US Army Corps
of Engineers®
Mobile District

WATER CONTROL MANUAL

APPENDIX A

JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

APALACHICOLA RIVER, FLORIDA AND GEORGIA

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

February 1958

Revised August 1972, July 1985, and March 2017

Jim Woodruff Lock and Dam

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 South Atlantic Division's approval date.

REGULATION ASSISTANCE PROCEDURES

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

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METRIC CONVERSION

Although values presented within this text are shown with English units only, a conversion table is listed in Exhibit B for your convenience.

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 The relationships among existing, constructed, or maintained project grades that are referenced to local or superseded datums (e.g., NGVD29, MSL), the current NSRS, and/or hydraulic/tidal datums, have been established per the requirements of Engineer Regulation 1110-2-8160 and in accordance with the standards and procedures as outlined in Engineer Manual 1110-2-6056. A Primary Project Control Point has been established at this project and linked to the NSRS. Information on the Primary Project Control Point, designated JW-CEPD, and the relationship between current and legacy datums are in Exhibit B.

WATER CONTROL MANUAL

APPENDIX A

JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE
APALACHICOLA RIVER, FLORIDA AND GEORGIA

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PERTINENT DATA

(see Exhibit A, page E-A-1 for Supplementary Pertinent Data)

GENERAL	
Damsite, miles above mouth of Apalachicola River	106.3
Drainage from Chattahoochee River, square miles	8,708
Drainage from Flint River, square miles	8,456
Total drainage area above Jim Woodruff, square miles	17,164
Total drainage area in Apalachicola Basin, square miles	19,573
RESERVOIR	
Length at elevation 77.0 feet NGVD29, miles Flint River / Chattahoochee River to George W. Andrews	47 / 46.8
Minimum operating pool elevation, feet NGVD29	76.5
Normal operating pool elevation, feet NGVD29	77.0
Maximum operating pool elevation, feet NGVD29	77.5
Emergency drawdown elevation, feet NGVD29	76.0
Absolute maximum pool elevation, feet NGVD29 (non-flood conditions)	77.8
Area at pool elevation 77.0 feet NGVD29 – acres	37,500
Total volume at elevation 77.0 feet NGVD29 – acre-feet	367,318
Shoreline miles at elevation 77.0 NGVD29 – miles	532
GATED SPILLWAY	
Total length, including end pier – feet	766
Crest Elevation – feet NGVD29	48.0
FIXED-CREST SPILLWAY	
Total length – feet	1,634
Crest Elevation – feet NGVD29	79.0
EARTH OVERFLOW DIKE	
Total length (crest elevation 85.0 feet NGVD29) - feet	2,130
Total length of transition (elev. 85.0 to 107.0 feet NGVD29) - feet	690
Top width – feet	25
POWER PLANT	
Generating capacity (declared*) MW (3 units @ 14.45)	43.35
NAVIGATION LOCK	
Distance center to center of gate pintles – feet	505
Maximum lift – feet	33

* 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.

I - INTRODUCTION

1-01. Authorization. Section 7 of the Flood Control Act of 1944 instructed the Secretary of the Army to prescribe regulations for the use of storage allocated for flood control (later termed flood risk management) or navigation at all U.S. Army Corps of Engineers (Corps) reservoirs. Therefore, this water control manual has been prepared as directed in the Corps' Water Management Regulations, specifically Engineer Regulation (ER) 1110-2-240, *Water Control Management (30 May 2016)*. That regulation prescribes the policies and procedures to be followed in carrying out water management activities, including establishment and updating of water control plans for Corps and non-Corps projects, as required by Federal laws and directives. This manual is also prepared in accordance with pertinent sections of the Corps' Engineer Manual (EM) 1110-2-3600, *Management of Water Control Systems (30 November 1987)*; under the format and recommendations described in ER 1110-2-8156, *Preparation of Water Control Manuals (31 August 1995)*; and ER 1110-2-1941, *Drought Contingency Plans (15 September 1981)*. Revisions to this manual are to be processed in accordance with ER 1110-2-240. 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.

1-02. Purpose and Scope. This individual project manual describes the water control plan for the Jim Woodruff Lock and Dam and Lake Seminole (Jim Woodruff Project). The combined facilities of this project are also referred to as the Woodruff/Seminole Site and is one of three sites that make up the ACF Rivers Project. Walter F. George Lock and Dam and Lake and George W. Andrews Lock and Dam and Lake George W. Andrews are the other two. The description of the project's physical components, history of development, water control activities, and coordination with others are provided as supplemental information to enhance the knowledge and understanding of the water control plan. The Jim Woodruff Project water control regulations must be coordinated with the multiple projects in the Apalachicola-Chattahoochee-Flint (ACF) Basin to ensure consistency with the purposes for which the system was authorized. In conjunction with the *ACF Basin Master Water Control Manual*, this manual provides a general reference source for Jim Woodruff water control regulation. It is intended for use in day-to-day, real-time water management decision making and for training new personnel.

1-03. Related Manuals and Reports

Other manuals related to the Jim Woodruff Project water control regulation activities include the *Operation and Maintenance Manual* for the project and the *ACF Basin Master Water Control Manual*.

One master manual and five individual project manuals, which are incorporated as appendices, compose the complete set of water control manuals for 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 – Appendix E

The original water control manual for Jim Woodruff Lock and Dam and Lake Seminole was published in February 1958. A revised water control manual was published in August of 1972 and includes additional revisions published in July of 1985. This revision supersedes any prior editions.

The Jim Woodruff emergency action plan (EAP) entitled *Emergency Action Plan, Jim Woodruff Project* serves to consolidate guidance documents regarding actions to be taken by project personnel should an emergency situation be identified. Guidance includes training for identification of indicators, notification procedures, remedial action scenarios, reservoir dewatering procedures, inventory of emergency repair equipment, and a list of local repair forces.

The Definite Project Report also contains useful historical information on the design, construction and planned operation of the Jim Woodruff Project. The original report prepared in 1946 was titled *Definite Project Report on Junction Project, Apalachicola River.* The Mobile District prepared a revised Definite Project Report incorporating the changes resulting from conference decisions, comments by Headquarters, and additional investigations and studies. The revised report, dated 15 March 1948, was titled *Definite Project Report on Jim Woodruff Dam, Apalachicola River.* All appendices to this report are contained in the two volumes of the report.

Prior to the issuance of the ACF Basin Master 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 prepared in compliance with the National Environmental Policy Act (1969), Council on Environmental Quality guidelines, and Corps implementing regulations. Access to the final document, dated 16 December 2016, is available by request from the Mobile District.

1-04. Project Owner. The Jim Woodruff Project is a Federally-owned project entrusted to the Corps, South Atlantic Division (SAD), Mobile District.

1-05. Operating Agency. The Jim Woodruff Project is operated and maintained by the Corps, Mobile District under the supervision and direction of the Operations Project Manager located in Eufaula, Alabama, and Site Manager at Chattahoochee, Florida.

1-06. Regulating Agencies. Authority for water control regulation of the Jim Woodruff Project has been delegated to the SAD Commander. Day-to-day water control regulation activities are the responsibility of the Mobile District, Engineering Division, Water Management Section (Mobile District). Jim Woodruff Project is regulated in coordination with the other ACF Basin Projects in a system-wide balanced approach to meet its Federally authorized purposes. It is the responsibility of the Mobile District to develop water control regulation procedures for the ACF Basin Federal projects. The regulating instructions presented in the basin water control plan are prepared by the Mobile District with approval of 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 - DESCRIPTION OF PROJECT

2-01. Location. Jim Woodruff Lock and Dam (Figure 2-1) is about 1,000 feet downstream of the confluence of the Chattahoochee and Flint Rivers that unite 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. Interstate 10 crosses the river south of the dam. The dam crosses the Georgia-Florida line on the east bank. Approximately 1,500 feet of the overflow dike is in Decatur County, Georgia, with the remainder of the structure in Gadsden County, Florida, on the east bank and Jackson County, Florida, on the west bank. The 17,164-square mile drainage area upstream of Jim Woodruff Dam is almost equally divided between the Chattahoochee and Flint Rivers. The location of the project, at mile 106.3 on the Apalachicola River, is shown on Plates 2-1 to 2-3.

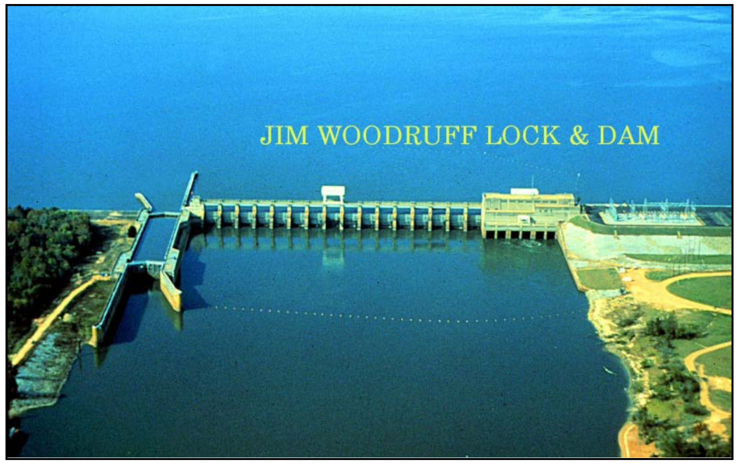


Figure 2-1. Jim Woodruff Lock and Dam

2-02. Purpose. Jim Woodruff Lock and Dam is a multipurpose project originally authorized under the River and Harbors Acts of 1945 and 1946 to be operated in conjunction with the other Federal works of improvement in the ACF basin for the authorized system purposes. The Jim Woodruff Project is operated to provide benefits for authorized purposes of hydropower, navigation, recreation, water quality, and fish and wildlife conservation. The Corps has consulted with the U.S. Fish and Wildlife Service (USFWS) regarding effects on threatened and endangered species downstream of Jim Woodruff Dam, and determines minimum releases from Jim Woodruff Dam consistent with a USFWS Biological Opinion.

2-03. Physical Components. The Jim Woodruff Project consists of a dam with its axis about normal to the river channel; an 82- by 450-foot, single-lift lock; a 43.35-megawatt (MW) power plant and appurtenances; and a reservoir extending up the Chattahoochee River to George W. Andrews Lock and Dam, and up the Flint River for 47 river miles at normal operating pool elevation. The reservoir provides a 9-foot depth for navigation from Jim Woodruff Lock and Dam to the George W. Andrews Lock and Dam on the Chattahoochee River, and to Bainbridge, Georgia, on the Flint River. The principal features of the structure, described in detail in subsequent paragraphs, are from west to east bank - a fixed-crest spillway; a navigation lock; a concrete gated spillway; a powerhouse with intake section constituting part of the dam; and an earth overflow dike with the switchyard on the end next to the powerhouse. Overall length of the structure including the lock and powerhouse sections is approximately 6,150 feet. Sections and a plan of the lock and dam and appurtenant works are shown on Plate 2-4.

a. Gated Spillway. The gated spillway (Figure 2-2) occupies the west half of the river channel and extends into the west bank to the navigation lock. Its eastern end connects with the powerhouse. The spillway with crest elevation 48.0 feet NGVD29 has an overall length of 766 feet, and consists of 16 gated bays. Flow is controlled by split-leaf, vertical-lift gates 40 feet wide by 30.5 feet high. The lower leaves have a top elevation of 63.0 feet NGVD29 and the top of the upper leaves is at elevation 78.5 feet NGVD29. Thus, a freeboard of 1.5 feet is provided above the normal pool at elevation 77.0 feet NGVD29. The upper gate leaves in the two end bays are split in half to facilitate trash removal. The concrete piers between the gate bays support a steel service bridge with the deck at elevation 107.0 feet NGVD29 on which there are gantry cranes to manipulate the gates. For close regulation, means are provided for dogging the upper leaves at 2.5-foot and 6.0-foot openings. The gated spillway rating is shown in Plates 2-5 through 2-7.

Figure 2-2. Jim Woodruff Spillway Gates

b. Fixed-Crest Spillway. The conventional, concrete, gravity-type, fixed-crest spillway (Figures 2-3 and 2-4) is on the right overbank with its east end connecting with the lock, and its west end keying into the west bluff by means of an abutment and a concrete gravity cutoff wall. The spillway section has a net length of 1,584 feet with an abutment section consisting of an adit monolith 50 feet long, giving a total length of 1,634 feet. The concrete gravity cutoff wall is approximately 49 feet long. The crest of the spillway is at elevation 79.0 feet NGVD29, which allows a 2-foot freeboard above the normal operating pool. Water will not flow over the fixed-crest spillway until all usable gates in the controlled spillway are fully opened, and, if the gates have been properly operated, the tailwater will have attained elevation 77.5 feet NGVD29. A high-apron bucket is provided to direct flow toward the surface for energy dissipation. The structure is backfilled on the downstream side with random earth fill, which is protected by a thick layer of random rock-fill removed during the excavation. A 5-foot-wide by 7-foot-high gallery is provided for grouting and inspection and to provide access to the lock from the adit on the right bank. A rating curve showing a total spillway discharge including the fixed-crest spillway is shown in Plate 2-8.

Figure 2-3. Fixed-Crest Spillway without Flow Over the Top

Figure 2-4. Fixed-Crest Spillway with Waves Splashing Over the Top

c. Earth Embankment Sections. The earth embankment sections are rolled-fill structures including an impervious and a pervious zone. The overflow dike with a crest at elevation 85.0

feet NGVD29 is 2,130 feet long, extending from the left abutment to a 690-foot-long transition section, which connects the dike with the switchyard and parking area at elevation 107.0 feet NGVD29. Except for the difference in crest elevation, the dike and transition sections are the same, having a 25-foot-wide crown, a cutoff trench to sound rock backfilled with impervious material, a grout curtain from the bottom of the cutoff trench 50 feet into sound rock, 1 on 2.5 side slopes, and an 18-inch-thick grouted riprap protective coverage on a 6-inch gravel base except for the middle 18 feet of the crown, which is paved with concrete for a roadway to provide access from the left abutment to the powerhouse area. The switchyard and parking area section is 491 feet long and 260 feet wide. The side slopes from crest elevation 107.0 to 85.0 feet NGVD29, are 1 on 3, and from that elevation to ground surface, 1 on 4. The slopes are protected by 18 inches of grouted riprap on a 6-inch gravel base.

d. Powerhouse. The powerhouse (Figure 2-5) and intake structure, in the river channel near the east bank as shown on Plate 2-4, constitutes part of the dam. The structure is a reinforced concrete building with overall outside dimensions of 258.7 feet by 122 feet at the foundation. It contains three, 14.45 MW generating units complete with all operating equipment and appurtenances. The generator unit blocks are 65 feet wide along the longitudinal centerline except that the block for unit 3 is 67 feet wide to provide space for the spillway gate guides. In addition, there is an erection bay block, which forms a portion of the retaining wall for the earth embankment and which is flanked upstream and downstream by additional retaining walls. Plate 2-4 shows a section through the powerhouse. Ratings for the Kaplan turbines are shown on Plates 2-9 through 2-12.

Figure 2-5. Powerhouse and Tailrace

In 1993 a report was published on the rehabilitation of the Jim Woodruff powerhouse. Due to various factors including degraded tailwater levels, increased operating head, higher energy demand, and poor design and failure of components of the 36 years old turbines, the reliability of the plant had decreased significantly. In July 1993, the *Powerhouse Major Rehabilitation Evaluation Report* was published. Excerpts from the report follow.

The major rehabilitation of the Jim Woodruff Project consisted of the replacement of three turbines, rewinding the three generators and the replacement of several required peripheral electrical components, most notably new transformers. Units 1 and 2 returned to service in 2001 and unit 3 returned to service in 2002. The rehabbed plant output is now 16,055 KVA at 90 percent power factor, making the units 14.45 MW each. The three units combined produce an output of 43.35 MW.

e. Switchyard. The location of the switchyard with reference to other portions of the project is shown in Plate 2-4. It contains the generator step-up transformers and high-voltage equipment required for switching and metering the energy delivered to the local power companies. The power plant output is fed to the transformers through a 13.8-kilovolt (kv) bus located in the switchyard tunnel. Three coupling capacitor potential devices are connected to each transmission line for synchronization, operation of indicating instruments, and carrier current applications.

f. Lock. The lock (Figure 2-6) is on the west overbank of the Apalachicola River between the fixed-crest and the gated spillways. The lock axis is at an angle of 83 degrees with the gated spillway axis and an angle of 97 degrees with the fixed-crest spillway to provide an easier approach to the draw span of the highway bridge that is approximately one-half mile downstream. The lock chamber is 82 feet wide by 505 feet long, center to center of pintles, and provides 454.4 feet of usable length between the miter posts of the lower gate leaves when open and the farthest downstream face of the upper miter sill. The maximum lift is 33 feet. The top of the upper sill is at elevation 54.0 feet NGVD29, 22 feet below the minimum operating pool, elevation 76.0 feet NGVD29; and the top of the lower sill is at elevation 30.0 feet NGVD29, 11.5 feet below minimum tailwater. The tops of the lock walls and upstream guide and guard walls are at elevation 82.0 feet NGVD29, 0.3 feet below the headwater elevation for the maximum flood of record and five feet above normal operating pool. Operation of the lock will be discontinued when the upper pool reaches elevation 81.0 feet NGVD29. The expected frequency that that stage will be exceeded is once every 175 years with a duration of about 20 days. The maximum elevation since the project was constructed reached 78.66 feet NGVD29 on April 7th 1960. The top of the downstream guide and guard walls is also at elevation 82.0 feet NGVD29 to provide approximately 2.8 feet of freeboard when lock operation is discontinued. The intake ports in the upper sill are connected to 10- by 10-foot culverts in each lock wall that discharge water into the lock chamber through 14 side ports in each wall, spaced 18 feet center to center. The lock is emptied through the same ports with the discharge being through a bottom lateral diffuser downstream from the miter gates. The filling and emptying valves are of the reversed tainter type. To determine the volume of water (acre-feet) discharged each time the lock is emptied, multiply the gross head in feet by 0.905. A typical section through the lock is shown in Plate 2-4.

g. Lock Control Station. The lock control station is on the east lock wall next to the controlled-spillway section. It is 33 feet, 2 inches long by 25 feet, 6 inches wide with a 10-foot-wide-abutment containing a gasoline storage tank next to the gated spillway section for a total width of 35.5 feet along the axis of the dam. The control station is three floors high, providing suitable access from the spillway service bridge to the lock and to place the lock-master's office in a favorable position with relation to the other structures. All lock-operating machinery and equipment that could be damaged by floods is on the second floor at elevation 95.0 feet NGVD29.

h. Reservoir. The reservoir, Lake Seminole, covers an area of 37,500 acres at normal operating pool elevation 77.0 feet NGVD29 and has a total volume of 367,318 acre-feet. Area-capacity curves and values are shown in Plate 2-13. The pool extends up the Chattahoochee River 46.7 miles to George W. Andrews Lock and Dam and up the Flint River 47 miles. The total area within the taking line of 70,588 acres is outlined in Plate 2-14.

Figure 2-6. Lock Under Construction, Circa 1952-53

2-04. Related Control Facilities. Not applicable to the Jim Woodruff Project.

2-05. Real Estate Acquisition. The criteria for establishing the basic taking line required all the land that would be inundated by floods of all magnitudes up to and including the 50-year flood and that otherwise would not have been flooded under natural conditions, with the exception that increased flooding of some small amount would be accepted as of insignificant damaging effect. In addition, the taking line was required to be at least 3 feet above normal pool elevation 77.0 feet NGVD29 to allow for the effects of a permanent body of water on surrounding land.

Studies to determine the taking line showed that for floods of all magnitudes up to and including the 15-year flood, there would be an increase in stage of 2.1 feet or more immediately above the dam with progressively smaller increases upstream on the Chattahoochee and Flint Rivers. The studies also showed that for the 50-year flood at the dam site, the headwater would be at elevation 81.0 feet NGVD29 with a swell-head of 2.4 feet. Consequently, the basic taking line profile began at elevation 81.0 feet NGVD29 at the dam site and followed the backwater profiles of the 50-year flood up the Chattahoochee and Flint Rivers to the points where the backwater effects were shown to be negligible. Above those points, the taking line profiles were selected so as to envelope the appreciable backwater effects of all smaller floods, after which a transition was made to elevation 80.0 feet NGVD29.

At the time those studies were made, approximately 23 years of record were available to determine the elevation of the 50-year flood. Studies since then, using more than 50 years of record, indicate that the magnitude of the 50-year flood is considerably lower than was originally estimated. On the basis of the revised frequency, the headwater at the dam site for the 50-year flood would reach elevation 79.2 feet NGVD29 with a swellhead of about 1.8 feet.

The basic taking line is a theoretical line which is used to establish the actual taking in accordance with sound real estate practice. The basic taking line as indicated on Plate 2-14 therefore begins at elevation 81.0 feet NGVD29 at the dam and follows the 50-year flood profile up the Chattahoochee and Flint Rivers until the backwater effect for that flood is reduced to 1 foot. On the Chattahoochee, that occurs 9.5 miles above the dam at elevation 84.7 feet NGVD29. The taking line then makes a transition to elevation 85.0 feet NGVD29 at mile 10.0 and follows that elevation to mile 18.0, conservatively enveloping the 1-foot-or-more backwater effects of all floods smaller than the 50-year flood. At mile 18.0 where the topography is favorable, the taking line makes a quick transition to elevation 80.0 feet NGVD29 and follows that elevation to the upper limits of the reservoir. Similarly, on the Flint River, the taking line follows the 50-year flood backwater profile to elevation 85.0 feet NGVD29 at mile 15.0 above the dam, then makes a gradual transition to elevation 87.0 feet NGVD29 at mile 24.0 and remains at that elevation to mile 34.0 where favorable topography permits a quick transition to elevation 80.0 feet NGVD29. It then follows that level to the upper limits of the reservoir.

2-06. Public Facilities. Developing reservoir land and water areas for public use and recreational purposes has been accomplished in accordance with the Master Plan through the combined efforts of the Corps; state, county, and municipal agencies; and responsible civic organizations. Public use areas are shown in Plate 2-15.

The Corps has developed the east and west bank dam site areas. The operations site office with observation parking on the upper level, and roads, parking areas, a boat launch ramp and picnic and sanitary facilities on the lower level is on the east side, while an access road, parking areas and an overlook with benches have been constructed on the west side. Major development by state and local agencies has been accomplished in the Seminole State Park in

Georgia, the Three Rivers State Park in Florida, and the Chattahoochee and Bainbridge Municipal Park areas.

Recreational sites include 37 parks, 5 marinas, and 8 campgrounds (OMBIL 2016). Areas suitable for game management in Florida are licensed to the Florida Fish and Wildlife Conservation Commission; likewise, suitable areas in Georgia are licensed to the Georgia Game and Fish Commission. Those agencies are now managing licensed areas for fish and wildlife purposes. Management operations consist of planting food crops for game and waterfowl, controlled burning for improved quail range, and controlled hunting.

III - HISTORY OF PROJECT

3-01. Authorization. The Corps first considered a dam with a navigation lock on the Apalachicola River near Chattahoochee, Florida, in the early 1930s. The initial proposal was included in the report on the Apalachicola River system, House Document No. 308, 69th Congress, First Session. The report, which had a general plan for the overall development of the basin, was submitted to Congress in 1934 but was immediately recalled to consider additional information.

In 1939, the Corps submitted to Congress a general plan, prepared by the Mobile District, for the full development of the Apalachicola River system for navigation and hydropower. That plan, presented in House Document No. 342, 76th Congress, First Session, included a low-head dam and lock just below the junction of the Flint and Chattahoochee Rivers. In the initial reports and documents, the project was referred to as Junction Lock and Dam. After several revisions to the authorization and location and before construction, the name was later changed to its present name - Jim Woodruff Lock and Dam. The proposed structure had a fixed-crest spillway, a lock 45 feet by 450 feet, and provided a lift of 14 feet to the upper pool at elevation 58.0 feet NGVD29. The proposed structure had no provision to include hydropower.

The Rivers and Harbors Act of 1945 approved the general plan presented in House Document No. 342, 76th Congress, First Session, and authorized the initiation and partial accomplishment of that plan by constructing two locks and dams, one of which was the Junction Project. No work was accomplished on the project authorized by the Rivers and Harbors Act of 1945.

The Rivers and Harbors Act of 1946 approved a modification of the general plan that substituted the authorized lock and dam at the Junction Project with a higher lock and dam with normal pool elevation of 77.0 feet NGVD29 and included provisions for a hydropower plant. The modification also included an increase in the size of the locks at all navigation dams from 45 by 450 feet to 82 by 450 feet.

The change in name of the project from Junction Project to Jim Woodruff Dam was in accordance with Public Law 525, 79th Congress, Second Session. On 14 August 1957, the President signed Public Law 85-138, stating, "the lake created by the Jim Woodruff Dam on the Apalachicola River at the confluence of the Flint and Chattahoochee Rivers be known as Lake Seminole."

3-02. Planning and Design. A Definite Project Report, dated 1 August 1946, was prepared by Mobile District and transmitted to Headquarters by letter dated 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-MW 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. The Chief of Engineers approved the Definite Project Report subject to certain modifications and considerations proposed by that office and SAD.

The Mobile District prepared a revised Definite Project Report incorporating the changes resulting from conference decisions, comments by Headquarters, and additional investigations and studies. The revised report, dated 15 March 1948, was titled *Definite Project Report on Jim Woodruff Dam, Apalachicola River.* Additional design memoranda and their submittal dates are listed in Table 3-1.

Table 3-1. Design Memoranda

Definite Project Report on Jim Woodruff Dam, Apalachicola River (Vol. I and II)	March 1948
DM No.1 - Development and Management of Jim Woodruff Reservoir	March 1956
DM No. 1B(c2) - Construction Design Memorandum, Public Use and Access Facilities	March 1963
DM No. 1B - The Master Plan	January 1965
Forestry Management Plan (Supplement 1 to the Master Plan)	January 1965

3-03. Construction Construction (Figure 3-1) was initiated in September 1947, shortly after approval of the original Definite Project Report, under a contract awarded to W. C. Shepard Co., Inc., for the east bank overflow dike. In May 1949, a contract for construction of the lock and fixed-crest spillway was awarded to Perini, Walsh, Mills and Blythe Brothers Construction Companies; and in January 1952 that same company was awarded the contract for the gated spillway, powerhouse, and switchyard. The lock was opened to navigation in May 1954, and the power plant was placed in commercial operation in February 1957. Total cost of the project was $46,900,000. Figures 3-1 and 3-2 show construction phases at Jim Woodruff Lock and Dam.

Impounding of water in the reservoir for a partial filling began in May 1954. The water level reached elevation 65 feet NGVD29 during the first week of June and was held at approximately that level until 23 June when a gradual lowering of the pool began. It reached elevation 52 feet NGVD29 during the first week of July and remained at about that elevation until March 1955 when filling was resumed. The pool reached

Figure 3-1. Coffer Dam Protecting the Powerhouse Construction, Circa 1952-53

Figure 3-2. Construction of the Monolith, Circa May 1951

elevation 66 feet NGVD29 during the second week of April 1955 where it remained, except for fluctuations from variations in stream flow until January 1957 when filling to normal operating level began. The pool was considered full when it reached elevation 77.0 feet NGVD29 on 4 February 1957. Since then, the project has been operated with normal upper pool at elevation 77.0 feet NGVD29 with a maximum fluctuation of 2 feet between elevations 76.0 and 78.0 feet NGVD29 except for brief periods when construction activities or the limitation on maximum headwater-tailwater differential (see Paragraph 7-05) causes the pool to be temporarily lowered below elevation 76 feet NGVD29. Generally, the fluctuation is no more than one-half to three-quarters of a foot above or below the normal level.

3-04. Related Projects. Jim Woodruff Lock and Dam is one of five Federal reservoir projects within the ACF Basin. Buford, West Point, Walter F. George, and George W. Andrews Projects are located upstream of the project. The Corps reservoirs on the Chattahoochee River are operated as a system to accomplish authorized functions as described in the *ACF Basin Master Water Control Manual (with Appendices)*. In addition there are 10 privately-owned dams on the Chattahoochee and Flint Rivers. The two privately-owned reservoirs on the Flint River - Crisp County Dam and Albany Dam - have little effect on flows into Lake Seminole. The privately-reservoirs on the Chattahoochee River 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.

3-05. Modifications to Regulation. As a run-of-river project, no major changes to regulation practices have occurred at the dam. However, modifications have been made to the basin-wide operations to support releases for the authorized purposes, including navigation and conservation of Federally listed threatened and endangered species and their designated critical habitat in accordance with the Endangered Species Act of 1973, discussed below.

a. Navigation. A major factor influencing reservoir regulation is 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 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 Walter F. George Dam to help supply sufficient water in storage downstream to successfully implement the navigation window. Currently, a discharge of 20,600 cfs from Jim Woodruff Dam is required for a 9.0-foot channel without dredging.

Increasing flow requirements plus the loss of water quality certification from Florida, which caused the Corps to defer dredging the Apalachicola River, effectively closed commercial navigation on the Apalachicola River. 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. Through an iterative hydrologic modeling process, it was determined that a 5-month navigation season, January through May each year, can be provided that will improve navigation reliability without significantly affecting other project purposes. The 5-month navigation season included in the current water control plan 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. Releases made from Walter F. George Dam during hydropower operations contribute to the needed downstream navigation flows.

b. Revised Interim Operating Plan. The Revised Interim Operating Plan (RIOP) was implemented in June 2008 and modified in May 2012. The purpose of the RIOP was to support compliance with the Endangered Species Act of 1973 for Federally listed threatened and endangered species and their Federally designated 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 hydrologic conditions. However, releases made from Jim Woodruff Dam in accordance with the RIOP use 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 reflect the downstream end-result for system wide operations measured by daily releases from Jim Woodruff Dam into the Apalachicola River. The RIOP does 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 conservation storage of the system and releases from the upstream reservoirs as necessary to assure that the releases made from Jim Woodruff Dam would comply with the Endangered Species Act of 1973 by minimizing effects on Federally listed threatened and endangered species and Federally designated critical habitat.

c. Change in Peak Spillway Design Discharge. On 15 June 1970, the Mobile District submitted a report titled *Review of Design Features of Jim Woodruff Lock and Dam* to SAD. The report, which was submitted in accordance with EC 1110-2-34 dated 1 November 1966, shows a considerable reduction in peak discharge and peak pool elevation for the spillway design flood as compared with the original design studies. That was because of changes in criteria for the spillway design storm, and the considerations of additional projects built or under construction in the basin since the original studies were made.

3-06. Principal Regulation Problems. Soils in the Coastal Plain near the Jim Woodruff Project are often porous, permitting flow through the ground. Some evidence exists that the lake contributes inflow to the groundwater and to downstream flows. Limestone caves were discovered during construction near the eastern side of the dam. Despite grouting, there appears to be flow through the caves to a location below the dam.

The solid rock foundation is deeper under the powerhouse, and a sheet piling wall and other impervious fill was used to limit leakage there (Figures 3-3, 3-4, and 3-5). Figure 3-6 shows the location of piling walls, and Figure 3-7 shows examples of dewatering equipment.

Seepage under the dam is also believed to contribute to a boil known to exist in the river downstream of the dam (Figure 3-8). The source of water causing the boil originates from somewhere in the reservoir. The boil has existed at least 30 years and appears to remain stable.

Figure 3-3. Sheet Piling Upstream of the Powerhouse and Grouting Crew Pouring Grout into the Cavern, Circa 1955-56

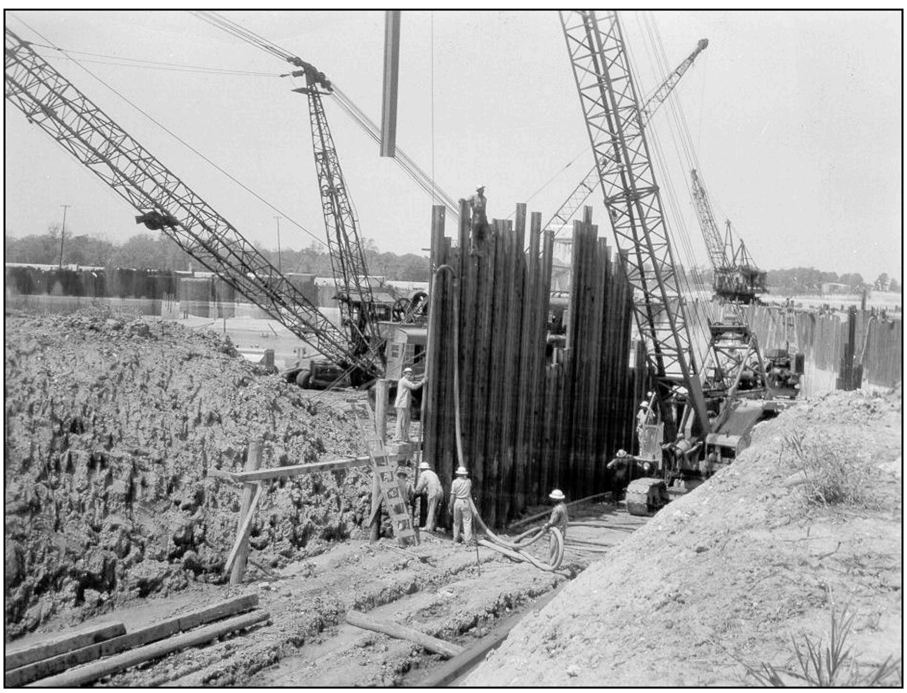


Figure 3-4. Sheet Piling Being Driven in Place, Circa 1955-56

Figure 3-5. Joint Cavity under the Foundation Area, Circa 1955-56

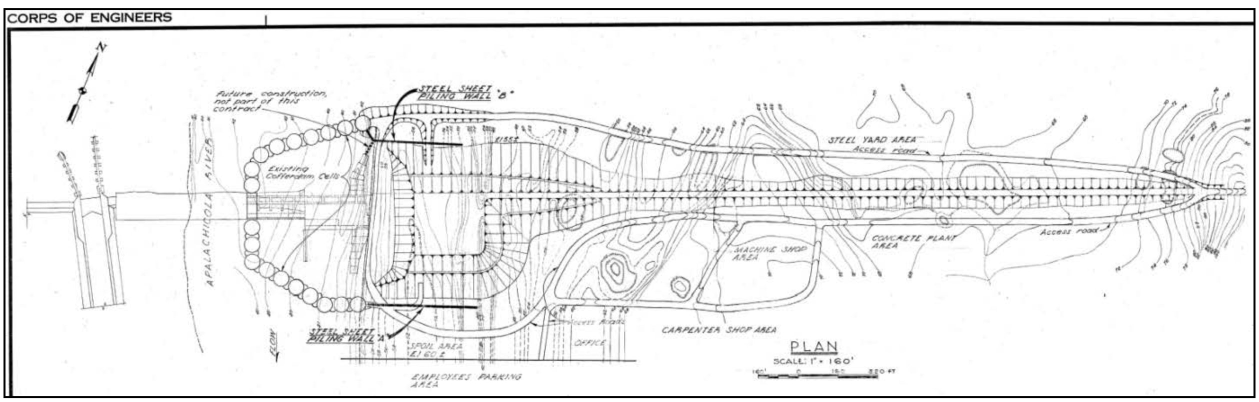


Figure 3-6. Location of Sheet Piling Wall. Some of the Coffer Dam Cells were not Removed and Remain in Place

Figure 3-7. Well points for dewatering the work area, Circa 1955-56

Figure 3-8. Boil in the River Caused by Underground Flow from the Reservoir

IV - WATERSHED CHARACTERISTICS

4-01. General Characteristics. The Jim Woodruff Project is located below the confluence of the Chattahoochee and Flint Rivers and receives runoff from 17,164 square miles. The reservoir extends to Bainbridge, Georgia, on the Flint River and to George W. Andrews Lock and Dam on the Chattahoochee River. The total ACF Basin including the Apalachicola River, downstream from Jim Woodruff Dam, has a drainage area of 19,573 square miles and spans about 385 miles from northeast Georgia to the Gulf of Mexico. The Chattahoochee and Flint Rivers share almost equally in drainage above Jim Woodruff, with 8,708 square miles and 8,456 square miles, respectively. The Apalachicola Basin adds an additional 2,409 square miles to the drainage area of the ACF Basin. The average slope in the vicinity of the Jim Woodruff Project is 0.9 feet per mile.

4-02. Topography. The Jim Woodruff Project is in the Coastal Plain south of the Fall Line, but much of the drainage area is in the Piedmont Region. The Piedmont Region consists of moderate- to high-grade metamorphic rocks, such as schists, amphibolites, gneisses and migmatites, and igneous rocks like granite. Topographically, the Piedmont Region mostly consists of rolling hills, although faulting has produced the impressive ridge of Pine Mountain near Warm Springs, Georgia. The Coastal Plain Region consists 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 Flint River is generally spring fed and is relatively clear. The use of groundwater for irrigation influences flow in the river. 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 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.

4-03. Geology and Soils. Jim Woodruff Lock and Dam is in the Coastal Plain region. The sedimentary rocks of the Coastal Plain partly consist of sediment eroded from the Piedmont over the past 100 million years and partly of limestones generated by marine organisms and processes at sea. One could generalize that buried Triassic rocks in the subsurface are various rift-basin siliciclastics, the Cretaceous strata are sandstones and shales, the Tertiary strata are limestones and shales, and the Quaternary strata are sands and muds. Tektites, the glassy products of meteorite impacts, are a minute proportion but a historically significant component of the Tertiary strata of the Coastal Plain.

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.

The lower Coastal Plain consists of a series of Quaternary beach complexes that parallel the modern coast and are younger nearer the coast. The 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.

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) actively monitors groundwater conditions in Georgia.

4-04. Sediment. In general, the quantity and size of sediment transported by rivers is influenced by the presence of dams. Impoundments behind dams serve as sediment traps where particles settle in the lake headwaters because of slower flows. Large impoundments such as Lake Seminole typically trap coarser particles plus some of the silt and clay. Often, releases from dams scour or erode the streambed downstream. Plans have been developed to measure the reservoir effects of sedimentation and retrogression at each of the Federal dams.

The original plans for sedimentation and retrogression ranges for the Jim Woodruff Project were formulated before filling the reservoir in 1954. Surveys of the sedimentation ranges occurred periodically as shown in Table 4-1. Data are not available for all ranges for each survey. Surveys of the 27 retrogression ranges were performed in 1987 and 1991. Plate 4-1 shows the locations of the sedimentation and retrogression ranges. In 2009, a hydrographic bathymetric survey of the entire lake was completed which allowed all previously established sedimentation ranges to be analyzed. The results of all surveys are stored on Microsoft Excel spreadsheets. Cross-sections from all three surveys have been plotted using Excel and have been visually examined. Overall, it is obvious that some siltation is occurring in the lower depths, below 65 to 70 feet NGVD29. Above those elevations, there appears to be little change. For those reasons, it is reasonable to conclude that the original area and capacity values remain valid. Therefore, this sediment range data has not resulted in revised area/capacity curves for Lake Seminole. Further sedimentation and retrogression surveys will be periodically conducted.

Table 4-1. Sedimentation Ranges

Year surveyed	Number of ranges surveyed	Total ranges
1954	0	24
1956-1957	40	42
1963	16	42
1976	39	42
1988-1989	40	42
2009	Hydrographic bathymetric surface	42

4-05. Climate. Chief factors that control the climate of the ACF Basin in the vicinity of the Jim Woodruff Project are its geographical position in the southern end of the temperate zone and its proximity to the Gulf of Mexico and South Atlantic Ocean. Frontal systems influence conditions throughout the year. During the warmer months, thunderstorms are a major producer of rainfall. Tropical disturbances and hurricanes also affect the region.

a. Temperature. The normal annual temperature in the vicinity of the Jim Woodruff Project is 66.8 degrees Fahrenheit (°F). That figure is based on normal temperatures at six stations in the vicinity of the Jim Woodruff Project: Headland, Alabama; Bainbridge International Paper Co., Blakely, and Colquitt, Georgia; and Chipley, and Quincy, Florida. The monthly and annual normal values for those stations are shown on Table 4-2 for 1981–2010. Climatologists define a climatic normal as the arithmetic average of a climate element, such as temperature, over a prescribed 30-year time interval. The National Climatic Data Center (NCDC) uses a homogenous and complete dataset with no changes to the collection site or missing values to determine the 30-year normal values. When developing this 30-year normal dataset, the NCDC has standard methods available to them to make adjustments to the dataset for any inhomogeneities or missing data before computing normal values. Extreme temperatures events for the six stations are presented in Table 4-3. Recorded temperatures have been as low as –1 °F at Blakely, Georgia, to as high as 110 °F at Blakely, Georgia.

b. <u>Precipitation</u>. The Apalachicola River System is in a region of heavy annual rainfall, which is fairly well distributed throughout the year. Some seasonal variation occurs, with about 36 percent of the normal annual precipitation occurring from December through March, while only about 21 percent occurs during the drier period of September through November. The normal monthly and annual precipitation for the southern portion of the ACF Basin is shown in Table 4-4.

Extreme rainfall events in the basin for six stations are listed in Table 4-5. The highest and lowest recorded rainfall for each month is listed for Headland, Alabama; Bainbridge International Paper Co., Blakely, and Colquitt, Georgia; and Chipley, and Quincy, Florida. The highest recorded monthly rainfall listed is more than 30 inches at Blakely. Also listed in Table 4-5 are the highest one-day rainfall occurrences. Flood-producing storms can occur over the Apalachicola River Basin at any time during the year, but they are much more frequent in the winter and early spring. Major storms in the winter are usually of the frontal type and the summer storms of the hurricane type. Snowfall is a rare occurrence in the southern portion of the ACF Basin and has never been an important contributing factor in any major flood recorded in the basin.

c. <u>Evaporation and Wind</u>: The presence of man-made reservoirs in the ACF Basin have affected the volume of surface water through increased evaporation and increased rainfall-runoff. At Lake Seminole, the annual evaporation is 43.20 inches and the predominant wind direction is south (at Tallahassee, Florida airport). The monthly distribution of annual reservoir evaporation is shown on Table 4-6.

Table 4-2. Normal Mean Temperature (1981–2010)

Station (NWS Station ID)		(°F)												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Headland, AL (013761)		48.5	52.4	59.4	65.9	74.3	80.0	81.8	80.9	76.5	67.3	58.7	50.8	66.4
Bainbridge Intl Paper C., GA (090586)		49.8	53.4	59.8	65.4	73.8	79.7	81.6	81.2	77.3	68.6	59.8	52.3	66.9
Blakely, GA (090979)		48.0	51.7	57.9	64.6	72.9	79.0	81.0	80.6	76.1	67.1	58.3	50.0	65.7
Colquitt 2W, GA (092153)		50.9	53.8	60.4	65.5	73.8	79.8	81.4	81.1	76.5	68.1	59.5	52.8	67.0
Chipley 3E, FL (081544)		50.7	54.1	60.4	66.6	74.8	80.8	82.9	82.4	78.1	68.7	59.9	52.5	67.7
Quincy 3 SSW, FL (087429		51.8	54.4	60.5	65.5	73.5	79.1	80.7	80.4	76.8	68.7	60.9	53.9	67.2
Average		50.0	53.3	59.7	65.6	73.9	79.7	81.6	81.1	76.9	68.1	59.5	52.1	66.8

Table 4-3. Extreme Temperatures in the Basin (°F)

HEADLAND, ALABAMA (04/1950-04/2012)

	Monthly Averages			Daily Extremes			
	Max	Min.	Mean	High	Date	Low	Date
Jan	58.3	36.3	47.3	84	04/1955	0	21/1985
Feb	62.7	39.6	51.1	87	18/1956	10	05/1996
Mar	70.0	46.3	58.2	89	11/1974	12	03/1980
Apr	78.2	53.6	65.8	94	23/1987	30	01/1987
May	85.1	61.6	73.3	100	28/1953	41	26/1979
Jun	90.2	67.8	79.0	104	27/1952	50	02/1956
Jul	91.3	69.9	80.6	103	25/1952	51	15/1967
Aug	91.0	69.1	80.0	102	20/1990	54	30/1986
Sep	87.3	64.9	76.1	100	16/1980	39	30/1967
Oct	78.7	53.6	66.1	96	02/1952	30	28/1957
Nov	69.3	44.8	57.0	88	02/1971	15	25/1970
Dec	61.3	38.7	50.0	83	17/1971	5	13/1962
Annual	**77.0**	**53.8**	**65.4**	**104**	**06/27/1952**	**0**	**01/21/1985**
Winter	60.8	38.2	49.5	87	02/18/1956	0	01/21/1985
Spring	77.8	53.8	65.8	100	05/28/1953	12	03/03/1980
Summer	90.8	68.9	79.9	104	06/27/1952	50	06/02/1956
Fall	78.4	54.4	66.4	100	09/16/1980	15	11/25/1970

BANBRIDGE INTL PAPER COMPANY, GEORGIA (10/1977-03/2012

	Monthly Averages			Daily Extremes			
	Max.	Min.	Mean	High	Date	Low	Date
Jan	61.9	36.8	49.3	83	31/2002	3	21/1985
Feb	65.9	40.3	53.1	85	27/1985	13	05/1996
Mar	72.9	46.7	59.8	89	22/1982	17	03/1980
Apr	79.4	52.1	65.6	94	25/1999	30	01/2003
May	86.4	60.4	73.4	102	24/1996	41	01/1996
Jun	90.5	67.9	79.2	105	23/1998	46	01/1984
Jul	92.5	70.8	81.6	103	07/1998	58	16/2007
Aug	92.0	70.4	81.2	102	23/1980	58	30/1992
Sep	88.6	66.2	77.5	100	21/1997	44	25/1990
Oct	81.1	54.8	67.9	94	02/1986	32	21/1989
Nov	73.3	47.0	60.1	89	02/1996	23	22/2000
Dec	64.6	40.3	52.5	83	08/1978	10	25/1983
Annual	**79.1**	**54.5**	**66.8**	**105**	**06/23/1998**	**3**	**01/21/1985**
Winter	64.1	39.1	51.6	85	02/27/1985	3	01/21/1985
Spring	79.6	53.1	66.3	102	05/24/1996	17	03/03/1980
Summer	91.6	69.7	80.7	105	06/23/1998	46	06/01/1984
Fall	81.0	56.0	68.5	100	09/21/1997	23	11/22/2000

BLAKELY, GEORGIA (09/1889-04/2012))

	Monthly Averages			Daily Extremes			
	Max.	Min.	Mean	High	Date	Low	Date
Jan	61.0	39.3	50.2	85	22/1911	6	06/1924
Feb	63.9	41.0	52.4	85	18/1911	-1	13/1899
Mar	71.3	47.1	59.1	96	21/1907	17	03/1980
Apr	78.6	53.5	66.1	97	30/1906	30	06/1920
May	85.9	61.2	73.5	102	28/1904	34	04/1903
Jun	91.1	68.0	79.6	108	16/1911	47	01/1984
Jul	91.5	70.3	80.9	107	11/1930	50	04/1901
Aug	91.5	70.0	80.8	105	07/1911	56	31/1986
Sep	88.2	65.9	77.0	110	05/1925	40	29/1967
Oct	79.9	55.3	67.7	101	06/1911	29	24/1917
Nov	69.9	45.5	57.7	92	09/1986	15	25/1950
Dec	62.5	40.0	51.2	89	17/1906	6	13/1962
Annual	**77.9**	**54.8**	**66.4**	**110**	**19250905**	**-1**	**02/13/1899**
Winter	62.5	40.1	51.3	89	12/17/1906	-1	02/13/1899
Spring	78.6	53.9	66.2	102	05/28/1904	17	03/03/1980
Summer	91.4	69.4	80.4	108	06/16/1911	47	06/01/1984
Fall	79.4	55.5	67.5	110	09/05/1925	15	11/25/1950

COLQUITT, GEORGIA (03/1956-04/2012)

	Monthly Averages			Daily Extremes			
	Max.	Min.	Mean	High	Date	Low	Date
Jan	61.3	38.1	49.8	85	30/1957	2	21/1985
Feb	65.6	40.9	53.1	87	27/1962	12	05/1996
Mar	72.7	46.8	59.7	90	28/1986	17	03/1980
Apr	80.3	53.5	66.9	94	25/1958	31	05/1992
May	86.3	60.7	73.4	99	24/1960	41	13/1960
Jun	90.8	67.6	79.3	104	30/1978	48	01/1984
Jul	92.4	70.4	81.4	105	13/1980	54	16/1967
Aug	91.8	69.9	80.8	105	01/1986	56	30/1992
Sep	88.7	66.0	77.3	100	17/1980	37	30/1967
Oct	80.8	54.8	67.8	97	02/1959	31	26/1968
Nov	72.3	46.4	59.4	89	04/1961	16	25/1970
Dec	64.5	40.0	52.2	88	14/1984	9	25/1983
Annual	**79.0**	**54.6**	**66.8**	**105**	**07/13/1980**	**2**	**01/21/1985**
Winter	63.8	39.7	51.7	88	12/14/1984	2	01/21/1985
Spring	79.7	53.7	66.7	99	05/24/1960	17	03/03/1980
Summer	91.7	69.3	80.5	105	07/13/1980	48	06/01/1984
Fall	80.6	55.7	68.2	100	09/17/1980	16	11/25/1970

CHIPLEY 3 E, FLORIDA (04/1939-04/2012)

	Monthly Averages			Daily Extremes			
	Max.	Min.	Mean	High	Date	Low	Date
Jan	62.6	39.0	50.8	84	11/1949	2	21/1985
Feb	65.8	41.3	53.5	86	08/1957	13	05/1996
Mar	72.7	47.6	60.1	90	30/2007	20	03/1980
Apr	79.5	54.0	66.7	97	13/1965	31	01/1987
May	85.9	61.4	73.7	100	14/1985	39	04/1971
Jun	90.3	68.6	79.5	104	07/1985	47	02/1972
Jul	91.2	71.0	81.1	104	15/1980	55	16/1967
Aug	91.0	70.7	80.9	102	13/1954	55	30/1986
Sep	88.0	66.3	77.1	106	01/2009	36	30/1967
Oct	80.7	55.0	67.8	96	01/1954	27	30/1952
Nov	71.7	45.7	58.7	88	01/1950	17	25/1970
Dec	64.6	40.4	52.5	85	08/1978	8	13/1962
Annual	**78.7**	**55.1**	**66.9**	**106**	**09/01/2009**	**2**	**01/21/1985**
Winter	64.3	40.2	52.3	86	02/08/1957	2	01/21/1985
Spring	79.4	54.3	66.8	100	05/14/1985	20	03/03/1980
Summer	90.9	70.1	80.5	104	07/15/1980	47	06/02/1972
Fall	80.1	55.7	67.9	106	09/01/2009	17	11/25/1970

QUINCY 3 SSW, FLORIDA (01/1968-04/2012)

	Monthly Averages			Daily Extremes			
	Max.	Min.	Mean	High	Date	Low	Date
Jan	61.8	39.3	50.6	83	29/1974	4	21/1985
Feb	65.5	41.8	53.6	85	17/1989	14	05/1996
Mar	71.8	47.9	59.8	90	11/1974	19	03/1980
Apr	78.7	53.9	66.3	92	23/1968	31	09/2007
May	85.1	61.6	73.3	100	29/2000	36	05/1997
Jun	89.6	68.4	79.1	102	19/1998	49	02/1972
Jul	90.8	70.8	80.8	102	14/1977	58	21/2009
Aug	90.0	70.5	80.3	101	18/1981	59	30/1986
Sep	87.3	66.9	77.1	98	22/1997	48	30/1970
Oct	80.0	56.8	68.4	93	02/1986	29	29/2008
Nov	71.7	48.4	60.0	87	03/2000	20	25/1970
Dec	64.8	41.9	53.3	84	17/1971	12	24/1989
Annual	**78.1**	**55.7**	**66.9**	**102**	**07/14/1977**	**4**	**01/21/1985**
Winter	64.0	41.0	52.5	85	02/17/1989	4	01/21/1985
Spring	78.5	54.5	66.5	100	05/29/2000	19	03/03/1980
Summer	90.1	69.9	80.1	102	07/14/1977	49	06/02/1972
Fall	79.6	57.4	68.5	98	09/22/1997	20	11/25/1970

Table 4-4. Normal Monthly Rainfall (Inches) for the Southern ACF Basin (1981-2010)

Location (NWS station ID)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Headland, AL (013761)	5.39	5.49	5.14	5.10	5.42	4.35	4.60	3.47	4.20	3.75	5.03	4.92	56.86
Bainbridge Intl Paper C., GA (090586)	4.93	4.93	5.49	3.52	3.55	5.64	5.68	4.81	3.96	3.45	3.49	3.64	53.09
Blakely, GA (090979)	5.50	4.82	5.32	3.51	3.33	5.09	4.16	4.53	3.86	2.67	3.75	4.51	51.05
Colquitt 2W, GA (092153)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chipley 3E, FL (081544)	5.24	4.99	5.76	4.05	3.84	6.09	6.91	5.95	4.00	3.32	4.32	4.61	59.08
Quincy 3 SSW, FL (087429	4.80	4.75	5.86	3.68	5.04	5.92	7.36	6.78	4.15	4.11	3.51	3.77	59.73
Southern area	5.17	5.00	5.51	3.97	4.24	5.42	5.74	5.11	4.03	3.46	4.02	4.29	55.96

Table 4-5. Extreme Rainfall in the Basin (Inches)

	HEADLAND, ALABAMA (013761)						
	Record: 04/1950 – 04/2012						
	Mean	High	Year	Low	Year	1 Day Max.	
January	5.55	13.69	1991	1.35	1954	5.25	06/1962
February	5.06	9.75	1974	0.71	1951	5.95	11/1981
March	5.60	15.39	1980	0.63	1955	6.70	28/2009
April	4.03	11.78	1975	0.32	1987	7.30	10/1975
May	4.00	10.68	1969	0.13	1962	4.70	27/1973
June	4.57	11.57	1989	0.89	1950	5.75	20/1972
July	6.08	19.42	1994	1.87	2010	9.08	06/1994
August	4.79	13.13	1996	0.69	1955	5.20	31/1996
September	3.87	11.63	1996	0.04	1972	4.00	24/1956
October	2.78	8.69	1996	0.00	1961	6.81	03/1996
November	3.37	11.53	1992	0.48	1956	6.65	09/1989
December	4.60	14.66	1953	0.61	1955	5.46	26/1964
Annual	**54.28**	**79.02**	**1964**	**31.99**	**1954**	**9.08**	**07/06/1994**
Winter	15.20	31.35	1974	7.39	1951	5.95	02/11/1981
Spring	13.63	29.01	1980	6.23	1954	7.30	04/10/1975
Summer	15.43	32.44	1994	7.10	1990	9.08	07/06/1994
Fall	10.02	22.61	1996	2.74	1952	6.81	10/03/1996

	BAINBRIDGE INTL PAPER CO, GEORGIA (090586)						
	Record: 10/1977 – 03/2012						
	Mean	High	Year	Low	Year	1 Day Max.	
January	5.00	14.60	1991	0.67	1989	3.49	11/1991
February	4.76	9.72	1986	1.26	2001	4.27	19/1988
March	5.88	13.34	2005	0.54	2004	5.95	06/1984
April	4.09	9.06	2005	0.58	1999	4.40	03/2009
May	3.56	13.55	1991	0.34	1998	3.00	29/1992
June	5.75	11.93	1989	0.60	2007	5.12	09/1989
July	5.61	13.52	2005	0.00	2009	3.40	30/2005
August	5.25	16.58	2008	2.10	1980	5.89	23/2008
September	4.29	15.90	1998	0.09	2009	4.57	03/1998
October	2.89	11.02	1994	0.02	1978	5.29	03/1994
November	3.24	9.06	1985	0.56	2007	7.10	22/1985
December	3.42	7.80	1982	0.32	1980	2.65	24/1978
Annual	**53.74**	**73.68**	**1994**	**37.84**	**1990**	**7.10**	**11/22/1985**
Winter	13.17	22.34	1984	4.31	1989	4.27	02/19/1988
Spring	13.53	29.03	1991	5.74	1986	5.95	03/06/1984
Summer	16.61	33.38	2005	6.78	2007	5.89	08/23/2008
Fall	10.42	19.11	2004	3.13	1991	7.10	11/22/1985

	BLAKELY, GEORGIA (090979)						
	Record: 09/1889 – 04/2012						
	Mean	High	Year	Low	Year	1 Day Max.	
January	4.95	14.10	1925	0.40	1909	5.57	19/1936
February	5.27	12.35	1939	0.77	1980	4.57	19/1962
March	5.64	15.86	1929	0.10	2006	10.88	15/1929
April	4.43	14.85	1928	0.24	1967	5.17	23/1928
May	3.87	12.66	1976	0.15	1965	5.69	25/1961
June	4.53	11.65	1965	0.72	1931	7.00	12/1906
July	6.48	30.23	1916	0.00	1900	9.90	08/1916
August	5.47	14.64	2008	0.96	1914	5.90	24/2008
September	3.95	14.54	1957	0.10	1904	7.50	10/2006
October	2.40	8.68	1959	0.00	1961	5.80	08/1894
November	3.03	10.11	1947	0.02	1931	4.76	01/1932
December	4.60	12.92	1953	0.55	1946	8.50	11/2008
Annual	**54.62**	**81.94**	**1948**	**28.74**	**1954**	**10.88**	**03/15/1929**
Winter	14.82	27.73	1973	5.88	1950	8.50	12/11/2008
Spring	13.93	28.25	1947	5.20	1925	10.88	03/15/1929
Summer	16.48	37.79	1916	7.46	2006	9.90	07/08/1916
Fall	9.38	24.43	1957	1.19	1931	7.50	09/10/2006

	COLQUITT, GEORGIA (092153))						
	Record: 03/1956 – 4/2012						
	Mean	High	Year	Low	Year	1 Day Max.	
January	5.13	13.60	1991	0.83	1969	5.62	25/1978
February	4.68	10.16	1986	0.56	2001	3.60	14/2009
March	5.78	13.22	1980	0.00	2006	7.75	28/2009
April	3.84	11.52	1975	0.33	1972	6.76	10/1975
May	3.44	12.18	1976	0.10	1965	4.06	03/2010
June	4.92	12.33	1989	0.49	1970	5.90	05/1995
July	5.08	12.46	1998	0.99	1977	3.29	21/1961
August	4.73	12.99	2003	1.09	2000	4.50	08/1970
September	4.35	17.46	1998	0.61	1985	9.80	15/2002
October	2.54	9.90	1959	0.00	1961	4.04	03/1994
November	3.14	8.77	1992	0.00	1959	5.30	22/1985
December	3.99	9.22	1982	0.32	1984	6.70	11/2008
Annual	**51.63**	**71.16**	**1975**	**36.44**	**2001**	**9.80**	**09/15/2002**
Winter	13.81	21.88	1964	5.45	1957	6.70	12/11/2008
Spring	13.06	27.03	2009	3.28	1986	7.75	03/28/2009
Summer	14.73	25.52	1989	7.40	1973	5.90	06/05/1995
Fall	10.03	21.63	1998	2.78	1991	9.80	09/15/2002

	CHIPLEY 3 E, FLORIDA (081544)						
	Record: 04/1939 – 04/2012						
	Mean	High	Year	Low	Year	1 Day Max.	
January	4.89	15.44	91	0.72	57	5.40	09/1997
February	4.81	10.41	98	0.87	76	5.80	16/1970
March	4.22	12.80	60	0.00	81	7.35	02/1960
April	4.22	12.80	60	0.00	81	7.35	02/1960
May	4.15	16.11	46	0.00	107	6.90	04/2010
June	5.41	15.21	89	0.84	93	6.83	09/1989
July	6.80	14.71	84	1.92	72	4.70	07/1994
August	5.94	18.64	39	1.27	54	6.00	31/1950
September	4.67	18.72	98	0.23	70	8.10	15/2002
October	2.94	10.96	59	0.00	43	4.95	19/2007
November	3.55	12.90	97	0.10	56	6.73	12/2002
December	4.34	16.43	53	0.39	80	8.00	11/2008
Annual	**57.50**	**79.62**	**64**	**29.09**	**54**	**8.10**	**09/152002**
Winter	14.05	25.01	98	3.94	57	8.00	12/11/2008
Spring	14.15	30.24	46	3.20	107	7.35	04/02/1960
Summer	18.14	34.17	101	8.27	54	6.83	06/09/1989
Fall	11.15	29.41	102	2.81	84	8.10	09/15/2002

	QUINCY 3 SSW, FLORIDA (087429)						
	Record: 01/1968 – 04/2012						
	Mean	High	Year	Low	Year	1 Day Max.	
January	5.09	19.74	91	0.00	103	4.05	08/1993
February	4.42	10.61	86	0.73	101	4.80	19/1988
March	5.58	14.31	91	0.33	106	6.00	02/1991
April	3.61	13.17	73	0.32	72	5.93	03/2009
May	4.40	16.42	91	0.00	96	4.65	11/1991
June	5.24	13.82	89	0.00	96	6.02	09/1989
July	7.31	18.08	69	1.04	83	3.52	13/1968
August	5.83	12.85	86	0.00	99	4.65	15/1987
September	4.24	19.15	69	0.00	98	11.77	21/1969
October	3.26	11.89	97	0.00	99	4.67	03/1994
November	3.13	14.77	97	0.00	98	4.40	22/1985
December	3.48	6.39	85	0.81	80	4.90	13/1985
Annual	**55.57**	**88.19**	**94**	**40.46**	**90**	**11.77**	**09/21/1969**
Winter	12.98	26.35	91	5.79	89	4.90	12/13/1985
Spring	13.59	37.72	91	4.73	104	6.00	03/021991
Summer	18.38	31.86	94	11.23	90	6.02	06/09/1989
Fall	10.62	29.55	97	0.28	98	11.77	09/21/1969

Table 4-6. Monthly Distribution of Annual Reservoir Evaporation (inches)

	Lake Seminole
January	1.73
February	2.07
March	3.47
April	4.38
May	4.98
June	5.09
July	4.84
August	4.68
September	4.38
October	3.62
November	2.27
December	1.69
Total	43.20

4-06. Storms and Floods. Frontal systems influence conditions throughout the year. During the warmer months, thunderstorms are a major producer of rainfall. Tropical disturbances and hurricanes also affect the region. The autumn months are usually dryer but flood producing storms can occur any time of the year. The major flood before construction of the Jim Woodruff Project occurred in March 1929. This storm resulted from a widely extending low pressure area that developed over eastern Colorado. The system moved rapidly to the east causing heavy rainfall in Mississippi, Alabama, and Georgia. Some areas experienced nearly 30 inches of rain in a 3-day period. The March 1929 flood is discussed further in the *ACF Master Water Control Manual*.

A significant flood after construction of the Woodruff project was the flood of July 1994. Tropical Storm Alberto formed in the Southeastern Gulf of Mexico between the Yucatan Peninsula and the western tip of Cuba on 30 June 1994. Alberto was near hurricane strength when it made landfall near Ft. Walton, Florida on 3 July. The storm moved to the Atlanta, Georgia area and then meandered southward. Up to 26 inches of rainfall occurred in areas between the Chattahoochee River and the Flint River. Record stages were recorded on some streams. The Mobile District Office (MDO) prepared a special report on the storm titled, *Flood of July 1994 Apalachicola-Chattahoochee-Flint River Basin*. The *ACF Master Water Control Manual* also describes the storm.

Another flood that caused the highest pool elevation on record occurred in March of 1998. A powerful spring storm system moved thought the southeast causing flooding throughout the ACF River Basin. While this storm did not have quite as large of a peak inflow as the July 1994 storm, the long duration of high inflows from this event drove the pool elevation to its record level.

Before construction of the Jim Woodruff Project, the spillway design flood, the standard project flood and the historical flood of March 1929 were routed through the proposed reservoir. The Jim Woodruff Project does not provide flood risk management operations. During large flood events, regulated releases from the dam will reduce the peak flows. Such a reduction in peak flows is measurable, but the effect on downstream stages is minimal. The project's effects of water control regulation on flows during flood events are described in Section 8-02, Flood Risk Management.

4-07. Runoff Characteristics. In the ACF Basin, rainfall occurs throughout the year but is less abundant from August through November. Only a portion of rainfall actually runs into local streams to form the major rivers. Factors that determine the percent of runoff into the streams include the intensity of the rain, antecedent conditions, ground cover and time of year (plants growing or dormant). Intense storms will have high runoff potential regardless of other conditions while a slow rain can produce little measurable runoff. The average monthly rainfall and average stream flow between Columbus, Georgia on the Chattahoochee River and Blountstown, Florida including the entire Flint River, are presented in Figure 4-1 to demonstrate the average variation in runoff. This information was computed by comparing flows with rainfall over the basin using the unimpaired flow dataset from 1939 to 2011. The percent of rainfall appearing as stream runoff is presented for each month. Similar rainfall runoff comparisons for the upper basin are presented in the *ACF Basin Master Water Control Manual*.

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.

Streamflow has been measured in the vicinity of Jim Woodruff Dam since 1922; first at the River Junction Station, located 1.5 miles below the dam from 1929 through 1939, and since then at the Chattahoochee Station, located 0.6 miles below the dam. Records of upper pool and tailwater levels, and inflows and outflows from the Jim Woodruff Dam are available beginning in February, 1957.

