US Army Corps of Engineers ®
Mobile District

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN WATER CONTROL MANUAL

Final Draft
APPENDIX F

CLAIBORNE LOCK AND DAM AND LAKE
ALABAMA RIVER, ALABAMA

U.S. ARMY CORPS OF ENGINEERS
SOUTH ATLANTIC DIVISION
MOBILE DISTRICT
MOBILE, ALABAMA

APRIL 1972
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Claiborne Lock and Dam
Alabama River, Alabama

NOTICE TO USERS OF THIS MANUAL

Regulations specify that this Water Control Manual be published in 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, contact can be made with the Water Management Section, Mobile District Office by phoning (251) 690-2730, during regular duty hours and (251) 509-5368 during non-duty hours. The Claiborne Lock Foreman can be reached at (251) 282-4575. The Millers Ferry Powerhouse can be reached at (334) 682-9124.

METRIC CONVERSION

Although values presented in the text are shown in 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). It is the U.S. Army Corps of Engineer's (Corps) policy that the designed, constructed, and maintained elevation grades of projects be reliably and accurately referenced to a consistent nationwide framework, or vertical datum - i.e., the National Spatial Reference System (NSRS) or the National Water Level Observation Network (NWLON) maintained by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration. The current orthometric vertical reference datum within the NSRS in the continental United States is the North American Vertical Datum of 1988 (NAVD88). The current NWLON National Tidal Datum Epoch is 1983 - 2001. The relationships among existing, constructed, or maintained project grades that are referenced to local or superseded datums (e.g., NGVD29, MSL), the current NSRS, and/or hydraulic/tidal datums, have been established per the requirements of Engineering Regulation 1110-2-8160 and in accordance with the standards and procedures as outlined in Engineering Manual 1110-2-6056. A Primary Project Control Point has been established at this project and linked to the NSRS. Information on the Primary Project Control Point, designated 6-21E, and the relationship between current and legacy datums are in Exhibit B.

CLAIBORNE LOCK AND DAM AND LAKE

WATER CONTROL MANUAL
ALABAMA RIVER, ALABAMA
U.S. Army Corps of Engineers, Mobile District, South Atlantic Division

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PERTINENT DATA

GENERAL

Location – Clarke, Monroe, & Wilcox Counties, Alabama; Alabama River, river mile 72.5	
Drainage area Millers Ferry to Claiborne – sq. mi.	836
Total drainage area above Claiborne Dam site – sq. mi.	21,473
Maximum Static Head (feet)	30

RESERVOIR

Length at elevation 36.0 feet NGVD29 – miles	60.5
Area at pool elevation 36.0 ft. NGVD29 – acres	6,290
Total volume at elevation 36.0 ft. NGVD29 – acre-feet	102,480

GATED SPILLWAY

Total length, including end piers - feet	416
Elevation of crest – NGVD29	15.0
Number and Type of gates	6 Tainter
Size of gates – feet	60x21
Elevation of top of gates in closed position – NGVD29	36.0

FIXED CREST SPILLWAY

Length – feet	500
Elevation of ogee crest – NGVD29	33.0
Type of stilling basin	roller bucket

EARTH OVERFLOW DIKES

Right Bank Dike	
Total length; Top width – feet	200; 25.0
Top elevation – NGVD29	40.0
Side slopes	1v to 3h
Left Bank Dike	
Total length including esplanade and ramp, feet	2,350
Top elevation – NGVD29	60.0
Top width – feet	32.0
Side slopes	1v to 4h

LOCK

Maximum lift – feet	30.0
Chamber width by length – feet	84 x 600

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 (now termed flood risk management) or navigation at all U.S. Army Corps of Engineers (Corps) reservoirs. This water control manual has been prepared as directed in the Corps' Engineering Regulation (ER) 1110-2-240, *Water Control Management, dated 8 October 1982*. This 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. This manual is also prepared under the format and recommendations described in ER 1110-2-8156, *Preparation of Water Control Manuals, dated 31 August 1995*; and ER 1110-2-1941, *Drought Contingency Plans, dated 15 September 1981*.

1-02. Purpose and Scope. The primary purpose of this manual is to document the water control plan for the Claiborne Lock and Dam Project. Details of the coordinated reservoir regulation plan for Claiborne Lock and Dam within the multiple project system of the Alabama River Basin are presented which insure optimum benefits consistent with the physical characteristics and purposes for which the system was authorized. Included are descriptions of physical components of the lock and dam, operating procedures, historical facts and other pertinent data. Also presented are general characteristics of the area including: flood frequencies, meteorology, examples of reservoir regulation and a discussion on river forecasting. In conjunction with the *ACT Basin Master Water Control Manual*, this manual provides a general reference source for Claiborne 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. The *Alabama-Coosa-Tallapoosa (ACT) River Basin - Basin Master Water Control Manual*, of which this is Appendix F, contains general information for the entire basin. Appendices to the basin master manual are prepared for all reservoir projects within the basin when one or more project functions are the responsibility of the Corps. Other manuals published for use by project personnel include Claiborne Lock and Dam Operation and Maintenance Manual, and CESAM Plan 500-1-4, Emergency Notification Procedures. A list of all the appendices for the ACT Basin and the master manual are listed below.

Alabama-Coosa-Tallapoosa River Basin Master Water Control Manual

- Appendix A - Allatoona Dam and Lake
- Appendix B - Weiss Dam and Lake (Alabama Power Company)
- Appendix C - Logan Martin Dam and Lake (Alabama Power Company)
- Appendix D - H. Neely Henry Dam and Lake (Alabama Power Company)
- Appendix E - Millers Ferry Lock and Dam and William "Bill" Dannelly Lake
- Appendix F - Claiborne Lock and Dam and Lake
- Appendix G - Robert F. Henry Lock and Dam and R. E. "Bob" Woodruff Lake
- Appendix H - Carters Dam and Lake and Carters Reregulation Dam
- Appendix I - Harris Dam and Lake (Alabama Power Company)

1-04. Project Owner. The Claiborne Lock and Dam project is a federally-owned project entrusted to the Corps, South Atlantic Division (SAD), Mobile District.

1-05. Operating Agency. The Corps' Mobile District operates the Claiborne Lock and Dam Project. Reservoir operation and maintenance are under the supervision of Operations Division. The project falls under the direction of the Operations Project Manager located at Tuscaloosa, Alabama. The lock is operated 24 hours a day, seven days a week. The Claiborne Lock Foreman can be reached at (251) 282-4575.

1-06. Regulating Agencies. Authority for the water control regulation of the Claiborne Project has been delegated to the SAD Commander. Water control regulation activities are the responsibility of the Mobile District, Engineering Division, Water Management Section. When necessary, the Water Management Section instructs the lockmaster regarding normal procedures and emergencies for unusual circumstances.

II – DESCRIPTION OF THE PROJECT

2-01. Location. Claiborne Lock and Dam is located 72.5 miles above the mouth of the Alabama River in the southwestern part of the State of Alabama. The dam and about 28 miles of the lower part of the reservoir lie entirely within Monroe County, except for two small reaches totaling about one mile which are in Clarke County. The remaining 32 miles of the reservoir are in Wilcox County. The project is shown on Plate 2-1, Plate 2-2, and on Figure 2-1.

Figure 2-1. Claiborne Lock and Dam

2-02. Project Purpose. The Claiborne Lock and Dam is primarily a navigation structure. The project's minimum reservoir level, elevation 32 feet NGVD29, provides navigation depths up to the Millers Ferry Lock and Dam. The Claiborne Project also reregulates the peaking power releases from the upstream Millers Ferry Project providing navigable depths in the channel below Claiborne. Other purposes provided by the project include water quality, public recreation and fish and wildlife conservation and mitigation. Recreation facilities and access to the reservoir are provided, but recreation is typically not considered in water control decisions. There is no flood risk management storage for this project.

2-03. Physical Components. The Claiborne Project consists of a concrete gravity-type dam with both a gated spillway section and a free overflow section, supplemented by earth dikes, a navigation lock and control station, and a reservoir extending 60.5 miles upstream to the Millers Ferry Lock and Dam. The project's principal features are described in detail in subsequent paragraphs. Plan, elevation and section views of project structures are shown on Plates 2-3 through 2-5.

a. Spillway. The spillway is a concrete gravity structure consisting of two different sections, a gated spillway and a free overflow un-gated spillway.

The gated spillway consists of a broad crested weir with the crest at elevation 15 feet NGVD29. The flow is controlled by six tainter gates, each 60 feet wide and 21 feet high. In the closed position the top of the gates are at elevation 36 feet NGVD29. The gates are mounted between eight-foot wide piers and are operated by individual electric hoists located on top of the piers. An access bridge for pedestrian traffic connects the top of the piers. The overall length of the gated spillway is 416 feet.

The un-gated spillway section is an ogee type, free overflow with the crest at elevation 33 feet NGVD29 and a length of 500 feet. Plan and elevation drawings of the fixed and gated spillways are shown on Plates 2-3 and 2-4.

b. Reservoir. The reservoir formed by the Claiborne Dam covers an area of 6,290 acres, and has a total volume of 102,480 acre-feet at the full pool elevation of 36 feet NGVD29. The reservoir extends upstream 60.5 miles to the Millers Ferry Lock and Dam and has a shoreline distance of about 216 miles. The reference pool elevation for dredging purposes is 35 feet NGVD29. Area and capacity curves are shown on Plate 2-6 and are tabulated in Table 2-1.

Table 2-1. Area – Capacity Data

POOL ELEV (ft NGVD29)	TOTAL AREA (acres)	TOTAL STORAGE (ac-ft)		POOL ELEV (ft NGVD29)	TOTAL AREA (acres)	TOTAL STORAGE (ac-ft)
2	0	0		26	4,490	50,830
3	80	40		27	4,610	55,380
4	180	170		28	4,700	60,030
5	290	410		29	4,800	64,790
6	420	770		30	4,900	69,640
7	570	1,260		31	5,040	74,610
8	720	1,900		**32	5,210	79,740
9	900	2,720		***33	5,410	85,040
10	1,080	3,710		34	5,650	90,570
11	1,290	4,900		****35	5,930	96,360
12	1,520	6,300		*****36	6,290	102,480
13	1,760	7,950		37	6,670	.108,950
14	2,010	9,840		38	7,080	115,820
*15	2,260	11,970		39	7,530	123,130
16	2,520	14,360		40	7,970	130,880
17	2,810	17,020		41	8,400	139,060
18	3,070	19,960		42	8,840	147,680
19	3,310	23,150		43	9,380	156,790
20	3,510	26,560		44	10,170	166,560
21	3,710	30,170		45	11,180	177,240
22	3,900	33,980		46	12,470	189,060
23	4,070	37,960		47	13,700	202,150
24	4,220	42,110		48	15,000	216,500
25	4,360	46,400		49	16,300	232,150
				50	17,590	249,090

* Gated spillway crest.
** Minimum pool.
*** Free - overflow spillway crest.
**** Reference pool elevation for dredging purposes.
***** Maximum operating pool.

c. Earth Dikes. On the right bank, an earth dike joins the abutment of the fixed-crest spillway and runs westwardly about 200 feet to high ground. This dike has a crest elevation of 40 feet NGVD29, which provides a freeboard of four feet above maximum operating pool. The crest will be overtopped by floods with a recurrence frequency of twice a year. The crest and both slopes have grouted riprap for protection from wave action and from high velocities during overtopping periods. The left bank dike begins at the mound adjacent to the lock and extends eastward 2,350 feet to high ground. The crest of this dike is at elevation 60.0 feet NGVD29, except where it slopes down to the level of the lock esplanade at elevation 51.0 feet NGVD29. Along the upstream face of the dike for 2,000 feet, excess excavated material has been dumped and leveled to elevation 58.0 feet NGVD29. On the downstream side of the dike, excess excavated material has been placed and leveled to elevation 56.0 feet NGVD29. The top of the dike is 32 feet wide and is covered by a paved roadway providing access to the lock area.

d. Lock. The lock is located on the left bank between the gated spillway and the left bank earth dike. The lock chamber is 84 feet wide and has a usable length of about 600 feet. The length from center to center of the gate pintles is 655 feet. The top of the upper stoplog sill and miter sill is at elevation 19 feet NGVD29, 13 feet below the minimum pool elevation of 32 feet NGVD29 and the top of the lower sill is at elevation -8 feet NGVD29, 13 feet below the minimum tailwater at elevation 5 feet NGVD29. The tops of the lock walls and of the upper and lower guide walls are all at elevation 51 feet NGVD29. The lock filling and emptying system consists of two rectangular intake ports located on the river side of the upper-gate blocks, which merge into a 10-foot square culvert in each of the chamber walls, a system of floor culverts located within the lock chamber, and an outlet structure on the riverside of the lock below the lower gate sill. The filling and emptying operation is controlled by reverse tainter valves located in the culverts. The volume of water, in acre-feet, discharged each time the lock is emptied can be determined by multiplying the gross head by 1.264. The lock plan and elevation are shown on Plate 2-5.

e. Lock Control Station. The Control Station is a three-story reinforced concrete building 34 feet long and 32 feet wide located on the lock monolith abutting the gated spillway. Control equipment for operating both the spillway and lock is located on the station's second floor where an unobstructed view of the lock is provided. The third floor is at the same level as, and provides access to, the spillway access bridge.

