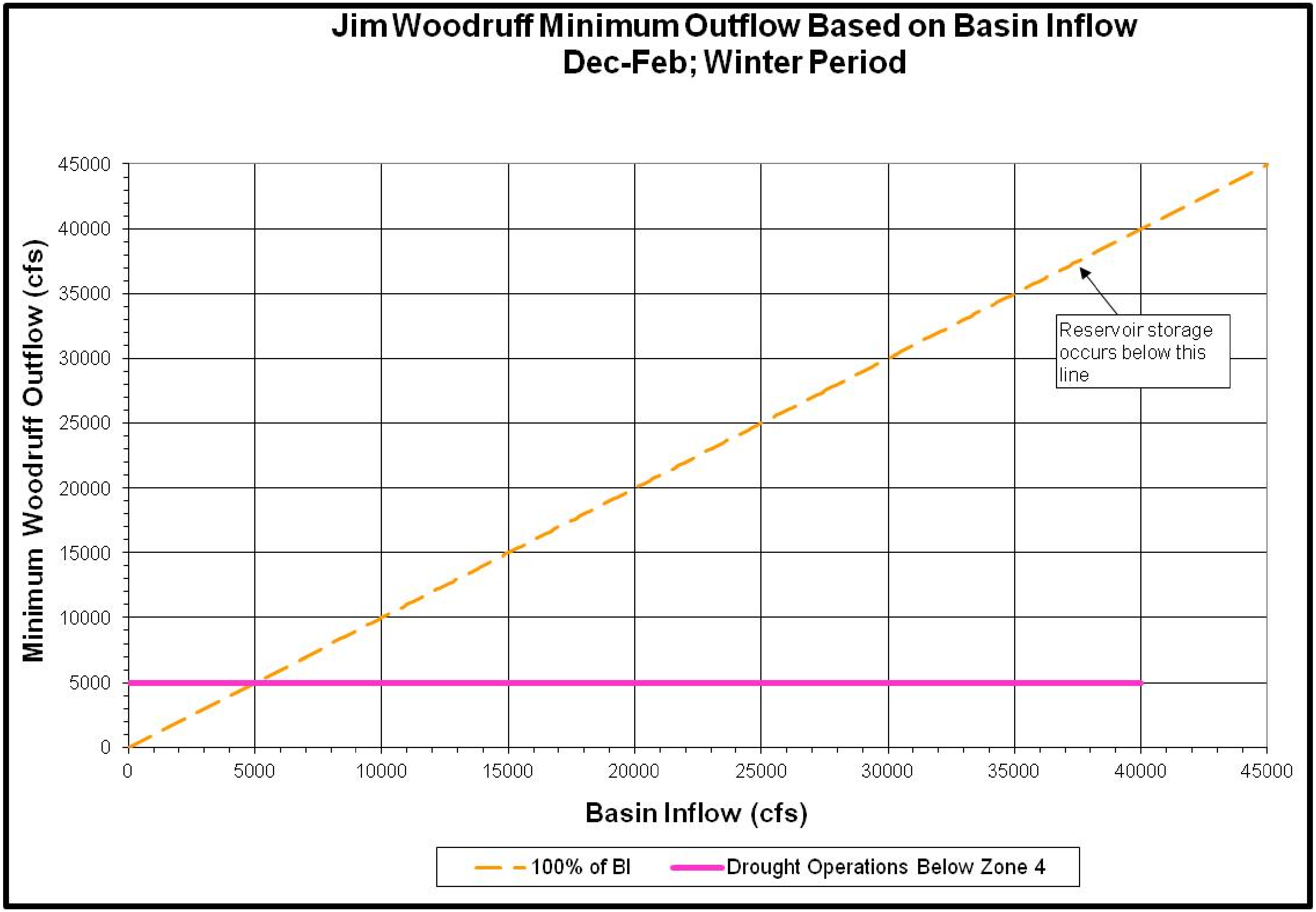
Note: The area below the dashed 100% of BI line represents the potential to store water in the basin storage projects

Figure 7-5. Minimum Woodruff Discharge during Spawning Season



Note: The area below the dashed 100% of BI line represents the potential to store water in the basin storage projects

Figure 7-6. Minimum Woodruff Discharge during Non-Spawning Season



Note: The area below the dashed 100% of BI line represents the potential to store water in the basin storage projects

Figure 7-7. Minimum Woodruff Discharge during Winter Season

7-09. Water Supply. Municipal and industrial (M&I) entities withdraw water from both the reservoirs and the rivers that comprise the ACF System. The reservoir withdrawals are made pursuant to two different legal authorities. M&I entities withdraw water directly from Lake Sidney Lanier and West Point Lake under relocation agreements. At Lake Sidney Lanier, water withdrawals from the reservoir are made pursuant to the existing relocation contracts for the Cities of Gainesville, Georgia, and Buford, Georgia, at rates not exceeding 8 (net) and 2 mgd, respectively. Buford intakes are at elevations 1,062, 1,052, 1,042, and 1,032 feet NGVD29. Gainesville has three intake structures, each with multiple intake ports ranging from elevation 1,063 down to 1,025 feet NGVD29. At West Point Lake, the City of LaGrange, Georgia, has a relocation contract for 8.35 mgd and was assigned the 12.96 mgd relocation contract of the now defunct Milliken Carpet Company. LaGrange's intakes are at elevation 600, 618, 623, and 628 feet NGVD29.

Pursuant to the Water Supply Act of 1958, the Corps has allocated 189,497 acre-feet in Lake Sidney Lanier for water supply in accordance with a water storage agreement with the State of Georgia. The amount of storage was estimated to yield 165 mgd during the critical drought, i.e., during the worst drought on record at the time the agreement was executed. The severity and frequency of droughts change over time, therefore, the yield of this storage may change over time.

For the purpose of managing water supply storage, the Mobile District has employed a storage accounting methodology that applies a proportion of inflows and losses, as well as direct withdrawals by specific users, to each account. The amount of water that may actually be withdrawn is ultimately dependent on the amount of water available in the storage account, which will naturally change over time.

Other M&I entities withdraw water directly from the Chattahoochee, Flint, and the Apalachicola Rivers for water supply. Reservoir operations are also influenced by agricultural water withdrawals on the Flint River. Agricultural demands vary depending on the climatic conditions but are generally 1.5 to 2 times the withdrawals by M&I entities (USFWS 2006). Water withdrawals in Georgia are made pursuant to water withdrawal permits issued by GADNR.

Releases from Buford Dam flow downstream in the Chattahoochee River to the Atlanta area municipal water intakes downstream. Peaking hydroelectric power generation generally occurs between 5:00 a.m. to 9:00 a.m. Central time and 3:00 p.m. to 10:00 p.m. Central time on Monday through Friday between 1 October and 31 March and between 1:00 p.m. to 7:00 p.m. on Monday through Friday between 1 April and 30 September. A by-product of these peaking releases is the accommodation of most water withdrawal supply needs for the City of Atlanta. However, under the 1946 Rivers and Harbors Act, generation might occur outside those time frames to specifically meet the city of Atlanta water supply needs, not to exceed 408 mgd.

ARC and the GPC have agreements to reregulate power releases from Buford Dam to provide a more dependable flow below Morgan Falls Dam. GPC operates the Morgan Falls Dam to support ARC's Water Management System for the Chattahoochee River. Morgan Falls Dam maintains a continuous minimum seasonal flow to provide a set flow at Peachtree Creek. The GPC releases include anticipated withdrawals by Cobb County-Marietta Water Authority and Atlanta. Withdrawals also occur at a number of other downstream M&I water supply intakes including the Cities of LaGrange, West Point, Columbus, and a number of industries; however, the Corps does not make specific water supply releases for these withdrawals.

7-10. Hydroelectric Power. The ACF Basin is in the southern sub-region of the Southeastern Electrical Reliability Corporation (SERC, formerly the Southeastern Electrical Reliability Council) and the larger North American Electrical Reliability Corporation. The southern sub-region of the SERC consists of five smaller control areas that are each individually managed by Alabama Electric Cooperative, Oglethorpe Power Corporation, South Mississippi Electrical Power Association, Walton Electric Membership Corporation, and the Southern Company. Southern Company's GPC Division is the primary private operator in the ACF Basin. GPC operates eight hydroelectric dams. The Buford, West Point, Walter F. George, and Jim Woodruff Projects include hydroelectric power plants. The total generation capacity of the four ACF hydroelectric power plants is 425.35 MW (declared). Through the Department of Energy's Southeastern Power Administration, the power plants provide power to nearly 500 preference customers throughout the southeastern United States. In calendar year (CY) 2013, the ACF Basin hydroelectric power plants generated nearly 1.17 million megawatt hours (MWH), enough electricity to supply approximately 115,000 households in the region. Table 7-5 shows the annual variation in hydropower generation for Calendar Years (CY) 2004-2013 at the four, ACF federal hydropower projects. Hydroelectric power generation is achieved by passing flow releases to the maximum extent possible through the turbines at each project, even when making releases to support other project purposes.

Table 7-5. ACF Hydropower Generation (MWH)

CY	Buford	West Point	Walter F. George	Woodruff	Total
2004	104,667	158,278	389,181	243,212	895,338
2005	214,630	183,195	466,378	240,929	1,105,132
2006	141,196	56,881	296,463	194,452	688,992
2007	123,860	93,526	210,311	171,531	599,228
2008	69,693	92,730	253,989	190,909	607,321
2009	134,932	237,765	491,488	171,762	1,035,947
2010	199,158	214,140	362,317	159,685	935,300
2011	176,028	134,378	266,926	178,608	755,940
2012	106,343	96,257	187,062	146,144	535,806
2013	212,413	251,237	470,117	233,401	1,167,168
					-
10-year sum	1,482,920	1,518,387	3,394,232	1,930,633	8,326,172
10-year average	148,292	151,839	339,423	193,063	832,617

The Buford, West Point, and Walter F. George Projects are operated as peaking plants, and provide electricity during the peak demand periods of each day and week. Hydroelectric power peaking involves increasing the discharge for a few hours each day to near the full capacity of one or more of the turbines. Typically, the Buford, West Point, and Walter F. George Projects provide generation five days a week at plant capacity throughout the year, as long as their respective lake levels are above Zone 4 and drought operations have not been triggered. For example, demand for peak hydroelectric power at Buford Dam typically occurs on weekdays from 5:00 a.m. to 9:00 a.m. Central time and from 3:00 p.m. to 10:00 p.m. between 1 October and 31 March, and on weekdays from 1:00 p.m. to 7:00 p.m. between 1 April and 30 September. The typical hours of generation represent releases that would normally meet water system demands and also provide the capacity specified in marketing arrangements. During dry periods, generation could be eliminated or limited to conjunctive releases. The typical, but not required, hours of operation by action zone are presented in Table 7-6.

Table 7-6. Typical Hours of Peaking Hydroelectric Power Generation by Federal Project

Action zone	Lake Lanier (hours of operation) normal ops/drought ops	West Point (hours of operation)	Walter F. George (hours of operation)
Zone 1	3/2	4	4
Zone 2	2/1	2	2
Zone 3	2/1	2	2
Zone 4*	0	0	0

***While hydropower would still be generated in Zone 4, it could not be generated on a regular peaking schedule under severe drought conditions.**

In addition to hydroelectric power generation being governed by action zone, there are also physical limitations that factor into the power generation decisions. During high flow conditions, the reduction in the difference in headwater and tailwater may cause the hydropower units at West Point, Walter F. George or Jim Woodruff to become inoperable due to loss of head. This would only occur during extremely high releases at West Point and Walter F. George, but often occurs multiple times in one year at Jim Woodruff as a result of more moderate high flow releases. A reduction in the generation capacity of a unit can also occur as a result of extremely low lake levels during droughts. Each plant's minimum operating head is included in supplementary pertinent data in the appendix for each project. Hydroelectric power generation at Buford Dam is often limited by the downstream channel capacity, limiting the continuous generation with both main units to four hours followed by five hours continuous generation with one main unit, before resuming generation with both main units. This is especially critical during periods of high flow in the winter and spring months.

Scheduled and unscheduled unit outages can occur throughout the year affecting the ability to release flow through some or all the turbines.

Because it does not have the ability to store appreciable amounts of flow, the Jim Woodruff Dam is operated as a run-of-the-river plant where inflows are passed continuously and electricity is generated around the clock. A limited hydroelectric power peaking operation occurs at Jim Woodruff Dam when daily average releases are less than the combined capacity of the powerhouse turbines (about 16,000 cfs) to deliver extra power during hours of peak demand for electricity. Those peaking releases are included in the daily average discharge computations for minimum flow provisions. The peaks are also included in the stage computations for the maximum fall rate schedule; however, the maximum fall rate schedule addresses the difference between the average river stage on consecutive calendar days, not the shorter-term differences that result from peaking operations within a calendar day. As average daily releases approach 6,500 cfs, peaking operations at the Jim Woodruff plant may be curtailed to maintain instantaneous releases greater than or equal to the 5,000 cfs minimum flow requirement.

7-11. Navigation. The existing project authorizes a 9-foot deep by 100-foot wide waterway from Apalachicola, Florida, to Columbus, Georgia, on the Chattahoochee River, and to Bainbridge, Georgia, on the Flint River. Conditions on the Apalachicola River have been such in recent years that a 9-foot deep channel has not been available for much of the year. Dredging on the Apalachicola River has been reduced since the 1980s because of a lack of adequate disposal area capacity in certain reaches of the river. No dredging has been conducted on the Apalachicola River since 2001 for a variety of reasons related to flow or funding levels and has been indefinitely deferred because of denial of a section 401 water quality certificate from the State of Florida. Also, the Apalachicola River was designated as a low use navigation project in Fiscal Year 2005 which greatly reduces the likelihood of receiving funding for maintenance dredging. The lack of dredging and routine maintenance has led to inadequate depths in the Apalachicola River navigation channel.

When supported by ACF Basin hydrologic conditions, the Corps will provide a reliable navigation season. The water management objective is to ensure a predictable minimum navigable channel in the Apalachicola River for a continuous period that is sufficient for navigation use.

Assuming basin hydrologic conditions allow, a typical navigation season would begin in January of each year and continue for 4 to 5 consecutive months (January through April or May). Figure 7-8 graphically represents the navigation season and its relationship to composite conservation storage. During the navigation season, the flows at the Blountstown, Florida, gage (USGS # 02358700) should be adequate to provide a minimum channel depth of 7 feet. The most recent channel survey and discharge-stage rating was used to determine the flow required to sustain a minimum navigation depth during the navigation season. Flows of 16,200 cfs provide a channel depth of 7 feet. Flows of 20,600 cfs provide a channel depth of 9 feet. The Corps' capacity to support a navigation season will be dependent on actual and projected system-wide conditions in the ACF Basin before and during January, February, March, April and May. Those conditions include the following:

- A navigation season can be supported only when ACF Basin composite conservation storage is in Zone 1 or Zone 2.
- A navigation season will not be supported when the ACF Basin composite conservation storage is in Zone 3 and below. Navigation support will resume when basin composite conservation storage level recovers to Zone 1.
- A navigation season will not be supported when drought operations are in effect. Navigation will not be supported until the ACF Basin composite conservation storage recovers to Zone 1.
- The determination to extend the navigation season beyond April will depend on ACF Basin inflows, recent climatic and hydrologic conditions, meteorological forecasts, and basin-wide model forecasts. On the basis of an analysis of those factors, the Corps will determine if the navigation season will continue through part or all of May.
- Down-ramping of flow releases will adhere to the Jim Woodruff Dam fall rate schedule for federally listed species during the navigation season.
- Releases that augment the flows to provide a minimum 7-foot navigation depth will also be dependent on navigation channel conditions that ensure safe navigation.

When it becomes apparent that, because of diminishing inflows, downstream flows and depths must be reduced, the Water Management Section will notify the Navigation Section that flows are anticipated to approach critical navigable depths. Water Management will provide the Navigation Section with a forecast of flows over the coming week and the Navigation Section will then issue navigation bulletins to project users. The notices will be issued as expeditiously as possible to give barge owners, and other waterway users, sufficient time to make arrangements to light load or remove their vessels before action is taken at Jim Woodruff Lock and Dam to reduce releases.

Although special releases will not be standard practice, they could occur for a short duration to assist navigation during the navigation season. For instance, releases can be requested to achieve up to a 9-foot channel. The Corps will evaluate such request on a case-by-case basis, subject to applicable laws and regulations and the conditions above.

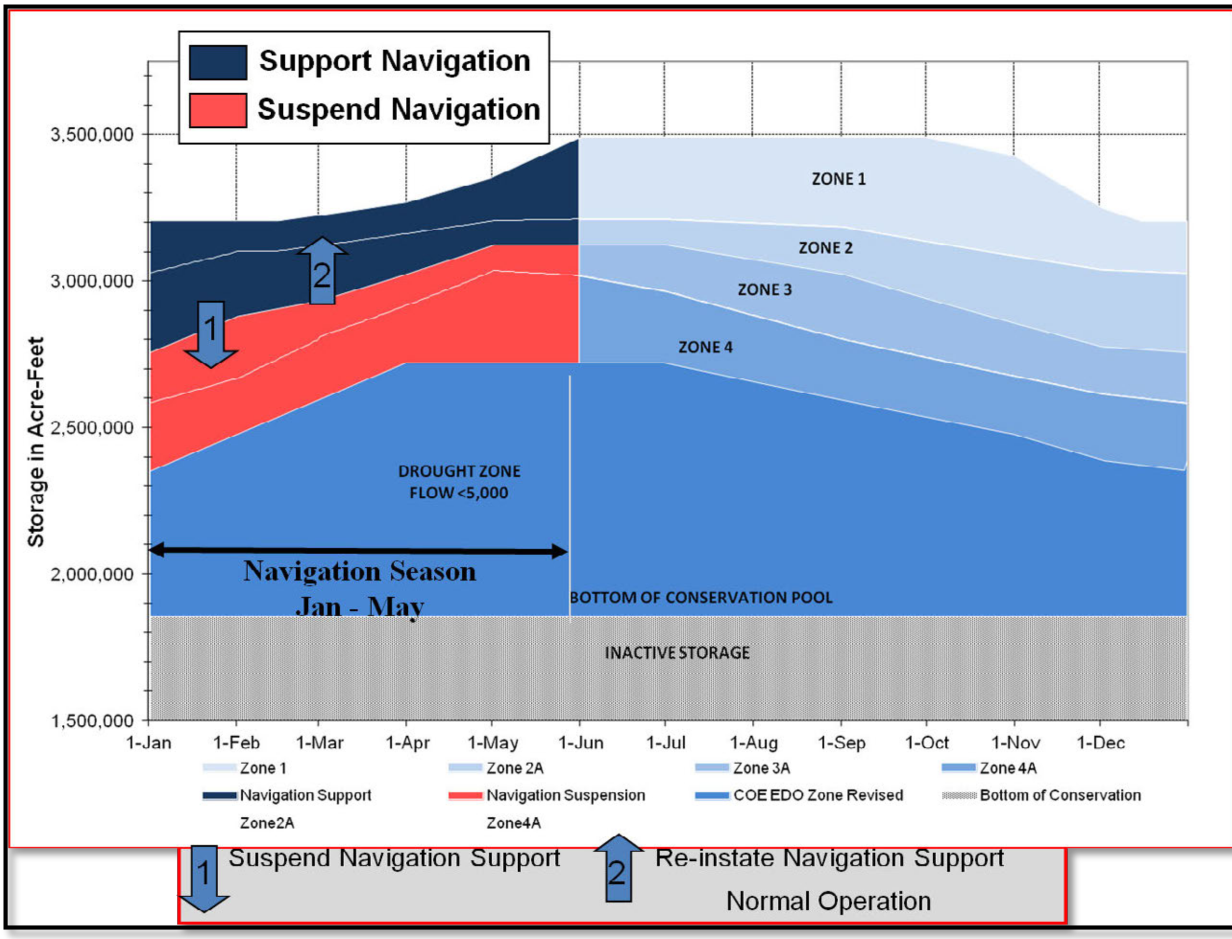


Figure 7-8. Composite Conservation Storage for Navigation

7-12. Drought Contingency Plans. In accordance with ER 1110-2-1941, Drought Contingency Plans, dated 15 September 1981, an ACF Drought Contingency Plan is included as Exhibit B of this manual. The following information provides a summary of the Drought Management Plan water control actions for the ACF Basin Corps projects.

Drought operations are triggered on the first day of the month following the day that ACF composite conservation storage enters Zone 3, from Zone 2 (Figure 7-9). At that time, all the composite conservation storage Zone 1 - 3 provisions (seasonal storage limitations, maximum fall rate schedule, and minimum flow thresholds) are suspended and management decisions are based on the provisions of the drought plan. Under the drought plan, the minimum discharge is determined in relation to composite conservation storage only. The drought plan for the ACF Basin specifies a minimum release from Jim Woodruff Dam and temporarily suspends the other minimum release and maximum fall rate provisions until composite conservation storage in the basin is replenished to a level that can support the minimum releases and maximum fall rates. The drought plan also includes a temporary waiver from the water control plan to allow temporary storage above the winter pool guide curve at the Walter F. George and West Point Projects if the opportunity presents itself. There is also an opportunity to begin spring refill operations at an earlier date to provide additional conservation storage for future needs.

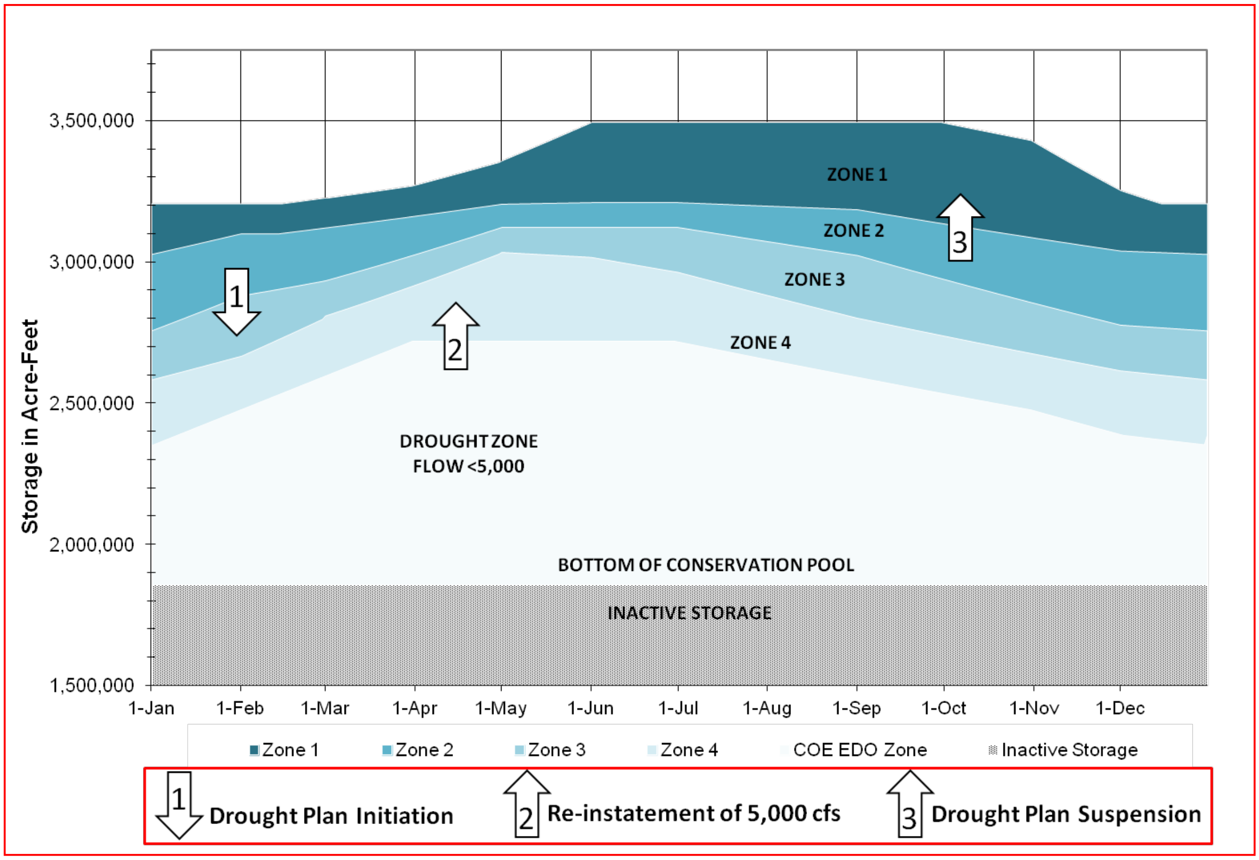


Figure 7-9. Drought Operation Triggers

The drought plan prescribes two minimum releases based on composite conservation storage in Zones 3 and 4 and an additional zone referred to as the Drought Zone. The Drought Zone delineates a volume of water roughly equivalent to the inactive storage in Buford, West Point and Walter F. George reservoirs plus Zone 4 storage in Buford. The Drought Zone line has been adjusted to include a smaller volume of water at the beginning and end of the calendar year. When the composite storage is within Zone 4 and above the Drought Zone, the minimum release from Jim Woodruff Dam is 5,000 cfs, and all basin inflow above 5,000 cfs that is capable of being stored may be stored. Once the composite conservation storage falls into the Drought Zone, the minimum release from Jim Woodruff Dam is 4,500 cfs and all basin inflow above 4,500 cfs that is capable of being stored may be stored. When transitioning from a minimum release of 5,000 to 4,500 cfs, fall rates will be limited to a 0.25-ft/day drop. The 4,500 cfs minimum release is maintained until composite conservation storage returns to a level above the top of the Drought Zone, at which time the 5,000-cfs minimum release is reinstated.