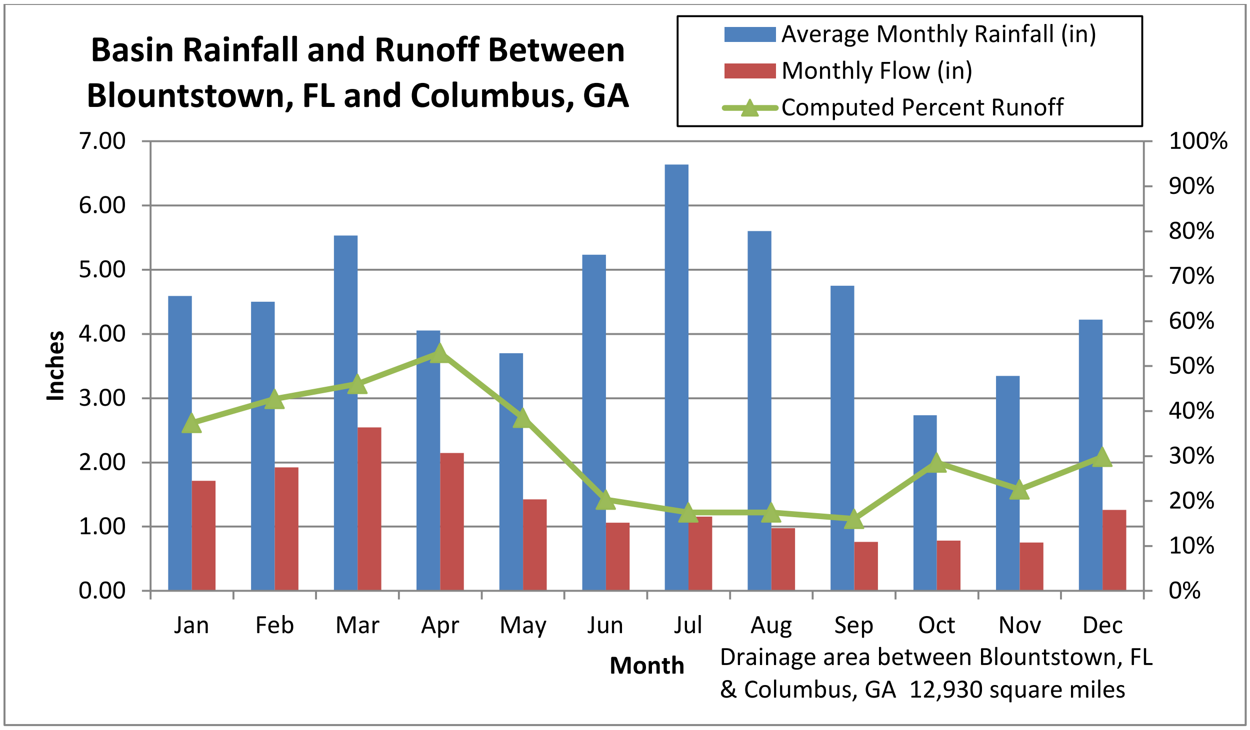


Figure 4-1. Basin Rainfall and Runoff between Blountstown, Florida and Columbus, Georgia

Daily river elevations below the dam for 1929 – 2015 are shown in Plates 4-2 to 4-6. Average monthly flows at Chattahoochee for 1922 – 2015 are tabulated in Plates 4-7 to 4-9. Those plates also show the maximum and minimum monthly flows.

The Blountstown gage, located about 29 miles downstream from Jim Woodruff Lock and Dam is the major indicator of navigation depths and flow volumes for the Apalachicola River. Flow records are available since 1939 at the Blountstown station. Reservoir regulations at the Jim Woodruff Project have some short-term effects at Blountstown, but the run-of-river operations do not affect long-term statistics.

Unimpaired flows were computed during studies with Alabama, Florida, and Georgia to determine effects of the existing reservoirs. The unimpaired flows account for consumptive uses, and losses and gains to stream flow (see Paragraph 8-11).

A comparison of unimpaired flows and observed flows for 1960 through 2011 reveals statistics of changed flows resulting for human activities. Table 4-7 and Figure 4-2 show some results of the analysis. Average monthly data were compared for both unimpaired flows and observed flows. The results reveal both changes in the volume of flows and a seasonal redistribution. Hydrographs shown on Plates 4-10 to 4-20 reveal that there was little impact from 1939 until sometime in the 1960s. Table 4-8 and Figure 4-3 show some results of the analysis for the period from 1939 through 1959. After then, increased population, altered land uses, and reservoir development began to cause changes in the basin river flow regime. The changes can be observed at the Blountstown gage. Table 4-9 and Figure 4-4 show some results of the analysis for a dry period from 2007 through 2008.

Table 4-7. Blountstown Seasonal Redistribution of Flows, 1960 - 2011

	Unimpaired Average Flow (cfs)	Observed Average Flow (cfs)	Average Gain or Loss Due to Redistribution of Flows (cfs)
Jan	28,914	27,887	-1,027
Feb	35,628	35,173	-455
Mar	41,043	39,636	-1,407
Apr	34,328	32,950	-1,379
May	22,419	20,849	-1,570
Jun	17,626	16,662	-964
Jul	17,721	17,088	-633
Aug	14,928	14,868	-61
Sep	12,343	12,645	301
Oct	12,747	12,550	-197
Nov	14,152	13,662	-491
Dec	20,804	20,758	-46
Total	272,654	264,726	-7,928
Average	22,721	22,060	-661

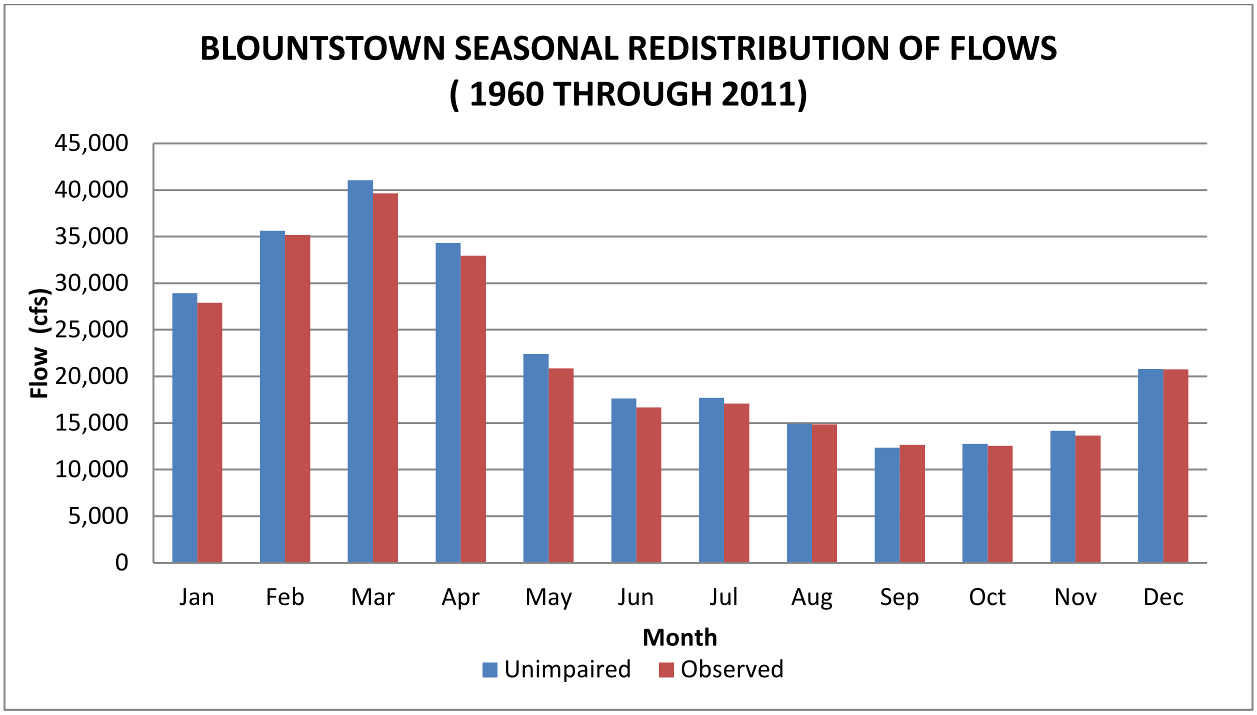


Figure 4-2. Redistribution of Flows at Blountstown (1960 - 2011)

Table 4-8. Blountstown Seasonal Redistribution of Flows 1939 - 1959

	Unimpaired Average Flow (cfs)	Observed Average Flow (cfs)	Average Gain or Loss Due to Redistribution of Flows (cfs)
Jan	26,562	26,038	-524
Feb	30,323	29,737	-586
Mar	40,057	40,067	10
Apr	36,889	36,455	-434
May	24,784	24,630	-154
Jun	17,822	17,511	-311
Jul	18,889	18,781	-108
Aug	15,993	16,021	28
Sep	12,875	12,781	-94
Oct	11,854	11,685	-169
Nov	12,694	12,530	-164
Dec	21,349	21,287	-62
Total	270,091	267,523	-2,568
Average	22,507	22,293	-214

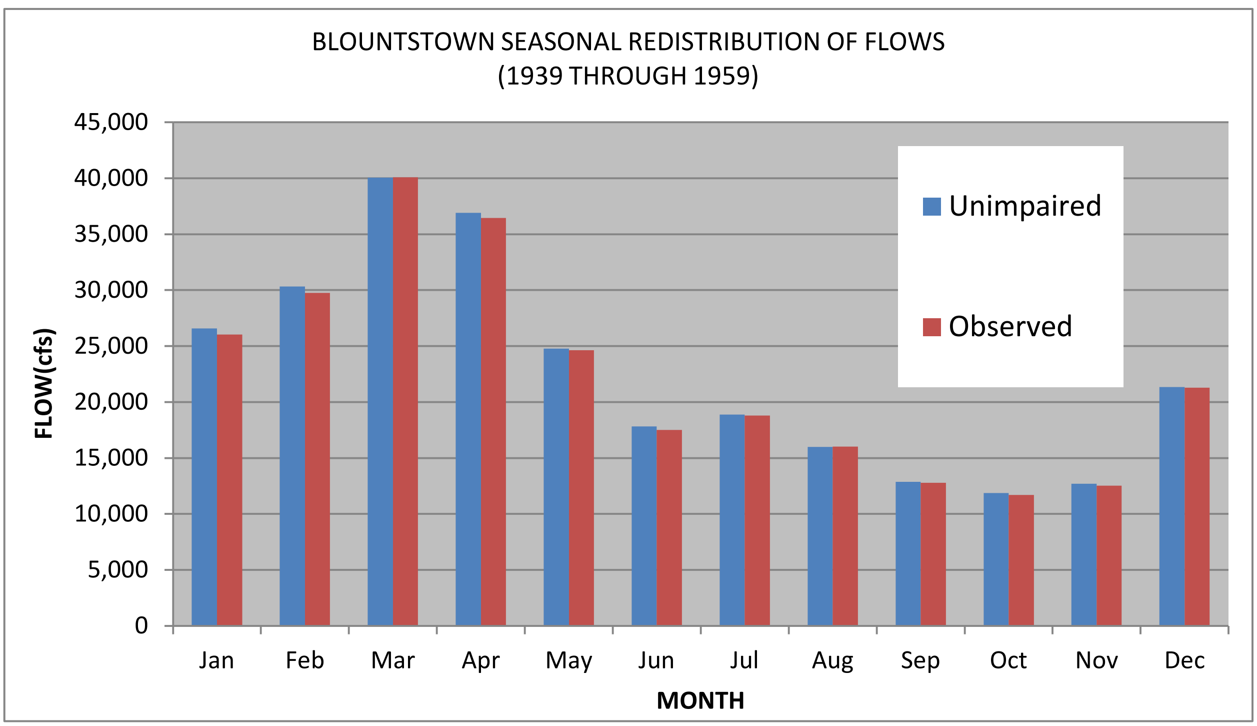


Figure 4-3. Redistribution of Flows at Blountstown (1939 - 1959)

Table 4-9. Blountstown Seasonal Redistribution of Flows (2007 – 2008)

	Unimpaired average flow	Observed average flow	Average gain or loss due to redistribution of flows
Jan	20,010.00	17,587.00	-2423
Feb	24,855.00	23,610.00	-1245
Mar	24,442.00	22,121.00	-2321
Apr	17,498.00	16,138.00	-1360
May	8,925.00	8,406.00	-519
Jun	6,202.00	5,859.00	-343
Jul	7,073.00	6,033.00	-1040
Aug	9,730.00	9,547.00	-183
Sep	7,744.00	8,020.00	276
Oct	5,857.00	6,412.00	555
Nov	6,179.00	7,787.00	1608
Dec	18,778.00	17,259.00	-1519
Total	157,293.00	148,779.00	-8,514
Average	13,107.75	12,398.25	-710

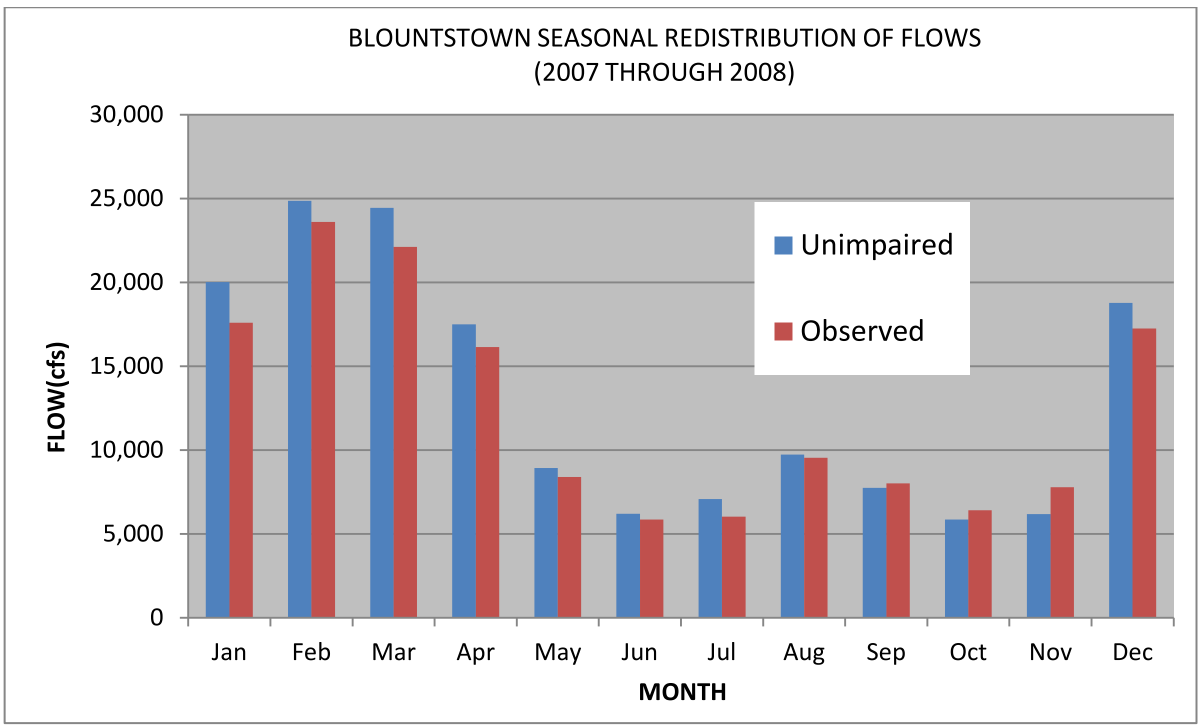


Figure 4-4. Redistribution of Flows at Blountstown (2007 - 2008)

4-08. Water Quality. Jim Woodruff Dam provides minimum continuous flow releases which benefits water quality downstream of the dam. Because of the shallowness of Lake Seminole and the relative amount of storage when compared to inflow, the lake does not stratify, and water quality downstream of the dam does not fluctuate to the same degree as at other reservoirs in the basin.

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 small, five acre area east of the confluence with Fish Pond Drain, which is pH impaired. Two TMDLs were completed in 1998 for chlordane and polychlorinated biphenyls (PCBs). Reduction for both was 0 percent because both are no longer used in Georgia. Georgia EPD 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 monitored water quality in the tailrace, and the data have shown that the water discharged from the dam generally has good water quality.

Uncontrolled growth of aquatic vegetation and algae is common to reservoirs, where stable water levels, shallow depths, sedimentation, and nutrient enrichment produce favorable conditions for vegetative growth. In the ACF Basin, Lake Blackshear and Lake Seminole have historically experienced noxious growth of aquatic vegetation. Non-native plant growth in the reservoir, specifically hydrilla, has adversely affected lake and dam operation purposes and has degraded water quality (decreased dissolved oxygen and increased nutrients) and aquatic life habitat. The problem is most severe in Lake Seminole, where as much as 68 percent of the lake's surface area has been covered by aquatic plants. The Corps has documented more than 900 species of aquatic and wetlands plants at Lake Seminole. Several noxious exotic species have become well established, including Eurasian milfoil (*Myriophyllum spicatum*), water hyacinth (*Eichornia crassipes*), and hydrilla. Hydrilla has exhibited the most prolific growth and range expansion, prompting the Corps to issue a Hydrilla Action Plan. Several methods, including aerial application of herbicides, mechanical harvesting, and even biological controls (the hydrillae fly, *Hydrillae pakistani* and the sterile grass carp) have been used in an attempt to control the spread of the plants.

4-09. Channel and Floodway Characteristics. The Apalachicola River extends from Jim Woodruff Dam to the Gulf of Mexico, a distance of 108 miles. The terrain is flat and the river is relatively straight. The Chipola River is the main tributary with a drainage area of 1,270 square miles. Shoals and sandbars tend to form preventing barge traffic except after dredging or during high river stages. Rock fill jetties have been constructed in some reaches to direct the flow into a narrower channel. The floodplain is about 10 miles wide and consists of heavily wooded swampland. The tailwater rating is shown in Plate 4-21. An examination of past records shows a very good relation between the daily discharge at the Jim Woodruff Project and the stage at Blountstown, Florida, the following morning. This relationship is shown in Plate 4-22. Table 4-10 provides flood damage information for the Blountstown, Florida area. Table 4-11 presents historical gage reading for this location. The information shown in Tables 4-10 and 4-11 is taken from the Southeast River Forecast Center (SERFC) website.

Table 4-10. Flood Damages at Blountstown, Florida

Gage height (feet)	Flood impacts at USGS Gage 02358700
28.6	A few houses in the central part of town will flood.
27.5	This is the 100 year flood level.
27	Low spots on highway 20 and 29 near town will flood. Flooding will begin to affect the entire Apalachicola River Basin.
26.4	This is the 50 year flood level.
26	Houses on river road will flood.
25.4	This is the 25 year flood level.
24.8	Water will reach the foundations of two houses east on highway 20. Minor damage will occur south on river road north, on Pear Street, and east on Mayhaw Street.
24.5	Lake Grove Road to the Chipola cutoff area will flood. Water will approach homes at Red Bull Island and the Dalkeith and Howard creek areas.
24.1	This is the 10 year flood level.
24	The Wewahitchka area will be affected downstream of Blountstown. Minor house flooding will occur at Kentucky landing, Chipola cutoff, Red Bull Island, Douglas, Brants, and Willis landings and Howards Creek area.
23.5	This is the 5 year flood level. Water will reach the walkway to Neal lumber office. Houses downstream at the Chipola cutoff area will begin to flood.
22	Minor lowland flooding will occur on many roads including Byrd Parker Road, Warmouth Drive, Gaskin Park, the end of Lake Grove Road, Elm Street on Red Bull Island, and lower landing on Howards Creek.
19	Minor lowland flooding will occur at Douglas and Willis landings campgrounds. The 19.0 to 24.5 ft levels at the Blountstown gage may at times not be representative of river levels in these areas due to tidal effects, winds, or local rainfall and should be used with caution.
15	Minor lowland flooding begins. This level is the top of the bank at the marina.

Table 4-11. Historical Crests at Blountstown, Florida (#02358700)

(1) 28.60 ft on 03/21/1929
(2) 27.90 ft on 01/27/1925
(3) 27.23 ft on 03/13/1998
(4) 27.21 ft on 07/10/1994
(5) 26.30 ft on 03/21/1990
(6) 24.75 ft on 01/29/1978
(7) 24.60 ft on 04/28/1928
(8) 24.40 ft on 03/08/1966
(9) 24.30 ft on 04/09/1960
(10) 24.20 ft on 04/02/2005

4-10. Upstream Structures. Above Jim Woodruff Dam on the Chattahoochee River are 14 dams on the main river. Ten are private, and four are Federal projects. The Federal projects are operated in a basin-wide water control plan to supply Jim Woodruff with any required flows.

The private dams have negligible effects on flows at Jim Woodruff. The Flint River is mostly free flowing with only two dams on it. Rating curves and tables for Albany (USGS gage #02352500), Montezuma (USGS gage #02349605), Newton (USGS gage #02353000), and Chattahoochee (USGS gage #02358000) are shown in Plates 4-23 to 4-26.

4-11. Downstream Structures. There are no downstream structures between the Jim Woodruff Project and the Apalachicola Bay.

4-12. Economic Data. The watershed above and the river basin below Lake Seminole are largely rural; containing only five cities with populations greater than 25,000 persons. The watershed above Lake Seminole extends to the headwaters of the Flint River Basin and to George W. Andrews Lock and Dam in the Chattahoochee River Basin. The watershed consists of 34 Georgia counties - 33 of which are in the Flint River Basin and one in the Chattahoochee River Basin - and two Alabama counties in the Chattahoochee River Basin. The Apalachicola River Basin below Lake Seminole consists of eight counties exclusively in Florida.

a. Population. The 2010 population of the 44 counties composing the Lake Seminole watershed and basin below totaled 1,823,315 persons. Table 4-12 contains the 2010 population and the 2010 per capita income for each of the counties.

The five major cities in the Lake Seminole Watershed, and their 2010 populations are Dothan, Alabama – 65,496, Albany, Georgia – 77,434, Hinesville, Georgia – 33,437; Peachtree City, Georgia – 34,364; and Warner Robbins, Georgia – 66,588.

b. Agriculture. The Lake Seminole watershed and basin below consist of approximately 13,000 farms averaging 310 acres per farm. In 2012 the area produced almost $6.9 billion in farm products sold (including livestock). Agriculture in the Jim Woodruff Project Watershed consists primarily of row crops, which account for 60 percent of the value of farm products sold. Cotton, peanuts, soybeans, corn, and vegetables are the principle row crops. Livestock production consists primarily of beef cattle; however, the area has recently experienced expansion of poultry and dairy operations.

c. Industry. The leading industrial sectors that provide non-farm employment are wholesale and retail trade, services, and manufacturing. These sectors account for a combined 66.1 percent of the non-farm employment in the basin. The remaining non-farm employment is provided by construction, finance, insurance, real estate, transportation, and public utilities. In 2005 the area contained 1,163 manufacturing establishments that provided 67,520 jobs with total earnings of more than $3.2 billion. Additionally, the value added by the area manufacturers totaled $8.7 billion. Table 4-13 contains information on the manufacturing activity for each of the counties in the Lake Seminole watershed and basin below.

Some major industry is along the waterway near Jim Woodruff. Of particular interest are the following:

Georgia Pacific Corporation. This plant is on the Chattahoochee River near Jakin, Georgia, in the upper reaches of the Lake Seminole pool. It uses six pumps with an intake elevation of 72.67 feet NGVD29. Pumping capacity is reduced at pool elevations below 75 feet NGVD29.

Farley Nuclear Power Plant. The plant is on the west bank of the Chattahoochee River near Columbia, Alabama. It becomes severely affected when the pool elevation at Lake Seminole drops below elevation 75.0 feet NGVD29. Southern Nuclear defines 2,000 cfs and 74.5 feet NGVD29 as minimum conditions for operation.

Plant Scholz, Florida. Scholz Electric Generating Plant is a coal-fired power station owned and operated by Southern Company. The plant is located four miles downstream of Jim Woodruff Lock and Dam near Sneads, Florida. For optimum plant operation, the plant requires a tailwater elevation below Jim Woodruff Lock and Dam of 38 feet NGVD29 and a minimum flow of 5,000 cfs. Plant Scholz might be able to maintain temporary operations with a flow of 3,200 cfs, which the company calculates to equate to between 36.5 and 36.8 feet NGVD29 at the plant's intake. Plant Scholz has never operated at intake levels lower than 37.5 feet NGVD29. On the basis of Southern Company calculations, 37.5 feet NGVD29 at the plant would require a flow of 4,200 cfs in the Apalachicola River, according to the hydrographic survey conditions that existed in 2012.

Table 4-12. Population and per Capita Income

County	2010 Population	2010 Per Capita Income	County	2010 Population	2010 Per Capita Income
Georgia			Georgia (continued)		
Baker	3,451	$ 16,379	Sumter	32,819	$ 17,436
Calhoun	6,694	12,452	Taylor	8,906	14,693
Clayton	259,424	18,958	Terrell	9,315	15,553
Colquitt	45,498	17,362	Turner	8,930	15,973
Crawford	12,630	20,692	Upson	27,153	17,398
Crisp	23,439	17,187	Webster	2,799	16,295
Decatur	27,842	17,833	Worth	21,679	18,348
Dooly	14,918	14,871	Subtotal, Georgia	1,354,693	
Dougherty	94,565	19,210			
Fayette	106,567	35,076	Florida		
Grady	25,011	17,785	Bay	168,852	$ 25,033
Henry	203,922	25,773	Calhoun	14,625	15,091
Houston	139,900	25,206	Franklin	11,549	21,005
Lamar	18,317	17,725	Gadsden	46,389	16,843
Lee	28,298	23,867	Gulf	15,863	17,968
Macon	14,740	12,902	Jackson	49,746	17,177
Marion	8,742	17,729	Liberty	8,365	17,003
Meriwether	21,992	18,295	Washington	24,896	18,470
Miller	6,125	19,895	Subtotal, Florida	340,285	
Mitchell	23,498	16,322			
Monroe	26,424	23,656	Alabama		
Peach	27,695	18,681	Geneva	26,790	$ 18,351
Pike	17,869	21,051	Houston	101,547	22,725
Randolph	7,719	17,632	Subtotal, Alabama	128,337	
Schley	5,010	16,122			
Seminole	8,729	19,263	Total Population	1,823,315	
Spalding	64,073	19,607			
Source: U.S. Census 2010					

Table 4-13. Manufacturing Activity

County	No. of Manufacturing Establishments	Total Manufacturing Employees	Total Earnings ($1,000)	Value Added by Manufactures ($1,000)
Georgia				
Baker	(NA)	(NA)	(NA)	(NA)
Calhoun	(NA)	264	6,653	(NA)
Clayton	148	5,862	335,546	876,343
Colquitt	56	3,156	96,567	103,889
Crawford	(NA)	83	1,439	(NA)
Crisp	26	1,356	54,242	145,019
Decatur	24	1,531	66,846	220,956
Dooly	9	1,344	42,891	(D)
Dougherty	80	6,709	462,865	2,554,112
Fayette	104	4,196	245,143	476,570
Grady	16	977	35,214	68,725
Henry	81	3,629	184,812	561,182
Houston	58	4,696	211,772	619,016
Lamar	13	845	35,242	38,748
Lee	(NA)	233	9,186	(NA)
Macon	15	1,187	60,879	134,916
Marion	5	686	20,844	(D)
Meriwether	16	912	49,170	161,538
Miller	(NA)	(D)	(D)	(NA)
Mitchell	20	3,207	89,540	94,751
Monroe	(NA)	328	10,478	(NA)
Peach	28	1,741	99,103	110,407
Pike	(NA)	524	20,185	(NA)
Randolph	(NA)	244	9,156	(NA)
Schley	9	735	29,764	83,912
Seminole	(NA)	(D)	(D)	(NA)
Spalding	64	4,457	219,804	653,759
Sumter	34	2,422	102,938	311,183
Taylor	(NA)	153	5,000	(NA)
Terrell	(NA)	486	15,292	(NA)
Turner	(NA)	385	11,079	(NA)
Upson	23	1,846	80,906	222,421
Webster	(NA)	(D)	(D)	(NA)
Worth	(NA)	383	13,001	(NA)
Florida				
Bay	133	3,401	$ 182,571	$ 404,555
Calhoun	(NA)	96	1,912	(NA)
Franklin	(NA)	(D)	(D)	(NA)
Gadsden	33	1,570	62,350	77,692
Gulf	(NA)	246	8,481	(NA)
Jackson	18	774	48,248	70,419
Liberty	(NA)	307	14,494	(NA)
Washington	9	912	30,652	(D)
Alabama				
Geneva	23	(D)	(D)	47,252
Houston	118	5,637	255,879	626,169
Totals	1,163	67,520	$ 3,230,144	$ 8,663,534

(NA) Data not available
(D) Data withheld to avoid disclosure

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 Jim Woodruff Project area 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, on average, over 50 percent of the total employment in the project area. The Florida counties have a larger percentage employed by government entities than the other two states. Table 4-14 contains information on the employment activity for each of the counties in the Lake Seminole watershed and basin.

e. Flood Risk Management. Lake Seminole does not contain any flood risk management storage nor in any other way does it provide flood protection for downstream areas. The floodplain of the Apalachicola River downstream of Lake Seminole is largely undeveloped and primarily consists of natural wildlife areas. Releases from the reservoir mimic the historic natural flows of the river and the periodic flooding in the floodplain is considered desirable and beneficial to the ecosystem. Some minor flooding issues exist along the Apalachicola River at Blountstown, Florida, and directly across the river at Bristol, Florida. Flood impacts for various river stages based in the USGS gage (#02358700) at Blountstown, Florida are described in Table 4-10.

Table 4-14. Employment

	Percent distribution by occupation					Percent in selected industries		Percent govern-ment workers (local state, or Federal)
	Manage-ment, profes-sional, and related occupa-tions	Service occupa-tions	Sales and office occupa-tions	Con-struction, extraction, and main-tenance occupa-tions	Production, trans-portation, and material moving occupa-tions	Agricul-ture, forestry, fishing and hunting	Manu-facturing	
Georgia								
Baker	30.5	12.3	23.5	9.8	24	14.5	13.7	8.9
Calhoun	23.2	27.7	25.1	11.5	12.4	3	7.5	17.7
Clayton	23.2	19.8	27.7	10.8	18.6	0.4	7.9	6.5
Colquitt	25.4	14.5	21.4	17.6	21.1	9.7	17	3.6
Crawford	26.4	16.7	25.9	13.4	17.6	1.6	11	7.2
Crisp	28.7	16.1	24.8	9.6	20.8	4.9	13	6.1
Decatur	25.9	20.7	24.5	12.4	16.5	6.2	11.5	6.5
Dooly	22.7	15.2	28	13	21.2	10	12.7	11.4
Dougherty	29.7	20.6	24.3	8.5	16.9	1.9	10	7.2
Fayette	42.6	12	26.9	6.9	11.6	0.2	7.9	6.8
Grady	29.5	13.5	26.3	16	14.6	6.1	12.5	4.3
Henry	28.6	17.5	23.8	12.6	17.5	3.9	16.5	3.8
Houston	29.5	18	27	11	14.6	1.2	9.5	4.6
Lamar	25.5	15.4	28.4	10.7	20	1.1	13.7	6.5
Lee	36.4	16.5	24	10	13	1.1	11.9	4.3
Macon	25.6	25.3	25.2	10.2	13.7	1.3	10.5	7.2
Marion	16.5	20.9	16.3	16.7	29.7	7.9	19.9	9.5
Meriwether	18.7	17.6	20.8	14.9	28	2.9	20.6	4.6
Miller	28	18	25	12.1	16.9	11.6	11.9	6.5
Mitchell	24.5	15.7	23.5	13.9	22.4	8.7	20.2	7.5
Monroe	31.9	15.3	24.3	14.4	14	2.4	8.4	6.1
Peach	25.8	17.7	21.5	19.2	15.8	3.2	10.6	10.5
Pike	31.2	13.2	24.2	13.5	18	1.2	14.7	4.5
Randolph	25.1	14.5	21	12.2	27.1	4.3	24.9	5.8
Schley	27.5	15.6	16.9	17.6	22.3	3.6	16.7	8.1
Seminole	23.4	21.7	25.5	13.5	15.9	7.8	14.4	4.2
Spalding	25.7	17.4	25.2	11.3	20.4	0.5	16.7	5.4
Sumter	31.5	20.2	21.1	10.1	17.1	3.5	12.7	6.7
Taylor	26.2	16.5	23	18.9	15.5	5.4	10.5	16.2
Terrell	23.1	19.2	25.1	9.6	23	5.1	16.9	6.8
Turner	30.8	18.6	24.1	12.1	14.4	3.5	8.4	13.3
Upson	21.5	19.9	23	12.8	22.9	1.6	18.7	7.1
Webster	36.9	16.6	16.4	15.2	14.9	6	15.1	9.6
Worth	25.3	18.9	23.9	16.4	15.4	4.5	8.7	6.9

Table 4-14 (Cont'd). Employment

	Percent distribution by occupation					Percent in selected industries		Percent govern-ment workers (local state, or Federal)
	Manage-ment, profes-sional, and related occupa-tions	Service occupa-tions	Sales and office occupa-tions	Con-struction, extraction, and main-tenance occupa-tions	Production, trans-portation, and material moving occupa-tions	Agricul-ture, forestry, fishing and hunting	Manu-facturing	
Florida								
Bay	31.4	21.2	26.4	11.5	9.5	0.6	5.6	8.3
Calhoun	23.2	27.7	25.1	11.5	12.4	3	7.5	17.7
Franklin	21.8	28.6	23.1	20.5	5.9	9.7	0.4	13.6
Gadsden	25.3	21.1	30.2	13.6	9.8	4.4	4.7	16
Gulf	24.8	20.4	28	15.3	11.5	2.9	7.3	10.6
Jackson	29.4	29.1	21.1	9.8	10.5	2.7	3.9	17.5
Liberty	29.5	17.5	17.3	22.2	13.6	9.2	9.2	15.2
Washington	26.8	27.1	24.5	12.4	9.3	1.7	7.1	10.1
Alabama								
Geneva	24.4	14.5	25.3	18.4	17.3	7.2	12.5	6.7
Houston	29.5	18	27	11	14.6	1.2	9.5	4.6

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 U.S. Geological Survey (USGS) and National Weather Service (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. The 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 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 Water Management Section both daily and in real-time.

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

Tables 5-1 and 5-2 list the stations along with pertinent information. Plate 5-1 displays the locations of the rainfall and stream gage stations within the Jim Woodruff Project basin.

Table 5-1. Rainfall Only Reporting Network, Woodruff

Station	Agency ID	Latitude	Longitude	Elevation (ft. NGVD29)
Chattahoochee River				
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	COLAI	31°15'	85°07'	176
Flint River				
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
Apalachicola River				
Jim Woodruff L&D	WRDFI	30°43'	84°52'	118
Apalachicola AP, FL	80211	29°43'	85°01'	20

Table 5-2. River Stage and Rainfall Reporting Network, Woodruff

Stream	Station	Station number	River miles above mouth	Drainage area (sq. mi.)	Gage zero (ft. NGVD29)	Flood stage (ft.)	Operating agency	Rain Gage
Chattahoochee								
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	G. Andrews Lake and tailwater	2343801	46.53	8,210	0.0	113	USGS	Y
Chattahoochee River	Columbia	2343805	46.5	8,213	0		USGS	N
Sawhatchee Creek	Cedar Springs	2343940	35.27	64.2	109.9		USGS	Y
Flint River								
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 Crk	Milford	2353500	19.8	620	150.3	11	USGS	Y
Ichawaynochaway Crk	Newton	2355350	69.5	1,040	98.67	24	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								
Apalachicola River	Jim Woodruff Lake	2357500	107.58	17,164	0 .0		USGS	Y
Apalachicola River	Jim Woodruff tailwater	2357700	107.58	17,164	0	66	USGS	N
Apalachicola River	Chattahoochee	2358000	107.02	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		USGS	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 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.

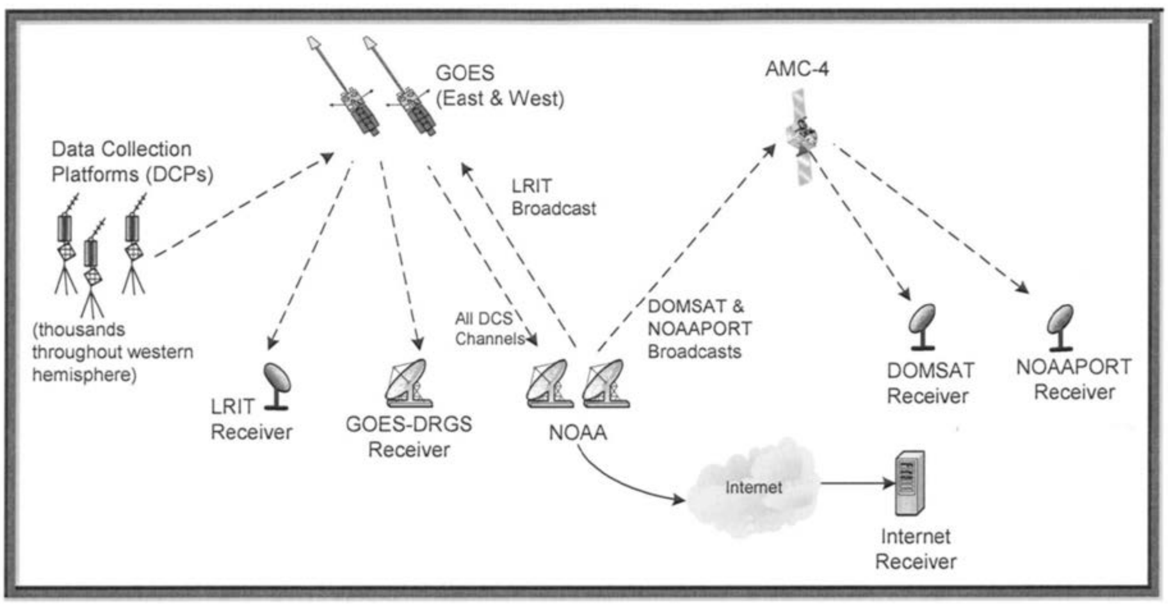


Figure 5-3. Typical Configuration of the GOES System

Typically, reporting stations log 15-minute data that are transmitted every hour. 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 through the 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.

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. In most cases, other Federal and state agencies maintain water quality stations for general water quality monitoring within the ACF Basin. In addition, real-time water quality parameters are collected at some stream gage locations maintained by the USGS. The USGS gages nearest the Jim Woodruff Project that collect water quality data are the Chattahoochee River at Mile 46 near Columbia AL gage (#02343805), and the Flint River at Bainbridge GA gage (#02356000).

5-03. Sediment Stations. In order to provide an adequate surveillance of sedimentation, a network of sediment ranges were established for Lake Seminole in 1954. Quantitative computations can be made from these ranges to determine the extent and degree of sedimentation and erosion. General conditions and changes have been measured and recorded using this network. The network of sediment stations is shown on Plate 4-1.

Sediment surveys were conducted in 1957, 1963, 1976, 1989, and 2009. Tetra Tech, Inc. was retained to conduct an analysis of the data and determine the extent and degree of sedimentation and erosion that has occurred in the lake and its tributaries over the years, and where appropriate, to speculate on the causes of those changes. This analysis and results are presented in a report entitled; “Sedimentation and Erosion Analysis for Lake Seminole”.

Bank erosion does not appear to be pervasive along the Lake Seminole shorelines. Low gradient shorelines and dense vegetation combine to resist erosion. Where human activities involve clearing vegetation from the lakeshore, often riprap has been placed to protect the banks. Bank erosion is more prevalent along the Chattahoochee and Flint riverine sections of the lake. The adjacent higher relief topography creates steeply sloping shorelines. These steep shorelines combined with high velocity flows during floods create the opportunity for higher bank erosion rates.

Sediment deposition is dominant in the Chattahoochee arm of the lake where heavy deposits have formed a southward advancing delta. The source of the sediment is not certain, but erosion of bare agricultural soils during the spring, bare construction site soils during land development, and streambank erosion are the common sources.

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 DCP data from gages throughout the ACF Basin. The DRS equipment and software then receives the DOMSAT data stream, decodes the DCPs 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 support of real-time operational decisions. Interagency data exchange has been implemented with the USGS and the SERFC. A direct link to the 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 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 MDO 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 MDO 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 MDO 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 SAD office in Atlanta, Georgia.

The primary communication network of the Jim Woodruff Project is a SCADA system network. The SCADA network is owned and operated by USACE and monitors powerhouse conditions and digitally records real-time project data hourly. Computer servers at the Jim Woodruff Project are connected to the Mobile District through the Corps Network, permitting data transfer at any time. The data include physical conditions at each of the reservoirs such as pool elevations, outflow, spillway gate openings, river stages, generation, and rainfall. Special instructions or deviations are usually transmitted by e-mail, telephone, or fax.

Emergency communication is available at the following numbers:

Water Management Section	251-690-2737
Chief of Water Management	251-690-2730 or 251-509-5368
Jim Woodruff Powerhouse	850-663-2291
Woodruff/Seminole Site Office	229-662-2001

5-06. Communication with Project

a. Regulating Office with Project Office. The Water Management Section is the regulating office for the Corps' projects in the ACF Basin. Communication between the Water Management Section and project offices is normally through daily hydropower generation schedules issued by the Southeastern Power Administration (SEPA). In addition, electronic mail, telephone, and facsimile are used daily for routine communication with the projects. 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 ensure timely response, significant coordination is often conducted by telephone between the project office and the Water Management Section. That direct contact ensures 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 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 Water Management Section through the Corps' network. The Water Management Section maintains constant contact with project operators. Operators have access to Mobile District Water Managers via email, land line and cell phone and notify the Water Management Section 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 Water Management Section. Water Management Section staff will manually input the information into the database. In addition, Mobile District Power project personnel 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 upon completion and furnished to the master water 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 within Operations Division or both, are responsible for requesting any scheduled system hydropower unit outages in excess of two hours. The Water Management Section out-of-service times are reported to Water Management on 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 Water Management Section and to SEPA. In such cases, minimum flow requirements can be met through spilling.

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 Woodruff Project, the operator on duty should notify the Water Management Section, Operations Division, and the Site 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. The Water Management Section should then notify the Mobile District Chief of Engineering and the Hydraulics and Hydrology Branch Chief. The District Water Management staff should also notify the SAD Water Management staff as soon as possible.

The Emergency Action Plan (EAP) for Jim Woodruff identifies the notification for rapid dissemination of emergency actions to take place prior to and/or following the failure of the Jim Woodruff Project. Refer to the EAP for specific details.

5-09. Role of Regulating Office. The Water Management Section of the MDO is responsible for developing operating procedures for both flood and non-flood conditions. Plans are developed to most fully use the water resources potential of each project to meet the authorized purposes. Those plans are presented in water control manuals such as this one. Water control manual preparation and updating is a routine operation of the Water Management Section. In addition, the Water Management Section maintains information on current and anticipated conditions, precipitation, and river-stage data to provide the background necessary for best overall operation. The Water Management Section arranges communication channels to the Power Project Manager and other necessary personnel. Instructions pertaining to reservoir regulation are issued to the Power Project Manager; however, routine instructions are normally issued directly to the powerhouse operator on duty.

5-10. Role of Power Project Manager. The Power Project Manager should be completely familiar with the approved operating plans for the Jim Woodruff Project. The Power Project Manager is responsible for implementing actions under the approved water control plans and carrying out special instructions from the Water Management Section. The Power Project Manager is expected to maintain and furnish records requested from him by the Water Management Section. Training sessions should be held as needed to ensure that an adequate number of personnel are informed of proper operating procedures for reservoir regulation. Unforeseen or emergency conditions at the project that require unscheduled manipulation of the reservoir should be reported to the Water Management Section as soon as practicable.

VI - HYDROLOGIC FORECASTS

6-01. General. Reservoir operations are scheduled by the Water Management Section 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 Water Management Section 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 conservation 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
"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. 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 the Corps. The Water Management Section maintains real-time observation of river and weather conditions data in the Mobile District. The Mobile District has capabilities to make forecasts for several areas in the ACF Basin. Observation of real-time stream conditions guides the accuracy of the forecasts. The Corps maintains contact with the River Forecast Center to receive forecast and other data as needed. Daily operation of the ACF River Basin during normal, flood risk management, and drought conservation regulation requires accurate, continual short-range and long-range elevation, streamflow, and river-stage forecasting. These short-range inflow forecasts are used as input in computer model simulations so that project release determinations can be optimized to achieve the regulation objectives stated in this manual. The Mobile District continuously monitors the weather conditions occurring throughout the basin and the weather and hydrologic forecasts issued by the NWS. The Mobile District then develops forecasts to meet the regulation objectives of the ACF projects. The Mobile District prepares 5-week inflow and lake elevation forecasts weekly based on estimates of rainfall and historical observed data in the basin. These projections assist in maintaining system balance and providing project staff and the public lake level 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 the preparation and public dissemination of forecasts relating to precipitation, temperatures, and other meteorological elements in the ACF Basin. The Mobile District use the NWS weather forecasts as a key source of information considered critical to its 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 7-day and longer forecasts for Bainbridge, Georgia, on the Flint River and for George Andrews on the Chattahoochee River and Blountstown, Florida, 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 adjust 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, and Tallahassee, Florida, are responsible for the maintenance of the gages located in the Jim Woodruff Project area. 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. During flood conditions, forecasts are made for two conditions: rainfall that has already fallen, and for potential rainfall (or expected rainfall). Decisions can be made on the basis of known events and *what if* scenarios. The Water Management Section prepares forecasts and receives the official forecasts from the SERFC.

a. Requirements. Accurate flood forecasting requires a knowledge of antecedent conditions, rainfall and runoff that has occurred, and tables or unit hydrographs to apply the runoff to existing flow conditions. Predictive QPF data are needed for what if scenario.

b. Methods. In determining the expected inflow into Lake Seminole, it is necessary to forecast the flows of the Chattahoochee River below the Walter F. George Project and the Flint River flow coming into Lake Seminole. Runoff or rainfall excess is estimated using the seasonal correlation values shown in Table 6-1 for the Flint River Basin and Table 6-2 for the Chattahoochee River Basin. The rainfall excess values for the Flint River Basin and the Chattahoochee River below Walter F. George Dam are distributed by means of the unit hydrographs adopted for the basins shown in Table 6-3. The two hydrographs, thus, obtained are combined with the routed release from Walter F. George Dam to give the hydrograph of total inflow expected into Lake Seminole. The release from Walter F. George Dam is routed by a lag routing procedure. Actual flows at gaging stations can be determined by using rating curves and tables. Rating curves and tables for Albany (USGS gage #02352500), Montezuma (USGS gage #02349605), and Newton (USGS gage #02353000), are shown in Plates 4-23 to 4-25. The tailwater rating curve for Jim Woodruff is shown in Plate 4-21.

For short-range flood forecasting the Water Management Section has 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).

Table 6-1. Rainfall-Runoff Relation for the Flint River Basin

Antecedent conditions	Average basin rainfall Total (inches)	Average runoff (inches)									
		0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90
Wet											
	0	0.00	0.05	0.05	0.10	0.10	0.15	0.15	0.20	0.25	0.25
	1	0.30	0.35	0.35	0.40	0.45	0.45	0.50	0.55	0.55	0.60
	2	0.60	0.65	0.70	0.70	0.75	0.80	0.80	0.85	0.90	0.90
	3	0.95	1.00	1.00	1.05	1.10	1.15	1.15	1.20	1.25	1.25
	4	1.30	1.35	1.35	1.40	1.45	1.45	1.50	1.55	1.60	1.60
	5	1.65	1.70	1.75	1.75	1.80	1.85	1.90	1.95	1.95	2.00
	6	2.05	2.10	2.15	2.20	2.25	2.25	2.30	2.35	2.40	2.45
	7	2.50	2.55	2.60	2.65	2.70	2.75	2.85	2.90	2.95	3.00
	8	3.05	3.15	3.20	3.25	3.35	3.40	3.50	3.55	3.65	3.75
	9	3.80	3.90	4.00	4.10	4.15	4.25	4.35	4.45	4.55	4.65
	10	4.75	4.85	4.95	5.05	5.15	5.25	5.35	5.45	5.55	5.65
Normal And Dry											
	0	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.10	0.10	0.10
	1	0.15	0.15	0.15	0.15	0.20	0.20	0.20	0.25	0.25	0.25
	2	0.25	0.30	0.30	0.30	0.35	0.35	0.35	0.40	0.40	0.40
	3	0.45	0.45	0.50	0.50	0.50	0.55	0.55	0.55	0.60	0.60
	4	0.65	0.65	0.70	0.70	0.75	0.75	0.80	0.80	0.85	0.85
	5	0.90	0.90	0.95	0.95	1.00	1.05	1.05	1.10	1.10	1.15
	6	1.20	1.20	1.25	1.25	1.30	1.35	1.35	1.40	1.45	1.45
	7	1.50	1.50	1.55	1.60	1.60	1.65	1.65	1.70	1.75	1.75
	8	1.80	1.80	1.85	1.90	1.90	1.95	2.00	2.00	2.05	2.05
	9	2.10	2.15	2.15	2.20	2.20	2.25	2.30	2.30	2.35	2.40
	10	2.40	2.45	2.50	2.55	2.55	2.60	2.65	2.70	2.75	2.75

Table 6-2. Rainfall-Runoff Relation for the Chattahoochee River Basin

Antecedent conditions	Average basin rainfall Total (Inches)	Average runoff (inches)									
		0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Wet											
	0	0.00	0.00	0.00	0.05	0.05	0.10	0.10	0.10	0.15	0.15
	1	0.20	0.20	0.25	0.25	0.30	0.30	0.35	0.35	0.40	0.40
	2	0.50	0.50	0.55	0.55	0.60	0.65	0.70	0.70	0.75	0.80
	3	0.85	0.90	0.95	0.95	1.00	1.05	1.10	1.15	1.20	1.25
	4	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75
	5	1.80	1.85	1.90	1.95	2.00	2.05	2.10	2.15	2.20	2.25
	6	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75
	7	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	3.25
	8	3.30	3.35	3.40	3.45	3.50	3.55	3.60	3.65	3.70	3.75
	9	3.80	3.85	3.90	3.95	4.00	4.05	4.10	4.15	4.20	4.25
	10	4.30	4.35	4.40	4.45	4.50	4.55	4.60	4.65	4.70	4.75
Normal											
	0	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.10	0.10
	1	0.10	0.15	0.15	0.15	0.15	0.20	0.20	0.20	0.25	0.25
	2	0.25	0.30	0.30	0.30	0.35	0.35	0.35	0.40	0.40	0.45
	3	0.45	0.50	0.50	0.50	0.55	0.55	0.55	0.60	0.60	0.65
	4	0.65	0.70	0.70	0.75	0.75	0.80	0.80	0.85	0.90	0.90
	5	0.95	1.00	1.05	1.10	1.15	1.15	1.20	1.25	1.30	1.35
	6	1.40	1.45	1.50	1.55	1.60	1.70	1.75	1.80	1.85	1.90
	7	1.95	2.00	2.05	2.10	2.15	2.25	2.30	2.35	2.40	2.45
	8	2.50	2.60	2.65	2.70	2.80	2.85	2.90	3.00	3.05	3.10
Dry											
	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05
	1	0.05	0.05	0.05	0.05	0.10	0.10	0.10	0.10	0.10	0.15
	2	0.15	0.15	0.20	0.20	0.20	0.20	0.25	0.25	0.25	0.25
	3	0.30	0.30	0.30	0.35	0.35	0.35	0.40	0.40	0.40	0.45
	4	0.45	0.45	0.50	0.50	0.55	0.55	0.60	0.60	0.65	0.65
	5	0.70	0.75	0.80	0.85	0.85	0.90	0.95	1.00	1.05	1.10
	6	1.15	1.20	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55
	7	1.60	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00

Table 6-3. Unit Hydrographs of Reservoir Inflow to the Jim Woodruff Project

Time (days)	Flint River drainage area 8,456 square miles	Chattahoochee River below Walter F. George drainage area 1,248 square miles
	24-hour unit hydrograph (cfs)	24-hour unit hydrograph (cfs)
0	0	0
1	1,520	3,000
2	4,620	11,500
3	8,490	11,200
4	12,790	2,300
5	17,270	1,900
6	21,170	700
7	24,030	0
8	25,610	
9	25,610	
10	23,760	
11	20,350	
12	16,190	
13	11,880	
14	7,950	
15	4,680	
16	2,180	
17	440	
18	0	

6-03. Conservation Purpose Forecasts. Forecasts for conservation operations are accomplished similarly to flood condition forecasts. Flows from the Flint River are combined with expected discharges from Walter F. George Lock and Dam on the Chattahoochee River. Runoff and other local inflows are added and 7-day or longer inflows are calculated. Doing so permits the Water Management Section to create a 7-day forecast of relatively uniform releases from the Jim Woodruff Dam through the powerhouse. Often, a weekend drawdown occurs in the lake level and recovery during weekdays because of hydropower peaking at Walter F. George.

a. <u>Requirements</u>. The ACF projects are 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.

b. <u>Methods</u>. The Water Management Section prepares 5-week inflow and lake elevation forecasts weekly based on estimates of rainfall and historical observed data in the basin. These projections assist in maintaining system balance and providing project staff and the public lake level trends based on the current hydrology and operational goals of the period. In addition, the Water Management Section provides weekly hydropower generation forecasts based on current power plant capacity, latest hydrological conditions, and system water availability. The Mobile District has also begun testing CWMS for short term forecasts in normal conditions. These forecasts are typically no longer than five days, provide forecasting reservoir inflow, outflow and pool elevation, and assist in the planning of reservoir releases for the coming week. These forecasts incorporate the current observed conditions and a 48-hour QPF provided by SERFC.

6-04. Long-Range Forecasts

a. Requirements. The Corps utilizes available information from the NWS to develop long-range forecasts to aid in the operation of the system and for planning purposes. These projections can vary from a 5-week forecast to a 6-month forecast.

b. Methods. 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 this incorporates a greater level of uncertainty and reliability. In extreme conditions, 3-month and 6-month forecasts can be produced based on 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 are used in long-range planning for prudent water management of the ACF reservoir projects.

6-05. Drought Forecasts

a. Requirements. ER1110-2-1941, *Drought Contingency Plans*, dated 15 September 1981, called for developing drought contingency plans for Corps' reservoirs. Drought recognition and drought forecast information can be used in conjunction with the drought contingency plan, which is further discussed in Chapter VII.

b. Methods. 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 Alabama Office of State Climatologist also produces 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 time periods reflect drought conditions when appropriate. There is also a heavy reliance on latest ENSO (El Niño/La Niña-Southern Oscillation) forecast modeling to represent the potential impacts of La Nina on drought conditions and spring inflows. Long-range models are used with greater frequency during drought conditions to forecast potential impacts to 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 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 planning. Other parameters are the ability of Lake Seminole to meet the demands placed on its storage, the probability that Lake Seminole pool elevation will return to normal seasonal levels, the conditions at other basin impoundments, basin streamflows, basin groundwater table levels, and the total available storage to meet hydropower marketing system demands.

c. <u>Drought Analysis</u>: Lake Seminole above Jim Woodruff Lock and Dam is a run-of-river project with almost no usable storage. It reregulates flow coming from the ACF storage projects and the Flint River, and has the largest drainage basin of any dam and lake in the ACF Basin. Below Woodruff the Apalachicola is completely unregulated. Figure 6-1 presents a graph of annual rainfall above Woodruff Lock and Dam since 1939. The actual rainfall, average, and 10-year running average years are shown. A cyclical pattern of higher rainfall periods and droughts, both long-term and short-term, have occurred in the period. Figure 6-2 also shows the basin rainfall in the basin above Woodruff Lock and Dam, along with the annual flow at the dam for the same period. The average flow is also presented to demonstrate the drought periods. Figure 6-3 presents the Woodruff Lock and Dam flow along with the percent of rainfall appearing as runoff. Considering the lack of storage, limited storage in the headwater projects, and the long durations of some droughts, a drought plan is needed to best manage the water resources.

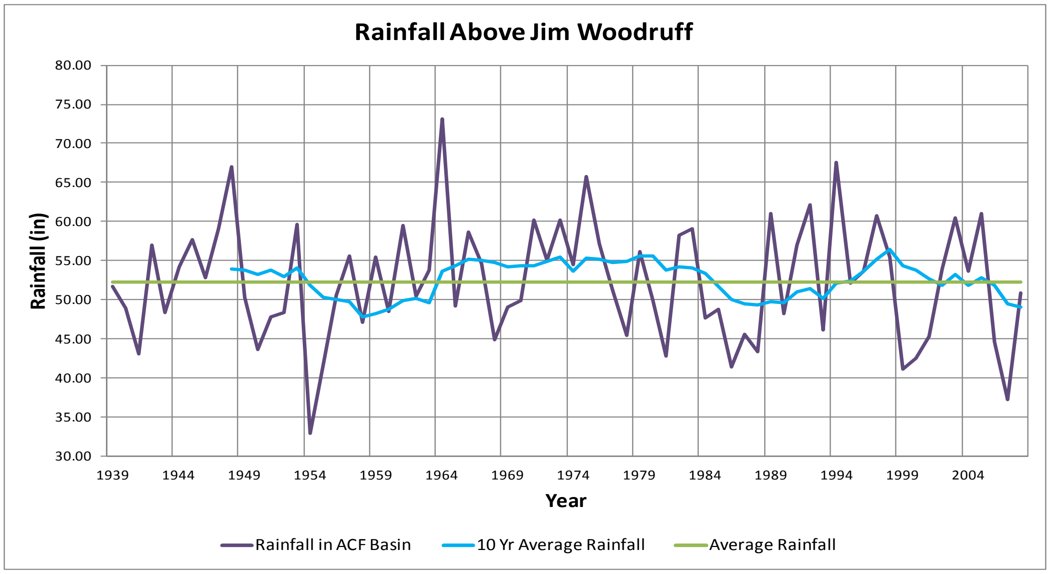
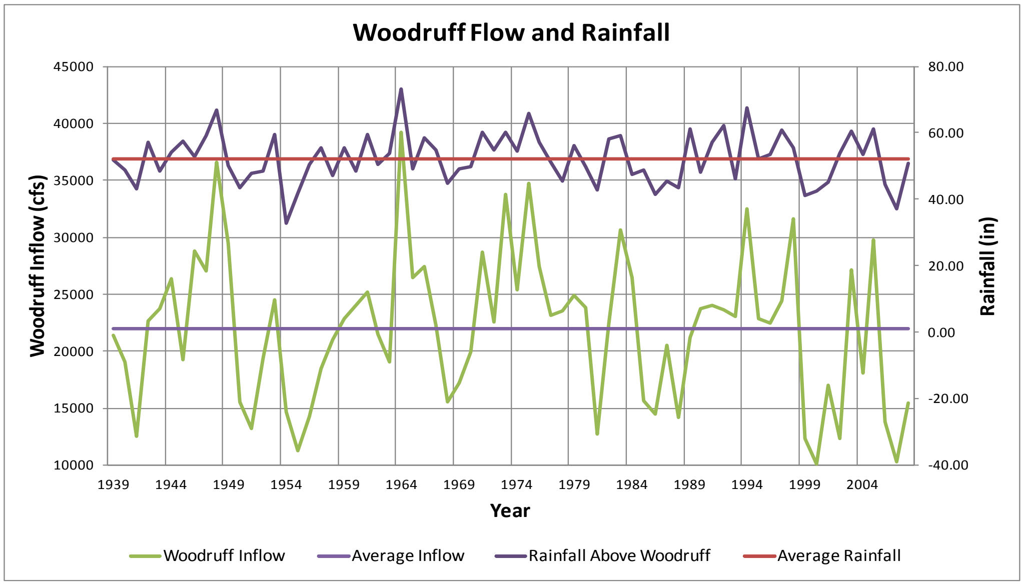


Figure 6-1. Rainfall Averaged Over Years



Note: The unimpaired inflow at Woodruff was used for Woodruff Inflow. Annual rainfall averaged from various gages in the headwaters of Woodruff.

Figure 6-2. Woodruff Dam Flow and Rainfall

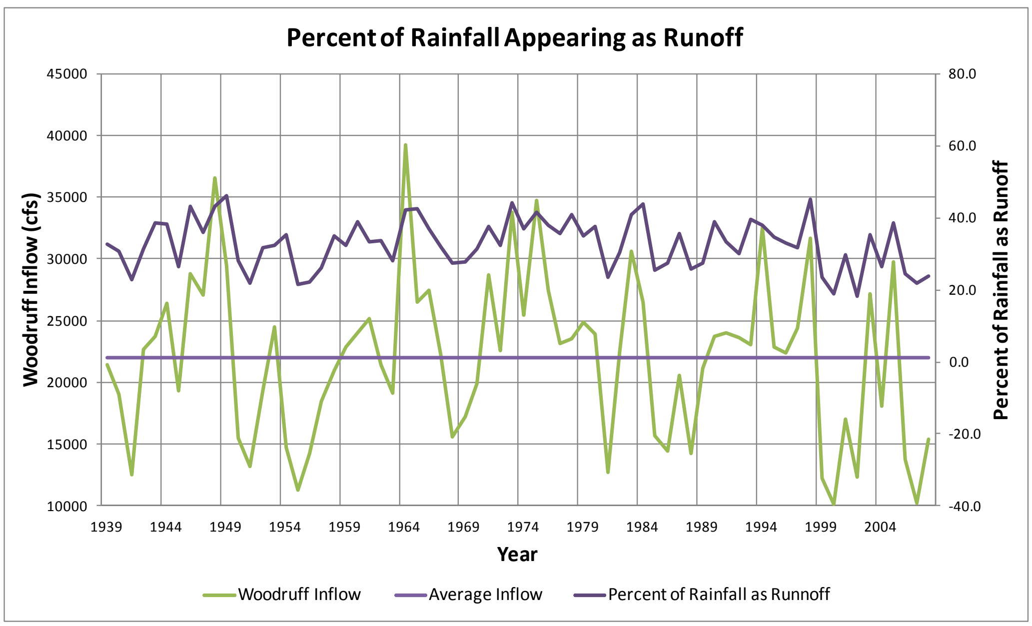


Figure 6-3. Percent of Rainfall Appearing as Runoff

d. Reference Documents. The drought contingency plan for the Jim Woodruff Project is summarized in Section 7-12 below. The complete ACF Drought Contingency Plan is provided in the Exhibit D.

VII - WATER CONTROL PLAN

7-01. General Objectives. The authorized purposes for the Jim Woodruff Lock and Dam and Lake Seminole as specified in the authorizing documents are hydroelectric power and navigation. Several other project purposes have been authorized at Jim Woodruff through nationwide authorizing legislation. Those purposes are water quality, recreation, conservation of Federally listed threatened and endangered species and their Federally designated critical habitat, fish and wildlife conservation, and water supply. Flood risk management is not an authorized function. The regulation plan seeks to balance the needs of all project purposes at the Jim Woodruff Project.

7-02. Constraints. One of the operating constraints is the limitation on maximum head. Investigation of the possibilities of excess stresses in the lock and spillway during periods when the tailwater is unusually low has shown that it is structurally undesirable to allow the difference between headwater and tailwater to exceed the limits shown in Plate 7-1. Whenever the tailwater elevation drops below elevation 44.5 feet NGVD29, static head can control project operation. Powerhouse operators should monitor the static head closely during such periods.

Fall rate, also called down-ramping rate, is the vertical drop in river stage (water surface elevation) that occurs over a given period. The fall rates for the Apalachicola River downstream of Jim Woodruff Dam are described in Paragraph 7-08.c.(2) and summarized in Table 7-3.

Minimum releases required from Jim Woodruff Dam are dependent on the ACF composite conservation zone described in Paragraph 7-08 c (1), Minimum Discharge. All flows and stage thresholds referenced in Chapter VII are measured at the USGS Apalachicola River gage near Chattahoochee, Florida (#02358000).

During the spawning period (March to May), the Corps operates releases from Jim Woodruff Dam to avoid affecting the Federally listed threatened and endangered species and their Federally designated critical habitat. Those species and their critical habitat are under the protection of the Endangered Species Act of 1973. Those effects are avoided by not allowing an 8-foot or greater drop in Apalachicola River stage over the previous 14-day period based on the USGS gage (#0235800) at Chattahoochee, Florida (i.e., is today's stage is less than 8 feet lower than the stage of any of the past 14 days). This is only applicable when flows are less than 40,000 cfs. During the spawning period releases from Jim Woodruff are less than 40,000 cfs about 75 percent of the time

7-03. Overall Plan for Water Control. One primary purpose of the Jim Woodruff Project is to extend navigation to Bainbridge, Georgia, on the Flint River and to George W. Andrews Lock and Dam on the Chattahoochee River. Another primary purpose is hydropower and thus maintaining an available head that is adequate for the production of hydroelectric power during most of an average year. The reservoir level is normally maintained near elevation 77.0 feet NGVD29 with pondage of one-half foot above and below this elevation being used to reregulate flows into the reservoir from upstream hydroelectric developments that operate as peaking plants. Navigation depths in the Apalachicola River are dependent on continuous flows and the Woodruff power plant, which is a run-of-river plant, operates around the clock every day except when occasional high discharges reduce the head causing the plant to be non-productive. High discharges resulting in the power plant to be non-productive have occurred less than two percent of the time over the lifespan of the project.