2-04. Real Estate Acquisition. Land acquisition authorization for the Claiborne Project was enacted under P.L. No. 14, dated 2 March 1945. The acreage acquired for all project purposes totals 5,700.050 acres. Of that total acreage, 3,015.470 acres were acquired in fee, 2,681.270 acres acquired by perpetual easement, and 3.310 acres acquired by license. The acquisition guide lines for flowage easements were based upon computations for backwater effect with the dam in place. The guideline adopted from Claiborne Dam to river mile 90.2 is at elevation 37.0 feet NGVD29. The guide line continues along a gradient established by a one-foot effect to elevation 49.0 feet NGVD29 at Millers Ferry Lock and Dam. There are a total of 9 Real Estate Segment Maps traversing Clarke, Monroe, and Wilcox Counties, which depict the 310 tracts acquired and the final acquisition limits based on the aforementioned elevations. Portions of the fee-owned land have been dedicated for intensive wildlife management as part of the Tennessee Tombigbee Waterway Wildlife Mitigation project. An overview of the real estate acquisition areas are shown on Plate 2-7.

2-05. Public Facilities. The Claiborne Project presently offers beaches, campgrounds, picnic areas, trails, hunting, boat launching ramps, and ferry crossings. There are 13 parks within the project area with McDuffie Landing Marina and the Lower Peachtree Parks being used for hunting only. All but two parks are operated by the Corps. Wilcox County operates Black Creek and Gulletts Bluff Parks. The Corps maintains Haines Island Park but Monroe County operates the ferry and maintains the access road there and at Davis Ferry Park. The Claiborne Lake Park facilities are managed from the resource manager's office at William "Bill" Dannelly

Reservoir. The Resource Manager can be reached at (334) 682-4655. Table 2-2 and Plates 2-7 and 2-8 show public use areas.

Table 2-2. Claiborne Lake Public Facilities

	Camping	Boat Ramps	Picnic	Play Ground	Swimming Area	Trails
Bells Landing	y	y	y			y
Black Creek		y				
Clifton Ferry		y	y			
Cobbs Landing		y				
Damsite East Bank						
Damsite West Bank	y		y			
Davis Ferry						
Gullets Bluff			y			
Haines Island	y	y	y	y	y	y
Holleys Ferry		y	y			y
Isaac Creek	y	y	y	y	y	y
Silver Creek	y	y	y			y

III - HISTORY OF PROJECT

3-01. Authorization. The original project for the improvement of the Alabama River was authorized by Congress on 18 June 1878 to provide for a navigation channel four feet deep and 200 feet wide from the mouth to Wetumpka and was modified on 13 July 1892 to provide a 6-feet channel. Subsequent acts approved in 1905 and 1910 provided for a channel 4-foot deep at low water from the mouth to Wetumpka by the use of contracting dikes and dredging. This project was 62 percent complete in 1942, the last year that any new work was performed. The 9-foot navigation channel was authorized by the River and Harbor Act of March 2, 1945 (P. L. 79-14). The authorization refers to House Document 77-414. The House Document recommended the authorization of a general plan for the basin "...in accordance with plans being prepared by the Chief of Engineers." The basin plan at that time contemplated a 9-foot deep navigable channel from the mouth of the Alabama River to Rome, Georgia, to be achieved by open river works and locks and dams.

3-02. Planning and Design.

The first comprehensive report on the optimum use of the water resources of the basin was prepared by the Corps in 1934, and was printed as House Document No. 66, 74th Congress, 1st session (308 Report). The plan contemplated five navigation dams on the Alabama River.

A resolution by the Committee on Rivers and Harbors, House of Representatives, passed on 28 April 1936, requested a review to determine if changes in economic conditions warranted modifying House Document No. 66, 74th Congress, with regard to the Alabama River. A resolution of the Committee on Commerce, U. S. Senate, adopted 18 January 1939, requested a review to determine the advisability of constructing reservoirs on the Alabama-Coosa Rivers and tributaries for development of hydroelectric power and improvement for navigation.

The Chief of Engineers in a report submitted on 15 October 1941 and printed as House Document No. 414, 77th Congress, 1st Session, recommended a general plan for the development of the basin. Congress authorized in the River and Harbor Act of 2 March 1945, (P.L. 79-14) the initial and partial accomplishment of this plan. Planning studies for the initially authorized projects on the Alabama River to provide navigation facilities with the maximum hydroelectric power feasible began in 1945.

A site selection report for the entire Alabama River was submitted on 10 December 1945. It recommended dredging the lower river and building the Claiborne, Millers Ferry and Jones Bluff locks and dams with power plants at the latter two projects. The first design memorandum for Claiborne, "General Design No. 1", was submitted on 12 April 1963. This report proposed the Claiborne plan to include a navigation lock, a gated spillway, a fixed spillway, a control station, and earth dikes on both banks. Seven other design memoranda dealing with particular project features were submitted during the next four years.

3-03. Construction. A contract to construct the Claiborne Lock and Dam was awarded to the Arundel and Dixon Companies, as a joint venture, on 22 April 1966. The lock and the gated spillway were completed in 1969 and the second stage cofferdam was placed to allow for fixed crest spillway construction. In November 1969, the pool was raised to elevation 31 feet NGVD29 and navigation through the lock was permitted on 15 November 1969. In early December 1969, the pool was raised to elevation 32 feet NGVD29 and was maintained between elevations 32 and 33 feet NGVD29, except during a brief flood period, until mid-May 1970 when the then full pool of 35.0 feet NGVD29 was attained.

3-04. Related Projects. Claiborne Lock and Dam is the lower of three projects providing navigation from the Port of Mobile, Alabama, to Montgomery, Alabama. The middle project, Millers Ferry Lock and Dam, is upstream at river mile 133.0. Robert F. Henry Lock and Dam Project is further upstream at river mile 236.3. Both Millers Ferry and Robert F. Henry Projects have hydropower capabilities.

The Alabama River Navigation Channel provides navigation from the mouth of the Alabama River upstream to Wetumpka, just north of Montgomery, Alabama. The dredging reference profile for the Alabama River Channel below Claiborne Lock and Dam, modified in the spring of 1988, provides for a 9-foot depth channel with a flow of 7,500 cfs.

3-05. Modifications to Regulations. There have been no modifications to the regulations originally established for the Claiborne Lock and Dam Project.

3-06. Principal Regulation Problems. There have been no significant regulation problems, such as erosion, boils, severe leakage, etc., at Claiborne Project.

IV – WATERSHED CHARACTERISTICS

4-01. General Characteristics. The Alabama-Coosa-Tallapoosa River System drains a small portion of Tennessee, northwestern Georgia, and northeastern and east-central Alabama. The Alabama River Basin has its source in the Blue Ridge Mountains of northwest Georgia. The main headwater tributaries are the Oostanaula and Etowah Rivers, which join near Rome, Georgia, to form the Coosa River. The Coosa River in turn joins the Tallapoosa River near Wetumpka, Alabama, approximately 14 miles north of Montgomery, Alabama, to form the Alabama River. The drainage basin is about 330 miles in length, and averages 70 miles wide with a maximum width of about 125 miles. The basin has a total drainage area of 22,500 square miles of which 21,473 square miles are above Claiborne. The basin above Claiborne is shown in Plate 2-1

4-02. Topography. The ACT River Basin is composed of an unusually wide range of topographic areas. The location of the river basin is within parts of five physiographic provinces: the Blue Ridge Province; the Valley and Ridge Province; the Piedmont Plateau; the Cumberland Plateau; and, the Coastal Plain. Each of these physiographic sub-divisions influences drainage patterns. High rounded mountains and steep narrow valleys characterize the northeastern portion of the basin in the Blue Ridge Province. Overburden is sparse except in the valley flood plains. The topography of the Valley and Ridge Province is alternating valleys and ridges with altitudes varying from approximately 600 to 1,600 feet. The dominant characteristics of the Cumberland Plateau are flat plateaus ranging in altitude from 1,500 to 1,800 feet that bound narrow, northeast southwest rending valleys. Rolling hills and occasional low mountains topographically characterize the Piedmont Province. Altitudes range from 500 to 1,500 feet. Low hills with gentle slopes and broad shallow valleys that contain slow-moving meandering streams with wide floodplains characterize the topography of the Coastal Plain.

The Alabama River has its source in the Blue Ridge Mountains of northwest Georgia. The main headwater tributaries are the Oostanaula and Etowah Rivers which join near Rome, Georgia, to form the Coosa River. The Coosa and Tallapoosa Rivers join in east-central Alabama about 27 stream miles northeast of Montgomery, Alabama to form the Alabama River. The Alabama then flows generally westward for 100 miles to Selma, Alabama and then southwestward 210 miles to its mouth where it joins the Tombigbee River to form the Mobile River. Mobile Bay and the port of Mobile are 45 miles farther south.

The Oostanaula, Etowah, Coosa and Tallapoosa Rivers are the principal tributaries to the Alabama River. The Cahaba River is the largest stream entering the river below its source. Other tributaries include Catoma Creek and Pine Barren, Mulberry and Turkey Creeks.

4-03. Geology and Soils. The formations underlying the watershed range from rugged crystalline rocks to unconsolidated sands, marls, and clays. Claiborne is in the Southern Red Hills Division of the Gulf Coastal Plain Physiographic Province. This province's softer sedimentary formations consist of typical coastal plain deposits of variable inter-bedded limestones, clays, sands and sandstones of the Paleocene and Eocene age. The deposits contrast sharply with the harder rocks of the provinces above. As the rivers leave the hard rocks and enter the softer formations, the difference in erosion characteristics causes rapids to form. This is commonly known as the "Fall Line". This Fall Line crosses the Cahaba River near Centreville, Alabama, the Coosa River near Wetumpka, and the Tallapoosa River near Tallassee, Alabama.

4-04. Sediment. Sedimentation ranges were established for the entire reservoir length and surveyed in 1996 and 2009. Retrogression ranges were also established and surveyed for about 40 miles below Claiborne Dam. Key ranges are resurveyed at regular intervals for any appreciable changes in channel geometry. The latest survey was in 2009 and is retained in the Hydraulic Data and Sedimentation Unit at the Mobile District Office. Sedimentation range locations appear on Plate 4-1 and retrogression range locations on Plate 4-2.