The drought plan provisions remain in place until conditions improve such that the composite conservation storage reaches Zone 1. At that time, the temporary drought plan provisions are suspended, and all the other provisions are reinstated. During the drought contingency operations, a monthly monitoring plan that tracks composite conservation storage to determine water management operations (the first day of each month will represent a decision point) will be implemented to determine which operational triggers are applied. In the event the composite conservation storage has not recovered to Zone 1 by 1 March, drought operations will be extended to the end of March unless all the federal reservoirs are full. The month of March usually provides the highest inflows into the reservoirs, but also has some of the highest flow requirements for release from Jim Woodruff Dam. This extension of drought operations allows for the full recovery of the federal storage projects in preparation for the spawning and spring refill period that occur from April through June.

7-13. Flood Emergency Action Plans. The Corps is responsible for developing Flood Emergency Action Plans for the ACF System, in accordance with ER 1110-2-1156, *Engineering and Design Safety of Dams – Policy and Procedures*, 28 October 2011. Each federal reservoir project in the ACF Basin has a stand-alone Emergency Action Plan document retained on site and in the Mobile District Office. Example data available are emergency contact information, flood inundation information, management responsibilities, and procedures for use of the plan.

7-14. Other. Other considerations, in addition to the authorized project purposes, may be accommodated on an as needed basis. Adjustments are made to system regulation at times for downstream construction, to aid in rescue or recovery from drowning accidents, environmental studies, or cultural resource investigations.

7-15. Deviation from Normal Regulation. Water management inherently involves adapting to unforeseen conditions. The development of water control criteria for the management of water resource systems is carried out throughout all phases of a water control project. The water control criteria are based on sound engineering practice utilizing the latest approved models and techniques for all foreseeable conditions. There may be further refinements or enhancements of the water control procedures in order to account for changed conditions resulting from unforeseen conditions, new requirements, additional data, or changed social or economic goals. However, it is necessary to define the water control plan in precise terms at a particular time in order to assure carrying out the intended functional commitments in accordance with the authorizing documents (EM 1110-2-3600 Management of Water Control Systems). Adverse impacts of the water control plan may occur due to unforeseen conditions. When this occurs, actions will be taken within applicable authority, policies, and coordination to address these conditions when they occur through the implementation of temporary deviations to the water control plan, such as interim operation plans. Such deviations may require additional environmental compliance prior to implementation.

The Corps is occasionally requested to deviate from the water control plan. Prior approval for a deviation is required from the Division Commander except as noted in subparagraph a. Deviation requests usually fall into the following categories:

a. <u>Emergencies</u>. Examples of some emergencies that can be expected at a project are drowning and other accidents, failure of the operation facilities, failure of another ACF project, chemical spills, treatment plant failures, and other temporary pollution problems. Water control actions necessary to abate the problem are taken immediately unless such action would reasonably be expected to create equal or worse conditions. The Mobile District will notify the Division office as soon as practicable.

b. Declared System Emergency. A Declared System Emergency can occur when there is a sudden loss of power within the electrical grid and there is an immediate need of additional power generation capability to meet the load on the system. In the Mobile District, a system emergency can be declared by the Southern Company or the Southeastern Power Administration's Operation Center. Once a system emergency has been declared, the requester will contact the project operator and request generation support. The project operator will then lend immediate assistance within the projects operating capabilities. Once support has been given, the project operator should inform the Mobile District Office immediately. The responsibilities and procedures for a Declared System Emergency are discussed in more detail in Division Regulation Number 1130-13-1, *Hydropower Operations and Maintenance Policies*. It is the responsibility of the District Hydropower Section and the Water Management Section to notify South Atlantic Division Operations Branch of the declared emergency. The Division Operations Branch should then coordinate with SEPA, District Water Management, and the District Hydropower section on any further actions needed to meet the needs of the declared emergency.

c. Unplanned Deviations. Unplanned instances can create a temporary need for deviations from the normal regulation plan. Unplanned deviations may be classified as either major or minor but do not fall into the category of emergency deviations. Construction accounts for many of the minor deviations and typical examples include utility stream crossings, bridge work, and major construction contracts. Minor deviations can also be necessary to carry out maintenance and inspection of facilities. The possibility of the need for a major deviation mostly occurs during extreme flood events. Requests for changes in release rates generally involve periods ranging from a few hours to a few days, with each request being analyzed on its own merits. In evaluating the proposed deviation, consideration must be given to impacts on project and system purposes, upstream watershed conditions, potential flood threat, project condition, and alternative measures that can be taken. Approval for unplanned deviations, either major or minor, will be obtained from the Division Office by telephone or electronic mail prior to implementation.

d. Planned Deviations. Planned deviations can result from scheduled maintenance of the water control equipment associated with the dam or hydropower generation or activities associated with the operation and maintenance of the reservoir facilities, including shoreline maintenance. Each condition should be analyzed on its merits. Sufficient data on flood potential, lake and watershed conditions, possible alternative measures, benefits to be expected, and probable effects on other authorized and useful purposes, together with the district recommendation, will be presented by letter or electronic mail to the Division Office for review and approval.

7-16. Rate of Release Change. Gradual changes are important when releases are being decreased and downstream conditions are very wet, resulting in saturated riverbank conditions. The Corps acknowledges that a significant reduction in basin releases over a short period can result in some bank sloughing, and release changes are scheduled accordingly when a slower rate of change does not significantly affect downstream flood risk. Overall, the effect of basin regulation on streambank erosion has been reduced because higher peak-runoff flows into the basin are captured and metered out more slowly.

Maximum fall rate on the Apalachicola River is addressed in Paragraph 7-07 of this manual.

VIII - EFFECT OF SYSTEM WATER CONTROL PLAN

8-01. General. ACF Basin multi-purpose reservoir and navigation projects have produced major effects on the basin's water and land resources and have provided significant local, regional, and national benefits. The following generally describe the effects and benefits produced by the federal water control regulation conducted in the ACF Basin.

The impacts of the *ACF Master Water Control Manual* and its Appendices have been fully evaluated in an Environmental Impact Statement (EIS) that was published on (date). A Record of Decision (ROD) for the action was signed on (date). During the preparation of the EIS, a review of all direct, secondary and cumulative impacts was made. As detailed in the EIS, the decision to prepare the Water Control Manual and the potential impacts was coordinated with Federal and State agencies, environmental organizations, Indian tribes, and other stakeholder groups and individuals having an interest in the basin. The ROD and EIS are public documents and references to their accessible locations are available upon request.

8-02. Flood Risk Management. One of the major benefits of the water control operations in the ACF System is flood risk management. Lake Sidney Lanier and West Point Lake both contain flood risk management storage space in which flood water is stored and later released in moderate amounts to prevent downstream flooding. Walter F. George Dam operates according to specified schedules for flood risk management, while George W. Andrews and Jim Woodruff Dams operate to pass inflows. During most years, one or more flood events occur in the ACF Basin. While most of the events are of minor significance, there are occasions where major storms occur that produce widespread flooding or unusually high river stages. Before project construction the record storm of December 1919, as well as major flooding events in July 1916, March 1929, and February 1961 resulted in extensive damage and loss of life in the basin. More recently, major floods have occurred in February 1990, January 1996, May 2003, and September 2009. While those four floods also resulted in considerable damage, a total of more than $216 million in estimated damages was prevented as a result of the ACF System flood risk management operations. Since 1989, more than $256 million in estimated flood damages from all flooding events have been prevented.

Generally, water is stored in the ACF Basin reservoirs during high-flow periods of the winter and spring and is released during the drier late summer and fall months of the year. This has the benefit of ensuring a greater availability of water to serve the various downstream purposes and uses during low-flow periods. The storage and release of water has resulted in a seasonal redistribution of flows below the reservoirs. By comparing the unimpaired flows - flows that would have occurred in the basin in the absence of any project development and consumptive use of water - with actual measured flows, the changes in volume and the seasonal redistribution can be observed.

8-03. Flood Emergency Action Plans. The Mobile District is responsible for developing Flood Emergency Action Plans for the ACF System. Individual Flood Emergency Action Plans have been developed for each of the system dams. The plans are presented in the individual project manuals in Appendices A through E. The plans are for use in coordination with the Mobile District during a flood emergency or for guidance if that communication with the District is lost. The plans are intended to serve only as temporary guidance for operating a project in an emergency until Mobile District staff can assess the results of real-time hydrologic model runs and issue more detailed instructions to project personnel. The benefits of Flood Emergency Action Plans are to minimize uncertainties in how to operate a project in a flood emergency, to facilitate quick action to mitigate the adverse impacts of a flood event, and to provide for emergency action exercises to train operating personnel on how to respond in an actual emergency flood situation.

8-04. Recreation. The Corps lakes in the ACF Basin are important recreational resources, providing significant economic and social benefits for the region and the nation. The five Corps projects in the basin contain more than 365,000 total acres of land and water, most of which are available for public use. Many recreational opportunities are provided at the lakes including boating, fishing, hunting, camping, picnicking, water skiing, and sightseeing. Mobile District park rangers and other project personnel conduct numerous environmental and historical educational tours and presentations, as well as water safety instructional sessions each year for the benefit of area students and project visitors. The reservoirs support popular sport fisheries, some of which have achieved national acclaim for trophy-size catches of largemouth bass. Corps lakes in the ACF Basin received almost 15 million visitors in 2012. Lake Sidney Lanier (Buford Dam) had more than 6.5 million visitors; West Point Lake more than 2.0 million visitors; Walter F. George Lake almost 3.3 million visitors; Lake George W. Andrews more than 221 thousand visitors; and Lake Seminole more than 2.4 million visitors in 2012. The local and regional economic benefits of recreation at the lakes are significant, totaling $577.5 million during 2012. Recreational visitor spending within 30 miles of each project was $253.3 million at Lake Sidney Lanier; $63.9 million at West Point Lake; $135.1 million at Walter F. George Lake; $8.4 million at Lake George W. Andrew; and $116.8 million at Lake Seminole. Approximately 53 percent of the spending was captured by the local economy as direct sales effects (source: http://www.corpsresults.us/recreation/recfastfacts.cfm).

The effects of the ACF Basin water control operations on recreation facilities and use at the projects are described as impact levels - Initial Impact Level, Recreation Impact Level, and Water Access Limited Level. The impact levels are defined as pool elevations with associated effects on recreation facilities and exposure to hazards within each lake. The first impact level is generally characterized by marginal effects on designated swimming areas, increased safety awareness regarding navigation hazards, minimal effects on Corps boat ramps, and minimal effects on private marina and dock owners. More substantial impacts begin to occur at the second and third impact levels. Recreation impact levels at the Corps reservoir projects in the ACF Basin are described further in the individual project water control manual appendices. The following are general descriptions of each impact level:

a. Initial Impact Level - Reduced swim areas, some recreational navigation hazards are marked, boat ramps are minimally affected, a few private boat docks are affected.

b. Recreation Impact Level - All swim areas are unusable, recreational navigation hazards become more numerous, boat ramps significantly affected, 20 percent of private boat docks affected.

c. Water Access Impact Level - Most water-based recreational activities are severely restricted, most boat ramps are unusable, navigation hazards become more numerous, 50 percent of private boat docks affected.

Impact levels have been developed for three of the ACF projects: Lake Sidney Lanier, West Point Lake and Walter F. George Lake. The George W. Andrews pool and Lake Seminole each have such small pool level fluctuations that impact levels have not been developed for those projects. Table 8-1 contains percent time simulated reservoir elevations would reach impact levels at Lake Sidney Lanier, West Point Lake, and Walter F. George Lake during the recreation period over the 73-year simulation period of record (1939 to 2011). A ResSim model representing the water control plan described in this manual simulates the system reservoir operation for the 73 year period using historic flow data. Daily reservoir elevations from the model are used as the data source for Table 8-1.

Table 8-1. Reservoir Impact Levels

Project	Initial impact level (percent time reached)	Recreation impact level (percent time reached)	Water access limited impact level (percent time reached)
Lake Sidney Lanier	1,066.0 feet NGVD29 (26.7%)	1,063.0 feet NGVD29 (7.1%)	1,060.0 feet NGVD29 (4.5%)
West Point Lake	632.5 feet NGVD29 (39.9%)	629.0 feet NGVD29 (22.7%)	627.0 feet NGVD29 (3.3%)
Walter F. George Lake	187.0 feet NGVD29 (4.5%)	185.0 feet NGVD29 (0.4%)	184.0 feet NGVD29 (0.0%)

d. Each Corps reservoir project also has a High Water Action Plan that establishes guidelines to determine areas impacted by high water levels during the normal recreation season and the actions to be taken by Operations personnel for each stage. The High Water Action Plan can be found as an exhibit within each individual project appendix.

8-05. Water Quality. The ACF projects are not operated to meet specific water quality standards. However, the projects are operated with the goal of improving water quality as demonstrated through continuous minimum releases and other incidental releases that provide benefits to water quality in the basin. Water releases made during hydropower generation, particularly from Buford Dam and West Point Dam, provide Chattahoochee River flows beneficial for waste assimilation at Atlanta and Columbus, Georgia. At Buford Dam, self-aspirating turbines have been installed to improve dissolved oxygen levels downstream. Two of the projects, Buford Dam and West Point Dam provide benefits to water quality by providing continuous minimum flow releases. At Buford Dam, the small turbine-generator is run continuously to provide a minimum flow from the dam of 550 to 660 cfs. The goal for minimum flows from Buford Dam is to provide a minimum flow of 750 cfs between May to October and 650 cfs between November to April at Atlanta, Georgia, in the Chattahoochee River 40 miles downstream from Buford Dam, measured just upstream of the confluence with Peachtree Creek. Occasional special releases are also made at Buford Dam to ensure adequate dissolved oxygen and water temperature at the Buford Trout Hatchery downstream of the dam. At West Point Dam, a small generating unit provides a continuous release of approximately 675 cfs. Although there are no minimum flow provisions downstream of Walter F. George Dam, when low dissolved oxygen values are observed below the dam, spillway gates are opened until the dissolved oxygen readings return to an acceptable level. At George W. Andrews Lock and Dam and Jim Woodruff Lock and Dam, which operate as run-of-the-river projects, inflows to the projects are continuously released downstream. Such continuous releases provide a benefit for water quality in the ACF Basin.

8-06. Fish and Wildlife

a. <u>Fish Spawning</u>. The water control plan benefits fish and wildlife, including threatened and endangered species, by maintaining steady reservoir levels during the spring fish spawning period, providing a gradual ramp down of river levels to prevent stranding endangered species and ensuring adequate flows in the river. Federally listed threatened and endangered species and their federally designated critical habitat are protected under the Endangered Species Act of 1973 and minimum flow provisions have been developed to minimize impacts due to low flow conditions. The Corps operates the ACF System to provide favorable conditions for annual fish spawning, both in the reservoirs and in the Apalachicola River. During the fish spawning period for each project as shown in Table 8-2, the Corps' goal is to operate for a generally stable or rising lake level. When climatic conditions preclude a favorable operation for fish spawning, the Corps consults with the state fishery agencies and the USFWS on balancing needs in the system and minimizing the effects of fluctuating lake or river levels. Operations for fish spawning help to increase the population of fish in the basin.

Table 8-2. Project-Specific Principal Fish Spawning Period

Project	Fish spawn period
Lake Sidney Lanier	1 April – 1 June
West Point	1 April – 1 June
Walter F. George	15 March – 15 May
Lake Seminole	1 March – 1 May
Apalachicola River	1 April – 1 June

b. Fish Passage. When project conditions allow, the Corps operates the lock at Jim Woodruff Lock and Dam from March through May to facilitate downstream to upstream passage of Alabama shad and other anadromous fishes (those that return from the sea to breed in the rivers where they were spawned). While there can be slight differences in the locking technique each year, generally two fish locking cycles are performed each day between 8 a.m. and 4 p.m.; one in the morning and one in the afternoon on each day that lock operators are scheduled to be present. The fish passage operations provide the benefit of allowing the fish to migrate upstream for spawning. Recent studies have demonstrated that fish passage operations are successful and helping to sustain the Alabama shad population, a species that has been petitioned for listing under the Endangered Species Act of 1973 (ESA).

c. Threatened and Endangered Species. The ESA protects federally listed threatened and endangered species and their federally designated critical habitat. The Corps manages releases from Jim Woodruff Dam to support the federally threatened Gulf sturgeon (*Acipenser oxyrinchus desotoi*), endangered fat threeridge (*Amblema neislerii*), threatened purple bankclimber (*Elliptoideus sloatianus*), and threatened Chipola slabshell (*Elliptio chipolaensis*), and areas designated as critical habitat for those species in the Apalachicola River. The releases provide a benefit by assuring a minimum flow necessary to protect and support the species and their habitats.

Fall rates are an important aspect of habitat suitability for the Gulf sturgeon, mussels, and host fish for the mussel species. Because Gulf sturgeon spawning most often occurs at depths between 8 and 18 feet, a rapid fall in river stage could result in exposure or stranding of eggs and larvae. A depth of 8 feet over the highest known Gulf sturgeon spawning habitat on the Apalachicola River corresponds to a flow of approximately 40,000 cfs. Under the ACF water control operations, effects on Gulf sturgeon spawning habitat are not expected. The Jim Woodruff Dam water management operations have mechanisms in place to ensure that when flows are less than 40,000 cfs, a decline more than 8 feet in less than 14 days during March, April, and May does not occur. The Jim Woodruff Dam water management operations also include a fall rate schedule when discharges are within the capacity of the powerhouse that facilitates movement of mussels and host fish as river stages decline.

Submerged habitat below the 10,000 cfs Apalachicola River stage supports the listed mussel species. An evaluation of the Apalachicola River inter-annual frequency of low flows indicates the Jim Woodruff Dam water management operations result in more years with flows less than 6,000 - 10,000 cfs than has historically occurred. However, the water management operations are not expected to result in flows less than 5,000 cfs except in extreme drought conditions worse than the record 2006 - 2008 drought. Flows less than 5,000 cfs have occurred previously. Stranding occurs when they are above the water for extended periods.

8-07. Water Supply. The ACF Basin projects and water control operations provide benefits for M&I water supply. A projected average annual gross amount of 185 mgd is withdrawn directly from Lake Sidney Lanier for M&I water supply. Entities that withdraw water from Lake Sidney Lanier include Habersham, White, Lumpkin, Dawson, Forsyth and Gwinnett Counties, and the Cities of Gainesville, Buford, and Cumming.

Of the total M&I water supply withdrawals from Lake Sidney Lanier, 10 mgd is taken pursuant to relocation contracts issued to the cities of Buford (2 mgd) and Gainesville (8 mgd net). Those water withdrawal contracts provide the specified water withdrawal amounts free of charge and are referred to as relocation contracts. The relocation contracts were issued as partial compensation for the relocation of the respective water supply intakes and treatment facilities as a result of project construction.

Downstream of Buford Dam are four metro Atlanta water utilities that withdraw a combined average annual maximum amount not to exceed 408 mgd from the Chattahoochee River. The residential water supply needs of a total estimated population of three million persons are served by those utilities, plus numerous commercial, industrial, and institutional enterprises. A total of up to 408 mgd is supplied through releases from Buford Dam’s peaking hydropower operations. This downstream water supply need is normally met as a by-product of peaking hydropower releases that occur Monday through Friday. However, under the 1946 Rivers and Harbors Act generation might occur outside peaking hydropower operations time frames to specifically meet the City of Atlanta water supply needs, not to exceed 408 mgd.

Originally two entities in West Point Lake were authorized to withdraw M&I water supply directly from the lake; LaGrange, Georgia (8.35 mgd) and the now defunct Milliken Carpet Company (12.96 mgd). Milliken Carpet Company assigned its relocation agreement to the City of LaGrange. The water withdrawal contracts are relocation contracts that were issued because of the relocation of the respective water supply intakes and treatment facilities during project construction.

All other M&I water supply withdrawals in the ACF Basin outside the federal projects are limited by applicable state-issued water withdrawal permits and to the available flows of water in the rivers that are largely incidental to the Corps water control operations. While the Corps does not operate the ACF System specifically for M&I water supply in the Chattahoochee River Basin below metropolitan Atlanta, water control operations provide a relatively stable and dependable water supply source for various entities within the basin.

8-08. Hydroelectric Power. Hydropower generation is provided at Buford Dam, West Point Dam, Walter F. George Dam, and Jim Woodruff Dam. The projects provide peaking power generation, i.e., power is generated during the hours that the demand for electrical power is highest except for the Woodruff Project, which operates as a run-of-river project. The ACF Basin hydropower projects, along with 22 other hydropower dams in the southeastern United States, compose the SEPA service area. Hydroelectric power generated at the Corps dams in the ACF Basin is sold by SEPA to a number of cooperatives and municipal power providers, referred to as preference customers. Hydroelectric power is one of the cheaper forms of electrical energy, and it can be generated and supplied quickly as needed in response to changing demand. Table 8-3 displays generation from 2004 - 2013 at federal projects in the ACF Basin.

Table 8-3. ACF Federal Project Power Generation (MWh)

Project	CY2004	CY2005	CY2006	CY2007	CY2008	CY2009	CY2010	CY2011	CY2012	CY2013
Buford	104,667	214,630	141,196	123,860	69,693	134,932	199,158	176,028	106,343	212,413
West Point	158,278	183,195	56,881	93,526	92,703	237,765	214,140	134,378	96,257	251,237
Walter F. George	389,181	466,378	296,463	210,311	253,989	491,488	363,317	266,926	187,062	470,117
Jim Woodruff	243,212	240,929	194,452	171,531	190,909	171,762	159,685	178,608	146,144	233,401
Totals	895,338	1,105,132	688,992	599,228	607,294	1,035,947	936,300	755,940	535,806	1,167,168

The projects with hydropower capability provide three principal power generation benefits:

1) Hydropower helps to ensure the reliability of the electrical power system in the SEPA service area by providing dependable capacity to meet daily peak power demands. For most plants, that condition occurs when the reservoir is at its maximum elevation. Dependable capacity at hydropower plants reduces the need for additional coal, gas, oil, or nuclear generating capacity.

2) The projects provide a substantial amount of energy at a small cost relative to thermal electric generating stations, reducing the overall cost of electricity. Hydropower facilities reduce the burning of fossil fuels, thereby reducing air pollution. Between CY 2004 and 2013, the four ACF hydropower projects (Buford, West Point, Walter F. George, and Jim Woodruff) produced an average of 832,715 MWH per calendar year, with a minimum of 535,806 and a maximum of 1,167,168 MWH.

3) Hydropower has several valuable operating characteristics that improve the reliability and efficiency of the electric power supply system, including efficient peaking, a rapid rate of unit unloading, and rapid power availability for emergencies on the power grid.

Hydropower plays an important role in meeting the electrical power demands of the region. The ACF Basin hydropower plants provide direct benefits to a large segment of the basin's population in the form of relatively low-cost power and the annual return of revenues to the Treasury of the United States.

8-09. Navigation. Construction of the 9.0-foot navigation channel in the ACF Basin, including construction of bendway easings, cutoffs, and training dike structures, began in 1957. Over the years and through the 1970s, additional cutoffs and river training structures were constructed to increase the ease and safety of barge tows navigating the river channel and to reduce costs of maintaining the system. The project authorization required local interests, consisting of six Florida counties bordering the Apalachicola River, to provide public port facilities and all lands, easements, rights-of-way and disposal areas for construction and maintenance of the navigation channel in the Apalachicola River. However, in 1988 the counties formally rescinded their commitments to provide local sponsorship for the project because of financial concerns. Subsequently, the Corps' efforts to maintain the navigation channel were largely through the use of within-bank disposal areas subject to federal navigation servitude, which required no easements from non-federal sponsors. Because of sustained drought conditions, dredging was not conducted in 2000, only limited dredging completed in 2001. No dredging has been conducted since 2001 due to a combination of flow conditions, funding restrictions, inadequate disposal area capacity, and the denial of water quality certification by the state of Florida in 2005. These factors led the USACE to reach a decision to defer dredging on the Apalachicola River in July 2006.