7-04. Standing Instructions to Damtender. If a significant communication failure occurs over an extended period, project staff must follow the standing instructions provided in Exhibit C. Standing Instructions to the Project Operator for Water Control describes the operator's responsibilities considered necessary for reservoir regulation. Those duties include reservoir operating procedures, data collecting, and data reporting. The orders serve only as a temporary way of bridging the period between not having orders and, once connection is restored, having the Water Management Section issue new orders. In general, the Jim Woodruff Project operates as a run-of-river project. As such, project operators' general standing instructions are to maintain the pool by passing inflow with equivalent discharge releases.

7-05. Flood Risk Management

a. Regulation during floods. Whenever the reservoir inflow exceeds the discharge capacity of the turbines (about 16,000 to 18,300 cfs for three turbines) the excess will be released through the gated spillway up to its capacity to prevent the pool from rising above elevation 77.8 feet NGVD29 at the dam. Flows in excess of the discharge capacity of the turbines are present about 40 percent of the time over the lifespan of the project. When forecasts indicate expected inflows in excess of 100,000 cfs, the pool will be lowered to elevation 77.0 feet NGVD29 in advance of the flood peak and held at that level until all usable spillway gates are fully open and there is no control over the outflow. The gated spillway can discharge up to 203,600 cfs. Discharges above about 70,000 cfs cause the power plant to be nonproductive because of the high tailwater, so that for higher flows, all outflow is through the spillway. When the inflow exceeds 203,600 cfs all usable gates will be fully opened and there is no control over the outflow. The pool rises as long as the inflow exceeds the discharge capacity of the spillway including the free-overflow section. The gates will remain fully open until the pool drops back to elevation 77.0 feet NGVD29 at which time, they will be operated as necessary to maintain the pool at or below elevation 77.0 feet NGVD29. When the flow recedes to 100,000 cfs, the gates will be gradually closed to maintain the pool within the normal operating range between 76.5 and 77.5 feet NGVD29. Flows in excess of 100,000 cfs have only occurred less than 0.5 percent of the time over the lifespan of the project.

Operation of the lock will be discontinued during flood periods when the headwater exceeds elevation 81 feet NGVD29, which is one foot below the top of the upstream approach walls. The estimated discharge will be 260,000 cfs, which has an expected recurrence interval of once in 175 years.

b. Operating schedule for spillway gates. Because of the soft rock in the river bed that is subject to erosion, the spillway gates will be operated to spread the flow uniformly over the entire spillway length. The gate opening schedule in Plates 2-5 to 2-7 gives the sequence and increments of opening which will accomplish this and also shows the discharges for all gate positions at pool elevations 76.0 through 79.0. Plate 2-8 shows the total spillway discharge for the gated and free-overflow sections for pool levels above elevation 79.0. The gate changes are made using one of two gantry cranes located on the spillway deck. The time required to physically make a spillway gate change can take up to one and one-half 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.

c. Flow over Fixed-Crest Spillway. The designers of the fixed-crest spillway assumed that the difference between the headwater and tailwater would not be more than 2.4 feet and the depth of water downstream from the spillway would be at least 27 feet at the time discharge begins over the fixed-crest section. Because the downstream apron was designed for that condition, flow will not be permitted over the spillway until all usable gates in the gated spillway have been fully opened.

d. Examples of Flood Regulation. The project's effects of water control regulation on flows during flood events are described in Section 8-02, Flood Risk Management.

The Jim Woodruff Project has no specific authorization for flood risk management. Because the project does not have consequential storage for flood waters, it must be operated to pass inflows. However, when inflows into upstream projects have subsided, the Jim Woodruff Project can be used to mitigate some flood damage through the timing of inflows into Lake Seminole. 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. If incidental to project authorities throughout the basin, temporary storage of flood waters can occur in upstream Federal reservoirs to allow the Flint River peak flows to pass through. By temporarily holding back releases, stacking flows from both the Chattahoochee and Flint Rivers can be avoided to some extent, thus allowing for lesser releases downstream. This has the potential to prevent more substantial flood damages from occurring near the Cities of Blountstown and Wewahitchka, Florida. This operation must be coordinated closely with timing of releases from Walter F. George, where most of the Jim Woodruff inflow on the Chattahoochee side originates.

7-06. Recreation. The Corps regulates Lake Seminole to maintain full and stable pools for recreation. The standard operations for Jim Woodruff Dam are probably as near the desired operation as practicable for recreation purposes. In addition, the maintenance of a relatively stable outflow enhances some recreation activities for the Apalachicola River.

7-07. Water Quality. The Jim Woodruff Project provides a continuous minimum flow downstream from the project. This continuous minimum flow during normal conditions, and the release of project inflows during drought conditions, improves downstream water quality.

7-08. Fish and Wildlife

a. Fish Spawning. In addition to providing for minimum flow 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, 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 Lake Seminole (see Table 7-1), the 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 Mobile District 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. Those operations are described in Division Regulation PDS-O-1, *Lake Regulation and Coordination for Fish Management Purpose* of May 2010, and the Mobile District's draft Standard Operating Procedure 1130-2-9, *Lake Reservoir Regulation and Coordination for Fish Management Purposes* of February 2005.

Table 7-1. Principal Fish Spawning Period

Project	**Fish spawn occurs between**
Lake Seminole	1 March –1 May
Apalachicola River	1 April – 1 June

b. 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 passage 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.

c. Endangered Species. The Corps manages releases from Jim Woodruff Dam to support the Federally threatened Gulf sturgeon (*Aciperser oxyrinchus desotoi*), and mussel species (endangered fat threeridge [*Ambloma neislerii*], threatened purple bankclimber [*Elliptoideus sloatianus*], and threatened Chipola slabshell [*Elliptio chipolachsis*]), and areas Federally designated as critical habitat for those species in the Apalachicola River. Those species and their designated critical habitat are under the protection of the Endangered Species Act of 1973. The 14 September 2016 Biological Opinion (BO) determined that these operations would not jeopardize the continued existence of the fat threeridge, purple bankclimber, Chipola slabshell, or Gulf sturgeon; and will not destroy or adversely modify designated critical habitat for any of the species (USFWS 2016). The BO includes an Incidental Take Statement (ITS) for the Gulf sturgeon and listed mussel species. The ITS (Exhibit E) identifies two forms of incidental take for Gulf sturgeon and two forms of take for the mussels and sets limits to these forms of incidental take. Through adaptive management it is expected that the take definitions and limits could change. Therefore, the District Water Managers will work closely with the Planning Division to monitor the levels of take in accordance with the ITS. Daily releases 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). However, there are also conditions under which maintenance of the maximum fall rate schedule is suspended and more conservative drought contingency operations begin (see Drought Contingency Plans, Paragraph 7-12). There are also limitations that do not require a net drawdown of system composite conservation storage unless basin inflow is less than 5,000 cfs.

(1) Minimum Discharge.

(a) Minimum discharges from Jim Woodruff Dam vary according to composite conservation storage, basin inflow per the 7-day moving average and by month. The releases are measured as a daily average flow in cfs at the USGS Chattahoochee, Florida, gage (#02358000). Table 7-2 shows minimum releases from Jim Woodruff Dam and when and how much basin inflow is available for increasing reservoir storage. Releases are dictated according to basin inflow threshold levels that vary by three seasons - spawning season (March to May); non-spawning season (June to November); and winter (December to February) - and incorporates composite conservation storage thresholds that factor into minimum release decisions. 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 7-1. 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. 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. When the composite conservation storage drops further into the Drought Zone, 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 below. During the spawning season, a daily monitoring plan that tracks composite conservation storage and basin inflow will be implemented to determine water management operations.

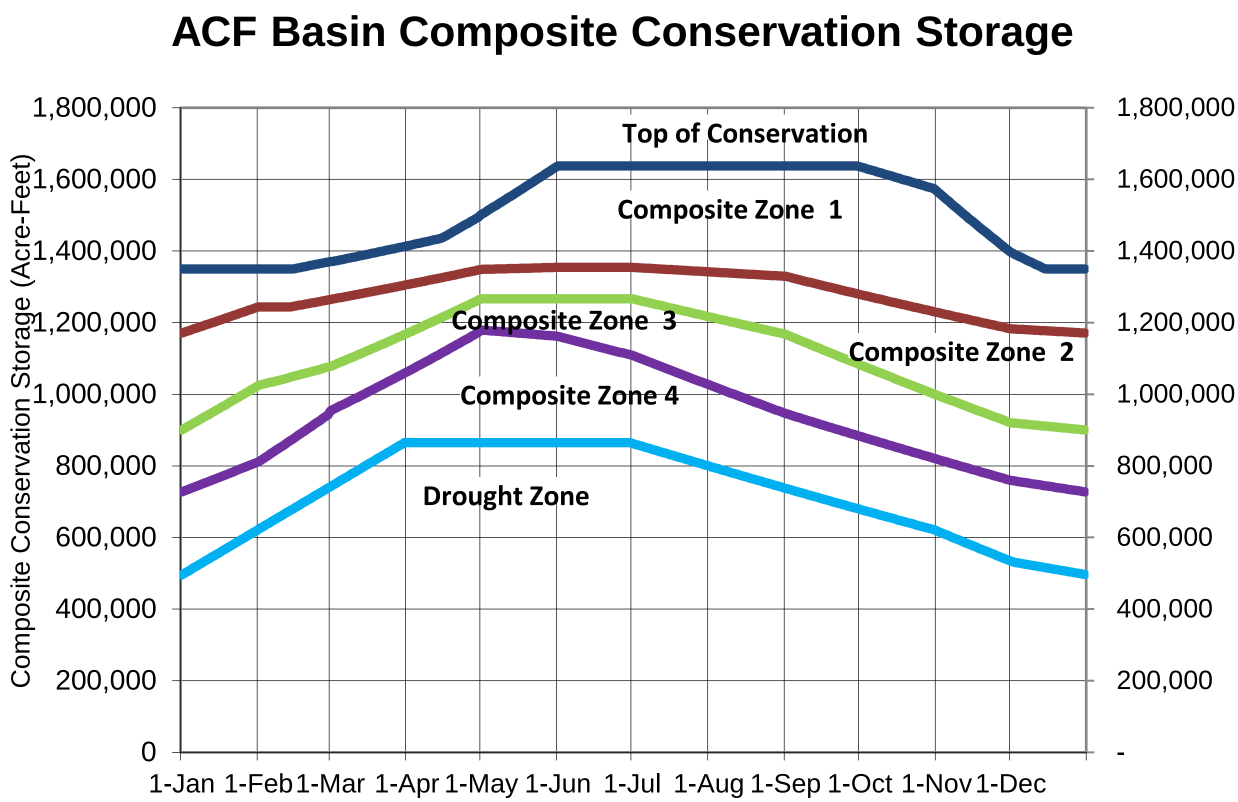


Figure 7-1. ACF Basin Composite Conservation Storage

(b) During the spawning period (March to May), the Corps operates Jim Woodruff Dam to minimize or avoid potential Gulf sturgeon take. Two sets of four basin inflow thresholds and corresponding releases exists according to composite conservation storage in Zones 1 - 3. One set of four basin inflow thresholds and corresponding releases exists when the composite conservation storage is in Zones 1 and 2. When composite conservation storage falls below the bottom of Zone 2 into Zone 3, the drought contingency operations may be triggered based on the monthly declaration schedule (see Figure 7-2). If the drought operations have not yet been initiated and the composite conservation storage is in Zone 3, then a separate set of four basin inflow thresholds and corresponding releases is utilized (Table 7.2). Potential Gulf sturgeon take is also avoided by ensuring that an 8-foot or greater drop in the 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 does not occur.

(c) During the non-spawning season (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 7-3).

(d) 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. When composite conservation storage falls below the bottom of Zone 2 into Zone 3, the drought contingency operations are triggered (see Figure 7-4).

(e) The flow rates included in Table 7-2 prescribe minimum releases for Jim Woodruff Dam. 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 below, or as needed to achieve other project purposes; such as hydroelectric power generation or flood risk management.

Table 7-2. Flow Releases from Jim Woodruff Dam

March - May	Zones 1 and 2	>= 34,000	= 25,000
		>= 16,000 and < 34,000	= 16,000 + 50% BI > 16,000
		>= 5,000 and < 16,000	= BI
		< 5,000	= 5,000
	Zone 3	>= 39,000	= 25,000
		>= 11,000 and < 39,000	= 11,000 + 50% BI > 11,000
		>= 5,000 and < 11,000	= BI
		< 5,000	= 5,000
June - November	Zones 1,2, and 3	>= 22,000	= 16,000
		>= 10,000 and < 22,000	= 10,000 + 50% BI > 10,000
		>= 5,000 and < 10,000	= BI
		< 5,000	= 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 Drought Zone	NA	= 4,500[e]

Footnotes:

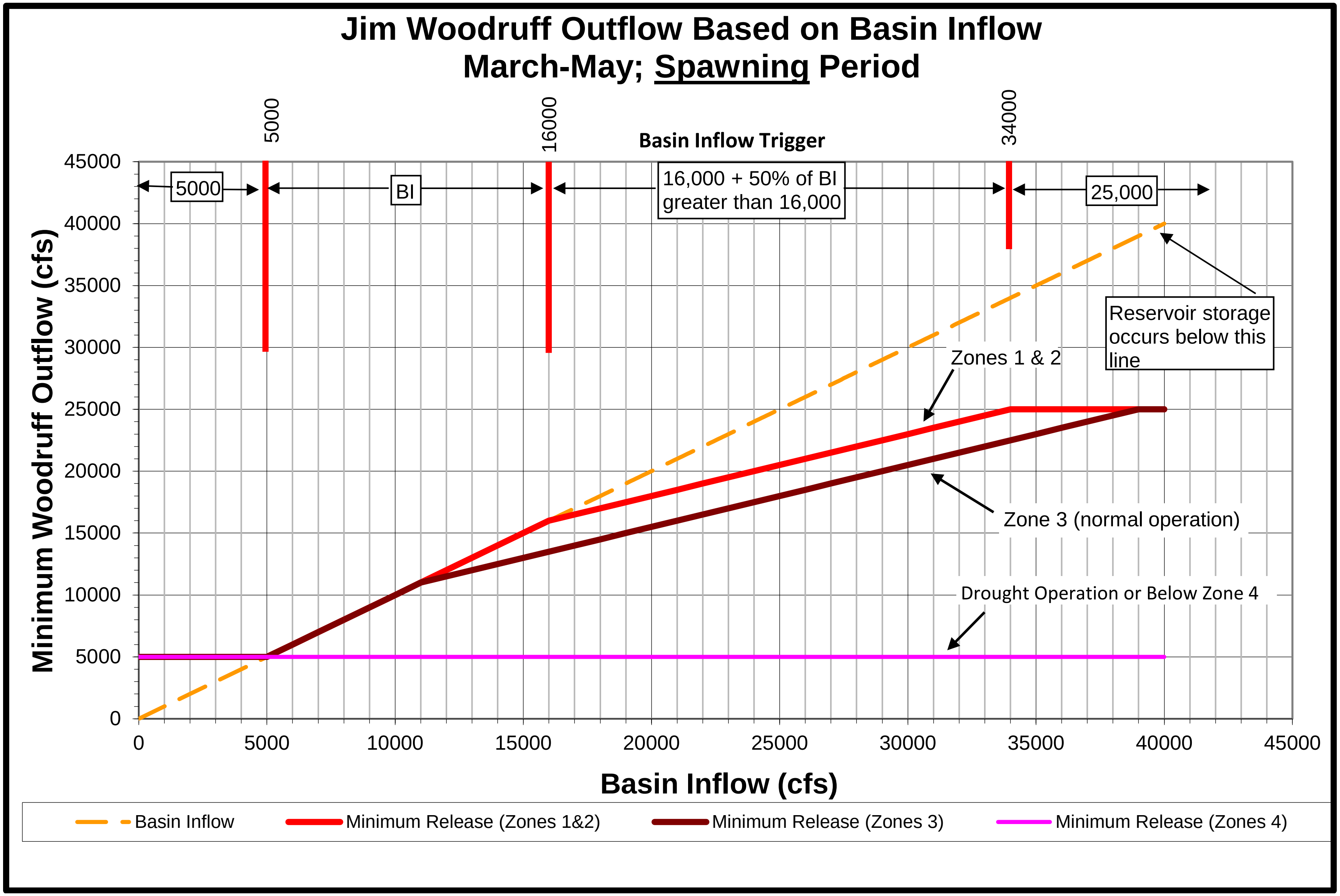
a. Basin inflow for composite conservation storage in Zones 1, 2, and 3 are calculated on the basis of the 7-day moving average basin inflow. Basin inflow for composite conservation storage in Drought Operations, Zones 3 and 4 or lower (Drought Zone) is calculated on the basis of the one-day basin inflow.

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.

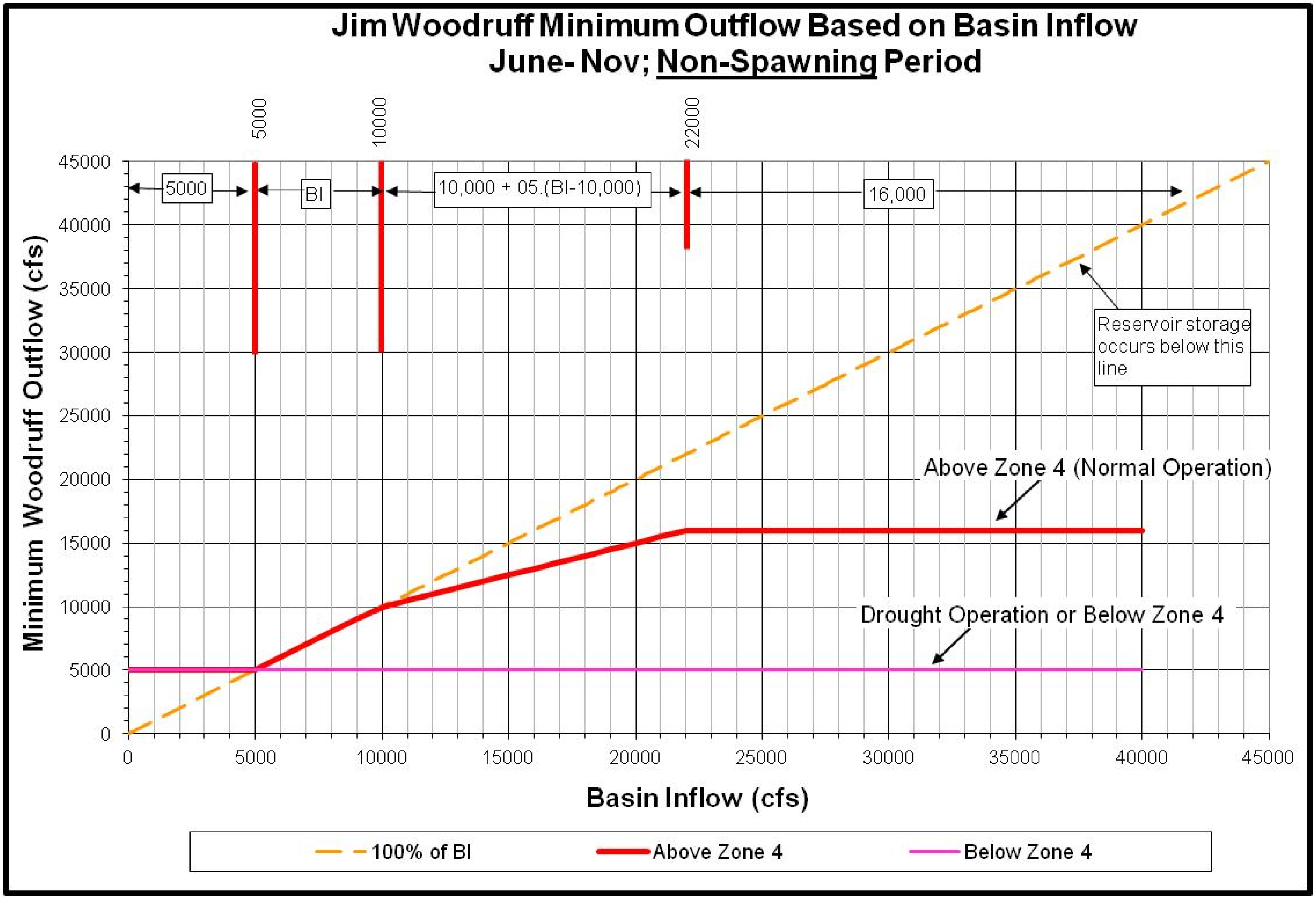
e. Once composite storage falls into the Drought Zone, ramp down to a minimum release of 4,500 cfs at rate of 0.25 ft/day based on the USGS gage at Chattahoochee, Florida (#02358000).



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

Note: The flow target is 4,500 cfs in the Drought Zone

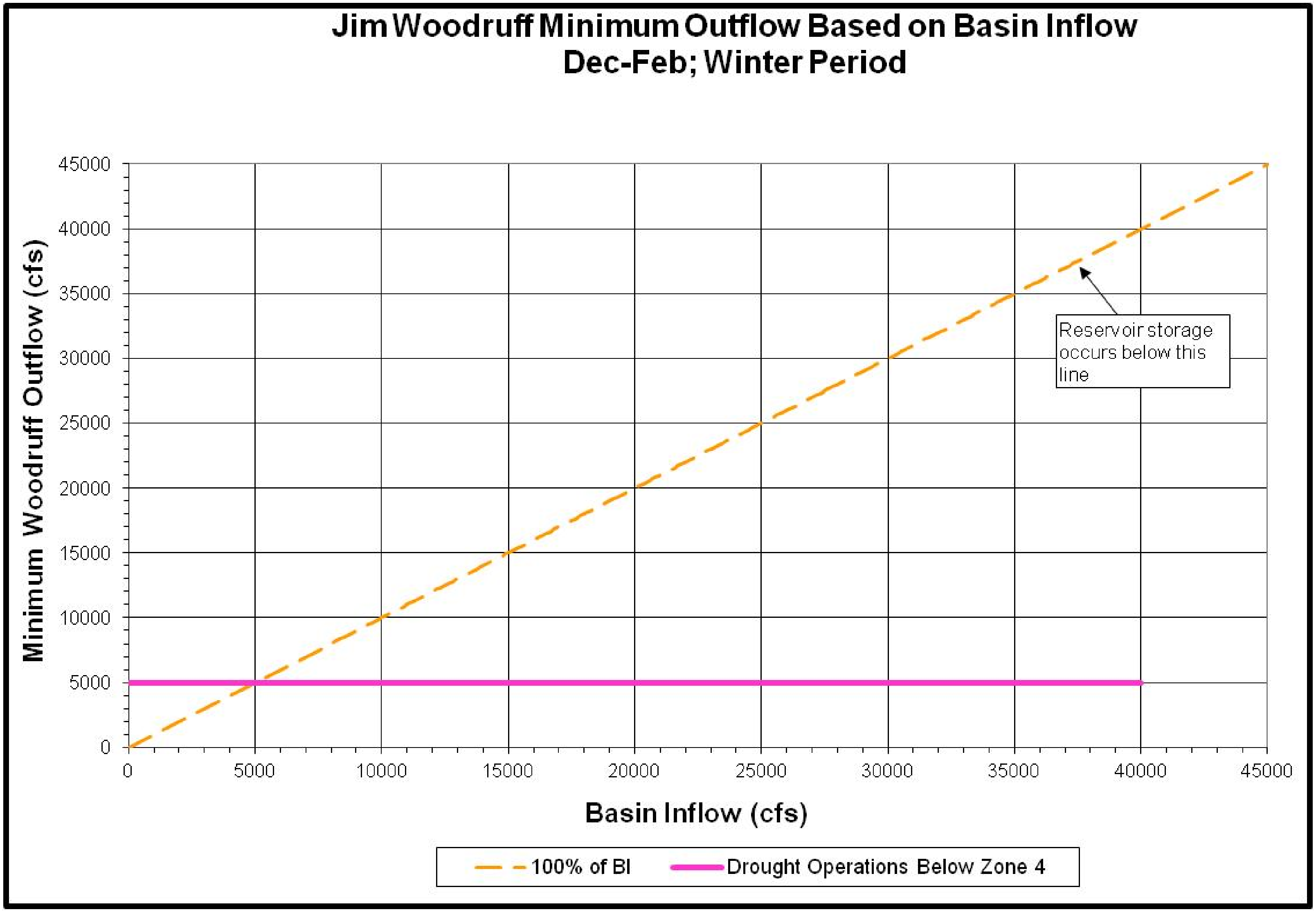
Figure 7-2. Minimum Woodruff Discharge during Spawning Season



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

Note: The flow target is 4,500 cfs in the Drought Zone

Figure 7-3. 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
Note: The flow target is 4,500 cfs in the Drought Zone

Figure 7-4. Minimum Woodruff Discharge during Winter Season

(2) 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. The fall rates are expressed in units of feet per day and are measured at the USGS Apalachicola River gage near Chattahoochee, Florida, as the difference between the daily average river stage of 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 7-3. When composite conservation storage is in Zone 3 and the drought contingency operation described below is implemented, the maximum fall rate schedule is suspended. Unless drought zone operations are triggered, fall rates under the drought contingency operation would be managed to match the fall rate of the 1-day basin inflow.

Table 7-3. 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.

ACF Basin inflow is computed by summing the local flow into the four Federal reservoirs: Lake Sidney Lanier, West Point Lake, Walter F. George Lake, and Lake Seminole. ACF Basin inflow is the amount of water that would flow past Jim Woodruff Lock and Dam during a given period, assuming all Corps reservoirs maintain a constant water surface elevation during that period, and reservoirs release only the net inflow into the project. Basin inflow is not the natural flow in the ACF Basin at the Jim Woodruff Lock and Dam Project site 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. ACF Basin inflow is expressed as a mathematical formula in Paragraph 6-01.

7-09. Water Supply. Two major industrial entities - Farley Nuclear Plant and Georgia Pacific, Cedar Springs - withdraw water from the Chattahoochee River headwaters of Lake Seminole. 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 for M&I (USFWS 2006). Water withdrawals in Georgia are made pursuant to water withdrawal permits issued by the Georgia Department of Natural Resources.

7-10. Hydroelectric Power. The power plant at Jim Woodruff Dam is operated in coordination with SEPA to supply generation to municipalities and electric cooperatives, the recipients of the Jim Woodruff hydroelectric resource. Jim Woodruff Dam is operated as a run-of-river plant where inflows are passed continuously and electricity is generated around the clock because it does not have any appreciable storage. 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 to deliver extra power during hours of peak demand for electricity. While the turbines at Jim Woodruff are rated to release as much as 18,300 cfs, it has been determined through observed operation that often the units are only able to achieve a combined flow of near 16,000 cfs. 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. Peaking operations at the Jim Woodruff Plant can be curtailed as average daily releases approach 6,700 cfs, to maintain instantaneous releases greater than or equal to the 5,000 cfs minimum flow requirement.

Limited pondage will be used in Lake Seminole to provide as steady a release as possible each week. As the flow increases, rising tailwater will result in reduction of head and a corresponding reduction in power output. Occasionally, during extreme floods, the tailwater will be so high that the plant will be out of production. The minimum generating head based on observed operation is in the range of 11 to 13 feet. That head will be equaled or exceeded 99 percent of the time. The rating table for hydropower production is shown in Plates 2-9 to 2-12. The actual monthly and annual hydropower production is shown in Plates 7-2 and 7-3.

The Jim Woodruff Project is equipped with three generating units with a maximum discharge rate of 18,300 cfs. It has been observed that the combined flow of these three units can often only reach 16,000 cfs. A relatively uniform flow will be released to aid downstream conditions. In general, when the daily discharge is 16,000 cfs or more, a uniform release will be maintained. When daily discharges are below the maximum discharge rate of the hydropower units, the units will “peak” to their maximum discharge for one hour during the day and then return to the discharge occurring before the one hour peak.

When inflows are less than turbine capacity, the power plant at Jim Woodruff Dam is operated to control the lake level within the normal operating range (elevation 76.5 and 77.5 feet NGVD29). When inflows are above turbine capacity, spillway releases will supplement the turbines. The power plant operates continuously unless floods reduce the head below the ability to generate.

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 as long as the reservoir level is maintained at or above elevation 76.0 feet-NGVD29. Normal operation for power and other purposes will not cause the pool level to drop below that elevation. However, unforeseen, rare events could result in pool levels below elevation 76.0 feet NGVD29. At such times, the draft of vessels operating in the upper reaches of the reservoir will be restricted.

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 was conducted in 2000 or 2002 because of sustained drought conditions in the basin, and only very limited dredging was conducted in 2001 and then was shut down because of sustained, low-flow conditions. No dredging has been conducted since 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 certification from Florida and recent congressional language that limits funding for dredging operations in the ACF Basin. The lack of dredging and routine maintenance has led to inadequate depths in the Apalachicola River to maintain a 9-foot navigation channel, except under high-flow conditions.

In 2012, in accordance with the Corps Inland Marine Transportation System guidance, Jim Woodruff Lock was classified as Level of Service (LOS) 6. Level of Service 6 requires that the lock be operated for commercial traffic by appointment only. However, maintenance staff mans the lock 10 hours per day, 5 days per week. When supported by ACF Basin hydrologic conditions, the Corps will provide a reliable navigation season. In so doing, the goal of the water management 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 7-5 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 downstream flows and depths must be reduced due to diminishing inflows, navigation bulletins will be issued 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 Dam to reduce releases.

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

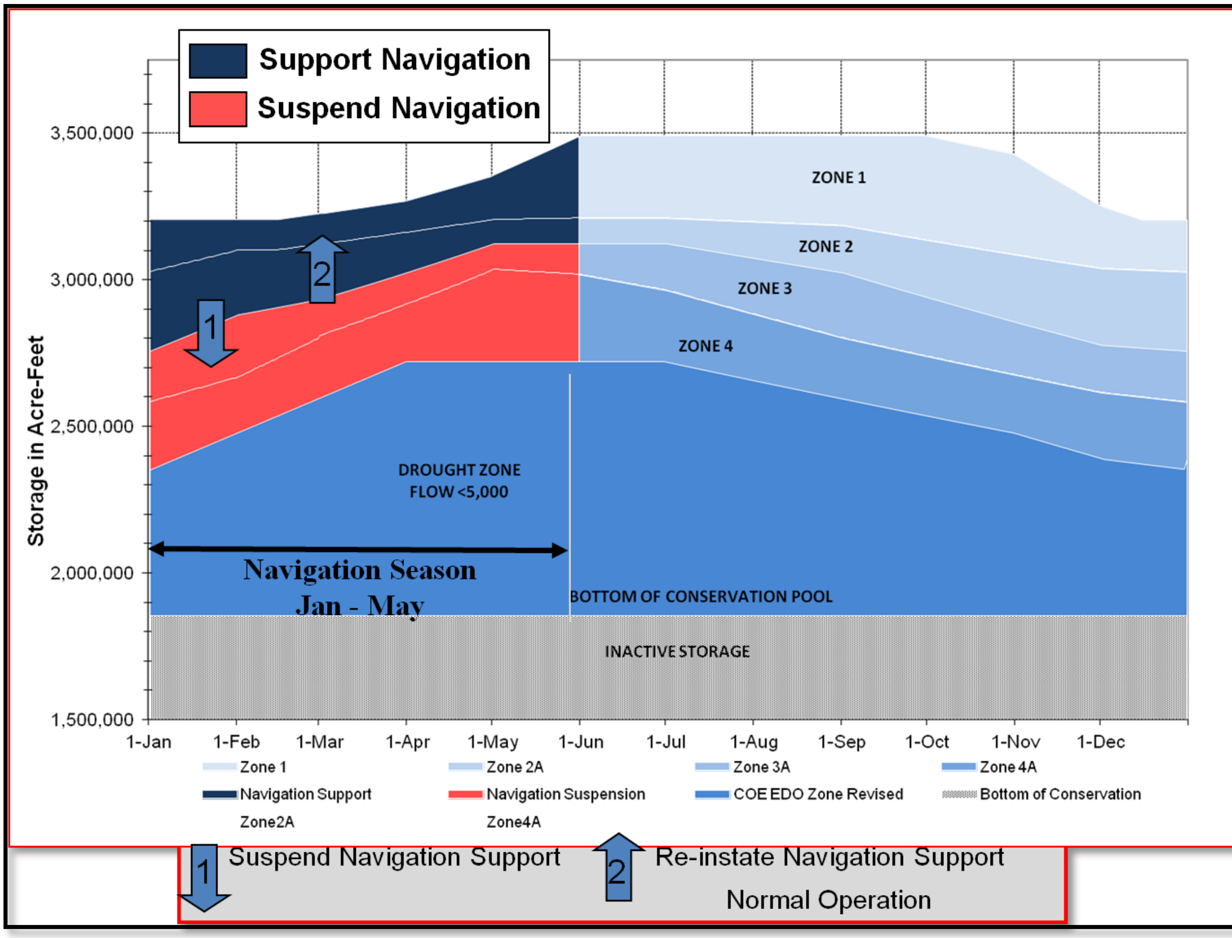


Figure 7-5. Composite Conservation Storage for Navigation

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 D 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 7-6). 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.

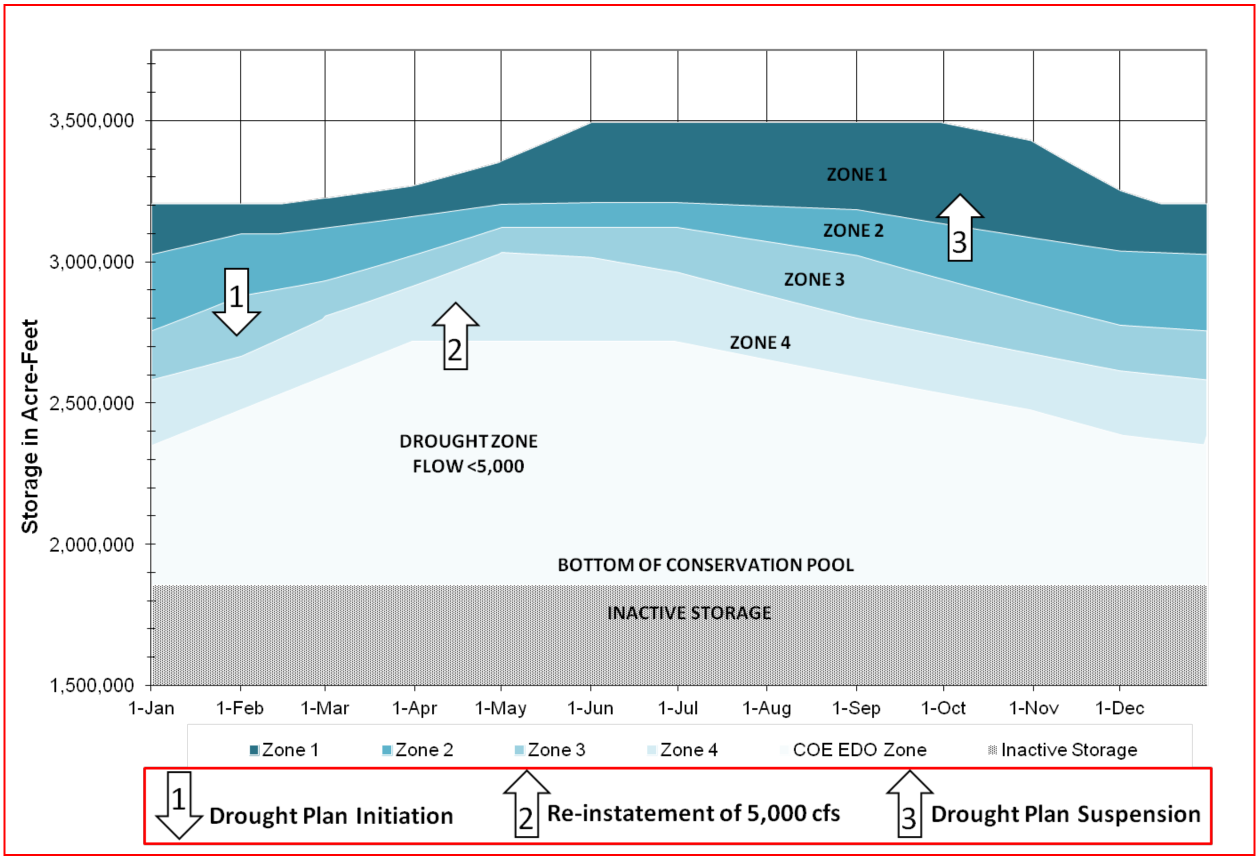


Figure 7-6. Drought Composite Storage Triggers

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 will be implemented that tracks composite conservation storage to determine the water management operations (the first day of each month will represent a decision point) that will be implemented and to determine which operational triggers, if any, should be applied. There is a special provision for the month of March under drought operation. If recovery conditions are achieved in February (after the 1st), drought plan provisions will not be suspended until 1 April, unless the level of composite conservation storage reaches the top of zone 1 (i.e. all Federal reservoirs are full) prior to 1 March. 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 Lock and 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.

During periods of low flow, the maximum level the pool reaches may be controlled by static head limitations discussed in Paragraph 7-04.

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*, 31 March 2014. The Jim Woodruff Project Emergency Action Plan, undated, is a stand-alone document retained on site and in the MDO. Example data available are emergency contact information, flood inundation information, management responsibilities, and procedures for use of the plan.

7-14. Other. Other considerations than just serving the authorized project purposes must be served from the basin as needed. 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 investigation. Several recreational events occur throughout the year, which require coordination with Lake Seminole project staff and the Water Management Section.

Since Lake Seminole was impounded, several nonnative aquatic species have grown to problem levels, particularly hydrilla (*Hydrilla verticillata*). Those plants have caused serious water resource problems such as small boat navigation interference, water quality degradation, fish and wildlife habitat degradation, recreation area use interference (e.g., obstruction of boat ramps), hydropower intake structure blockage, increase shoreline extension into lake because of trapping sediments, increased mosquito production, and a decrease in adjacent property values. Hydrilla has increased from one acre in 1967 to approximately 15,000 acres in recent years. Herbicidal applications, grass carp in confined areas, mechanical removal, and hydrilla flies have all been used as means of control over the years. Herbicidal application, while very costly, has proven to be the most effective technique and is the primary method used. Operation of Lake Seminole to aid in aquatic plant control might be necessary in periods when herbicides are applied to certain areas on the reservoir. The Natural Resources project management personnel will contact Water Management Section to request certain lake level regulation for the optimal application of herbicides. The operation of the reservoir will be limited to that which will not adversely affect other project purposes and operations. The Lake Seminole Hydrilla Action Plan has significant drawdown of the reservoir level as a means to control hydrilla, but such a drawdown was deemed unacceptable because of economic and physical impacts and other uncertainties.

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. Emergencies. 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 MDO 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 SAD 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. 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, streambank erosion has been reduced by capturing peak basin runoff in the reservoirs and metering the flows out more slowly than what would have occurred under natural conditions.

Releases from the Jim Woodruff Project are also limited by the maximum fall rate of the Apalachicola River stage that occurs over a given period of time in order to reduce the impacts on endangered species downstream. These maximum fall rates are described in Paragraph 7-08.c.(2) of this appendix and summarized in Table 7-3. The maximum fall rate schedule is suspended during drought contingency operations.

VIII - EFFECT OF WATER CONTROL PLAN

8-01. General. Jim Woodruff Lock and Dam is a multipurpose project originally authorized originally authorized under the River and Harbors Acts of 1945 and 1946 to be operated in conjunction with the other Federal works of improvement in the ACF Basin for the authorized system purposes. The Jim Woodruff Project is operated to provide benefits for authorized purposes including hydropower, navigation, recreation, water quality, and fish and wildlife conservation. The Corps has consulted with the USFWS regarding effects on threatened and endangered species downstream of Jim Woodruff Dam, and determines minimum releases from Jim Woodruff Dam consistent with a USFWS Biological Opinion.

The impacts of the *ACF Master Water Control Manual* and its Appendices, including this water control plan have been fully evaluated in an Environmental Impact Statement (EIS) that was published on dated 16 December 2016. A Record of Decision (ROD) for the action was signed on March 2017. 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. Jim Woodruff Lock and Dam (Lake Seminole) does not contain reservoir flood risk management storage. During large flood events, regulated releases from the dam reduce the peak flows to some extent; however, the effect on downstream stages is minimal.

a. Spillway Design Flood. Spillway Design Flood (SDF) is the criteria used by the Corps to design the spillway on a dam to prevent overtopping or damage to the spillway due to the occurrence of an extremely rare flood event. The basis of the SDF is the Probable Maximum Precipitation (PMP) centered and oriented in a manner that produces maximum runoff. This flood is also often referred to as the Probable Maximum Flood (PMF). A set of PMP storms were developed in conjunction with the Hydrometerological Section of the National Weather Service to determine the maximum possible rainfall in the basin. Four sets of unit hydrographs were then developed at the mouth of the Flint and Chattahoochee Rivers as well as upstream locations in the basin by analyzing the four largest pre-dam floods. The unit hydrographs were then applied to the PMP rainfall patterns and the largest flood produced by a given combination was chosen as the SDF. The SDF cannot be assigned a frequency of occurrence and was not used in any frequency analysis. The storm had an average storm depth of 14.2 inches on the Chattahoochee River Basin and 13.4 inches on the Flint River Basin for an average storm depth of 13.8 inches over the 17,164 square mile basin above Jim Woodruff Lock and Dam. The duration of the SDF is approximately two weeks with a peak inflow of 781,100 cfs and peak outflow of 690,700 cfs. Lake levels rise about 5 feet per day and peak at 96.73 feet NGVD29. Effects of the reservoir regulation of the SDF are depicted on Plate 8-1 and summarized in Table 8-1. Updated guidance requires the PMP be developed using Hydrometerological Report (HMR) 51 and 52 and that the SDF be routed with an antecedent pool elevation at the top of the flood risk management pool or by routing the Standard Project Flood five days before the SDF. The SDF is currently being reevaluated using this guidance and any changes to the SDF will be incorporated into the water control manual when available.

b. Standard Project Flood. The Standard Project Flood (SPF) is a theoretical flood, based on rainfall criteria, that would be reasonably possible and has been used in hydrologic analyses of reservoirs and river reaches. The SPF cannot be assigned a frequency of occurrence and was not used in any discharge-frequency analysis. The SPF would cause a peak pool elevation of 86.39 feet NGVD29 and a maximum discharge of 377,900 cfs. Peak inflow is 411,900 cfs. Effects of the reservoir regulation of the standard project flood are depicted in Plate 8-2 and summarized in Table 8-1.

Table 8-1. Design Floods

Flood Event	Reservoir Inflow (cfs)	Reservoir Outflow (cfs)	Peak Pool Elevation (ft. NGVD29)
Spillway Design	781,100	690,700	96.73
Standard Project	411,900	377,900	86.39

c. Historic Floods. The historical flood of March 1929 was examined during design of Jim Woodruff Lock and Dam. Effects of the March 1929 flood are shown in Plate 8-3. Peak hourly inflow was 303,400 cfs and the peak hourly outflow was 285,500 cfs. The peak pool elevation was 82.34 feet NGVD29.

Another major flood was the flood of July 1994. This flood was a result of Tropical Storm Alberto. The tropical storm became nearly stationary for several days over Georgia and parts of Alabama dumping over 20 inches of rain over large areas of the Flint River and over 15 inches of rain over the middle Chattahoochee River area. The pool elevation of Lake Seminole reached 78.05 feet NGVD29 with a peak hourly inflow of 249,889 cfs and a peak hourly outflow of 225,350 cfs. This flood was one of the largest regulated floods for the Walter F. George Project and one of the largest inflow events for Jim Woodruff Dam. Effects of reservoir regulation on the flood of July 1994 flood are depicted on Plate 8-4.

In March 1998 another major flood occurred. This was the result of a strong storm that dumped water over most of the ACF River Basin. This event produced the 2nd highest pool elevation on record of 78.37 feet NGVD29 at Lake Seminole with a peak hourly inflow of 246,394 cfs and a peak hourly discharge of 229,450 cfs. Effects of reservoir regulation on the flood of March 1998 flood are depicted on Plate 8-5.

8-03. Recreation. The operation of Lake Seminole within its normal operating levels provides the optimum conditions for water-based recreational activities. The project contains 37,500 acres of water and 52,816 acres of land. Public use facilities have been developed at Lake Seminole's 37 parks, 5 marinas, and 8 campgrounds (OMBIL 2016) for a variety of activities including camping, picnicking, boating, fishing, water skiing, swimming, and sightseeing. Hunting is also allowed in certain designated areas on project lands. Mobile District park rangers and other project personnel conduct numerous environmental education tours and presentations, as well as water safety instructional sessions each year for the benefit of area students and project visitors. Lake Seminole had a total of more than 2.4 million recreational visitors in 2012, and the effect on the local and regional economies is significant. Annual visitor spending, which occurs within 30 miles of the project, is estimated at $116.87 million.

8-04. Water Quality. All the ACF Basin projects, including Jim Woodruff Lock and Dam, are operated to meet the objective of benefitting water quality. At Jim Woodruff Lock and Dam, which operates as a run-of-river project, inflows to the project are continuously released downstream. Those continuous releases provide a benefit for downstream water quality in the Apalachicola River. Lake Seminole is supporting its designated recreation usage according to Georgia's 2014 draft integrated 305(b)/303(d) list of impaired waters, except for a small, 5-acre area east of the confluence with Fish Pond Drain, which is pH impaired.

8-05. Fish and Wildlife. The water control plan improves the ability of the Corps to maintain steady reservoir levels during the spring fish spawning period, provides for a gradual ramp down of river levels to prevent stranding species, and prevents effects on Federally listed threatened and endangered species and their Federally designated critical habitat by ensuring adequate flows in the river.

a. Fish Spawning. The Corps operates the ACF System to provide favorable conditions for annual fish spawning, both in the reservoirs and in the Apalachicola River. Operations for fish spawning help to increase the population of fish in the basin. During the fish spawning period, the goal of the Corps is to operate for a generally stable or rising lake level and a stable or gradually declining river stage on the Apalachicola River for approximately 4 to 6 weeks during the designated spawning period (1 March to 1 May for Lake Seminole and 1 April to 1 June for the Apalachicola River). 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.

b. Fish Passage. From March through May, the Corps operates the lock at Jim Woodruff Dam, if conditions and other factors allow 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 hatched. The fish passage operations provide the benefit of allowing the fish to migrate upstream for spawning. Recent fish passage operations have contributed to approximately a fourfold increase in the estimated Alabama shad population in the Apalachicola River according to the 2012 GDNR Annual Report entitled "*Spawning Population Size, Upstream Passage, and Behavior of Alabama Shad at/above Jim Woodruff Lock and Dam, Apalachicola River, Florida"*.

c. Threatened and Endangered Species. The ACF system of reservoirs, including Lake Seminole, is operated such that sufficient quantities of water are available to support compliance with the Endangered Species Act of 1973 by preventing effects on Federally listed threatened and endangered species and their Federally designated critical habitat in the ACF Basin. Water releases from the Jim Woodruff Dam directly 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 these 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. 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 the months of 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. Gulf sturgeon may also be impacted by hydropower peaking production during the spring spawning season (March-May) and by reductions in Apalachicola River floodplain inundation during most of the year. The USFWS 14 September 2016 ITS (Exhibit E) identifies two forms of incidental take for Gulf sturgeon and sets limits to these forms of incidental take. Through adaptive management, it is expected that the take definitions and limits could change. Therefore, the District water managers will work closely with the Planning Division to monitor the levels of take in accordance with the ITS.

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 that ACF Basin water management operations result in more years with flows less than 6,000 - 10,000 cfs than has 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. The USFWS 14 September 2016 ITS (Exhibit E) identifies two forms of incidental take for the listed mussels and sets limits to these forms of incidental take. Through adaptive management, it is expected that the take definitions and limits could change. Therefore, the District water managers will work closely with the Planning Division to monitor the levels of take in accordance with the ITS.

8-06. Water Supply. M&I water supply withdrawals occur from the Chattahoochee River headwaters of Lake Seminole. No water releases are made from the project specifically for downstream M&I water supply purposes. Water released from Jim Woodruff Lock and Dam for other authorized project purposes, particularly during dry periods, help to ensure a reasonably stable and reliable flow in the Apalachicola River to the benefit of downstream M&I water supply users. Critical elevations for water supply intakes that could be affected by the Jim Woodruff water control regulation include Farley Nuclear Plant upstream, which requires a minimum pool elevation of 74.5 feet NGVD29 and Georgia Pacific, which is also located upstream and requires a minimum pool elevation of 75.0 feet NGVD29. Plant Scholz, located downstream of Jim Woodruff Dam on the Apalachicola River has closed. It required a minimum discharge of 5,000 cfs From Jim Woodruff Dam but could temporarily operate at a water elevation of 37.5 feet NGVD29 (approximately 4,200 cfs).

8-07. Hydroelectric Power. The Jim Woodruff Dam hydropower project, along with 22 other hydropower dams in the southeastern United States, composes the SEPA service area. SEPA sells hydroelectric power generated by Corps plants 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.

Jim Woodruff Lock and Dam operates as a run-of-river project in that inflows to the project are continuously released downstream. Those releases are made through the turbines; therefore, hydropower is produced continuously at Jim Woodruff Dam. Generally, the weekend releases are lower than those during the weekdays because of the absence of peaking power operations at the upstream Walter F. George powerhouse on weekend days. When practicable, the powerhouse at Jim Woodruff Dam will increase outflow for a short duration during the day to provide a higher peak generation. The Jim Woodruff Project generated an annual average of 209,445 megawatt hours (MWH) between 1957 through 2015, with a minimum of 81,276 MWH (year 2000) and a maximum of 267,121 MWH (year 1967), dependent upon water availability.

8-08. Navigation. The Jim Woodruff Lock and Dam Project supports the authorized navigation purpose of the ACF System by providing a 9.0-foot navigation depth to the Walter F. George Project upstream and by water releases from the dam to support navigation depths downstream of the project. Navigation depths in the Lake Seminole usually result from maintaining the reservoir elevation at or above minimum operating level of 76.0 feet NGVD29.

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 was largely through the use of within-bank disposal areas subject to Federal navigation servitude, which required no easements from local sponsors. Because of sustained drought conditions, dredging was not conducted in 2000, only limited dredging was completed in 2001, and 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 in 2006 and later. No reported commercial navigation use occurs on the ACF waterway below Jim Woodruff Lock and Dam since the waterway users have negotiated contractual agreements for truck or rail transportation.

Table 8-2 contains calendar years 2005 - 2013 lock usage information from the Corps' Lock Performance Monitoring System regarding navigation activity through Jim Woodruff Lock and Dam. The system contains the numbers of lockages for commercial and non-commercial vessels and tonnages of various commodities passing through the lock.

Table 8-2. Navigation Activity at Jim Woodruff Lock and Dam

Lockages/vessels (number)	**CY2013**	**CY2012**	**CY2011**	**CY2010**	**CY2009**	**CY2008**	**CY2007**	**CY2006**	**CY2005**
Barges Empty						1	1		
Barges Loaded							1		1
Commercial Lockages						2	2	2	3
Commercial Vessels				2	2	2	2	2	6
Non-Commercial Lockages	3	2	4	11	9	6	4	4	11
Non-Commercial Vessels	3	2	4	11	9	6	4	4	11
Recreational Lockages	52	114	109	185	179	138	184	250	214
Recreational Vessels	130	262	197	392	353	171	313	430	426
Total Lockages	55	116	113	196	188	146	190	256	228
Total Vessels	133	264	201	405	364	179	319	436	443
Commodities (tons)									
Crude Material Except Fuels									
Equipment and Machinery							480		110
Total, All Commodities							480		110

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 five 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.

8-09. Drought Contingency Plans. The importance of drought contingency 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. Several drought periods have occurred since construction of Jim Woodruff Dam in 1957. The duration of low flows can be seasonal or they can last for several years. Some of the more extreme droughts occurred in the early and mid 1980s, and most of the time period between late1998 to mid-2009. There were periods of high flows during these droughts but the lower than normal rainfall trend continued.

The purpose of drought planning is to minimize the effect of drought, to develop methods for identifying drought conditions, and to develop both long- and short-term measures to be used to respond to and mitigate the effects of drought conditions. During droughts, reservoir regulation techniques are planned to preserve and ensure the more critical needs. Minimum instream flows protect the area below Jim Woodruff Dam and conservation efforts strengthen the ability to supply water supply needs.

For the Jim Woodruff Project, the Corps will coordinate water management during a drought with other Federal and state agencies, private power companies, navigation interests, and other interested stakeholders as necessary. Drought operations will be in compliance with the plan for the entire ACF Basin.

8-10. Flood Emergency Action Plans. Normally, all flood risk management operations are directed by the MDO. If, however, a storm of flood-producing magnitude occurs and all communications are disrupted between the district office and project personnel at the Jim Woodruff powerhouse, emergency operating procedures, as described in Exhibit C, Standing Instructions to Damtenders for Water Control, will begin. If communication is broken after some instructions have been received from the district office, those instructions will be followed for as long as they are applicable.

Flood emergency operations at Jim Woodruff Dam are the responsibility of the Jim Woodruff Power Plant Manager and powerhouse operators. It is their responsibility to follow the Emergency Action Plan for the Jim Woodruff Project. 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 effects 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.

The Jim Woodruff Project is not a flood risk management project, however actions occur that are related to flood risk management. Because flooding of the Lower Pool Park adjacent to the tailrace occurs regularly during high-flow periods, notification is given to the Resource Management staff at Lake Seminole when flows are anticipated to be greater than the 50,000 to 55,000 cfs range so that access to the park can be closed for public safety.

8-11. Frequencies. The ACF Basin Water Control Plan described in the *ACF Master Water Control Manual* influences the duration of flows at Jim Woodruff Dam. As a run-of-river project, the inflows are released downstream with some weekly variation.

a. Peak Inflow Probability. The frequency curve for inflows into Lake Seminole, based on peak annual calculated project inflows from 1958 -2013, is shown on Figure 8-1.

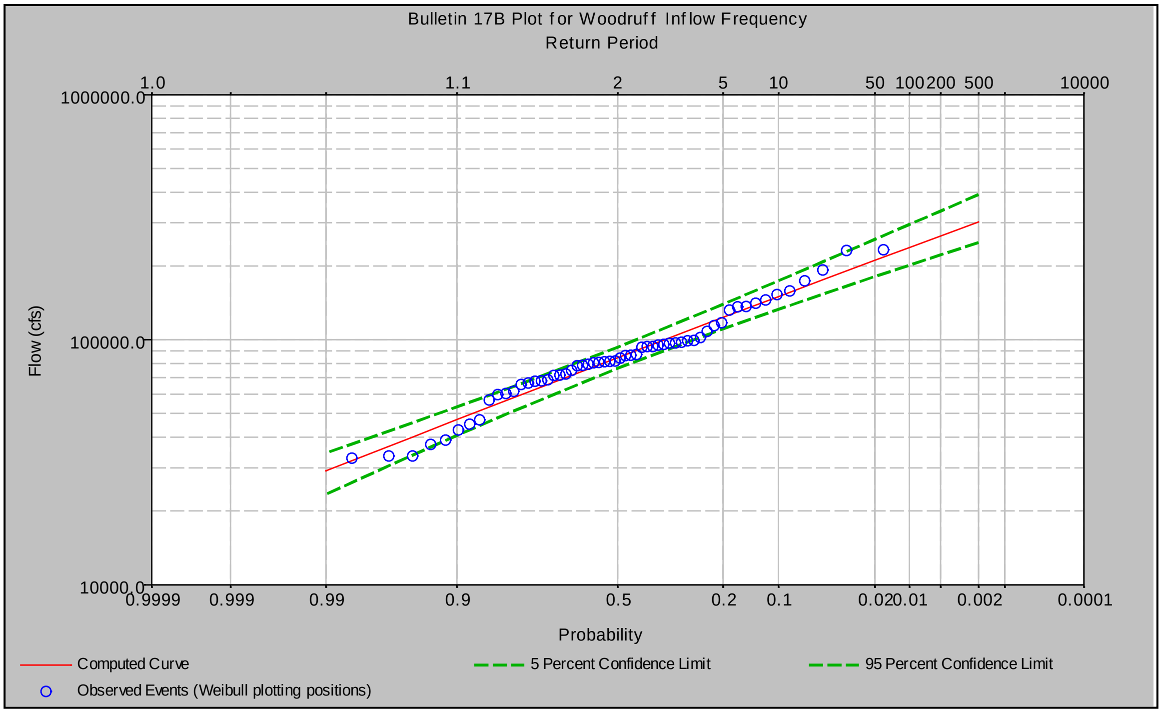


Figure 8-1. Inflow Frequency Curve at Lake Seminole

b. <u>Pool Elevation Duration and Frequency</u>. The Water Control Plan for the ACF Basin influences the lake levels at Lake Seminole. Lake Seminole is considered a run-of-river project; however, it can fluctuate up to 2.8 feet in some circumstances. In very rare instances, it has been drawn down well below its absolute minimum of 76.0 feet NGVD 29. Figure 8-2 shows the annual pool elevation duration curves for modeled and observed data from 1958 – 2011. Three curves are presented: the observed data from the project, as well as model results from the previous water control plan and the updated water control plan presented in this manual.

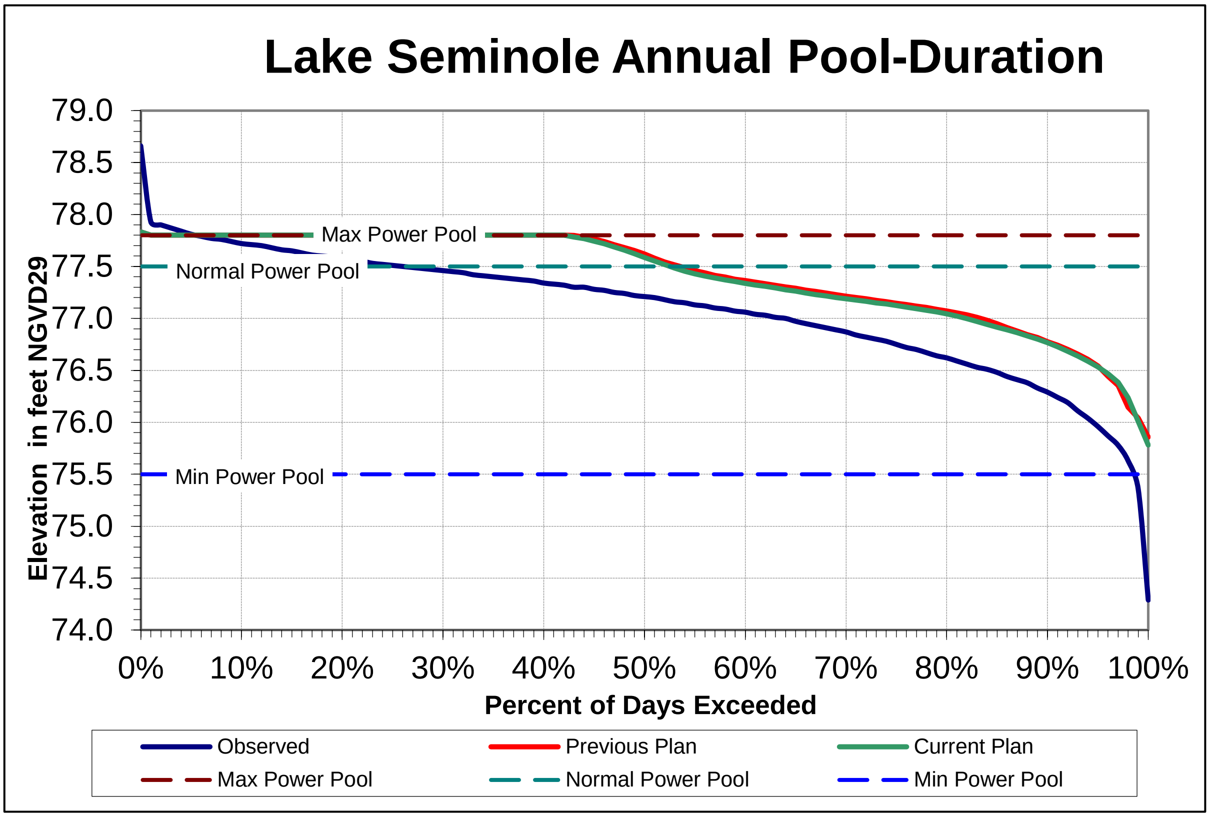


Figure 8-2. Annual Elevation Duration Curves at Lake Seminole for Observed and Modeled Data (1958 – 2011)

c. Chattahoochee Gage Flow-Duration and Frequency. Below Jim Woodruff Lock and Dam, the ACF System is completely unregulated. Therefore, looking at the Chattahoochee gage (USGS #02358000) below the dam on the Apalachicola River can give a good indication of the cumulative effect of regulation on the ACF System. Figure 8-3 shows a comparison of the duration of flows for observed gage readings, the previous water control plan, and the current water control plan outlined in this manual. It shows there is little annual effect between the two plans and what has observed to occur. Figures 8-4 and 8-5 depict a wet month and a dry month respectively. This shows there is little deviation in durations on monthly bases except in the very low end of the flow regime. The regulated and unregulated flow frequency curves for the Chattahoochee gage is shown on Plate 8-6.