Claiborne Lake is the most downstream of the three Alabama River Lakes. Claiborne Lake can be divided into three major reaches based on the sedimentation trends: The upper third is undergoing light sedimentation, the middle third is undergoing bed scour, and the lower third is undergoing a medium degree of sedimentation. The greater sedimentation near the downstream end of the lake is expected in a run-of-the-river project located immediately below another impoundment project. Shoreline conditions are mixed deposition and erosional. Shorelines are typically well vegetated with gently sloping banks tending to be more depositional, and steeper banks being more erosional.

4-05. Climate.

a. Temperature. The ACT Basin area has long, warm summers, and relatively short, mild winters. In the southern end of the basin, the average annual temperature is 65 degrees Fahrenheit (°F) with a mean monthly range from 46 °F in January to 80 °F in July and August. In the northern end, the average annual temperature is 62 °F with a mean monthly range from 42 °F in January to 79 °F in July. Extreme temperatures recorded in the basin range from a low of minus 17 °F at Lafayette, Georgia, in January 1940 to a high of 112 °F at Centreille, Alabama, in September 1925. The frost-free season varies from about 200 days in the northern valleys to about 260 days in the southern part of the basin. The normal monthly and annual temperatures for various portions of the Alabama Basin are shown on Table 4-1. Extremes and average temperature data at six representative stations throughout the basin are shown in Plate 4-3. The location of the stations is shown on Plate 4-4.

Table 4-1. Normal 30-year Air Temperature for Selected Sites in/near Claiborne Basin
(Based on 1981 to 2010 Normals published by National Weather Service)

Normal Temperature Based on 30-Year Period – 1981 Through 2010 (degrees Fahrenheit)														
Station		**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUNE**	**JULY**	**AUG**	**SEPT**	**OCT**	**NOV**	**DEC**	**ANNUAL**
Greenville (USC00013519)	Max	57.6	61.7	69.1	75.9	83.0	88.3	90.4	90.0	85.7	77.2	68.4	59.4	75.6
	Mean	45.5	49.2	55.7	62.5	70.6	76.8	79.3	79.0	74.4	64.7	55.6	47.5	63.4
	Min	33.4	36.7	42.3	49.1	58.2	65.3	68.2	68.1	63.1	52.2	42.8	35.6	51.3
Evergreen (USC00012758)	Max	58.8	63.0	70.6	77.1	84.2	89.2	90.9	90.6	86.6	78.2	69.3	60.8	76.7
	Mean	47.2	50.7	57.5	64.0	72.1	78.3	80.5	80.2	75.7	66.1	56.9	49.4	64.9
	Min	35.6	38.4	44.3	50.8	59.9	67.4	70.0	69.8	64.9	54.1	44.5	38.0	53.2
Camden 3NW (USC00011301)	Max	56.7	61.4	69.9	77.0	84.2	89.6	91.7	91.4	87.2	77.7	68.0	59.1	76.2
	Mean	46.0	49.9	57.5	64.5	72.3	78.8	81.0	80.7	75.9	65.6	56.2	48.2	64.7
	Min	35.2	38.5	45.2	52.0	60.4	68.0	70.3	69.9	64.6	53.6	44.4	37.3	53.3
Thomasville (USC00018178)	Max	57.3	61.5	69.4	76.5	83.6	89.0	90.9	91.0	86.7	77.5	68.3	59.1	76.0
	Mean	46.3	50.2	57.5	64.1	72.2	78.4	80.8	80.6	75.6	65.7	56.7	48.3	64.8
	Min	35.4	38.8	45.5	51.6	60.8	67.9	70.7	70.1	64.6	53.9	45.2	37.5	53.6
Claiborne Basin	Max	57.6	61.9	69.8	76.6	83.8	89.0	91.0	90.8	86.6	77.7	68.5	59.6	76.1
	Mean	46.3	50.0	57.1	63.8	71.8	78.1	80.4	80.1	75.4	65.5	56.4	48.4	64.5
	Min	34.9	38.1	44.3	50.9	59.8	67.2	69.8	69.5	64.3	53.5	44.2	37.1	52.9

b. Precipitation. The ACT Basin lies in a region of heavy annual rainfall which is fairly well distributed throughout the year. The normal annual precipitation for the Claiborne watershed area is 58.04 inches. Fifty-eight percent of the rainfall occurs during the winter and spring months, 23 percent in the summer, and 19 percent in the fall. The normal monthly and annual precipitations for various stations in or near the Claiborne watershed are shown on Table 4-2. The maximum calendar year rainfall over the ACT Basin was 78 inches in 1929 and the minimum annual was 32 inches in 1954. The highest annual station rainfall recorded in the ACT Basin was 104.03 inches at Flat Top, Georgia, in 1949; the lowest recorded was 22.00 inches at Primrose Farm, Alabama, in 1954. The light snowfall that occasionally occurs seldom covers the ground for more than a few days and has never affected any major flood in the basin. Precipitation extremes and averages for the basin are shown on Plate 4-5.

Table 4-2. Normal 30-year Precipitation for Selected Sites in/near Claiborne Basin
(Based on 1981 to 2010 Normals published by National Weather Service)

Normal Precipitation Based on 30-Year Period – 1981 Through 2010 (inches)														
Station		**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUNE**	**JULY**	**AUG**	**SEPT**	**OCT**	**NOV**	**DEC**	**ANNUAL**
Greenville (USC00013519)	Mean	5.27	4.86	6.10	3.97	3.94	5.00	5.79	4.76	4.17	3.64	5.20	4.66	57.36
Evergreen (USC00012758)	Mean	5.67	5.33	6.14	4.46	4.52	5.52	6.51	5.07	4.31	3.55	4.88	5.06	61.02
Camden 3NW (USC00011301)	Mean	5.54	5.09	5.93	4.12	4.32	4.25	5.56	4.15	3.57	2.86	5.32	5.14	55.85
Thomasville (USC00018178)	Mean	5.58	5.10	5.82	4.03	4.43	4.62	6.12	3.96	4.14	3.54	5.24	5.23	57.81
Claiborne Basin	Mean	5.52	5.10	6.00	4.15	4.30	4.85	6.00	4.49	4.05	3.40	5.16	5.02	58.04

4-06. Storms and Floods.

a. General. Flood-producing storms may occur over the basin anytime but are more frequent during the winter and early spring. These storms are usually of the frontal variety lasting two to four days. Summer storms are the convective type thundershowers with high intensity rainfall over small areas which produce local floods. In the fall, occasional heavy rains may accompany dissipating tropical cyclones.

b. Record Floods. A major storm system in the spring of 1990 produced record floods on the Alabama River. On 16 March 1990, with the river still high from previous rains, the entire basin received very heavy rainfall for two days. For the two day total R. F. Henry reported 9.0 inches, Millers Ferry reported 6.75 inches and Claiborne had 9.5 inches. The upper ACT Basin received an average of 6 to 7 inches during this period. Claiborne discharged a record breaking 255,000 cfs on March 25, 1990, producing a tailwater of 56.6 feet NGVD29. The previous records, a maximum daily discharge of 215,000 cfs and a maximum tailwater of 55.0 feet NGVD29, were caused by an April 1979 storm. The largest known flood for the entire period of record is the historical flood of 1961 with a peak discharge of 267,000 cfs. . Another significant flood occurred on 11-16 March 1929, when 10 inches of rainfall over a period of three days was recorded in the vicinity of Auburn, Alabama. A peak discharge was not recorded for the historical flood of April 1886, which is the greatest flood on record for the Millers Ferry Project immediately upstream of Claiborne.

4-07. Runoff Characteristics. The streams contributing flow to the Alabama River above the Claiborne Dam site exhibit wide variations in runoff characteristics. They range from very flashy in the mountainous regions of the Coosa Basin above Rome, Georgia, to very slow rising and falling in the lower reaches. The mean annual discharge for the period October 1930 through September 2008 is 31,934 cfs or about 1.5 cfs per square mile.

Streamflow at Dam Site. The average daily discharges are shown in Plate 4-6 through Plate 4-12. These flows were developed from two USGS gages. The initial gaging station at Claiborne, located 5.7 miles downstream from the Claiborne Dam site at the U. S. Highway 84 Bridge, was established in 1930. This gage was used for discharge and stage measurements from 1930 through September 1975. Because the drainage basin above Claiborne is so large and the area between the dam and the U. S. Highway 84 Bridge is so small, the flow at the Highway 84 gage is adequate to represent the flow at the dam site. The second, and present-day gage is located at the dam site and is used for data from October 1975 thru the present (February 2010.)

Also shown on Plates 4-6 through 4-12 are the unimpaired flow data at Claiborne. This data set represents the flow that would have occurred if it had not been impacted by man. The original unimpaired flow data set developed as part of the Alabama-Coosa-Tallapoosa and Apalachicola Chattahoochee Flint (ACT/ACF) River Basins Comprehensive Water Resources Study, included data at over 50 locations for the 1939 to 1993 period of record and the original report is titled *ACT/ACF Comprehensive Water Resources Study, Surface Water Availability Volume I: Unimpaired Flow*, July 8, 1997. The data set has recently been extended through 2008. This input data has been adjusted for the impacts of the water use, withdrawals, returns, stream regulation and evaporation. Because of the occurrence of negative flows in the daily values, the data has been smoothed using 3-, 5-, or 7-day averaging. This preserves the volume of the flow and eliminates most of the small negative flows in some of the daily flow data.

Mean monthly and annual flows developed from the two USGS gages within the Claiborne watershed are presented on Table 4-3 (found at the end of this Section starting on page 4-10).

4-08. Water Quality. Generally, the surface waters of streams in the Alabama Basin are of good chemical quality. Water quality in Claiborne Lake is influenced by physical dynamics (depth, temperature, flow, etc.). Stratification and turnover are not significant issues due to generally shallow depth. There are also various sources of pollutant loads to the lake including tributaries and upstream contributions, both point and non-point. Upstream sources are dominated by those pollutants entering directly via the Alabama River. Point sources are generally municipal and industrial discharges regulated by the Alabama Department of Environmental Management (ADEM) and agricultural practices contribute the largest percentage of non-point pollutants.

The reservoir has been identified by ADEM in its 2012 Draft 303(d) list as violating State water quality standards for the following uses: swimming (mercury, organic enrichment), fish and wildlife (mercury, organic enrichment, siltation), and public water supply (organic enrichment). ADEM has set a standard for chlorophyll *a* in the lake of a maximum15µg/L during the growing season from April through October. The average chlorophyll *a* measured in the forebay by ADEM during the 2005 wet year was 9.26 µg/L and in the 2000 dry year 11.05 µg/L, all less than the ADEM standard. The ADEM standard for dissolved oxygen is a minimum 5.0 mg/L. Dissolved oxygen levels generally remains above the standard in the forebay; however, during times of low flow and high temperatures it has fallen as low as 4.97 mg/L during the period from 2000-2010. The ADEM standard for water temperature is a maximum 90 °F. Temperatures in Claiborne Lake range generally from 50 °F to 86 °F with occasional peaks of about 90 °F. In shallower embayments, there are greater fluctuations in these parameters and occasionally the standards are not met.

4-09. Channel and Floodway Characteristics. The navigation channel from the mouth of the Alabama River to Montgomery, Alabama has an authorized depth of nine feet and a width of 200 feet. Historically, the major problems in the channel below Claiborne have been stream degradation and the recurring shoaling which follows the annual high flow period. A study in 1987 showed that streambed degradation had affected the navigation channel from Claiborne Lock and Dam to about 15 miles downstream; the report also stated that the degradation process had probably reached an equilibrium condition. In this reach of the river, the degradation had lowered the water surface elevation and caused rock outcrops. In addition, it was found that there was less flow available than previously anticipated. In response to this report, the dredge reference profile was lowered using a design flow reduced from 8,450 cfs to 7,500 cfs, and a few of many rock outcrops were removed. Periodic dredging and constructing and/or replacing training dikes are performed when funds are available to help maintain the 9-foot channel. There are no major flood damage centers immediately downstream of the Claiborne Project.