As much as 1.2 million tons of cargo moved on the ACF waterway as recently as 1985. The principal commodity was sand and gravel, which is not dependent on navigable depths on the Apalachicola River and can move economically at shallower depths than can some other commodities. The next most important products were petroleum products and fertilizers. Commercial waterborne traffic has continually declined in recent years as difficulties in maintaining the project and providing a reliable channel have increased. Repeated drought conditions since the 1980s resulted in dramatic reductions in commercial traffic on the waterway. More recently, since 2000, a reliable channel has not been provided and channel availability has been dependent on available flows. As a result, commercial barge commodity shipments have fallen from near 600,000 tons before the start of drought conditions in 1998 to none between 2006 and 2014, except for 480 tons of "equipment and machinery" moved in 2007 and a Steward Machine Company barge in 2014. There were however, a number of recreational lockages, with total vessels being locked through ranging from a low of 133 in 2013 to a high of 405 in 2010 (from 2007 – 2013). The Apalachicola navigation project was classified as a low use project in FY2005. Previous waterway users below Jim Woodruff Lock and Dam have since negotiated contractual agreements for truck or rail transportation. Navigation support has been limited to special shipments. Specifics regarding navigation activity are provided in the project appendices, where applicable.

Coordination with the previous waterway users in the ACF Basin identified the need for changes in the Corps' water control operations to provide a more reliable flow regime, without dredging, to support at least a 7.0-foot navigation channel in the Apalachicola River. On the basis of Apalachicola River navigation channel surveys, a flow of 16,200 cfs at the Blountstown gage, about 20 miles below Jim Woodruff Lock and Dam, is required to provide for a 7.0-foot channel. That flow requirement assumes no maintenance dredging is performed in the navigation channel. Through an iterative hydrologic modeling process, it was determined that a 5-month navigation season, January through May each year, could be provided that would improve navigation reliability without significantly affecting other project purposes. The 5-month navigation season recommended for implementation on the ACF waterway can, in the absence of maintenance dredging, improve the total reliability of a 7.0-foot navigation channel in the Apalachicola River from 21 percent to as much as 42 percent. For a 7.0-foot channel that is at least 90 percent reliable for any single navigation season, the total reliability over the period of record would improve from the present 36 percent to 54 percent during the navigation season.

8-10. Drought Contingency Plans. The ACF Basin Drought Contingency Plan (DCP), included as Exhibit B, allows the USACE to respond to droughts in a timely manner. Provisions are included for coordinating with appropriate federal, state, and local stakeholders during the occurrence of drought conditions.

The importance of drought plans has become increasingly obvious as more demands are placed on the water resources of the basin. During low-flow conditions, the system might not be able to fully support all project purposes. The ACF Basin DCP includes methods for identifying drought conditions; includes measures to be used to respond to and mitigate the effects of drought conditions; and helps minimize the effect of drought on the ACF Basin water resources.

IX – SYSTEM WATER CONTROL MANAGEMENT

9-01. Responsibilities and Organization. Responsibilities for developing and monitoring water resources and the environment in the ACF Basin are shared by many federal and state agencies including the Corps, EPA, National Park Service, U.S. Coast Guard, USGS, U.S. Department of Energy, U.S. Department of Agriculture, USFWS, and NOAA. Interested state agencies include GAEPD, ADEM, the Alabama Office of Water Resources (OWR), the Florida Department of Environmental Protection (FDEP), the Northwest Florida Water Management District, and the Florida Fish and Wildlife Conservation Commission.

a. U.S. Army Corps of Engineers. Authority for water control regulation of the federally authorized reservoir projects in the ACF Basin has been delegated to the SAD Commander. The responsibility for day-to-day water control regulation activities has been entrusted to the Mobile District, Engineering Division, Water Management Section. Water control actions for each project are regulated in a system-wide, balanced approach to meet the federally authorized purposes. The Mobile District is required to develop water control regulation procedures for the ACF Basin federal projects for all foreseeable conditions. The Mobile District monitors the projects for compliance with the approved water control plan. In accordance with the water control plan, the Mobile District performs water control regulation activities that include: determining project water releases, declaring water availability for authorized purposes daily, projecting daily and weekly reservoir pool levels and releases, preparing weekly river basin status reports, tracking and projecting basin composite conservation storage, determining and monitoring daily and 7-day basin inflow, managing high-flow regulation and coordinating internally within the Mobile District and externally with basin stakeholders. When necessary, the Mobile District instructs the project operator regarding normal water control regulation procedures, as well as abnormal or emergency situations, such as floods. The federal projects are tended by operators under direct supervision of a Power Project Manager and an Operations Project Manager. The Mobile District communicates directly with the powerhouse operators at the Carters (remotely operate Buford Powerhouse), Walter F. George (remotely operate West Point Powerhouse), and Jim Woodruff Powerhouses and with other project personnel as necessary. The Mobile District is responsible for collecting historical project data, such as lake levels, flow forecasts and weekly basin reports with other federal, state, and local agencies; and the general public. The Mobile District website where this data is provided is: http://www.sam.usace.army.mil/.

b. Other Federal Agencies

1) National Weather Service (NWS). The NWS is the federal agency in NOAA that is responsible for weather warnings and weather forecasts. With support from the Corps-NWS Cooperative Gaging Program, the NWS forecast offices, along with the Southeast River Forecast Center (SERFC), maintain a network of rainfall and flood reporting stations throughout the ACF Basin. NWS continuously provides current weather conditions and forecasts. The SERFC prepares river forecasts for many locations throughout the ACF Basin and provides the official flood stage forecasts along the ACF Rivers. Often, the SERFC prepares predictions on the basis of *what if scenarios*, such as Quantitative Precipitation Forecasts (QPFs). The QPF is a prediction of the spatial precipitation across the United States and the region. The Corps, NWS, and SERFC share information regarding rainfall, project data, and streamflow forecasts. In addition, the NWS provides information on hurricane forecasts and other severe weather conditions. They monitor drought conditions and provide the information to the public. The National Integrated Drought Information System is available for the ACF Basin at website

www.drought.gov. This website provides a single source of information regarding drought conditions by sharing information gathered from the NOAA Climate Prediction Center, the Corps, state agencies, universities, and other pertinent sources of data through the drought portal.

2) U.S. Geological Survey (USGS). The USGS is an unbiased, multi-disciplinary science organization that focuses on biology, geography, geology, geospatial information, and water. The agency is responsible for the timely, relevant, and impartial study of the landscape, natural resources, and natural hazards. Through the Corps-USGS Cooperative Gaging program, the USGS maintains a comprehensive network of gages in the ACF Basin. The USGS Water Science Centers in Georgia, Alabama, and Florida publish real-time reservoir levels, river and tributary stages, and flow data through the USGS National Water Information System (NWIS) web site. The Mobile District uses the USGS to operate and maintain project water level gaging stations at each federal reservoir to ensure the accuracy of the reported water levels.

3) Southeastern Power Administration (SEPA). SEPA was created in 1950 by the Secretary of the Interior to carry out the functions assigned to the Secretary by the Flood Control Act of 1944. In 1977, SEPA was transferred to the newly created U.S. Department of Energy. SEPA, headquartered in Elberton, Georgia, is responsible for marketing electric power and energy generated at reservoirs operated by the Corps. The power is marketed to nearly 500 preference customers in Georgia, Florida, Alabama, Mississippi, southern Illinois, Virginia, Tennessee, Kentucky, North Carolina, and South Carolina.

i. The objectives of SEPA are to market electricity generated by the federal reservoir projects, while encouraging its widespread use at the lowest possible cost to consumers. Power rates are formulated using sound financial principles. Preference in the sale of power is given to public bodies and cooperatives, referred to as preference customers. SEPA does not own transmission facilities and must contract with other utilities to provide transmission, or *wheeling* services, for the federal power.

ii. SEPA's responsibilities include the negotiation, preparation, execution, and administration of contracts for the sale of electric power; preparation of repayment studies to set wholesale rates; the provision, by construction, contract or otherwise, of transmission and related facilities to interconnect reservoir projects and to serve contractual loads; and activities pertaining to the operation of power facilities to ensure and maintain continuity of electric service to its customer.

iii. SEPA schedules the hourly generation schedules for each federal project within the system based on the daily and weekly water volume availability declarations of the USACE.

4) U.S. Fish and Wildlife Service (USFWS). The USFWS is a bureau within the Department of the Interior whose mission is working with others to conserve, protect and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people. The USFWS is the responsible agency for the protection of federally listed threatened and endangered species and their designated critical habitat in accordance with the Endangered Species Act. The USFWS also coordinates with other federal agencies under the auspices of the Fish and Wildlife Coordination Act. The Corps Mobile District coordinates water control actions and management with USFWS in accordance with both laws.

c. State Agencies

1) Alabama. The Alabama Office of Water Resources (OWR) administers programs for river basin management, river assessment, water supply assistance, water conservation, flood mapping, the National Flood Insurance Program and water resources development. Further, OWR serves as the State liaison with federal agencies on major water resources related projects, conducts any special studies on instream flow needs, and administers environmental education and outreach programs to increase awareness of Alabama's water resources.

i. The Alabama Department of Environment Management (ADEM) Drinking Water Branch works closely with the more than 700 water systems in Alabama that provide safe drinking water to four million citizens.

ii. The Alabama Chapter of the Soil and Water Conservation Society fosters the science and the art of soil, water, and related natural resource management to achieve sustainability.

iii. The Alabama Department of Conservation and Natural Resources has responsibility for both freshwater and saltwater fisheries in the state.

2) Georgia. The Department of Natural Resources (GADNR) has statewide responsibilities for the management and conservation of Georgia's natural and cultural resources. Within GADNR, the Georgia Environmental Protection Division (GAEPD) conducts water resource assessments to determine a sound scientific understanding of the condition of the water resources, in terms of the quantity of surface water and groundwater available to support current and future in-stream and off-stream uses and the capacity of the surface water resources to assimilate pollution. Regional water planning councils in Georgia prepare recommended Water Development and Conservation Plans. Those regional plans promote the sustainable use of Georgia's waters through the selection of an array of management practices, to support the state's economy, protect public health and natural systems, and enhance the quality of life for all citizens. Georgia Wildlife Resources Division protects non-game and endangered wildlife in the state.

3) Florida. The Northwest Florida Water Management District stretches from the St. Marks River Basin in Jefferson County to the Perdido River in Escambia County. The district is one of five water management districts in Florida created by the Water Resources Act of 1972. In the district's 11,305-square-mile area are several major hydrologic (or drainage) basins: Perdido River and Bay System, Pensacola Bay System (Escambia, Blackwater, and Yellow rivers), Choctawhatchee River and Bay System, St. Andrew Bay System, Apalachicola River and Bay System, and St. Marks River Basin (Wakulla River). The district is a cooperating agency with the Corps and USGS for operating and maintaining the Apalachicola River at Chattahoochee, Florida stream gage downstream of the Jim Woodruff Project.

i. The Florida Department of Environmental Protection has the primary role of regulating public water systems in Florida.

ii. The Florida Fish and Wildlife Conservation Commission has responsibility for both freshwater and saltwater fisheries in the state.

d. Georgia Power Company. The GPC is an electric utility headquartered in Atlanta, Georgia. It is the largest of the four electric utilities owned and operated by Southern Company. GPC is an investor-owned, tax-paying public utility serving more than 2.25 million customers in all but four of Georgia's 159 counties. It employs approximately 9,000 workers. It owns and operates 20 hydroelectric dams, 14 fossil fueled generating plants, and two nuclear power plants that provide electricity to more than two million customers.

e. Stakeholders. Many non-federal stakeholder interest groups are active in the ACF Basin. The groups include lake associations, M&I water users, navigation interests, environmental organizations, and other basin-wide interests groups. Coordinating water management activities with the interest groups, federal and state agencies, and others is accomplished as required on an ad-hoc basis and on regularly scheduled water management teleconferences when needed to share information regarding water control regulation actions and gather stakeholder feedback. Table 9-1 lists state and federal agencies and active stakeholders in the ACF Basin that have participated in the ACF Basin water management teleconferences and meetings associated with the 2007 - 2009 drought. Federal and state political representatives also participated in the teleconferences. The ACF stakeholder teleconferences were held from July 2007 to April 2010.

Table 9-1. ACF Basin Water Management Teleconference Stakeholder Participants

Alabama	Others
Office of the Governor	AL Rivers Alliance
AL OWR	Apalachicola Natl. Estuarine Research Reserve
AL DEM	Apalachicola River Keeper
AL Department of Conservation	ARC (Atlanta Regional Commission)
	CCMWA (Cobb County-Marietta Water Authority)
Florida	City of Gainesville
Office of the Governor	City of LaGrange
FDEP	City of West Point
FL F&W Conservation Commission	Columbus Water Works
NWFWMD	Franklin Co. Seafood Workers Assoc (FCSWA)
	Georgia Pacific(Cedar Springs)
Georgia	Georgia Power
Office of the Governor	Gulf Power (FL)
GADNR	Gwinnett Co Water
GAEPD	Help Save Apalachicola River
GAWRD	Lake Lanier Association
	Lake Seminole Association
Federal agencies	MeadWestvaco
EPA	Middle Chattahoochee Water Coalition
FERC - Atlanta	SeFPC
FERC - DC	Southern Company
NPS (Chattahoochee Nat Recreational Area)	Southern Nuclear
SEPA	TRWDA (Tri-Rivers Waterway Dev Assoc)
U.S. Coast Guard	Upper Chattahoochee River Keeper
USFWS-AL	West Point Lake Coalition
USFWS-FL	
USFWS-GA	
USGS-AL	
USGS-FL	
USGS-GA	

9-02. Local Press and Corps Bulletins. The local press consists of periodic publications in or near the ACF Basin. Montgomery, Columbus, and Atlanta have some of the large daily newspapers, which often publish articles related to the ACF Basin. The public has direct contact with the USACE and can contact the Public Affairs Office or visit the Mobile District website to obtain information. The USACE and Mobile District publishes e-newsletters regularly which are made available to the general public via email and postings on various websites. Complete, real-time information is available at the Mobile District's Water Management homepage http://water.sam.usace.army.mil/. The Mobile District Public Affairs Office issues press releases as necessary to provide the public with information regarding Water Management issues and activities.

9-03. Framework for Water Management Changes. Continued increases in the use of water resources demand constant monitoring and evaluating reservoir regulations and reservoir systems to ensure their most efficient use. Also, special interest groups often request modifications of the basin water control manual or project specific water control plans which could impact project purposes. Therefore, within the constraints of Congressional authorizations and engineering regulations, the water control plan and operating techniques are often reviewed to see if improvements are possible without violating authorized project functions. This review can result in a revision to the basin manual or to the project specific, water control plans. When deemed appropriate, temporary deviations to the water control plan, as discussed in 7-15 "Deviation from Normal Regulation", can be implemented to provide the most efficient regulation while balancing the multiple purposes of the ACF Basin-wide System and individual projects.

TABLES

Table 2-11. Water Users in ACF Basin, Georgia

County	Facility	Permit number	Municipal or Industrial	River basin	Source water
Harris	Harris County Water Dept	072-1224-01	M	Chattahoochee	Bartlett's Ferry Res
Douglas	Douglasville - Douglas County W & S A	048-1216-03	M	Chattahoochee	Bear Creek
Fulton	GCG Members' Purchasing Committee, Inc.	060-1209-04	I	Chattahoochee	Big Creek
Fulton	Roswell, City Of - Big Creek	060-1209-01	M	Chattahoochee	Big Creek
Taylor	Unimin Georgia Company, L.P.	133-1109-02	I	Flint	Black Creek (Remote Jr.)
Troup	Hogansville, City Of	141-1222-01	M	Chattahoochee	Blue Creek Res
Coweta	Coweta County Water & Sewerage Authority	038-1218-02	M	Chattahoochee	BT Brown Reservoir
Fulton	Cherokee Town & Country Club	060-1290-09	I	Chattahoochee	Bull Sluice Lake
Meriwether	Woodbury, City Of	099-1106-02	M	Flint	Cain Cr Res On Pond Cr
Meriwether	Roosevelt Warm Springs Rehab	099-1106-04	M	Flint	Cascade Creek
Fulton	Palmetto, City Of	060-1218-01	M	Chattahoochee	Cedar Creek
Heard	Heard County Water Authority	074-1220-02	M	Chattahoochee	Centralhatchee Creek
Cobb	Cobb Co - Marietta Water Authority	033-1290-01	M	Chattahoochee	Chattahoochee River
Cobb	Georgia Power Co - Plant Atkinson	033-1291-09	I	Chattahoochee	Chattahoochee River
Cobb	Georgia Power Co - Plant McDonough	033-1291-03	I	Chattahoochee	Chattahoochee River
Coweta	Georgia Power Co - Plant Yates	038-1291-02	I	Chattahoochee	Chattahoochee River
DeKalb	DeKalb Co Public Works - Water & Sewer	044-1290-03	M	Chattahoochee	Chattahoochee River
Early	Great Southern Paper Co. (Ga. Pacific Corp.)	049-1295-01	I	Chattahoochee	Chattahoochee River
Early	Homestead Energy Resources, LLC	049-1295-02	I	Chattahoochee	Chattahoochee River
Early	Longleaf Energy Associates, LLC	049-1295-03	I	Chattahoochee	Chattahoochee River
Fulton	Atlanta Athletic Club	060-1209-02	I	Chattahoochee	Chattahoochee River
Fulton	Atlanta, City of	060-1291-01	M	Chattahoochee	Chattahoochee River
Fulton	Atlanta-Fulton Co. Water Res. Commission	060-1207-02	M	Chattahoochee	Chattahoochee River
Fulton	Tattersall Club Corp	060-1290-08	I	Chattahoochee	Chattahoochee River
Habersham	Baldwin, City of	068-1201-04	M	Chattahoochee	Chattahoochee River
Harris	Chat Valley Water Supply District	072-1291-04	M	Chattahoochee	Chattahoochee River
Harris	WestPoint Home, Inc.	072-1293-03	I	Chattahoochee	Chattahoochee River
Heard	Georgia Power Co - Plant Wansley	074-1291-06	I	Chattahoochee	Chattahoochee River
Heard	Heard County Water Authority	074-1291-08	I	Chattahoochee	Chattahoochee River
Muscogee	Continental Carbon	106-1225-07	I	Chattahoochee	Chattahoochee River
Muscogee	Eagle & Phenix Hydroelectric Project, Inc.	106-1225-04	I	Chattahoochee	Chattahoochee River
Muscogee	Eagle & Phenix Mills, LLC	106-1293-07	I	Chattahoochee	Chattahoochee River

County	Facility	Permit number	Municipal or Industrial	River basin	Source water
Muscogee	Georgia Power Co - Plant Goat Rock	106-1225-08	I	Chattahoochee	Chattahoochee River
Troup	West Point, City Of	141-1292-02	M	Chattahoochee	Chattahoochee River
Lumpkin	Birchriver Chestatee Company, LLC	093-1202-03	I	Chattahoochee	Chestatee River
Forsyth	Southeast Investments, L.L.C.	058-1207-08	I	Chattahoochee	Dick Creek
Douglas	Douglasville - Douglas County W & S A	048-1217-03	M	Chattahoochee	Dog River Reservoir
Marion	Unimin Georgia Company, L.P.	096-1225-09	I	Chattahoochee	Duck Pond on a trib to Black Creek
Pike	Zebulon, City Of	114-1104-01	M	Flint	Elkins Creek
Fayette	Board of Commissioners of Fayette County	056-1102-06	M	Flint	Flat Creek Reservoir
Clayton	Clayton County Water Auth - Flint	031-1102-07	M	Flint	Flint River
Dougherty	Georgia Power Co - Plant Mitchell	047-1192-01	I	Flint	Flint River
Fayette	Board of Commissioners of Fayette County	056-1102-13	M	Flint	Flint River
Macon	Weyerhaeuser Company	094-1191-01	I	Flint	Flint River
Pike	Griffin, City of	114-1191-02	M	Flint	Flint River
Spalding	Griffin, City Of	126-1190-01	M	Flint	Flint River
Forsyth	Lanier Golf Club	058-1207-05	I	Chattahoochee	Golf Course Pond #1
Habersham	Cornelia, City Of	068-1201-01	M	Chattahoochee	Hazel Creek, Camp Cr Res, Emergency Camp Cr
Carroll	Carroll County Water Authority	022-1217-01	M	Chattahoochee	HC Seaton Reservoir(Snake Cr)
Heard	Heard County Water Authority	074-1220-03	M	Chattahoochee	Hillabahatchee Creek
Fayette	Board of Commissioners of Fayette County	056-1102-12	M	Flint	Horton Creek Reservoir
Coweta	Senoia, City Of	038-1102-05	M	Flint	Hutchins Lake
Clayton	Clayton County Water Auth - Shoal	031-1101-01	M	Flint	J.W. Smith Res./Shoal Cr.
Forsyth	Sequoia Golf Windermere, LLC	058-1207-09	I	Chattahoochee	James Creek
Fulton	Riverfarm Enterprises, Inc.(RiverPines Golf)	060-1207-04	I	Chattahoochee	Johns Creek
Worth	Crisp County Power Comm - Hydro	159-1112-02	I	Flint	Lake Blackshear
Worth	Crisp County Power Comm - Steam	159-1112-01	I	Flint	Lake Blackshear
Muscogee	Columbus, City Of	106-1293-05	M	Chattahoochee	Lake Oliver
Muscogee	Smiths Water Authority	106-1225-05	M	Chattahoochee	Lake Oliver (Chat R)
Fayette	Board of Commissioners of Fayette County	056-1102-03	M	Flint	Lake Peachtree
Dawson	McRae and Stolz, Inc.	042-1202-01	I	Chattahoochee	Lake Sidney Lanier
Forsyth	Forsyth County Board Of Commissioners	058-1207-06	M	Chattahoochee	Lake Sidney Lanier
Forsyth	Cumming, City Of	058-1290-07	M	Chattahoochee	Lake Sidney Lanier
Hall	Buford, City Of	069-1290-04	M	Chattahoochee	Lake Sidney Lanier
Hall	Gainesville, City Of	069-1290-05	M	Chattahoochee	Lake Sidney Lanier

County	Facility	Permit number	Municipal or Industrial	River basin	Source water
Hall	Gwinnett County Water & Sewerage Auth	069-1290-06	M	Chattahoochee	Lake Sidney Lanier
Hall	LLI Management Company, LLC	069-1205-01	I	Chattahoochee	Lake Sidney Lanier
Hall	LLI Management Company, LLC (Pineisle)	069-1205-02	I	Chattahoochee	Lake Sidney Lanier
Talbot	Manchester, City of	130-1106-06	M	Flint	Lazer Creek
Fayette	Board of Commissioners of Fayette County	056-1102-09	M	Flint	Line Cr (McIntosh Site)
Coweta	Newnan Utilities	038-1102-11	M	Flint	Line Creek
Forsyth	Sequoia Golf Olde Atlanta LLC	058-1207-03	I	Chattahoochee	Man-Made Lakes
Upson	Thomaston, City Of	145-1105-01	M	Flint	Potato Creek
Upson	Thomaston, City Of	145-1105-02	M	Flint	Potato Creek
Upson	Thomaston, City Of	145-1105-03	M	Flint	Raw Water Cr Res
Coweta	Newman Utilities	0381221-02	M	Chattahoochee	Raw Water Reservoirs
Taylor	Unimin Georgia Company, L.P.	133-1109-01	I	Flint	Remote Pond on Black Creek
Talbot	Manchester, City of	130-1106-05	M	Flint	Rush Creek Reservoir
Coweta	Newnan Utilities	038-1221-01	M	Chattahoochee	Sandy/Browns Creek
Heard	Georgia Power Co - Plant Wansley	074-1291-07	I	Chattahoochee	Service Water Reservoir
Habersham	Clarkesville, City Of	068-1201-03	M	Chattahoochee	Soque River
Habersham	Ha-Best, Inc.	068-1201-06	I	Chattahoochee	Soque River
Pike	Griffin, City of	114-1104-03	M	Flint	Still Branch Reservoir
Cobb	Caraustar Mill Group, Inc. - Mill 2	033-1214-02	I	Chattahoochee	Sweetwater Creek
Cobb	Caraustar Mill Group, Inc. - Sweetwater	033-1214-01	I	Chattahoochee	Sweetwater Creek
Douglas	East Point, City Of	048-1214-03	M	Chattahoochee	Sweetwater Creek
Upson	Southern Mills, Inc.	145-1104-02	I	Flint	Thundering Springs Lake
White	White County Water & Sewer Authority	154-1202-02	M	Chattahoochee	Turner Creek
Fulton	Standard Golf Club	060-1209-03	I	Chattahoochee	Unnamed Trib To Johns Cr.
Chattahoochee	Fort Benning	026-1225-01	M	Chattahoochee	Upatoi River
Troup	Lagrange, City Of	141-1292-01	M	Chattahoochee	West Point Lake
Coweta	Newnan Utilities	038-1103-02	M	Flint	White Oak Creek
Fayette	Board of Commissioners of Fayette County	056-1102-10	M	Flint	Whitewater Creek
Fayette	Fayetteville, City Of	056-1102-14	M	Flint	Whitewater Creek
Lumpkin	Dahlonega, City Of - New Plant	093-1204-01	M	Chattahoochee	Yahoola Creek