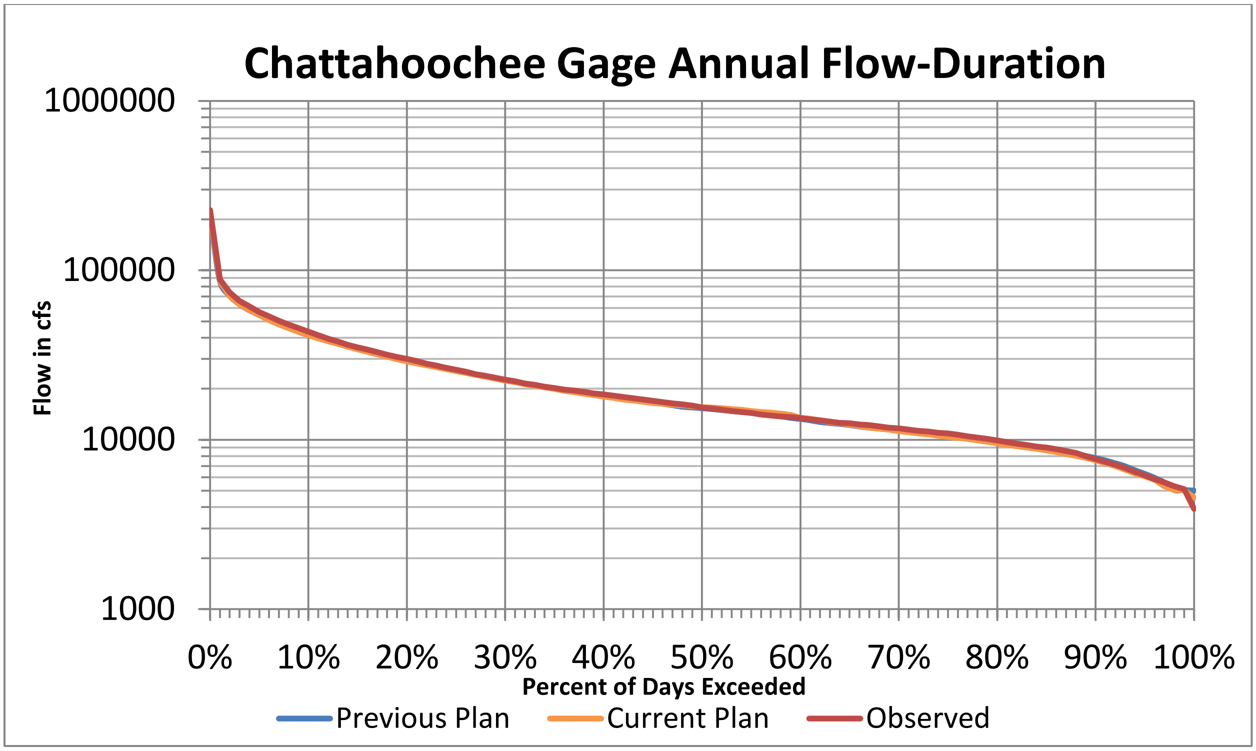


Figure 8-3. Annual Flow Duration Curves at Chattahoochee Gage (USGS #02358000) for Observed and Modeled Data (1939 – 2011)

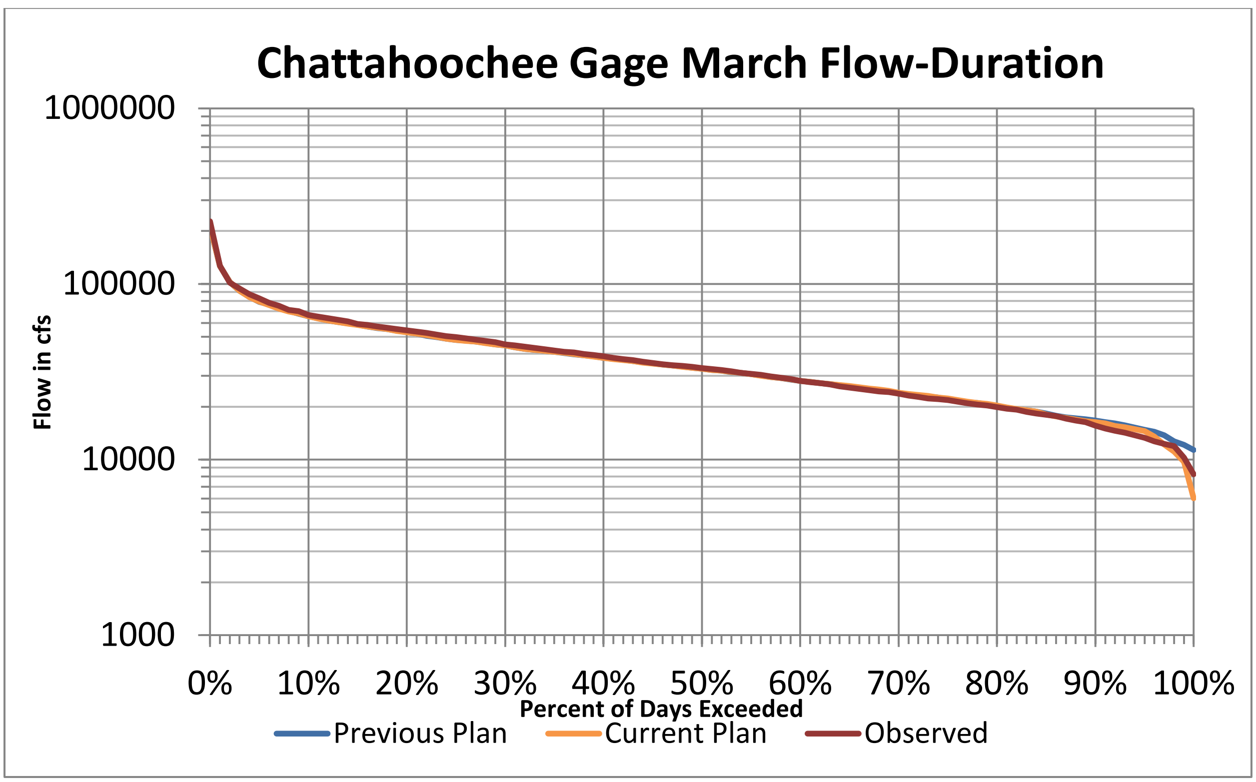


Figure 8-4. March Flow Duration Curves at Chattahoochee Gage (USGS #02358000) for Observed and Modeled Data (1939 – 2011)

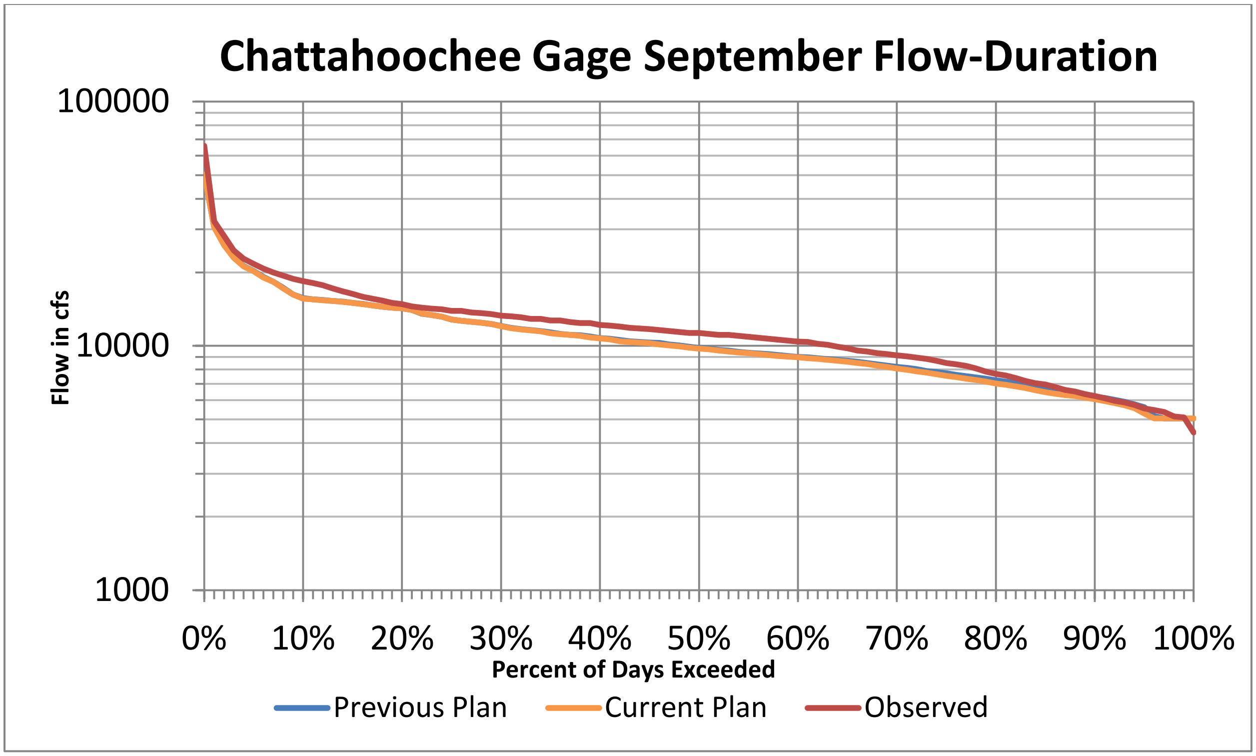


Figure 8-5. September Flow-Duration at Chattahoochee (USGS #02358000) Gage for Observed and Modeled Data (1939 – 2011)

8-12. Other Studies - Examples of Regulation. The run-of-river type of operation at the Jim Woodruff Project has minor regulation effects downstream. However, the system of reservoirs in the basin does have an effect on flows. The combined effects of Buford Dam, West Point Dam, and Walter F. George Lock and Dam can be seen in the Blountstown hydrographs shown in Plates 4-10 through 4-20 for 1939 through 2015. In those hydrographs, the observed flows are compared with the unimpaired flows. (Unimpaired flows are what would have existed without effects of human activities). An analysis of those hydrographs reveals that there was little impact from 1939 until the 1960s. After then, increased population, altered land uses, and reservoir development began to cause changes in the flow regime at Blountstown.

IX - WATER CONTROL MANAGEMENT

9-01. Responsibilities and Organization. Responsibilities for developing and monitoring water resources and the environment at the Jim Woodruff Project are shared by many Federal and state agencies including the Corps, U.S. Environmental Protection Agency, National Parks Service, U.S. Coast Guard, USGS, U.S. Department of Energy, U.S. Department of Agriculture, USFWS, and NOAA. Interested state agencies include GAEPD, Georgia Wildlife Resources Division, Alabama Department of Environmental Management (ADEM), Alabama Office of Water Resources (OWR), Northwest Florida Water Management District, Florida Department of Environmental Protection, and Florida Fish and Wildlife Conservation Commission.

a. U.S. Army Corps of Engineers. Authority for water control regulation of the Jim Woodruff Project has been delegated to the SAD Commander. The responsibility for day-to-day water control regulation activities has been entrusted to the Mobile District. The Jim Woodruff Project is regulated in coordination with other Corps projects in the ACF Basin to meet its authorized purposes. It is Mobile District's responsibility to develop water control regulation procedures for the Jim Woodruff Project. The Water Management Section monitors the project for compliance with the approved water control plan. In accordance with the water control plan, the Water Management Section 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 Water Management Section instructs the project operator regarding normal water control regulation procedures, as well as abnormal or emergency situations, such as floods. The project is tended by operators under direct supervision of the Power Project Manager and the Woodruff/Seminole Site Manager. The Water Management Section communicates directly with the powerhouse operators at the Jim Woodruff powerhouse 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 a multidisciplinary 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 Alabama, Florida, and Georgia publish real-time reservoir levels, river and tributary stages, and flow data through the USGS National Weather Information Service Web site. The Water Management Section 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 almost 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.

4) U.S. Fish and Wildlife Service (USFWS). The USFWS is an agency of 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 Federally designated critical habitat in accordance with the Endangered Species Act of 1973. The USFWS also coordinates with other Federal agencies under the auspices of the Fish & Wildlife Coordination Act of 1958. The Corps, Mobile District, with support from the Water Management Section, coordinates water control actions and management with USFWS in accordance with both laws.

c. <u>State Agencies</u>

1) Alabama. 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 Environmental Management 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 Soils 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, to protect public health and natural systems, and to 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. <u>Stakeholders</u>. 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 these interest groups, state and Federal agencies, and others is accomplished as required on an ad-hoc basis and on regularly scheduled water management teleconferences that occur during unusual flood or drought conditions to share information regarding water control regulation actions and gather stakeholder feedback. The Master Manual (Table 9-1) provides a list of state and Federal agencies and active stakeholders in the ACF Basin that have participated in the ACF Basin water management teleconferences and meetings.

9-02. Interagency Coordination

Local Press and Corps Bulletins. The local press includes any periodic publications in or near the Jim Woodruff Watershed and the ACF Basin. Tallahassee, Florida, and Bainbridge, Georgia have some of the larger daily newspapers in the vicinity of the project that often publish articles related to the project and associated rivers and streams. Their representatives have direct contact with the Corps through the Public Affairs Office. The Corps and the Mobile District publish 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. Special interest groups often request modifications of the basin water control plan or project specific water control plan. The Jim Woodruff Project and other ACF Basin projects were constructed to meet specific, authorized purposes, and major changes in the water control plans would require modifying, either the project itself or the purposes for which the projects were built. However, continued increases in the use of water resources demand constant monitoring and evaluation of reservoir regulations and systems to ensure their most efficient use. Within the constraints of congressional authorizations and engineer regulations, the water control plan and operating techniques are often reviewed to see if improvements are possible without violating authorized project functions. When deemed appropriate, temporary variances to the water control plan approved by SAD can be implemented to provide the most efficient regulation while balancing the multiple purposes of the ACF Basin-wide System.

9-04. Reports. There are various monthly charts, short-term hydrologic reports, emergency regulation reports, graphical and tabular summaries, flood situation reports and other quarterly, seasonal, or annual reports that are developed and used in the management of the water resources in the ACF Basin. Many of these reports are available on the Mobile District's water management website at http://water.sam.usace.army.mil/. Examples of reports and data used by water management personnel are shown in Table 9-1 below:

Table 9-1. Reports and Data Used in Water Management

Today's Project Data	Lake Elevation and Five Week Forecast
Hourly Stage, Chattahoochee and Flint Rivers	Average Daily Inflow to Lakes by Month
ACF Basin 7-Day Average Inflow	ACF Basin Conservation Storage Chart
Historic Project Data	Record Levels for Rivers and Lakes
Mobile District River Bulletin	Hydropower Generation Schedule
After Action Flood Reports	District River System Status
Annual Flood Damage Reduction Report	

EXHIBIT A

SUPPLEMENTARY PERTINENT DATA

EXHIBIT A
SUPPLEMENTARY PERTINENT DATA

GENERAL

Dam site, river miles above mouth of Apalachicola River	106.3
Drainage area George W. Andrews Lock and Dam to Jim Woodruff, square miles	8,954
Total drainage area above Jim Woodruff Lock and Dam, square miles	17,164

STREAM FLOW

Drainage area at dam site – square miles	17,164
Period of continuous record (Chattahoochee gage)	1923-2015
Average annual flow for period of record – cfs	21,489
Minimum monthly flow for period of record – cfs (Aug 1988)	4,750
Maximum monthly flow at damsite (Mar 1929) – cfs	171,632
Discharge at bankfull – cfs	77,000
Maximum design flood of record (March-April 1929)	
Natural peak inflow – cfs	303,400
Regulated peak outflow – cfs	285,500
Regulated peak headwater – feet NGVD29	82.34
Peak tailwater elevation – feet NGVD29	80.40
Spillway design flood	
Peak inflow to full reservoir – cfs	781,100
Regulated peak outflow – cfs	690,700
Regulated peak headwater – feet NGVD29	96.73
Peak tailwater elevation – feet NGVD29	96.10
Total rainfall (Spillway design flood) – inches	
Chattahoochee basin	14.2
Flint basin	13.4
Entire basin above dam	13.8
Standard project flood	
Peak inflow to full reservoir – cfs	781,100
Regulated peak outflow – cfs	690,700
Regulated peak headwater – feet NGVD29	86.39
Peak Tailwater elevation – feet NGVD29	84.95

SUPPLEMENTARY PERTINENT DATA (Cont'd)

GENERAL HYDRAULIC DATA

Conditions	Total discharge cfs	Tailwater elev. Feet NGVD29	Head water elev. Feet NGVD29	Swell-head ft	Average interval between occurrences, years
Pool begins to rise above normal due to flood inflows	203,600	75.3	77.0	1.70	25
Flow begins over fixed-crest spill-way	228,000	77.1	79.0	1.90	47
Flow begins over lock	278,000	80.0	82.0	2.00	Over 100
Maximum flood of record	285,500	80.40	82.34	1.96	Over 100
Flow begins over dike	345,000	83.3	85.0	1.70	Over 100
Flow begins over saddle, right bank	519,000	90.1	91.0	0.90	Over 1,000
Spillway-design flood	690,700	96.73	96.10	0.63	Over 1,000

RESERVOIR

Minimum operating pool elevation, feet NGVD29	76.5
Normal operating pool elevation, feet NGVD29	77.0
Maximum operating pool elevation, feet NGVD29	77.5
Emergency drawdown elevation, feet NGVD29	76.0
Absolute maximum pool elevation, feet NGVD29 (non-flood conditions)	77.8
Area at pool elevation 77.0 feet NGVD29– acres	37,500
Area acquired in fee simple – acres	60,072
Area acquired by easement with right to inundate – acres	6,516
Area in river bed – acres	4,000
Total area within taking line – acres	70,588
Total reservoir volume at elevation 77.0 feet NGVD29 – acre-feet	367,318
Shoreline miles at elevation 77.0 feet NGVD29 – miles	532
Reservoir length at elevation 77.0 feet NGVD29– river miles	
Chattahoochee River to George W. Andrews L&D	46.8
Flint River	47.0

LOCK

Nominal size of chamber – feet	82 x 450
Distance center to center of gate pintles – feet	505
Maximum lift – feet	33
Elevation of upper miter sill – feet NGVD29	54.0
Elevation of lower miter sill – feet NGVD29	30.0
Elevation of top of lock walls – feet NGVD29	82.0
Elevation of top of guide walls – feet NGVD29	82.0

SUPPLEMENTARY PERTINENT DATA (Cont'd)

LOCK (Cont'd)

Elevation of top of guard walls – feet NGVD29	82.0
Freeboard on upper guide and guard walls when lock becomes inoperative – feet	82.0
Freeboard on lower guide and guard walls when lock becomes inoperative – feet	2.8
Percent of time lock is inoperative	75
Height of upper gate	28' 4"
Height of lower gate	52' 4"
Size of culvert at valves – feet	10 x 10
Depth of submergence of valves by lower pool – feet	7.0
Type of emergency dams	Stop-log
Type of operating machinery	Hydraulic
Swellhead when lock is over topped – feet	2.0

LOCK OPERATING CHARACTERISTICS – FILLING

1.5-minute valve-opening time	
Total time required to fill lock chamber, starting with valves closed – minutes	6.31
Maximum rate of rise – fpm	10.25
Maximum flow into chamber – cfs	7,010
Filling coefficient	0.88
6-minute valve-opening time	
Total time required to fill lock chamber, starting with valves closed – minutes	8.58
Maximum rate of rise – fpm	6.23
Maximum flow into chamber – cfs	4,260
Filling coefficient	0.88

LOCK OPERATING CHARACTERISTICS – EMPTYING

1.5-minute valve-opening time	
Total time required to empty lock chamber, starting with valves closed – minutes	7.25
Maximum rate of fall – fpm	8.94
Maximum flow from chamber – cfs	6,110
Emptying coefficient	0.75
6-minute valve-opening time	
Total time required to empty lock chamber, starting with valves closed – minutes	9.52
Maximum rate of fall – fpm	5.75
Maximum flow from chamber – cfs	3,390
Emptying coefficient	0.75

SUPPLEMENTARY PERTINENT DATA (Cont'd)

GATED SPILLWAY

Total length, including end pier – feet	766
Net length – feet	640
Elevation of crest – feet NGVD29	48.0
Number of piers including end pier	16
Width of piers – feet	
End pier	6
Other piers	8
Height of piers above spillway crest – feet	59
Type of gates	Vertical lift (split leaf)
Number of gates	16
Length of gates – feet	40
Height of gates – feet	30.5
Weight of top leaf – lbs	47,444
Weight of bottom leaf – lbs	66,402
Method of operating gates	Gantry Crane
Number of gantry cranes provided	2*
*one of these cranes will operate powerhouse intake gates also	
Capacity of gantry crane – tons	75
Maximum discharge capacity (pool elev. 77.0) – cfs	203,600
Elevation of top of gates in closed position – feet NGVD29	78.5
Elevation of access bridge – feet NGVD29	107.0
Elevation of apron – feet NGVD20	20.0 (max)
Thickness of apron – feet	3 (min)

FIXED-CREST SPILLWAY

Total length – feet	1,634
Net length – feet	1,584
Elevation of crest – feet NGVD29	79.0
Elevation of bucket – feet NGVD29	69.39

EARTH OVERFLOW DIKE

Total length (crest elevation 85.0 feet NGVD29) – feet	2,130
Total length of transition (elev. 85.0 to elev. 107.0 feet NGVD29) – feet	690
Top width – feet	25
Side Slopes	18" grouted riprap on 6" gravel base
Maximum swellhead when dike is overtopped – feet	1.8
Recurrence interval of flood which will overtop dike – years	Over 100
Freeboard, top of dike above normal upper pool – feet	8

SUPPLEMENTARY PERTINENT DATA (Cont'd)

POWER PLANT

Overload capacity at normal operating pool - kW	43,350
Turbine discharge at normal pool (elev. 77.0) – cfs	
1 unit operating	5,500
2 units operating	12,000
3 units operating	18,300
Tailwater elevations – feet NGVD29	
1 unit operating	41.5
2 units operating	45.3
3 units operating	48.4
Net head, full load – feet	30.5
Minimum head for generation – feet	9
Percent of time minimum head equaled or exceeded	99.2
Powerhouse	
Length – feet	258.7
Width – feet	122.0
Type of construction	Reinforced concrete
Type of turbines	Kaplan
Number of units	3
Spacing of units – feet	65
Installed capacity (3@ 14,450) – kW	43,345
Capacity of turbines at 75 rpm and rated head (32.5') – hp	20,000
Elevation centerline of distributor – feet NGVD29	52.0
Elevation centerline of intake – feet NGVD29	53.5
Elevation low point of draft tube – feet NGVD29	4.0
Generator rating, kW (.09 p.f., 16.055 kVA, 3-phase, 60 cycles, 75 rpm)	14,450
Station auxiliary power	
Source	2 taps from 13.8 kv bus
Number of 3-phase transformers	2
Emergency gas generator – kW	400
Type of intake gates	Double leaf, vertical lift
Number of intake gates, each unit	2 (4 leaves)
Number of intake gates, provided	4 (8 leaves)
Size of intake gates	23'9" x 30'7"
Method of operating intake gates (*This crane is one of the two provided to operate spillway gates.)	75 ton gantry crane*
Type of draft tube gate	Vertical leaf (slide)
Number of draft tube gates, each unit	2 (4 leaves)
Number of draft tube gates, provided	4 (8 leaves)
Method of operating draft tube gates	20-ton gantry crane

SUPPLEMENTARY PERTINENT DATA (Cont'd)

POWER PLANT (Cont'd)

Switchyard and parking areas	
Location	East of powerhouse
Elevation – feet NGVD29	107.0
Width of section – feet	260
Length of section – feet	491
Slope protection	18" riprap on 6" gravel base
Side slopes ground surface to elevation 85.0 feet NGVD29	1 on 4
Side slopes, elev. 85.0 to elev. 107.0 feet NGVD29	1 on 3
Drawdown for pondage (normally elev 77.5 to 76.5 feet NGVD29) – ft	1
Volume for pondage – acre feet	37,500
Plant output – kW	
At full load	43,350
At minimum generating head	6,000
Est. average annual energy during design – kWh	238,090,000
Actual average annual production (1957-2015) – kWh	209,445,000

EXHIBIT B

UNIT CONVERSIONS
AND
VERTICAL DATUM CONVERSION INFORMATION

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	3.86×10^{-7}	2.47×10^{-4}
1 km^2	10^6	1	100	1.55×10^9	1.076×10^7	1.196×10^6	0.3861	247.1
1 ha	10^4	0.01	1	1.55×10^7	1.076×10^7	1.196×10^4	3.86×10^{-3}	2,471
1 in^2	6.45×10^{-4}	6.45×10^{10}	6.45×10^{-8}	1	6.94×10^{-3}	7.7×10^{-4}	2.49×10^{-10}	1.57×10^7
1 ft^2	.0929	9.29×10^{-8}	9.29×10^{-6}	144	1	0.111	3.59×10^{-8}	2.3×10^{-5}
1 yd^2	0.8361	8.36×10^{-7}	8.36×10^{-5}	1296	9	1	3.23×10^{-7}	2.07×10^{-4}
1 mi^2	2.59×10^6	2.59	259	4.01×10^9	2.79×10^7	3.098×10^6	1	640
1 ac	4047	0.004047	0.4047	6.27×10^6	43560	4840	1.56×10^{-3}	1

LENGTH CONVERSION

UNIT	cm	m	km	in.	ft	yd	mi
cm	1	0.01	0.0001	0.3937	0.0328	0.0109	6.21×10^{-6}
m	100	1	0.001	39.37	3.281	1.094	6.21×10^{-4}
km	10^5	1000	1	39,370	3281	1093.6	0.621
in.	2.54	0.0254	2.54×10^{-5}	1	0.0833	0.0278	1.58×10^{-5}
ft	30.48	0.3048	3.05×10^{-4}	12	1	0.33	1.89×10^{-4}
yd	91.44	0.9144	9.14×10^{-4}	36	3	1	5.68×10^{-4}
mi	1.01×10^5	1.61×10^3	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	3.05×10^6	70.05	1.58×10^4	2.28×10^7	22.824
m^3/day	1.16×10^{-5}	1	0.0116	4.09×10^{-4}	35.31	8.1×10^{-4}	0.1835	264.17	2.64×10^{-4}
l/s	0.001	86.4	1	0.0353	3051.2	0.070	15.85	2.28×10^4	2.28×10^{-2}
ft^3/s	0.0283	2446.6	28.32	1	8.64×10^4	1.984	448.8	6.46×10^5	0.646
ft^3/day	3.28×10^{-7}	1233.5	3.28×10^{-4}	1.16×10^{-5}	1	2.3×10^{-5}	5.19×10^{-3}	7.48	7.48×10^{-6}
ac-ft/day	0.0143	5.451	14.276	0.5042	43,560	1	226.28	3.26×10^5	0.3258
gal/min	6.3×10^{-5}	0.00379	0.0631	2.23×10^{-3}	192.5	4.42×10^{-3}	1	1440	1.44×10^{-3}
gal/day	4.3×10^{-8}	3785	4.38×10^{-4}	1.55×10^{-6}	11,337	3.07×10^{-6}	6.94×10^{-4}	1	10^{-6}
mgd	0.0438		43.82	1.55	1.34×10^5	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	8.1×10^{-7}	2.64×10^{-7}
m^3	1000	1	61,023	35.31	264.17	8.1×10^{-4}	2.64×10^{-4}
in^3	1.64×10^{-2}	1.64×10^{-5}	1	5.79×10^{-4}	4.33×10^{-3}	1.218×10^{-8}	4.33×10^{-9}
ft^3	28.317	0.02832	1728	1	7.48	2.296×10^{-5}	7.48×10^6
gal	3.785	3.78×10^{-3}	231	0.134	1	3.07×10^{-6}	10^6
ac-ft	1.23×10^6	1233.5	75.3×10^6	43,560	3.26×10^5	1	0.3260
million gallon	3.785×10^6	3785	2.31×10^8	1.34×10^5	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.

VERTICAL DATUM CONVERSION INFORMATION

Jim Woodruff Coordinate Comparisions
Mobile District Survey No. 09-025

Note: All State Plane Coordinates are in the North American Datum of 1983 (NAD83), Georgia West Zone, U.S. Survey Foot

Designation	OPUS Results						from NGS Data Sheets			PICES	USGS	USCOE	Desc.
	Northing	Easting	NAVD 88 Elev.				Northing	Easting	NAVD 88 Elev.	NGVD 29 Elev.	NGVD 29 Elev.	NGVD 29 Elev.	
JW-CEPD	257634.744	2077311.347	81.296										FBDWD
PBM JW1	258686.504	2076828.635	81.358										FBDWD
11-24A													FBD COE
BM 1											107.898		FCM COE
11-505			66.090							66.684			FAD COE
TBM JW1			81.270									80.680	FBC
TBM JW2			81.340									80.750	FBDWD
TBM JW3			81.340									80.750	FBDWD
TBM JW4			81.390									80.800	FBC
Gage Information													
Upper Pool			77.3								77.5	77.5	Normal Elev.
Lower Pool			47.3								47.5	47.5	Normal Elev.
NGS Control Information													
JACKO 044				262320.486	2043256.740	178.545	262320.366	2043256.764					FCM Jack
JACKO 046				255305.615	2070605.302	94.809	255305.623	2070605.244					FCM Jack
N 134				255682.881	2070595.654	97.444			97.519				FCM USCGS
R 392				262304.765	2043207.388	177.970			178.103				FSR USCGS

Legend

SBD COE= Set Brass Disc, US Army Corps of Engineers
SBC = Set Brass Cap, GCT LB3501
FBDWD = Found War Department Brass Disc
FBC = Found Brass Cap, Deformation Monitoring Station
FAD COE = Found Aluminum Disc, US Army Corps of Engineers
FBD COE = Found Brass Disc, US Army Corps of Engineers
FCM COE = Found Concrete Monument, US Army Corps of Engineers
FCM USCGS = Found Concrete Monument, United States Coast & Geodetic Survey
FSR USCGS = Found Stainless Steel Rod, United States Coast & Geodetic Survey
FCM Jack = Found Concrete Monument, Jackson County, FL

Geomap Technologies, Inc. / GCT, Inc. *11/24/2009*

SURVEY DATASHEET (Version 1.0)

PID: BBBL78
Designation: JW-CEPD
Stamping: JW-CEPD 2009
Stability: Most reliable; expected to hold position well
Setting: Large structures with deep foundations
Description: JW-CEPD, Begin at U.S. Post Office, Chattahoochee, FL; go westerly along Hwy. No.90 ±1.1 miles to paved road to Lock & Dam on right, thence northerly along paved road for ±0.5 miles to Lock & Dam. Station is on west side of lock chamber ±60' south of the downstream gate. Station is a War Department Disc set in the concrete walk' ±4' west of the west concrete guard rail and ±8' north of the south guard rail.
Observed: 2009-08-22T12:35:00Z
Source: OPUS - page5 0909.08

Close-up View

REF_FRAME: NAD_83 (CORS96)	EPOCH: 2002.0000	SOURCE: NAVD88 (Computed using GEOID03)	UNITS: m	SET PROFILE	DETAILS

LAT:	30° 42' 23.58744"	± 0.015	m
LON:	-84° 51' 51.85631"	± 0.020	m
ELL HT:	-3.360	± 0.015	m
X:	491308.004	± 0.019	m
Y:	-5466639.396	± 0.016	m
Z:	3237962.210	± 0.017	m
ORTHO HT:	24.779	± 0.033	m

	UTM 16	**SPC** 1002(GA W)
NORTHING:	3399028.185m	78527.227m
EASTING:	704521.355m	633165.765m
CONVERGENCE:	1.09090218°	-0.35630695°
POINT SCALE:	1.00011602	0.99995508
COMBINED FACTOR:	1.00011655	0.99995561

CONTRIBUTED BY

wwalker
GCT, Inc.

Horizon View

The numerical values for this position solution have satisfied the quality control criteria of the National Geodetic Survey. The contributor has verified that the information submitted is accurate and complete.

Jim Woodruff Lock and Dam

EXHIBIT C

STANDING INSTRUCTIONS TO THE PROJECT OPERATOR FOR WATER CONTROL

JIM WOODRUFF LOCK AND DAM

STANDING INSTRUCTIONS TO THE PROJECT OPERATOR FOR WATER CONTROL JIM WOODRUFF LOCK AND DAM

1. BACKGROUND AND RESPONSIBILITIES

a. **General Information**. These *Standing Instructions to the Project Operator for Water Control, Jim Woodruff Lock and Dam* are written in compliance with Paragraph 9-2 of EM-1110-2-3600 (Engineering and Design, *Management of Water Control Systems*, 30 November 1987) and with ER-1110-2-240 (Engineering and Design, *Water Control Management*, 30 May 2016). A copy of these standing instructions must be kept on hand at the project site at all times. Any deviation from the standing instructions will require approval of the District Commander.

(1) **Project Purposes**. The Jim Woodruff Lock and Dam project is operated for hydropower, fish and wildlife conservation, recreation, water quality, and navigation.

(2) **Chain of Command**. The Project Operator is responsible to the Water Control Manager for all water control actions.

(3) **Structure**. The Jim Woodruff Lock and Dam is about 1,000 feet downstream from the point where the Chattahoochee and Flint Rivers unite 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 line on the left bank. Approximately 1,500 feet of the overflow dike is in Decatur County, Georgia, with the remainder of the structure being in Gadsden County, Florida, on the left bank and Jackson County, Florida, on the right bank. The drainage area above Jim Woodruff Dam, 17,164 square miles, is about equally divided between the Chattahoochee and Flint Rivers.

(4) **Operation and Maintenance (O&M)**. All O&M activities are the responsibility of the U.S. Army Corps of Engineers (Corps).

b. **Role of the Project Operator**.

(1) **Normal Conditions (dependent on day-to-day instruction)**. The Water Control Manager will coordinate the daily water control actions with Southeastern Power Administration (SEPA). The Project Operator will then receive instructions from SEPA on an as needed basis. Such communication will be increased to hourly if the need develops.

(2) **Emergency Conditions (flood, drought, or special operations)**. During emergency conditions, the Project Operator will be instructed by the Water Control Manager daily or hourly for all water control actions. If communications with Water Management Section are cut off, the Project Operator will continue to follow the Water Control Plan and contact the Water Management Section as soon as communication is reestablished. In the event that flooding occurs and communications with Mobile District are cut off, the Project Operator will use the instructions below guide until communications with the Mobile District are restored. If communication is lost after some instructions are issued, follow those instructions as long as they are applicable.

1. Increasing Inflows. Check to see which one of the following two conditions is met and follow the instructions.

    a. 4 hour average inflows below 100,000 cfs. Begin opening spillway gates to match the calculated 4 hour average inflow by following the gage operating schedule. If additional gate steps are needed to limit the pool elevation below a maximum of 77.8 feet NGVD29, adjust accordingly.

b. 4-hour average inflows above 100,000 cfs. If the pool elevation is above 77.0 feet NGVD29, increase the outflow to bring the pool elevation down to 77.0 feet NGVD29 within 12 hours. Maintain pool near elevation 77.0 until such time as all spillway gates are open or inflows begin to decrease.

2. Decreasing Inflows. Maintain the maximum gate step until the pool recedes to elevation 77.0 feet NGVD29. If 4-hour average inflows are above 100,000 cfs begin decreasing the release by no more than 20,000 cfs an hour until such time as the pool can be maintained near 77.0 feet NGVD29. If 4-hour average inflows are below 100,000 cfs, resume normal operations of maintaining the pool between elevation 76.5 and 77.5 feet NGVD29.

2. DATA COLLECTION AND REPORTING

a. **General**. The Project Operator will report hourly the pool elevation, tailwater elevation, turbine discharge, spillway discharge, capacity, and general project status on the computer and have it accessible to the Water Control Manager by computer network.

b. **Normal Conditions**. The Project Operator will record the following items daily, and will report them by 6:30 a.m. (0630) central time to the Water Management Section either by computer network, by fax machine (334-694-4058), or by telephone conversation (334-690-2737):

(1) Pool elevation in feet above mean sea level at 6 a.m. and 12 midnight (0600 and 2400) for the period since the last report.

(2) Precipitation in hundredths of an inch.

(3) Average plant discharge in cubic feet per second (cfs) for the first 4 hours of each day and for the 24 hours of the previous day.

(4) Average turbine discharge for the 24 hours of the previous day.

(5) Inflow to the lake in cfs for the first 4 hours of each day and for the 24 hours of the previous day.

(6) Current day's scheduled and previous day's actual generation in megawatt-hours. Include the schedule for the current day's generation.

(7) Total generating capacity of the plant in megawatts.

(8) Stage at 6 a.m. of the current day for the gages at Flint River at Bainbridge, Georgia, and Apalachicola River near Blountstown, FL. Gages may be added or deleted as requested by the Water Management Section.

(9) USGS Gage #02358000 Primary and Secondary gages

Location. Lat 30°42'03", long 84°51'33", in NW1/4 sec.32, T.4 N., R.6 W., Jackson County, Hydrologic Unit 03130011, on downstream side of abandoned bridge downstream of U.S. Highway 90, 0.6 mile downstream from Jim Woodruff Dam, 0.6 mile upstream from Mosquito Creek, 1.0 mile west of Chattahoochee, and 106 miles upstream from mouth.

Every six hours or when operational conditions change, operators will evaluate and compare the primary and secondary gage sensor data transmitted from the Chattahoochee, Florida, gage to ensure that the sensors are providing consistent readings as releases are being reduced to near the 5,000 cfs minimum daily average and when discrepancies or other failures are identified.

If equipment malfunction, storm events, or other unforeseen circumstances result in temporary operations that are inconsistent with the provisions of the Water Control Plan, the following internal communication procedures will be followed.

- As soon as an issue is identified, Water Management Section staff and Project Operators will make the appropriate adjustments to regain consistency with the Water Control Plan in regard to release requirements.
- The Corps, Mobile District will contact the Panama City Field Office of the U.S. Fish and Wildlife Service (USFWS) and describe the circumstances that led to the unanticipated event and the actions taken to rectify it, discuss potential impacts of the action on listed species in the Apalachicola River, and discuss additional actions needed, if any, to ensure that continuing operations are consistent with the provisions of the Water Control Plan.
- The Corps, Mobile District will document the discussion with the USFWS in a letter and post the letter on the Corps Web site for other state agencies, stakeholders, and interested public to access.

c. **Regional Hydrometeorological Conditions**. The Water Control Manager will inform the Project Operator of any regional hydrometeorological conditions that might affect water control actions.

3. WATER CONTROL ACTION AND REPORTING

a. **Normal Conditions**. During normal conditions, all releases will be made through the turbine units. The Project Operator will follow the *Jim Woodruff Reservoir Regulation Manual* for normal water control actions and will report directly to the Water Control Manager.

b. **Emergency Conditions**. During high flows, the operator at Jim Woodruff will follow the instructions for spillway gate settings according to the Gate Operating Schedule. Discharges above about 108,000 cfs will cause the power plant to be nonproductive because of the high tailwater, so that for higher flows all outflow will be through the spillway. When the inflow exceeds 203,600 cfs, all usable gates will be fully open and there will be no control over the outflow. The pool will rise as long as the inflow exceeds the discharge capacity of the spillway including the free-overflow section. The gates will remain fully open until the pool drops back to elevation 77.5; then the gages will be operated as necessary to maintain the pool at or below elevation 77.5.

c. **Head Limitations**. When releases are within powerhouse capacity, limitation on maximum head at Jim Woodruff can become an issue within the normal operating range. The project operator should refer to Plate 7-1 of this manual to insure head limits are not being violated. If it appears that head limits have been or will be violated, the project operator should contact the water management section immediately.

d. **Inquiries**. All significant inquiries received by the Project Operator from citizens, constituents, or interest groups regarding water control procedures or actions must be referred directly to the Water Control Manager.

e. **Water Control Problems**. The Project Operator must immediately notify the Water Control Manager, by the most rapid means available, if an operational malfunction, erosion, or other incident occurs that could affect project integrity in general or water control capability in particular.

EXHIBIT D

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 LAKE
JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

U.S. Army Corps of Engineers

South Atlantic Division

Mobile District

MARCH 2017

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 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 30 May 2016. 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:

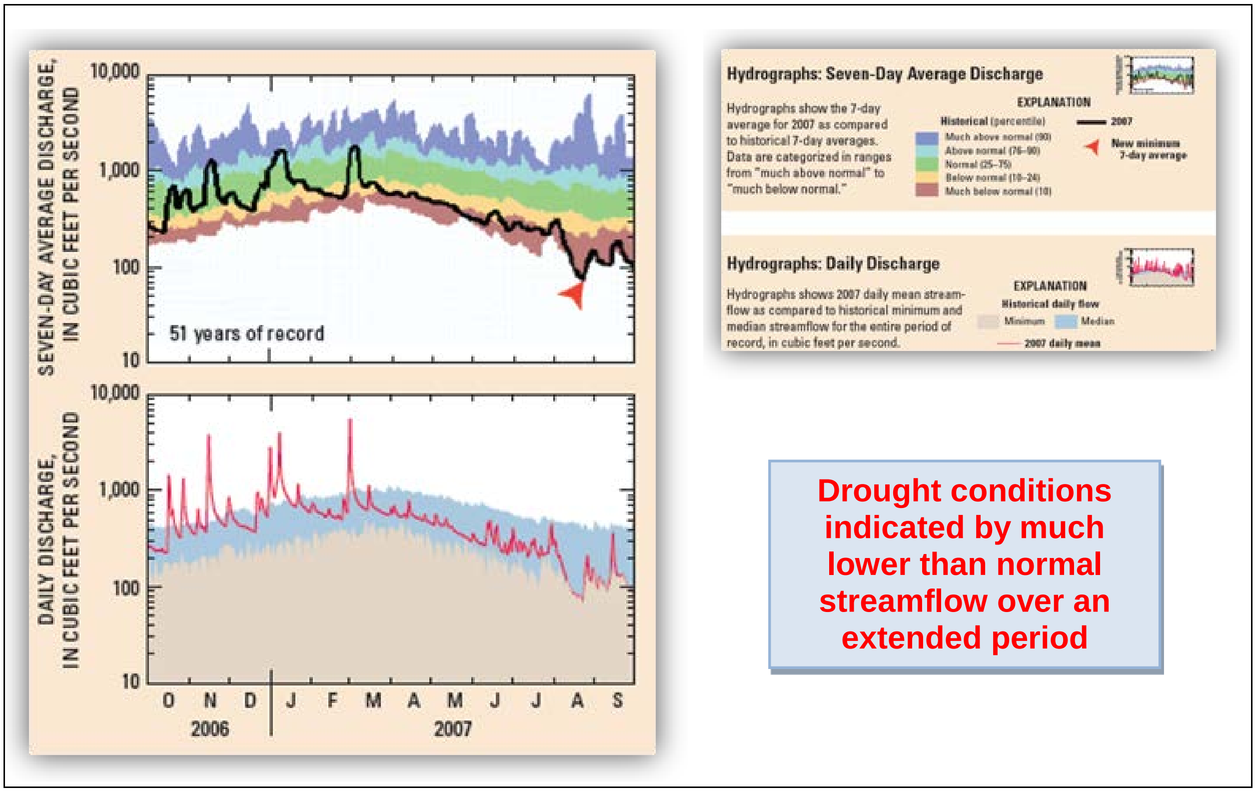
(1) Provider of drought information. Data on reservoir storage including archives of past data should be included in NIDIS. For the Corps, most of the data are available at the District level. Mobile District data are provided on the Internet. The Corps has other data that could be useful in drought 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, 2006 – 2008, and 2011 - 2012. 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. The 2011 – 2012 drought began to the development of a strong La Nina in the summer of 2010, resulting in the driest summer in Georgia in the 21st century, thus far. The summer of 2011 also produced the seventh driest summer on record in Georgia. Winter rains of 2012 brought the end of this drought.



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. groundwater); 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.

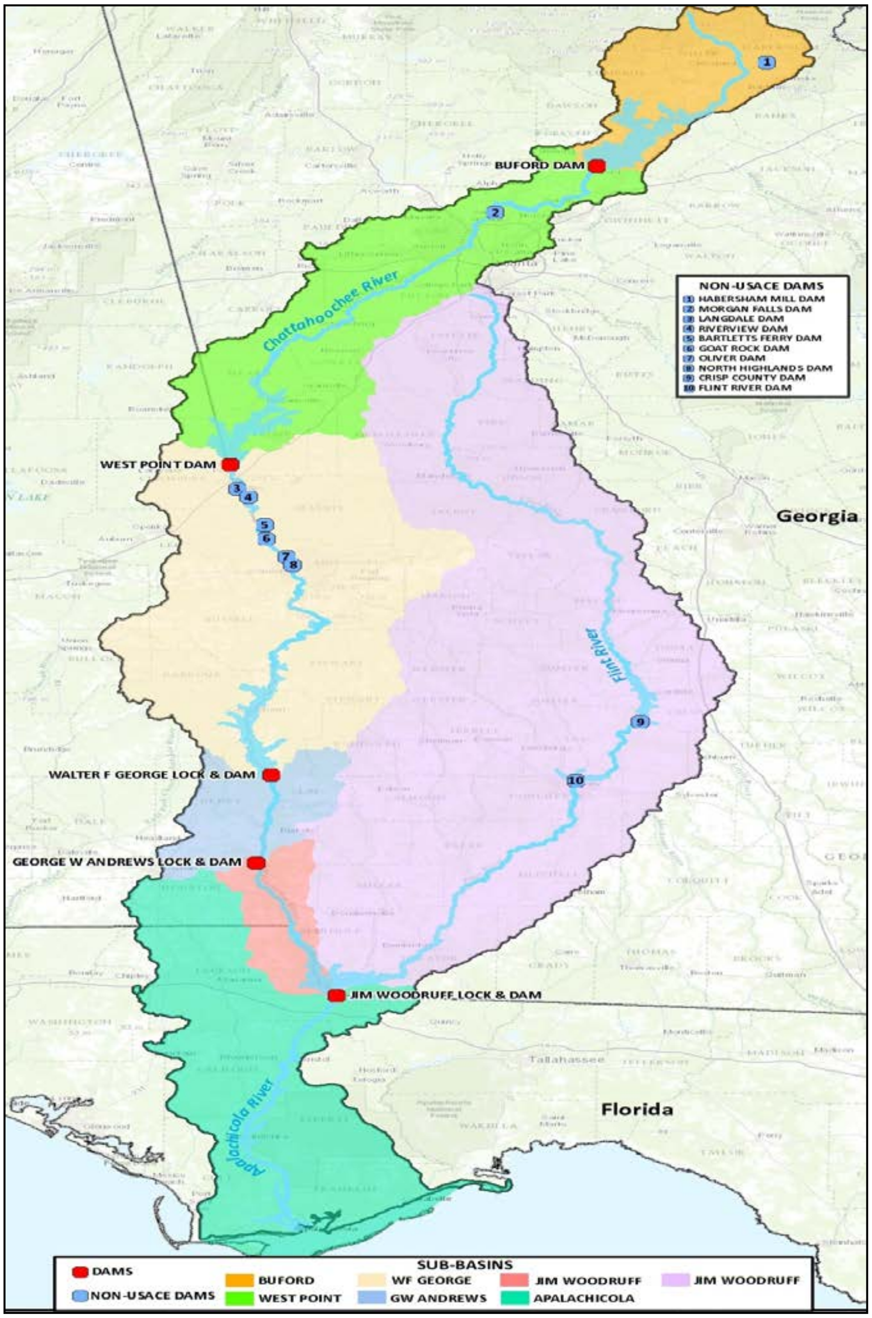


Figure 2. ACF Basin Project Location Map

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 1,613,576 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. 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 3). 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.

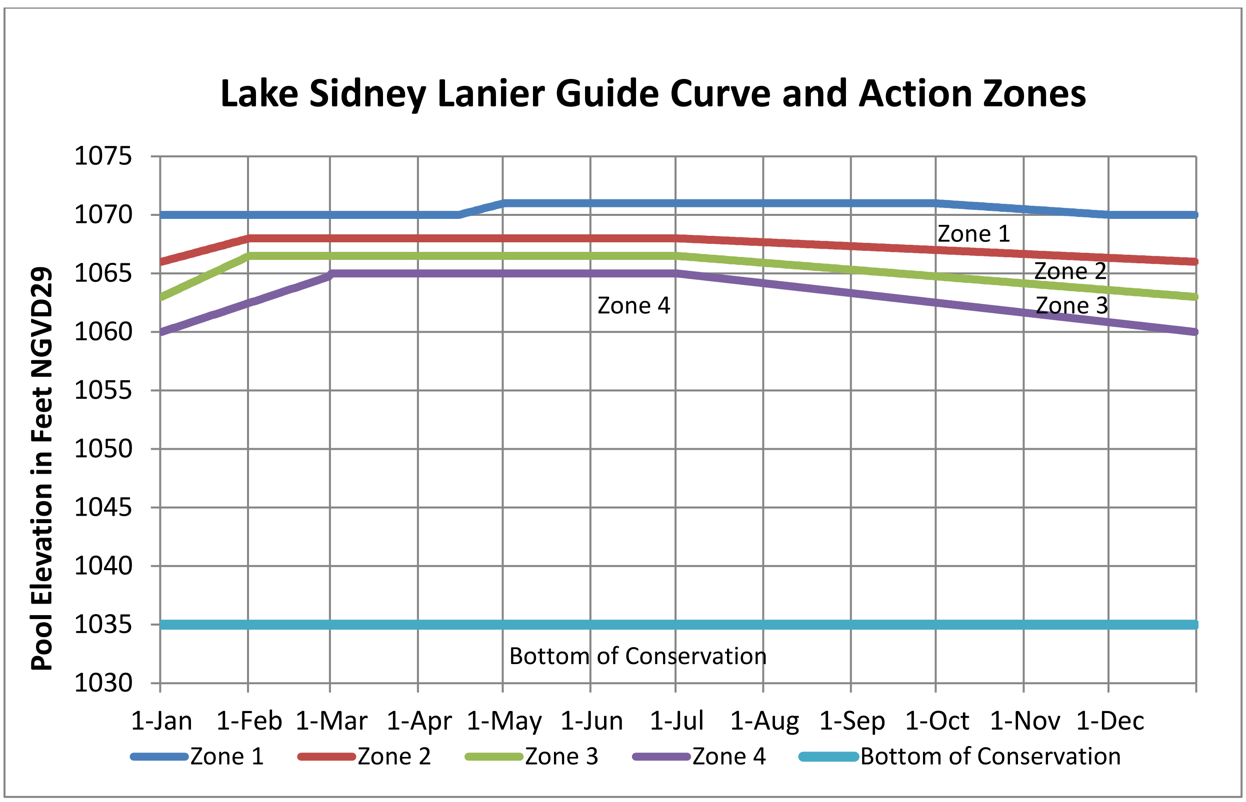


Figure 3. Lake Sidney Lanier Guide Curve and Action Zones

b. West Point 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.

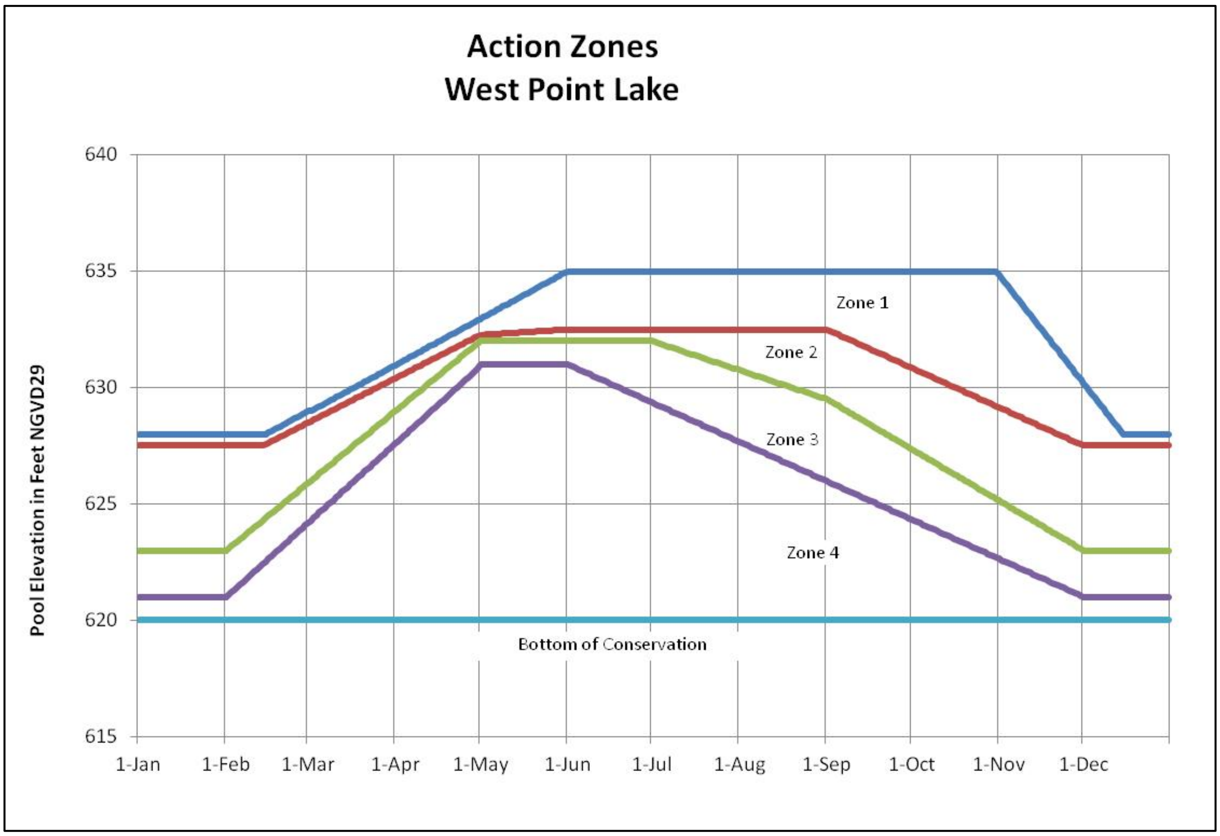


Figure 4. West Point Lake Guide Curve and Action Zones

c. Walter F. George Lake. 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.

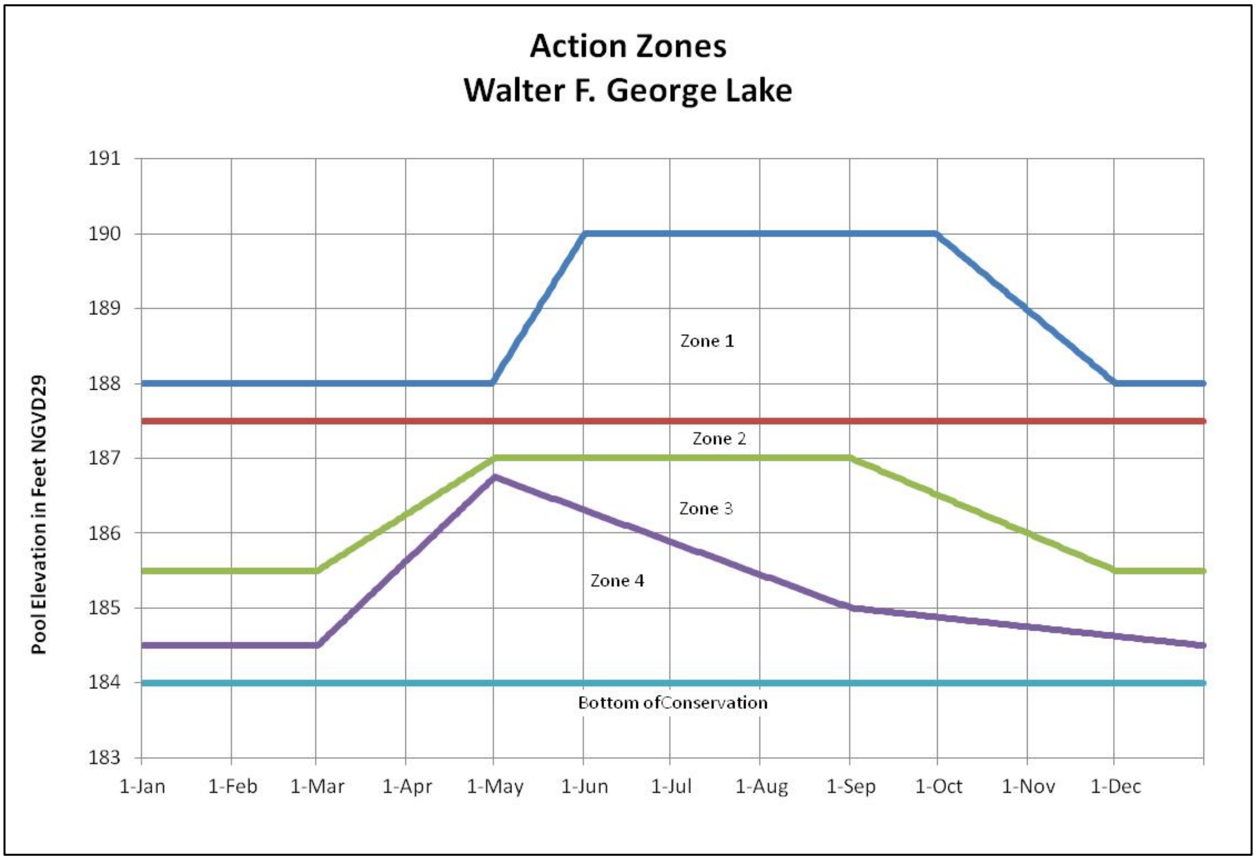


Figure 5. Walter F. George Lake Guide Curve and Action Zones

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
WestRock	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 Sidney Lanier Project has a minimum flow release requirement, that along with local inflows, will provide a minimum of 750 cfs between May to October and 650 cfs between November to April, measured 40 miles downstream from Buford Dam in the Chattahoochee River, just upstream of the confluence with Peachtree Creek. 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 25-26 feet (dependent on pool elevation) 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.

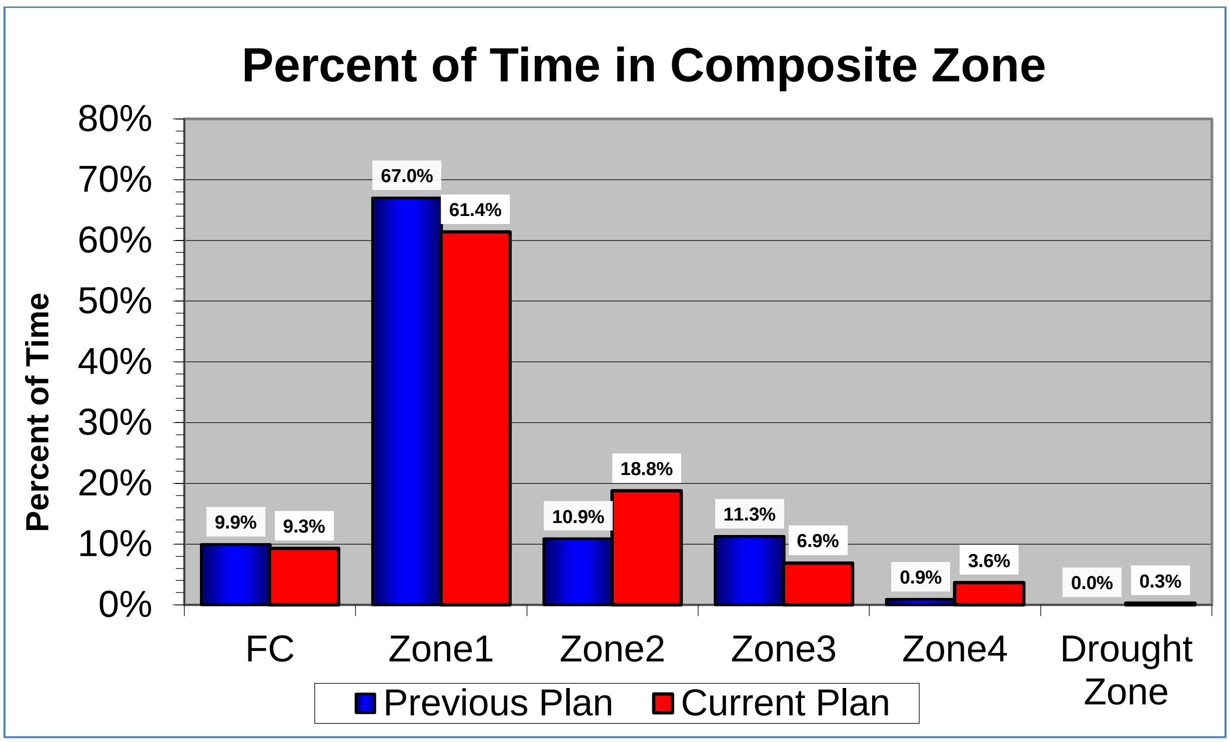


Figure 6. Percent of Time in Composite Conservation and Flood Zones

7-02. Drought Contingency Plan

The drought plan specifies a minimum release from Jim Woodruff Lock and 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 Lock 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 Lock and 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 0.25feet/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.

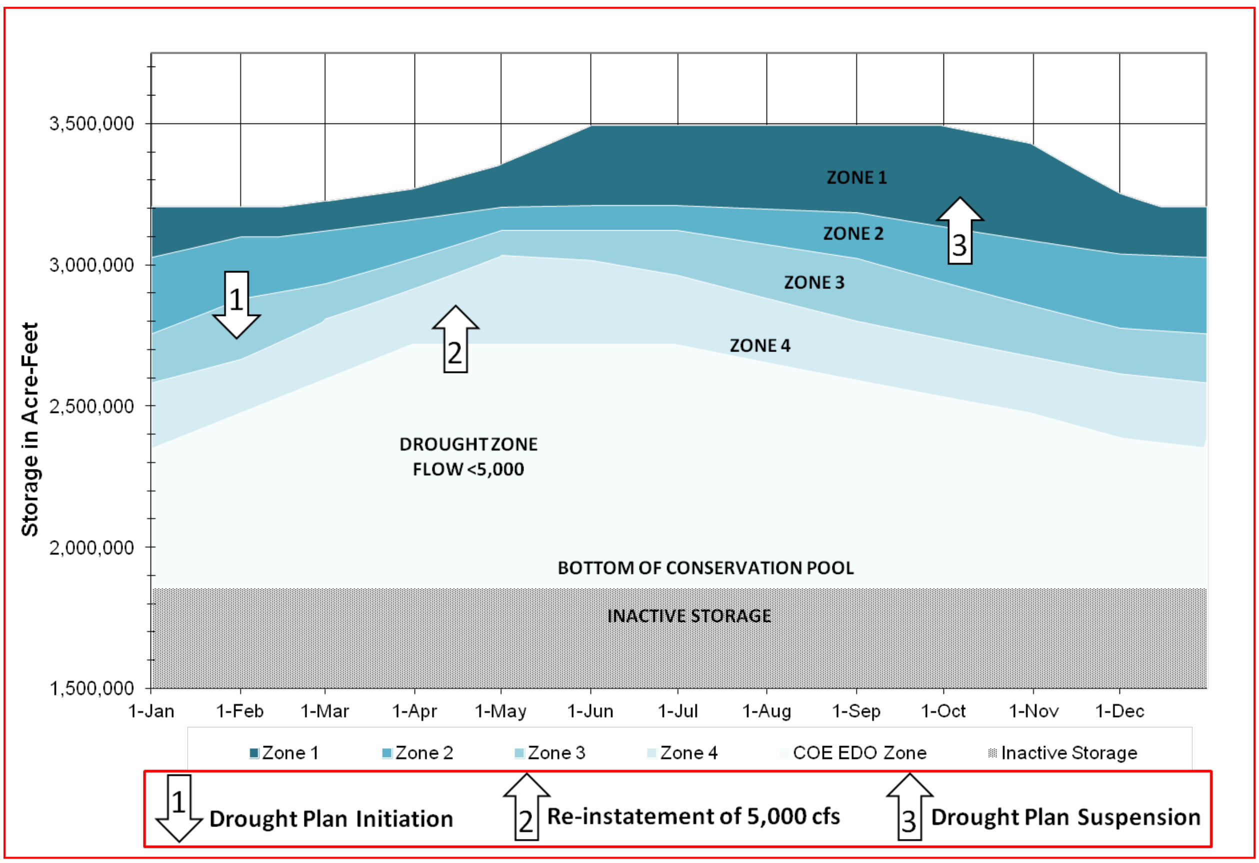


Figure 7. ACF Composite Conservation Storage Zones and Drought Plan Triggers

During the drought contingency operations, a monthly monitoring plan will be implemented that tracks composite conservation storage to determine the water management operations (the first day of each month will represent a decision point) that will be implemented and to determine which operational triggers, if any, should be applied. There is a special provision for the month of March under drought operation. If recovery conditions are achieved in February (after the 1st), drought plan provisions will not be suspended until 1 April, unless the level of composite conservation storage reaches the top of zone 1 (i.e. all Federal reservoirs are full) prior to 1 March. 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 Lock and 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.

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. <u>Extreme Drought Conditions</u>. When the total composite conservation storage drops to about 10 percent, 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, 25-26 feet (dependent on pool elevation); Walter F. George, 88 feet) will be maintained.