4-10. Upstream Structures. Above Claiborne Lock and Dam are ten Alabama Power Company (APC) hydroelectric projects on the Coosa and Tallapoosa Rivers and four Corps projects. Millers Ferry and Robert F. Henry are located on the Alabama River above Claiborne Lock and Dam. Allatoona and Carters are located above the APC Coosa projects. The Hickory Log Creek Project was constructed in 2007 by the city of Canton, Georgia and Cobb County–Marietta Water Authority (CCMWA), and is located approximately 25 miles northeast of Allatoona Dam. Table 4-4 shows the upstream projects and their drainage areas. There are no dams downstream of Claiborne.

Table 4-4. Federal and Non-Federal Projects in ACT Basin

Agency	Alabama River Projects	Drainage Area sq. mi.
COE	Claiborne	21,473
COE	Millers Ferry	20,637
COE	R. F. Henry	16,233
	Coosa River Projects	
APC	*Jordan/Bouldin	10,165
APC	Mitchell	9,830
APC	Lay	9,087
APC	Logan Martin	7,700
APC	Neely Henry	6,600
APC	Weiss	5,273
COE	Allatoona	1,122
COE	Carters	374
Canton/CCMWA	**Hickory Log Creek	8
	Tallapoosa Projects	
APC	Thurlow	3,325
APC	Yates	3,250
APC	Martin	3,000
APC	Harris	1,453

* Jordan Dam is located on the Coosa River at river mile 18.9. Walter Bouldin Dam is located on a by-pass of the Jordan Dam and discharges into a canal which enters the Woodruff Lake at Coosa River mile 4.2.

*** Water is pumped directly from the Etowah River to support project, thus such a small drainage area.

4-11. Economic Data. The watershed surrounding the Claiborne Project consists of Clarke and Monroe Counties within Alabama. The watershed includes both developed urban and residential land uses and rural land uses within the watershed.

a. Population. The 2010 population of the two counties bordering the Claiborne Lock and Dam totaled 48,901. The income data for each county is shown in Table 4-5.

Table 4-5. Income Data per County

County	Population (2010)	Per Capita Income	Persons living below poverty
Clarke County	25,833	17,372	29.2%
Monroe County	23,068	17,652	25.4%
Total	48,901		

b. Agriculture – The Claiborne watershed and basin below consist of approximately 727 farms totaling 177,000 acres. In 2005, the agricultural production in the area totaled $12 million in farm products sold and total farm earnings of $6.7 million. Agriculture in the Claiborne Project watershed and basin consists primarily of livestock, which accounts for a majority of the value of farm products sold. Table 4-6 contains agricultural production information and farm earnings for each of the counties within the Claiborne Lock and Dam watershed and basin below.

Table 4-6. Agricultural Production and Income per County

County	2005 Farm Earnings ($1,000)	Number of Farms	Total Farm Acres (1,000)	Acres Per Farm	Value of Farm Products Sold ($1,000)	Percent Sold From	
						Crops	Livestock
Alabama							
Clarke County	740	284	57	201	2,000	25.9	74.1
Monroe County	5,986	443	120	271	10,000	39.8	60.2
Totals	6,726	727	177	243	12,000		
Source: U.S. Census Bureau, County and City Data Book: 2007							

c. Industry. The leading industrial sectors that provide non-farm employment are local and state government, retail trade, and manufacturing. In 2005, the Claiborne Lock and Dam area counties had 50 manufacturing establishments that provided 5,522 jobs with total earnings of more than $314 million. Table 4-7 shows information on the manufacturing activity for each of the counties in the Claiborne Lock and Dam watershed and basin below.

Table 4-7. Manufacturing Activity per County

County	No. of Manufacturing Establishments	Total Manufacturing Employees	Total Earnings ($1,000)	Value Added by Manufactures ($1,000)
Alabama				
Clarke County	30	1,922	103,476	224,625
Monroe County	20	3,600	210,889	354,898
Totals	50	5,522	314,365	579,523

(D)-Data withheld to avoid disclosure

Source: U.S. Census Bureau, County and City Data Book: 2007

d. Flood Damages. Because the dam is considered a run-of-the-river project, with very little storage, there are no quantifiable flooding impacts from the project. A table of water surface elevations at Claiborne and associated impacts is shown in Table 4-8.

Table 4-8. Flooding Impacts and Associated Claiborne Gage Elevation

Claiborne Gage Ht (ft NGVD29)	Flooding Impacts
27	Flooding of low lying lands and some roads near the confluence of the Alabama and Tombigbee rivers will occur.
35	Flooding of pasturelands along the lower Alabama river will occur.
40	Considerable flooding of agricultural lands in the area will occur.

Note: Flooding of agricultural lands will begin to gradually subside as the river drops below 40 feet however some overflow will continue until the level drops below 27 feet.

TABLE 4 – 3. ANNUAL, MONTHLY, AND DAILY FLOW DATA
(Monthly Flow in cfs 1930 - 1975 at USGS Gage 02429500; 1976 - 2011 at USGS Gage 02428400)

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Monthly Max	Monthly Min	Daily Max	Daily Min
1930				30,520	20,090	13,270	11,800	12,690	15,680	14,500	30,980	17,810					
1931	25,710	22,240	24,510	34,140	18,510	11,710	9,650	10,540	8,056	7,420	6,830	31,600	17,576	34,140	6,830	77,700	6,200
1932	53,320	83,060	38,210	39,680	27,680	17,020	23,400	16,290	15,530	17,360	22,390	82,080	36,335	83,060	15,530	157,000	7,850
1933	106,500	73,710	80,510	66,460	25,410	15,090	17,800	13,840	13,150	12,500	12,130	12,340	37,453	106,500	12,130	170,000	10,400
1934	18,850	15,730	63,710	21,900	17,080	20,890	13,950	20,390	14,230	37,400	19,680	20,080	23,658	63,710	13,950	122,000	9,590
1935	30,810	37,000	78,630	50,990	31,490	17,540	12,910	14,270	13,210	9,555	12,910	15,810	27,094	78,630	9,555	122,000	8,460
1936	111,800	119,900	35,150	112,300	23,510	15,090	14,640	18,500	11,980	13,440	11,590	20,540	42,370	119,900	11,590	183,000	9,750
1937	91,630	65,080	57,730	51,730	68,700	18,130	13,550	11,560	17,960	17,460	22,540	18,550	37,885	91,630	11,560	128,000	8,650
1938	20,830	18,540	48,660	150,900	24,340	17,750	26,940	26,240	13,330	9,975	10,050	10,470	31,502	150,900	9,975	227,000	8,800
1939	18,650	54,850	74,390	38,880	20,920	31,200	14,970	83,450	20,320	14,310	11,160	12,640	32,978	83,450	11,160	196,000	9,920
1940	28,010	58,610	50,890	36,030	24,840	19,460	58,550	15,780	10,680	9,153	10,270	19,350	28,469	58,610	9,153	98,600	8,400
1941	29,280	26,240	38,050	23,010	14,400	9,415	26,880	21,920	10,980	8,731	6,894	29,710	20,459	38,050	6,894	86,900	5,380
1942	29,570	42,440	76,800	43,530	16,820	24,430	16,630	22,140	14,600	12,820	11,380	26,930	28,174	76,800	11,380	133,000	9,320
1943	79,040	42,650	88,910	74,660	27,790	15,320	16,600	17,960	12,530	9,717	13,000	13,560	34,311	88,910	9,717	182,000	8,540
1944	29,630	48,390	86,430	126,200	66,680	18,040	13,020	17,010	14,090	9,906	10,810	15,540	37,979	126,200	9,906	168,000	8,390
1945	25,410	53,610	54,530	45,930	56,070	15,890	14,780	12,570	10,330	11,000	12,050	29,700	28,489	56,070	10,330	114,000	8,390
1946	110,900	94,900	84,290	69,960	56,410	43,690	25,960	24,020	19,410	13,130	17,580	17,840	48,174	110,900	13,130	149,000	10,300
1947	87,320	60,660	64,750	77,590	39,490	22,970	18,440	12,210	10,680	9,328	22,890	37,310	38,637	87,320	9,328	163,000	7,760
1948	23,570	89,310	85,630	65,710	17,530	13,600	17,920	23,190	11,960	11,440	45,990	131,800	44,804	131,800	11,440	218,000	8,400
1949	84,440	98,980	61,590	57,010	59,990	25,810	33,580	20,650	18,560	11,750	15,390	15,370	41,927	98,980	11,750	136,000	9,780
1950	25,770	36,160	51,770	27,320	24,220	16,390	23,570	23,790	29,960	13,890	12,810	16,410	25,172	51,770	12,810	84,400	10,000

TABLE 4 – 3. ANNUAL, MONTHLY, AND DAILY FLOW DATA
(Monthly Flow in cfs 1930 - 1975 at USGS Gage 02429500; 1976 - 2011 at USGS Gage 02428400)

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Monthly Max	Monthly Min	Daily Max	Daily Min
1951	24,300	33,720	40,510	99,190	23,960	13,400	13,980	11,030	9,635	8,823	13,670	41,990	27,851	99,190	8,823	148,000	6,020
1952	42,830	44,010	85,950	46,300	22,110	17,490	9,990	11,590	9,679	8,484	8,590	18,580	27,134	85,950	8,484	107,000	5,900
1953	55,660	56,290	66,050	48,990	70,270	15,750	15,370	11,240	10,030	12,030	10,110	43,980	34,648	70,270	10,030	124,000	6,000
1954	44,780	33,920	34,800	33,460	16,710	11,980	7,738	7,853	7,060	6,133	6,815	7,975	18,269	44,780	6,133	80,500	4,840
1955	22,230	39,990	30,330	73,670	22,940	18,050	15,120	15,380	8,688	8,127	9,621	11,720	22,989	73,670	8,127	135,000	6,940
1956	9,110	50,150	67,850	61,730	19,880	11,140	12,670	7,692	9,224	11,900	9,242	22,770	24,447	67,850	7,692	127,000	5,490
1957	23,330	50,420	36,580	98,490	35,150	19,690	17,700	9,680	13,200	20,330	41,950	52,100	34,885	98,490	9,680	154,000	6,990
1958	32,600	52,250	73,150	46,910	33,670	15,000	27,790	15,400	14,440	13,870	11,620	14,310	29,251	73,150	11,620	118,000	9,400
1959	24,880	48,940	43,750	41,830	19,060	38,790	11,970	9,797	11,240	17,290	18,700	21,440	25,641	48,940	9,797	71,100	8,280
1960	36,080	57,530	65,880	61,300	19,980	12,280	9,414	12,340	10,560	15,690	12,520	16,510	27,507	65,880	9,414	112,000	7,860
1961	18,760	62,330	165,100	86,310	28,540	27,550	28,410	13,470	16,200	9,579	9,784	107,200	47,769	165,100	9,579	266,000	8,350
1962	82,070	65,370	67,350	88,480	20,260	14,460	13,400	9,718	10,320	13,350	17,770	18,070	35,052	88,480	9,718	128,000	7,510
1963	45,900	45,510	70,800	24,740	43,830	23,840	21,250	13,430	9,666	11,050	9,275	23,450	28,562	70,800	9,275	100,000	7,960
1964	47,430	58,660	100,300	144,500	69,750	16,490	15,600	15,000	10,860	22,340	16,240	35,050	46,018	144,500	10,860	192,000	9,000
1965	45,830	71,350	63,880	54,520	14,890	17,050	14,390	12,780	11,200	17,030	11,450	15,880	29,188	71,350	11,200	112,000	9,620
1966	26,090	79,610	87,660	24,590	51,980	17,280	11,050	11,870	11,890	20,210	29,030	24,380	32,970	87,660	11,050	148,000	8,120
1967	38,510	39,400	27,420	10,750	26,140	15,350	30,000	24,760	33,310	18,210	33,580	72,920	30,863	72,920	10,750	96,000	7,250
1968	83,170	25,930	38,050	47,290	35,740	14,380	12,950	14,440	8,291	8,366	12,080	24,690	27,115	83,170	8,291	100,000	5,830
1969	37,990	50,530	40,900	43,050	41,600	17,930	12,050	11,960	16,670	16,100	9,347	18,220	26,362	50,530	9,347	95,300	6,000
1970	29,580	28,300	62,680	43,840	20,040	26,580	9,060	14,140	13,200	10,860	16,690	19,580	24,546	62,680	9,060	140,000	2,850
1971	38,420	70,450	121,500	52,780	34,960	17,490	20,170	25,500	18,010	11,290	10,940	47,190	39,058	121,500	10,940	173,000	6,880