1

EXHIBIT A

UNIT CONVERSIONS

AREA CONVERSION

UNIT	m^2	km^2	ha	in^2	ft^2	yd^2	mi^2	ac
1 m^2	1	10^{-6}	10^{-4}	1550	10.76	1.196	3.86 X 10^{-7}	2.47 X 10^{-4}
1 km^2	10^6	1	100	1.55 X 10^9	1.076 X 10^7	1.196 X 10^6	0.3861	247.1
1 ha	10^4	0.01	1	1.55 X 10^7	1.076 X 10^7	1.196 X 10^4	3.86 X 10^{-3}	2,471
1 in^2	6.45 X 10^{-4}	6.45 X 10^{10}	6.45 X 10^{-8}	1	6.94 X 10^{-3}	7.7 X 10^{-4}	2.49 X 10^{-10}	1.57 X 10^7
1 ft^2	.0929	9.29 X 10^{-8}	9.29 X 10^{-6}	144	1	0.111	3.59 X 10^{-8}	2.3 X 10^{-5}
1 yd^2	0.8361	8.36 X 10^{-7}	8.36 X 10^{-5}	1296	9	1	3.23 X 10^{-7}	2.07 X 10^{-4}
1 mi^2	2.59 X 10^6	2.59	259	4.01 X 10^9	2.79 X 10^7	3.098 X 10^6	1	640
1 ac	4047	0.004047	0.4047	6. 27 X 10^6	43560	4840	1.56 X 10^{-3}	1

LENGTH CONVERSION

UNIT	cm	m	km	in.	ft	yd	mi
cm	1	0.01	0.0001	0.3937	0.0328	0.0109	6.21 X 10^{-6}
m	100	1	0.001	39.37	3.281	1.094	6.21 X 10^{-4}
km	10^5	1000	1	39,370	3281	1093.6	0.621
in.	2.54	0.0254	2.54 X 10^{-5}	1	0.0833	0.0278	1.58 X 10^{-5}
ft	30.48	0.3048	3.05 X 10^{-4}	12	1	0.33	1.89 X 10^{-4}
yd	91.44	0.9144	9.14 X 10^{-4}	36	3	1	5.68 X 10^{-4}
mi	1.01 X 10^5	1.61 X 10^3	1.6093	63,360	5280	1760	1

FLOW CONVERSION

UNIT	m^3/s	m^3/day	l/s	ft^3/s	ft^3/day	ac-ft/day	gal/min	gal/day	mgd
m^3/s	1	86,400	1000	35.31	3.05 X 10^6	70.05	1.58 X 10^4	2.28 X 10^7	22.824
m^3/day	1.16 X 10^{-5}	1	0.0116	4.09 X 10^{-4}	35.31	8.1 X 10^{-4}	0.1835	264.17	2.64 X 10^{-4}
l/s	0.001	86.4	1	0.0353	3051.2	0.070	15.85	2.28 X 10^4	2.28 X 10^{-2}
ft^3/s	0.0283	2446.6	28.32	1	8.64 X 10^4	1.984	448.8	6.46 X 10^5	0.646
ft^3/day	3.28 X 10^{-7}	1233.5	3.28 X 10^{-4}	1.16 X 10^{-5}	1	2.3 X 10^{-5}	5.19 X 10^{-3}	7.48	7.48 X 10^{-6}
ac-ft/day	0.0143	5.451	14.276	0.5042	43,560	1	226.28	3.26 X 10^5	0.3258
gal/min	6.3 X 10^{-5}	0.00379	0.0631	2.23 X 10^{-3}	192.5	4.42 X 10^{-3}	1	1440	1.44 X 10^{-3}
gal/day	4.3 X 10^{-8}	3785	4.38 X 10^{-4}	1.55 X 10^{-6}	11,337	3.07 X 10^{-6}	6.94 X 10^{-4}	1	10^{-6}
mgd	0.0438		43.82	1.55	1.34 X 10^5	3.07	694	10^6	1

VOLUME CONVERSION

UNIT	liters	m^3	in^3	ft^3	gal	ac-ft	million gal
liters	1	0.001	61.02	0.0353	0.264	8.1 X 10^{-7}	2.64 X 10^{-7}
m^3	1000	1	61,023	35.31	264.17	8.1 X 10^{-4}	2.64 X 10^{-4}
in^3	1.64 X 10^{-2}	1.64 X 10^{-5}	1	5.79 X 10^{-4}	4.33 X 10^{-3}	1.218 X 10^{-8}	4.33 X 10^{-9}
ft^3	28.317	0.02832	1728	1	7.48	2.296 X 10^{-5}	7.48 X 10^6
gal	3.785	3.78 X 10^{-3}	231	0.134	1	3.07 X 10^{-6}	10^6
ac-ft	1.23 X 10^6	1233.5	75.3 X 10^6	43,560	3.26 X 10^5	1	0.3260
million gallon	3.785 X 10^6	3785	2.31 X 10^8	1.34 X 10^5	10^6	3.0684	1

COMMON CONVERSIONS

1 million gallons per day (mgd) = 1.55 cfs
1 day-second-ft (DSF) = 1.984 acre-ft = 1 cfs for 24 hours
1 cubic foot per second of water falling 8.81 feet = 1 horsepower
1 cubic foot per second of water falling 11.0 feet at 80% efficiency = 1 horsepower
1 inch of depth over one square mile = 2,323,200 cubic feet
1 inch of depth over one square mile = 0.0737 cubic feet per second for one year

EXHIBIT B

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN DROUGHT CONTINGENCY PLAN

DROUGHT CONTINGENCY PLAN

FOR

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

BUFORD DAM AND LAKE SIDNEY LANIER
WEST POINT DAM AND LAKE
WALTER F. GEORGE LOCK AND DAM AND WALTER F. GEORGE LAKE
JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

U.S. Army Corps of Engineers

South Atlantic Division

Mobile District

____2016

DROUGHT CONTINGENCY PLAN FOR U.S. ARMY CORPS OF ENGINEERS RESERVOIRS APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

I – INTRODUCTION

1-01. Purpose of Document. The purpose of this Drought Contingency Plan (DCP) is to provide a basic reference for water management decisions and responses to water shortage in the Apalachicola-Chattahoochee-Flint (ACF) River Basin (referred to as the ACF River Basin or the ACF Basin) induced by climatological droughts. As a water management document, it is limited to those drought concerns relating to water control management actions. Because of the long-term nature of a drought and the specific problems that could result, this document details only a limited number of specific actions that can be carried out related to water control. The primary purpose of this DCP is to document the overall ACF Basin drought management plan for the federal projects, document the data needed to support water management decisions, and to define the coordination needed to manage the ACF federal project's water resources to ensure that they are used in a manner consistent with the needs that develop during the drought. This DCP addresses the water control regulation of the five principal federal reservoirs (Table 1) on the Chattahoochee River and their effects on the downstream Apalachicola River. Details of the drought management plan as it relates to each project and its water control regulation during droughts are provided in the water control plan within the respective appendix to the ACF Master Water Control Manual.

Table 1. Federal Reservoirs on the Chattahoochee River Within the ACF River Basin

Location	Chattahoochee River drainage area (square miles)	Percentage of total basin (19,573 sq mi)	Percentage of Chattahoochee Basin (8,708 sq mi)
Buford Dam and Lake Sidney Lanier	1,034	5.3%	11.9%
West Point Dam and Lake	3,440	17.6%	39.5%
Walter F. George Lock and Dam and Walter F. George Lake	7,460	38.1%	85.7%
George W. Andrews Lock and Dam and Lake George W. Andrews	8,210	41.9%	94.3%
Jim Woodruff Lock and Dam and Lake Seminole	8,708 (+8,456 Flint River)	44.5% (43.2% Flint River)	100.0% (100% Flint River Basin)

II – AUTHORITIES

2-01. Authorities. The following list provides the policies and guidance that are pertinent to the development of drought contingency plans and actions directed therein.

a. ER 1110-2-1941, *Drought Contingency Plans*, dated 15 Sep 1981. This regulation provides policy and guidance for the preparation of drought contingency plans as part of the Corps of Engineers' overall water management activities.

b. ER 1110-2-8156, *Preparation of Water Control Manuals*, dated 31 Aug 1995. This document provides a guide for preparing water control manuals for individual water resource projects and for overall river basins to include drought contingency plans.

c. ER 1110-2-240, *Water Control Management*, dated 8 Oct 1982. This regulation prescribes the policies and procedures to be followed in water management activities including special regulations to be conducted during droughts. It also sets the responsibility and approval authority in development of water control plans.

d. EM 1110-2-3600, *Management of Water Control Systems*, dated 30 Nov 1987. This guidance memorandum requires that the drought management plan be incorporated into the project water control manuals and master water control manuals. It also provides guidance in formulating strategies for project regulation during droughts.

III – DROUGHT IDENTIFICATION

3-01. Definition. Drought can be defined in different ways - meteorological, hydrological, agricultural, and socioeconomic. In this DCP, the definition of drought used in the *National Study of Water Management During Drought* (USACE 1994) is used.

> Droughts are periods of time when natural or managed water systems do not provide enough water to meet established human and environmental uses because of natural shortfalls in precipitation or streamflow.

That definition defines drought in terms of its impact on water control regulation, reservoir levels, and associated conservation storage. Water management actions during droughts are intended to balance the water use and water availability to meet water use needs. Because of hydrologic variability, there cannot be 100 percent reliability that all water demands are met. Droughts occasionally will be declared and mitigation or emergency actions initiated to lessen the stresses placed on the water resources within a river basin. Those responses are tactical measures to conserve the available water resources (USACE 2009).

3-02. Drought Identification. There is no known method of predicting how severe or when a drought will occur. There are, however, indicators that are useful in determining when conditions are favorable: below normal rainfall; lower than average inflows; and low reservoir levels, especially immediately after the spring season when rainfall and runoff conditions are normally the highest. When conditions indicate that a drought is imminent, the Mobile District will increase the monitoring of the conditions and evaluate the impacts on reservoir projects if drought conditions continue or become worse for 30-, 60-, or 90-day periods. Additionally, Mobile District will determine if a change in operating criteria would aid in the total regulation of the river system and if so, what changes would provide the maximum benefits from any available water.

Various products are used to detect and monitor the extent and severity of basin drought conditions. One key indicator is the U.S. Drought Monitor available through the U.S. Drought Portal, www.drought.gov. The National Weather Service (NWS) Climate Prediction Center (CPC) also develops short-term (6- to 10-day and 8- to 14-day) and long-term (1-month and 3-month) precipitation and temperature outlooks and a U.S. Seasonal Drought Outlook, which are useful products for monitoring dry conditions. The Palmer Drought Severity Index is also used as a drought reference. The Palmer index assesses total moisture by using temperature and precipitation to compute water supply and demand and soil moisture. It is considered most relevant for non-irrigated cropland and primarily reflects long-term drought. However, the index requires detailed data and cannot reflect an operation of a reservoir system. The state climatologists also produce a Lawn and Garden Index, which gives a basin-wide ability to determine the extent and severity of drought conditions. The runoff forecasts developed for both short- and long-range periods reflect drought conditions when appropriate. There is also a heavy reliance on the latest El Niño Southern Oscillation (ENSO) forecast modeling to represent the potential effects of La Niña on drought conditions and spring inflows. Long-range models are used with greater frequency during drought conditions to forecast potential effects on reservoir elevations, ability to meet minimum flows, and water supply availability. A long-term, numerical model, Extended Streamflow Prediction, developed by the NWS, provides probabilistic forecasts of streamflow and reservoir stages on the basis of climatic conditions, streamflow, and soil moisture. Extended Streamflow Prediction results are used in projecting possible future drought conditions. Other parameters and models can indicate a lack of rainfall and runoff and the degree of severity and continuance of a drought. Models using data of previous droughts or a percent of current to mean monthly flows with several operational schemes have proven helpful in forecasting reservoir levels for water management planning purposes. Other parameters considered during drought management are the ability of the various lakes to meet the demands placed on storage, the probability that lake elevations will return to normal seasonal levels, basin streamflows, basin groundwater table levels, and the total available storage to meet hydropower marketing system demands.

3-03. National Integrated Drought Information System (NIDIS). An NIDIS pilot program has been established for the ACF River Basin with the goal of developing a Regional Drought Early Warning Information System (RDEWS). The ACF RDEWS can be accessed through the U.S. Drought Portal, www.drought.gov.

a. The National Integrated Drought Information System Act of 2006 (Public Law 109-430) described the functions of NIDIS as follows:

The National Integrated Drought Information System shall:

(1) Provide an effective drought early warning system that — (A) is a comprehensive system that collects and integrates information on the key indicators of drought in order to make usable, reliable, and timely drought forecasts and assessments of drought, including assessments of the severity of drought conditions and impacts; (B) communicates drought forecasts, drought conditions, and drought impacts on an ongoing basis to (i) decision makers at the federal, regional, state, tribal, and local levels of government; (ii) the private sector; and (iii) the public, in order to engender better informed and more timely decisions thereby leading to reduced impacts and costs; and (C) includes timely (where possible real-time) data, information, and products that reflect local, regional, and state differences in drought conditions;

(2) Coordinate, and integrate as practicable, federal research in support of a drought early warning system; and

(3) Build upon existing forecasting and assessment programs and partnerships.

The law requires National Oceanic and Atmospheric Administration (NOAA) to consult with relevant federal, regional, state, tribal, and local government agencies, research institutions, and the private sector in developing the NIDIS and that each federal agency must cooperate as appropriate with NOAA.

The NIDIS ACF Basin RDEWS will be a Web-based system with information on drought preparedness, mitigation, and relief to serve policy and decision makers at all levels - local, state, regional, and national. The objective of NIDIS is to improve (1) observing systems, (2) monitoring, analysis, assessment, and prediction tools, and (3) impacts monitoring and assessment. It calls for more drought research and support for drought preparedness planning.

b. The U.S. Army Corps of Engineers' (Corps') Role in NIDIS. Corps contributions are most important in three areas: data and data management tools, drought preparedness planning, and impacts monitoring and assessment.

Several aspects of NIDIS affect the Corps.

(1) Drought Monitoring: NIDIS can integrate reservoir storage information so it would be easier for decision makers to assess hydrologic drought. The Mobile District has that information available, but it would need to be linked with NIDIS.

(2) Quantifying Drought Impacts: The Corps is one of the lead federal agencies for several sectors affected by drought and specifically mentioned by the NIDIS program; for

example, economic impacts of low flow and low reservoir levels on inland navigation, hydropower, and recreation.

(3) Drought Research: Topics recommended for further research include developing "methodologies to integrate data on climate, hydrology, water available in storage, and socioeconomic and ecosystem conditions" and "new decision support tools that would give decision-makers a better range of risks and options to consider."

The following are some specific items for Mobile District participation in NIDIS:

(1) Provider of drought information. Data on reservoir storage including archives of past data should be included in NIDIS. For the Corps, most of the data are available at the District level. Mobile District data are provided on the Internet. The Corps has other data that could be useful in drought impact assessment, including water supply, navigation, hydropower, and recreation data.

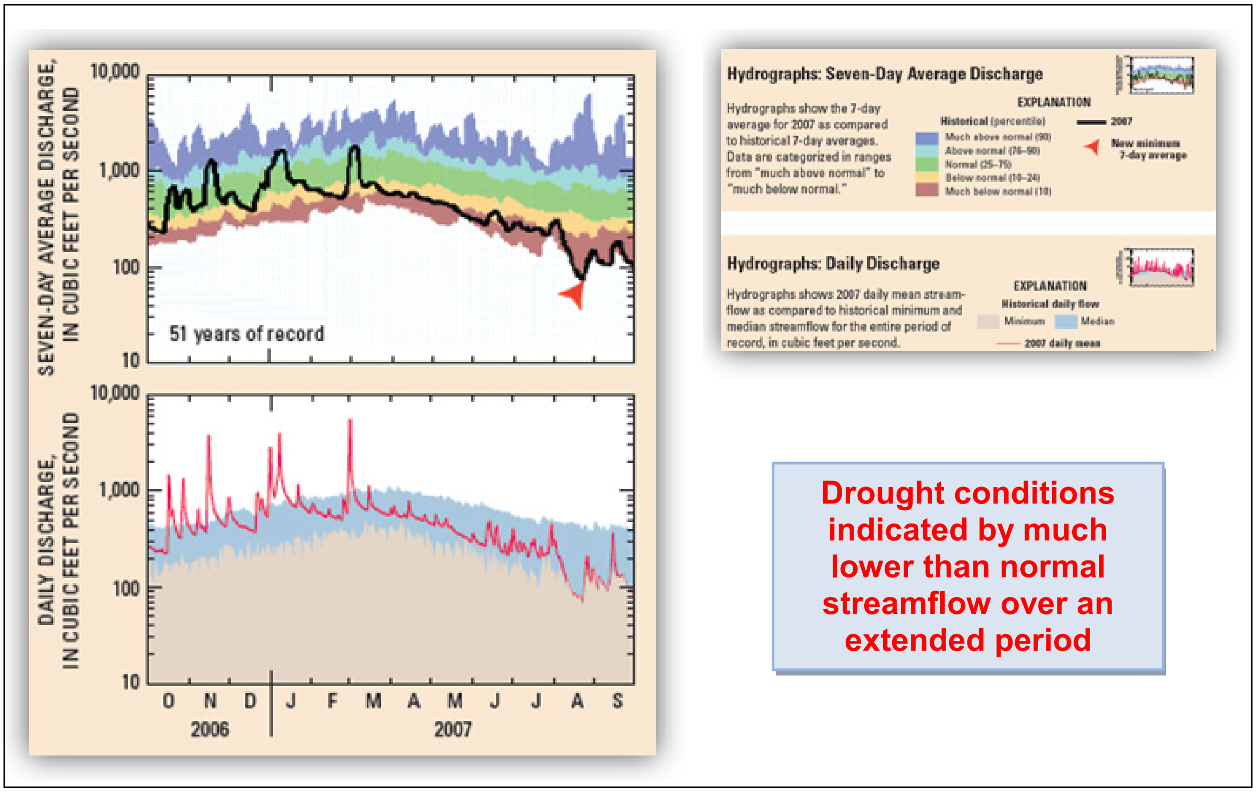
(2) Drought preparedness planning. The Corps has sufficient authority to develop drought plans for its projects that are better integrated with state, tribal, and local drought plans. Drought preparedness planning is one aspect of integrated watershed planning, and the Corps should be more proactive in drought planning for river basins with Corps projects.

(3) Impacts monitoring and assessment. The Corps has expertise in water resource areas that are affected by drought, such as navigation, hydropower, recreation, water supply, and ecosystems. However, additional research is necessary to quantify drought impacts.

(4) User of drought information. The Corps is a potential user of NIDIS. All Corps reservoirs are required to have DCPs. NIDIS could improve the triggers that implement the drought plans. NIDIS provides a forum for improved coordination between the Corps and the NWS Southeast River Forecast Center and the NOAA-supported Regional Climate Centers. New products are coming out that could increase the lead-time of river forecasts.

3-04. Historical Droughts. Several drought events have occurred in the ACF Basin with varying degrees of severity and duration. Four of the most significant historical basin-wide droughts occurred in 1954 – 1956, 1980 – 1981, 1985 – 1989, and 2006 – 2008. The 1985 - 1989 drought caused water shortages in Atlanta in 1986. That resulted in the need for the Corps to make adjustments in the water management practices at Buford Dam and to accelerate the publication and implementation of a drought management strategy for the ACF Basin in August 1986 (USACE, Mobile District 1986). The drought, with a recurrence interval of 50 to 100 years in the north and 10 to 25 years in central and south Georgia, caused over one-third of the private wells across the basin to run dry (USGS 2000). Water shortages occurred in the ACF Basin again from 1999 - 2002 and during 2006 - 2008. The 2006 - 2008 drought was the most devastating recorded in Alabama and western Georgia. Precipitation declines began in December 2005. Those shortfalls continued through the winter of 2006 – 2007 and spring 2007, exhibiting the driest winter and spring in the recorded period of record. North Georgia received less than 75 percent of normal precipitation (30-year average). New record low monthly streamflows occurred at 80 of 101 stations with 20 or more years of record. New record low 7-day-average streamflows occurred at 21 of 101 stations with 20 or more years of record (USGS 2007). Figure 1 shows a graphical depiction of the drought conditions as indicated by streamflow shortfalls. The drought reached peak intensity in 2007, resulting in a D-4 Exceptional Drought Intensity (the worst measured) throughout the summer of 2007. Rainfall at Gainesville, Georgia, (Lake Sidney Lanier) was only about 20 inches (the annual average precipitation there is 54.75 inches) for the entire year. That caused Lake Sidney

Lanier to record its daily record low lake elevations each day from 11 December 2007, through 10 December 2008. Furthermore, from 1 March 2008, through 1 August 2008, the Lake was three to five feet lower than the previous low for that day.



Source: USGS 2008

Figure 1. A Graphical Description of Drought as Indicated by Streamflow Shortfalls; Chattahoochee River near Cornelia

3-05. Severity. Water shortage problems experienced during droughts are not uniform throughout the ACF Basin. Even during normal, or average, hydrologic conditions, various portions of the basin experience water supply problems. The severity of the problems is primarily attributed to the pattern of human habitation within the basin; the source of water utilized (surface water vs. ground water); and the characteristics of the water resources available for use. During droughts, these problems can be intensified. A severe drought in the basin develops when a deficiency of rainfall occurs over a long time period and has a typical duration of 18 to 24 months. The number of months of below normal rainfall is more significant in determining the magnitude of a drought in the basin than the severity of the deficiency in specific months. However, the severity of the rainfall deficiency during the normal spring wet season has a significant impact on the ability to refill reservoirs after the fall/winter drawdown period. Another confounding factor which influences droughts in the basin is the variability of rainfall over the basin, both temporarily and spatially.

IV – BASIN AND PROJECT DESCRIPTION

4-01. Basin Description. There are 15 reservoirs on the mainstems of the Apalachicola, Chattahoochee, and Flint Rivers: 5 are federally owned (Corps) and 10 are privately owned projects. Of the 15 reservoirs, 12 are on the Chattahoochee River, 2 are on the Flint River, and one is on the Apalachicola River. A brief description of the Corps projects with conservation storage (presented in order from upstream to downstream) is provided below. Figure 2 shows the Corps and non-Corps reservoir projects in the ACF Basin. Plate 2-2 provides a profile view of the ACF Rivers and Reservoirs.