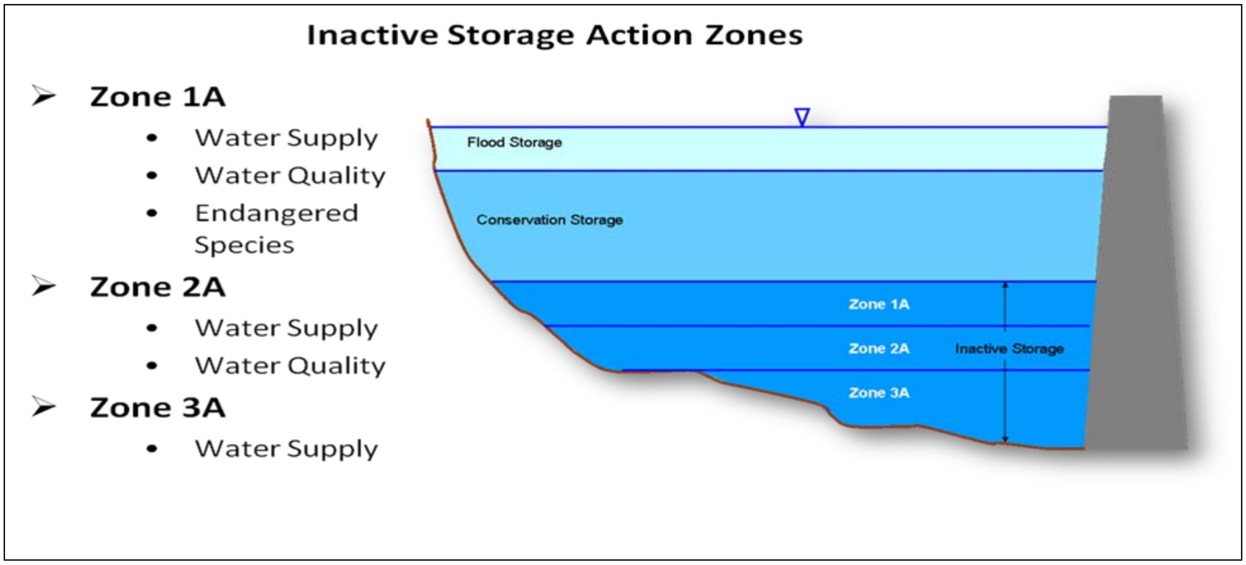
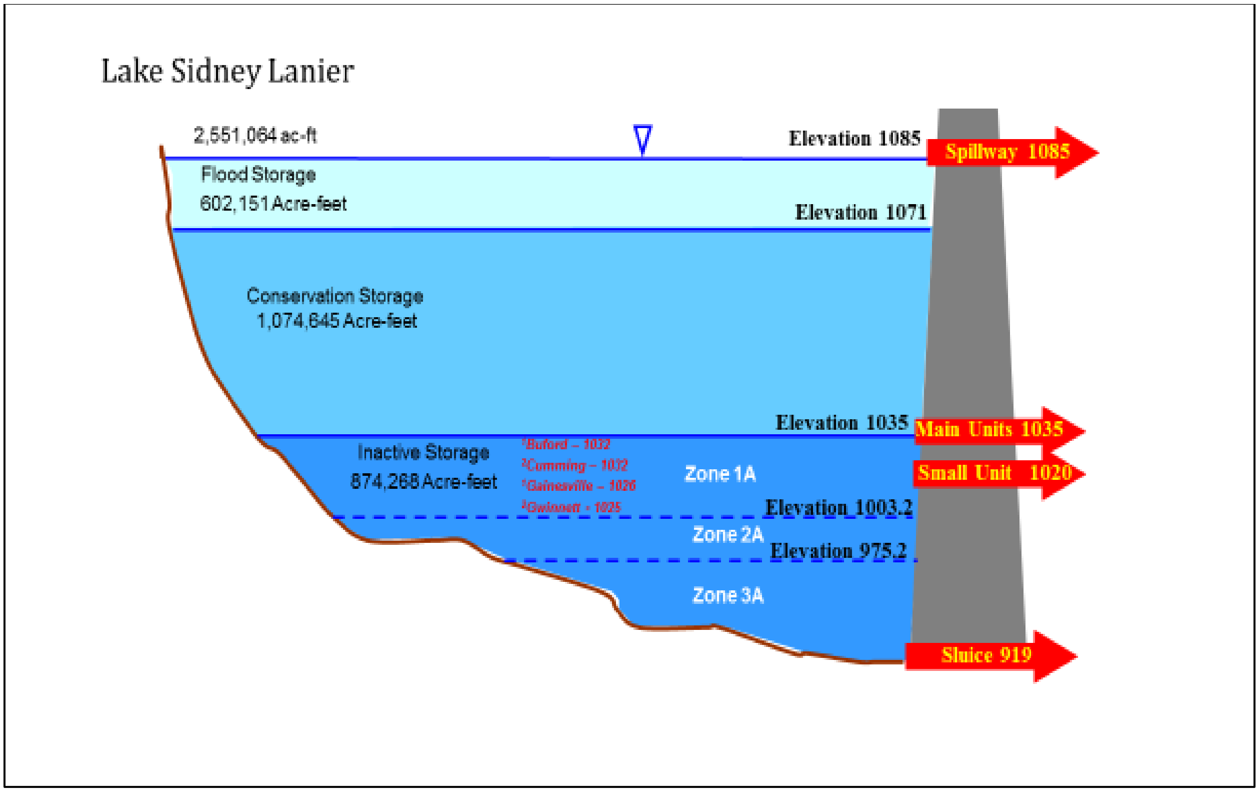


Figure 8. Inactive Storage Zones and Typical Water Use Needs

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

Project	Zone 3A	Zone 2A	Zone 1A	Unusable Inactive
Lake Sidney Lanier	113,327	232,245	528,696	0
West Point Lake	33,344	138,331	53,620	73,101
Walter F. George Lake	0	169,605	311,207	170,960
Total	146,671	540,181	893,523	244,061



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)

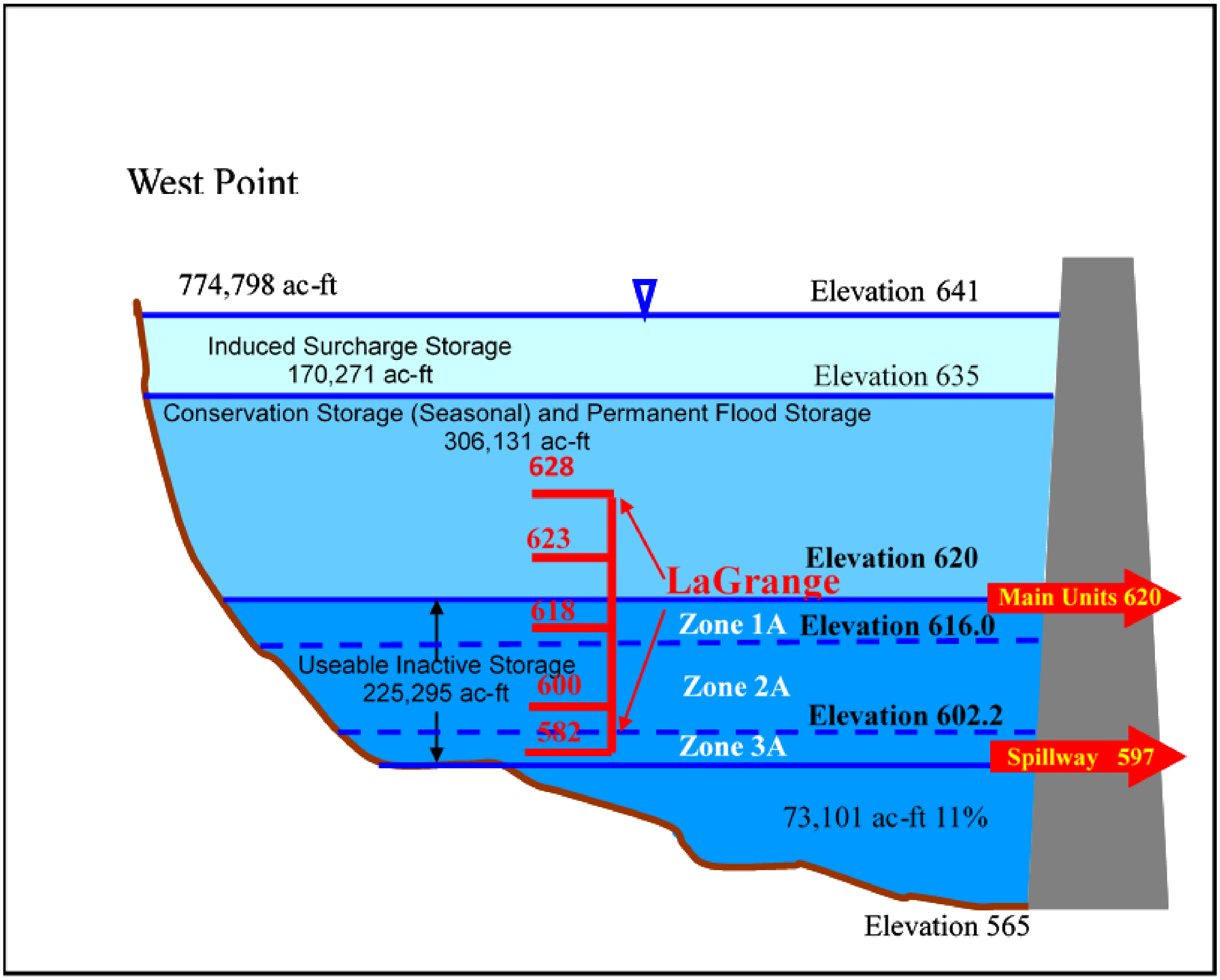


Figure 10. West Point Lake Storage Zones, Storage Capacities, and Critical Lake Levels (all elevations in feet NGVD29)

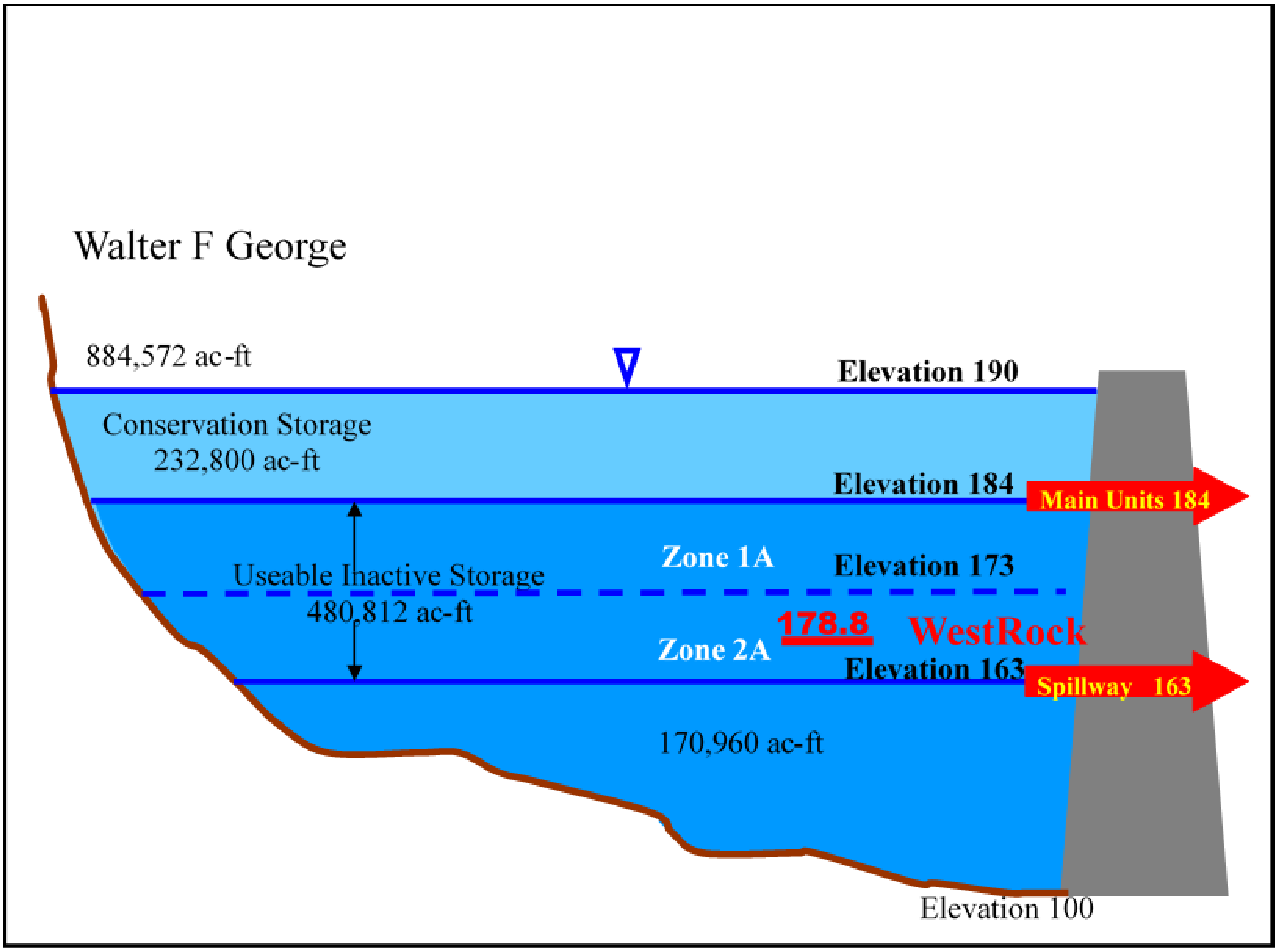


Figure 11. Walter F. George Lake Storage Zones, Storage Capacities, and Critical Lake Levels (all elevations in feet NGVD29)

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
WestRock (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	Chattohoochee River	Lake Harding	4.5	521
Russell	WestRock	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 11 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 11. 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	

IX – REFERENCES

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EXHIBIT E

INCIDENTAL TAKE STATEMENT
(Section 13 of Biological Opinion, 14 September 2016)

13 INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the USFWS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the USFWS as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering [50 CFR §17.3]. Incidental take is defined as take that is incidental to, and not the purpose of, an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of an Incidental Take Statement (ITS).

The measures described below are non-discretionary, and the USACE must insure that they become binding conditions of any contract or permit issued to carry out the proposed action for the exemption in Section 7(o)(2) to apply. The USACE has a continuing duty to regulate the action covered by this incidental take statement. If the USACE: (1) fails to assume and implement the terms and conditions or, (2) fails to require any contracted group to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of Section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the USACE must report the progress of the action and its impact on the species to the USFWS as specified in the ITS [50 CFR §402.14(I)(3)].

13.1 AMOUNT OR EXTENT OF TAKE ANTICIPATED

The extent of the take is described below based on the effects analyses presented in Sections 5 for Gulf sturgeon and 10 for mussels. Two forms of take are expected for Gulf sturgeon and two for the three mussel species.

13.1.1 Gulf Sturgeon

Take of Gulf sturgeon eggs and larvae may occur due to rapid increases and decreases in stage and discharge associated with hydropeaking operations at Jim Woodruff Dam during the spawning season (March 1-May 31). The form of this take is injury or mortality of fertilized eggs and larvae caused by sudden alteration of water depth and velocity, which disrupts normal hatching and dispersal patterns and reduces food resources for larval sturgeon. The take will occur during and shortly after spawning and hatching, as spawning habitats potentially become temporarily unsuitable during the months of March, April, and May. Our analysis in section 5.2.2 indicates that hydropeaking events causing this form of take will occur on average 32 days per spawning season or up to 160 days in the next five spawning seasons; however, we are unable to estimate the number of individual eggs and larvae affected.

The second form of take of Gulf sturgeon is caused by WCM operations reducing the estuarine invertebrate production, which is critical to juvenile sturgeon growth and survival in the first winter of life. The take will occur in in the late summer and fall (July 15-November 24) as well as winter and spring periods (November 24-June1). Our analysis in Section 5.2.1 indicates that the floodplain inundation critical to developing these food resources will be reduced on average from 674,000 ac-days per year to 655,000 ac-day per year in the late summer and fall period (i.e., by 19,000 ac-day per year or up to 95,000 ac-day per year in the next five years) and on average by 2.4 days or (i.e., 12.1 days over five years) during the winter and spring periods; however, we are unable to estimate the number of individual juveniles affected.

The USFWS anticipates the incidental taking of Gulf sturgeon associated with WCM operations will be difficult to detect for the following reasons:

- Gulf sturgeon are wide-ranging;
- they occur in habitats and at low densities that make finding a dead or impaired specimen unlikely, and
- changes to fitness parameters (e.g., decreased growth or recruitment) are difficult to assess in the small population in the ACF Basin.

Therefore, USACE will monitor the extent of Gulf sturgeon take using 1) the aggregate number of days in which hydropeaking occurs (i.e., number of days with flows between 6,700 and 18,300 cfs between March 1 and May 31) not to exceed an average 32 days per spawning season or up to 160 days in the next five spawning seasons; and 2) the floodplain inundation will not be reduced below 655,000 ac-day per summer and fall period on average (or a reduction of up to 95,000 ac-days over the next five summer and fall periods) or below 135 days during the winter and spring period on average (or a reduction of up to 12 days over the next five winter and spring periods). These are surrogate measures that indicate the frequency of conditions created by WCM operations that cause the anticipated taking. Exceeding these surrogate measures of the levels of incidental take for Gulf sturgeon shall prompt a reinitiation of this consultation.

13.1.2 Mussels

Take of listed mussels due to the WCM may occur when conditions are such that USACE reduces the releases from Woodruff Dam below 10,000 cfs. The form of this take is mortality that results from habitat modification leading to oxygen stress, temperature stress, and/or increased predation. These conditions may result in immediate or delayed mortality, and as such, mussels that are able to move and remain submerged may still be found dead in the water after the reduction in flows. The take may occur in microhabitats that become exposed or isolated from flowing water when releases from Woodruff Dam are less than 10,000 cfs. In addition, take includes harm that occurs as a result of reduced growth and/or reproduction due to the high temperatures and low dissolved oxygen that has been shown to occur in these habitats. Take of fat threeridge and Chipola slabshell due to the WCM may also occur when conditions are such that USACE reduces the floodplain inundation to less than 30 consecutive days between March 1 and August 15. The form of this take is harm through reduction in host fish populations and mortality of glochidia. These conditions may result in reduced recruitment of fat threeridge and Chipola slabshell in the subsequent year. Our analysis in section 10.2.1.1 indicates that the 30-day floodplain inundation critical to host fish production will be reduced on average by 12.3 percent per year. The magnitude of this effect is currently unknown, but we believe it to be very small (i.e., <0.02% of the population).

Our analysis in section 10.2.1.4 indicate a 3-8.1 percent chance of implementing a reduction in flows less than 5,000 cfs, because the 1939-2012 simulations trigger the 4,500 minimum flow of the WCM three times (in 2007, 2011, and 2012). Therefore, we expect that incidental take of listed mussels attributable to the reduction in flow to 4,500 cfs could at most consist of one event in the next five years. We also anticipate that mussels could recolonize habitats greater than 5,000 cfs and be incidentally taken during subsequent low flows. Our model results indicate that incidental take of listed mussels attributable to the reduction flows greater than 5,000 cfs occur with a 13.5 percent chance, and one event of this nature is likely to occur at flows above 5,000 cfs in the next five years.

We expect a maximum of 34,000 fat threeridge may be exposed in the Apalachicola River, Chipola Cutoff, and Chipola River downstream of the Chipola Cutoff when the minimum flow is reduced to 4,500 cfs (22,000 individuals) and when individuals recolonize habitats greater than 5,000 cfs followed by stranding during subsequent low flows (12,000 individuals). We expect a maximum of 90 purple bankclimbers (60 if flows are reduced to 4,500 cfs; 30 in habitats greater than 5,000 cfs) may be exposed on the rock shoal near RM 105 and at a few locations elsewhere in the action area during each of these events. We expect a maximum of 106 Chipola slabshell (53 if flows are reduced to 4,500 cfs; 53 in habitats greater than 5,000 cfs) may be exposed in the Chipola River downstream of the Chipola Cutoff and middle Apalachicola during this event.

USACE will monitor the extent of this form of take based on observed mortality. Additionally, fat threeridge and Chipola slabshell may experience harm through reduced recruitment. USACE will monitor the extent of this form of take using a surrogate measure that indicates the frequency of conditions created by WCM operations that cause the anticipated taking; a year with less than 30 consecutive days of at least 31,000 ac of floodplain inundation between March 1 and August 15 will not occur more than once in the next five years. Exceeding this level of incidental take for these three mussel species shall prompt a reinitiation of this consultation.

13.2 EFFECT OF THE TAKE

In the accompanying BO, the USFWS determined that the level of anticipated take for declining fall rates and reductions in flow as low as 4,500 cfs, or when individuals recolonize habitats greater than 5,000 cfs, would not result in jeopardy to the species or destruction or adverse modification of designated or proposed critical habitat, assuming no more than reduction in flow to 4,500 cfs and no more than one reduction in flow to 5,000 cfs occur within the duration of the BO.

13.3 REASONABLE AND PRUDENT MEASURES

The USFWS believes the following reasonable and prudent measures are necessary and appropriate to minimize the impacts of incidental take of Gulf sturgeon, fat threeridge, purple bankclimber, and Chipola slabshell on the Apalachicola River. The measures described below supersede the measures described in previous BOs. The numbering system used in this opinion includes the year in order to avoid confusion with the previous opinions.

RPM 2016-1. Adaptive Management. Identify ways to avoid and minimize take and implement alternative management strategies within the scope of the authorities of WCM as new information is collected.

Rationale: Additional information will be collected to address uncertainties about the listed species and their critical habitat PCEs in the action area, water use upstream, and climatic conditions. This information needs to be evaluated to determine if actions to avoid and minimize take associated with the USACE's water management operations are effective or could be improved within the scope of the WCM. Appendix C and Appendix D present possible uncertainties about USACE actions and a preliminary assessment of actions to be assessed through adaptive management identified by USFWS. Putting this information in the proper decision context of USACE's operations is the fundamental basis for adaptive management according to policy and guidance under both USACE and USFWS (PARMS 2004, Williams et al. 2007, Williams and Brown 2012, USACE 2013, USACE 2015b). Formalizing the adaptive management process will provide a framework for assessing management options that are within the authority of USACE Mobile District under the WCM as well as setting the appropriate decision context for future updates to the WCM as appropriate.

RPM 2016-2. Water Quantity and Water Quality Stations. Develop and implement a monitoring program associated with USGS, NOAA or other similar monitoring stations within the ACF Basin for water quantity and water quality parameters.

Rationale: Gaging of water quantity and quality within the ACF Basin will be used to inform estimates of take and management options to be assessed through adaptive management (RPM 2016-1). Improved water quality information is also essential to understanding the influences of USACE management on key water quality parameters associated with PCEs for critical habitat of listed mussels and sturgeon.

RPM 2016-3. Species Monitoring. Monitor the level of take associated with the WCM and evaluate ways to avoid and minimize take by monitoring the distribution and abundance of the listed species in the action area.

Rationale: Monitoring populations and relevant habitat conditions associated with take of listed species within the ACF Basin will serve the USACE's information needs for future consultations on updates to the WCM and associated activities. Further, as habitat conditions change, it is necessary to monitor the numbers and spatial distribution of the populations to determine the accuracy of the take estimates. Monitoring will inform the adaptive management framework developed for RPM 2016-1.

13.4 TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the USACE must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are mandatory. Adaptive management, monitoring, and other conditions in the RPMs and conservation measures are subject to the availability of funds by Congress, or revenue from the project operations. The USACE will exercise its best efforts to secure funding for those activities. In the event the necessary funding is not obtained to accomplish the RPM activities by the dates established, the USACE will reinitiate consultation with USFWS. Upon the signing of a Record of Decision, these terms and conditions supersede those of the previous BO and its amendments. These terms and conditions are effective until replaced by a BO or amended BO in the ACF basin.

13.4.1 Adaptive Management (RPM 2016-1)

a) **Develop an Adaptive Management Framework.** The USACE and USFWS will develop an adaptive management framework for identifying ways to minimize take as new information is collected. Implementation of these adaptive management strategies will begin by March 14, 2017 or within 60 days of the Record of Decision being signed, whichever comes later. The framework will:

    i) Outline the adverse effects identified in the BO.
    ii) Specify objectives to assess those effects and identify possible alternative actions to minimize those effects. Appendix C and D provide examples of uncertainties and a preliminary assessment of actions that identified providing more floodplain

inundation, reducing opportunities for hydropeaking, and reducing frequency of low flows as general outcomes of actions that would address the adverse effects.

iii) Identify specific, measureable attributes to monitor progress toward the objectives, the sampling design(s) for measuring those attributes, and the period over which monitoring will be conducted.

iv) Describe process for evaluating the adverse effects and developing, implementing, and assessing the recommended actions to further avoid and minimize take of listed species included in this consultation.

b) **Establish an Adaptive Management Technical Team.** In order to accomplish a), USACE will establish an informal, multi-agency technical team. This team will consist of technical staff from USACE and USFWS. Technical representatives from other Federal agencies (e.g., National Marine Fisheries Service, USGS) may be asked to participate as mutually agreed upon by USACE and USFWS. This team will develop and implement the adaptive management framework.

This adaptive management technical team will meet as needed, but at least annually during the next five years, or until a new BO is issued, to review and discuss the monitoring efforts established in the adaptive management plan. As appropriate and based on the data collected and analyses done pursuant to the management/work plans described in a), the technical advisory team will identify potential conservation measures, within the scope of the WCM, to further avoid and minimize take of listed species in the river reaches included as part of this consultation.

c) **Minimize Foraging Effects on Juvenile Gulf Sturgeon:** To minimize the negative effects of the WCM on food production for juvenile Gulf sturgeon and adverse modification to critical habitat, USACE will inundate the floodplain with a magnitude of at least 100,000 ac in pulses of at least 15 consecutive days in July 15-November 24 over 5 years (based on metrics GS4 and GS5 in section 5.2.1). Additional water will be added to the floodplain during the November 24-June 1 for an average of 12 days (based on GS1). USACE will monitor the biological effect of these proposed actions (e.g., starting by monitoring primary productivity in the Apalachicola River), and the details of how and when in these time periods the floodplain is inundated will be explored within the authority of the WCM through adaptive management. Through an incremental approach over 5 years, the result of adaptive management will be a set of management rules and targeted monitoring to meet these criteria. For example, if a 30-day pulse in July-August is provided, this may also benefit mussel host fish populations (based on M2, M3 in section 10.2.1.1). The adaptive management technical team will begin analyzing food production in the lower Apalachicola River as measured at the Sumatra gage. Use of chlorophyll a and turbidity monitoring will be reviewed by the adaptive management team to determine if it would capture the effects of the action on the food production or to determine if another monitoring regime in the vicinity of the Sumatra gage is more efficient and effective than chlorophyll a and turbidity monitoring at the gage.

d) **Implement Adaptive Management Recommendations.** The USACE shall assume responsibility for implementing the monitoring actions that the adaptive management technical team recommends and that the USFWS agrees are reasonable and necessary to understand, avoid, and minimize take resulting from the actions taken under USACE's WCM.

e) **Review WCM Implementation.** The USACE shall organize semi-annual meetings with USFWS to review implementation of the WCM and adaptive management framework including new data and results, information needs and methods to address those needs, evaluations and monitoring specified in this ITS, formulate actions that minimize take of listed species, and monitor the effectiveness of those actions.

f) **Provide Annual Report.** The USACE shall provide an annual report to USFWS on or before January 31 each year documenting (1) compliance with the terms and conditions of this ITS during the previous year, (2) any conservation measures implemented for listed species in the action area; and (3) recommendations for actions in the coming year to minimize take of listed species.

g) **Provide Monthly Status Update.** The USACE shall provide by email or other timely electronic means to USFWS on a monthly basis the status of WCM implementation including the hydrology of the system, composite system storage, and any data related to any other adopted criteria.

13.4.2 Water Quantity and Water Quality Stations (RPM 2016-2)

a) **Monitor Water Quantity and Water Quality.** USACE and USFWS will work with USGS to develop and implement a monitoring program that supplements current monitoring stations within the ACF Basin. USACE, in collaboration with USGS, will begin implementation of additional gaging by March 14, 2017 or within 60 days of the Record of Decision being signed, whichever comes later. The supplemental information to be collected will include additional water quantity and/or water quality parameters related to PCEs for critical habitat of the listed species, including flow, water temperature, salinity, and dissolved oxygen. The USACE will be responsible for funding the annual maintenance costs associated with the supplemental data collected at these existing gage locations for the duration of the BO to aid in monitoring abiotic conditions tied to the baseline and potential changes in take. Through the adaptive management approach the USFWS and USACE will assess the need to increase, reduce, or change the monitoring locations set forth in these terms and conditions. Additional to the species monitoring described in RMP 2016-3, the following gages will be monitored for discharge, stage, water temperature, dissolved oxygen at a minimum, with other water quality parameters as needed (pH, conductivity, turbidity, salinity) to assess the status and possible adverse modification of PCEs for critical habitat and associated take for listed mussels and sturgeon. Each gage shall monitor river conditions at 15-minute or other appropriate intervals and seasons as agreed by USFWS with data transmitted via satellite to the USGS office, for display on the USGS web page in real-time, and available in regular reports. The Chattahoochee and Sumatra gages will be monitored at least monthly. If the latest measurement suggests that the Chattahoochee gage height less than the current unshifted rating curve value corresponds to a discharge of 5,000 cfs, do not reduce releases until the USGS verifies discharge via field measurement or until coordination with the USFWS and USGS indicates that a discharge measurement is unnecessary. All data will be shared with the USFWS at least annually in the report described for RPM 2016-1. Parameters currently missing from gage stations or additional parameters required (if any) are indicated next to the gage name:

   a. Chattahoochee River
      i. MI 46 near Columbia (USGS 02343805) - water temperature, dissolved oxygen

b. Tributaries to Lake Seminole
    i. Spring Creek near Reynoldsville (USGS 02357150) - dissolved oxygen
    ii. Flint River at Bainbridge (USGS 02356000) - dissolved oxygen
c. Apalachicola River
    i. Apalachicola River at Chattahoochee (USGS 02358000) - water temperature, dissolved oxygen
    ii. Apalachicola River at Sumatra (USGS 02359170) - water temperature, dissolved oxygen, salinity (and possibly chlorophyll a and turbidity as assessed by the adaptive management technical team)

b) **Establish New Gage Stations.** Additional gages (Figure 13.1 and Section 14) may be established if the scientific information obtained from monitoring leads the adaptive management technical team to determine additional gages downstream are necessary to capture the effect of the action on food production or foraging access for Gulf sturgeon.

13.4.3 Species Monitoring (RPM 2016-3)

In consultation with the USFWS, the USACE shall plan and implement the following monitoring efforts relative to the endangered and threatened species, their habitats, designated critical habitat that will develop information necessary to understand the impact of incidental take and to ensure that the anticipated levels of incidental take are not exceeded.

a) Monitoring and Reporting Take

a. USACE will, in coordination with USFWS and the adaptive management technical team, develop and implement monitoring programs to establish baselines and track changes in abundance, density, and frequency of occurrence of fat threeridge, Chipola slabshell and purple bankclimber within the aquatic habitats downstream of Woodruff Dam. This species monitoring is additional to and complements the water quality monitoring as part of RPM 2016-2. Reports and data will be provided to the USFWS at least annually and will be shared with the adaptive management technical team as needed. These monitoring plans will be completed and implemented by March 14, 2017 or within 60 days of the Record of Decision being signed, whichever comes later.

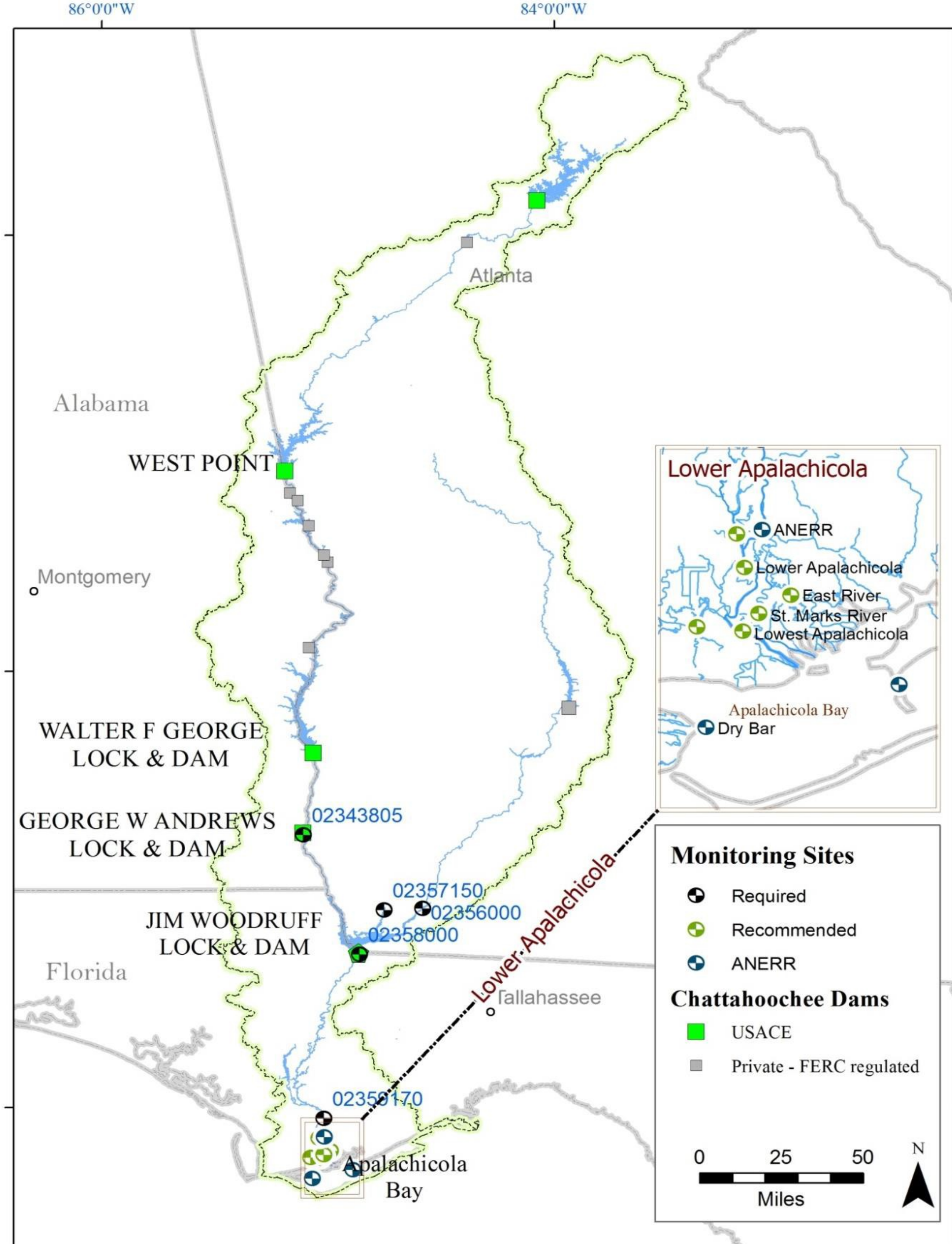
    i. Take of mussels due to exposure from declining minimum releases shall be monitored in accordance with the monitoring plan developed by USACE and approved by USFWS to ensure that the anticipated level of take (section 13.1) is not exceeded.
    ii. Take of mussels due to a reduction in floodplain inundation during the host fish spawning/rearing season shall be monitored in accordance with the monitoring plan developed by USACE and approved by USFWS to ensure the anticipated level of take (section 13.1) is not exceeded. Possible monitoring parameters include, but are not limited to, host fish availability and glochidial infection rates.

b. In coordination and collaboration with USFWS and the adaptive management technical team, USACE will develop and implement a plan to create opportunities within existing operations to monitor the outcome of actions to minimize potential effects of hydropeaking at Jim Woodruff Dam and reduction in floodplain inundation on Gulf sturgeon. This species monitoring is additional to and complements the water quality monitoring as part of RPM 2016-2. USACE will submit a draft plan for USFWS review and approval by January 1, 2017 or 60 days before the first Gulf sturgeon spawning season after the Record of Decision is signed, whichever comes later. Reports and data will be provided to the USFWS at least annually. Monitoring objectives and design will be linked to assessment of take and to assessment of the success of the adaptive management actions (i.e., targeted monitoring for adaptive management).

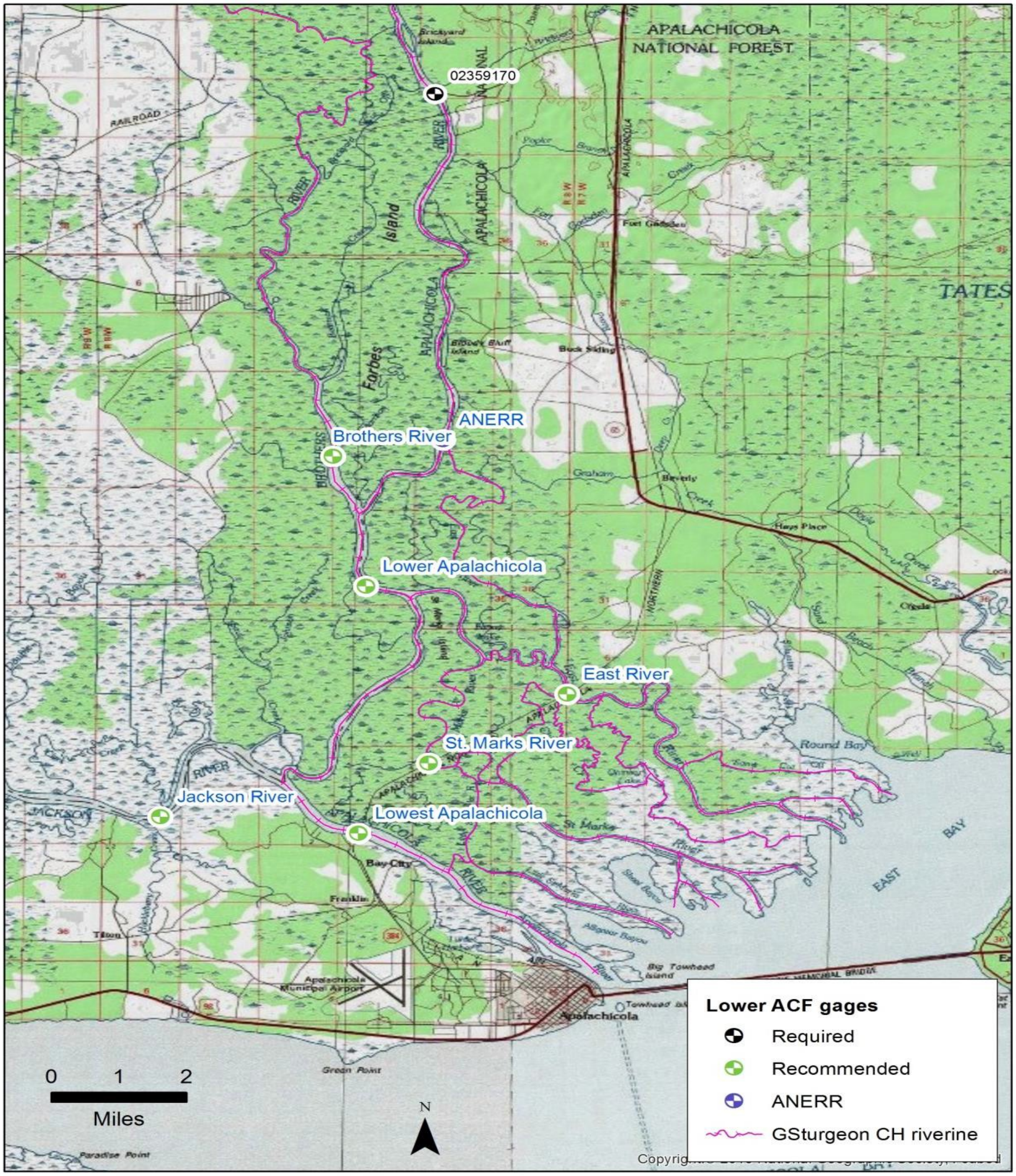
i. Based on 13.4.1 c), possible monitoring parameters for floodplain inundation include, but are not limited to, young of year and juvenile Gulf sturgeon survival and growth.

ii. Possible monitoring parameters for hydropeaking include, but are not limited to, available spawning habitat, spawning behavior, egg viability, larval survival and growth.

b) **Adapt Monitoring:** Coordinate monitoring results with the adaptive management technical team and, if needed, adapt the monitoring according to the adaptive management technical team recommendations and the formal adaptive management framework developed for RPM 2016-1.


86°0'0"W
84°0'0"W
34°0'0"N
32°0'0"N
30°0'0"N
Atlanta
Alabama
WEST POINT
Montgomery
WALTER F GEORGE
LOCK & DAM
GEORGE W ANDREWS
LOCK & DAM
02343805
02357150
02356000
02358000
JIM WOODRUFF
LOCK & DAM
Florida
Lower Apalachicola
Tallahassee
02359170
Apalachicola
Bay
Lower Apalachicola
ANERR
Lower Apalachicola
East River
St. Marks River
Lowest Apalachicola
Apalachicola Bay
Dry Bar
Monitoring Sites
Required
Recommended
ANERR
Chattahoochee Dams
USACE
Private - FERC regulated
0
25
50
Miles
N

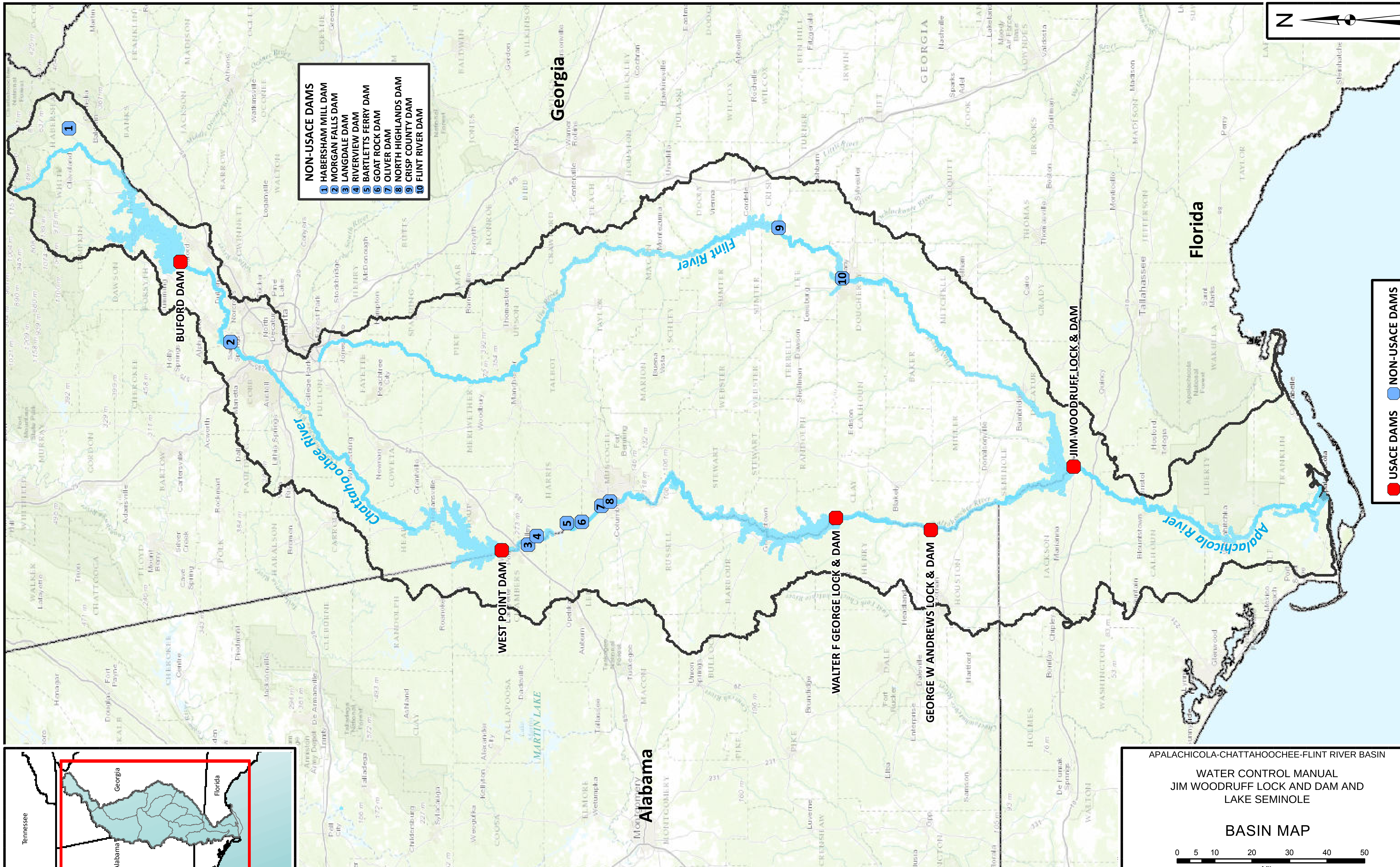
A



B

Figure 13.1 Apalachicola - Chattahoochee - Flint River Basin (A) and estuary rivers (B) showing a potential water quantity and water quality monitoring design for RPM 2016-2 and Conservation Recommendation 2 in reference to the five USACE projects included in this consultation and other Federally regulated projects in the basin.

PLATES



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND
LAKE SEMINOLE

BASIN MAP

0 5 10 20 30 40 50
Miles

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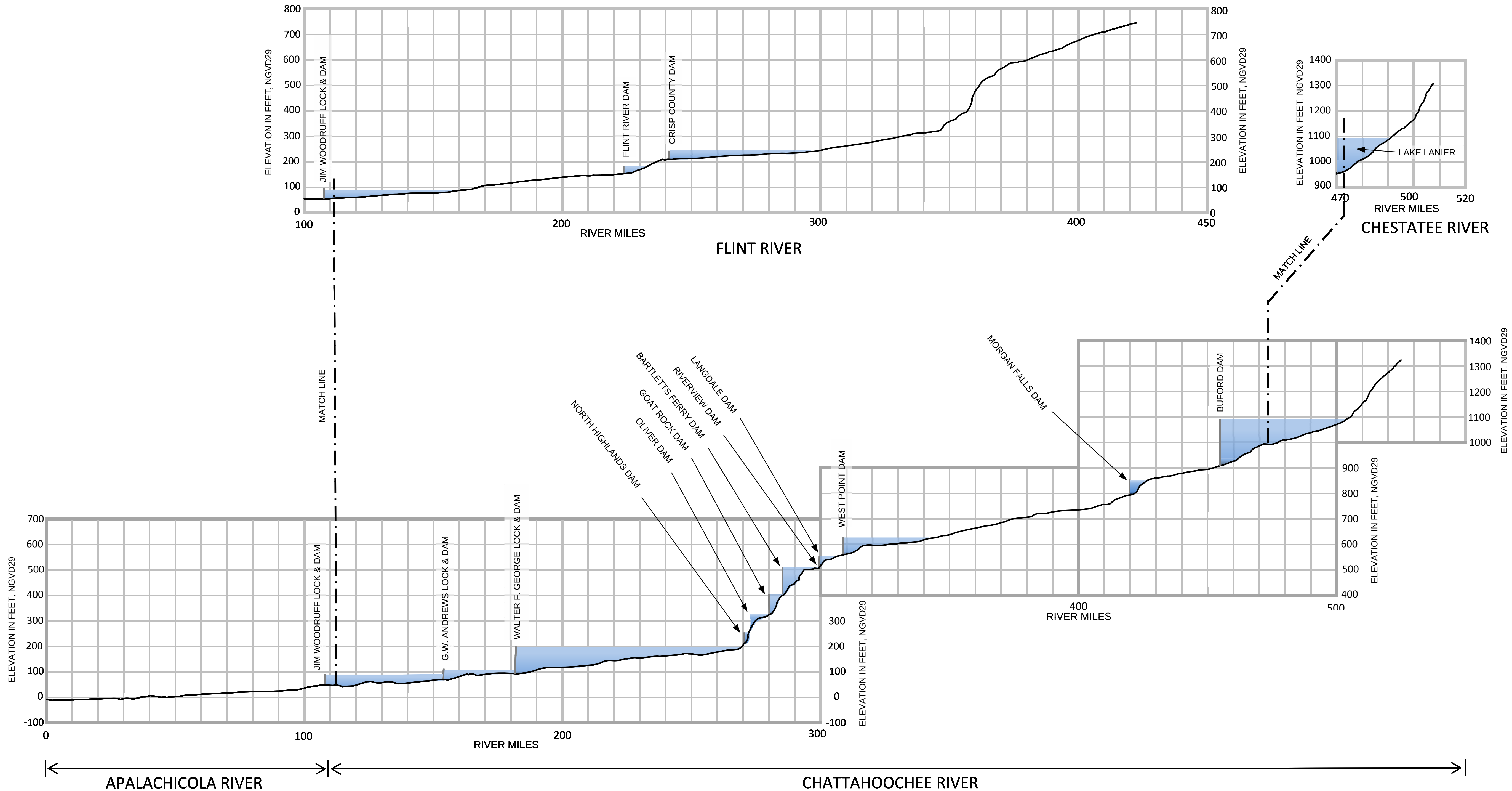


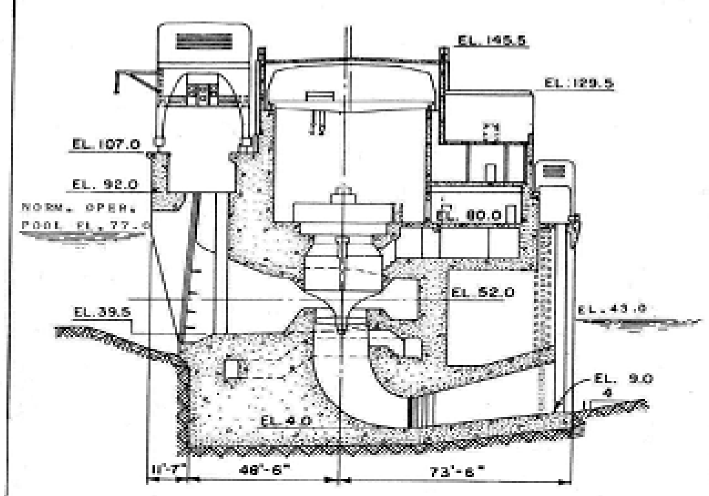
APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL

JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

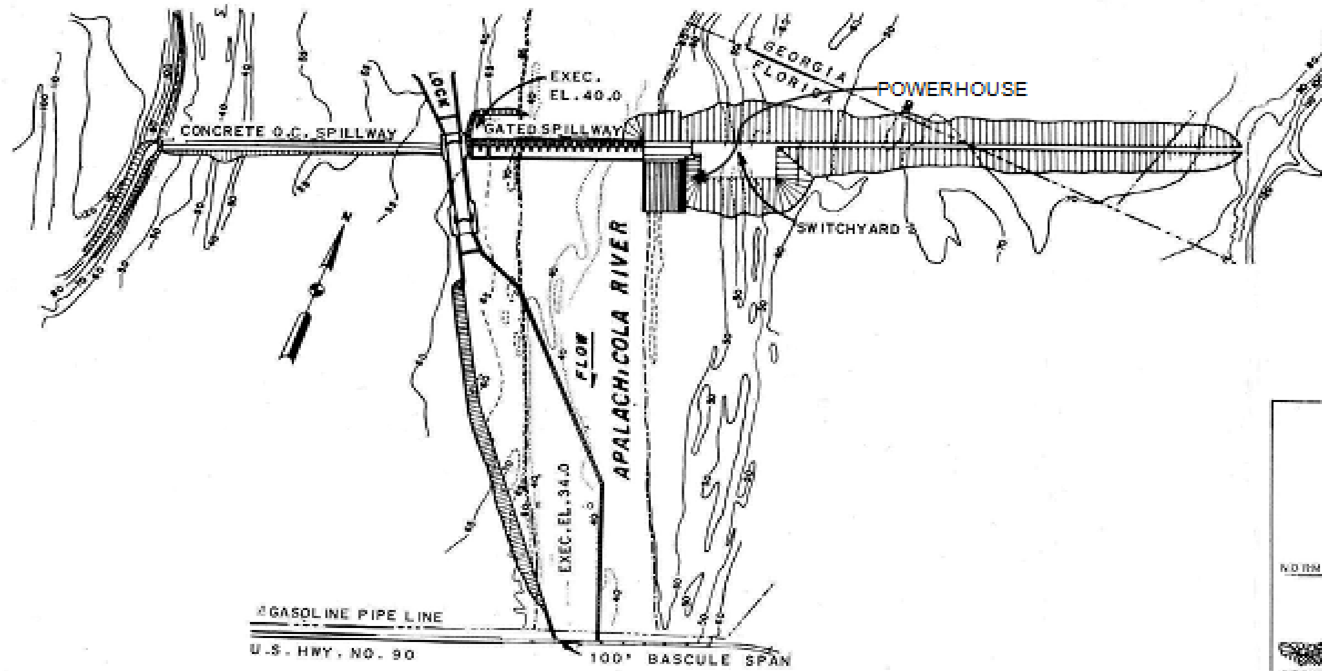
RIVER PROVILE AND RESERVOIR DEVELOPMENT


N
WEST POINT DAM
WALTER F GEORGE LOCK & DAM
GEORGE W ANDREWS LOCK & DAM
JIM WOODRUFF LOCK & DAM
Lake Seminole
Atlanta Hartsfield AP, GA
Griffin
Molena
Woodbury, GA
Carsonville
Talbotton, GA
Montezuma, GA
Montezuma
Turkey Creek
Preston, GA
Americus, GA
Eufaula Wildlife Refuge, AL
Clayton, AL
Crisp County Power Dam, GA
Kinchafoonee Creek
Dawson, GA
Muckalee Creek
Oakfield
Cuthbert, GA
Albany
Albany 3SE, GA
Pachitla Creek
Abbeville, AL
Ichawaynochaway Creek (Milford)
Newton
Headland, AL
Andrews (Pool)
Andrews (Tailwater)
Columbia
Sawhatchee Creek
Blakley, GA
Ichawaynochaway Creek (Newton)
Camilla 3SE, GA
Colquitt, GA
Hopeful
Spring Creek
Bainbridge
CHIPLEY 3 E, FL
Chipola
Chattahoochee
Chattahoochee River
Flint River
Patsiliga Creek
Whitewater Creek
Buck Creek
Muckalee Creek
Kinchafoonee Creek
Ichawaynochaway Creek
Chickasawhatchee Creek
Cooleewahee Creek
Spring Creek
Big Slough
Line Creek
White Oak Creek
Potato Creek
Mississippi
Alabama
Georgia
South Carolina
Florida
DAMS
RAIN GAGE
RIVER GAGE
RAIN AND RIVER GAGE
APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN
WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND
LAKE SEMINOLE
RIVER STAGE &
RAINFALL GAGE MAP
0 5 10 20 30 40
Miles



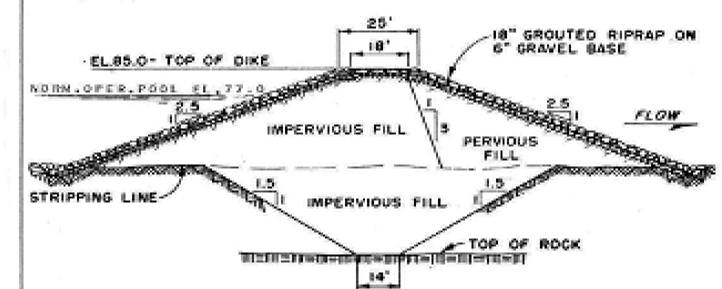
SECTION THROUGH POWERHOUSE

SCALE IN FEET



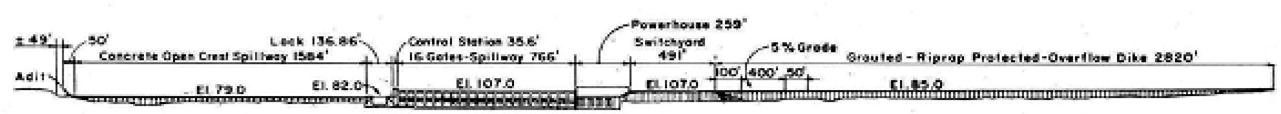
PLAN

SCALE IN FEET

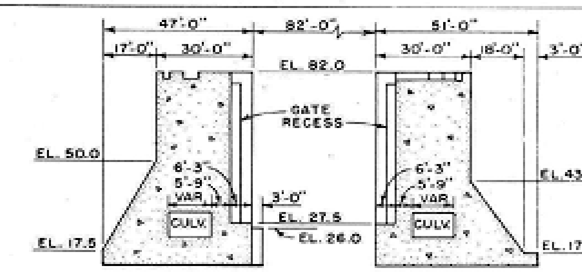


TYPICAL DIKE SECTION

SCALE IN FEET

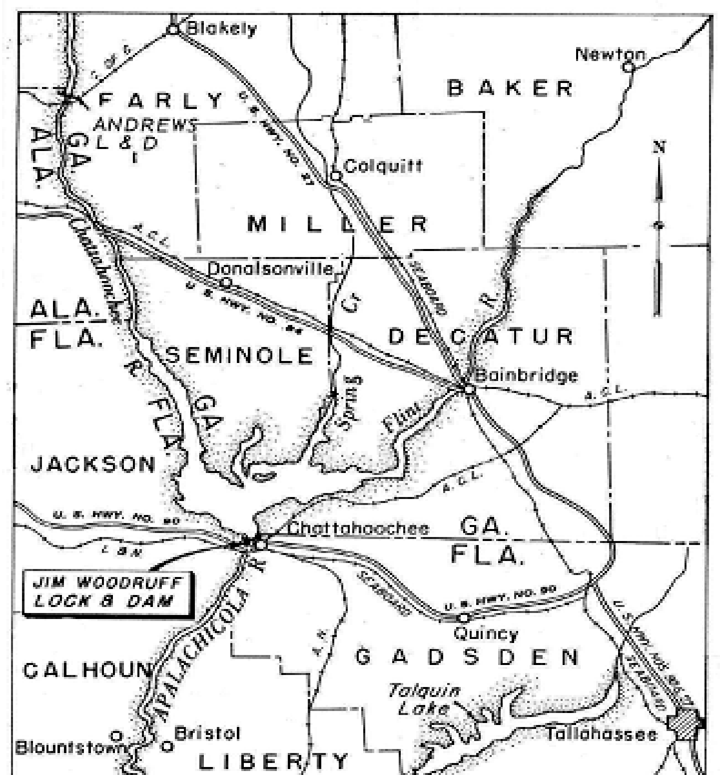


DOWNSTREAM ELEVATION
NOT TO SCALE



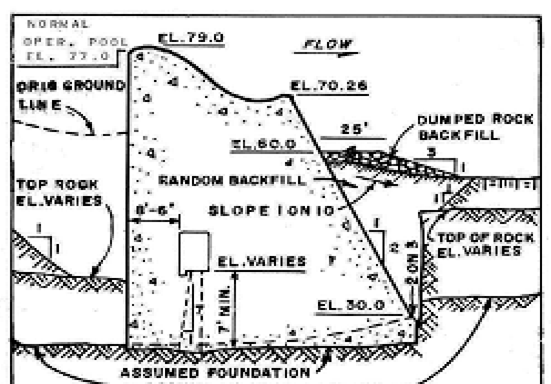
TYPICAL LOCK SECTION

SCALE IN FEET



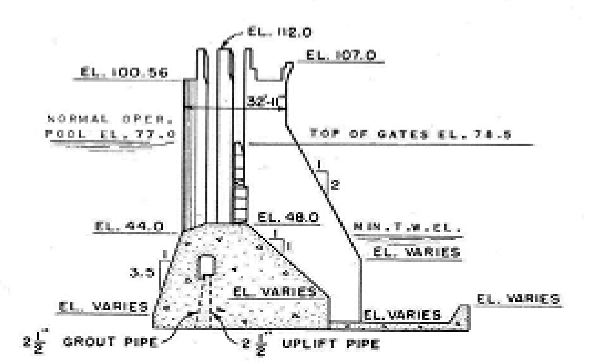
VICINITY MAP

SCALE OF MILES



CONCRETE GRAVITY OPEN CREST SPILLWAY

SCALE IN FEET



GATED SPILLWAY SECTION

SCALE IN FEET

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

PLAN AND SECTIONS OF DAM, POWERHOUSE AND LOCK

Gate	Gate opening (feet)															
Step	Gate number															
No.	T-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	T-2
1	C	C	C	C	C	2.5	C	C	C	C	C	C	C	C	C	C
2	C	C	C	2.5	C	2.5	C	C	C	C	C	C	C	C	C	C
3	C	2.5	C	2.5	C	2.5	C	C	C	C	C	C	C	C	C	C
4	C	2.5	2.5	2.5	C	2.5	C	C	C	C	C	C	C	C	C	C
5	C	2.5	2.5	2.5	2.5	2.5	C	C	C	C	C	C	C	C	C	C
6	C	2.5	2.5	2.5	2.5	2.5	2.5	C	C	C	C	C	C	C	C	C
7	C	2.5	2.5	2.5	2.5	2.5	2.5	C	C	C	C	C	2.5	C	C	C
8	C	2.5	2.5	2.5	2.5	2.5	2.5	C	C	C	C	C	2.5	C	2.5	C
9	C	2.5	2.5	2.5	2.5	2.5	2.5	C	C	C	C	C	2.5	2.5	2.5	C
10	C	2.5	2.5	2.5	2.5	2.5	2.5	C	C	C	C	2.5	2.5	2.5	2.5	C
11	C	2.5	2.5	2.5	2.5	2.5	2.5	C	C	2.5	C	2.5	2.5	2.5	2.5	C
12	C	2.5	2.5	2.5	2.5	2.5	2.5	2.5	C	2.5	C	2.5	2.5	2.5	2.5	C
13	C	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	C	2.5	2.5	2.5	2.5	C
14	C	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	C
15	C	2.5	2.5	2.5	2.5	6.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	C
16	C	2.5	2.5	6.0	2.5	6.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	C
17	C	6.0	2.5	6.0	2.5	6.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	C
18	C	6.0	6.0	6.0	2.5	6.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	C
19	C	6.0	6.0	6.0	6.0	6.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	C
20	C	6.0	6.0	6.0	6.0	6.0	6.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	C
21	C	6.0	6.0	6.0	6.0	6.0	6.0	2.5	2.5	2.5	2.5	2.5	6.0	2.5	2.5	C
22	C	6.0	6.0	6.0	6.0	6.0	6.0	2.5	2.5	2.5	2.5	2.5	6.0	2.5	6.0	C
23	C	6.0	6.0	6.0	6.0	6.0	6.0	2.5	2.5	2.5	2.5	2.5	6.0	6.0	6.0	C
24	C	6.0	6.0	6.0	6.0	6.0	6.0	2.5	2.5	2.5	2.5	6.0	6.0	6.0	6.0	C
25	C	6.0	6.0	6.0	6.0	6.0	6.0	2.5	2.5	6.0	2.5	6.0	6.0	6.0	6.0	C

Gate	Spillway discharge (cfs)																						
Step	Pool elevation																						
No.	76	76.5	76.6	76.7	76.8	76.9	77	77.1	77.2	77.3.	77.4	77.5	77.6	77.7	77.8	77.9	78	78.1	78.2	78.3	78.4	78.5	79
1	1,920	1,960	1,970	1,970	1,980	1,990	2,000	2,010	2,010	2,020	2,030	2,040	2,040	2,050	2,060	2,070	2,080	2,080	2,090	2,100	2,110	2,110	2,150
2	3,840	3,920	3,930	3,950	3,970	3,980	4,000	4,010	4,030	4,040	4,060	4,070	4,090	4,100	4,120	4,140	4,150	4,170	4,180	4,200	4,210	4,230	4,300
3	5,750	5,880	5,900	5,920	5,950	5,970	5,990	6,020	6,040	6,060	6,090	6,110	6,130	6,160	6,180	6,200	6,230	6,250	6,270	6,290	6,320	6,340	6,450
4	7,670	7,830	7,870	7,900	7,930	7,960	7,990	8,020	8,060	8,090	8,120	8,150	8,180	8,210	8,240	8,270	8,300	8,330	8,360	8,390	8,420	8,450	8,600
5	9,590	9,790	9,830	9,870	9,910	9,950	9,990	10,030	10,070	10,110	10,150	10,190	10,220	10,260	10,300	10,340	10,380	10,410	10,450	10,490	10,530	10,560	10,750
6	11,510	11,750	11,800	11,850	11,900	11,940	11,990	12,040	12,080	12,130	12,180	12,220	12,270	12,310	12,360	12,410	12,450	12,500	12,540	12,590	12,630	12,680	12,900
7	13,430	13,710	13,770	13,820	13,880	13,930	13,990	14,040	14,100	14,150	14,210	14,260	14,310	14,370	14,420	14,470	14,530	14,580	14,630	14,680	14,740	14,790	15,040
8	15,350	15,670	15,730	15,800	15,860	15,920	15,990	16,050	16,110	16,170	16,230	16,300	16,360	16,420	16,480	16,540	16,600	16,660	16,720	16,780	16,840	16,900	17,190
9	17,260	17,630	17,700	17,770	17,840	17,910	17,980	18,050	18,120	18,090	18,260	18,330	18,400	18,470	18,540	18,610	18,680	18,740	18,810	18,880	18,950	19,010	19,340
10	19,180	19,590	19,670	19,750	19,830	19,900	19,980	20,060	20,140	20,220	20,290	20,370	20,450	20,520	20,600	20,680	20,750	20,830	20,900	20,980	21,050	21,130	21,490
11	21,100	21,550	21,630	21,720	21,810	21,890	21,980	22,070	22,150	22,240	22,320	22,410	22,490	22,580	22,660	22,740	22,830	22,910	22,990	23,070	23,160	23,240	23,640
12	23,020	23,500	23,600	23,700	23,790	23,880	23,980	24,070	24,170	24,260	24,350	24,440	24,540	24,630	24,720	24,810	24,900	24,990	25,080	25,171	25,260	25,350	25,790
13	24,940	25,460	25,570	25,670	25,770	25,880	25,980	26,080	26,180	26,280	26,380	26,480	26,580	26,680	26,780	26,880	26,980	27,070	27,170	27,270	27,370	27,460	27,940
14	26,860	27,420	27,530	27,640	27,760	27,870	27,980	28,080	28,190	28,300	28,410	28,520	28,630	28,730	28,840	28,950	29,050	29,160	29,260	29,370	29,470	29,580	30,090
15	28,750	29,370	29,490	29,620	29,740	29,860	29,980	30,100	30,220	30,340	30,460	30,570	30,690	30,810	30,920	31,040	31,160	31,270	31,390	31,500	31,610	31,730	32,290
16	30,650	31,320	31,460	31,590	31,720	31,850	31,980	32,110	32,240	32,370	32,500	32,630	32,750	32,880	33,010	33,130	33,260	33,390	33,510	33,630	33,760	33,880	34,490
17	32,550	33,270	33,420	33,560	33,700	33,840	33,980	34,130	34,270	34,400	34,540	34,680	34,820	34,960	35,090	35,230	35,360	35,500	35,630	35,770	35,900	36,030	36,690
18	34,440	35,220	35,380	35,530	35,680	35,840	35,990	36,140	36,290	36,440	36,590	36,740	36,880	37,030	37,180	37,320	37,470	37,610	37,760	37,900	38,040	38,190	38,890
19	36,340	37,180	37,340	37,500	37,670	37,830	37,990	38,150	38,310	38,470	38,630	38,790	38,950	39,110	39,260	39,420	39,570	39,730	39,880	40,040	40,190	40,340	41,090
20	38,240	39,130	39,300	39,480	39,650	39,820	39,990	40,170	40,340	40,510	40,680	40,840	41,010	41,180	41,350	41,510	41,680	41,840	42,010	42,170	42,330	42,490	43,290
21	40,130	41,080	41,260	41,450	41,630	41,820	42,000	42,180	42,360	42,540	42,720	42,900	43,080	43,250	43,430	43,610	43,780	43,960	44,130	44,300	44,470	44,650	45,490
22	42,030	43,030	43,220	43,420	43,610	43,810	44,000	44,190	44,380	44,570	44,760	44,950	45,140	45,330	45,510	45,700	45,890	46,070	46,250	46,440	46,620	46,800	47,700
23	43,930	44,980	45,190	45,390	45,600	45,800	46,000	46,210	46,410	46,610	46,810	47,010	47,210	47,400	47,600	47,790	47,990	48,180	48,380	48,570	48,760	48,950	49,900
24	45,830	46,930	47,150	47,360	47,580	47,790	48,010	48,220	48,430	48,640	48,850	49,060	49,270	49,480	49,680	49,890	50,090	50,300	50,500	50,700	50,900	51,110	52,100
25	47,720	48,880	49,110	49,330	49,560	49,790	50,010	50,230	50,460	50,680	50,900	51,120	51,330	51,550	51,770	51,980	52,200	52,410	52,620	52,840	53,050	53,260	54,260

NOTE.
Nomenclature used in table has the following meanings:

C – Closed gate
2.5 – Upper leaf raised 2.5 feet
6.0 - Upper leaf raised 6.0 feet
U – Upper leaf removed
15.5 - lower leaf raised 15.5 feet
B - Bottom gate leaf removed
UT - Upper leaf of trash gate removed
T - Lower leaf of trash gate removed