TABLE 4 – 3. ANNUAL, MONTHLY, AND DAILY FLOW DATA
(Monthly Flow in cfs 1930 - 1975 at USGS Gage 02429500; 1976 - 2011 at USGS Gage 02428400)

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Monthly Max	Monthly Min	Daily Max	Daily Min
1972	99,090	62,700	68,760	27,160	26,290	16,690	18,130	13,410	13,450	8,125	14,360	49,860	34,835	99,090	8,125	161,000	7,240
1973	77,860	54,290	78,490	105,100	76,300	56,530	23,640	15,330	12,170	11,930	15,030	32,560	46,603	105,100	11,930	155,000	7,660
1974	82,800	77,140	32,740	68,120	21,160	20,670	15,600	17,210	22,670	8,860	12,990	40,340	35,025	82,800	8,860	111,000	7,300
1975	79,110	109,400	94,320	84,450	32,950	25,300	29,790	41,240	30,460	57,680	31,170	36,420	54,358	109,400	25,300	169,000	13,400
1976	73,520	50,100	89,740	93,140	53,290	24,820	25,460	14,340	12,790	8,845	14,620	38,950	41,635	93,140	8,845	213,000	6,590
1977	55,950	32,830	99,940	102,500	17,470	12,980	7,843	10,970	14,200	25,590	48,380	28,270	38,077	102,500	7,843	161,000	6,220
1978	66,170	48,410	45,950	24,240	60,290	26,880	9,592	12,670	8,330	6,828	7,612	16,150	27,760	66,170	6,828	128,000	5,630
1979	55,690	59,960	109,500	147,600	43,790	29,120	22,810	15,010	19,410	25,920	35,430	23,770	49,001	147,600	15,010	215,000	7,900
1980	53,100	51,800	112,500	126,000	62,250	19,740	11,810	8,400	7,075	12,900	14,140	13,710	41,119	126,000	7,075	202,000	6,650
1981	9,615	54,070	28,340	46,280	10,050	15,660	8,487	6,988	8,762	6,535	7,712	19,540	18,503	54,070	6,535	130,000	5,540
1982	61,850	91,580	49,370	51,770	34,580	16,240	14,950	13,770	6,973	11,240	16,800	78,030	37,263	91,580	6,973	141,000	6,220
1983	51,390	82,840	79,400	107,400	51,710	26,680	15,980	9,704	13,230	9,991	32,380	93,480	47,849	107,400	9,704	160,000	8,290
1984	77,190	46,720	60,070	54,250	55,010	15,130	15,790	44,030	11,880	11,790	15,940	30,690	36,541	77,190	11,790	117,000	5,560
1985	18,490	64,620	29,070	14,720	17,440	8,572	17,820	18,290	9,252	12,530	14,690	22,390	20,657	64,620	8,572	112,000	6,740
1986	13,870	26,350	40,380	9,129	8,196	7,756	6,506	6,481	5,486	5,398	28,430	41,240	16,602	41,240	5,398	121,000	3,890
1987	53,550	63,430	71,700	27,600	14,490	15,640	13,470	7,970	7,152	6,715	6,609	11,210	24,961	71,700	6,609	119,000	5,130
1988	35,830	32,540	17,020	16,130	8,332	6,985	7,585	5,909	21,490	12,230	27,070	17,190	17,359	35,830	5,909	101,000	4,820
1989	50,440	27,620	72,320	58,910	19,870	62,470	59,580	14,770	15,130	34,850	34,700	55,490	42,179	72,320	14,770	132,000	8,830
1990	86,580	126,000	145,000	40,110	26,110	11,920	11,310	9,006	7,229	9,290	10,870	20,070	41,958	145,000	7,229	255,000	5,610
1991	27,920	49,840	50,520	45,130	75,120	29,670	21,360	12,880	12,630	9,657	19,060	27,390	31,765	75,120	9,657	117,000	7,200
1992	53,820	60,780	55,350	25,320	10,870	19,030	12,130	17,290	18,880	12,120	65,300	80,910	35,983	80,910	10,870	144,000	8,860

TABLE 4 – 3. ANNUAL, MONTHLY, AND DAILY FLOW DATA
(Monthly Flow in cfs 1930 - 1975 at USGS Gage 02429500; 1976 - 2011 at USGS Gage 02428400)

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Monthly Max	Monthly Min	Daily Max	Daily Min
1993	90,120	55,600	63,640	45,820	22,360	11,560	10,650	10,430	8,253	7,087	15,760	20,530	30,151	90,120	7,087	142,000	5,600
1994	30,740	58,250	61,970	67,130	16,340	14,000	45,430	19,420	16,400	24,830	17,740	48,270	35,043	67,130	14,000	111,000	7,190
1995	35,000	65,840	77,170	22,840	13,250	9,559	8,633	8,374	6,206	49,420	54,100	51,250	33,470	77,170	6,206	139,000	5,170
1996	56,170	87,870	88,820	42,250	20,790	16,260	12,430	13,870	15,810	13,150	18,500	37,840	35,313	88,820	12,430	133,000	7,600
1997	62,450	65,940	81,970	33,740	39,700	47,670	21,350	14,400	9,338	18,950	29,870	47,890	39,439	81,970	9,338	170,000	7,230
1998	85,100	102,600	101,500	57,840	24,000	14,790	9,722	10,480	11,790	14,850	10,400	16,440	38,293	102,600	9,722	205,000	5,350
1999	33,830	55,970	38,190	16,610	15,540	19,860	31,640	8,579	6,477	8,216	7,902	11,060	21,156	55,970	6,477	139,000	5,260
2000	17,630	13,310	29,870	42,700	8,695	6,312	5,859	5,923	5,904	5,484	10,320	14,380	13,866	42,700	5,484	116000	4,050
2001	26,460	34,920	124,500	55,660	13,310	26,480	14,410	12,730	15,850	7,988	9,095	23,260	30,389	124,500	7,988	174000	5,690
2002	36,140	32,020	30,770	22,920	17,250	7,592	7,363	6,860	11,640	16,318	42,907	65,723	24,792	65,723	6,860	126000	4,850
2003	31,174	56,014	68,313	51,030	100,787	55,270	64,597	32,358	13,922	10,050	19,012	23,103	43,803	100,787	10,050	145000	5,060
2004	26,529	60,924	20,045	11,618	14,116	13,034	12,982	8,379	34,814	15,476	51,633	64,855	27,867	64,855	8,379	118000	2,960
2005	26,194	51,161	56,735	79,667	23,926	31,071	58,505	25,065	11,853	9,401	11,730	22,630	33,995	79,667	9,401	167000	5,020
2006	37,090	47,500	41,660	18,490	22,230	7,174	5,828	6,208	5,775	7,570	23,490	16,600	19,968	47,500	5,775	106,000	5,110
2007	35,330	19,690	15,700	9,125	6,063	5,029	4,781	4,575	4,592	4,152	3,653	2,937	9,636	35,330	2,937	80,000	1,540
2008	7,846	25,560	27,670	21,670	15,730	8,020	4,495	18,720	6,934	6119	7775	32113	15,221	32,113	4,495	99,300	2,940
2009	42,530	12,820	68,210	60,400	51,590	12,990	74,545	9,060	37,580	53,270	66,330	100,300	43,795	100,300	9,060	158,750	4,365
2010	69,560	8,280	68,120	23,680	30,010	14,880	7,523	6,942	5,079	5,365	9,484	12,750	27,908	69,560	5,079	145,417	3,042
2011	14,450	24,240	63,910	43,650	10,600	6,113	7,521	5,749	8,687	5,718	10,934	28,158	19,114	63,910	5,718	132,875	2,747

TABLE 4 – 3. ANNUAL, MONTHLY, AND DAILY FLOW DATA
(Monthly Flow in cfs 1930 - 1975 at USGS Gage 02429500; 1976 - 2011 at USGS Gage 02428400)

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Monthly Max	Monthly Min	Daily Max	Daily Min
														Per. of Record Max	Per. of Record Min	Per. of Record Max	Per. of Record Min
AVG 1930-1975	48,432	55,783	64,665	60,043	32,829	19,649	18,321	17,506	14,116	13,966	15,911	30,709	32,764	165,100	6,133	266,000	2,850
AVG 1976-2011	42,868	24,992	65,853	43,973	30,194	13,367	26,952	8,732	15,757	19,490	27,358	43,780	30,444	147,600	2,937	255,000	1,540
AVG 1930-2011	43,373	25,159	66,069	45,703	30,813	13,391	26,967	9,362	16,111	19,543	26,359	43,308	30,759	165,100	2,937	266,000	1,540

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 ACT 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

The Water Management Section employs a staff of hydrologic field technicians and contract work to USGS to operate and maintain Corps' gages throughout the ACT Basin. Corps personnel also maintain precipitation gages at project locations over the ACT Basin.

All rainfall gages equipped as DCPs are capable of being part of the reporting network. Data is received from 22 stations in and around the Alabama River Basin from Montgomery, Alabama to Millers Ferry Lock and Dam. The data are recorded in 15-minute intervals and these data are reported hourly. The 10 stations listed in Table 5-1 are considered the rainfall reporting network for the R. F. Henry, Millers Ferry, and Claiborne Projects. The locations of these rainfall stations are shown on Plate 5-1. River conditions above Montgomery, Alabama are reflected in outflows from Jordan-Bouldin Dam on the Coosa River, and the Thurlow Dam on the Tallapoosa River.

Rainfall and upstream conditions are updated regularly throughout the day. Forecast of runoff are prepared and compared to those prepared by the River Forecast Center.

Table 5-1. Rainfall Reporting Network for the Alabama River Basin

LOCATION	STREAM	LATITUDE	LONGITUDE
Montgomery (at US 31)	Alabama River	32.411389	-86.408333
Catoma Creek	Catoma Creek	32.307222	-86.299444
R. F. Henry L&D	Alabama River	32.316667	-86.783333
Selma	Alabama River	32.405556	-87.018611
Centreville	Cahaba River	32.945	-87.139167
Suttle	Cahaba River	32.529167	-87.198889
Marion Junction	Cahaba River	32.443889	-87.180278
Millers Ferry L&D	Alabama River	32.1	-87.398056
Claiborne-L&D	Alabama River	31.615	-87.550556
Choctaw Bluff	Alabama River	31.363611	-87.765

All river stage gages equipped as DCPs are capable of being part of the reporting network. Data is available from many stations in and adjacent to the ACT Basin. The river stage gages listed in the section of Table 5-2 titled “River Stage Gages in the Daily Hydrologic Network” are used to plan operations at the Claiborne Project. All of these stage gages are not required for daily operations but the information is available when desired. The locations of these and other river stage gages are shown on Plate 5-2. In addition, river stage gages listed in the section of Table 5-2 titled “Other River Stage Gages Within the Alabama River Basin” are available if necessary, but do not report daily.