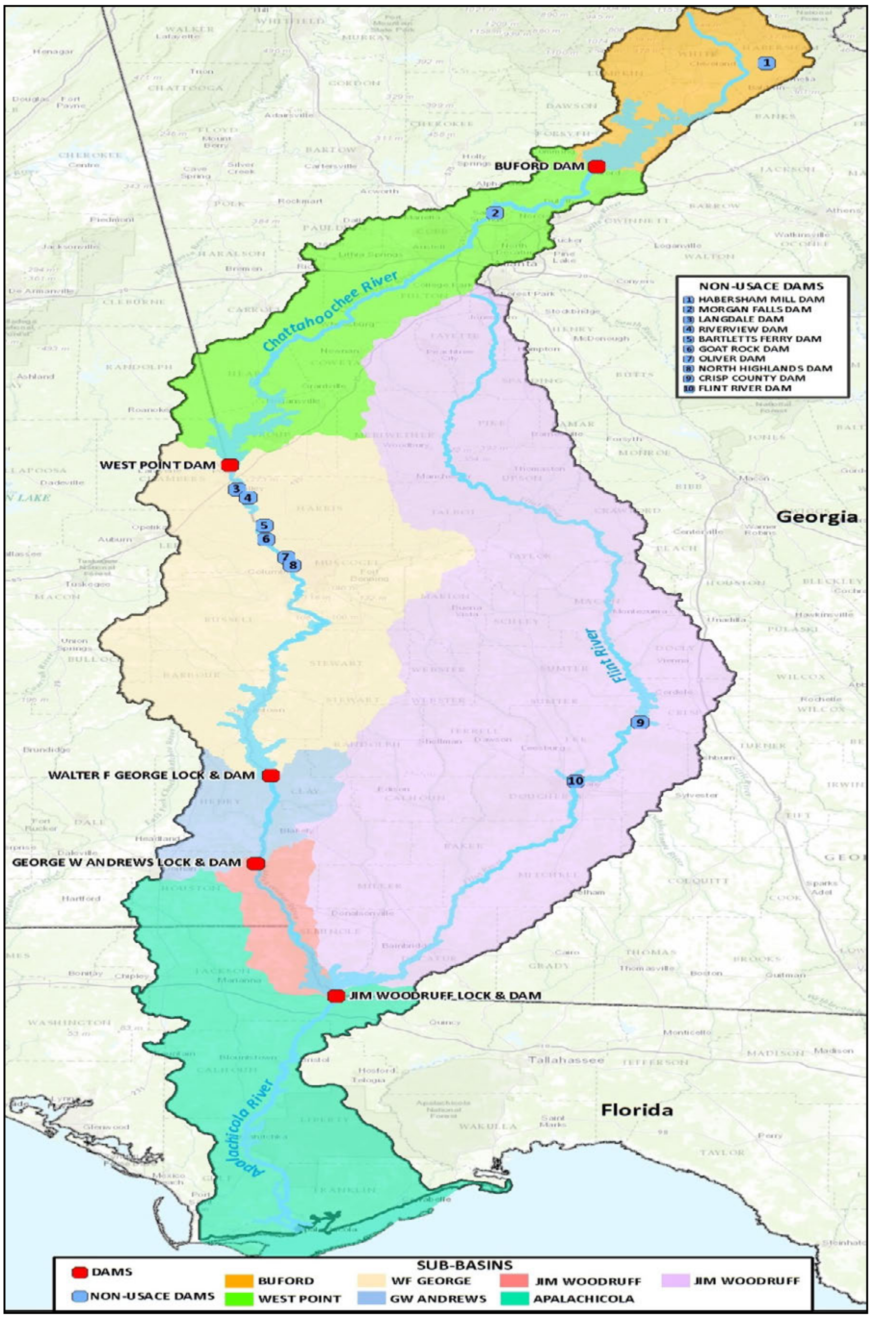


Figure 2. ACF Basin Project Location Map

4-02. Project Description. The Corps operates five projects in the ACF Basin (in downstream order): Buford Dam and Lake Sidney Lanier, West Point Dam and Lake, Walter F. George Lock and Dam and Lake, George W. Andrews Lock and Dam and Lake George W. Andrews on the mainstem of the Chattahoochee River, and Jim Woodruff Lock and Dam and Lake Seminole, immediately below the confluence of the Chattahoochee and Flint Rivers at the upstream extent of the Apalachicola River. George W. Andrews Project is a lock and dam without any appreciable water storage. Lake Sidney Lanier, West Point Lake, and Walter F. George Lake, have a combined conservation storage capacity (relative to the top of each reservoir's full summer pool) of 1,638,131 acre-feet (ac-ft). The Jim Woodruff Project is operated as a run-of-river project and only very limited pondage is available to support project purposes.

a. Lake Sidney Lanier (Buford Dam). Lake Sidney Lanier is formed by Buford Dam, which is about 48 miles northeast of Atlanta on the Chattahoochee River. The project is at river mile 348.3 on the Chattahoochee River. The project's authorization, general features, and purposes are described in the Buford Dam and Lake Sidney Lanier Water Control Manual (Appendix B of the ACF Master Water Control Manual). The Lake Sidney Lanier top of conservation pool is elevation 1,071 feet during the late spring and summer months (May through September) and 1,070 feet during the remainder of the year as shown in the water control plan guide curve (Figure 4). However, the lake level could fluctuate significantly from the guide curve over time, depending primarily on basin inflows but also influenced by project operations, evaporation, withdrawals, and return flows. The small turbine unit at Buford Dam is run continuously and provides a continuous minimum release of 550 to 660 cfs to the Chattahoochee River. Under drier conditions when basin inflows are reduced, project operations are adjusted to conserve storage in Lake Sidney Lanier while continuing to meet project purposes in accordance with four action zones as shown on Figure 3.

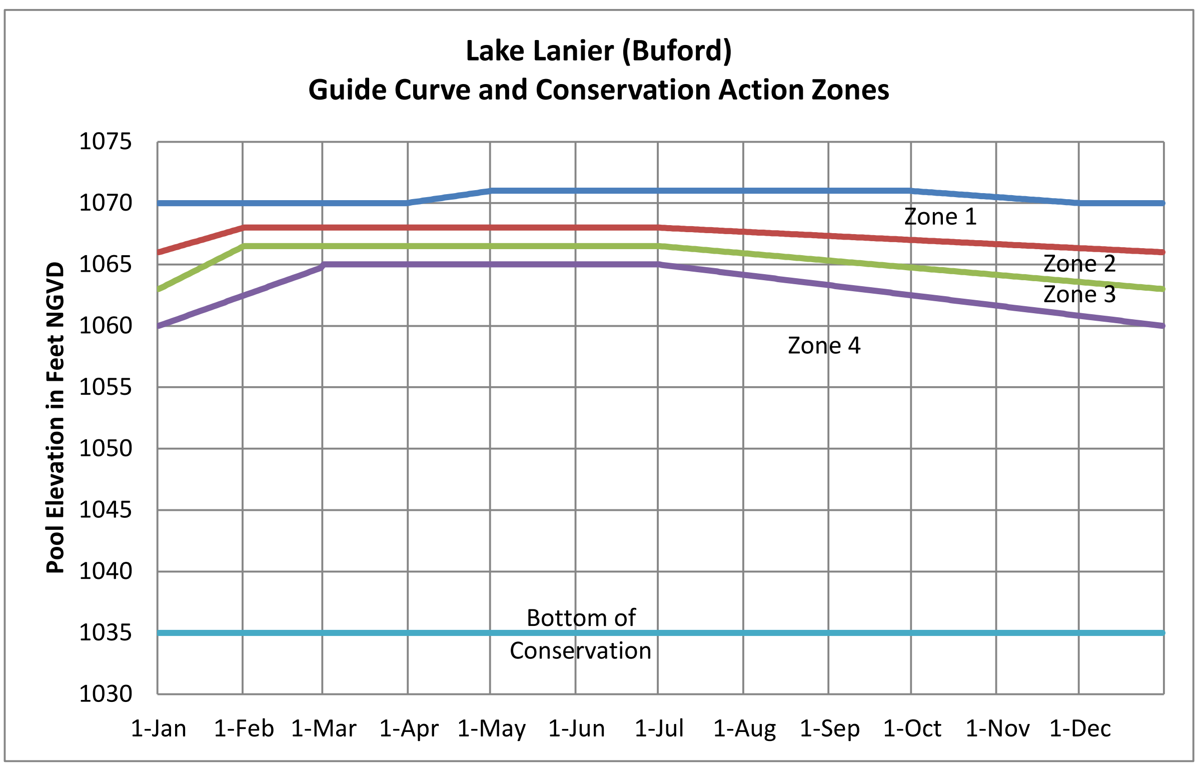


Figure 3. Lake Sidney Lanier Guide Curve and Action Zones

b. West Point Dam and Lake. West Point Lake is formed by West Point Dam, a Corps reservoir on the Alabama-Georgia state line near West Point, Georgia, at Chattahoochee river mile 201.4. The project's authorization, general features, and purposes are described in the West Point Dam and Lake Water Control Manual (Appendix E of the ACF Master Water Control Manual). The West Point Lake top of conservation pool is elevation 635 feet from June through August, transitioning to elevation 632.5 feet from mid-October through mid-November, and transitioning to elevation 628 feet from January through mid-February, as shown in the water control plan guide curve (Figure 4). However, the lake level can fluctuate significantly from the guide curve over time, dependent primarily on basin inflows but also influenced by project operations, evaporation, and withdrawals and return flows in the basin above the dam. West Point Dam provides a continuous minimum release of 670 cfs to the Chattahoochee River. Under drier conditions when basin inflows are reduced, project operations are adjusted to conserve storage in West Point Lake while continuing to meet project purposes in accordance with four action zones as shown on Figure 4. Power releases during the low-flow season augment flows at the GPC projects along the Chattahoochee River and provide water for municipal and industrial (M&I) needs in the vicinity of Columbus, Georgia, and potentially for navigation on the Apalachicola River below Jim Woodruff Lock and Dam.

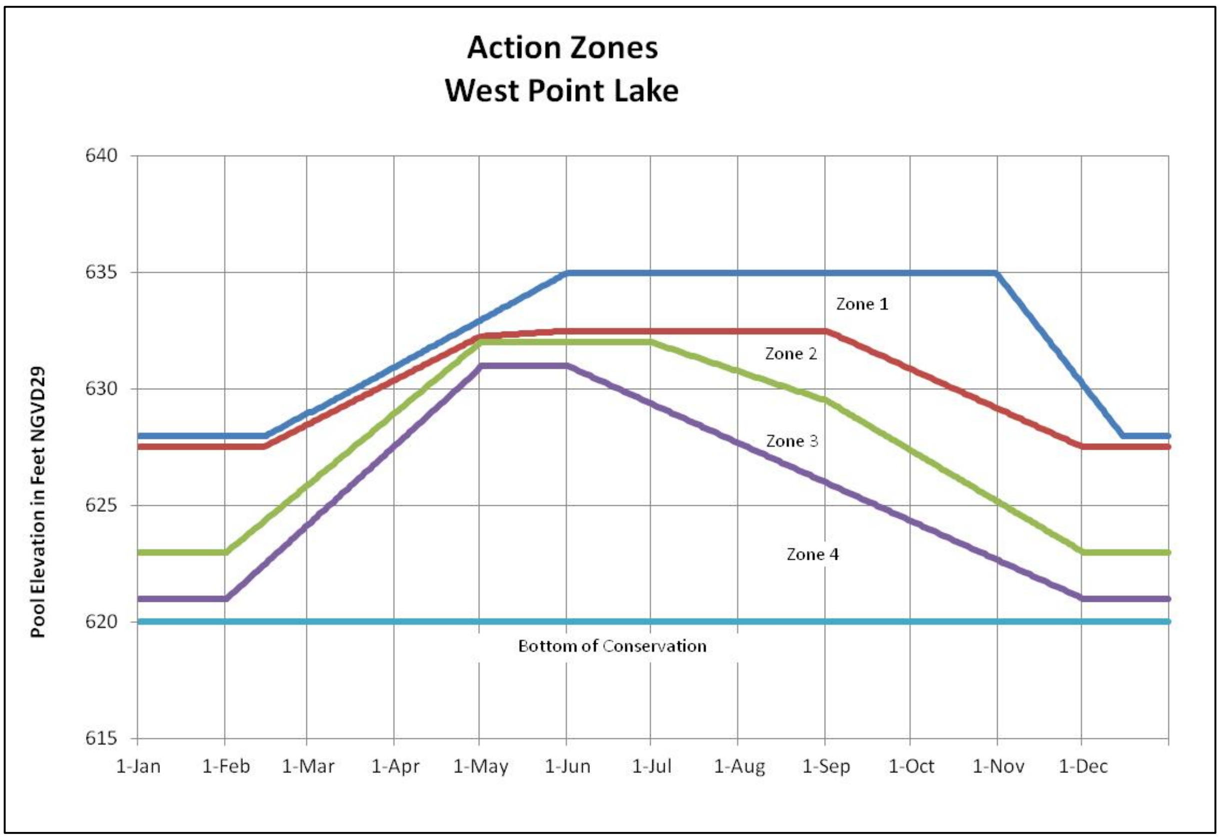


Figure 4. West Point Lake Guide Curve and Action Zones

c. Walter F. George Reservoir (Walter F. George Lock and Dam). Walter F. George Lake, also known as Lake Eufaula, is created by the Walter F. George Lock and Dam on the Chattahoochee River. Walter F. George Lock and Dam are about 86 miles downstream of Columbus, Georgia, at Chattahoochee river mile 75.0. The project's authorization, general features, and purposes are described in the Walter F. George Lock and Dam and Walter F. George Lake Water Control Manual (Appendix C of the ACF Master Water Control Manual).

The Walter F. George Lake top of conservation pool is elevation 190 feet from June through September, transitioning to elevation 188 feet from December through April, as shown in the water control plan guide curve (Figure 5). However, the lake level can fluctuate significantly from the guide curve over time, dependent primarily on basin inflows but also influenced by project operations, evaporation, and withdrawals and return flows in the basin above the dam. Under drier conditions when basin inflows are reduced, project operations are adjusted to conserve storage in Walter F. George Lake while continuing to meet project purposes in accordance with four action zones as shown on Figure 5.

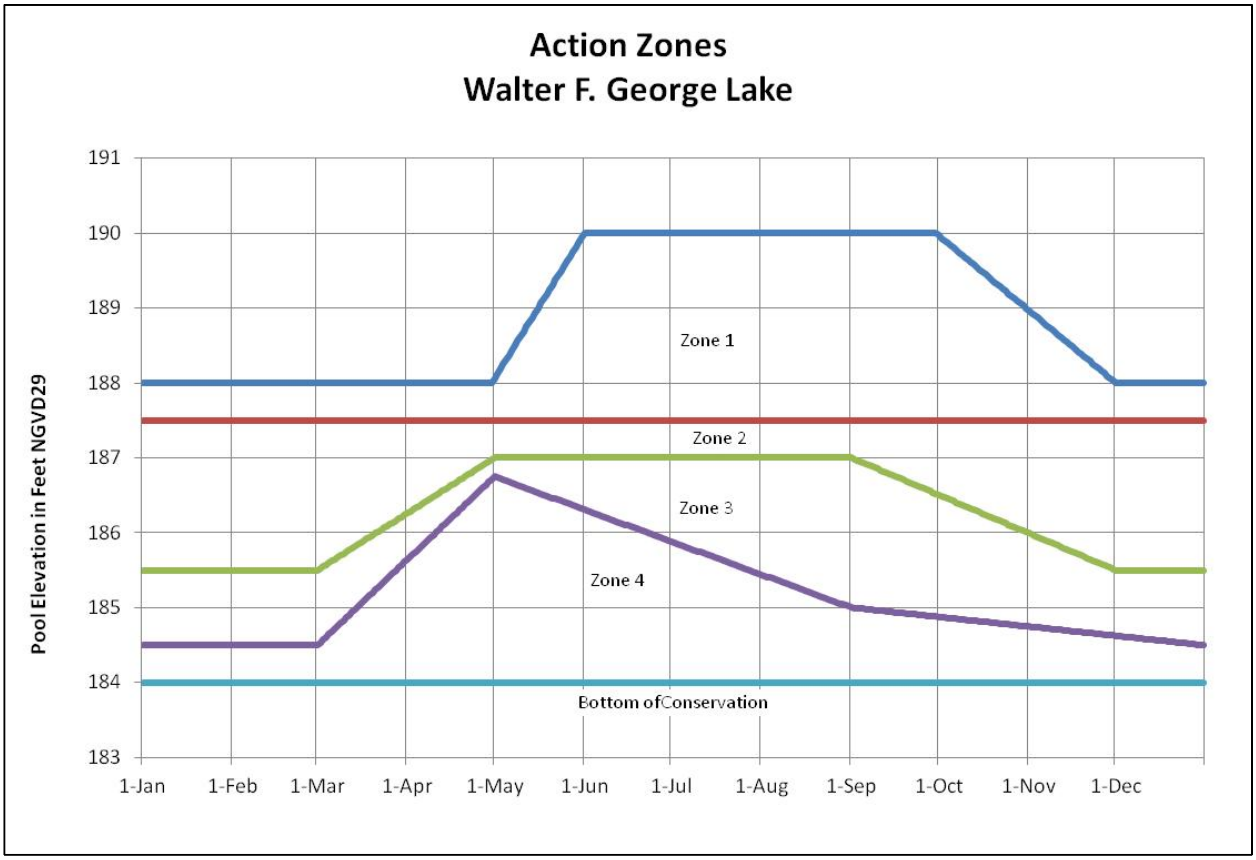


Figure 5. Walter F. George Lake Guide Curve and Action Zones

As other ACF water management objectives are addressed, lake levels might decline during prime recreation periods. Drought conditions will cause further drawdowns in lake levels. While lake levels will be slightly higher than what would naturally occur if no specific drought actions are taken, reservoir levels will decline thus triggering impacts associated with reaching initial recreation and water access limited levels. Large reservoir drawdowns affect recreational use: access to the water for boaters and swimmers is inhibited; submerged hazards (e.g., trees, shoals, boulders) become exposed or nearly exposed, posing safety issues; and exposed banks and lake bottoms become unsightly and diminish the recreation experience. Consequently, for Lake Sidney Lanier, West Point Lake, and Walter F. George Lake, certain levels are identified in each impoundment at which recreation would be affected (Table 2). The *Initial Impact level* (IIL) represents the level at which recreation impacts are first observed (i.e., some boat launching ramps are unusable, most beaches are unusable or minimally usable, and navigation hazards begin to surface). The *Recreation Impact level* (RIL) defines the level at which major impacts on concessionaires and recreation are observed (more ramps are not usable, all beaches are unusable, boats begin having problems maneuvering in and out of marina basin areas, loss of retail business occurs). The level at which severe impacts are observed in all aspects of recreational activities is called the *Water Access Limited level* (WAL). At that point, all or almost all boat ramps are out of service, all swimming beaches are unusable, major navigation hazards occur, channels to marinas are impassable and/or wet slips must be relocated, and a majority of private boat docks are unusable.

Table 2. Impact Levels (ft NGVD29) on Recreation at Federal Projects in the ACF Basin

Project	IIL	RIL	WAL
Lake Sidney Lanier	1,066	1,063	1,060
West Point Lake	632.5	629	627
Walter F. George Lake	187	185	184

V – WATER USES AND USERS

5-01. Water Uses and Users

a. Uses - The ACF Basin rivers and lakes are a major source of water supply to many cities, industries, and farms for wastewater dilution, municipal water supply, fish and wildlife propagation, hydropower generation, and recreational boating and fishing. Most of the population in the metro Atlanta, Georgia, region depends on surface water from the Chattahoochee River for drinking water supply. Municipal and Industrial (M&I) use is the primary water demands along the middle and lower Chattahoochee River. Agricultural use is the primary demand for water along the Flint River.

b. Users - The following tables list the surface water uses and water users within the Georgia, Alabama, and Florida and in the ACF Basin.

Table 3. Georgia Surface Water Use in the ACF Basin, 2005

Water use category	Quantity (mgd)	% of Total
Total Use	*1, 326.51*	*100%*
Public Supply	525.75	39.6%
Domestic and Commercial	6.90	0.5%
Industrial and Mining	121.84	9.2%
Irrigation	75.92	5.7%
Livestock	16.06	1.3%
Thermoelectric Power Generation	580.04	43.7%

Table 4. Georgia M&I Surface Water Withdrawals in the ACF Basin

River basin	Permit holder	Permit number	County	Source water	Permit limit max day (mgd)	Permit limit monthly average (mgd)
Upper Chattahoochee River Basin – headwaters to Whitesburg, GA						
Chattahoochee	City of Baldwin	068-1201-04	Habersham	Chattahoochee River	4.000	3.000
Chattahoochee	City of Clarkesville	068-1201-03	Habersham	Soque River	1.500	1.000
Chattahoochee	City of Cornelia	068-1201-01	Habersham	Hazel Creek, Camp Creek Reservoir, Emergency Camp Cr.	4.000	4.000
Chattahoochee	HaBest, Inc.[a]	068-1201-06	Habersham	Soque River	223.000	128.000
Chattahoochee	White County Water & Sewer Authority	154-1202-02	White	Turner Creek	2.000	1.800
Chattahoochee	Birchriver Chestatee Company, LLC	093-1202-03	Lumpkin	Chestatee River	0.430	0.430
Chattahoochee	Dahlonega, City of	093-1204-03	Lumpkin	Yahoola Creek Reservoir	9.100	6.800

River basin	Permit holder	Permit number	County	Source water	Permit limit max day (mgd)	Permit limit monthly average (mgd)
Chattahoochee	Dahlonega, City of, New Plant	093-1204-01	Lumpkin	Yahoola Creek	1.500	1.250
Chattahoochee	McRae and Stolz, Inc	042-1202-01	Dawson	Lake Sidney Lanier	0.780	0.500
Chattahoochee	Buford, City of	069-1290-04	Hall	Lake Sidney Lanier	2.500	2.000
Chattahoochee	Gainesville, City of	069-1290-05	Hall	Lake Sidney Lanier	35.000	30.000
Chattahoochee	LLI Management Company, LLC	069-1205-01	Hall	Lake Sidney Lanier	0.600	0.600
Chattahoochee	LLI Management Company, LLC (Pineisle)	069-1205-02	Hall	Lake Sidney Lanier	0.600	0.600
Chattahoochee	Gwinnett County Water & Sewerage Auth	069-1290-06	Hall	Lake Sidney Lanier		150.000
Chattahoochee	Cumming, City of	058-1290-07	Forsyth	Lake Sidney Lanier	21.000	18.000
Chattahoochee	Forsyth County Board of Commissioners	058-1207-06	Forsyth	Lake Sidney Lanier	16.000	14.000
Chattahoochee	Lanier Golf Club	058-1207-05	Forsyth	Golf Course Pond #1	0.290	0.210
Chattahoochee	Sequoia Golf Olde, Atlanta LLC	058-1207-03	Forsyth	ManMade Lakes	0.340	0.200
Chattahoochee	Sequoia Golf Windermere, LLC	058-1207-09	Forsyth	James Creek	0.400	0.400
Chattahoochee	Southeast Investments, L.L.C.	058-1207-08	Forsyth	Dick Creek	0.200	0.080
Chattahoochee	Dekalb Co Public Works Water & Sewer	044-1290-03	Dekalb	Chattahoochee River	140.000	140.000
Chattahoochee	Atlanta Athletic Club	060-1209-02	Fulton	Chattahoochee River	0.860	0.430
Chattahoochee	Atlanta, City of	060-1291-01	Fulton	Chattahoochee River	180.000	180.000
Chattahoochee	Atlanta-Fulton Co. Water Res Commission	060-1207-02	Fulton	Chattahoochee River	90.000	90.000
Chattahoochee	Cherokee Town & Country Club	060-1290-09	Fulton	Bull Sluice Lake	0.720	0.430
Chattahoochee	GCG Members' Purchasing Committee, Inc.	060-1209-04	Fulton	Big Creek	2.000	1.000
Chattahoochee	Palmetto, City of	060-1218-01	Fulton	Cedar Creek	0.600	0.450
Chattahoochee	Riverfarm Enterprises, Inc. (RiverPines Golf)	060-1207-04	Fulton	Johns Creek	1.150	0.500
Chattahoochee	Roswell, City of Big Creek	060-1209-01	Fulton	Big Creek	1.200	1.200
Chattahoochee	Standard Golf Club	060-1209-03	Fulton	Unnamed tributary to Johns Creek	0.750	0.600
Chattahoochee	Tattersall Club Corp	060-1290-08	Fulton	Chattahoochee River	0.250	0.250

River basin	Permit holder	Permit number	County	Source water	Permit limit max day (mgd)	Permit limit monthly average (mgd)
Chattahoochee	Caraustar Mill Group, Inc. - Mill 2	033-1214-02	Cobb	Sweetwater Creek	0.864	0.864
Chattahoochee	Caraustar Mill Group, Inc. - Sweetwater	033-1214-01	Cobb	Sweetwater Creek	0.560	0.490
Chattahoochee	Cobb Co Marietta Water Authority	033-1290-01	Cobb	Chattahoochee River	87.000	87.000
Chattahoochee	Georgia Power Co Plant Atkinson	033-1291-09	Cobb	Chattahoochee River	432.000	432.000
Chattahoochee	Georgia Power Co Plant McDonough	033-1291-03	Cobb	Chattahoochee River	394.000	394.000
Chattahoochee	Douglasville Douglas County W & S A	048-1216-03	Douglas	Bear Creek	6.400	6.000
Chattahoochee	Douglasville Douglas County W & S A	048-1217-03	Douglas	Dog River Reservoir	23.000	23.000
Chattahoochee	East Point, City of	048-1214-03	Douglas	Sweetwater Creek	13.200	11.500
Chattahoochee	Carroll County Water Authority	022-1217-01	Carroll	HC Seaton Reservoir (Snake Cr)	8.000	8.000
Chattahoochee	Coweta County Water & Sewerage Authority	038-1218-02	Coweta	BT Brown Reservoir	10.000	6.700
Chattahoochee River - Whitesburg to Jim Woodruff Dam (Lake Seminole)						
Chattahoochee	Georgia Power Co Plant Yates	038-1291-02	Coweta	Chattahoochee River	720.000	700.000
Chattahoochee	Newnan Utilities	038-1221-01	Coweta	Sandy/Browns Creek	8.000	8.000
Chattahoochee	Newnan Utilities	038-1221-02	Coweta	Raw Water Reservoirs	14.000	14.000
Chattahoochee	Georgia Power Co Plant Wansley	074-1291-06	Heard	Chattahoochee River	116.000	116.000
Chattahoochee	Georgia Power Co Plant Wansley	074-1291-07	Heard	Service Water Reservoir	110.000	110.000
Chattahoochee	Heard County Water Authority	074-1220-03	Heard	Hillabahatchee Creek	4.000	3.100
Chattahoochee	Heard County Water Authority	074-1291-08	Heard	Chattahoochee River	0.550	0.550
Chattahoochee	Hogansville, City of	141-1222-01	Troup	Blue Creek Res	1.000	1.000
Chattahoochee	Lagrange, City of	141-1292-01	Troup	West Point Lake	22.000	20.000
Chattahoochee	West Point, City of	141-1292-02	Troup	Chattahoochee River	2.100	1.800
Chattahoochee	Chat Valley Water Supply District	072-1291-04	Harris	Chattahoochee River	8.000	5.800
Chattahoochee	Harris County Water Dept	072-1224-01	Harris	Bartlett's Ferry Res	3.000	3.000
Chattahoochee	WestPoint Home, Inc.	072-1293-03	Harris	Chattahoochee River	4.000	3.500
Chattahoochee	Columbus, City of	106-1293-05	Muscogee	Lake Oliver	90.000	90.000