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Gate	Gate opening (feet)																Spillway discharge (cfs)																						
Step	Gate number																Pool elevation																						
No.	T-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	T-2	76	76.5	76.6	76.7	76.8	76.9	77	77.1	77.2	77.3.	77.4	77.5	77.6	77.7	77.8	77.9	78	78.1	78.2	78.3	78.4	78.5	79
26	C	6.0	6.0	6.0	6.0	6.0	6.0	6.0	2.5	6.0	2.5	6.0	6.0	6.0	6.0	C	49,620	50,830	51,070	51,310	51,540	51,780	52,010	52,250	52,480	52,710	52,940	53,170	53,400	53,630	53,850	54,080	54,280	54,480	54,690	54,890	55,090	55,290	56,270
27	C	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	2.5	6.0	6.0	6.0	6.0	C	51,520	52,780	53,030	53,280	53,530	53,770	54,020	54,260	54,490	54,710	54,930	55,140	55,360	55,570	55,790	56,000	56,210	56,420	56,640	56,850	57,060	57,260	58,300
28	C	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	C	53,410	54,730	54,970	55,200	55,430	55,660	55,890	56,120	56,350	56,580	56,810	57,030	57,260	57,480	57,710	57,930	58,150	58,370	58,590	58,810	59,030	59,250	60,330
29	C	6.0	6.0	6.0	6.0	U	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	C	55,920	57,360	57,650	57,940	58,220	58,510	58,790	59,080	59,360	59,640	59,920	60,210	60,490	60,770	61,050	61,330	61,610	61,880	62,160	62,440	62,720	62,990	64,370
30	C	6.0	6.0	U	6.0	U	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	C	58,300	60,000	60,340	60,680	61,020	61,360	61,690	62,030	62,370	62,710	63,040	63,380	63,720	64,050	64,390	64,720	65,060	65,390	65,720	66,050	66,380	66,700	68,330
31	C	U	6.0	U	6.0	U	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	C	60,680	62,640	63,030	63,420	63,810	64,210	64,600	64,990	65,380	65,760	66,140	66,520	66,900	67,280	67,660	68,040	68,420	68,800	69,180	69,560	66,940	70,320	72,220
32	C	U	U	U	6.0	U	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	C	63,070	65,280	65,710	66,150	66,580	67,010	67,440	67,870	68,300	68,730	69,160	69,590	70,020	70,450	70,880	71,310	71,740	72,170	72,610	73,040	73,470	73,910	76,090
33	C	U	U	U	U	U	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	C	65,450	67,850	68,330	68,800	69,280	69,760	70,230	70,710	71,190	71,670	72,150	72,630	73,110	73,590	74,070	74,550	75,040	75,520	76,010	46,790	76,980	77,470	79,930
34	C	U	U	U	U	U	U	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	C	67,770	70,390	70,910	71,430	71,950	72,480	73,000	73,530	74,050	74,580	75,110	75,640	76,170	76,700	77,240	77,770	78,310	78,840	79,380	79,920	80,460	81,010	83,730
35	C	U	U	U	U	U	U	6.0	6.0	6.0	6.0	6.0	U	6.0	6.0	C	70,070	72,900	73,460	74,030	74,600	75,170	75,750	76,320	76,900	77,470	78,050	78,630	79,210	79,790	80,380	80,960	81,550	82,140	82,730	83,320	83,910	84,510	87,510
36	C	U	U	U	U	U	U	6.0	6.0	6.0	6.0	6.0	U	6.0	U	C	72,340	75,390	76,000	76,610	77,230	77,850	78,470	79,090	79,720	80,340	80,970	81,600	82,230	82,860	83,500	84,130	84,770	85,410	86,050	86,690	87,340	87,990	91,270
37	C	U	U	U	U	U	U	6.0	6.0	6.0	6.0	6.0	U	U	U	C	74,590	77,860	78,520	79,180	79,840	80,510	81,180	81,850	82,520	83,190	83,870	84,540	85,220	85,900	86,580	87,270	87,960	88,660	89,350	90,050	90,750	91,460	94,960
38	C	U	U	U	U	U	U	6.0	6.0	6.0	6.0	U	U	U	U	C	76,820	80,310	81,020	81,720	82,430	83,150	83,860	84,580	85,290	86,010	86,730	87,460	88,910	88,930	89,670	90,410	91,150	91,890	92,630	93,380	94,120	94,860	98,540
39	C	U	U	U	U	U	U	6.0	6.0	U	6.0	U	U	U	U	C	79,030	82,750	83,500	84,250	85,000	85,760	86,520	87,280	88,050	88,820	89,600	90,370	91,160	91,940	92,720	93,500	94,290	95,070	95,850	96,620	97,400	98,170	102,040
40	C	U	U	U	U	U	U	U	6.0	U	6.0	U	U	U	U	C	81,240	85,170	85,960	86,750	87,550	88,360	89,170	89,980	90,800	91,620	92,440	92,360	94,080	94,900	95,720	96,530	97,350	98,160	98,970	99,780	100,590	101,400	105,470
41	C	U	U	U	U	U	U	U	U	U	6	U	U	U	U	C	83,420	87,560	88,400	89,250	90,100	90,950	91,810	92,660	93,520	94,380	95,240	96,090	96,940	97,790	98,640	99,490	100,330	101,180	102,030	102,870	103,720	104,570	108,820
42	C	U	U	U	U	U	U	U	U	U	U	U	U	U	U	C	85,590	89,950	90,840	91,730	92,630	93,520	94,410	95,310	96,200	97,090	97,970	98,850	99,740	100,620	101,500	102,380	103,260	104,140	105,020	105,900	106,790	107,670	112,090
43	C	U	U	U	U	U	U	U	U	U	U	U	U	U	U	UT	86,890	91,550	92,480	93,410	94,340	95,280	96,200	97,130	98,050	98,970	99,890	100,800	101,720	102,640	103,550	104,470	105,390	106,310	107,230	108,150	109,070	109,990	114,610
44	C	U	U	U	U	U	U	U	U	U	U	U	U	U	U	T	90,710	95,340	96,270	97,190	98,110	99,020	99,930	100,840	101,760	102,670	103,570	104,480	105,390	106,310	107,220	108,130	109,050	109,960	110,870	111,780	112,690	113,600	118,260
45	C	U	U	U	U	15.5	U	U	U	U	U	U	U	U	U	T	97,110	101,430	102,290	103,150	104,010	104,870	105,730	106,590	107,450	108,320	109,180	110,040	110,900	111,770	112,630	113,490	114,360	115,230	116,100	116,990	117,880	118,780	123,400
46	C	U	U	15.5	U	15.5	U	U	U	U	U	U	U	U	U	T	103,010	107,080	107,890	108,710	109,530	110,350	111,160	111,980	112,800	113,610	114,430	115,260	116,080	116,920	117,760	118,610	119,460	120,330	121,210	122,090	122,980	123,880	128,380
47	C	15.5	U	15.5	U	15.5	U	U	U	U	U	U	U	U	U	T	108,460	112,350	113,120	113,900	114,680	115,460	116,250	117,040	117,830	118,630	119,450	120,270	121,100	121,940	122,780	123,640	124,500	125,360	126,220	127,090	127,950	128,810	133,140
48	C	15.5	15.5	15.5	U	15.5	U	U	U	U	U	U	U	U	U	T	113,520	117,250	118,010	118,770	119,540	120,320	121,110	121,910	122,720	123,530	124,360	125,180	126,010	126,850	127,680	128,510	129,340	130,170	131,000	131,840	132,670	133,510	137,700
49	C	15.5	15.5	15.5	15.5	15.5	U	U	U	U	U	U	U	U	U	T	118,190	121,920	122,690	123,470	124,260	125,050	125,860	126,660	127,470	128,280	129,090	129,890	130,700	131,500	132,310	133,120	133,930	134,740	135,550	136,360	137,170	137,980	141,950
50	C	15.5	15.5	15.5	15.5	15.5	15.5	U	U	U	U	U	U	U	U	T	122,590	126,430	127,220	128,010	128,800	129,590	130,380	131,160	131,940	132,730	133,520	134,310	135,100	135,890	136,680	137,406	138,250	139,030	139,810	140,590	141,360	142,120	145,870

NOTE.
Nomenclature used in table has the following meanings:

C – Closed gate
2.5 – Upper leaf raised 2.5 feet
6.0 - Upper leaf raised 6.0 feet
U – Upper leaf removed
15.5 - lower leaf raised 15.5 feet
B - Bottom gate leaf removed
UT - Upper leaf of trash gate removed
T - Lower leaf of trash gate removed

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Gate Step No.	Gate opening (feet) — Gate number T-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	T-2
51	C	15.5	15.5	15.5	15.5	15.5	15.5	U	U	U	U	U	15.5	U	U	T
52	C	15.5	15.5	15.5	15.5	15.5	15.5	U	U	U	U	U	15.5	U	15.5	T
53	C	15.5	15.5	15.5	15.5	15.5	15.5	U	U	U	U	U	15.5	15.5	15.5	T
54	C	15.5	15.5	15.5	15.5	15.5	15.5	U	U	U	U	15.5	15.5	15.5	15.5	T
55	C	15.5	15.5	15.5	15.5	15.5	15.5	U	U	15.5	U	15.5	15.5	15.5	15.5	T
56	C	15.5	15.5	15.5	15.5	15.5	15.5	15.5	U	15.5	U	15.5	15.5	15.5	15.5	T
57	C	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	U	15.5	15.5	15.5	15.5	T
58	C	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	T
59	C	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
60	C	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	B
61	C	15.5	15.5	15.5	15.5	B	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	B
62	C	15.5	15.5	B	15.5	B	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	B
63	C	B	15.5	B	15.5	B	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	B
64	C	B	B	B	15.5	B	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	B
65	C	B	B	B	B	B	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	B
66	C	B	B	B	B	B	B	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	B
67	C	B	B	B	B	B	B	15.5	15.5	15.5	15.5	15.5	B	15.5	15.5	B
68	C	B	B	B	B	B	B	15.5	15.5	15.5	15.5	15.5	B	15.5	B	B
69	C	B	B	B	B	B	B	15.5	15.5	15.5	15.5	15.5	B	B	B	B
70	C	B	B	B	B	B	B	15.5	15.5	15.5	15.5	B	B	B	B	B
71	C	B	B	B	B	B	B	15.5	15.5	B	15.5	B	B	B	B	B
72	C	B	B	B	B	B	B	B	15.5	B	15.5	B	B	B	B	B
73	C	B	B	B	B	B	B	B	B	B	15.5	B	B	B	B	B
74	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B

Gate Step No.	Spillway discharge (cfs) — Pool elevation 76	76.5	76.6	76.7	76.8	76.9	77	77.1	77.2	77.3.	77.4	77.5	77.6	77.7	77.8	77.9	78	78.1	78.2	78.3	78.4	78.5	79
51	129,940	130,700	131,470	132,240	133,010	133,780	134,550	135,330	136,100	136,880	137,650	138,420	139,190	139,950	140,710	141,470	142,210	142,950	143,680	144,410	145,140	145,860	149,550
52	133,870	137,800	138,590	139,370	140,150	137,640	138,410	139,170	139,920	140,670	141,420	142,160	142,890	143,620	144,330	145,040	145,750	146,460	174,170	147,880	148,600	149,330	153,140
53	137,550	141,460	142,240	143,020	143,800	144,580	145,360	146,130	146,910	147,670	148,430	149,190	146,160	146,860	147,560	148,260	148,960	149,670	150,400	151,130	151,870	152,640	156,640
54	140,860	144,770	145,550	146,320	147,100	147,860	148,630	149,380	150,130	150,870	151,600	152,320	153,040	153,750	154,460	155,170	155,880	156,600	157,320	154,270	155,070	155,880	159,940
55	143,900	147,770	148,540	149,290	150,040	150,780	151,510	152,230	152,940	153,650	154,350	155,060	155,770	156,480	157,190	157,920	158,650	159,400	160,160	160,930	161,730	162,530	162,920
56	146,720	150,510	151,230	151,950	152,670	153,370	154,070	154,780	155,480	156,180	156,890	157,610	158,330	159,070	159,820	160,580	161,370	162,170	162,980	163,810	164,640	165,470	169,570
57	149,290	152,930	153,640	154,340	155,040	155,740	156,450	157,160	157,870	158,600	159,340	160,100	160,870	161,660	162,470	163,280	164,110	164,940	165,780	166,610	167,440	168,260	172,140
58	151,580	155,130	155,830	156,540	157,250	157,970	158,710	159,450	160,210	160,990	161,790	162,600	163,430	164,260	165,100	165,940	166,770	167,600	168,420	169,220	170,010	170,780	174,510
59	153,620	157,170	157,900	158,630	159,380	160,150	160,930	161,730	162,550	163,390	164,230	165,070	165,920	166,760	167,600	168,420	169,230	170,020	170,800	171,560	172,310	173,060	176,730
60	156,310	160,170	160,990	161,840	162,700	163,580	164,470	165,360	166,250	167,130	168,000	168,860	169,700	170,520	171,330	172,120	172,910	173,690	174,460	175,230	176,000	176,770	180,730
61	159,110	163,520	164,450	165,390	166,330	167,260	168,180	169,080	169,960	170,810	171,650	172,490	173,310	174,120	174,930	175,750	176,560	177,370	178,190	179,020	179,870	180,720	185,080
62	162,120	167,020	167,990	168,940	169,870	170,780	171,660	172,540	173,410	174,260	175,120	175,970	176,820	177,690	178,550	179,440	180,330	181,240	182,150	183,080	184,000	184,940	189,590
63	165,250	170,290	171,230	172,160	173,070	173,970	174,870	175,770	176,670	177,570	178,480	179,410	180,350	181,310	182,280	183,250	184,240	185,230	186,220	187,210	188,200	189,180	194,030
64	168,230	173,170	174,110	175,040	175,980	176,920	177,870	178,830	179,800	180,800	181,810	182,830	183,870	184,910	185,950	187,000	188,040	189,080	190,110	191,130	192,160	193,180	198,280
65	170,810	175,720	176,690	177,670	178,670	179,680	180,720	181,770	182,840	183,920	185,010	186,100	187,190	188,280	189,370	190,450	191,520	192,590	193,670	194,740	195,810	196,880	202,220
66	173,020	178,030	179,060	180,120	181,200	182,300	183,410	184,530	185,670	186,810	187,940	189,070	190,190	191,300	192,420	193,530	196,450	195,760	196,880	197,990	199,100	200,220	205,770
67	174,930	180,150	181,260	182,390	183,550	184,700	185,870	187,040	188,210	189,370	190,530	191,680	192,830	193,980	195,130	196,280	197,430	198,580	199,730	200,870	202,020	203,170	208,910
68	177,530	182,900	184,020	185,150	186,290	187,430	188,570	189,700	190,830	191,950	193,070	194,190	195,310	196,440	197,560	198,690	199,870	201,050	202,230	203,410	204,590	205,770	211,660
69	180,080	185,800	186,970	188,140	189,310	190,470	191,620	192,770	193,930	195,080	196,240	197,400	198,550	199,710	200,860	202,020	203,180	204,330	205,490	206,640	207,800	208,960	214,750
70	182,550	188,520	189,710	190,900	192,080	193,260	194,450	195,630	196,820	198,000	199,180	200,370	201,550	202,740	203,930	205,110	206,300	207,480	208,670	209,860	211,050	212,230	218,180
71	184,890	190,990	192,200	193,410	194,620	195,830	197,040	198,250	194,460	200,670	201,880	203,100	204,310	205,520	206,730	207,950	209,160	210,380	211,590	212,810	214,020	215,240	221,320
72	187,080	193,250	194,480	195,710	196,950	198,180	199,410	200,640	201,880	203,110	204,350	205,580	206,820	208,050	209,290	210,530	211,770	213,000	214,240	215,480	216,720	217,960	224,110
73	189,110	195,360	196,610	197,860	199,120	200,370	201,620	202,870	204,120	205,380	206,630	207,880	209,140	210,390	211,650	212,900	214,160	215,420	216,670	217,930	219,190	220,450	226,670
74	190,880	197,240	198,510	199,780	201,060	202,320	203,600	204,870	206,150	207,420	208,700	209,970	211,250	212,520	213,800	215,070	216,350	217,630	218,910	220,180	221,450	222,710	229,100

NOTE.
Nomenclature used in table has the following meanings:

C – Closed gate
2.5 – Upper leaf raised 2.5 feet
6.0 - Upper leaf raised 6.0 feet
U – Upper leaf removed
15.5 - lower leaf raised 15.5 feet
B - Bottom gate leaf removed
UT - Upper leaf of trash gate removed
T - Lower leaf of trash gate removed

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

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GATE OPERATING SCHEDULE
AND SPILLWAY DISCHARGE

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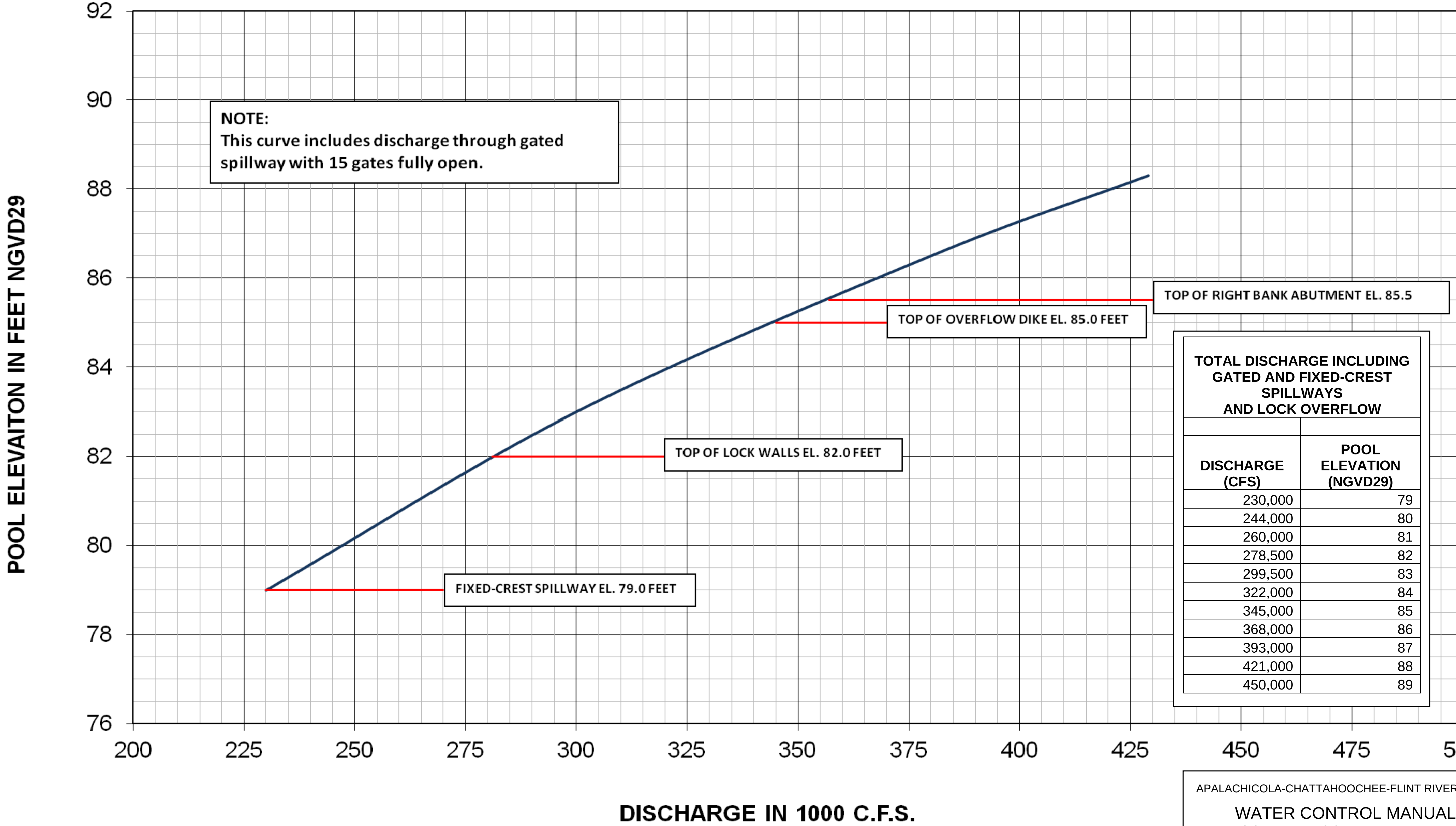

TOTAL DISCHARGE INCLUDING GATED AND FIXED-CREST SPILLWAYS AND LOCK OVERFLOW

DISCHARGE (CFS)	POOL ELEVATION (NGVD29)
230,000	79
244,000	80
260,000	81
278,500	82
299,500	83
322,000	84
345,000	85
368,000	86
393,000	87
421,000	88
450,000	89

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

DISCHARGE CURVE
GATED AND FIXED-CREST SPILLWAYS, LOCK, OVERFLOW DIKE AND ABUTMENT

GENERATOR OUTPUT IN MEGAWATTS	GROSS HEAD IN FEET																													
	6	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	8	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9
	TURBINE DISCHARGE IN CUBIC FEET PER SECOND																													
0.25	2900	2720	2540	2360	2180	2000	1860	1750	1650	1570	1520	1470	1440	1410	1390	1365	1345	1320	1300	1285	1260	1249	1238	1227	1216	1205	1194	1183	1172	1161
0.5											3000	2870	2720	2570	2440	2300	2180	2070	1980	1910	1840	1812	1784	1756	1728	1700	1672	1644	1616	1588
0.75											6750	6375	6000	5625	5250	4875	4500	4125	3750	3375	3000	2909	2818	2727	2636	2545	2454	2363	2272	2181
1																					4800	4560	4350	4150	3900	3760	3580	3420	3260	3120

GENERATOR OUTPUT IN MEGAWATTS	GROSS HEAD IN FEET																													
	9	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	10	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9	11	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.8	11.9
	TURBINE DISCHARGE IN CUBIC FEET PER SECOND																													
1	3000	2885	2780	2690	2610	2545	2480	2430	2375	2325	2280	2235	2195	2160	2120	2080	2050	2020	1990	1960	1930	1910	1895	1875	1860	1845	1830	1820	1805	1795
2											6200	5900	5600	5310	5030	4750	4450	4160	3950	3810	3690	3600	3525	3455	3390	3320	3260	3200	3140	3085

GENERATOR OUTPUT IN MEGAWATTS	GROSS HEAD IN FEET																													
	12	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	13	13.1	13.2	13.3	13.4	13.5	13.6	13.7	13.8	13.9	14	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9
	TURBINE DISCHARGE IN CUBIC FEET PER SECOND																													
1	1790	1775	1760	1745	1730	1715	1700	1685	1670	1655	1640	1626	1612	1598	1584	1570	1556	1542	1528	1514	1500	1487	1474	1461	1448	1435	1422	1409	1396	1383
2	3030	2975	2930	2885	2850	2810	2780	2750	2720	2695	2670	2650	2625	2605	2580	2560	2540	2520	2500	2480	2460	2441	2422	2403	2384	2365	2346	2327	2308	2289
3	5650	5490	5350	5200	5030	4880	4720	4550	4390	4230	4070	3980	3900	3840	3785	3730	3680	3640	3595	3560	3528	3486	3447	3411	3377	3346	3317	3290	3265	3242
4											8250	7870	7520	7180	6880	6580	6300	6030	5800	5580	5400	5230	5085	4960	4840	4740	4650	4580	4520	4480

GENERATOR OUTPUT IN MEGAWATTS	GROSS HEAD IN FEET																													
	15	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	16	16.1	16.2	16.3	16.4	16.5	16.6	16.7	16.8	16.9	17	17.1	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.9
	TURBINE DISCHARGE IN CUBIC FEET PER SECOND																													
1	1370	1363	1356	1349	1342	1335	1328	1321	1314	1307	1300	1295	1290	1285	1280	1275	1270	1265	1260	1255	1250	1245	1240	1235	1230	1225	1220	1215	1210	1205
2	2270	2257	2243	2229	2215	2202	2189	2176	2164	2152	2140	2128	2116	2104	2092	2080	2068	2057	2046	2035	1990	1981	1972	1963	1954	1945	1936	1927	1918	1909
3	3220	3207	3192	3177	3160	3143	3125	3107	3088	3068	3048	3024	3002	2979	2958	2937	2917	2897	2877	2858	2840	2824	2807	2790	2773	2757	2740	2723	2706	2689
4	4440	4388	4344	4302	4260	4220	4180	4142	4104	4068	4032	3993	3957	3922	3890	3859	3830	3803	3777	3752	3728	3712	3695	3677	3657	3636	3615	3592	3569	3545
5	7630	7380	7130	6880	6640	6420	6200	6000	5805	5640	5480	5360	5255	5160	5070	5000	4940	4895	4860	4840	4824	4778	4733	4689	4647	4606	4566	4527	4489	4452
6											9750	9400	9080	8760	8440	8140	7850	7590	7340	7105	6880	6670	7480	6300	6130	5990	5860	5745	5640	5550

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
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RATING TABLE FOR ONE TURBOGENERATING UNIT

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GENERATOR OUTPUT IN MEGAWATTS	GROSS HEAD IN FEET																													
	18	18.1	18.2	18.3	18.4	18.5	18.6	18.7	18.8	18.9	19	19.1	19.2	19.3	19.4	19.5	19.6	19.7	19.8	19.9	20	20.1	20.2	20.3	20.4	20.5	20.6	20.7	20.8	20.9
	TURBINE DISCHARGE IN CUBIC FEET PER SECOND																													
1	1200	1195	1191	1186	1182	1178	1173	1168	1164	1160	1155	1150	1146	1142	1137	1132	1128	1124	1119	1114	1110	1106	1101	1097	1092	1088	1084	1079	1075	1070
2	1900	1891	1882	1873	1864	1855	1846	1837	1828	1819	1810	1801	1792	1783	1774	1765	1756	1747	1738	1729	1720	1712	1704	1696	1688	1680	1672	1664	1656	1648
3	2672	2654	2636	2619	2603	2587	2571	2556	2541	2526	2512	2498	2484	2471	2458	2445	2432	2420	2408	2396	2384	2374	2364	2353	2342	2331	2319	2306	2294	2281
4	3520	3491	3464	3437	3410	3384	3359	3334	3310	3287	3264	3241	3210	3197	3176	3156	3136	3116	3097	3078	3060	3045	3029	3013	2996	2979	2961	2943	2925	2907
5	4416	4383	4350	4317	4285	4253	4221	4189	4158	4127	4096	4064	4033	4003	3973	3944	3916	3888	3861	3834	3808	3785	3762	3739	3715	3690	3665	3640	3615	3589
6	5480	5400	5330	5270	5210	5160	5110	5070	5035	5005	4992	4947	4903	4861	4819	4779	4740	4701	4664	4628	4592	4560	4527	4495	4463	4431	4398	4366	4335	4303
7	8680	8400	8110	7830	7570	7330	7100	6885	6670	6455	6256	6162	6072	5987	5906	5829	5755	5685	5619	5556	5496	5441	5389	5338	5290	5243	5198	5154	5112	5071
8											10800	10380	9960	9580	9200	8870	8550	8245	7950	7670	7448	7265	7094	6935	6787	6651	6524	6407	6299	6199
9																					14500	13250	12220	11400	10750	10170	9710	9360	9065	8800
GENERATOR OUTPUT IN MEGAWATTS	GROSS HEAD IN FEET																													
	21	21.1	21.2	21.3	21.4	21.5	21.6	21.7	21.8	21.9	22	22.1	22.2	22.3	22.4	22.5	22.6	22.7	22.8	22.9	23	23.1	23.2	23.3	23.4	23.5	23.6	23.7	23.8	23.9
	TURBINE DISCHARGE IN CUBIC FEET PER SECOND																													
1	1066	1062	1057	1053	1048	1044	1040	1035	1031	1026	1022	1018	1013	1009	1004	1000	996	991	987	982	978	974	969	965	960	956	952	947	943	938
2	1640	1633	1626	1619	1612	1605	1598	1591	1584	1577	1570	1564	1557	1550	1544	1538	1531	1524	1518	1512	1505	1498	1492	1485	1479	1472	1466	1460	1453	1446
3	2268	2256	2244	2231	2219	2206	2193	2179	2165	2151	2136	2123	2111	2099	2088	2077	2066	2056	2046	2037	2025	2016	2008	2000	1991	1982	1974	1966	1957	1948
4	2888	2866	2845	2825	2806	2788	2770	2754	2738	2723	2708	2697	2685	2673	2660	2648	2635	2623	2610	2597	2584	2570	2556	2542	2529	2517	2505	2493	2482	2471
5	3564	3535	3507	3480	3455	3431	3408	3385	3364	3344	3324	3307	3290	3273	3256	3240	3224	3208	3192	3176	3160	3145	3129	3114	3099	3084	3070	3055	3040	3026
6	4272	4239	4207	4175	4145	4116	4088	4061	4034	4009	3984	3961	3938	3916	3894	3872	3851	3830	3809	3788	3768	3748	3728	3708	3689	3670	3651	3633	3615	3597
7	5032	4997	4962	4928	4894	4860	4826	4793	4760	4728	4696	4663	4631	4600	4570	4541	4512	4484	4457	4430	4404	4378	4353	4329	4306	4283	4260	4239	4217	4196
8	6108	6039	5972	5907	5844	5783	5724	5667	5612	5559	5508	5456	5407	5360	5316	5273	5232	5194	5157	5122	5088	5059	5030	5002	4974	4946	4919	4892	4865	4838
9	8552	8309	8082	7871	7674	7492	7324	7168	7025	6893	6772	6677	6586	6499	6417	6339	6264	6193	6125	6061	6000	5942	5887	5835	5786	5739	5694	5651	5611	5573
10											11000	10600	10210	9840	9480	9160	8840	8550	8275	8040	7816	7685	7559	7439	7322	7211	7104	7002	6904	6810
11																					11900	11575	11240	10920	10620	10330	10050	9785	9525	9285

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WATER CONTROL MANUAL
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RATING TABLE FOR ONE TURBOGENERATING UNIT

GENERATOR OUTPUT IN MEGAWATTS	GROSS HEAD IN FEET																													
	24	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.8	24.9	25	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	26	26.1	26.2	26.3.	26.4	26.5	26.6	26.7	26.8	26.9
	TURBINE DISCHARGE IN CUBIC FEET PER SECOND																													
1	934	930	925	921	916	912	908	903	899	894	890	888	887	885	884	882	880	879	877	876	874	872	871	869	868	866	864	863	861	860
2	1440	1434	1429	1424	1418	1412	1407	1402	1396	1390	1385	1381	1377	1373	1369	1365	1361	1357	1353	1349	1345	1340	1336	1331	1327	1322	1318	1314	1309	1304
3	1940	1933	1926	1919	1912	1905	1898	1891	1884	1877	1870	1864	1858	1852	1846	1840	1834	1828	1822	1816	1810	1803	1796	1789	1782	1775	1768	1761	1754	1747
4	2460	2449	2439	2429	2419	2410	2401	2393	2384	2376	2368	2363	2357	2350	2343	2335	2326	2317	2308	2298	2288	2275	2262	2250	2239	2229	2219	2209	2200	2192
5	3012	2997	2982	2968	2955	2942	2929	2916	2904	2892	2880	2871	2861	2850	2839	2828	2817	2805	2793	2780	2768	2753	2739	2726	2713	2700	2688	2676	2665	2654
6	3580	3564	3548	3532	3516	3500	3483	3466	3450	3433	3416	3397	3379	3362	3345	3329	3313	3298	3284	3270	3256	3244	3232	3220	3208	3195	3183	3170	3158	3145
7	4176	4157	4138	4119	4100	4081	4062	4044	4025	4006	3988	3971	3954	3937	3919	3900	3881	3862	3843	3824	3804	3781	3758	3737	3717	3699	3680	3663	3647	3631
8	4812	4785	4759	4733	4708	4683	4659	4636	4613	4590	4568	4548	4528	4507	4487	4466	4445	4424	4402	4381	4360	4337	4315	4293	4271	4251	4230	4210	4190	4171
9	5536	5506	5476	5446	5416	5386	5355	5325	5295	5266	5236	5204	5173	5143	5114	5086	5058	5032	5006	4981	4956	4931	4912	4890	4868	4845	4822	4799	4775	4752
10	6720	6631	6456	6467	6392	6322	6256	6193	6135	6080	6028	5986	5945	5904	5864	5825	5786	5747	5710	5672	5636	5508	5561	5526	5492	5459	5427	5396	5366	5336
11	9048	8831	8626	8433	8252	8083	7924	7775	7636	7505	7384	7283	7185	7092	7002	6915	6832	6752	6676	6602	6532	6462	6395	6332	6273	6218	6165	6116	6069	5025
12											10500	10230	9970	9720	9490	9260	9025	8800	8600	8420	8248	8144	8043	7942	7844	7748	7653	7560	7469	7379

GENERATOR OUTPUT IN MEGAWATTS	GROSS HEAD IN FEET																													
	27	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9	28	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9	29	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9
	TURBINE DISCHARGE IN CUBIC FEET PER SECOND																													
1	858	856	855	853	852	850	848	847	845	844	842	840	839	837	836	83.4	832	831	829	828	826	824	823	821	820	818	816	815	813	812
2	1300	1296	1293	1290	1286	1282	1279	1276	1272	1268	1265	1261	1257	1253	1259	1245	1241	1237	1233	1229	1225	1222	1219	1216	1213	1210	1207	1204	1201	1198
3	1740	1735	1730	1725	1720	1715	1710	1705	1700	1695	1690	1685	1680	1675	1670	1665	1660	1655	1650	1645	1640	1635	1630	1625	1620	1615	1610	1605	1600	1595
4	2184	2175	2166	2158	2150	2143	2137	2131	2127	2123	2120	2114	2108	2103	2097	2090	2084	2078	2071	2064	2058	2052	2046	2040	2034	2028	2022	2016	2010	2004
5	2644	2635	2627	2618	2609	2600	2590	2581	2571	2562	2552	2541	2530	2520	2510	2501	2492	2484	2475	2468	2460	2454	2448	2441	2435	2428	2421	2414	2407	2399
6	3132	3119	3107	3094	3081	3068	3055	3042	3030	3017	3004	2990	2977	2964	2951	2939	2928	2916	2905	2894	2884	2874	2865	2856	2846	2837	2828	2819	2810	2801
7	3616	3605	3593	3580	3567	3554	3541	3527	3513	3499	3484	3468	3453	3438	3423	3408	3393	3378	3364	3350	3336	3322	3308	3294	3281	3268	3255	3243	3231	3219
8	4152	4136	4119	4102	4084	4066	4048	4029	4010	3991	3972	3950	3929	3908	3889	3871	3853	3836	3819	3803	3788	3775	3762	3749	3736	3723	3709	3696	3683	3669
9	4728	4704	4681	4657	4633	4610	4586	4562	4539	4515	4492	4467	4443	4420	4398	4376	4355	4334	4314	4295	4276	4258	4241	4224	4207	4190	4174	4158	4142	4127
10	5308	5284	5260	5235	5210	5184	5158	5132	5105	5079	5052	5022	4993	4965	4938	4912	4887	4863	4840	4818	4796	4777	4757	4738	4719	4700	4682	4663	4644	4626
11	5984	5951	5919	5886	5854	5821	5788	5756	5724	5692	5660	5626	5593	5561	5530	5500	5471	5443	5416	5390	5364	5342	5320	5297	5274	5252	5228	5205	5182	5159
12	7292	7208	7125	7044	6965	6887	6811	6737	6666	6596	6528	6454	6384	6320	6260	6204	6152	6104	6060	6018	5980	5950	5921	5893	5865	5838	5812	5786	5761	5736
13	9550	9425	9300	9180	9060	8945	8830	8715	8600	8490	8380	8286	8195	8107	8022	7939	7859	7782	7707	7634	7564	7496	7430	7366	7305	7245	7187	7131	7076	7023
14																					10250	10165	10085	10005	9925	9850	9775	9705	9630	9565

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL

JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

RATING TABLE FOR ONE TURBOGENERATING UNIT

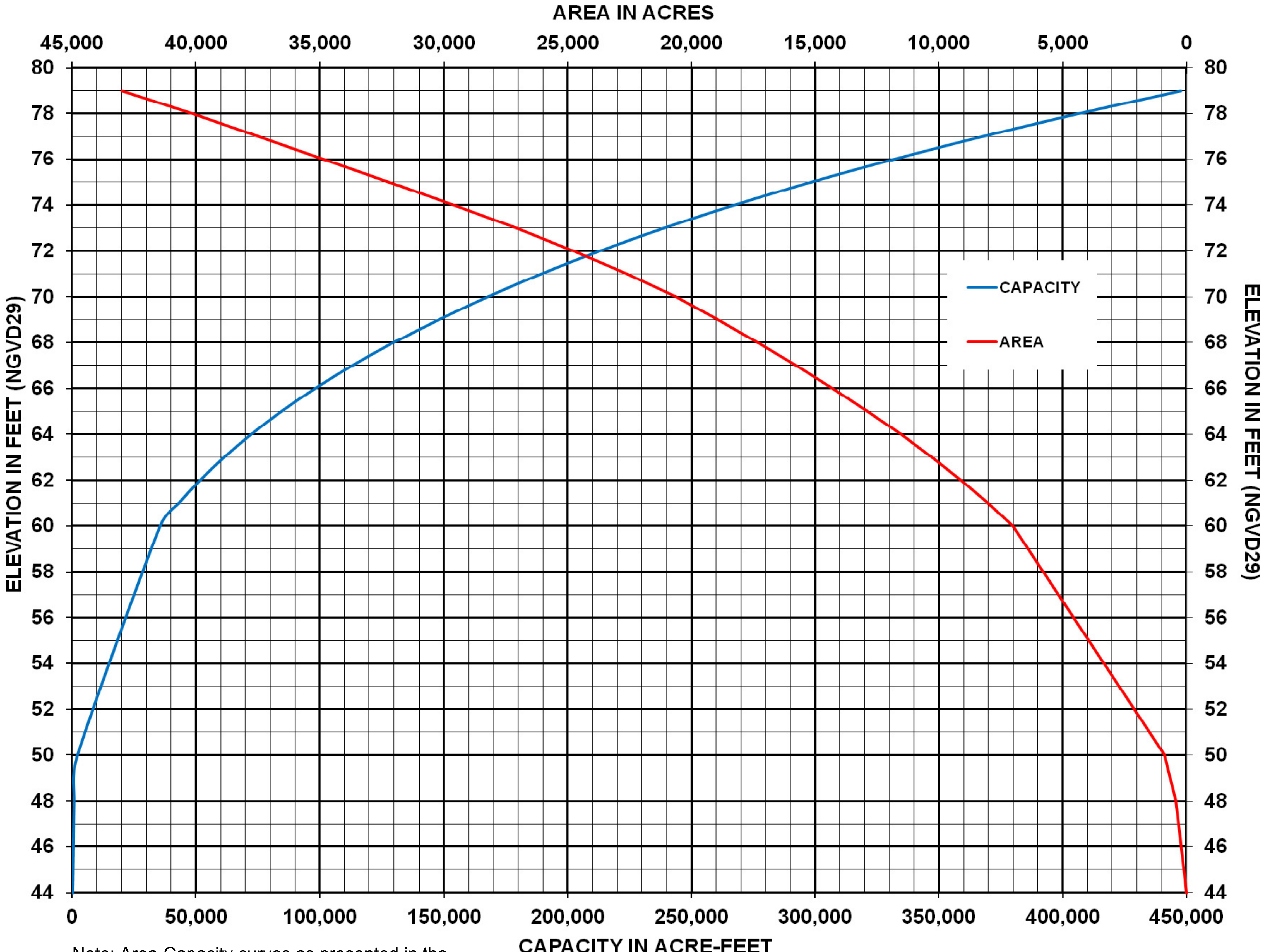
PAGE 3 OF 4

GENERATOR OUTPUT IN MEGAWATTS	GROSS HEAD IN FEET																														
	30	30.1	30.2	30.3	30.4	30.5	30.6	30.7	30.8	30.9	31	31.1	31.2	31.3	31.4	31.5	31.6	31.7	31.8	31.9	32	32.1	32.2	32.3	32.4	32.5	32.6	32.7	32.8	32.9	33
	TURBINE DISCHARGE IN CUBIC FEET PER SECOND																														
1	810	808	805	803	801	798	796	794	792	789	787	785	782	780	777	775	773	770	768	765	763	761	758	756	754	752	749	747	745	742	740
2	1195	1192	1189	1186	1183	1180	1177	1174	1171	1168	1165	1162	1158	1154	1151	1148	1144	1140	1137	1134	1130	1127	1124	1121	1118	1115	1112	1109	1106	1103	1100
3	1590	1585	1580	1575	1570	1565	1560	1555	1550	1545	1540	1536	1532	1528	1524	1520	1516	1512	1508	1504	1500	1496	1492	1488	1484	1480	1476	1472	1468	1464	1460
4	1998	1993	1987	1981	1975	1969	1963	1957	1951	1945	1939	1933	1927	1921	1915	1909	1903	1897	1891	1885	1880	1874	1868	1862	1856	1850	1844	1838	1832	1826	1820
5	2392	2384	2377	2369	2361	2354	2346	2339	2331	2323	2316	2309	2301	2294	2287	2280	2273	2267	2260	2254	2248	2242	2236	2231	2226	2221	2216	2212	2207	2204	2200
6	2792	2783	2775	2766	2758	2750	2741	2733	2724	2716	2708	2700	2692	2684	2677	2669	2661	2654	2647	2639	2632	2625	2618	2612	2606	2600	2594	2588	2582	2577	2572
7	3208	3197	3187	3176	3165	3155	3145	3134	3124	3114	3104	3094	3085	3075	3066	3056	3046	3037	3027	3018	3009	2999	2990	2981	2972	2963	2954	2946	2937	2928	2919
8	3656	3642	3628	3614	3601	3588	3575	3563	3551	3540	3528	3516	3504	3493	3482	3471	3460	3449	3439	3429	3420	3409	3399	3388	3377	3366	3355	3343	3332	3320	3308
9	4112	4097	4082	4068	4054	4040	4026	4012	3999	3985	3972	3959	3946	3933	3920	3907	3895	3882	3869	3857	3844	3831	3818	3806	3793	3779	3766	3753	3739	3726	3712
10	4608	4590	4572	4554	4536	4519	4502	4485	4469	4452	4436	4420	4404	4388	4373	4357	4342	4327	4313	4298	4284	4270	4255	4241	4227	4213	4199	4185	4171	4158	4145
11	5136	5109	5084	5060	5037	5015	4994	4974	4956	4937	4920	4901	4882	4865	4848	4832	4816	4802	4788	4776	4764	4748	4732	4716	4699	4681	4663	4643	4623	4062	4580
12	5712	5690	5668	5645	5623	5600	5577	5554	5531	5507	5484	5462	5439	5417	5394	5371	5348	5325	5301	5277	5252	5230	5207	5185	5163	5142	5121	5100	5080	5060	5040
13	6972	6925	6879	6833	6787	6743	6698	6655	6612	6570	6528	6489	6450	6412	6375	6338	6301	6265	6228	6192	6156	6124	6092	6062	6033	6005	5977	5951	5926	5903	5882
14	9500	9445	9395	9340	9290	9230	9180	9120	9060	9000	8940	8869	8799	8730	8662	8595	8529	8464	8399	8335	8272	8209	8147	8086	8026	7967	7909	7852	7796	7741	7686

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

RATING TABLE FOR ONE TURBOGENERATING UNIT



Note: Area-Capacity curves as presented in the 1957 Jim Woodruff water control manual.

Area-Capacity Table

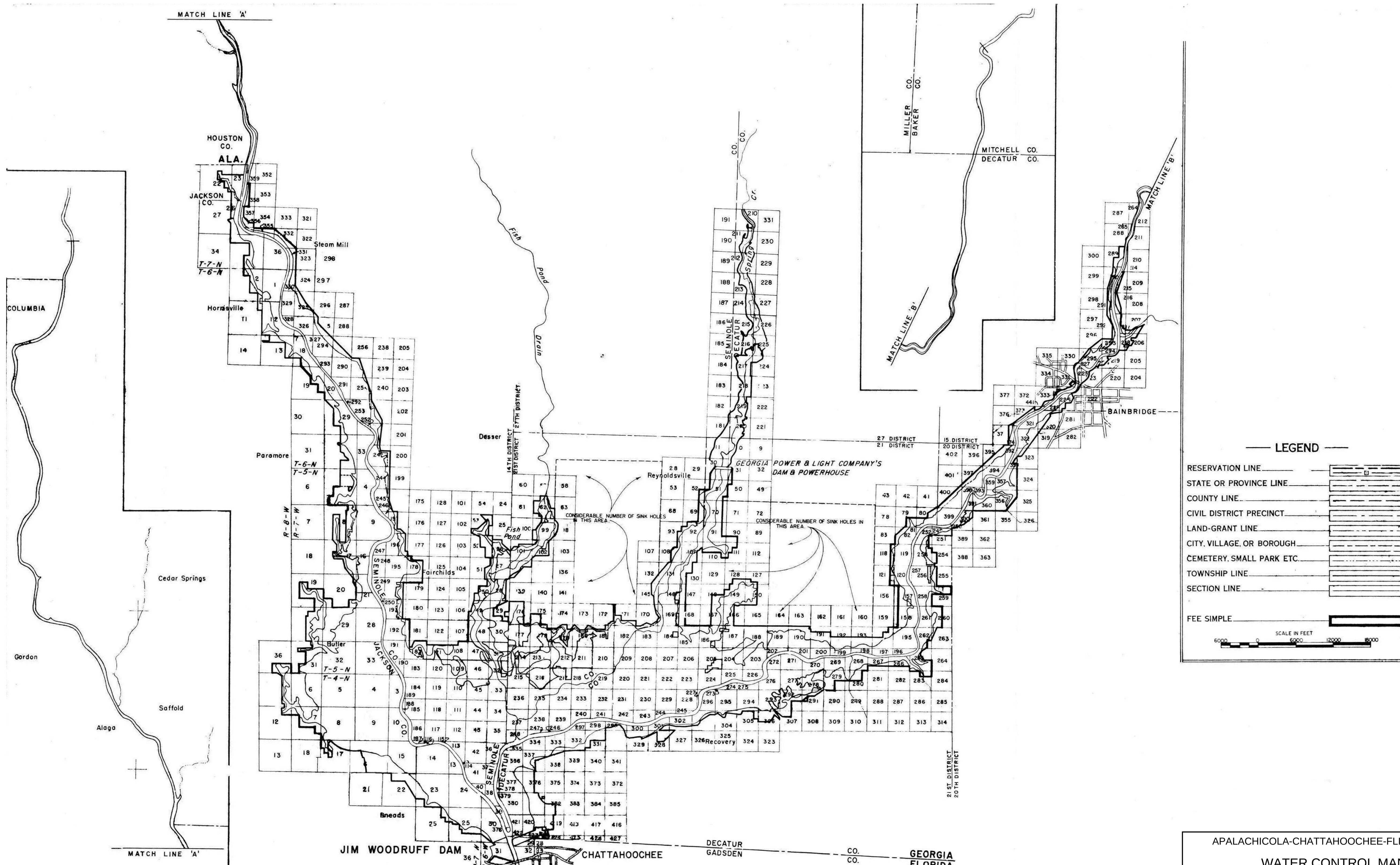
Elevation (feet, NGVD29)	Area (acres)	Capacity (acre-feet)
44	0	0
48*	433	682
50	880	1,967
60	7,009	35,368
61	8,030	42,881
62	9,127	51,453
63	10,300	61,160
64	11,549	72,078
65	12,874	84,283
66	14,275	97,851
67	15,752	112,859
68	17,305	129,381
69	18,937	147,495
70	20,650	167,282
71	22,620	188,898
72	24,750	212,565
73	27,060	238,449
74	29,580	266,748
75	32,200	297,633
76	34,840	331,153
77**	37,500	367,318
78	40,200	406,163
79***	42,980	447,738

* Crest of gates spillway
** Normal operating pool level
*** Crest of free-overflow spillway

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

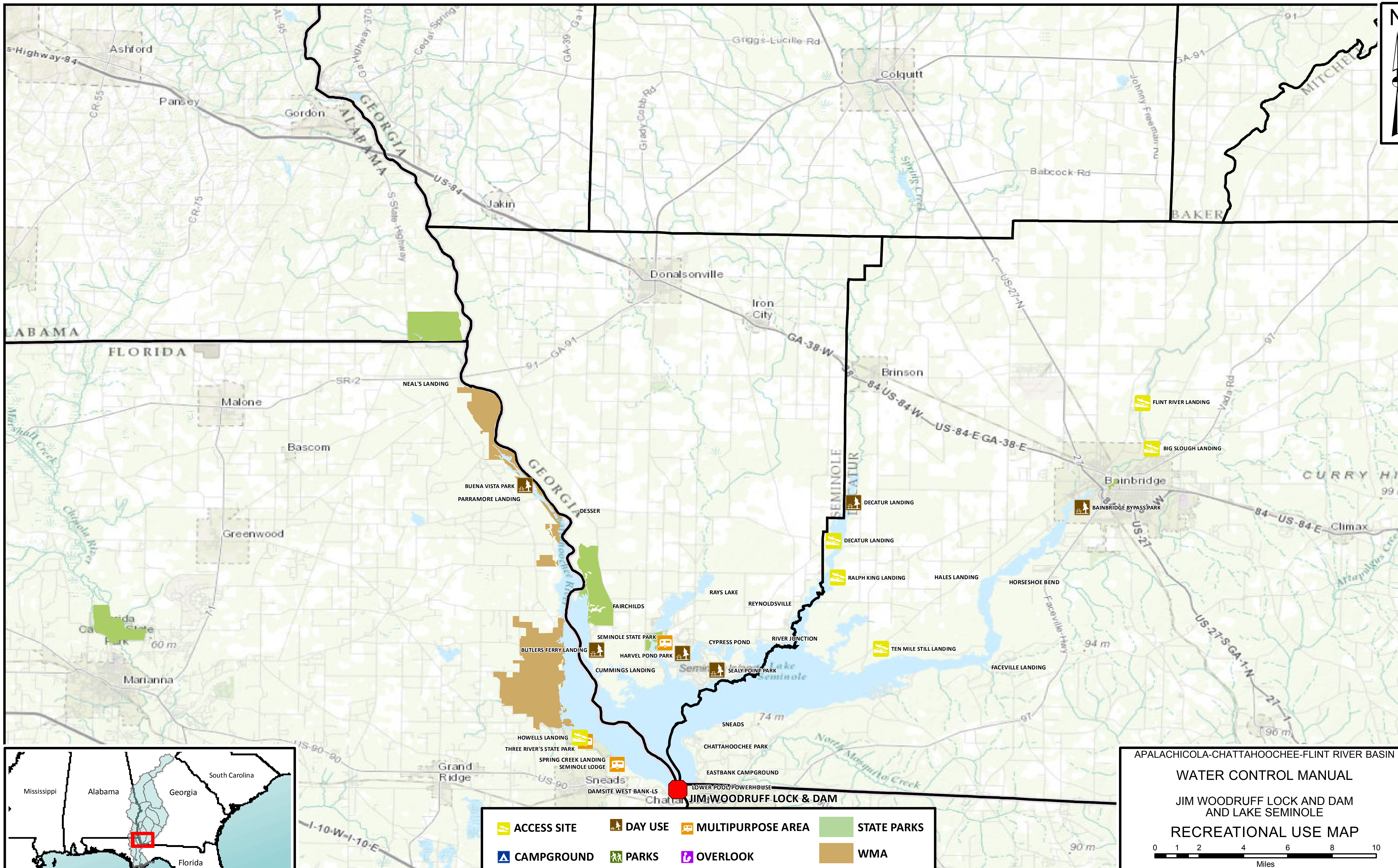
AREA CAPACITY CURVES AND TABLE

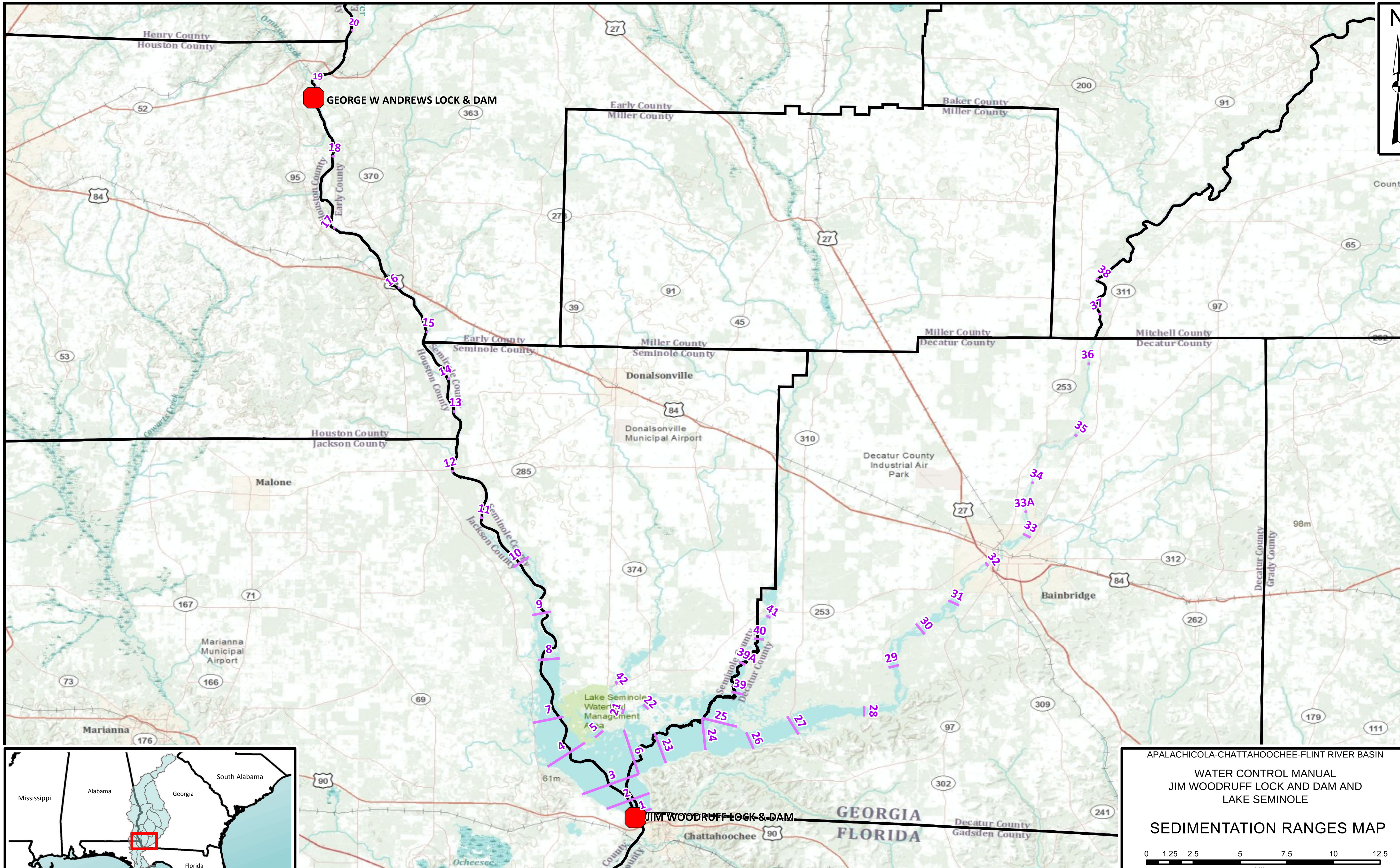


APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

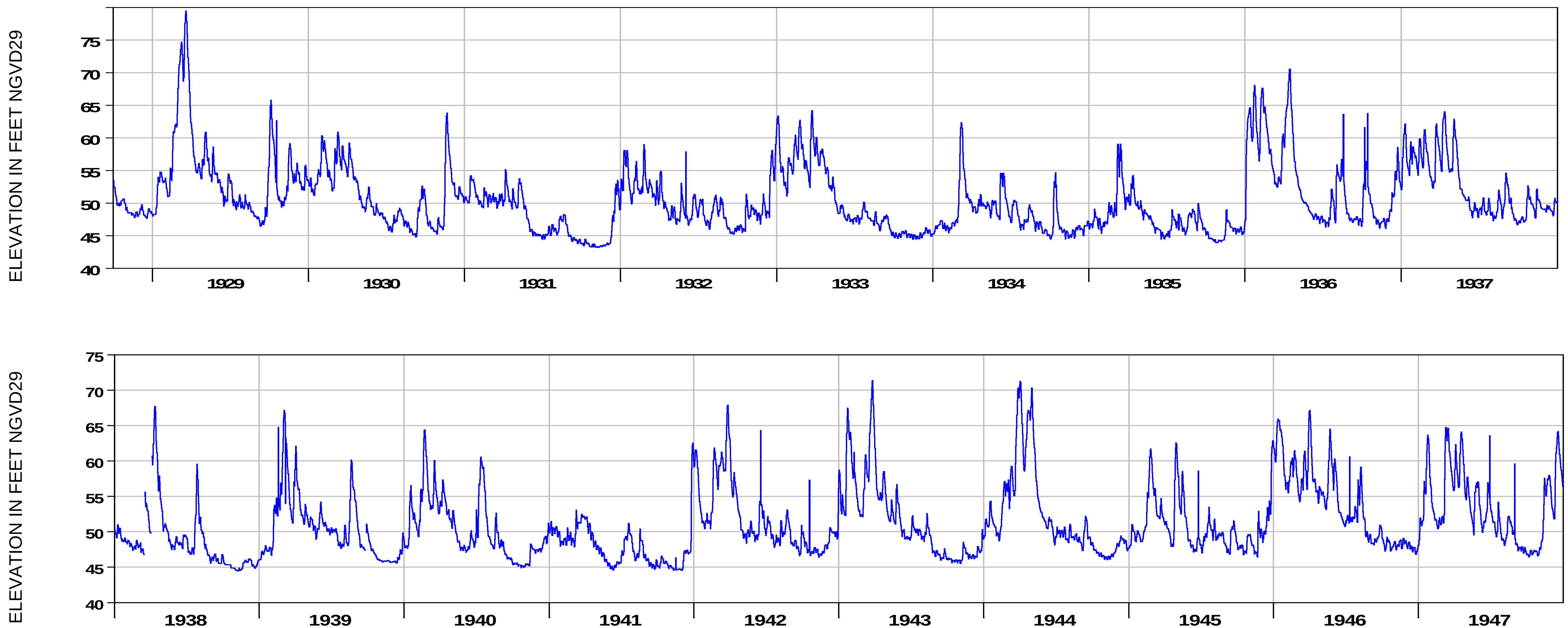
WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND
LAKE SEMINOLE

REAL ESTATE ACQUISITION AREAS


APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN
WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM
AND LAKE SEMINOLE
RECREATIONAL USE MAP
0 1 2 4 6 8 10
Miles
ACCESS SITE
DAY USE
MULTIPURPOSE AREA
STATE PARKS
CAMPGROUND
PARKS
OVERLOOK
WMA
N
JIM WOODRUFF LOCK & DAM
LOWER POOL/POWERHOUSE
DAMSITE WEST BANK-LS
EASTBANK CAMPGROUND
CHATTAHOOCHEE PARK
SNEADS
SPRING CREEK LANDING
SEMINOLE LODGE
HOWELLS LANDING
THREE RIVER'S STATE PARK
CUMMINGS LANDING
BUTLERS FERRY LANDING
SEMINOLE STATE PARK
HARVEL POND PARK
SEALY POINT PARK
CYPRESS POND
RIVER JUNCTION
FAIRCHILDS
RAYS LAKE
REYNOLDSVILLE
DESSER
BUENA VISTA PARK
PARRAMORE LANDING
NEAL'S LANDING
DECATUR LANDING
RALPH KING LANDING
HALES LANDING
HORSESHOE BEND
TEN MILE STILL LANDING
FACEVILLE LANDING
BAINBRIDGE BYPASS PARK
FLINT RIVER LANDING
BIG SLOUGH LANDING
Lake Seminole
Ashford
Pansey
Gordon
Jakin
Colquitt
Donalsonville
Iron City
Brinson
Bainbridge
Climax
Malone
Bascom
Greenwood
Marianna
Grand Ridge
Sneads
GEORGIA
ALABAMA
FLORIDA
SEMINOLE
DECATUR
BAKER
MITCHELL
Mississippi
Alabama
Georgia
South Carolina
Florida



GEORGE W ANDREWS LOCK & DAM
JIM WOODRUFF LOCK & DAM
Henry County
Houston County
Early County
Miller County
Baker County
Seminole County
Jackson County
Decatur County
Mitchell County
Grady County
Gadsden County
Donalsonville
Donalsonville Municipal Airport
Decatur County Industrial Air Park
Bainbridge
Malone
Marianna
Marianna Municipal Airport
Chattahoochee
Lake Seminole Waterfowl Management Area
GEORGIA
FLORIDA
Mississippi
Alabama
Georgia
South Alabama
Florida
N
APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN
WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND
LAKE SEMINOLE
SEDIMENTATION RANGES MAP
0 1.25 2.5 5 7.5 10 12.5
Miles



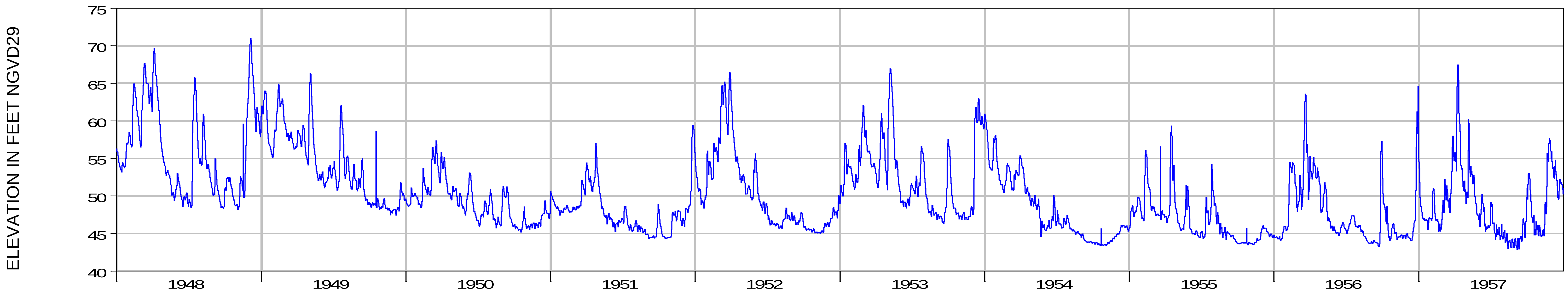
APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