In addition to the automated reporting stations, stage and flow data at APC projects are furnished to the Corps, Mobile District daily by the APC Birmingham office. The APC also receives DCP transmissions directly from gages throughout the ACT Basin.

Data from the river-stage station at Millers Ferry can be received at any time by contacting personnel at the project. Pool and tailwater elevations as well as inflow and outflow at R. F. Henry, Millers Ferry, and Claiborne are reported each morning to the Water Management Section. Most of stations within the basin are maintained by the USGS.

Table 5-2. Reporting Stage Gages Used for Lower Alabama River

Location	Station No.	Stream	River Mi. Above Mouth	Drainage Area (mi2)	Gage Zero Elev. (Feet NGVD29)	Flood Stage (Feet)	Servicing Agency
River Stage Gages in the Daily Hydrologic Network							
Montgomery	02420000	Alabama R.	287.6	15,087	97.90		USGS
Montgomery	02421000	Catoma Ck.	16.1	290	151.02	20	USGS
R. F. Henry (HW)	02421350	Alabama R.	236.3	16,233	0.00		USGS
R. F. Henry (TW)	02421351	Alabama R.	236.3	16,233	0.00	122	USGS
Selma	02423000	Alabama R.	214.8	17,095	61.8	45	USGS
Centreville	02424000	Cahaba R.	81.2	1,027	180.74	23	USGS
Suttle	02424590	Cahaba R.	31.0	1,480	97.64		USGS
Marion Junction	02425000	Cahaba R.	21.4	1,766	86.72	36	USGS
Millers Ferry (HW)	02427505	Alabama R.	133.0	20,637	0.00		USGS
Millers Ferry (TW)	02427506	Alabama R.	133.0	20,637	0.00	66	USGS
Claiborne (HW)	02428400	Alabama R.	72.5	21,473	0.00		USGS
Claiborne (TW)	02428401	Alabama R.	72.5	21,473	0.00	42	USGS
Other River Stage Gages Within the Alabama River Basin							
Jones	02422500	Mulberry Ck.	11.0	203	165.23		USGS
Mtn. Brook	02423380	Cahaba R.	153.6	140	443.85		USGS
Cahaba Hts.	02423425	Cahaba R.	144.9	201	410.00		USGS
Hoover	02423496	Cahaba R.	138.9	226	379.56		USGS
Acton	02423500	Cahaba R.	136.8	230	375.00		USGS
Snow Hill	02427250	Pine Barren Ck.	4.0	261	126.60		USGS

b. Reporting. The Water Management Section operates and maintains a Water Control Data System (WCDS) for the Mobile District 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.

Data are collected at Corps sites and throughout the ACT 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 (DCP). The DCP is a computer microprocessor at the gage site. A DCP 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 DCP then saves the information, performs simple analysis of it, and then transmits the information to a fixed geostationary satellite. DCPs transmit real-time data at regular intervals to the GOES System operated by the National Oceanic and Atmospheric Administration (NOAA). The GOES Satellite's Data Collection System 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 Water Management Section operates and maintains a Local Readout Ground System (LRGS) that collects the DCP-transmitted, real-time data from the DOMSAT. Figure 5-3 depicts a typical schematic of how the system operates.

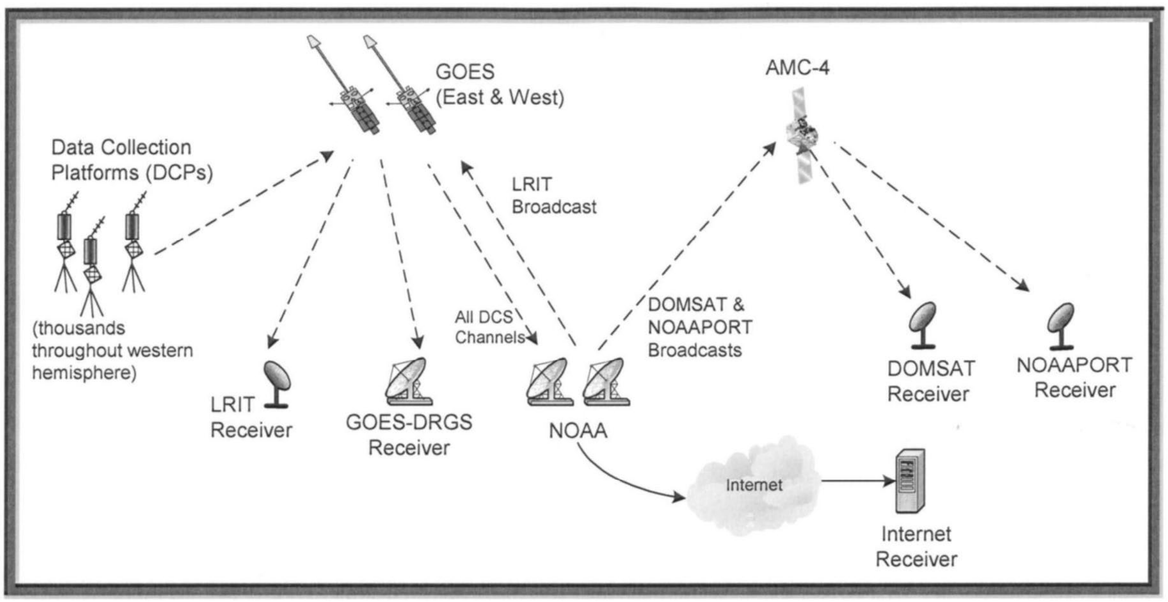

Figure 5-3. Typical configuration of the GOES System

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 DCP and GOES antenna are capable of being part of the reporting network. Telephone is an option for other communications. Data for the project and the DCPs are downloaded both daily and hourly through the Corps' server network to the Water Management Section.

c. Maintenance. The Corps, Mobile District has a cooperative program with the USGS and their office in Montgomery, Alabama for both maintenance and the exchange of data for the gages identified in the above paragraphs. Maintenance of the gages is accomplished by the USGS according to the program. 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 Alabama Water Science Center, 75 Technacenter Drive, Montgomery, AL 36117
Phone: (334) 395-4120 Web: http://al.water.usgs.gov

5-02. Water Quality Stations. There are no Corps operated or maintained water quality stations in the Claiborne Project area. However, there are some real-time water quality parameters collected at several of the stream gages maintained by the USGS for general water quality monitoring purposes. The data for these stations can be obtained from the USGS yearly publication, ***Water Resources Data Alabama***. The Alabama Department of Environmental Management also periodically samples water quality throughout the Alabama portion of the basin on a rotating schedule.

5-03. Sediment Stations. In order to provide an adequate surveillance of sedimentation, a network of sediment ranges were established for Claiborne Lake in 1996. 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. In order to monitor degradation and aggradation of the Alabama River, a network of retrogression ranges were established and surveyed for about 40 miles below Claiborne Dam. This network is shown on Plate 4-2.

Sediment surveys were conducted in 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 Alabama River Lakes”. Sedimentation and erosion classifications were developed for each range. Based on the percentage change for the entire cross section, range cross sections were classified for sedimentation as “Heavy” (greater than 15% change), “Medium” (5 to 15% change), “Light” (0 to 5%), and “None” (0 or negative change). Erosion classifications were also developed from bank retreat and advance rates. A bank retreat or advance rate is the average change in location, measured in feet, of the shoreline. It is the area bounded between two cross section profiles at the shore erosion zone (square-feet) divided by the height of shore erosion zone (feet). The shorelines were separated into two groups, erosional and depositional. The erosional group was further divided into three classes by percentile. The 25% of shorelines showing the greatest bank retreat were classes as “Acute,” the middle 50% in bank retreat were classes as “Moderate,” and the 25% with the least bank retreat were classes as “Slight.” Shorelines in the depositional group were classed as “Deposition.”

Claiborne Lake is the most downstream of the three Alabama River Lakes. It has no major tributaries with historical sedimentation ranges, thus the analysis results for all 16 ranges represent the main channel of the Alabama River. Results are displayed in Table 5-3. The range numbering starts with 1A below Millers Ferry, in numerical order to range 16 above Claiborne Lock and Dam.

Table 5-3. Sedimentation Range Results for Claiborne Lake

Rangeline	Sedimentation Classification	Shoreline Erosion Classification: 1966 to 2010	
		Left Bank	Right Bank
1A	Light	Deposition	Deposition
2A	None	Acute	Deposition
3A	Light	Deposition	Deposition
4A	Light	Deposition	Moderate
5A	Light	Deposition	Deposition
6A	Light	Deposition	Deposition
7A	None	Acute	Moderate
8A			
9A	None	Moderate	Deposition
10A	None	Slight	Moderate
11A	Medium	Deposition	Deposition
12A	None	Deposition	Deposition
13A	Heavy	Slight	Deposition
14A	Light	Deposition	Moderate
15A	Medium	Moderate	Deposition
16A	None	Slight	Moderate

In general the sedimentation trend along the river is “Light” below Millers Ferry Lock and Dam, scoured bed along the mid portion from range 7A through range 10A, then classed “Medium” for deposition for the lowest third above Claiborne Lock and Dam. The trend for increasing sedimentation while progressing downstream is reasonable for a run-of-the river impoundment located immediately below another impoundment: Reduced sediment load along the upper reach due to sediment being trapped in the upstream impoundment and increased sedimentation along the lowest reach immediately above the downstream dam. However, the cause of the bed scour along the middle reach is not apparent. The average reduction in bed elevation is about three to five feet averaged across the bed width for ranges 7A, through 10A. Although range 8A also exhibits bed scour, it was excluded from the analysis because there was a discrepancy between the alignments of the historical data and the current data. Review of aerial photographs suggests the actual channel width is similar to that of the 1996 survey and there is no indication of changes which would manifest a wider rangeline. The difference in range 8A is likely due to an incorrect azimuth or bearing of the rangeline.

5-04. Recording Hydrologic Data.

The Water Control Data Support System (WCDSS) 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 Hydrologic Engineering Center (HEC) Data Storage System (DSS) databases and programs.

To provide the data needed to support proper analysis, a DOMSAT Receive Station (DRS) is used to retrieve DCP data from gages throughout the ACT 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.

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 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 NWS Southeast River Forecast Center (SERFC). A direct link to SERFC is maintained to provide real-time products generated by NWS offices. Information includes weather and flood forecasts and warnings, tropical storm information, NEXRAD radar rainfall, graphical weather maps and more. Likewise, a direct link to USGS gages in the field allows for direct downloading of USGS data to Corps databases.

5-05. Communication Network.

The global network of the Corps consists of private, dedicated, leased lines between every Division and District office worldwide. Those lines are procured through a minimum of two General Services Administration-approved telephone vendors, and each office has a minimum of two connections, one for each vendor. The primary protocol of the entire Corps network is Ethernet. The reliability of the Corps' network is considered a command priority and, as such, supports a dedicated 24 hours per day Network Operations Center. The use of multiple telephone companies supplying the network connections minimizes the risk of a one cable cut causing an outage for any office. Such dual redundancy, plus the use of satellite data acquisition, makes for a very reliable water control network infrastructure.

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

The primary communication network of the Claiborne Project is a SCADA system network. The SCADA network includes a microwave link between Millers Ferry and Claiborne Dam. The SCADA network also monitors and digitally records real-time project data hourly. The data include physical conditions at the reservoir such as pool elevations, outflow, 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 (cell)
Claiborne Lock Foreman	251-282-4575
or Millers Ferry Powerhouse	334-682-9124

5-06. Communication With Project Office.

a. Regulating Office with Project Office. Communication between the Water Management Section and the project office at Claiborne Lock and Dam is by computer network, commercial telephone, or fax. Communication between the project offices is also done by computer network, telephone, fax, or by Private Access Exchange (PAX) or Southern Link Radio System.

b. Between Project Office and Others. The Water Management Section communicates daily with the NWS and APC to exchange data and forecasting information. The data exchange is made by computer and is supplemented by telephone and facsimile when necessary. The Water Management Section also has a computer link with the NWS's Advanced Weather Interactive Processing System (AWIPS) communication system via the River Forecast Center in Atlanta, Georgia. The Water Management Section and Claiborne use a telephone auto-answer recorded message to provide daily information to the public. Water resources information is available to the public at the Corps' website, http://water.sam.usace.army.mil. The site contains real-time information, historical data and general information that may be of interest to the public.