River basin	Permit holder	Permit number	County	Source water	Permit limit max day (mgd)	Permit limit monthly average (mgd)
Chattahoochee	Continental Carbon	106-1225-07	Muscogee	Chattahoochee River	0.900	0.660
Chattahoochee	Eagle & Phenix Hydro-electric Project, Inc.[b]	106-1225-04	Muscogee	Chattahoochee River	1,694.000	1,694.000
Chattahoochee	Eagle & Phenix Mills, LLC	106-1293-07	Muscogee	Chattahoochee River	1.400	1.300
Chattahoochee	Smiths Water Authority	106-1225-05	Muscogee	Lake Oliver (Chattahoochee River)	8.000	8.000
Chattahoochee	Southern Power Co Plant Franklin	106-1225-08	Muscogee	Chattahoochee River	31.500	31.500
Chattahoochee	Unimin Georgia Company, L.P.	096-1225-09	Marion	Duck pond on tributary to Black Cr	1.152	0.768
Chattahoochee	Fort Benning	026-1225-01	Chattahoochee	Upatoi River	12.000	10.000
Chattahoochee	Great Southern Paper Co. (Ga. Pacific Corp.)	049-1295-01	Early	Chattahoochee River	144.000	115.000
Chattahoochee	Homestead Energy Resources, LLC[c]	049-1295-02	Early	Chattahoochee River	16,130.000	16,130.000
Chattahoochee	Longleaf Energy Associates, LLC	049-1295-03	Early	Chattahoochee River	27.000	25.000
Flint River Basin – headwaters to Jim Woodruff Dam (Lake Seminole)						
Flint	Clayton County Water Auth Flint	031-1102-07	Clayton	Flint River	40.000	40.000
Flint	Clayton County Water Auth Shoal	031-1101-01	Clayton	J.W. Smith Res./ Shoal Cr.	17.000	17.000
Flint	Board of Commissioners of Fayette County	056-1102-03	Fayette	Lake Peachtree	0.550	0.500
Flint	Board of Commissioners of Fayette County	056-1102-06	Fayette	Flat Creek Reservoir	4.500	4.000
Flint	Board of Commissioners of Fayette County	056-1102-09	Fayette	Line Cr (McIntosh Site)	17.000	12.500
Flint	Board of Commissioners of Fayette County	056-1102-10	Fayette	Whitewater Creek	2.000	2.000
Flint	Board of Commissioners of Fayette County	056-1102-12	Fayette	Horton Creek Reservoir	14.000	14.000
Flint	Board of Commissioners of Fayette County	056-1102-13	Fayette	Flint River	16.000	16.000
Flint	Fayetteville, City of	056-1102-14	Fayette	Whitewater Creek	3.000	3.000
Flint	Newnan Utilities	038-1102-11	Coweta	Line Creek	12.000	12.000
Flint	Newnan Utilities	038-1103-02	Coweta	White Oak Creek	7.000	7.000
Flint	Senoia, City of	038-1102-05	Coweta	Hutchins Lake	0.300	0.300
Flint	Griffin, City of	126-1190-01	Spalding	Flint River	13.200	12.000

River basin	Permit holder	Permit number	County	Source water	Permit limit max day (mgd)	Permit limit monthly average (mgd)
Flint	Griffin, City of	114-1104-03	Pike	Still Branch Reservoir	48.000	42.000
Flint	Griffin, City of	114-1191-02	Pike	Flint River	50.000	50.000
Flint	Zebulon, City of	114-1104-01	Pike	Elkins Creek	0.400	0.300
Flint	Roosevelt Warm Springs Rehab	-	Meriwether	Cascade Creek	0.144	0.144
Flint	Woodbury, City of	099-1106-02	Meriwether	Cain Cr Res On Pond Cr	0.750	0.500
Flint	Southern Mills, Inc.	145-1104-02	Upson	Thundering Springs Lake	0.650	0.500
Flint	Thomaston, City of	145-1105-01	Upson	Potato Creek	4.400	3.400
Flint	Thomaston, City of	145-1105-02	Upson	Potato Creek	1.440	0.400
Flint	Thomaston, City of	145-1105-03	Upson	Raw Water Cr Res	4.300	4.300
Flint	Manchester, City of	130-1106-05	Talbot	Rush Creek Reservoir	2.000	1.440
Flint	Manchester, City of	130-1106-06	Talbot	Lazer Creek	4.300	3.700
Flint	Unimin Georgia Company, L.P.	133-1109-01	Taylor	Remote Pond on Black Creek	2.592	1.728
Flint	Unimin Georgia Company, L.P.	133-1109-02	Taylor	Black Creek (Remote Jr.)	0.576	0.384
Flint	Weyerhaeuser Company	094-1191-01	Macon	Flint River	13.500	11.500
Flint	Crisp County Power Comm - Hydro[d]	159-1112-02	Worth	Lake Blackshear	4,847.300	4,847.300
Flint	Crisp County Power Comm Steam	159-1112-01	Worth	Lake Blackshear	15.000	15.000
Flint	Georgia Power Co Plant Mitchell	047-1192-01	Dougherty	Flint River	232.000	232.000

a. Georgia withdrawal permit issued in 2007 for proposed flow through non-Corps hydroelectric power project at existing dam in Habersham County.

b. Georgia withdrawal permit (active as of 2009) for proposed non-Corps hydroelectric power development at Eagle-Phenix Dam. Request submitted to FERC on 10/21/2010 to surrender license (*Federal Register*, Vol.75, No. 209, 10/29/2010).

c. Georgia withdrawal permit (active as of 2009) for proposed non-Corps hydroelectric power development at George W. Andrews Lock and Dam. FERC terminated the license for project on 11/15/2007.

d. Georgia withdrawal permit (active as of 2009) for flow through non-Corps hydropower generation at Lake Blackshear.

Table 5. Alabama Surface Water Use in the ACF Basin, 2005

Water use category	Quantity (mgd)	% of total
Total Use	*165.95*	*100%*
Public Supply	18.92	11.4%
Industrial and Mining	29.76	17.9%
Thermoelectric Power Generation	105.36	63.5%
Irrigation	11.33	6.8%
Livestock	0.58	0.4%

Table 6. Alabama M&I Surface Water Withdrawals in the ACF Basin, 2005

Withdrawal by	County	Withdrawal (mgd)
Westpoint Home Inc. - Fairfax Finishing Plant (Westpoint Stevens Inc.)	Chambers	2.16
Chattahoochee Valley Water Supply District	Chambers	4.72
Smiths Water and Sewer Authority (Smiths Station Water System)	Lee	2.29
Opelika Water Works Board	Lee	7.48
Phenix City Utilities	Russell	7.04
MeadWestvaco Corporation	Russell	27.60
Southern Nuclear Company - Farley Nuclear Plant	Houston	105.36

Source: Hutson et al. 2009

Table 7. Florida M&I Surface Water Withdrawals in the ACF Basin

Withdrawal by	Avg daily withdrawal (monthly avg mgd)	Max daily withdrawal (monthly avg mgd)	Min daily withdrawal (monthly avg mgd)	Years for which data are available
Apalachicola River – Jim Woodruff Dam (Lake Seminole) to Apalachicola Bay				
Gulf Power (Scholz Electric)	86.72	129.60	0.0	1990–2012
St. Joe Timberland (Prudential Ins.)	0.95	10.75	0.00	1999–2008
City of Port St. Joe	0.77	4.51	0.00	2002–2012

Source: Withdrawal data compiled by USACE, Mobile District, for use in modeling the ACF Basin with HEC ResSim.

VI. – CONSTRAINTS

6-01. General. The availability of water resources in the ACF Basin is constrained by existing water supply storage contracts, Corps water control manuals, minimum flow requirements from Buford and West Point Dams, GPC FERC licenses, and industrial water quality flow needs. Existing water supply storage contracts do not include the use of the inactive storage pool and would require developing and implementing an emergency storage contract in order to access this water resource.

Each Corps project has a water control manual that specifies operational requirements for varying basin conditions and requires a deviation approval to operate outside the parameters established by the manual. The Buford Dam and Lake Lanier Project has a minimum flow release requirement, that along with local inflows, will provide a minimum of 750 cfs downstream at Atlanta, Georgia. Physical constraints of the Buford Project are generally limited to available powerhouse capacity, sluice capacity, and downstream channel capacity. As the project approaches the bottom of conservation pool, the powerhouse turbines can no longer effectively run and discharge will be limited to sluice operation. Also, channel capacity limitations downstream constrains peaking operations from both units to four hours or less to keep the volume of the releases within bankfull capacity. The West Point Project has a minimum flow release requirement of 670 cfs and a channel capacity limitation of 40,000 cfs. The Walter F. George Project has a maximum head limit constraint (difference between lake and tailwater elevations) of 88 feet and a downstream bankfull channel capacity of 65,000 cfs. The George W. Andrews Project has a maximum head limit constraint of 26 feet and a downstream bankfull channel capacity of 40,000 cfs. The Jim Woodruff Project has a varying head limitation that ranges between 33 to 38.5 feet and a downstream bankfull channel capacity of 77,000 cfs. The operation of the Jim Woodruff Project is also constrained by varying aspects including limitations on ramping rates and minimum flow requirements downstream.

The GPC projects are operated under FERC licenses which define specific operational requirements for each project and require approval from FERC and possibly the Corps and State agencies before any revised operations could be implemented. Some industrial NPDES permits within the ACF Basin have water quality discharge limitations which are impacted by the volume of water flow in the river.

VII – DROUGHT MANAGEMENT PLAN

7-01. General. The Water Control Plan for the ACF Basin and each individual project implements drought conservation actions on the basis of composite conservation storage in Lake Sidney Lanier, West Point Lake, and Walter F. George Lake. Composite conservation storage is calculated by combining the conservation storage of Lake Sidney Lanier, West Point Lake, and Walter F. George Lake. Each of the individual storage reservoirs consists of four action zones. The composite conservation storage uses the four zone concepts as well; i.e., Zone 1 of the composite conservation storage represents the combined storage available in Zone 1 for each of the three storage reservoirs. Simulation modeling of the Water Control Plan for the 73 years between 1939 and 2011 gives an indication of how often to expect drought conservation actions. Figure 6 presents the expected percent of time that the conservation storage will be in each composite storage zone according to historical flows. Two scenarios are presented: (1) The previous operating plan in place prior to this manual update which includes the year 2007 water supply occurring from Lake Sidney Lanier and from the Chattahoochee River below Buford Dam and (2) The current operating plan detailed in this manual update which includes water supply withdraws based on the increased water supply demand as described in section 7-09.

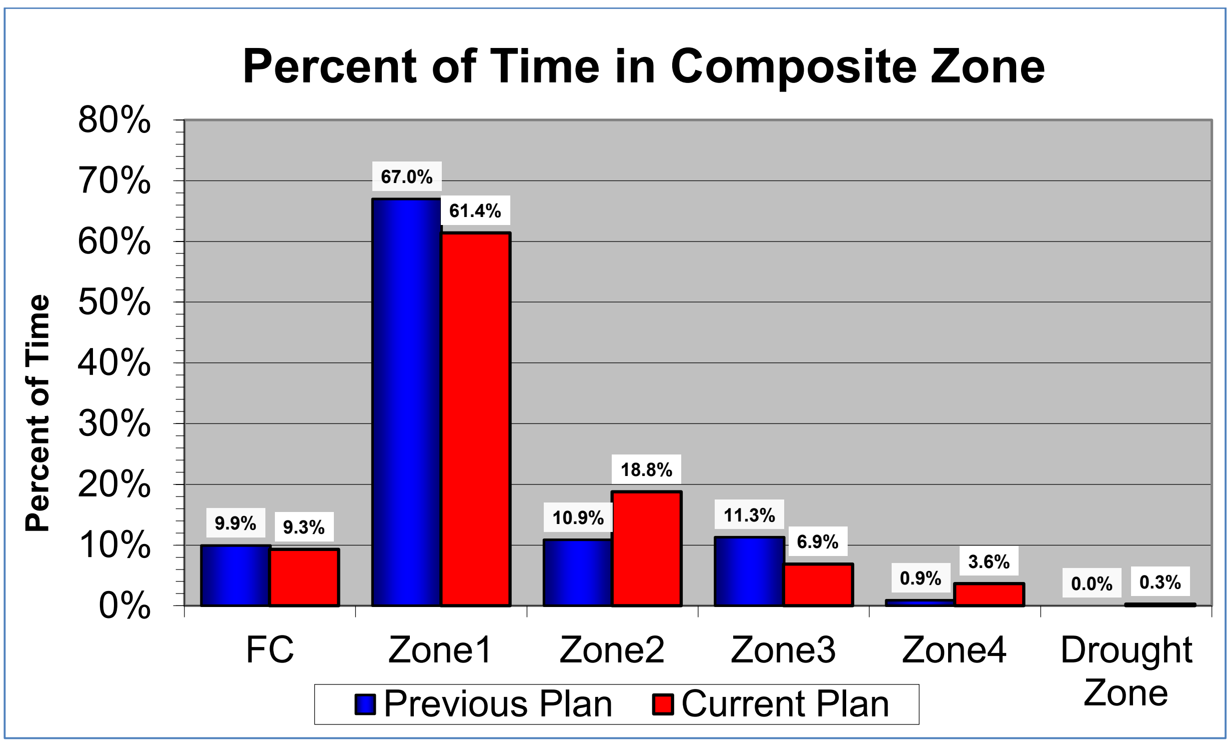


Figure 6. Percent of Time in Composite Conservation and Flood Zones

7-02. Drought Contingency Plan

The drought plan specifies a minimum release from Jim Woodruff Dam and temporarily suspends the normal minimum release and maximum fall rate provisions until composite conservation storage in the basin is replenished to a level that can support them. Under the drought plan, minimum discharge is determined in relation to the composite conservation storage and not the average basin inflow. The drought plan is triggered when the composite conservation storage falls below the bottom of Zone 2 into Zone 3 (Figure 7). At that time, all the composite conservation storage Zone 1 through 3 provisions (seasonal storage limitations, maximum fall rate schedule, and minimum flow thresholds) are suspended, and management decisions are based on the provisions of the drought plan. The drought plan includes the option for a temporary waiver from the existing water control plan to allow temporary storage above the winter pool guide curve at the Walter F. George and West Point projects to provide additional conservation storage for future needs, if conditions in the basin dictate the need for such action. The drought plan prescribes two minimum releases on the basis of composite conservation storage in Zones 3 and 4 and an additional zone referred as the Drought Zone. The Drought Zone delineates a volume of water roughly equivalent to the inactive storage in lakes Sidney Lanier, West Point, and Walter F. George, plus Zone 4 storage in Lake Sidney Lanier. The Drought Zone line has been adjusted to include a smaller volume of water at the beginning and end of the calendar year. When the composite conservation storage is within Zone 4 and above the Drought Zone, the minimum release from Jim Woodruff Dam is 5,000 cfs and all basin inflow above 5,000 cfs that is capable of being stored may be stored. Once the composite conservation storage falls below the Drought Zone, the minimum release from Jim Woodruff Dam is 4,500 cfs and all basin inflow above 4,500 cfs that is capable of being stored may be stored. When transitioning from a minimum release of 5,000 to 4,500 cfs, fall rates are limited to 0.25 ft/day drop. The 4,500-cfs minimum release is maintained until composite conservation storage returns to a level above the top of the Drought Zone, at which time the 5,000-cfs minimum release is reinstated. The drought plan provisions remain in place until conditions improve such that the composite conservation storage reaches Zone 1. At that time, the temporary drought plan provisions are suspended and all the other provisions of the basin water control plan are reinstated.

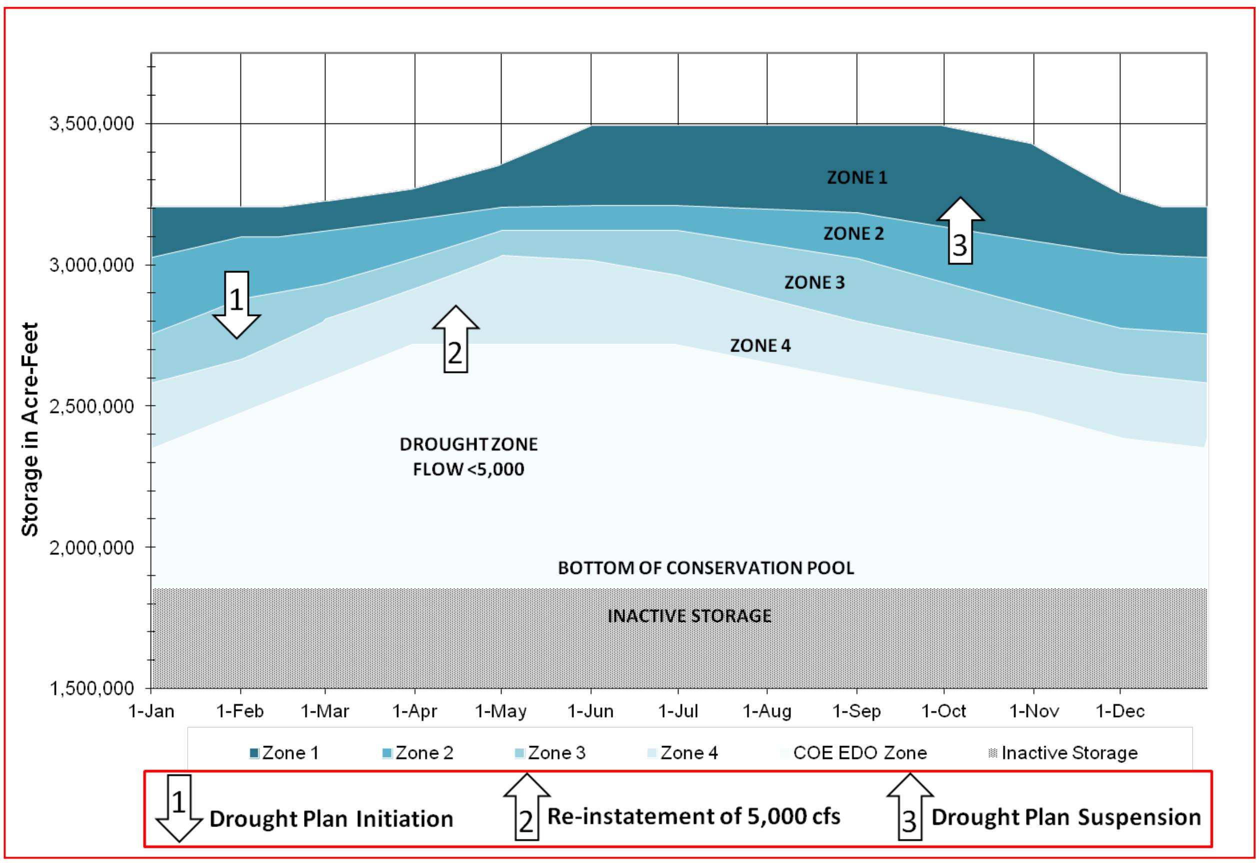


Figure 7. ACF Composite Conservation Storage Zones and Drought Plan Triggers

During the drought contingency operations, a monthly monitoring plan that tracks composite conservation storage to determine water management operations (the first day of each month represents a decision point) is implemented to determine which operational triggers are applied. In addition, recent climatic and hydrological conditions experienced and meteorological forecasts are used when determining the set of operations in the upcoming month. Although the drought plan provides for flows lower than 5,000 cfs in the river, provisions that allow for reduced flows during the refill period when system storage is lower and storage conservation measures when composite conservation storage is in Zone 4 should result in fewer occasions when those low flows are triggered or in occasions where storage shortages result in flows less than 5,000 cfs. Details of implementing the DCP for each individual project are provided in the individual project water control plans documented in the individual water control manuals as appendices to the master water control manual.

7-03. Extreme Drought Conditions. When the remaining composite conservation storage is about 10 percent of the total capacity, additional emergency actions might be necessary. When conditions have worsened to that extent, use of the inactive storage must be considered. Such an occurrence could be contemplated in the second or third year of a drought. Inactive storage zones have been designated for the three federal projects with significant storage (Figure 8). Table 8 provides the inactive storage capacity within the inactive storage zones for each project. Figures 9 through 11 provide detailed information for each project including storage capacities and critical lake levels. The operational concept established for the extreme drought impact level and to be implemented when instituting the use of inactive storage is based on the following actions:

(1) Inactive storage availability is identified to meet specific critical water use needs within existing project authorizations.

(2) Emergency uses will be identified in accordance with emergency authorizations and through stakeholder coordination. Typical critical water use needs within the basin are associated with public health and safety. Table 9 lists the users of the critical water needs that have been identified in the ACF Basin during past droughts.

(3) Weekly projections of the inactive storage water availability to meet the critical water uses from Buford Dam downstream to the Apalachicola River will be used when making water control decisions regarding withdrawals and water releases from the federal reservoirs.

(4) The inactive storage action zones will be instituted as triggers to meet the identified priority water uses (releases will be restricted as storage decreases). Figure 8 lists the typical critical water uses for each inactive storage zone.

(5) Dam safety considerations will always remain the highest priority. The structural integrity of the dams due to static head limitations (Jim Woodruff, 38.5 feet; George W. Andrews, 26 feet; Walter F. George, 88 feet) will be maintained.