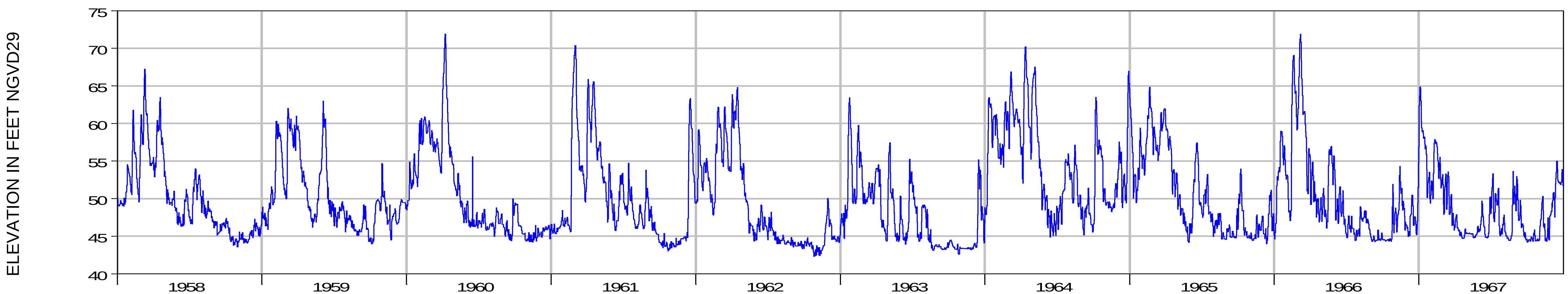
WATER CONTROL MANUAL

JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

HISTORICAL RIVER ELEVATIONS AT CHATTAHOOCHEE, FLORIDA

PAGE 1 OF 5



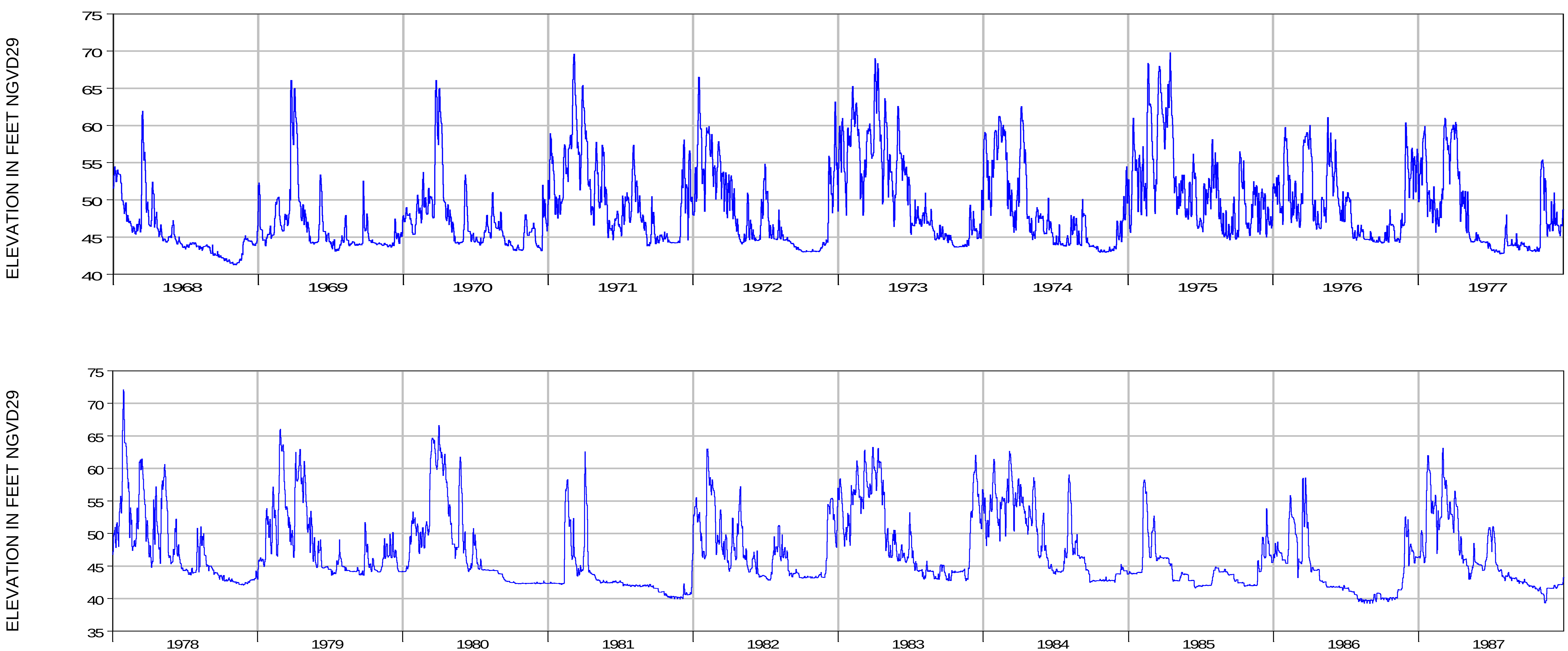


APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

HISTORICAL RIVER ELEVATIONS AT CHATTAHOOCHEE, FLORIDA

PAGE 2 OF 5



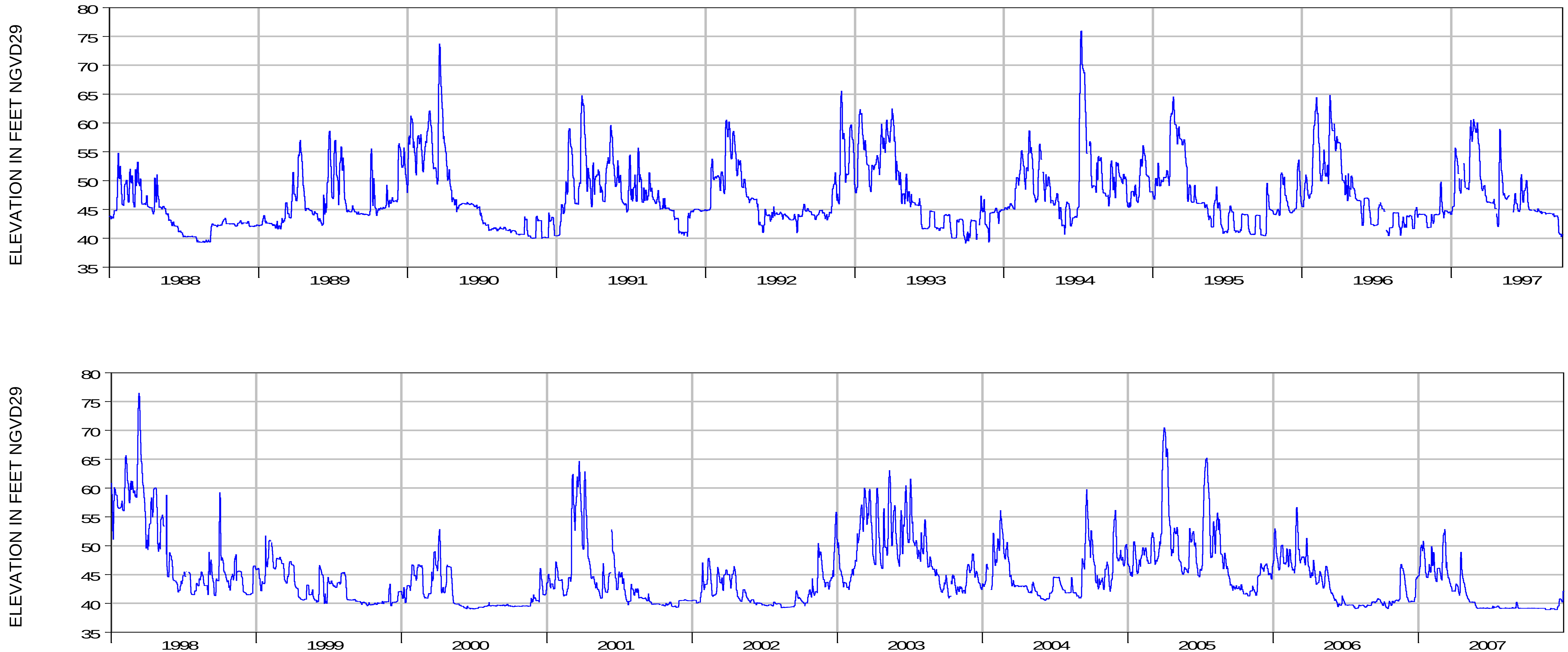
APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL

JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

HISTORICAL RIVER ELEVATIONS AT CHATTAHOOCHEE, FLORIDA

PAGE 3 OF 5



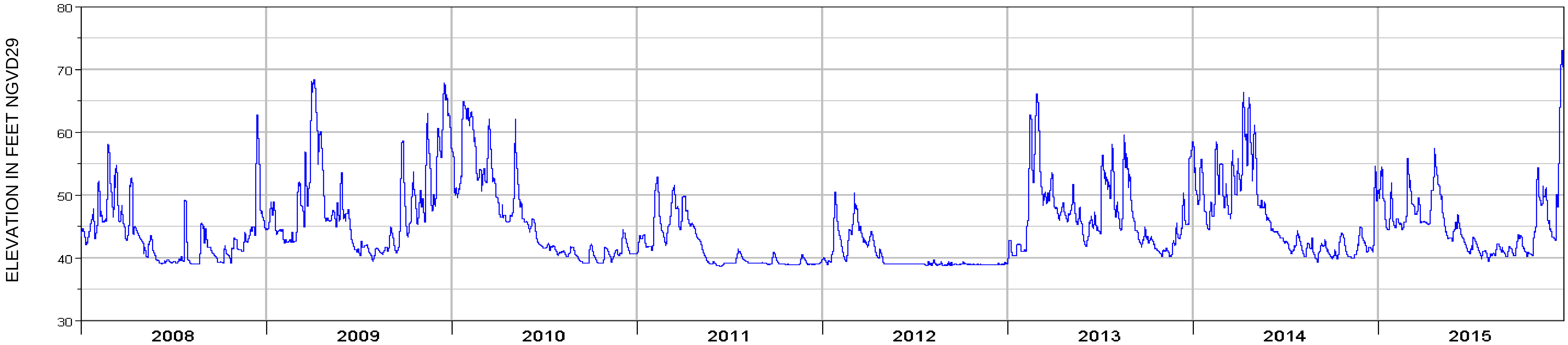
APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL

JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

HISTORICAL RIVER ELEVATIONS AT CHATTAHOOCHEE, FLORIDA

PAGE 4 OF 5



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL

JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

HISTORICAL RIVER ELEVATIONS AT CHATTAHOOCHEE, FLORIDA

PAGE 5 OF 5

	Chattahoochee 02358000 Average Monthly Discharge in cfs Period of Record														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG	MIN	MAX
1922							17965	14632	9562	9211	8467	16462	12716	8467	17965
1923	21884	32325	44861	29487	34397	36437	23890	23852	18723	10909	11520	19406	25641	10909	44861
1924	27255	24714	32500	33063	21719	18847	20923	11849	12910	16155	10350	17506	20649	10350	33063
1925	106977	38725	24732	17627	12155	9560	8556	6204	5163	7371	13087	12344	21875	5163	106977
1926	37342	34018	35352	42903	17429	14753	14584	21226	18383	13106	13483	16316	23241	13106	42903
1927	16148	22204	25568	14567	9640	11319	13697	13187	7946	7185	7200	14103	13564	7185	25568
1928	15548	17648	30406	56330	37968	30267	30268	32526	30607	19552	13797	14174	27424	13797	56330
1929	22813	38375	171632	37240	36242	23847	19442	15819	13788	37510	28203	28145	39421	13788	171632
1930	27171	35039	38616	31423	18565	14340	11282	11786	14911	11561	28990	23419	22259	11282	38616
1931	23432	19989	20210	21803	19584	8898	9010	11592	7235	5980	5524	14870	14011	5524	23432
1932	29055	28659	23487	18980	15752	15473	14674	17526	9827	12395	15370	27348	19046	9827	29055
1933	37090	43011	41055	37987	21400	13810	14358	12188	11383	8111	7888	8906	21432	7888	43011
1934	10748	11234	31042	17737	17490	21200	14729	13443	10030	14199	8658	10584	15091	8658	31042
1935	12023	13854	27455	20687	14503	8905	11031	11685	12670	7056	9299	9688	13238	7056	27455
1936	62468	64917	32765	72170	20077	12860	14026	24600	11710	20848	12160	24787	31116	11710	72170
1937	40600	41100	37345	44217	34545	16497	15758	15358	17633	15377	17823	16890	26095	15358	44217
1938	17365	14186	19219	51150	17671	15277	19145	16095	9610	8180	7714	8670	17023	7714	51150
1939	11772	27200	47613	31250	20974	21810	16835	26558	17520	12371	9127	10166	21100	9127	47613
1940	19365	36479	30245	26527	15400	13057	32052	14658	10367	7184	9716	13403	19038	7184	36479
1941	16755	14511	19058	16750	9840	7148	13984	11123	7562	6973	6387	18740	12403	6387	19058
1942	31813	31361	53100	31960	16603	19663	16374	18003	12920	12174	10953	16468	22616	10953	53100
1943	45084	32800	62777	35247	24248	17057	17277	15181	9753	8413	9960	11010	24067	8413	62777
1944	20223	23852	55535	80703	42545	17380	15629	15348	15547	10574	9647	13432	26701	9647	80703
1945	15668	29968	26658	19363	27713	12493	15587	14977	14580	12348	13953	26684	19166	12348	29968
1946	58513	38468	36368	40923	38123	27670	20642	24123	15080	13023	13197	11929	28171	11929	58513
1947	33065	22525	44655	45217	28639	24883	20029	17226	12003	10374	26447	40842	27159	10374	45217
1948	29545	47331	64935	61137	20316	17537	37855	29255	17100	18245	28230	70394	36823	17100	70394
1949	45703	53196	37868	36310	39197	23040	31168	23642	19717	14174	13283	15229	29377	13283	53196
1950	16052	17954	27035	21610	15513	16093	12013	11358	14387	8985	8788	11728	15126	8788	27035
1951	14281	13207	16258	24283	13570	9547	9921	8129	7304	7225	11157	20541	12952	7225	24283
1952	19032	29248	58865	31777	19939	16930	9268	9862	9708	7205	7230	11600	19222	7205	58865
1953	24335	28021	31832	29697	44977	15633	22661	14187	13431	16968	11210	42903	24655	11210	44977
1954	34665	23261	24394	21497	13250	10863	10699	8188	6092	5319	5990	8798	14418	5319	34665
1955	14052	19432	12781	19333	12208	7892	12446	10923	6850	5499	5909	7991	11276	5499	19432

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND
LAKE SEMINOLE

AVERAGE MONTHLY FLOWS
CHATTAHOOCHEE, FLORIDA

Chattahoochee 02358000 Average Monthly Discharge in cfs Period of Record															
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG	MIN	MAX
1956	7262	20801	27681	24113	13561	8594	10153	7721	10537	11268	7682	16369	13812	7262	27681
1957	14472	13352	22719	39857	23984	12633	10225	7008	8567	14607	19001	23974	17533	7008	39857
1958	19726	29321	46223	39413	18558	14360	19855	15161	10585	9589	9011	11310	20259	9011	46223
1959	17023	37464	44006	30810	18858	31903	15771	12715	12330	15591	16564	16971	22501	12330	44006
1960	26703	48455	39774	65573	20481	13793	13110	13584	11976	13188	10162	11596	24033	10162	65573
1961	12687	32796	47439	57157	29448	20033	20339	16248	14096	8345	8707	29267	24714	8345	57157
1962	32429	30896	42055	50487	17752	14920	12619	10294	9514	9228	10478	12558	21102	9228	50487
1963	28168	30789	23865	20913	20410	17889	17661	12211	8841	9217	9152	18898	18168	8841	30789
1964	51990	48717	64923	71313	53258	16817	26006	27884	17683	38497	21600	41326	40001	16817	71313
1965	38935	52418	50703	39250	17277	26317	20290	14306	13100	17313	13080	16026	26585	13080	52418
1966	33435	57782	72671	24010	27745	20983	13535	16116	11573	12816	20137	17284	27341	11573	72671
1967	45629	35729	23916	14280	13423	15960	20626	16390	18387	12439	16657	29881	21943	12439	45629
1968	29774	17076	30313	18957	13394	11960	11239	10744	9125	7773	8860	12858	15173	7773	30313
1969	15742	18943	24329	30237	21135	13423	10993	12874	13977	12665	11227	13406	16579	10993	30237
1970	17955	23518	40300	37553	13035	17703	13258	17077	12967	10392	15530	14892	19515	10392	40300
1971	31000	38500	67348	34603	30500	16070	20732	25335	14277	12923	12150	31410	27904	12150	67348
1972	43103	41641	32139	19693	14677	17280	17010	13190	10413	9757	10421	33668	21916	9757	43103
1973	46526	59332	44484	70503	38148	39463	18097	18342	13667	11729	12687	17019	32500	11729	70503
1974	42742	58879	25823	41727	18455	15787	11916	14806	14763	10548	10430	20268	23845	10430	58879
1975	37700	53893	65071	69543	26697	27620	26994	29100	16587	27468	23190	21923	35482	16587	69543
1976	31845	33579	38916	28973	36342	28703	20194	13868	12480	14997	18027	42258	26682	12480	42258
1977	39771	22154	53116	37907	14529	11887	9815	12016	11237	10108	25583	18581	22225	9815	53116
1978	49094	42732	46071	25480	36168	17837	11526	19148	11606	9527	8570	9401	23930	8570	49094
1979	20658	41279	45032	55477	26426	14953	13461	12139	13487	14213	16537	15816	24123	12139	55477
1980	19994	25838	64042	62503	33268	17443	14058	11790	9669	9110	9050	9096	23822	9050	64042
1981	9065	28656	16026	23923	10406	10210	9658	9265	9066	7104	5614	7614	12217	5614	28656
1982	28384	48736	22194	24463	18200	14017	15952	21139	13380	12400	12723	35626	22268	12400	48736
1983	37213	50479	58765	58337	22481	19623	17132	13306	13130	12635	14563	47219	30407	12635	58765
1984	40874	37872	51161	37170	32390	17490	15613	30148	15060	10842	11007	13648	26106	10842	51161
1985	13158	32575	21365	15080	12132	9877	9476	13942	12427	9864	11008	21761	15222	9476	32575
1986	19371	29696	29458	13983	9530	8779	7441	5259	6421	5978	12213	20855	14082	5259	29696
1987	36855	36596	46003	27553	15387	18903	19068	11861	10638	8826	7137	9250	20673	7137	46003
1988	19932	24162	23568	19437	15339	9377	6510	4750	9477	11326	11023	10527	13786	4750	24162
1989	11403	10423	17419	28970	14552	25083	33539	15684	14267	20787	18897	33177	20350	10423	33539
1990	50897	53639	66923	27770	17094	16380	9618	8677	7912	7885	9127	9733	23804	7885	66923

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND
LAKE SEMINOLE

AVERAGE MONTHLY FLOWS
CHATTAHOOCHEE, FLORIDA

Chattahoochee 02358000 Average Monthly Discharge in cfs Period of Record

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		AVG	MIN	MAX
1991	18125	30650	45403	25383	38174	22543	26187	21871	17527	12766	9976	14858		23622	9976	45403
1992	23297	39117	37700	20917	12842	13173	12642	12906	13743	13503	31790	43532		22930	12642	43532
1993	47710	33643	52081	39773	21100	12894	11813	11050	9566	9720	13274	15216		23153	9566	52081
1994	17916	33196	34745	27343	15856	14627	87781	31948	25440	30368	21867	33929		31251	14627	87781
1995	27861	57611	44600	20747	15320	14426	11594	11580	10138	15299	20953	19948		22506	10138	57611
1996	25916	48679	52216	29000	19365	14447	12673	10780	11019	13349	11421	15716		22049	10780	52216
1997	26929	39132	32781	17912	22142	18950	17294	14313	11182	11482	19663	51665		23620	11182	51665
1998	49813	67314	90332	44747	28835	13006	13196	12447	14563	18641	15897	11511		31692	11511	90332
1999	15884	22679	17281	10885	8807	11040	12035	10874	6548	5727	6246	7576		11298	5727	22679
2000	11546	16648	14573	17330	8413	4826	5117	5806	5889	5659	6361	10301		9372	4826	17330
2001	14690	11989	57190	30863	11562	18599	11152	9585	7173	6130	5975	7337		16020	5975	57190
2002	9036	13771	14771	13892	8326	6578	6084	5735	6991	8206	17304	20129		10902	5735	20129
2003	15858	23761	48703	32947	43039	37117	35358	25697	13971	12046	13311	16794		26550	12046	48703
2004	17684	30017	16387	11510	9885	9458	12740	9998	28414	16400	20491	24729		17310	9458	30017
2005	21103	24346	41758	71787	21735	25523	56319	32348	15087	10360	11844	18429		29220	10360	71787
2006	25039	23454	26532	16117	13772	6953	5773	5738	6969	6169	12123	9153		13149	5738	26532
2007	21310	18943	19490	13536	6869	5153	5351	5154	5343	5133	4976	5981		9770	4976	21310
2008	14771	28407	24023	18237	9048	5405	5863	13523	8945	7111	10321	29319		14581	5405	29319
2009	17668	11400	37090	66720	22055	14456	8214	8444	21894	22635	36443	74955		23256	8214	66720
2010	54223	61171	41835	19457	29571	14129	9203	8097	5977	7158	7724	9836		22365	5977	61171
2011	10824	20052	21965	19640	7521	4781	6244	5484	5734	5346	5651	5196		9870	4781	21965
2012	11309	11050	16241	9513	5352	5525	5498	5438	5212	5381	5316	5418		7604	5212	16241
2013	8890	45385	38268	22007	21268	15220	37094	32965	14873	10091	9465	26761		23524	8890	45385
2014	32718	35716	30267	61778	29505	13476	11275	8955	8761	9992	10229	16633		22442	8761	61778
2015	25185	20357	24841	28208	16050	13071	9489	8474	8727	10320	28306	49838		20239	8474	49838
AVG	27362	32323	38743	33314	21114	16134	16673	14783	12180	11933	13143	20167		21489	11933	38743
MIN	7262	10423	12781	9513	5352	4781	5117	4750	5163	5133	4976	5196		6704	4750	12781
MAX	106977	67314	171632	80703	53258	39463	87781	32965	30607	38497	36443	74955		68383	30607	171632

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

AVERAGE MONTHLY FLOWS
CHATTAHOOCHEE, FLORIDA

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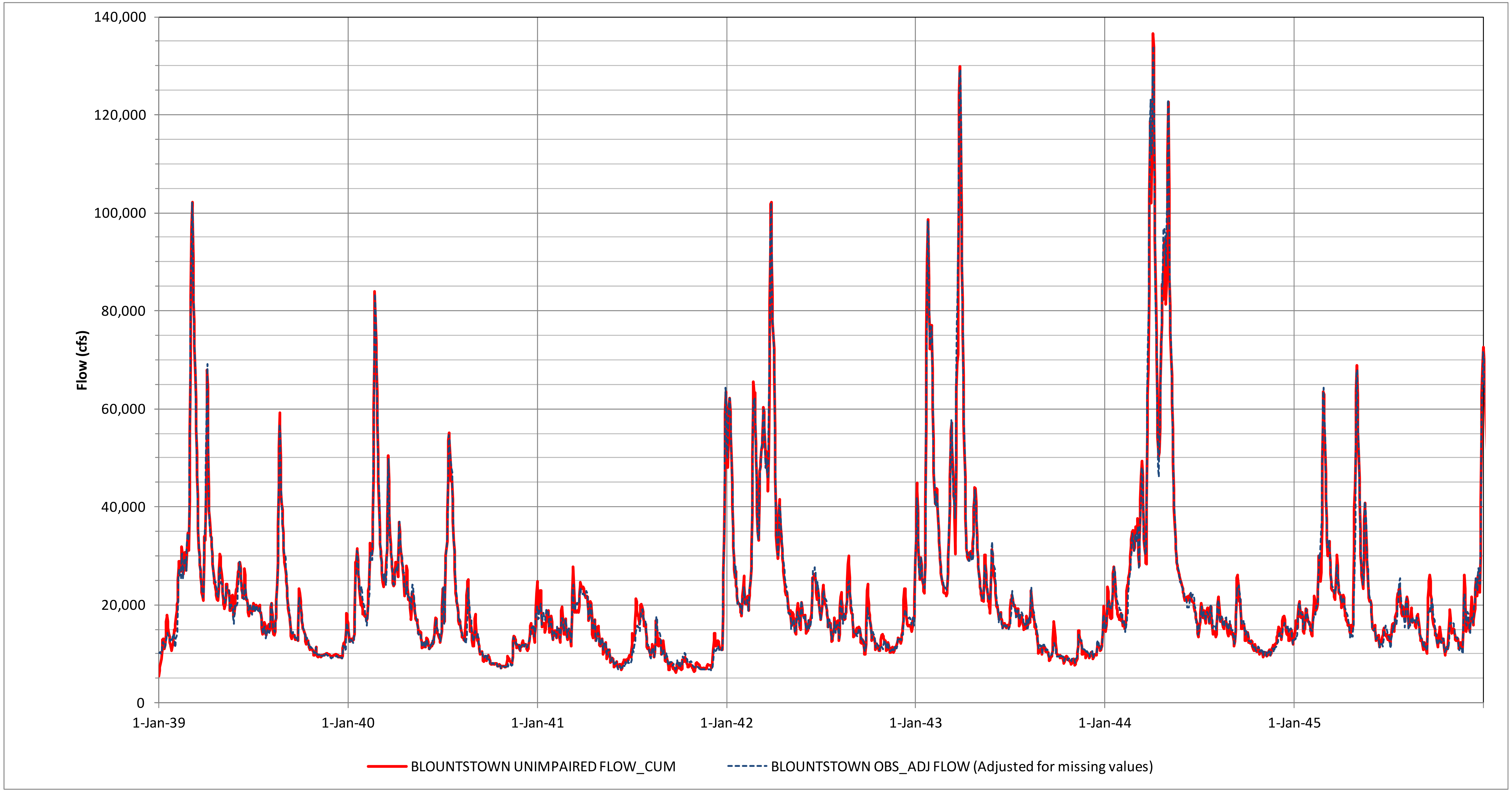

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

BLOUNTSTOWN, FLORIDA
OBSERVED FLOWS AND UNIMPAIRED FLOWS

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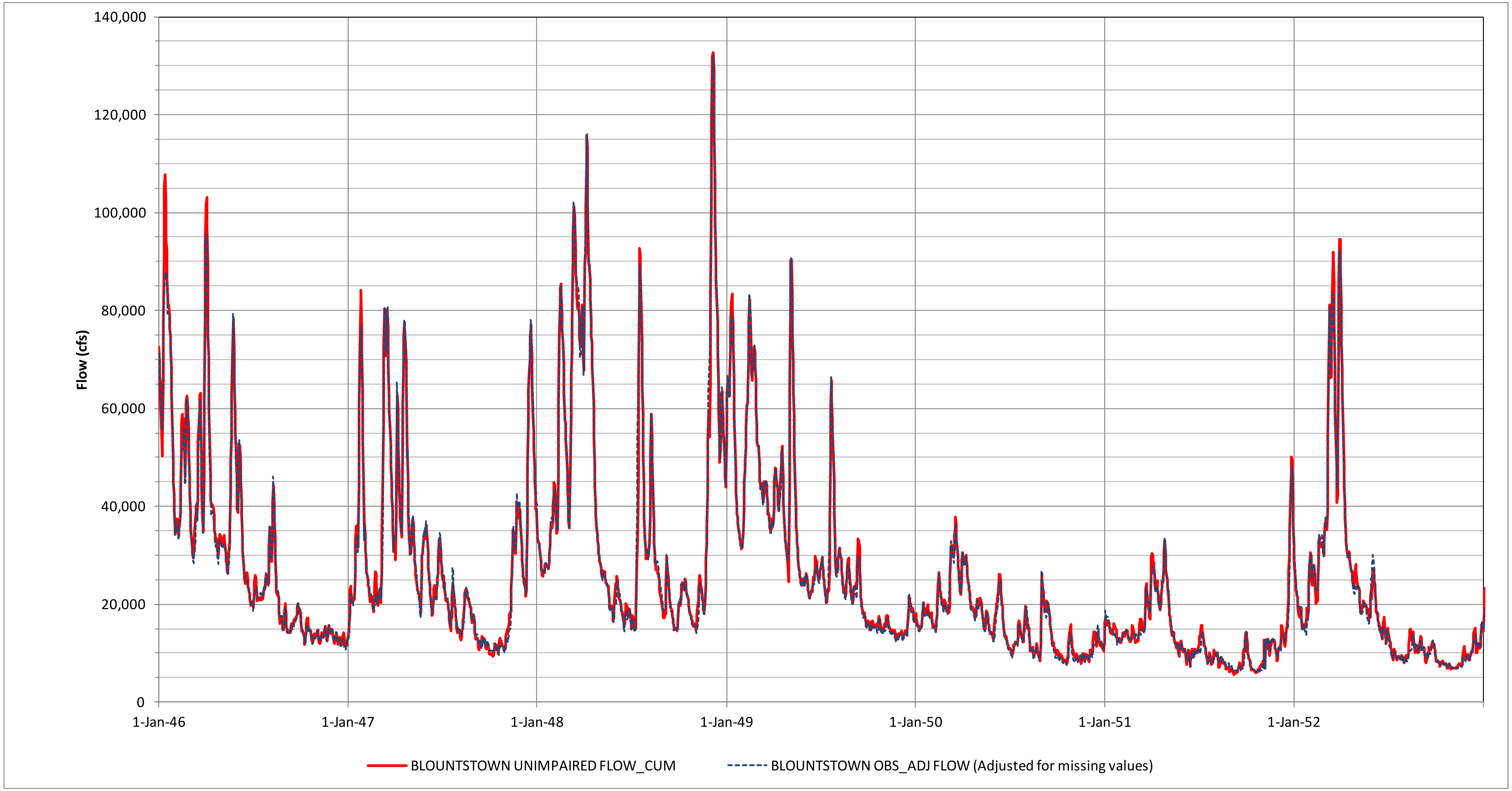

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JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

BLOUNTSTOWN, FLORIDA
OBSERVED FLOWS AND UNIMPAIRED FLOWS

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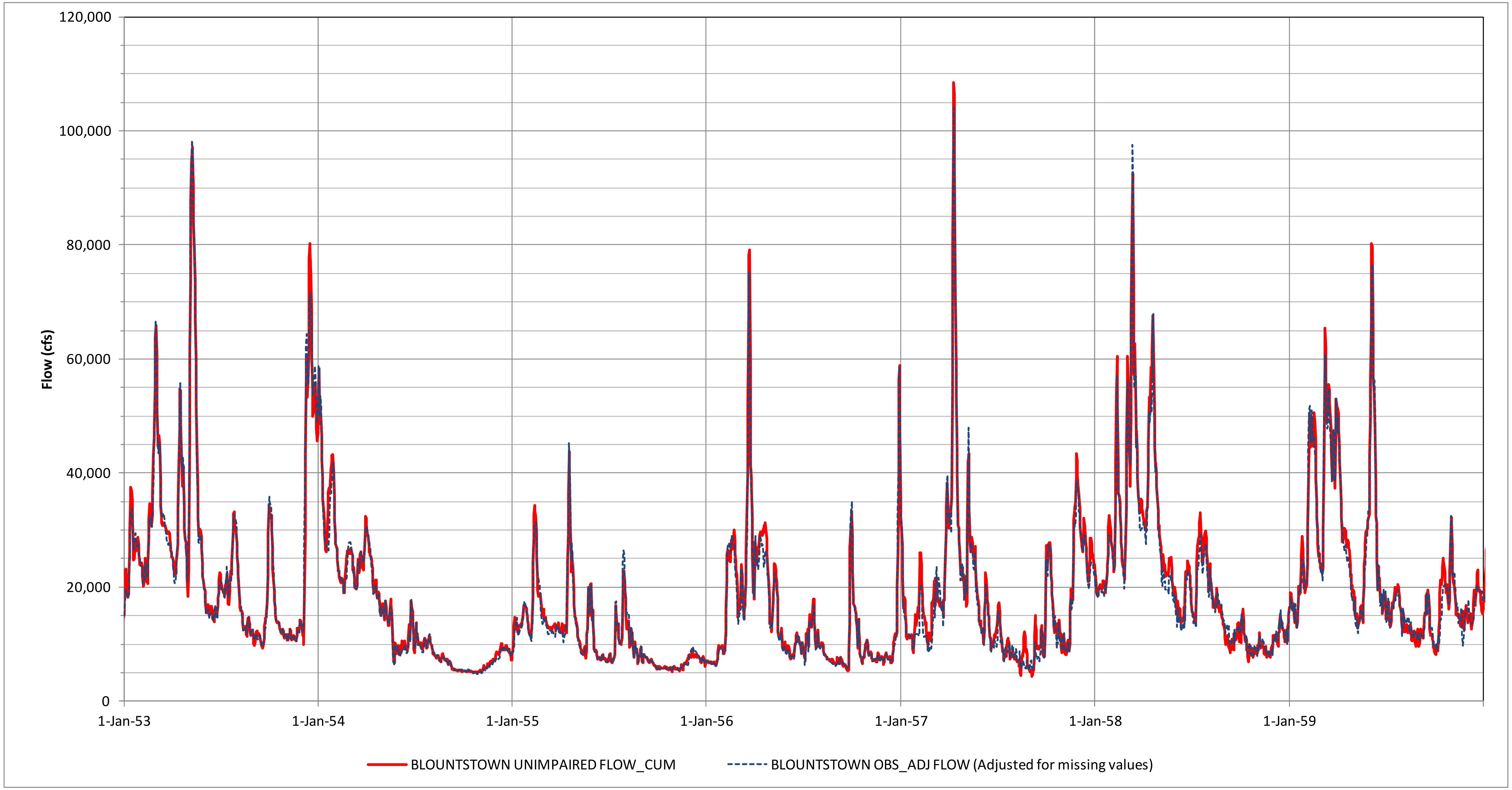

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JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

BLOUNTSTOWN, FLORIDA
OBSERVED FLOWS AND UNIMPAIRED FLOWS

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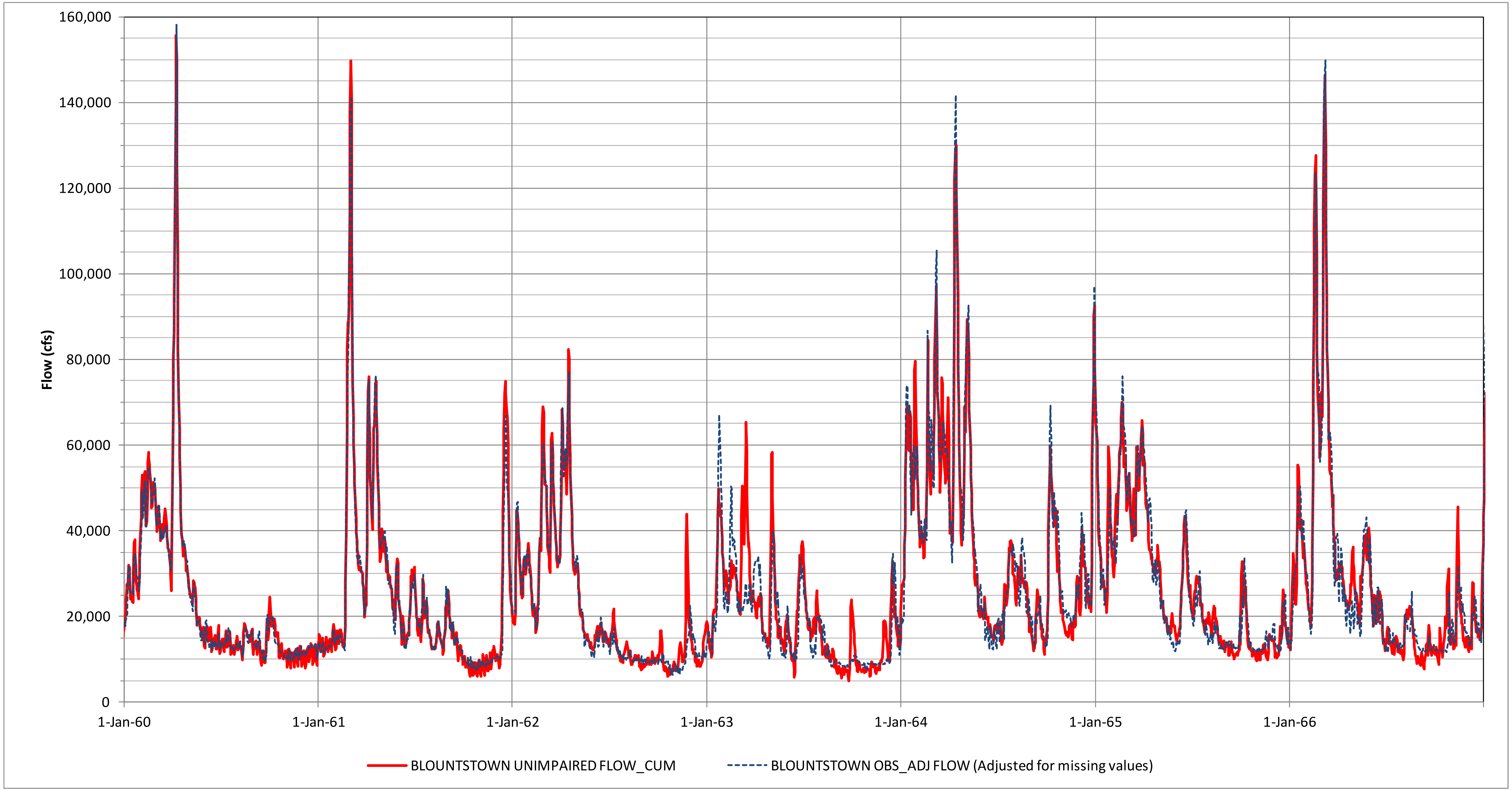

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JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

BLOUNTSTOWN, FLORIDA
OBSERVED FLOWS AND UNIMPAIRED FLOWS

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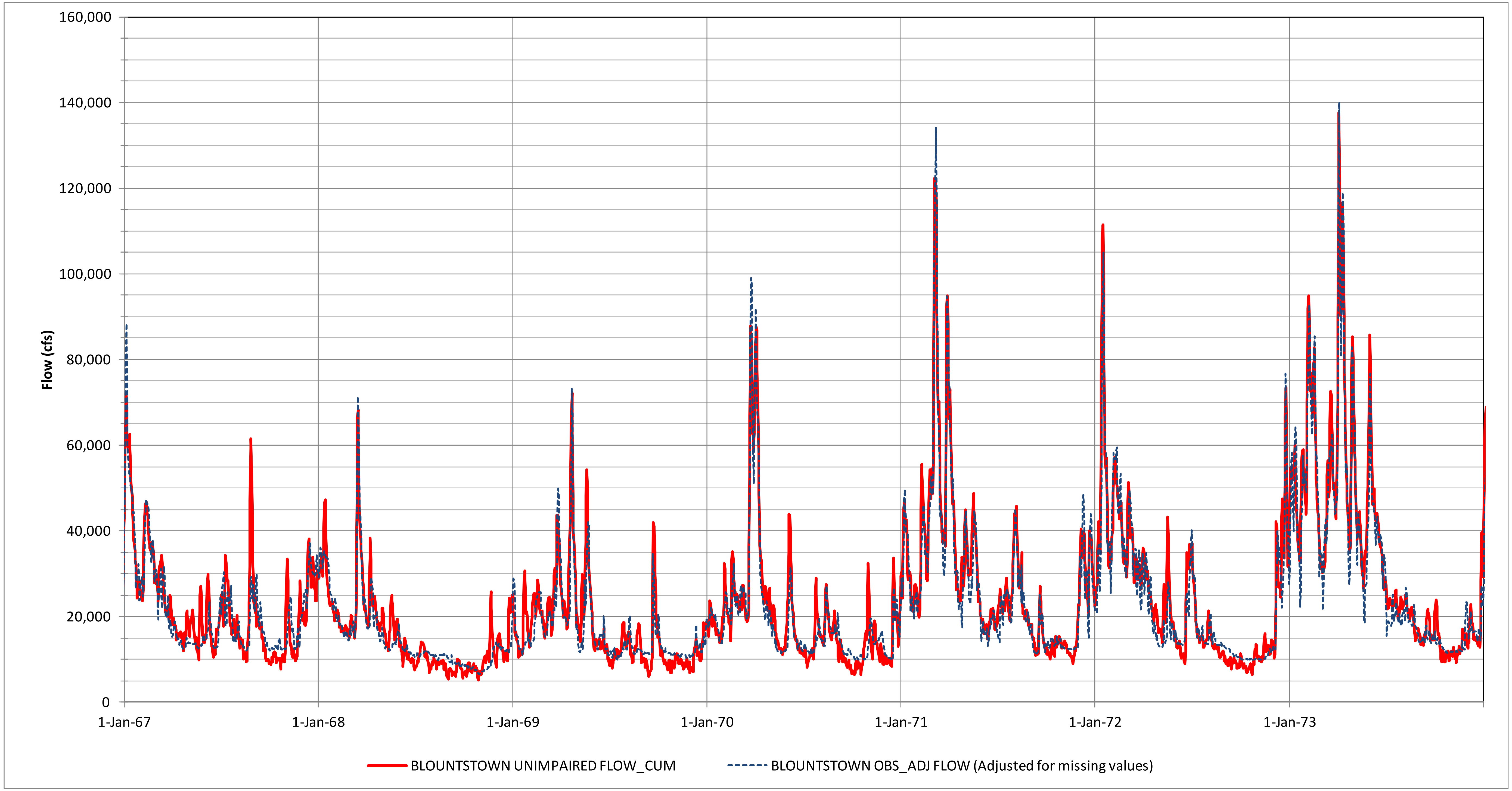

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JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

BLOUNTSTOWN, FLORIDA
OBSERVED FLOWS AND UNIMPAIRED FLOWS

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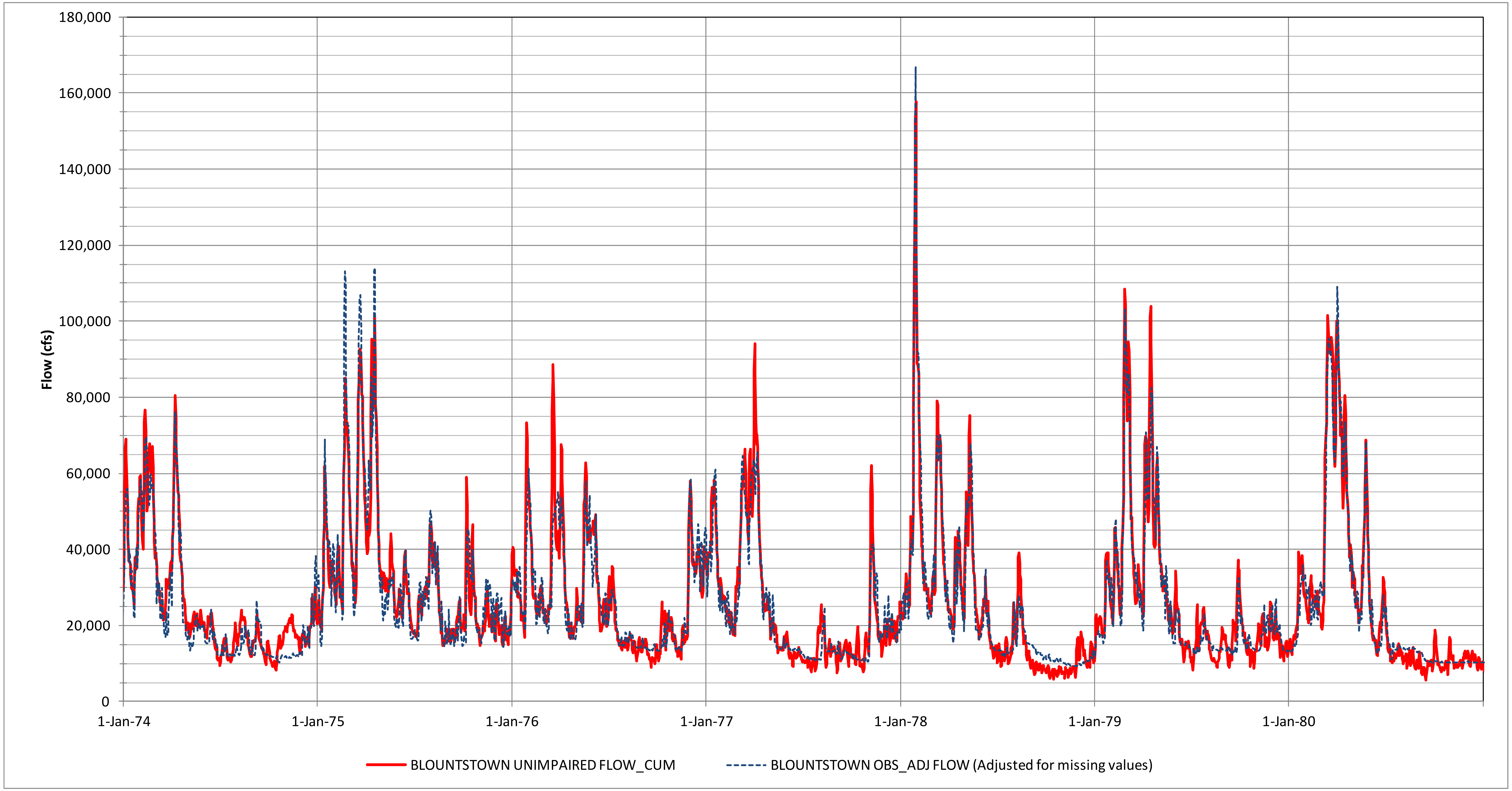

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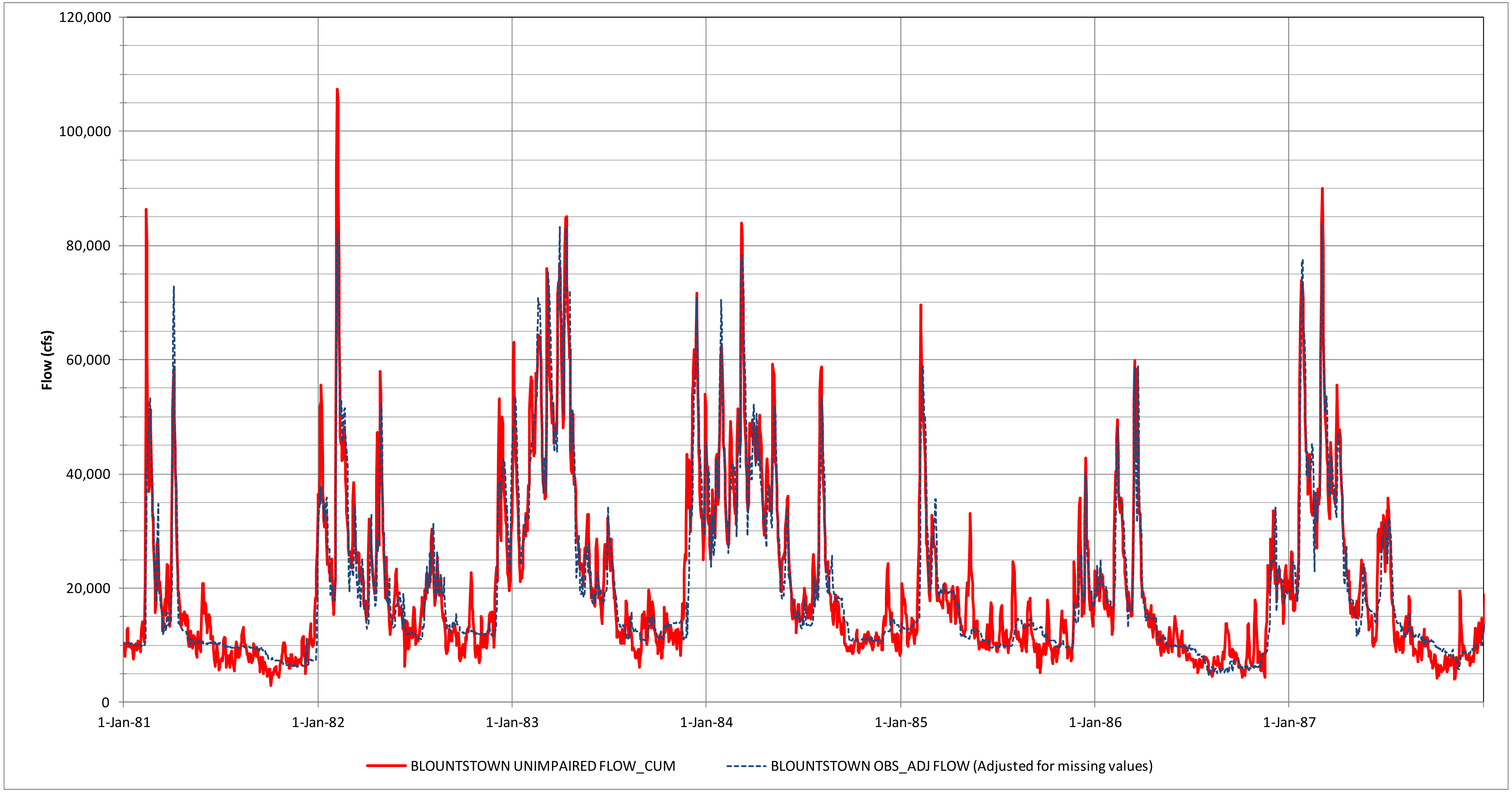
JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

BLOUNTSTOWN, FLORIDA
OBSERVED FLOWS AND UNIMPAIRED FLOWS



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JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

BLOUNTSTOWN, FLORIDA
OBSERVED FLOWS AND UNIMPAIRED FLOWS

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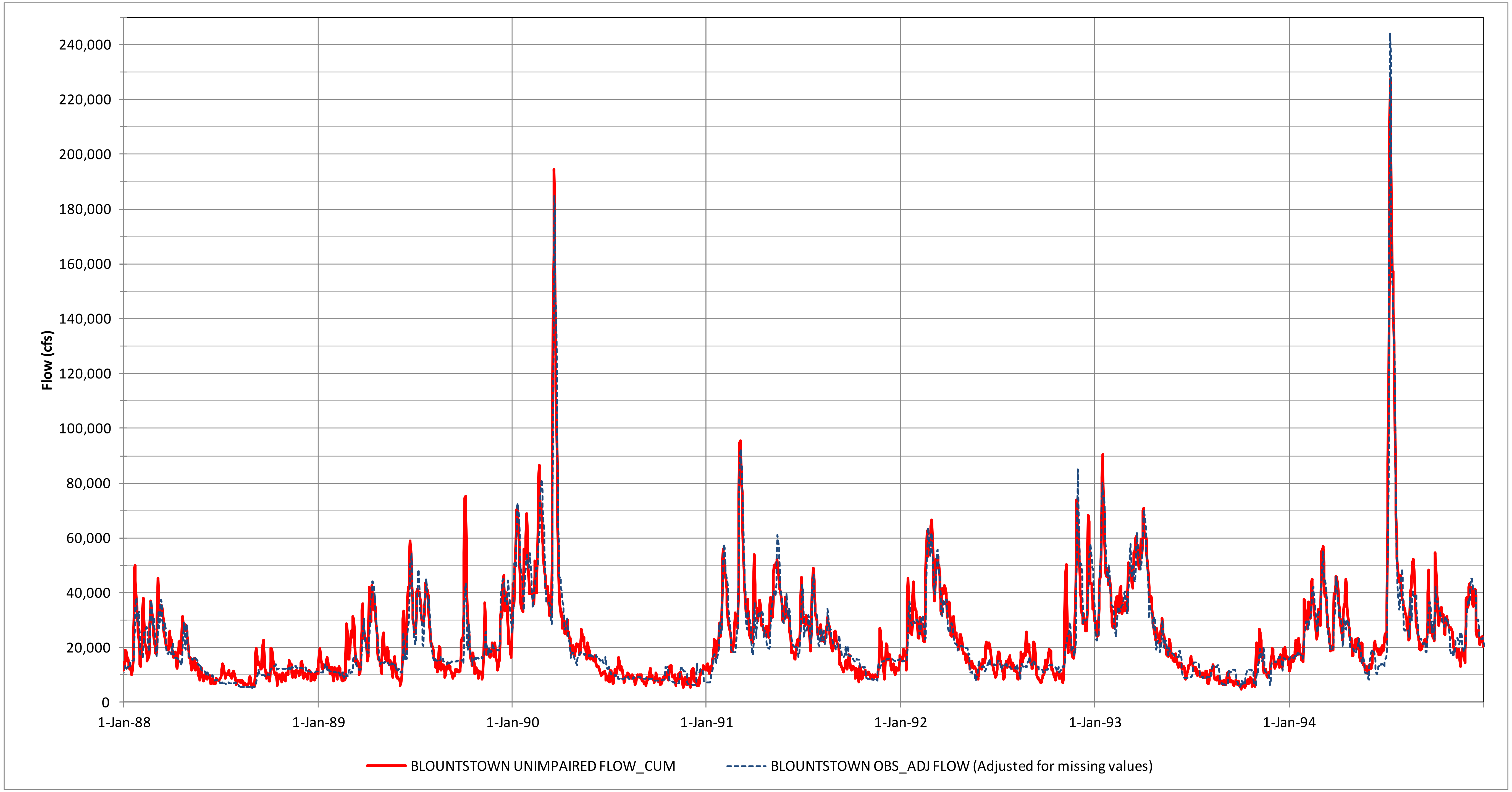

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JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

BLOUNTSTOWN, FLORIDA
OBSERVED FLOWS AND UNIMPAIRED FLOWS

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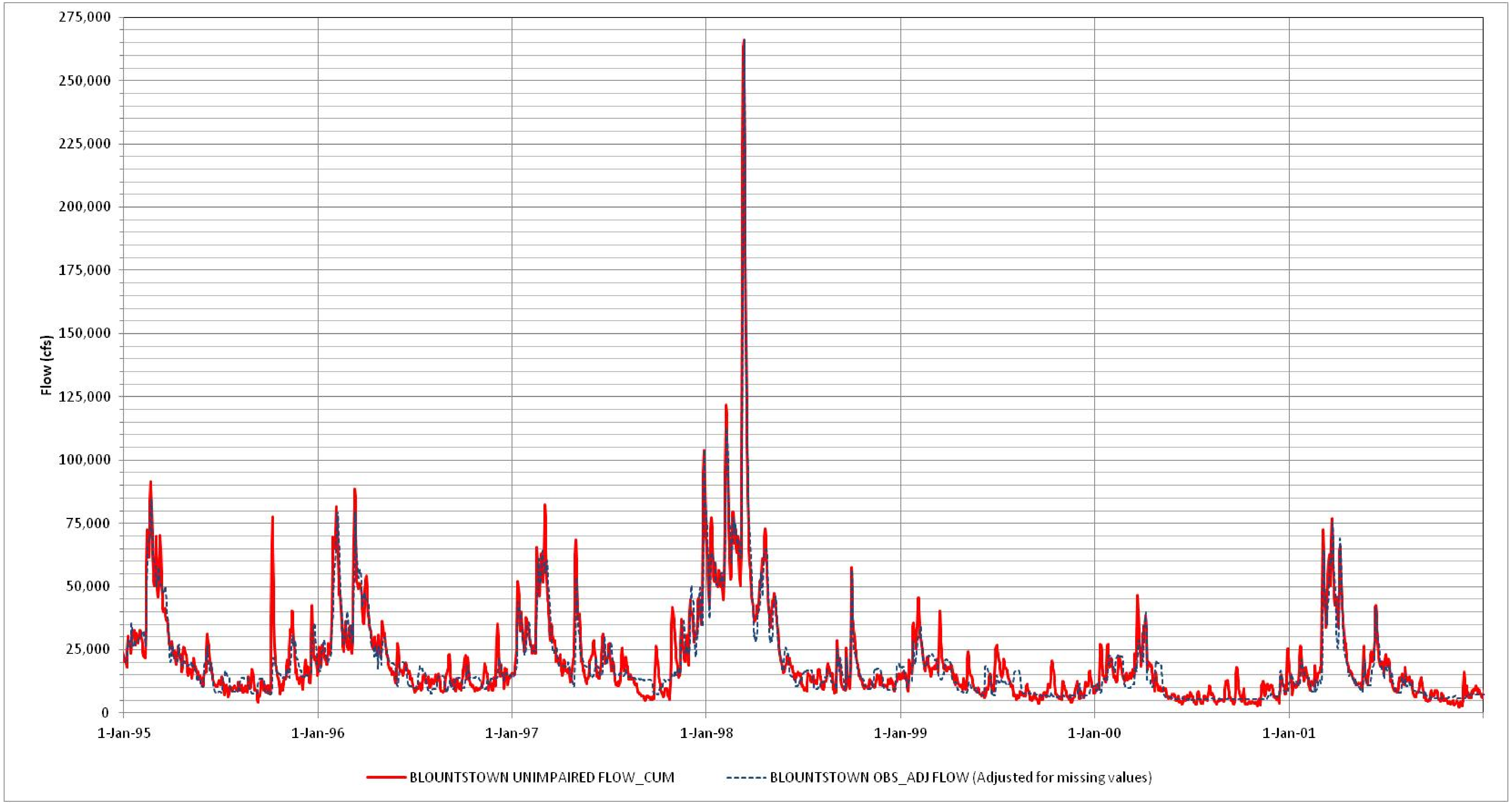

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JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

BLOUNTSTOWN, FLORIDA
OBSERVED FLOWS AND UNIMPAIRED FLOWS

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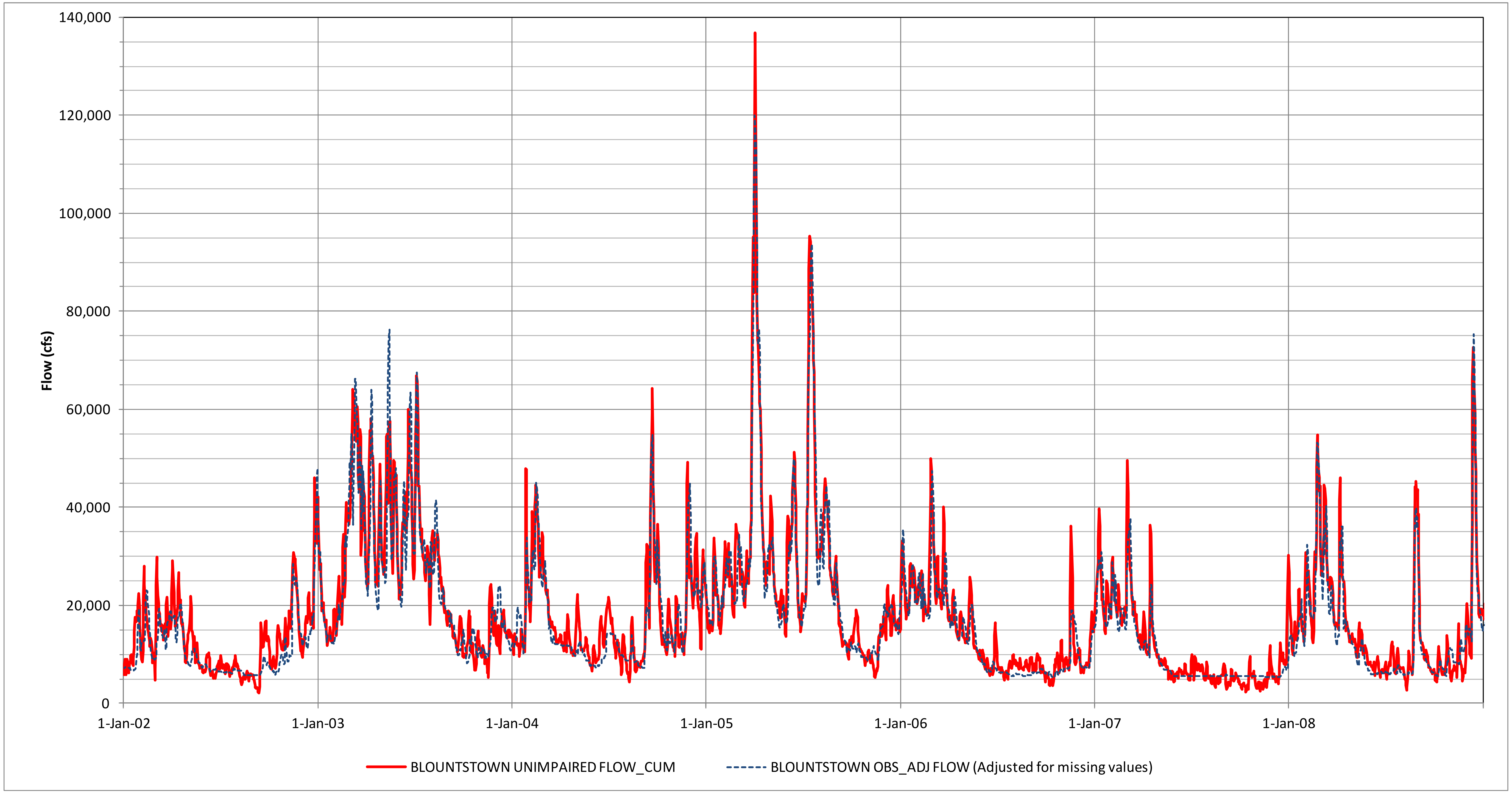

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

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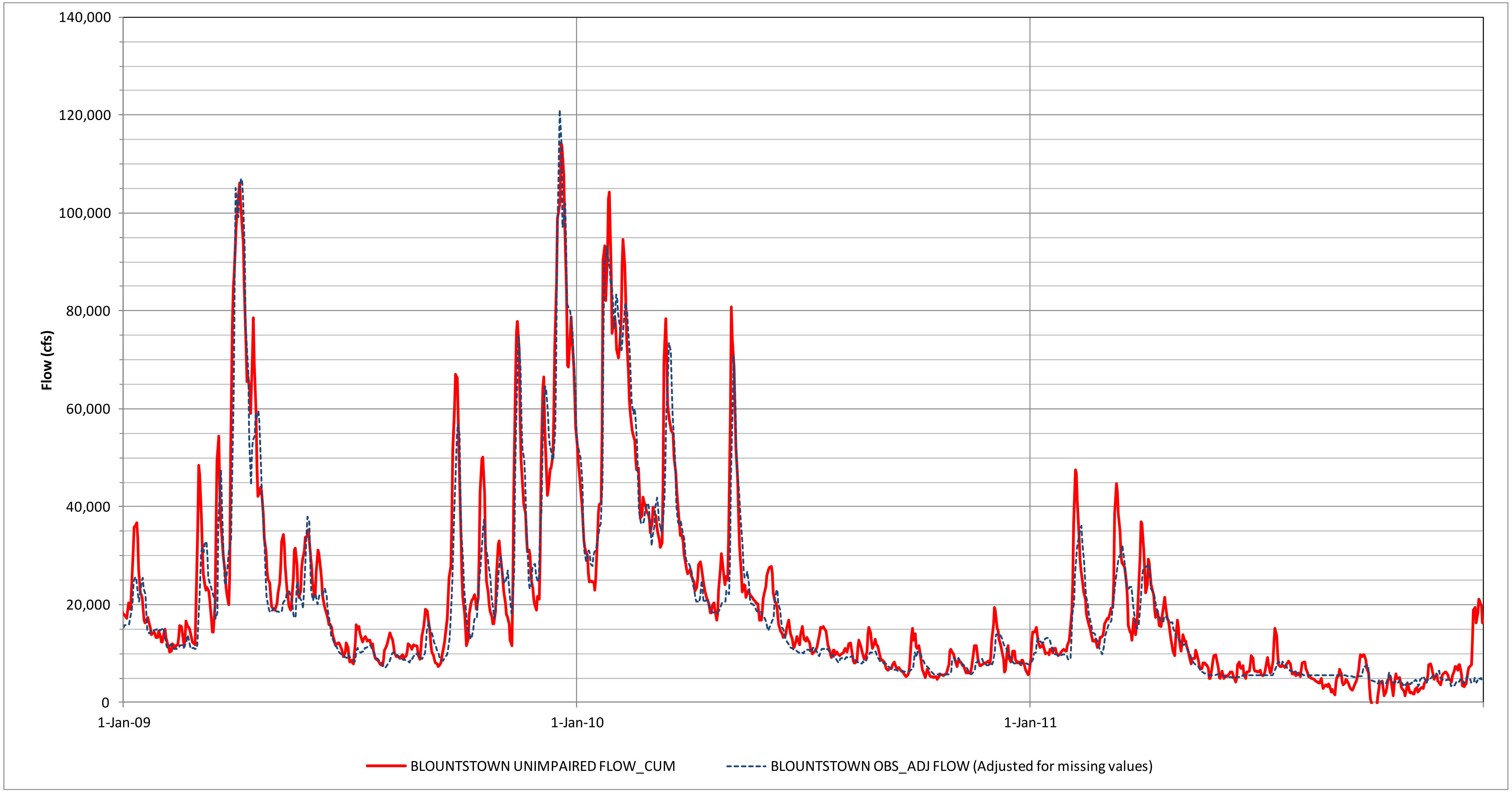
JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

BLOUNTSTOWN, FLORIDA
OBSERVED FLOWS AND UNIMPAIRED FLOWS



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JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