5-07. Project Reporting Instructions. Claiborne data is automatically recorded hourly. The data includes pool elevation, tailwater elevation, gate step, and precipitation. A file containing the hourly data is sent via the DCP System every four hours. The information is downloaded in the Water Management Section and retained indefinitely. In addition, every morning at 6:00 A.M., instantaneous values of the same parameters are recorded and sent to Millers Ferry and are subsequently downloaded by the Water Management Section through the LDS System.

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 Claiborne Project, the operator on duty should notify the Water Management Section, Operations Division and the Operations Project Manager at the project. A coordinated effort among those offices and the District's Emergency Management Office will develop notifications to make available to local law enforcement, government officials and emergency management agencies.

5-09. Role of Regulating Office. The Water Management Section of the Mobile District Office 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 with the constraints of authorized functions. 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 pertaining to reservoir regulation to the Operations Project Manager and other necessary personnel.

VI – HYDROLOGIC FORECAST

6-01. General. Two forecasts are available for locations along the Alabama River. 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 prepares forecasts for internal use. All features of the forecasting procedure are subject to modification and refinement as additional data and operating experience dictate. In general, forecasts are made for Corps projects and control points along the river. Inflows and outflows are estimated for R. F. Henry, Millers Ferry, and Claiborne Projects.

a. Role of Corps. The Water Management Section maintains real-time observation of river and weather conditions in the Mobile District. The Water Management Section has capabilities to make forecasts for several areas in the ACT Basin. Those areas include all the federal projects and other locations. Observation of real-time stream conditions provides guidance of 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 ACT 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 Water Management Section continuously monitors the weather conditions occurring throughout the ACT Basin and the forecasts issued by the NWS. Whenever possible, the NWS weather and hydrologic forecasts are used. The Water Management Section develops forecasts that are used to meet the regulation objectives of the Corps ACT Reservoirs. In addition, the Water Management Section provides weekly hydropower generation forecasts using current power plant capacity, latest hydrological conditions, and system water availability.

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

(1) The NWS is the federal agency responsible for preparing and issuing streamflow and river-stage forecasts for public dissemination. That role is the responsibility of SERFC co-located in Peachtree City, Georgia with the Peachtree City Weather Forecast Office (WFO). SERFC is responsible for the supervision and coordination of streamflow and river-stage forecasting services provided by the NWS WSFOs in Peachtree City, Georgia, and Birmingham, Alabama. SERFC routinely prepares and distributes 5-day streamflow and river-stage forecasts at key gaging stations along the Coosa, Tallapoosa, and Alabama Rivers. Streamflow forecasts are available at additional forecast points during periods above normal rainfall. In addition, SERFC provides a revised regional QPF based on local expertise beyond the NWS Hydrologic Prediction Center QPF. SERFC also provides the Water Management Section with flow forecasts for selected locations upon request. Table 6-1 lists the forecast stations in the Alabama River Basin.

(2) 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 following days, the release decision data are sent to SERFC. Taking release decision data coupled with local inflow forecasts at forecast points along the ACT system, SERFC can provide forecasts of inflow into Corps projects. Having revised inflow forecasts from SERFC, the Corps has up-to-date forecast data to make the following days' release decisions.

(3) Alabama Power Company (APC) provides hourly discharge data from APC's Jordan, Bouldin, and Thurlow projects and provides a 7-day forecast of average daily releases from Jordan, Bouldin, and Thurlow projects.

Table 6-1. Southeast River Forecast Center Forecast Locations for Alabama River Basin

Daily Stage/Elevation Forecasts (Feet NGVD29)				
	Station	**Station ID**	**Action Stage***	**Flood Stage****
	Montgomery	MGMA1	26	35
	R. F. Henry TW	TYLA1	122	122
	Millers Ferry TW	MRFA1	61	66
	Claiborne TW	CLBA1	35	42
Daily 24-hour Inflow in Morning (10 a.m.) State Forecast Discussion				
Reservoir		**Station ID**		
R. F. Henry		TYLA1		
Millers Ferry		MRFA1		
Additional Stage Forecasts Only for Significant Rises				
River/Creek	**Station**	**Station ID**	**Action Stage**	**Flood Stage**
Coosa	Weiss Dam	CREA1		564
Coosa	Gadsden	GAPA1		511
Coosa	Logan Martin Dam	CCSA1		465
Coosa	Childersburg	CHLA1		402
Coosa	Wetumpka	WETA1	40	45
Tallapoosa	Wadley	WDLA1		13
Tallapoosa	Milstead	MILA1	15	40
Tallapoosa	Tallapoosa Wt Pit	MGYA1	15	25
Catoma Creek	Montgomery	CATA1	16	20
Alabama	Selma	SELA1	30	45
Cahaba	Cahaba Hts	CHGA1		14
Cahaba	Centreville	CKLA1	20	23
Cahaba	Suttle	SUTA1	28	32
Cahaba	Marion Junction	MNJA1	15	36

* Action Stage – The stage which some type of mitigation action in preparation for possible significant hydrologic activity occurs.
** Flood Stage – The stage for which a rise in water surface level begins to impact lives, property, or commerce.

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 SERFC.r

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* scenarios.

b. Methods. For determining flood conditions at the Claiborne Project, the observed hourly discharges out of Robert F. Henry and Millers Ferry Projects, along with APC's Jordan, Bouldin, and Thurlow Projects and the APC's daily 7-day forecast for the Coosa and Tallapoosa Rivers are used.

6-03. Conservation Purpose Forecasts. The Claiborne Project is essentially a run-of-the-river project and has no practical conservation storage in the reservoir. Therefore, it is unnecessary to forecast for conservation purposes at this project.

6-04. Long-Range Forecasts.

a. Requirements. The Alabama River Projects are modified run-of-the-river projects and have no practical conservation storage in the reservoirs. Therefore, it is unnecessary to forecast for conservation purposes at these projects. However, the Corps does utilize available information from the NWS and projected release forecast from Alabama Power Company projects on the Coosa and Tallapoosa Rivers to aid in the operation of the system and for planning studies.

b. Methods. In extreme conditions, three-month and six-month forecasts can be produced based on observed hydrology and comparative percentage hydrology inflows into the ACT 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 ACT Projects.

6-05. Drought Forecast.

a. Requirements. Engineering Regulation (ER) 1110-2-1941, Drought Contingency Plans, dated 15 September 1981, called for developing drought contingency plans for all Corps' reservoirs. Drought recognition and drought forecast information can be used in conjunction with the drought contingency plan.

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 drought reference. However, the index requires detailed data and cannot reflect an operation of a reservoir system. 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, 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.

c. Reference Documents. The drought contingency plan for the Claiborne Project is summarized in Section 7-13 below. The complete ACT Drought Contingency Plan is provided in the *Master Water Control Manual for the ACT River Basin, Exhibit C*.

VII - WATER CONTROL PLAN

7-01. General Objectives. The original congressionally authorized purpose for the Claiborne Lock and Dam as contained in its authorizing legislation was navigation. Several other project purposes have been added through general authorizations including water quality, recreation, and fish and wildlife conservation and mitigation. The regulation plan seeks to balance the needs of all project purposes at the Claiborne Project and at other projects in the ACT Basin and is intended for use in day-to-day, real-time water management decision making and for training new personnel.

7-02. Constraints.

a. Full Discharge Capacity. The full discharge capacity of the spillway (gated and fixed) at elevation 36.0 feet NGVD29 is 70,763 cfs. Once the spillway capacity is reached a free overflow condition will prevail. There will be little difference in the water surface upstream and downstream of the dam. The river may continue to rise just as it would in the absence of any structure.

b. Head Limitation. Design criteria for stability against overturning and sliding of the Claiborne structures make it imperative that the head, difference between headwater and tailwater elevation, not exceed 30 feet at any time.

c. Location on the System. Claiborne is the most downstream of the three federal projects on the system below Montgomery, Alabama. Power generation pulses, sometimes sub-daily, at Millers Ferry, 60 miles upstream, and Robert F. Henry (Jones Bluff Powerhouse) further upstream require constant monitoring to provide proper gate operation to maintain a pool between 32.0 and 36.0 feet NGVD29, and provide adequate flow releases for downstream use. Although there is little storage in the pool, one project purpose is to reregulate Millers Ferry releases. The gates must be adjusted gradually to smooth the flow, allowing the tailwater to rise gradually and to prevent erosion below the dam.

7-03. Overall Plan for Water Control. The Claiborne Lock and Dam project is a run-of-river project, meaning that it does not store inflows except to reregulate them over a short period. The purpose of the project is to reregulate flows downstream for navigation. The three projects, Claiborne, Millers Ferry and Robert F. Henry Locks and Dams provide a stair step, low water navigation channel from Claiborne, Alabama, upstream to Montgomery, Alabama. Claiborne Project, operating normally between a maximum pool of 36.0 feet NGVD29 and a minimum pool of 32.0 feet NGVD29, provides navigation up to Millers Ferry and smoothes Millers Ferry peaking discharges over a 24-hour period to provide stable navigation depths in the channel below. The upper pool may fluctuate up to 36.5 feet NGVD29 for short periods to allow for maximum flow reregulation.

7-04. Spillway Gate Operation. Except in high flow conditions, spillway gate settings will require nearly constant monitoring. They will be adjusted as specified in Sections 7-12 and 7-13 to maintain the pool level between limiting elevations 32.0 and 36.0 feet NGVD29. The upper pool can rise to elevation 36.5 feet NGVD29 temporarily so long as the top of all gates are 0.25 feet above the level of the upper pool. The six spillway gates are numbered in sequence beginning at the left bank or east end of the spillway, adjacent to the lock. Plates 7-1 through 7-18 show gate operation schedule and spillway discharge. Efforts should be made to prevent the top of the gates from being submerged to prevent logs and debris from collecting on the gates, thus making them difficult or too heavy to operate. The target discharge rate to release through the Claiborne Dam spillway gates is based on the upcoming day's Millers Ferry Powerhouse generation schedule and Claiborne pool elevation, as shown on Plate 7-19. The combined discharge curves for the Claiborne Dam spillway, lock, and overbank dikes is shown on Plate 7-20.