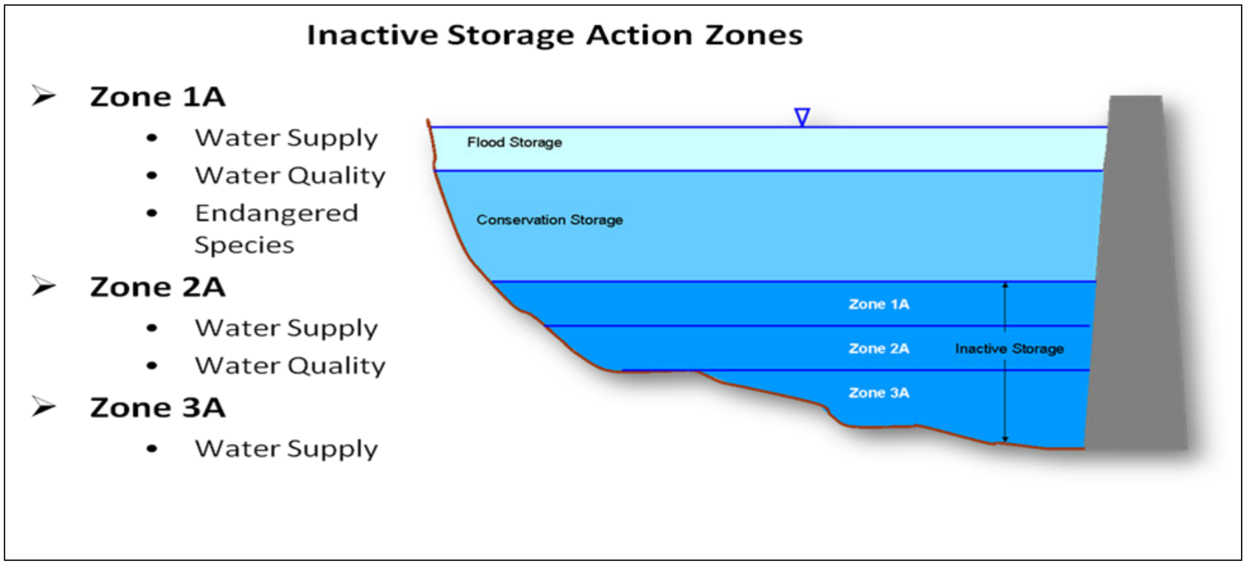
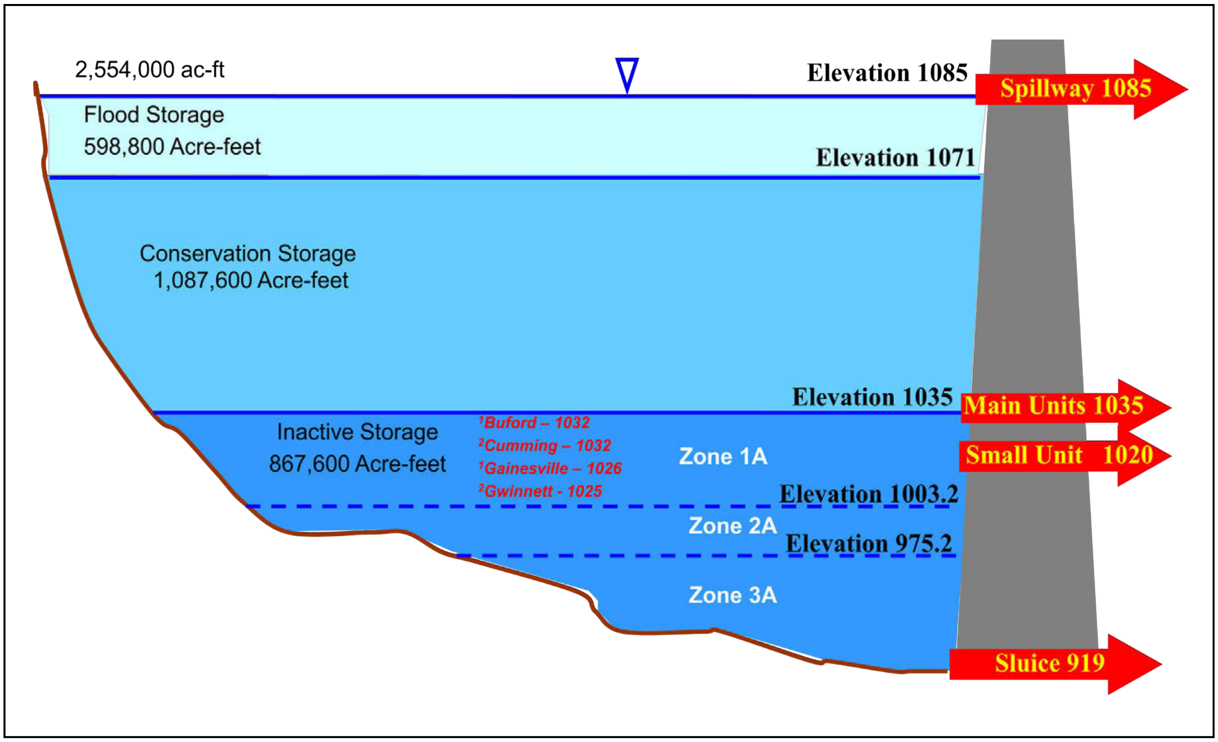


Figure 8. Inactive Storage Zones and Typical Water Use Needs

Table 8. ACF Reservoir Inactive Storage Zone Capacities (ac-ft)

Project	Zone 3A	Zone 2A	Zone 1A	Unusable Inactive
Buford Dam	100,823	234,699	532,078	0
West Point Dam	33,344	138,331	53,620	73,101
Walter F. George	0	178,501	314,799	196,700
Total	134,869	554,345	901,589	266,062



Notes: [1] Buford and Gainesville have existing relocation water supply contracts; [2] Cumming and Gwinnett intakes are available for emergency withdrawals subject to approval of emergency contracts under emergency authorizations during drought.

Figure 9. Lake Sidney Lanier Storage Zones, Storage Capacities, and Critical Lake Levels (all elevations in feet NGVD29)

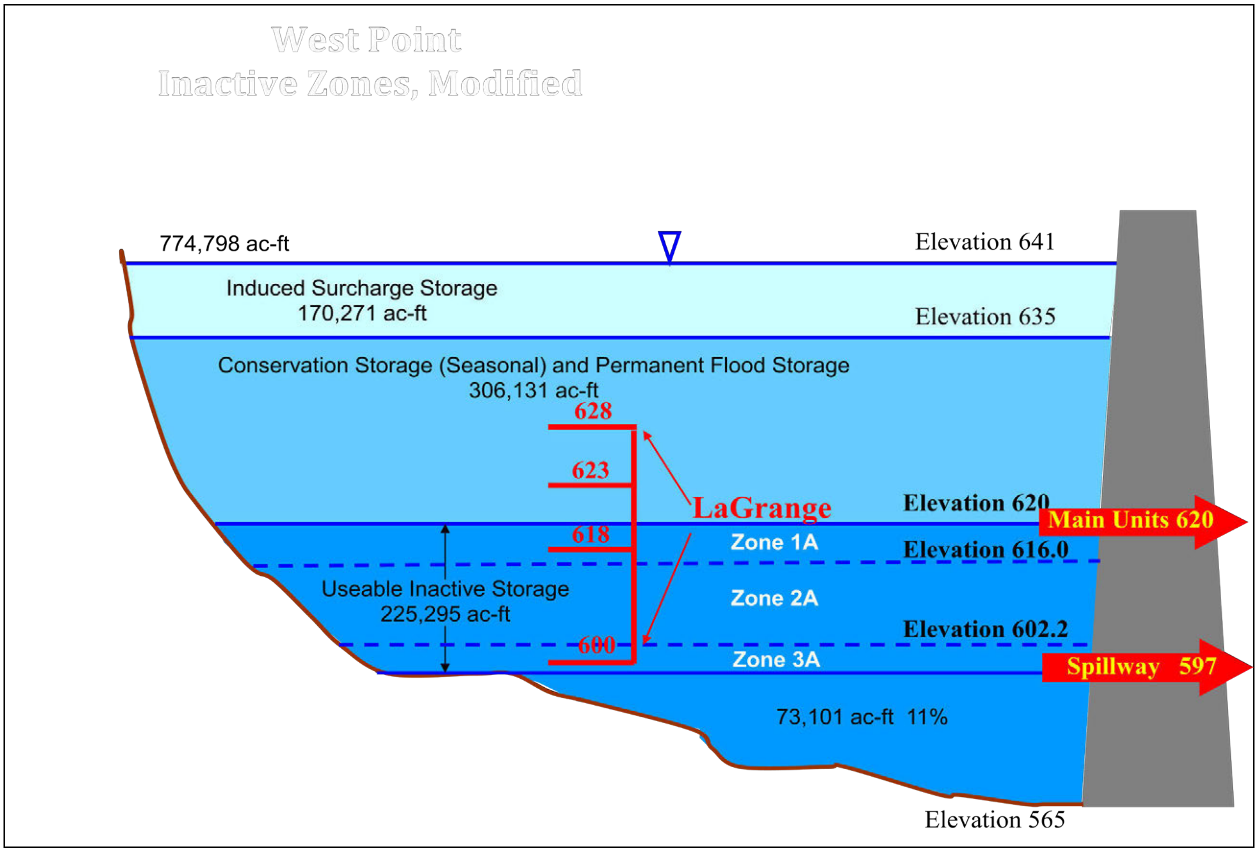


Figure 10. West Point Lake Storage Zones, Storage Capacities, and Critical Lake Levels (all elevations in feet NGVD29)

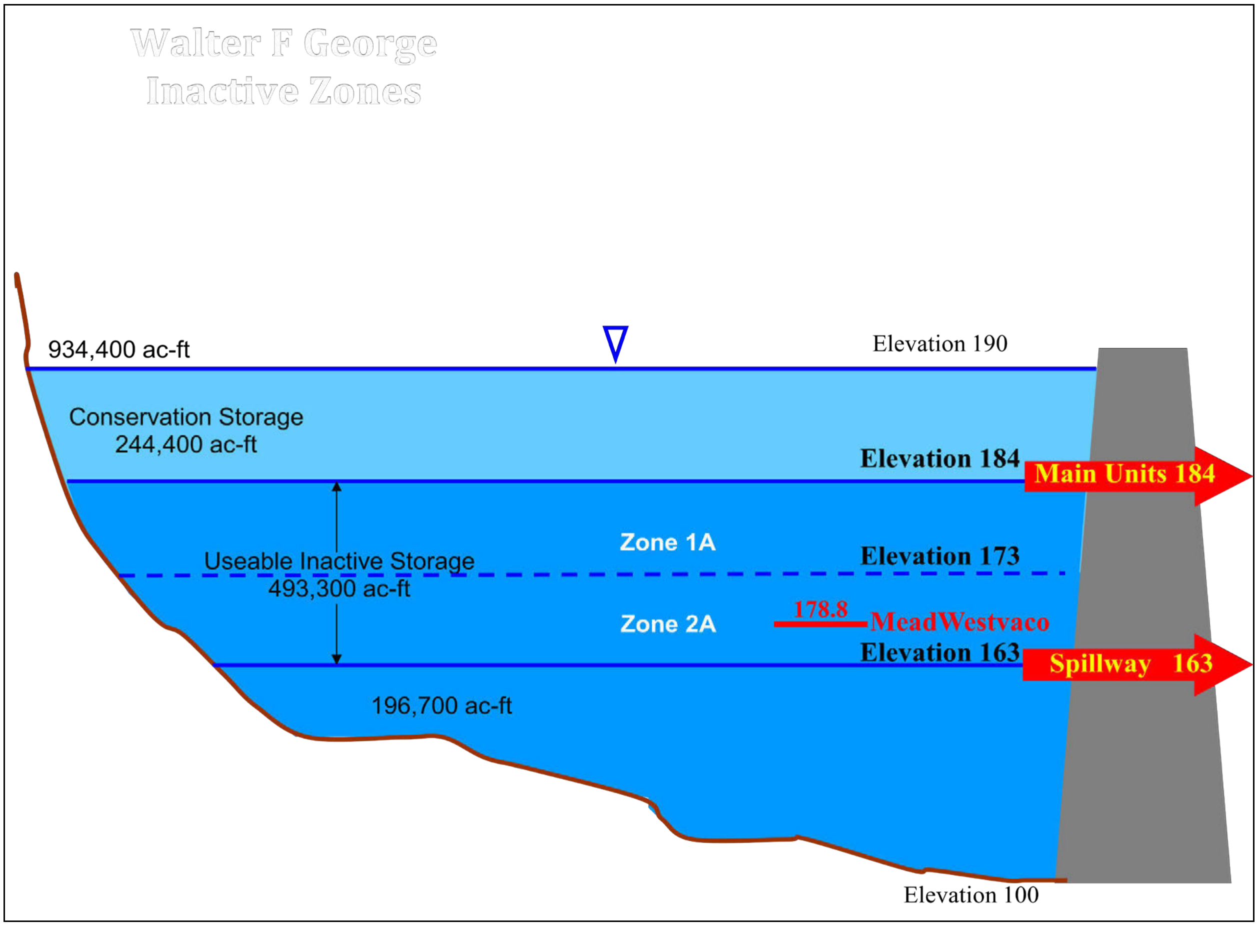


Figure 11. Walter F. George Lake Storage Zones, Storage Capacities, and Critical Lake Levels (all elevations in feet NGVD29)

Table 9. Critical Water Needs Identified in the ACF Basin

Water Quality	Municipal Intake
Buford Trout Hatchery	Gwinnett
Atlanta Waste Assimilation	Cumming
WP dam tailwater	Gainesville
Eufaula National Wildlife Refuge	Buford
WFG tailwater	Cobb County-Marietta Water Authority
Apalachicola Bay	Chat Valley Water Supply District
State Water Quality	City of Atlanta
7Q10 at water returns	City of Columbus
Reservoir Fish & Wildlife Resources	City of LaGrange
	City of West Point
	Dekalb County
	Harris County Water Dept
	Phenix City
	Smiths Water and Sewer Authority
Industrial Intake	**Thermal Power**
Atlanta Athletic Club	Farley Nuclear Plant
Eagle & Phenix Hydroelectric Project, Inc.	Plant Sholz
Georgia Pacific	Plant Yates
MeadWestvaco (Mahrt Mill - River Intake)	Plant Wansley
Tattersall Club Corp	Plant McDonough
Westpoint Stevens Inc	

Table 10 list critical water intakes in the ACF Basin. The minimum operating level represents the lowest water surface elevation in feet that the facility can safely withdraw water. This information was obtained from stakeholders during the 2007-2009 drought. While the table is not comprehensive it represents the best information available at the time of print.

Table 10. Critical Water Intakes in the ACF Basin

County	Facility	Permit Number	Municipal or Industrial	River Basin	Source Water	Permitted Monthly Average (Millions of Gallons/Day)	Minimum Operating Level (Water Surface in feet above NGVD 1929)
Fulton	Atlanta Athletic Club	060-1209-02	I	Chattahoochee	Chattahoochee River	0.43	unknown
Fulton	Atlanta, City of	060-1291-01	M	Chattahoochee	Chattahoochee River	180	745
Fulton	Atlanta-Fulton Co. Water Res. Commission	060-1207-02	M	Chattahoochee	Chattahoochee River	90	877
Habersham	Baldwin, City of	068-1201-04	M	Chattahoochee	Chattahoochee River	3	unknown
Hall	Buford, City Of	069-1290-04	M	Chattahoochee	Lake Sidney Lanier	2	1032
Harris	Chat Valley Water Supply District	072-1291-04	M	Chattahoochee	Chattahoochee River	5.8	548

County	Facility	Permit Number	Municipal or Industrial	River Basin	Source Water	Permitted Monthly Average (Millions of Gallons/Day)	Minimum Operating Level (Water Surface in feet above NGVD 1929)
Fulton	Cherokee Town & Country Club	060-1290-09	I	Chattahoochee	Bull Sluice Lake	0.43	unknown
Clayton	Clayton County Water Auth - Shoal	031-1101-01	M	Flint	J.W. Smith Res./Shoal Cr.	17	
Cobb	Cobb Co - Marietta Water Authority	033-1290-01	M	Chattahoochee	Chattahoochee River	87	793
Muscogee	Columbus, City Of	106-1293-05	M	Chattahoochee	Lake Oliver	90	300
Muscogee	Continental Carbon	106-1225-07	I	Chattahoochee	Chattahoochee River	0.66	unknown
Habersham	Cornelia, City Of	068-1201-01	M	Chattahoochee	Hazel Creek,Camp Cr Res, Emergency Camp Cr	4	unknown
Forsyth	Cumming, City Of	058-1290-07	M	Chattahoochee	Lake Sidney Lanier	18	1041
Dekalb	Dekalb Co Public Works - Water & Sewer	044-1290-03	M	Chattahoochee	Chattahoochee River	140	867
Muscogee	Eagle & Phenix Hydroelectric Project, Inc.	106-1225-04	I	Chattahoochee	Chattahoochee River	1,694.00	unknown
Muscogee	Eagle & Phenix Mills, LLC	106-1293-07	I	Chattahoochee	Chattahoochee River	1.3	unknown
Douglas	East Point, City Of	048-1214-03	M	Chattahoochee	Sweetwater Creek	11.5	724
Forsyth	Forsyth County Board Of Commissioners	058-1207-06	M	Chattahoochee	Lake Sidney Lanier	14	no intake
Hall	Gainesville, City Of	069-1290-05	M	Chattahoochee	Lake Sidney Lanier	30	1025
Cobb	Georgia Power Co - Plant Atkinson	033-1291-09	I	Chattahoochee	Chattahoochee River	432	
Muscogee	Georgia Power Co - Plant Goat Rock	106-1225-08	I	Chattahoochee	Chattahoochee River	31.5	unknown
Cobb	Georgia Power Co - Plant McDonough	033-1291-03	I	Chattahoochee	Chattahoochee River	394	738
Dougherty	Georgia Power Co - Plant Mitchell	047-1192-01	I	Flint	Flint River	232	unknown
Heard	Georgia Power Co - Plant Wansley	074-1291-06	I	Chattahoochee	Chattahoochee River	116	662
Heard	Georgia Power Co - Plant Wansley	074-1291-07	I	Chattahoochee	Service Water Reservoir	110	
Coweta	Georgia Power Co - Plant Yates	038-1291-02	I	Chattahoochee	Chattahoochee River	700	683
Early	Great Southern Paper Co. (Ga. Pacific Corp.)	049-1295-01	I	Chattahoochee	Chattahoochee River	115	75
Hall	Gwinnett County Water & Sewerage Auth	069-1290-06	M	Chattahoochee	Lake Sidney Lanier	150	1029
Harris	Harris County Water Dept	072-1224-01	M	Chattahoochee	Bartlett's Ferry Res	3	unknown
Heard	Heard County Water Authority	074-1291-08	I	Chattahoochee	Chattahoochee River	0.55	unknown
Early	Homestead Energy Resources, LLC	049-1295-02	I	Chattahoochee	Chattahoochee River	16,130.00	unknown
Troup	Lagrange, City Of	141-1292-01	M	Chattahoochee	West Point Lake	16	600
Hall	LLI Management Company, LLC	069-1205-01	I	Chattahoochee	Lake Sidney Lanier	0.6	unknown

County	Facility	Permit Number	Municipal or Industrial	River Basin	Source Water	Permitted Monthly Average (Millions of Gallons/Day)	Minimum Operating Level (Water Surface in feet above NGVD 1929)
Hall	LLI Management Company, LLC (Pineisle)	069-1205-02	I	Chattahoochee	Lake Sidney Lanier	0.6	unknown
Early	Longleaf Energy Associates, LLC	049-1295-03	I	Chattahoochee	Chattahoochee River	25	unknown
Dawson	McRae and Stolz, Inc.	042-1202-01	I	Chattahoochee	Lake Sidney Lanier	0.5	unknown
Muscogee	Smiths Water Authority	106-1225-05	M	Chattahoochee	Lake Oliver (Chat R)	8	322
Fulton	Tattersall Club Corp	060-1290-08	I	Chattahoochee	Chattahoochee River	0.25	unknown
Troup	West Point, City Of	141-1292-02	M	Chattahoochee	Chattahoochee River	1.8	554
Harris	WestPoint Home, Inc.	072-1293-03	I	Chattahoochee	Chattahoochee River	3.5	547.75
White	White County Water & Sewer Authority	154-1202-02	M	Chattahoochee	Turner Creek	1.8	
Houston	Southern Nuclear Company - Farley Nuclear Plant	AL0024619	I	Chattahoochee River	Seminole Lake		74.5
Lee	Opelika Water Works Board	0000816	M	Chattohooche e River	Lake Harding	4.5	521
Russell	MeadWestvaco Corporation	AL0000817	I	Chattahoochee River	W.F. George Lake	22	185
Russell	Phenix City Utilities	0001142	M	Chattahoochee River	North Highland Reservoir		258
Jackson	Plant Sholz		I	Apalachicola River	Apalachicola River		37.5
	Trout Hatchery			Chattahoochee River	Chattahoochee River		902

VIII – DROUGHT MANAGEMENT COORDINATION AND PROCEDURES

8-01. Corps Coordination. It is the responsibility of the Mobile District to monitor climatological and hydrometeorological conditions at all times to make prudent water management decisions with water conservation as a priority. Mobile District makes daily decisions and coordinates regularly with other District representatives from the various areas for which the river systems are operated - hydropower, recreation, navigation, environmental, and others to exchange information concerning the operation of the river system. Such coordination includes conducting weekly meetings with these other district elements. Daily water management decisions regarding water availability, lake level forecasts, and storage forecasts are determined using the information obtained along with current project and basin hydrometeorological data. A weekly District River System Status report is prepared that summarizes the conditions in each of the river basins. When conditions become evident that normal, low-flow conditions are worsening, Mobile District will elevate the District coordination to a heightened awareness. When drought conditions are imminent, Emergency Management representatives will be notified of the conditions and will be included in the regular coordination activities.

8-02. Interagency Coordination. Mobile District will be involved with the NIDIS coordination for interagency and stakeholder teleconferences. Additionally, Mobile District will support the environmental team regarding actions that require coordination with the USFWS for monitoring threatened and endangered species and with the Environmental Protection Agency (EPA), Georgia Environmental Protection Division (GAEPD), Florida Department of Environmental Protection (FDEP) and Alabama Department of Environmental Management (ADEM) regarding requests to lower water quality minimum flow requirements below Buford Dam and West Point Dam.

8-03. Public Information and Coordination. When Mobile District determines that a change in the water control actions from normal regulation to drought regulation is imminent, it is important that various users of the system are notified so that any environmental or operational preparations can be completed before any impending reduction in reservoir discharges, river levels, and reservoir pool levels. In periods of severe drought in the ACF Basin it will be within the discretion of the Division Commander to approve the enactment of ACF Basin Water Management conference calls. For the ACF Basin, when the basin composite conservation storage is within Zone 3 and climatic predictions predict a continuation of severe drought conditions that will deplete the composite conservation storage into Zone 4 (Drought Operations), the Division Commander will initiate the teleconference calls. The purposes of the calls are to share ongoing water management decisions with basin stakeholders and to receive stakeholder input regarding needs and potential effects on users in the basin. Depending on the severity of the drought conditions, the calls will be conducted at regular monthly or biweekly intervals. If issues arise, more frequent calls would be implemented. Table 10 lists state and federal agencies and active stakeholders in the ACF Basin that have participated in previous ACF Basin water management teleconferences and meetings.

Local Press. The local press consists of periodic publications in or near the ACF Basin. Montgomery, Columbus, and Atlanta have some of the larger daily papers. The papers often publish articles related to the rivers and streams. Their representatives have direct contact with the Corps through the Public Affairs Office. In addition, they can access the Corps web pages for the latest project information. The Mobile District Public Affairs Office issues press releases as necessary to provide the public with information regarding water management issues and activities and also provides information via the Mobile District internet homepage.

Corps Bulletins. The Corps and the Mobile District also publish e-newsletters regularly, but they are not widely distributed to the general public. A District River System Status report is updated weekly. That report along with historical and real-time information is available at the Mobile District Water Management Section homepage http://water.sam.usace.army.mil/.