BLOUNTSTOWN, FLORIDA
OBSERVED FLOWS AND UNIMPAIRED FLOWS

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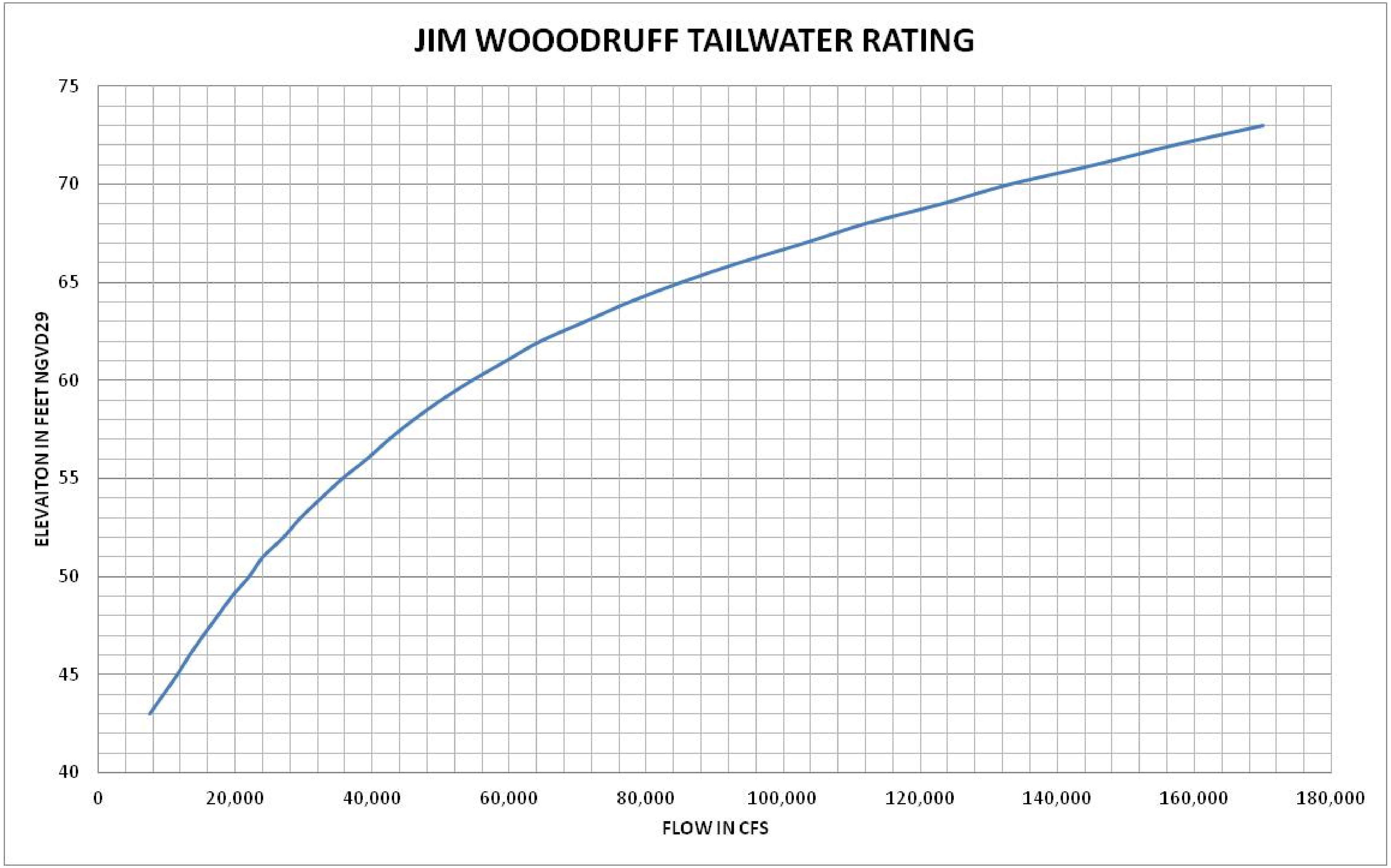
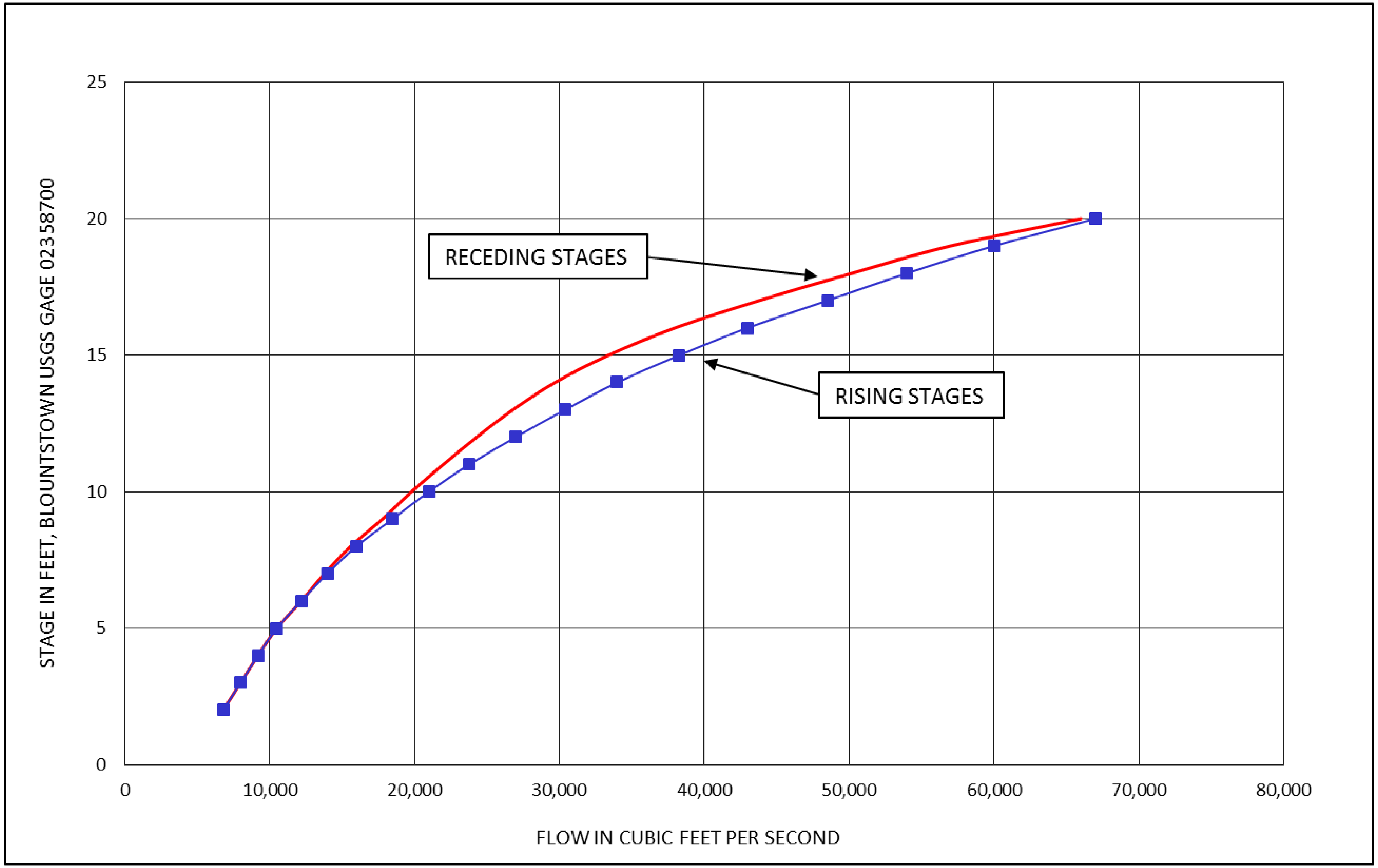


Tailwater Rating	
Flow (cfs)	Stage (feet)
7,500	43
9,500	44
11,500	45
13,300	46
15,300	47
17,400	48
19,500	49
22,000	50
24,000	51
27,000	52
29,500	53
32,500	54
35,600	55
39,200	56
42,400	57
46,000	58
50,000	59
54,500	60
59,500	61
64,500	62
71,000	63
77,500	64
85,000	65
93,500	66
103,000	67
112,000	68
123,000	69
133,000	70
145,500	71
157,000	72
170,000	73

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

TAILWATER RATING

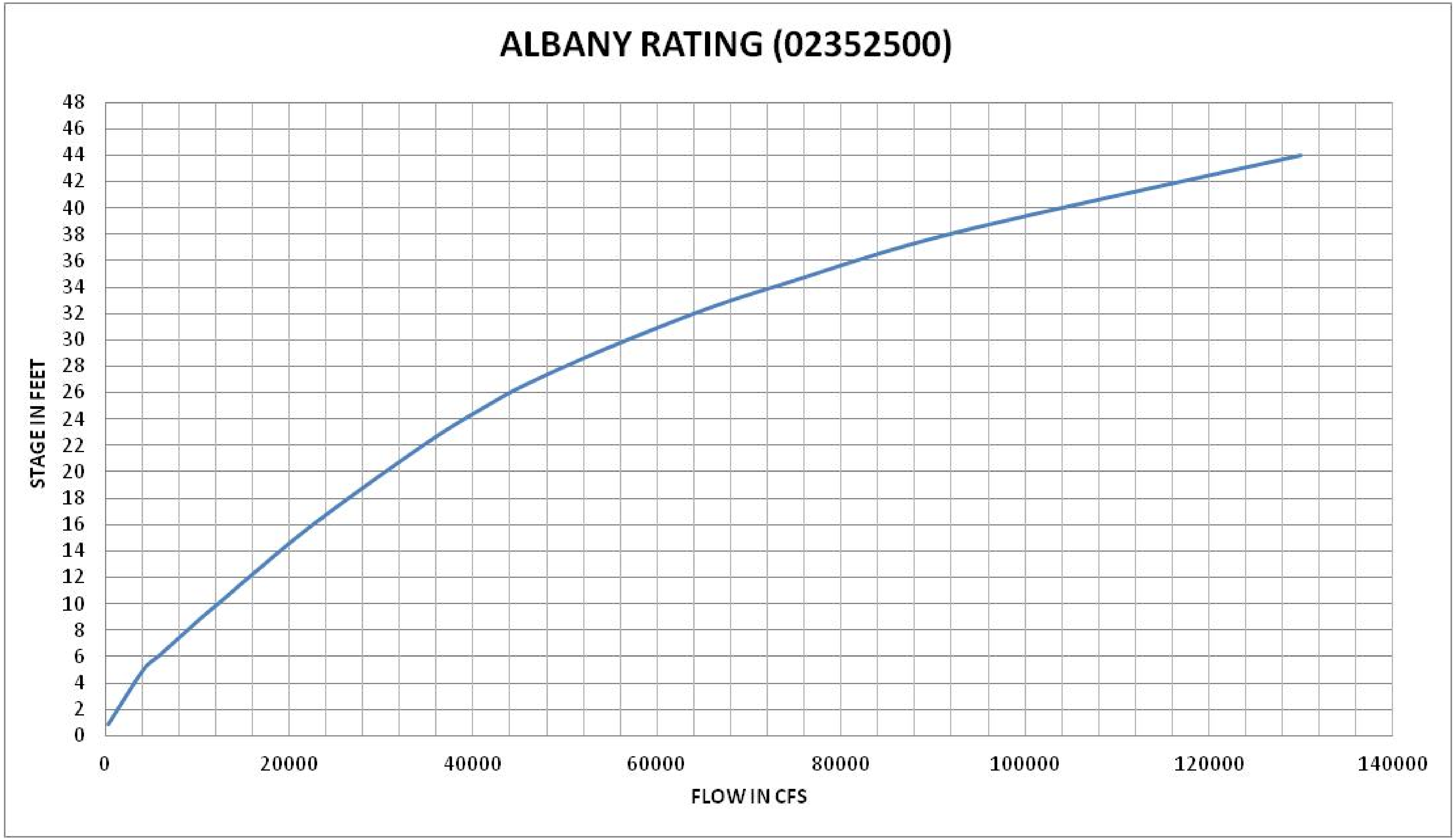


Relationship between Jim Woodruff discharge and Blountstown stage			
Receding stages		Rising stages	
Stage (feet)	Flow (cfs)	Stage (feet)	Flow (cfs)
2	6,800	2	6,800
3	8,000	3	8,000
4	9,200	4	9,200
5	10,500	5	10,500
6	12,200	6	12,200
7	14,000	7	13,800
8	16,000	8	15,600
9	18,500	9	17,800
10	21,000	10	19,800
11	23,800	11	22,000
12	27,000	12	24,300
13	30,400	13	26,800
14	34,000	14	29,700
15	38,300	15	33,400
16	43,000	16	38,000
17	48,500	17	43,800
18	54,000	18	50,200
19	60,000	19	57,000
20	67,000	20	66,000

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

RELATIONSHIP BETWEEN
JIM WOODRUFF OUTFLOW AND
BLOUNTSTOWN STAGE

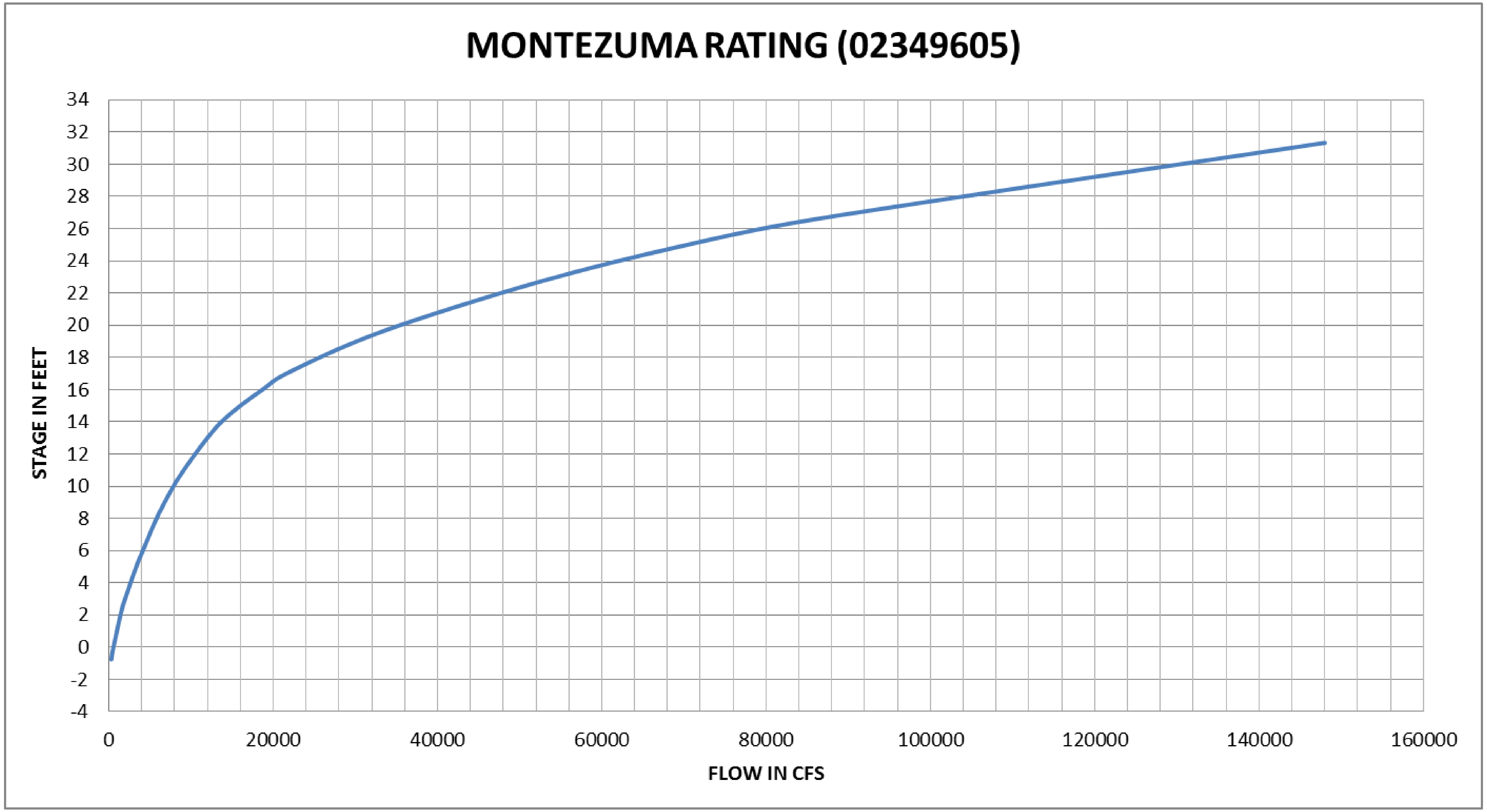


Albany Rating	
Stage (in feet)	Flow (in cfs)
0.87	399
2	970
4	2,810
6	5,800
8	9,000
10	12,300
12	15,700
14	19,100
16	22,600
18	26,400
20	30,400
22	34,600
24	39,100
26	44,100
28	50,100
30	56,800
32	64,000
34	72,600
36	81,900
38	91,800
40	104,000
42	116,000
44	130,000

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

ALBANY RATING
FLINT RIVER
USGS # 02352500
RATING #14.0
DRAINAGE AREA 5,310 SQUARE MILES
GAGE ZERO 150.03 FEET NGVD29

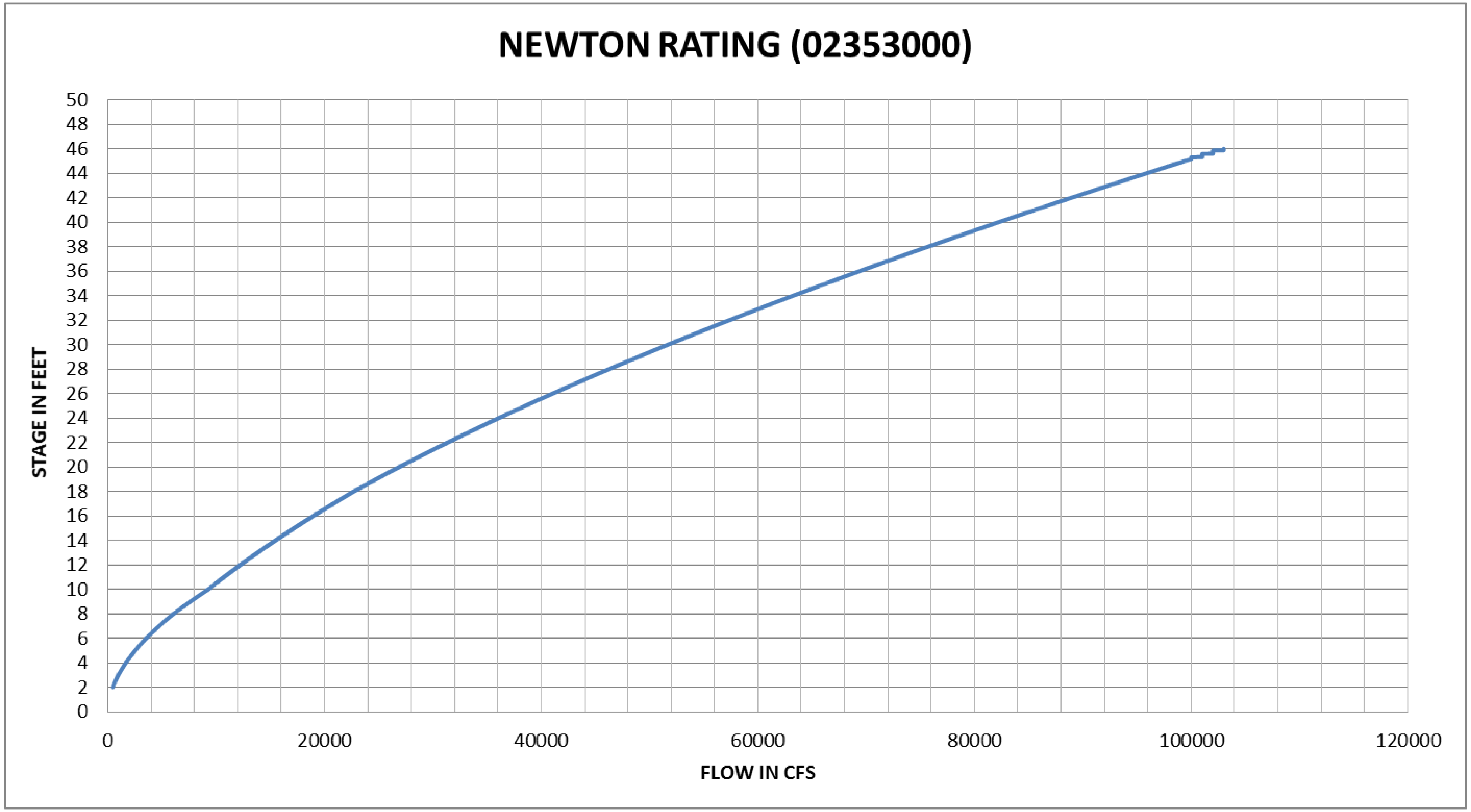


Montezuma Rating	
Stage (in feet)	Flow (in cfs)
-0.76	299
2	1,400
3	1,980
4	2,630
5	3,340
6	4,130
7	4,950
8	5,810
9	6,780
10	7,850
11	9,120
12	10,500
13	12,000
14	13,700
15	16,000
16	18,700
17	21,600
18	25,600
20	35,300
22	47,500
23	54,500
24	62,100
26	80,000
28	102,000
30	128,000
31.33	148,000

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

MONTEZUMA RATING
FLINT RIVER
USGS # 02349605
RATING #13.1
DRAINAGE AREA 2,920 SQUARE MILES
GAGE ZERO 255.83 FEET NGVD29

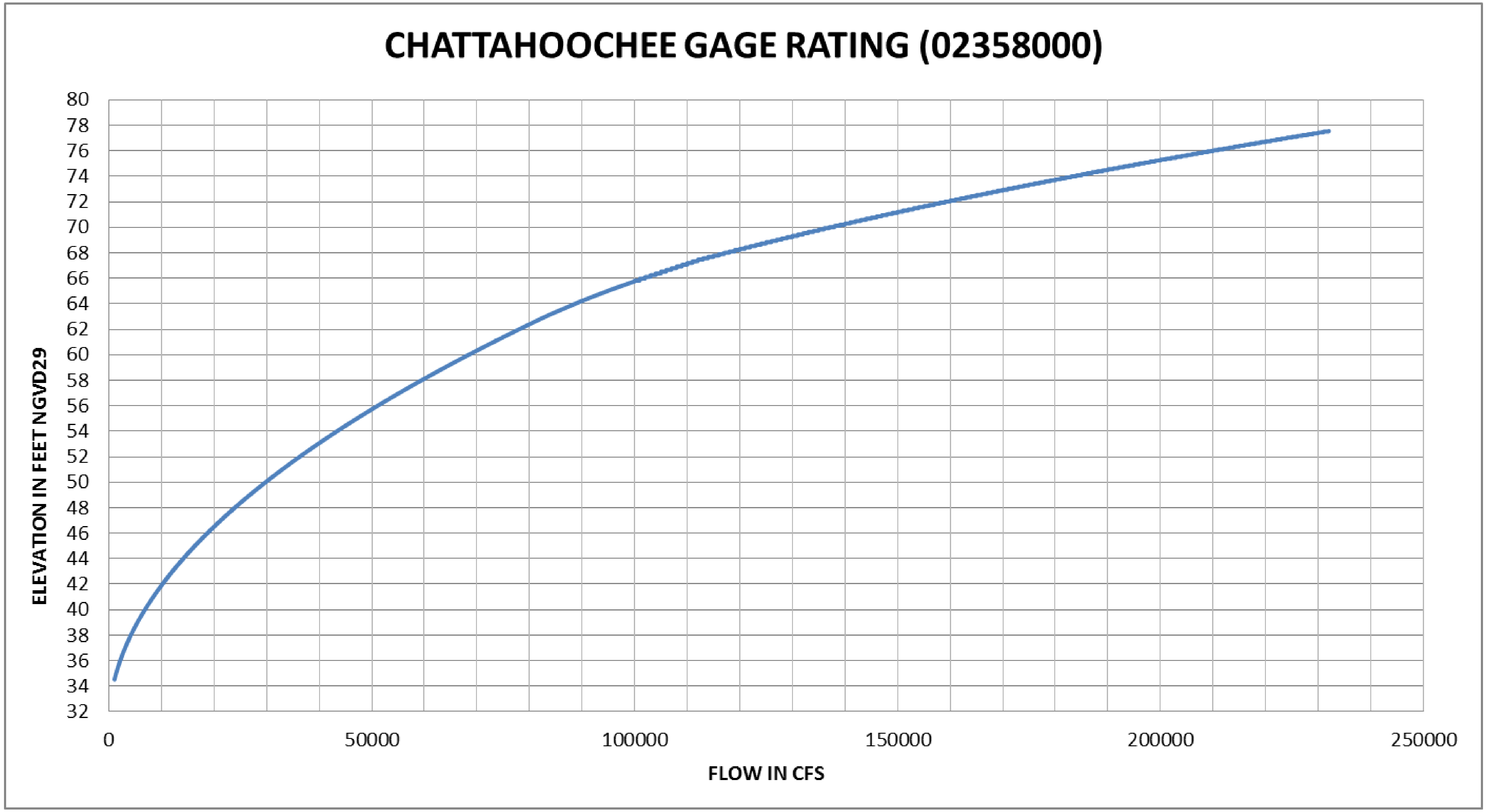


Newton Rating	
Stage (feet)	Flow (cfs)
2	455
4	1,660
6	3,530
8	6,050
10	9,250
20	26,900
30	51,700
40	82,200
46	103,000

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

NEWTON RATING
FLINT RIVER
USGS # 02353000
RATING #12.2
DRAINAGE AREA 5,740 SQUARE MILES
GAGE ZERO 110.20 FEET NGVD29



Chattahoochee Rating	
Stage (feet)	Flow (cfs)
34.51	1,080
40	6,860
50	29,800
60	68,400
70	137,000
77.57	232,000

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

CHATTAHOOCHEE GAGE RATING
APALACHICOLA RIVER
USGS # 02358000
RATING #38.0
DRAINAGE AREA 17,200 SQUARE MILES
GAGE ZERO 00.00 FEET NGVD29


N
WEST POINT DAM
WALTER F GEORGE LOCK & DAM
GEORGE W ANDREWS LOCK & DAM
JIM WOODRUFF LOCK & DAM
Lake Seminole
Atlanta Hartsfield AP, GA
Griffin
Molena
Woodbury, GA
Carsonville
Talbotton, GA
Montezuma, GA
Montezuma
Turkey Creek
Preston, GA
Americus, GA
Eufaula Wildlife Refuge, AL
Clayton, AL
Crisp County Power Dam, GA
Cuthbert, GA
Kinchafoonee Creek
Dawson, GA
Muckalee Creek
Oakfield
Albany
Albany 3SE, GA
Pachitla Creek
Abbeville, AL
Ichawaynochaway Creek (Milford)
Newton
Headland, AL
Headland, AL
Andrews (Pool)
Andrews (Tailwater)
Columbia
Sawhatchee Creek
Blakley, GA
Ichawaynochaway Creek (Newton)
Camilla 3SE, GA
Colquitt, GA
Hopeful
Spring Creek
Bainbridge
CHIPLEY 3 E, FL
Chipola
Chattahoochee
Chattahoochee River
Flint River
DAMS
RAIN GAUGE
RIVER GAUGE
RAIN AND RIVER GAUGE
Mississippi
Alabama
Georgia
South Carolina
Florida
APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN
WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND
LAKE SEMINOLE
RIVER STAGE &
RAINFALL GAUGE MAP
0 5 10 20 30 40
Miles

Jim Woodruff
Limitation on maximum head

Maximum Pool Elevation (feet NGVD29)

Tailwater Elevation	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
38.0*	76.50	76.50	76.50	76.50	76.50	76.51	76.51	76.51	76.51	76.51
0.1	76.52	76.52	76.52	76.52	76.52	76.53	76.53	76.53	76.53	76.53
0.2	76.54	76.54	76.54	76.54	76.54	76.55	76.55	76.55	76.55	76.55
0.3	76.56	76.56	76.56	76.56	76.56	76.57	76.57	76.57	76.57	76.57
0.4	76.58	76.58	76.58	76.58	76.58	76.59	76.59	76.59	76.59	76.59
0.5	76.60	76.60	76.60	76.60	76.60	76.61	76.61	76.61	76.61	76.61
0.6	76.62	76.62	76.62	76.62	76.62	76.63	76.63	76.63	76.63	76.63
0.7	76.64	76.64	76.64	76.64	76.64	76.65	76.65	76.65	76.65	76.65
0.8	76.66	76.66	76.66	76.66	76.66	76.67	76.67	76.67	76.67	76.67
0.9	76.68	76.68	76.68	76.68	76.68	76.69	76.69	76.69	76.69	76.69
39	76.70	76.70	76.71	76.71	76.71	76.72	76.72	76.72	76.72	76.73
0.1	76.73	76.73	76.74	76.74	76.74	76.75	76.75	76.75	76.75	76.76
0.2	76.76	76.76	76.77	76.77	76.77	76.78	76.78	76.78	76.78	76.79
0.3	76.79	76.79	76.80	76.80	76.80	76.81	76.81	76.81	76.81	76.82
0.4	76.82	76.82	76.83	76.83	76.83	76.84	76.84	76.84	76.84	76.85
0.5	76.85	76.85	76.86	76.86	76.86	76.87	76.87	76.87	76.87	76.88
0.6	76.88	76.88	76.89	76.89	76.89	76.90	76.90	76.90	76.90	76.91
0.7	76.91	76.91	76.92	76.92	76.92	76.93	76.93	76.93	76.93	76.94
0.8	76.94	76.94	76.95	76.95	76.95	76.96	76.96	76.96	76.96	76.97
0.9	76.97	76.97	76.98	76.98	76.98	76.99	76.99	76.99	76.99	77.00
40	77.00	77.00	77.00	77.00	77.00	77.01	77.01	77.01	77.01	77.01
0.1	77.01	77.01	77.01	77.01	77.01	77.02	77.02	77.02	77.02	77.02
0.2	77.02	77.02	77.02	77.02	77.02	77.03	77.03	77.03	77.03	77.03
0.3	77.03	77.03	77.03	77.03	77.03	77.04	77.04	77.04	77.04	77.04
0.4	77.04	77.04	77.04	77.04	77.04	77.05	77.05	77.05	77.05	77.05
0.5	77.05	77.05	77.05	77.05	77.05	77.06	77.06	77.06	77.06	77.06
0.6	77.06	77.06	77.06	77.06	77.06	77.07	77.07	77.07	77.07	77.07
0.7	77.07	77.07	77.07	77.07	77.07	77.08	77.08	77.08	77.08	77.08
0.8	77.08	77.08	77.08	77.08	77.08	77.09	77.09	77.09	77.09	77.09
0.9	77.09	77.09	77.09	77.09	77.09	77.10	77.10	77.10	77.10	77.10
41	77.10	77.10	77.10	77.10	77.10	77.11	77.11	77.11	77.11	77.11
0.1	77.11	77.11	77.11	77.11	77.11	77.12	77.12	77.12	77.12	77.12
0.2	77.12	77.12	77.12	77.12	77.12	77.13	77.13	77.13	77.13	77.13
0.3	77.13	77.13	77.13	77.13	77.13	77.14	77.14	77.14	77.14	77.14
0.4	77.14	77.14	77.14	77.14	77.14	77.15	77.15	77.15	77.15	77.15
0.5	77.15	77.15	77.15	77.15	77.15	77.16	77.16	77.16	77.16	77.16
0.6	77.16	77.16	77.16	77.16	77.16	77.17	77.17	77.17	77.17	77.17
0.7	77.17	77.17	77.17	77.17	77.18	77.18	77.18	77.18	77.18	77.18
0.8	77.18	77.18	77.18	77.18	77.18	77.19	77.19	77.19	77.19	77.19
0.9	77.19	77.19	77.19	77.19	77.19	77.20	77.20	77.20	77.20	77.20
42	77.20	77.20	77.20	77.20	77.21	77.21	77.21	77.21	77.21	77.21
0.1	77.21	77.22	77.22	77.22	77.22	77.22	77.22	77.23	77.23	77.23

* Tailwater elevation should not fall blow elevation 38.0.

Jim Woodruff
Limitation on maximum head

Maximum Pool Elevation (feet NGVD29)

Tailwater Elevation	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
42.2	77.23	77.23	77.23	77.23	77.24	77.24	77.24	77.24	77.24	77.24
0.3	77.24	77.25	77.25	77.25	77.25	77.25	77.25	77.26	77.26	77.26
0.4	77.26	77.26	77.26	77.26	77.27	77.27	77.27	77.27	77.27	77.27
0.5	77.27	77.28	77.28	77.28	77.28	77.28	77.28	77.28	77.29	77.29
0.6	77.29	77.29	77.29	77.29	77.30	77.30	77.30	77.30	77.30	77.30
0.7	77.30	77.31	77.31	77.31	77.31	77.31	77.31	77.32	77.32	77.32
0.8	77.32	77.32	77.32	77.32	77.33	77.33	77.33	77.33	77.33	77.33
0.9	77.34	77.34	77.34	77.34	77.34	77.34	77.34	77.34	77.35	77.35
43	77.35	77.35	77.35	77.35	77.36	77.36	77.36	77.36	77.36	77.36
0.1	77.36	77.36	77.36	77.36	77.37	77.37	77.37	77.37	77.37	77.37
0.2	77.38	77.38	77.38	77.38	77.39	77.39	77.39	77.39	77.39	77.39
0.3	77.40	77.40	77.40	77.40	77.40	77.40	77.40	77.41	77.41	77.41
0.4	77.41	77.41	77.41	77.41	77.42	77.42	77.42	77.42	77.42	77.42
0.5	77.42	77.43	77.43	77.43	77.43	77.43	77.43	77.44	77.44	77.44
0.6	77.44	77.44	77.44	77.44	77.45	77.43	77.45	77.45	77.45	77.45
0.7	77.46	77.46	77.46	77.46	77.46	77.46	77.46	77.47	77.47	77.47
0.8	77.47	77.47	77.47	77.48	77.48	77.48	77.48	77.48	77.48	77.48
0.9	77.48	77.49	77.49	77.49	77.49	77.49	77.49	77.50	77.50	77.50
44	77.50	77.50	77.51	77.51	77.52	77.52	77.53	77.53	77.54	77.54
0.1	77.55	77.55	77.56	77.56	77.57	77.57	77.58	77.58	77.59	77.59
0.2	77.60	77.60	77.61	77.61	77.62	77.62	77.63	77.63	77.64	77.64
0.3	77.65	77.65	77.66	77.66	77.67	77.67	77.68	77.68	77.69	77.69
0.4	77.70	77.70	77.71	77.71	77.72	77.72	77.73	77.73	77.74	77.74
0.5	77.75	77.75	77.76	77.76	77.77	77.77	77.78	77.78	77.79	77.79
0.6	77.80	77.80	77.81	77.81	77.82	77.82	77.83	77.83	77.84	77.84
0.7	77.85	77.85	77.86	77.86	77.87	77.87	77.88	77.88	77.89	77.89
0.8	77.90	77.90	77.91	77.91	77.92	77.92	77.93	77.93	77.94	77.94
0.9	77.95	77.95	77.96	77.96	77.97	77.97	77.98	77.98	77.99	77.99
45	78.00									

NOTE: WATER MANAGEMENT SECTION SHOULD BE NOTIFIED BEFORE EXCEEDING A POOL LEVEL OF 77.50 WHEN OPERATING WITHIN 0.5' OF MAXIMUM HEAD LIMIT

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

LIMITATION ON MAXIMUM HEAD

YEAR		Jim Woodruff Monthly Hydropower Production For Period of Record MWHs													Min	Max	Total
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
1957			7,258	14,076	10,437	18,712	17,303	15,236	11,541	13,291	19,324	17,094	19,562		7,258	19,562	163,834
1958		23,058	16,669	12,254	13,022	23,351	20,439	22,007	22,503	17,222	15,345	13,913	17,993		12,254	23,351	217,776
1959		23,271	16,874	15,224	20,203	20,794	19,650	22,727	19,941	18,770	21,679	21,554	24,216		15,224	24,216	244,903
1960		23,780	14,555	18,824	12,363	24,686	20,549	21,048	21,714	18,649	20,146	16,423	19,233		12,363	24,686	231,970
1961		20,711	15,976	17,889	12,662	22,898	22,770	25,146	22,956	20,514	13,933	14,691	18,058		12,662	25,146	228,204
1962		21,681	20,018	18,055	14,791	22,075	21,072	19,169	16,259	14,486	14,674	15,793	19,488		14,486	22,075	217,561
1963		20,402	20,376	25,285	20,915	21,765	20,489	23,519	19,076	14,554	15,507	13,952	20,479		13,952	25,285	236,319
1964		15,734	15,663	12,479	11,797	17,164	23,044	23,838	23,986	23,583	19,231	25,224	20,220		11,797	25,224	231,963
1965		20,484	14,655	15,954	19,521	23,938	22,265	25,612	21,952	20,590	22,911	21,229	23,752		14,655	25,612	252,863
1966		20,778	14,618	12,623	24,548	23,421	24,287	22,177	24,836	18,555	20,427	25,055	24,018		12,623	25,055	255,343
1967		18,282	19,016	24,877	22,325	21,957	23,191	24,907	22,727	23,116	19,480	22,938	24,305		18,282	24,907	267,121
1968		23,876	23,939	23,124	24,775	22,224	19,215	7,815	7,467	6,028	5,230	5,941	8,680		5,230	24,775	178,314
1969		9,904	9,475	10,314	10,452	9,687	8,863	7,975	8,847	8,334	8,295	7,518	10,226		7,518	10,452	109,890
1970		25,935	24,062	21,060	22,173	20,736	22,350	21,385	23,932	18,918	17,581	23,342	21,806		17,581	25,935	263,280
1971		23,695	18,589	11,310	20,596	22,809	23,925	24,961	24,094	20,904	21,164	19,921	22,675		11,310	24,961	254,643
1972		19,053	15,979	20,186	23,056	22,523	21,671	22,882	21,839	17,582	16,545	17,354	20,628		15,979	23,056	239,298
1973		17,100	12,984	18,543	11,493	20,678	18,847	25,493	25,484	21,481	18,877	19,575	24,426		11,493	25,493	234,981
1974		20,227	13,772	24,803	19,481	26,093	23,235	20,509	23,540	21,127	17,672	16,922	24,512		13,772	26,093	251,893
1975		20,991	15,725	14,106	12,533	24,849	23,063	23,557	20,030	16,499	21,662	16,997	24,637		12,533	24,849	234,649
1976		23,572	21,575	21,260	22,307	22,202	23,543	24,296	22,656	17,270	20,789	19,802	20,451		17,270	24,296	259,723
1977		21,406	23,580	17,225	21,158	21,201	20,048	17,061	20,635	18,142	17,943	19,519	25,812		17,061	25,812	243,730
1978		19,626	17,313	19,239	23,408	20,462	23,148	19,488	20,781	18,383	16,937	13,430	16,367		13,430	23,408	228,582
1979		23,829	17,805	19,062	15,714	23,190	21,645	20,842	19,034	18,774	22,169	22,926	22,881		15,714	23,829	247,871
1980		21,885	23,376	13,618	13,045	21,788	22,409	20,293	17,760	15,831	15,446	14,876	15,662		13,045	23,376	215,989
1981		15,453	13,310	21,777	17,996	16,685	16,076	14,921	15,071	14,308	11,954	10,069	13,612		10,069	21,777	181,232
1982		24,237	16,355	25,782	23,130	24,837	20,582	21,918	25,572	19,770	19,004	18,559	22,839		16,355	25,782	262,585
1983		22,066	16,608	16,177	15,067	26,438	23,810	19,129	17,838	17,091	17,865	17,121	12,462		12,462	26,438	221,672
1984		12,783	12,166	11,300	13,705	20,093	22,294	19,851	23,886	22,189	17,376	16,999	21,492		11,300	23,886	214,134
1985		20,314	19609	25,467	22,340	19,530	15,858	16,071	22,339	19,781	16,933	17,419	25,262		15,858	25,467	240,923

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

HISTORICAL HYDROPOWER PRODUCTION

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YEAR		Jim Woodruff Monthly Hydropower Production For Period of Record MWHs													Min	Max	Total
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
1986		25,671	20,077	20,971	17,742	15,870	14,353	13,263	9,176	10,887	10,795	13,497	17,206		9,176	25,671	189,508
1987		13,023	14,792	17,608	19,649	16,059	17,602	20,445	15,586	14,814	11,727	10,239	15,364		10,239	20,445	186,908
1988		19,106	20,802	23,837	20,952	17,056	11,180	8,178	8,309	13,388	16,112	15,969	16,136		8,178	23,837	191,025
1989		15,911	10,756	18,128	18,468	16,279	14,505	20,930	22,162	17,361	21,146	22,815	19,983		10,756	22,815	218,444
1990		15,321	13,572	12,699	17,639	22,805	18,999	10,905	8,348	7,892	9,876	11,529	11,706		7,892	22,805	161,291
1991		16,505	17,593	17,153	22,469	17,970	20,204	22,533	23,863	22,827	18,700	14,603	22,655		14,603	23,863	237,075
1992		21,452	17,335	18,323	22,879	17,635	13,658	15,026	16,629	18,725	18,369	18,542	17,026		13,658	22,879	215,599
1993		16,253	17,731	13,131	18,569	17,279	13,228	16,254	13,787	12,040	12,730	18,390	21,825		12,040	21,825	191,217
1994		23,551	17,574	17,758	19,816	14,046	18,431	9,688	21,471	22,303	22,560	23,105	19,560		9,688	23,551	229,863
1995		20,414	11,389	16,252	23,200	16,237	17,392	15,562	14,320	11,734	20,056	21,797	20,933		11,389	23,200	209,285
1996		20,525	12,629	11,543	20,389	20,666	17,837	17,577	15,514	14,706	15,013	12,800	15,351		11,543	20,666	194,550
1997		14,472	15,509	19,748	20,653	21,543	22,249	21,687	17,679	12,920	15,624	19,091	11,567		11,567	22,249	212,742
1998		13,258	7,248	8,297	15,213	21,614	16,842	18,544	17,309	17,335	16,351	17,580	13,902		7,248	21,614	183,493
1999		17,598	20,624	18,717	13,860	11,788	191	15,189	15,419	7,518	6,230	3,055	0		0	20,624	130,189
2000		0	4,252	10,283	14,005	8,377	4,757	6,181	6,577	6,270	6,454	6,643	7,477		0	14,005	81,276
2001		6,282	6,176	6,174	13,324	14,534	11,221	13,997	14,855	9,397	8,651	9,156	11,982		6,174	14,855	125,749
2002		12,504	15,178	19,021	18,703	14,616	9,271	10,097	9,421	11,438	14,278	21,489	16,417		9,271	21,489	172,433
2003		16,612	18,979	13,626	19,728	16,232	19,443	20,192	26,384	22,686	21,326	18,743	21,452		13,626	26,384	235,403
2004		21,496	18,987	22,221	19,566	18,041	16,437	22,751	18,494	18,820	22,415	21,152	22,832		16,437	22,832	243,212
2005		22,552	20,252	17,912	11,915	26,174	17,494	15,435	22,055	21,757	18,610	20,277	26,496		11,915	26,496	240,929
2006		23,337	21,578	18,339	23,037	21,888	11,397	11,067	10,929	10,947	10,739	16,132	15,062		10,739	23,337	194,452
2007		25,387	21,973	21,124	20,646	11,504	9,716	10,546	10,161	9,860	10,051	9,587	10,976		9,587	25,387	171,531
2008		22,403	18,906	22,231	22,270	15,046	10,054	10,659	10,837	14,070	13,815	17,470	13,148		10,054	22,403	190,909
2009		17,398	17,093	13,282	7,570	16,470	17,709	14,573	16,339	19,810	23,762	18,715	7,040		7,040	23,762	189,761
2010		13,384	6,122	11,476	16,535	14,408	12,842	16,643	15,081	10,054	12796	13923	16444		6,122	16,643	159,708
2011		20,296	20,126	25,521	25,553	13,663	9,672	11,948	10,741	11,137	10465	9519	10187		9,519	25,553	178,828
2012		14,185	17,835	23,960	16,789	10,755	10,393	10,562	7,913	7,488	7451	9019	10213		7,451	23,960	146,563
2013		16,169	11,248	15,336	24,959	25,750	24,584	17,938	18,950	21,546	18521	16301	21002		11,248	25,750	232,304
2014		25,881	15,048	13,949	8,716	21,746	23,086	18,817	16,104	13,554	11395	15502	18505				
2015		23,053	23,985	19,173	22,812	22,478	21,163	17,392	14,682	15,460	17493	18509	13876				
Avg		19,106	16,394	17,452	18,180	19,412	17,823	17,770	17,583	16,008	16,095	16,463	17,832		11,412	23,281	209,445
Min		0	4,252	6,174	7,570	8,377	191	6,181	6,577	6,028	5,230	3,055	0		0	10452	81,276
Max		25,935	24,062	25,782	25,553	26,438	24,584	25,612	26,384	23,583	23,762	25,224	26,496		18,282	26,496	267,121

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

HISTORICAL HYDROPOWER PRODUCTION

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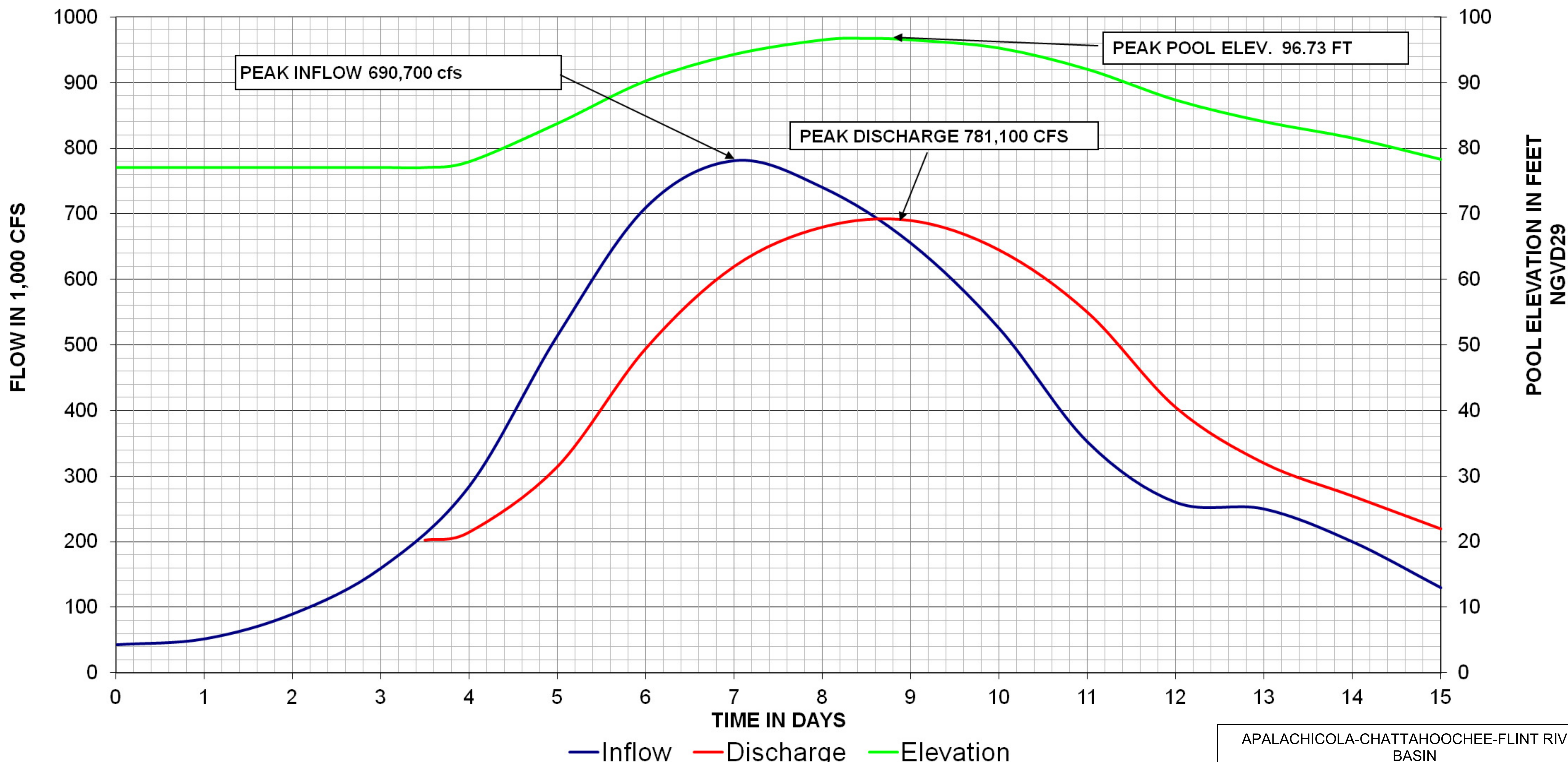
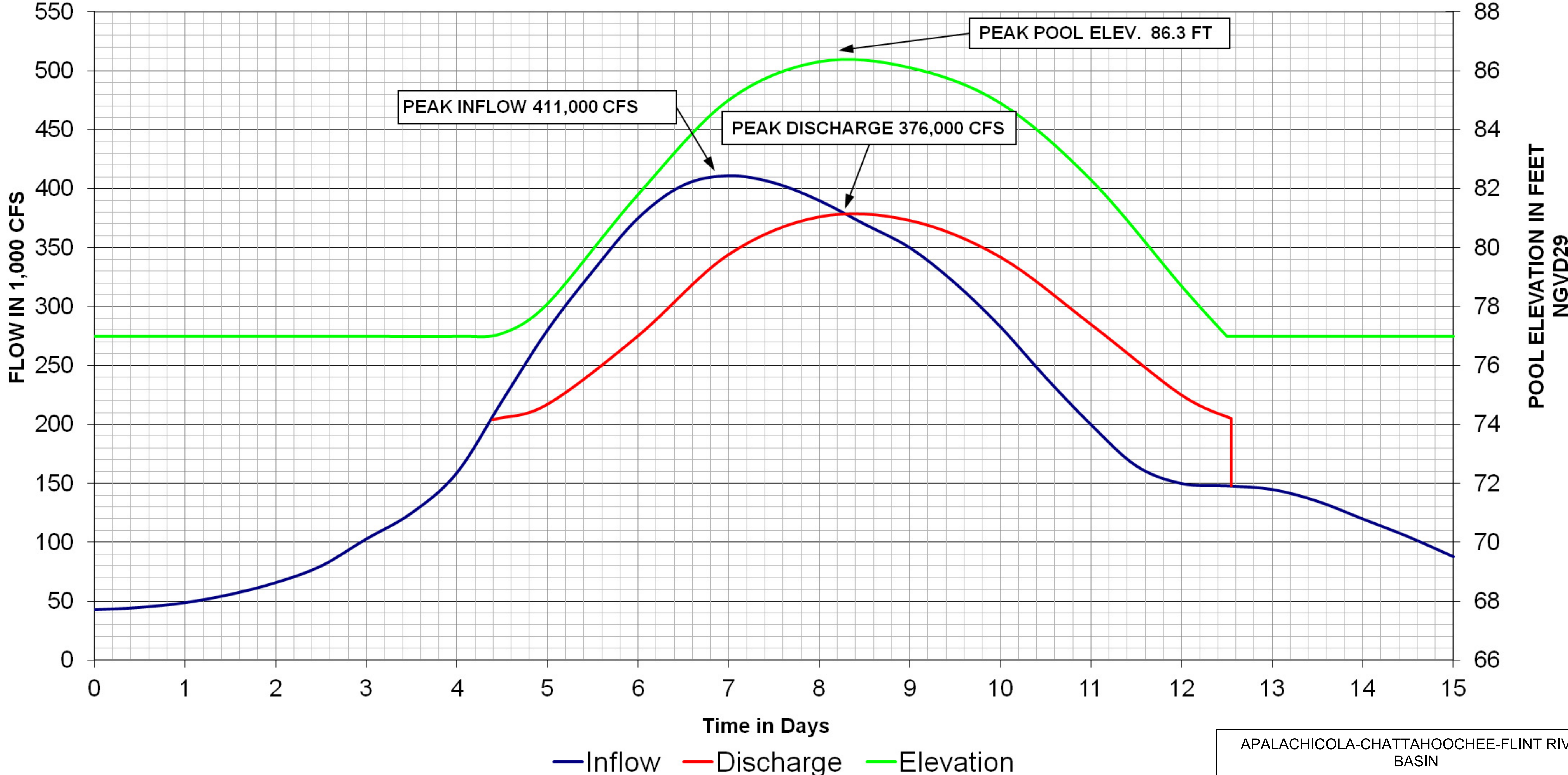


APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

INFLOW-OUTFLOW-POOL STAGE HYDROGRAPHS
SPILLWAY DESIGN FLOOD



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

INFLOW-OUTFLOW-POOL STAGE HYDROGRAPHS
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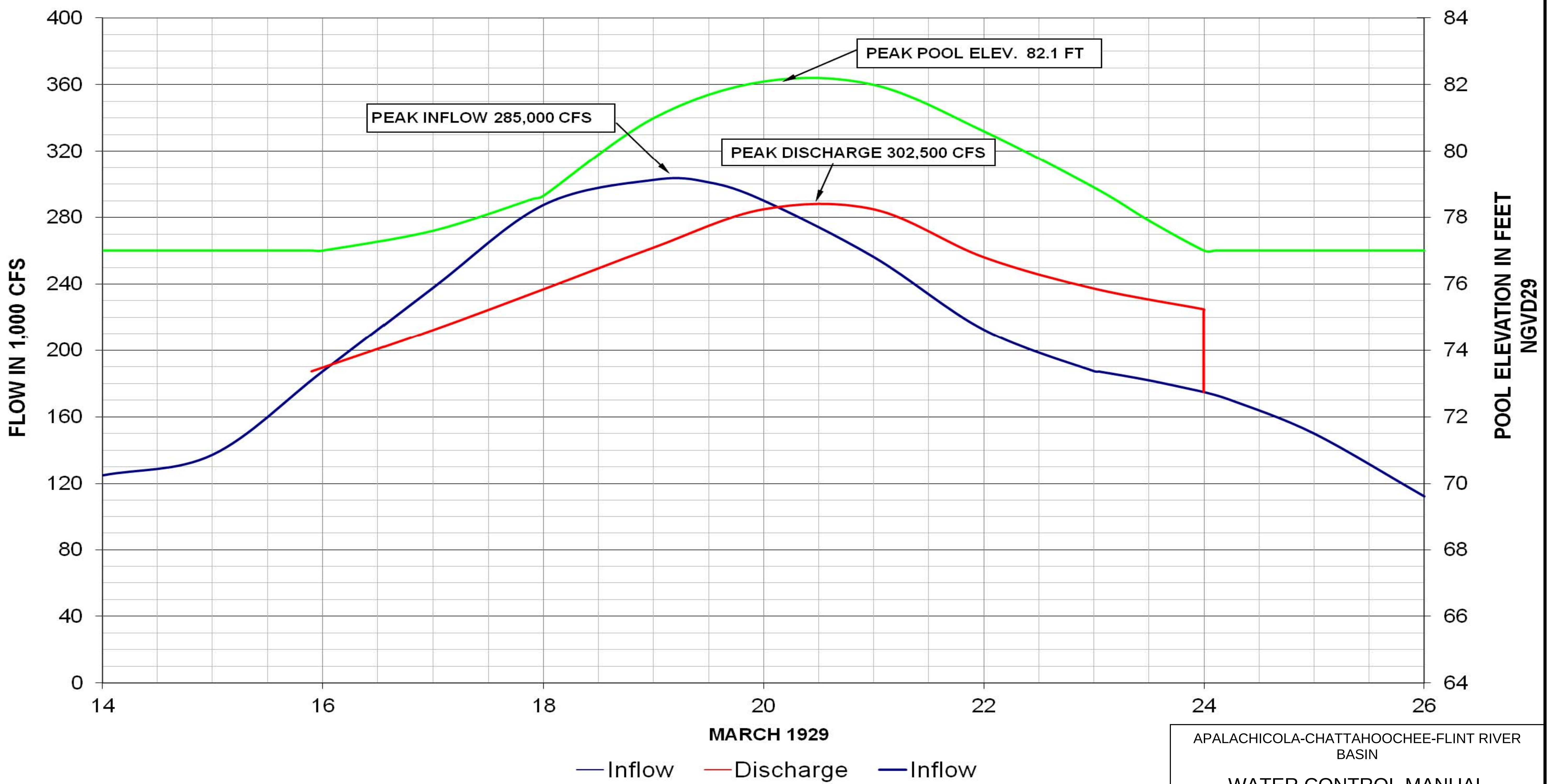
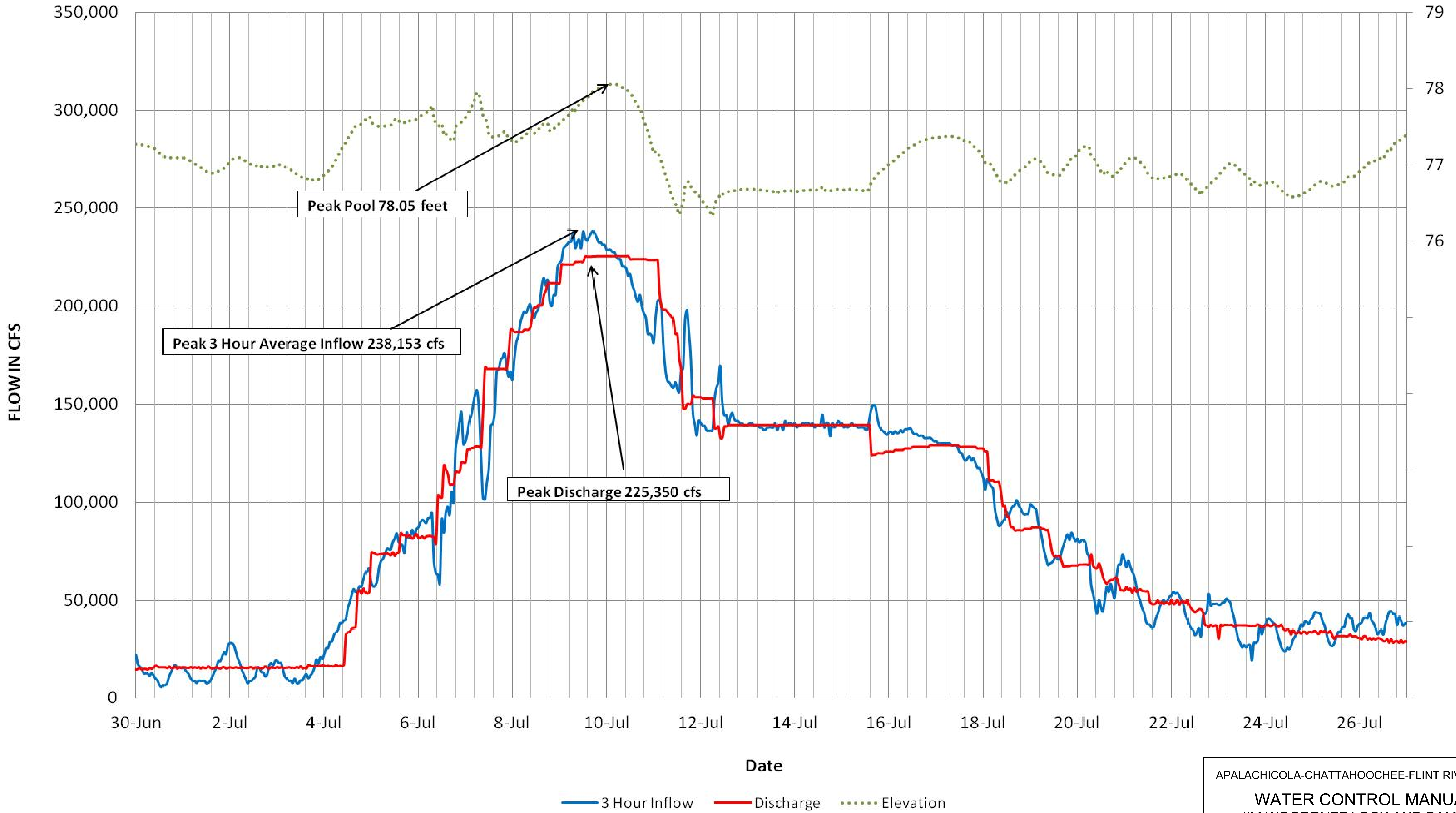


APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

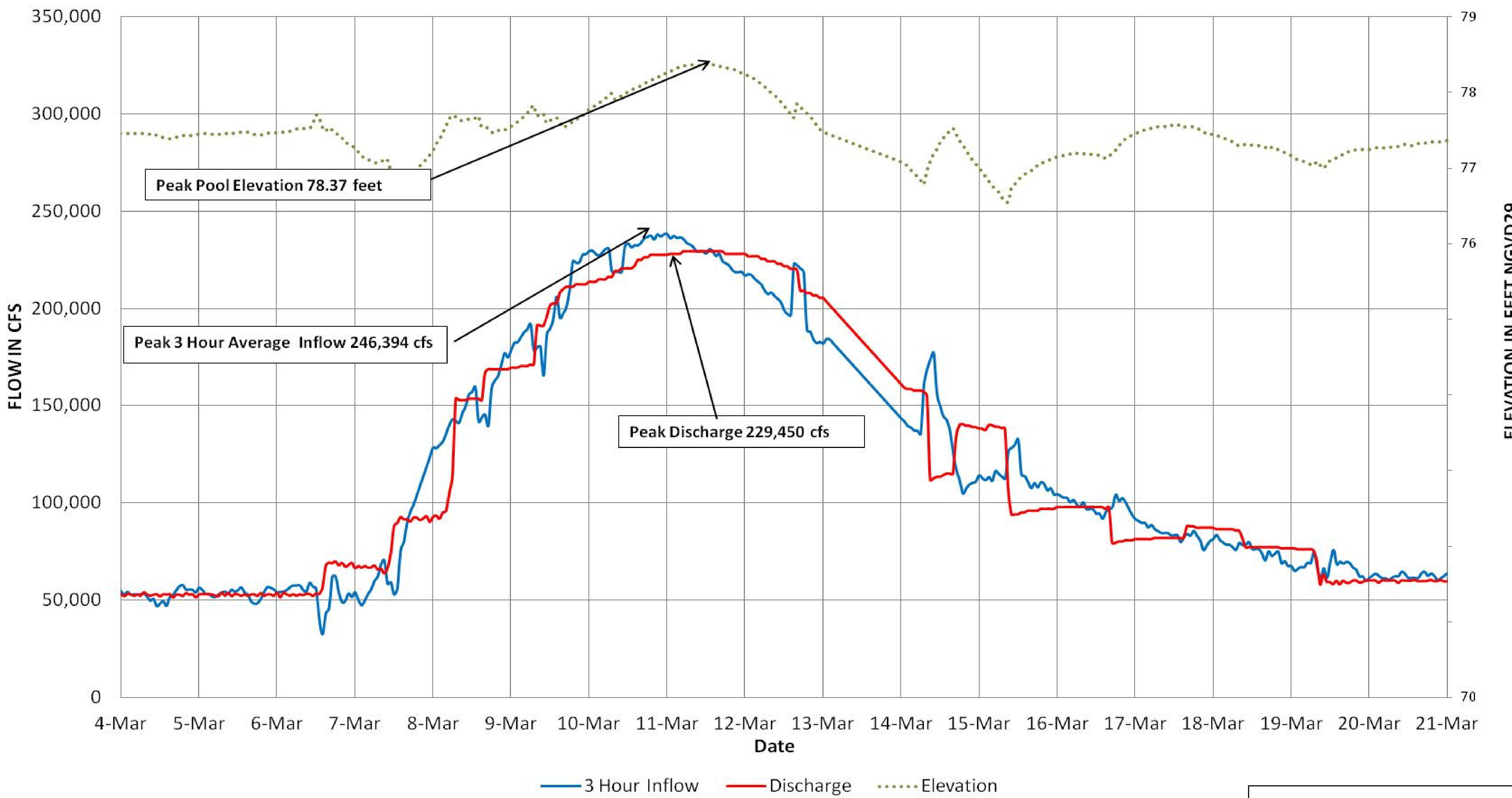
INFLOW-OUTFLOW-POOL STAGE HYDROGRAPHS
FLOOD OF MARCH 1929



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND LAKE SEMINOLE

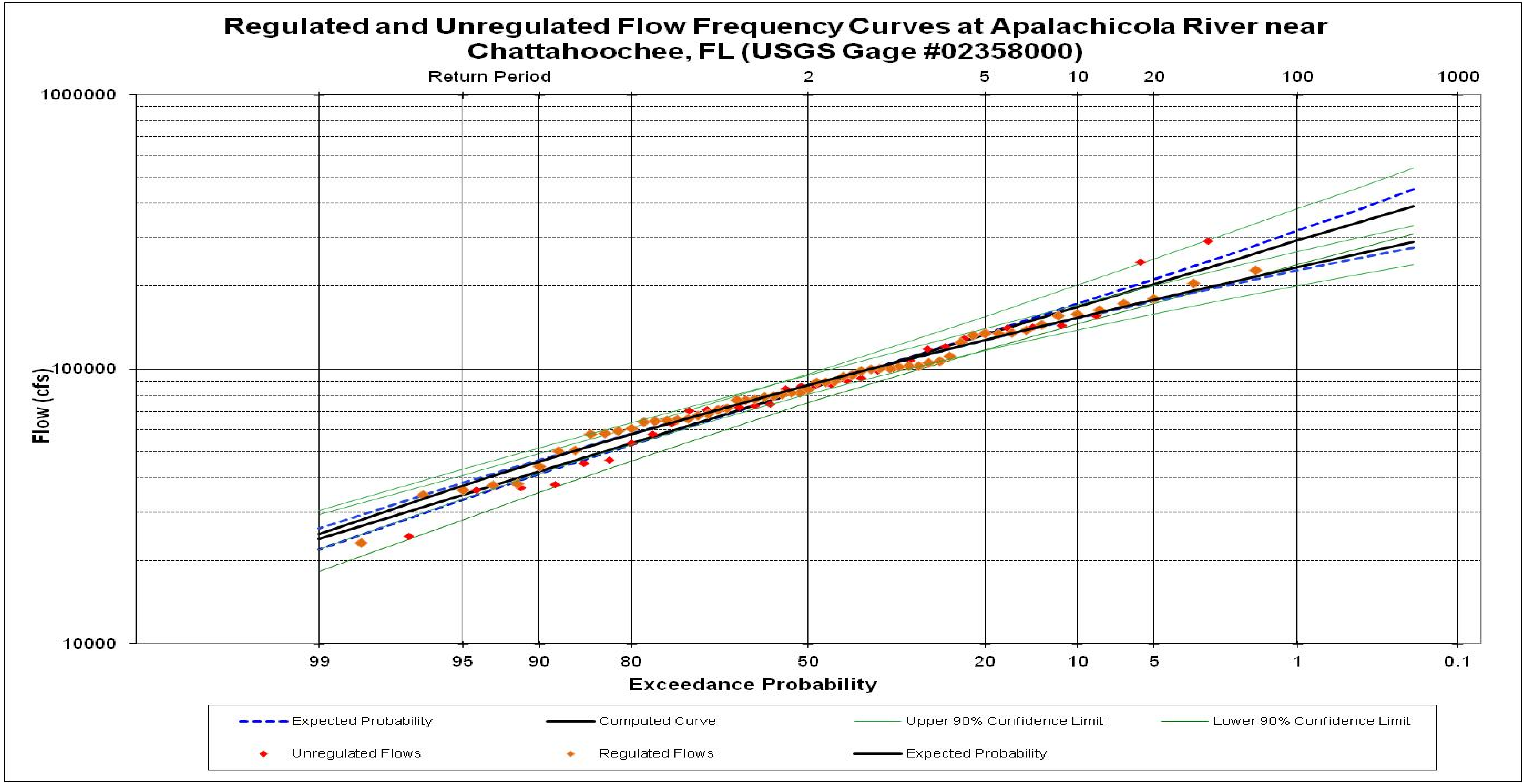
INFLOW-OUTFLOW-POOL STAGE HYDROGRAPHS
FLOOD OF July 1994



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND
LAKE SEMINOLE

INFLOW-OUTFLOW-POOL STAGE
HYDROGRAPHS
FLOOD OF March 1998



Unregulated period: 1919 -1957
Regulated period: 1957 – 2013

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN
WATER CONTROL MANUAL
JIM WOODRUFF LOCK AND DAM AND

LAKE SEMINOLE
FLOW FREQUENCY CURVES FOR THE APALACHICOLA RIVER NEAR CHATTAHOOCHEE, FL