Table 10. ACF Basin Water Management Teleconference Stakeholder Participants

Alabama	Others
Office of Governor	AL Rivers Alliance
AL OWR	Apalachicola Natl. Estuarine Research Reserve
AL DEM	Apalachicola River Keeper
AL Dept of Conservation	ARC (Atlanta Regional Commission)
	CCMWA
Florida	City of Gainesville
Office of Governor	City of LaGrange
FL DEP	City of West Point
FL F&W Conservation Commission	Columbus Water Works
NWFWMD	Franklin Co. Seafood Workers Assoc (FCSWA)
	Georgia Pacific(Cedar Springs)
Georgia	Georgia Power
Office of Governor	Gulf Power (FL)
GA DNR	Gwinnett Co Water
GA EPD	Help Save Apalachicola River
	Lake Lanier Association
	Lake Seminole Association
Federal agencies	MeadWestvaco
EPA	Middle Chattahoochee Water Coalition
FERC – Atlanta	SeFPC
FERC – DC	Southern Company
NPS (Chattahoochee Nat Recreational Area)	Southern Nuclear (Hydro)
SEPA	TRWDA (Tri-Rivers Waterway Dev Assoc)
U.S. Coast Guard	Upper Chattahoochee River Keeper
USFWS-AL	West Point Lake Coalition
USFWS-FL	Weyerhaeuser
USFWS-GA	
USGS-AL	
USGS-FL	
USGS-GA	

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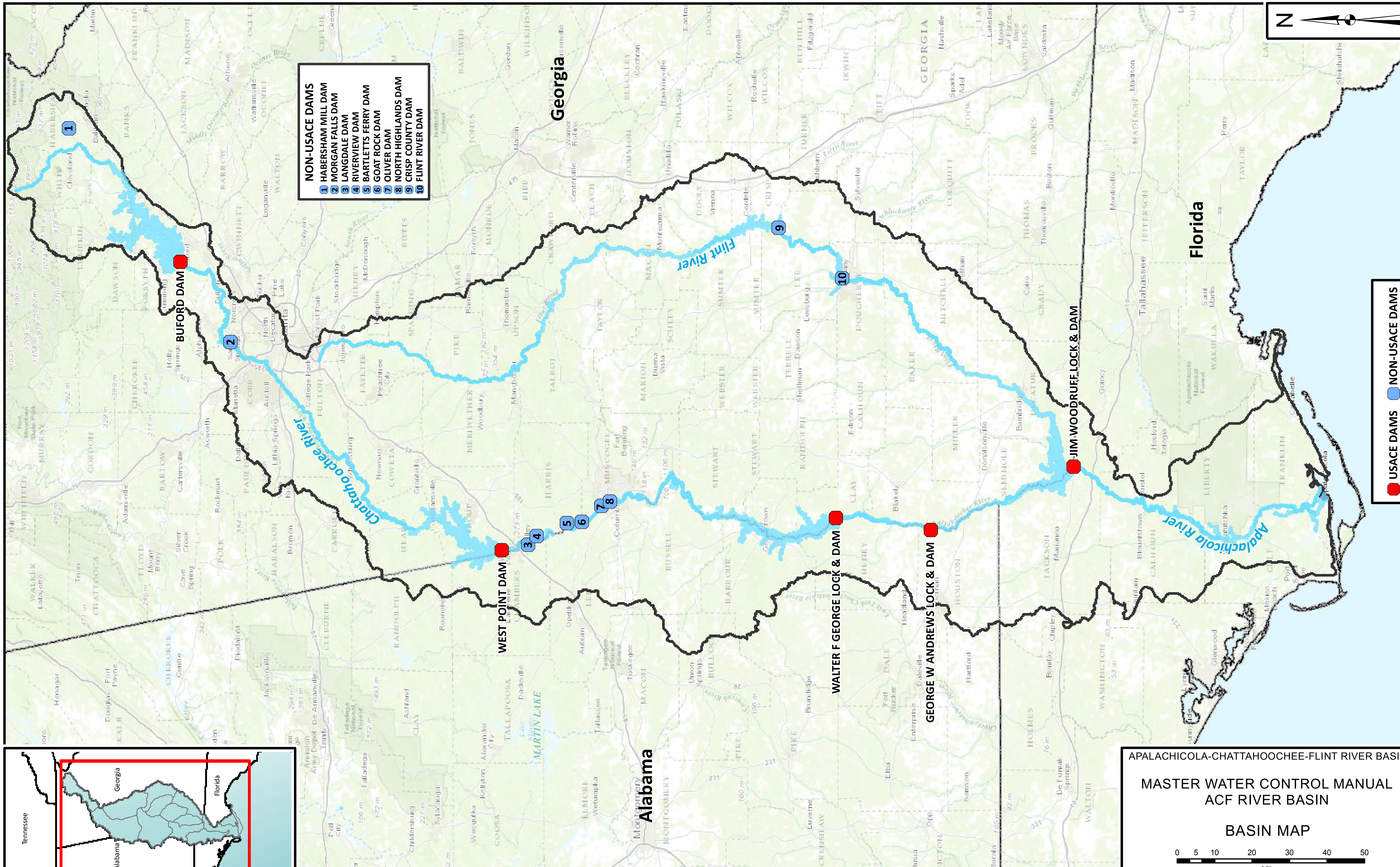
PLATES

CORPS OF ENGINEERS U.S. ARMY



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

MASTER WATER CONTROL MANUAL
ACF RIVER BASIN

BASIN MAP

0 5 10 20 30 40 50
Miles

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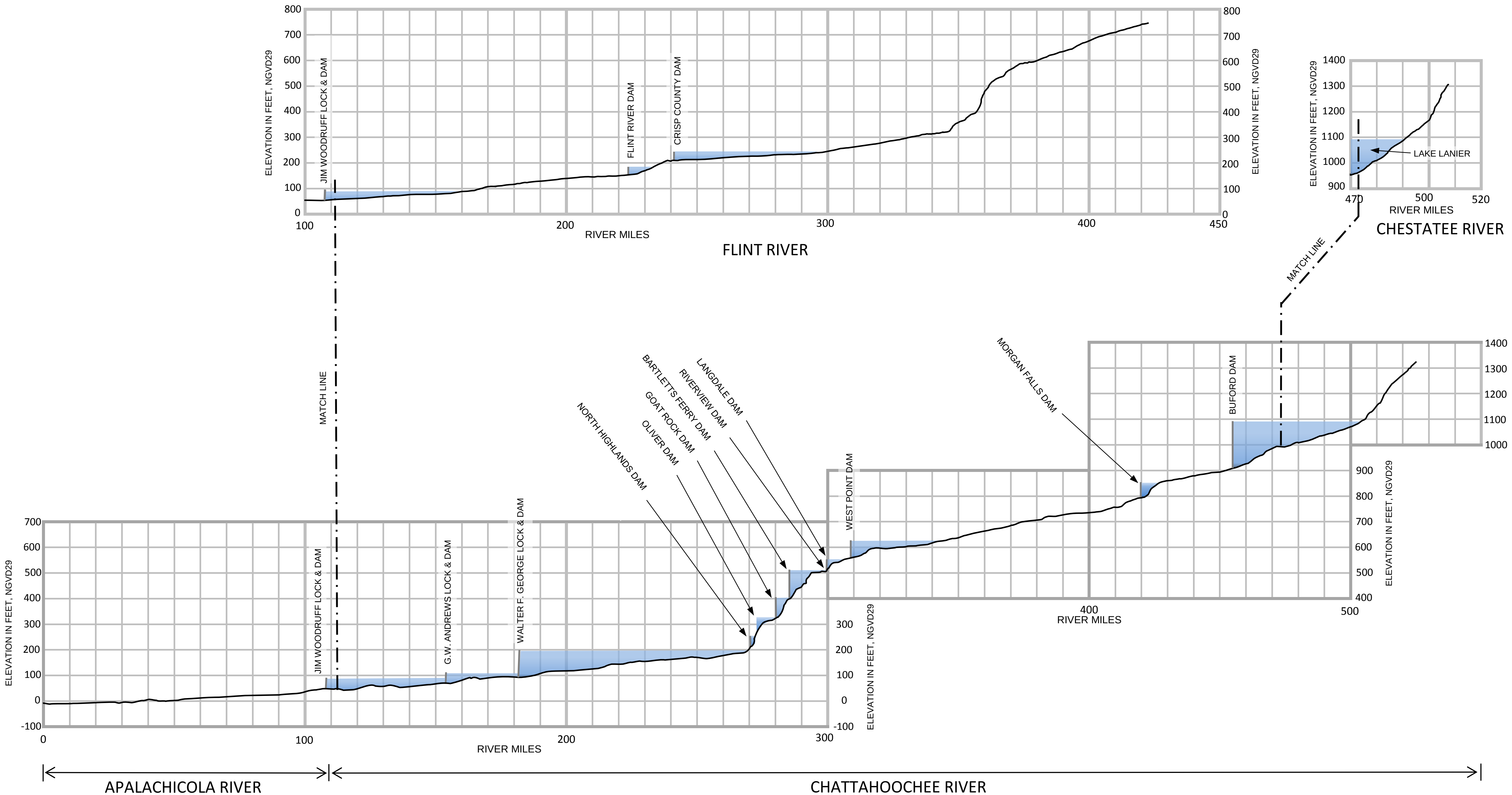
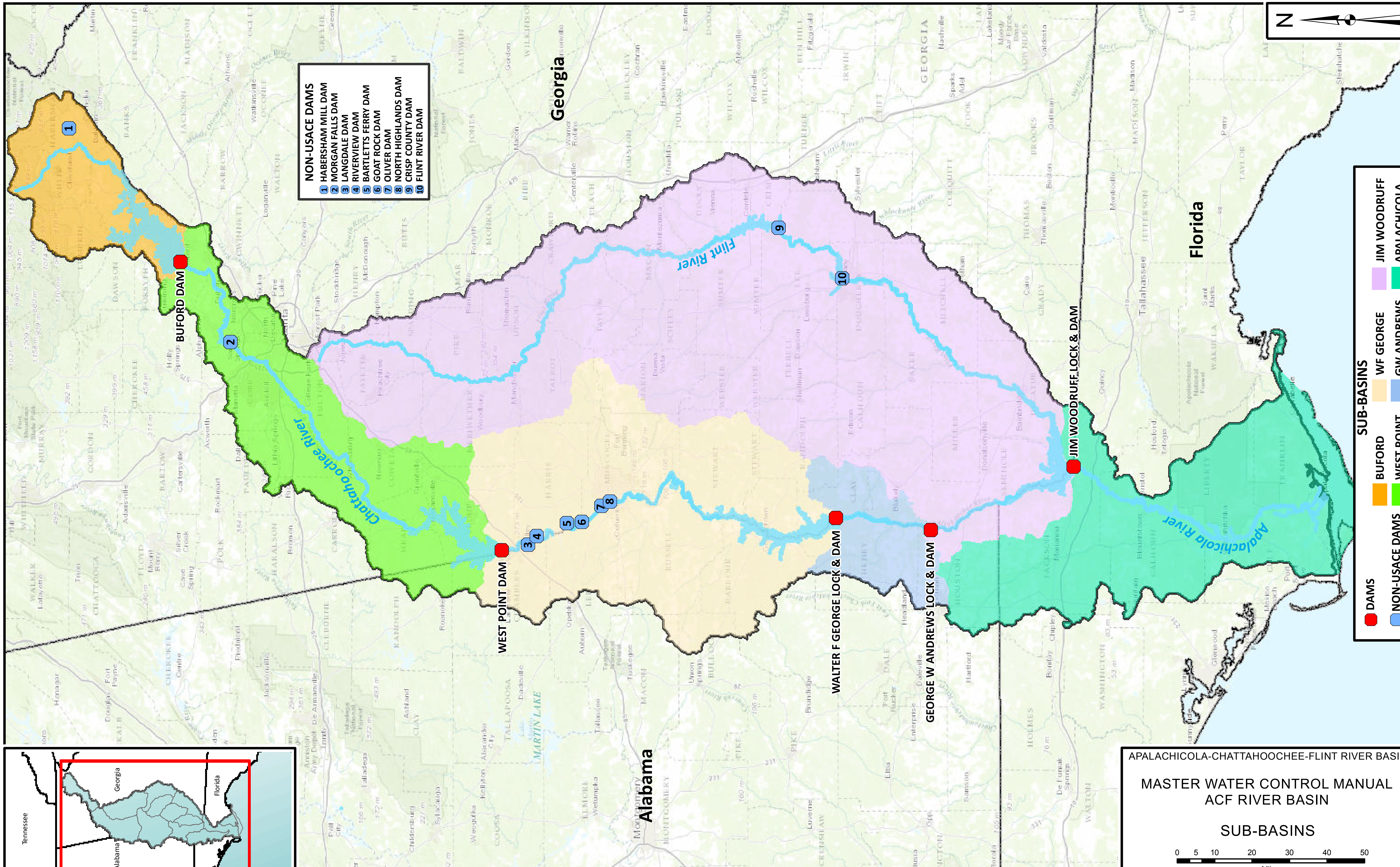


APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

MASTER WATER CONTROL MANUAL

ACF FIVER BASIN

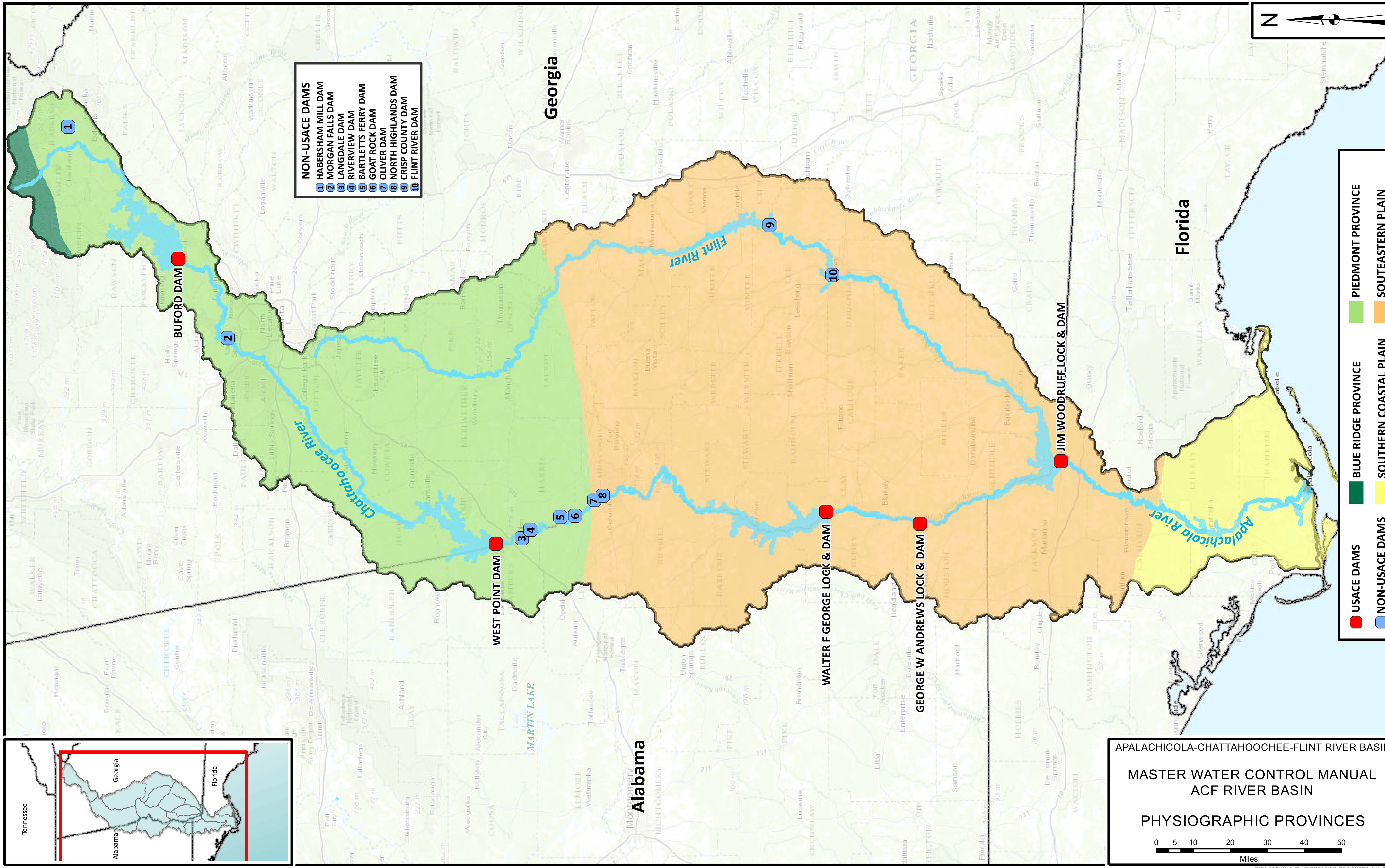
RIVER PROVILE AND RESERVOIR DEVELOPMENT



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

MASTER WATER CONTROL MANUAL
ACF RIVER BASIN

SUB-BASINS


NON-USACE DAMS
1 HABERSHAM MILL DAM
2 MORGAN FALLS DAM
3 LANGDALE DAM
4 RIVERVIEW DAM
5 BARTLETTS FERRY DAM
6 GOAT ROCK DAM
7 OLIVER DAM
8 NORTH HIGHLANDS DAM
9 CRISP COUNTY DAM
10 FLINT RIVER DAM
Georgia
Florida
Alabama
BUFORD DAM
WEST POINT DAM
WALTER F GEORGE LOCK & DAM
GEORGE W ANDREWS LOCK & DAM
JIM WOODRUFF LOCK & DAM
Chattahoochee River
Flint River
Apalachicola River
MARTIN LAKE
PIEDMONT PROVINCE
SOUTEASTERN PLAIN
BLUE RIDGE PROVINCE
SOUTHERN COASTAL PLAIN
USACE DAMS
NON-USACE DAMS
Tennessee
APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN
MASTER WATER CONTROL MANUAL
ACF RIVER BASIN
PHYSIOGRAPHIC PROVINCES
0 5 10 20 30 40 50
Miles
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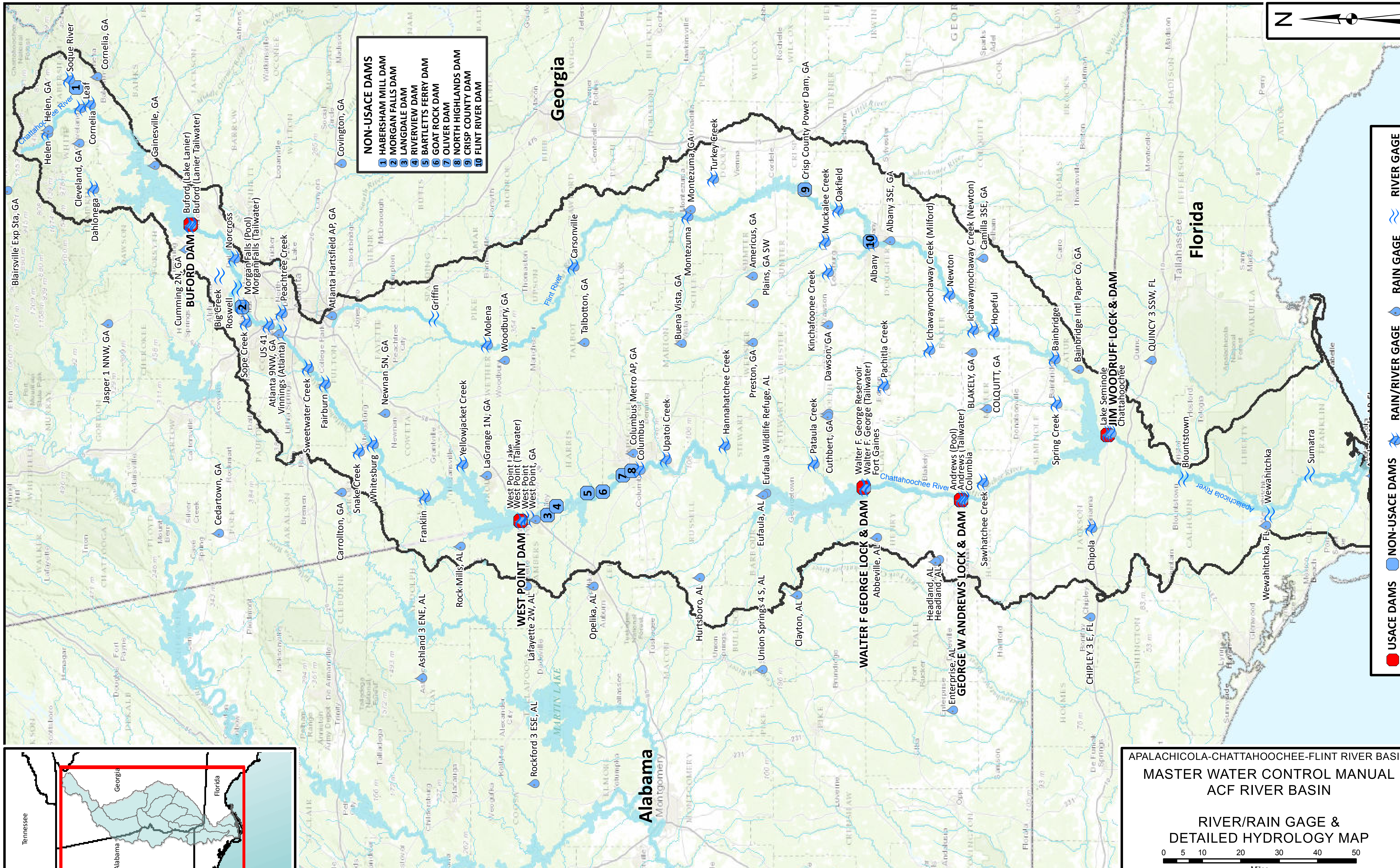

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

MASTER WATER CONTROL MANUAL
ACF RIVER BASIN

RIVER/RAIN GAGE &
DETAILED HYDROLOGY MAP

0 5 10 20 30 40 50
Miles

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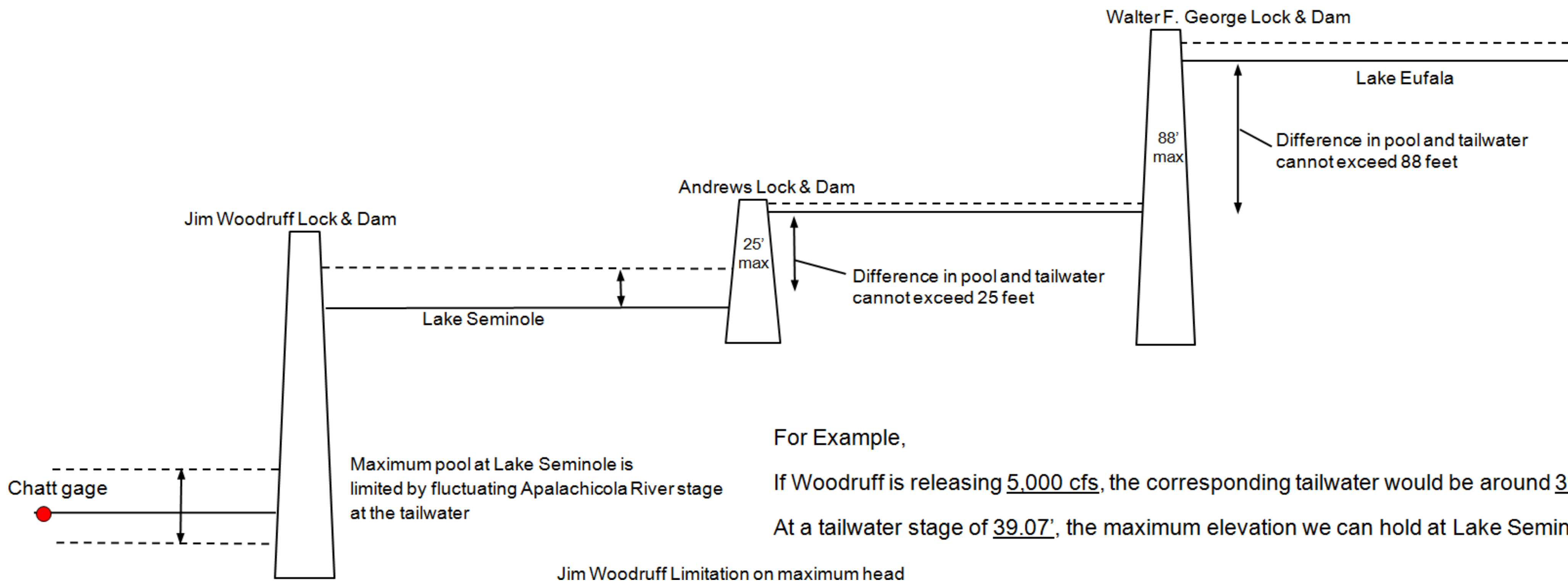
ACF Head Limits Explained



For Example,

If Woodruff is releasing 5,000 cfs, the corresponding tailwater would be around 39.07'.

At a tailwater stage of 39.07', the maximum elevation we can hold at Lake Seminole is 76.72'.

Chattahoochee Rating Curve

TW stage	Flow (cfs)	TW stage	Flow (cfs)
39.06	5520	39.39	5980
39.07	5540	39.40	5990
39.08	5550	39.41	6010
39.09	5560	39.42	6020
39.10	5580	39.43	6030
39.11	5590	39.44	6050
39.12	5610	39.45	6060
39.13	5620	39.46	6080
39.14	5630	39.47	6090
39.15	5650	39.48	6100
39.16	5660	39.49	6120
39.17	5670	39.50	6130
39.18	5690	39.51	6150
39.19	5700	39.52	6160
39.20	5710	39.53	6180
39.21	5730	39.54	6190
39.22	5740	39.55	6200
39.23	5760	39.56	6220
39.24	5770	39.57	6230
39.25	5780	39.58	6250
39.26	5800	39.59	6260
39.27	5810	39.60	6280
39.28	5820	39.61	6290
39.29	5840	39.62	6300
39.30	5850	39.63	6320
39.31	5870	39.64	6330
39.32	5880	39.65	6350
39.33	5890	39.66	6360
39.34	5910	39.67	6380
39.35	5920	39.68	6390
39.36	5940	39.69	6410
39.37	5950	39.70	6420
39.38	5960	39.71	6430

Jim Woodruff Limitation on maximum head

Maximum Pool Elevation at Woodruff

Tailwater Elev.	Max. Pool	Tailwater Elev.	Max. Pool
39.06	76.72	39.39	76.82
39.07	76.72	39.40	76.82
39.08	76.72	39.41	76.82
39.09	76.73	39.42	76.83
39.10	76.73	39.43	76.83
39.11	76.73	39.44	76.83
39.12	76.74	39.45	76.84
39.13	76.74	39.46	76.84
39.14	76.74	39.47	76.84
39.15	76.75	39.48	76.84
39.16	76.75	39.49	76.85
39.17	76.75	39.50	76.85
39.18	76.75	39.51	76.85
39.19	76.76	39.52	76.86
39.20	76.76	39.53	76.86
39.21	76.76	39.54	76.86
39.22	76.77	39.55	76.87
39.23	76.77	39.56	76.87
39.24	76.77	39.57	76.87
39.25	76.78	39.58	76.87
39.26	76.78	39.59	76.88
39.27	76.78	39.60	76.88
39.28	76.78	39.61	76.88
39.29	76.79	39.62	76.89
39.30	76.79	39.63	76.89
39.31	76.79	39.64	76.89
39.32	76.80	39.65	76.90
39.33	76.80	39.66	76.90
39.34	76.80	39.67	76.90
39.35	76.81	39.68	76.90
39.36	76.81	39.69	76.91
39.37	76.81	39.70	76.91
39.38	76.81	39.71	76.91

APALACHICOLA-CHATTAHOOCHEE-FLINT BASIN

MASTER WATER CONTROL MANUAL
ACF RIVER BASIN

ACF HEAD LIMITS EXPLAINED