The following paragraphs outline methods for regulating the pool under various conditions. Claiborne's pool elevation will be maintained above elevation 32.0 feet NGVD29 to allow for 13-foot depth over the upper miter sill and allow sufficient depth for a 9-foot navigation channel into the Millers Ferry Lock approach upstream. There are two distinct modes of flow regulation of the Claiborne Project. During most of the year, roughly May through December, average daily outflow from the upstream Millers Ferry Project will be less than 28,000 day-second-feet (dsf) and will be in the form of peak power releases for varying hours of the day. When such moderate to low flows exist, Claiborne will operate as a flow re-regulator as described in paragraphs a and b below. Operation for higher flows is described in paragraphs c and d.

a. Moderate and Low Flow Regulation. The available storage at Claiborne will be used to reregulate daily releases from Millers Ferry into a steady release from Claiborne to insure stable navigable depths downstream while maintaining a pool above elevation 32.0 feet NGVD29. During moderate to low flows a target continuous discharge from Claiborne will be the objective with the Claiborne pool fluctuating to meet this goal. This target flow is linked to Millers Ferry upcoming day's generation schedule, Claiborne's pool level at crest, and the gate schedule operation. When the Claiborne pool has crested (usually between 10 p.m. and 4 a.m.) the Locktender can take Millers upcoming day generation total (in megawatt hours) and the Claiborne crest elevation and referring to Plate 7-19 can locate the target flow. The Claiborne Locktender on duty should begin to change the gate settings on the hour following the time the Claiborne upper pool crests, and should make gate changes every hour until the new discharge is reached. The maximum number of gate step changes per hour can be determined according to Plate 7-19. To release the target discharge, the Claiborne Locktender can set gates according to the gate schedule in the following manner. If the upper pool is rising, the Locktender should set the gates so the discharge is just less than the target flow. If the upper pool is falling, the gates should be set at the discharge just greater than the target flow. Experienced lock personnel may deviate from this guide to make smooth transitions in outflows from Claiborne while maintaining the Claiborne upper pool within the limits of 36.0 to 32.0 feet NGVD29. This procedure may be modified as necessary when required by events at Millers Ferry or significant rainfall between Claiborne and Millers Ferry.

b. Low Flows. A low flow period at Claiborne is when the average weekly flow drops below 10,000 cfs. During this time the outflow at Claiborne will be regulated as nearly as possible to a uniform continuous flow equal to that average weekly flow. In extreme low flow (less than 7,000 cfs) the Water Management Section may request the lockmaster to closely maintain a target tailwater elevation superseding guidelines shown on Plate 7-19. In such situations the Water Management Section will closely monitor the Claiborne pool and make adjustments in outflows from Millers Ferry to maintain the Claiborne pool within acceptable limits.

c. High Water and Floods. During high water, the Claiborne Lake elevation is maintained by passing the inflow through the spillway gates and over the free overflow section until the full discharge capacity of the spillway is reached. When the inflow exceeds about 67,000 cfs, all gates will be fully opened and there will be no control over the outflow. The pool and tailwater levels will continue to rise as flow increases closely emulating a natural river condition. When the pool peaks and recedes to elevation 35.0 feet NGVD29 the spillway gates are once again operated to control the reservoir level and outflows. Any departures from this operation should be coordinated with the Water Management Section. Plate 7-20 shows the total spillway and overbank discharge for pool levels above elevation 32 feet NGVD29. The tailwater rating curve for Claiborne Lock and Dam is on Plate 7-21 and the headwater and tailwater rating curves for Millers Ferry are on Plate 7-22.

d. Indefinite Generation at Millers Ferry. Whenever the Claiborne personnel are notified that the Millers Ferry Powerhouse will continue to operate three turbines (90 mw) indefinitely, the Locktender will open six gates per hour until gate step #60 is reached or until the upper pool level reaches 36.0 feet NGVD29. The Locktender will make whatever gate setting necessary to gradually return the pool to near elevation 35.0 feet NGVD29.

e. Changes in Millers Ferry Schedule. Every effort is made to generate at Millers Ferry according to the schedule set the previous day. However, it may become necessary to change Millers Ferry's generation schedule. If this should happen, multiply the amount of change in generation (mwh) by 20. Add this amount to the current target outflow and change the Claiborne discharge to this amount. It may be necessary to change gate openings according to note "Maximum Gate Settings" on Plate 7-19.

7-05. Standing Instructions to Project Operator. Standing Instructions to the Project Operator for Water Control can be found on Exhibit C in the back of this manual. It describes the operator’s duties and responsibilities for reservoir regulation including operating procedures, data collecting, and data reporting.

7-06. Flood Risk Management. There is no dedicated flood storage in the Claiborne Project, but flowage easements have been obtained encompassing all lands subjected to an increased frequency of flooding from operation of the project.

7-07. Recreation. The Claiborne Lock and Dam project is an important part of the Alabama River Lakes (ARL) recreational resource, providing both economic and social benefits for the region and the Nation. The ARL is composed of the Claiborne, Millers Ferry, and Robert F. Henry Projects. The ARL contains 33,852 acres of land and 576 miles of shoreline, most of which is available for public use. A wide variety of recreational opportunities are provided at the lake including boating, fishing, camping, picnicking, water skiing, and sightseeing. Mobile District park rangers and other project personnel conduct numerous environmental and historical education tours and presentations, as well as water safety instructional sessions each year for the benefit of area students and project visitors. The Resource Manager will be responsible for contacting various lakeshore interests and keeping the public informed of lake conditions during drawdown periods. The Resource Manager will close beaches and boat ramps as necessary, patrol the lake, mark hazards, and perform other necessary tasks to mitigate the effects of low lake levels.

7-08. Water Quality. Claiborne Lock and Dam operating to provide a 24-hour continuous flow is beneficial to the assimilative characteristics of the river. Several industries on the Alabama River have designed effluent discharges based on the 7Q10 flow of 6,600 cfs mentioned previously. When flows recede to this level, conditions will be closely monitored so adequate warning can be given to the users if it becomes necessary to reduce flows further. The following paragraphs explain the procedures to follow should the flows drop below 6,600 cfs.

7-09. Fish and Wildlife. Both sport and commercial fisheries experienced a net gain from the Claiborne impoundment. The pool fluctuates one to three feet, but these fluctuations are less severe than the pre-impoundment conditions. A more stable pool during the spring spawning season is beneficial to the production of largemouth bass, crappie, and other sunfishes. Potential spawning sites are provided by the increased shoreline. Flow regulation for navigation benefit downstream fisheries. Wildlife management measures are not feasible within the small area controlled under easements along the shoreline. However, portions of fee-owned land have been dedicated for intensive wildlife management as part of the Tennessee-Tombigbee Waterway Wildlife Mitigation Project.

When Alabama River flow and project conditions allow, the Corps operates the lock from February through May to facilitate downstream/upstream passage of migratory fishes. While there can be slight differences in the locking technique each year, generally two fish locking cycles are performed each day between 8 AM and 4 PM, depending on facility staffing; one in the morning and one in the afternoon.

7-10. Water Supply. Based upon information provided by the Alabama Office of Water Resources in 2010, there is one major withdrawal that occurs from Claiborne Lake, International Paper at Pine Hill.

7-11. Hydroelectric Power. Claiborne Lock and Dam Project does not have hydropower.

7-12. Navigation.

Navigation is an important use of water resources in the ACT Basin. The Alabama River, from Montgomery, Alabama, downstream to the Mobile, Alabama, area, provides a navigation route for commercial barge traffic, serving as a regional economic resource. A minimum flow is required to ensure usable water depths to support navigation. Congress has authorized continuous navigation on the river, when sufficient water is available. The three Corps locks and dams on the Alabama River and a combination of dredging, river training works, and flow augmentation together support navigation depths on the river. The lack of regular dredging and routine maintenance has led to inadequate depths at times in the Alabama River navigation channel.

When supported by maintenance dredging, ACT Basin reservoir storage, and hydrologic conditions, adequate flows will provide a reliable navigation channel. In so doing, the goal of the water control plan is to ensure a predictable minimum navigable channel in the Alabama River for a continuous period that is sufficient for navigation use. Figure 7-1 shows the effect of dredging on flow requirements for different navigation channel depths during normal hydrologic conditions (1992 - 1994). As shown on Figure 7-1, pre-dredging conditions exist between November and April; dredging occurs between May and August; and post-dredging conditions exist from September through October, until November rainfall causes shoaling to occur somewhere along the navigation channel.

A 9-foot-deep by 200-foot-wide navigation channel is authorized on the Alabama River to Montgomery, Alabama. When a 9.0-foot channel cannot be met, a shallower 7.5-foot channel would still allow for light loaded barges moving through the navigation system. A minimum depth of 7.5 feet can provide a limited amount of navigation. Under low flow conditions, even the 7.5-foot depth has not been available at all times.

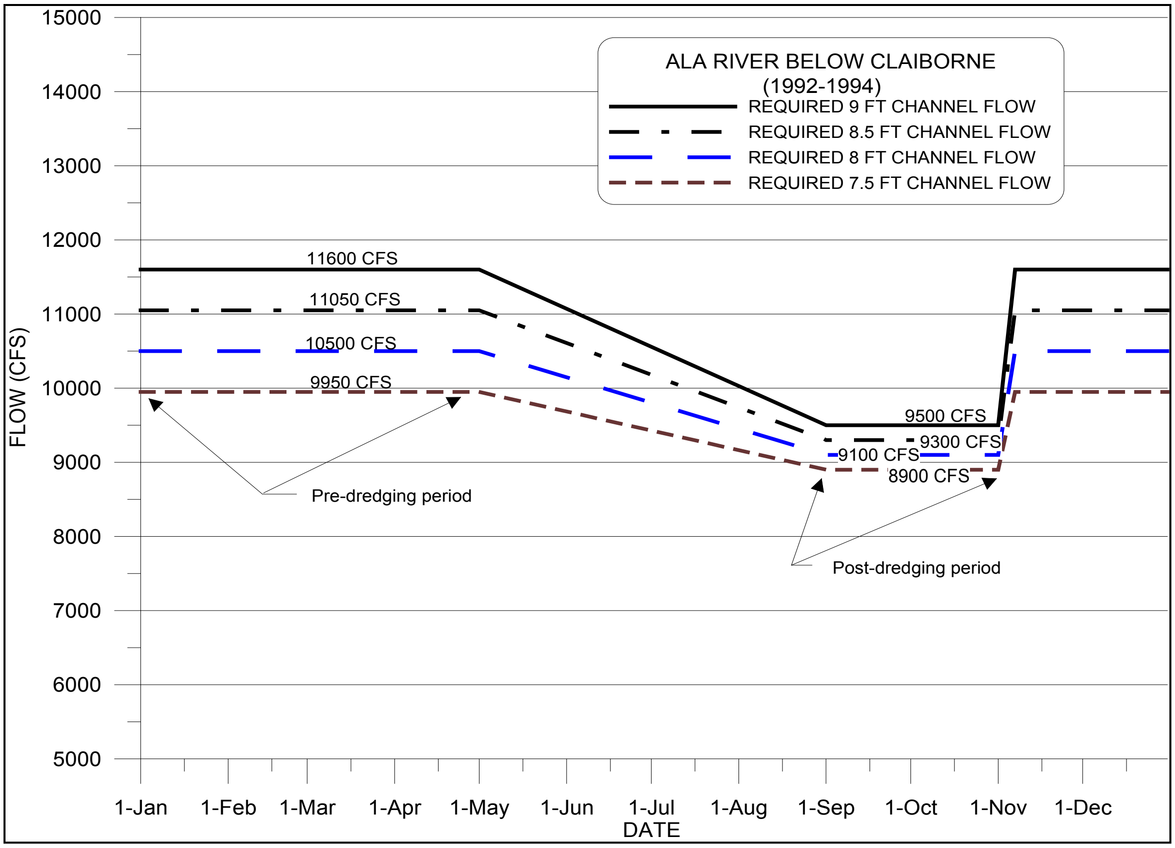

Figure 7-1. Flow-Depth Pattern (Navigation Template) During Normal Hydrologic Conditions (1992–1994)

Flow releases from upstream APC projects have a direct influence on flows needed to support navigation depths on the lower Alabama River. Flows for navigation are most needed in the unregulated part of the lower Alabama River below Claiborne Lock and Dam. When flows are available, R. F. Henry, Millers Ferry, and Claiborne are regulated to maintain stable pool levels, coupled with the necessary channel maintenance dredging, to support sustained use of the authorized navigation channel and to provide the full navigation depth of 9 feet. When river conditions or funding available for dredging of the river indicates that project conditions (9-foot channel) will probably not be attainable in the low water season, the three Alabama River projects are operated to provide flows for a reduced project channel depth as determined by surveys of the river. APC operates it reservoirs on the Coosa and Tallapoosa Rivers (specifically flows from their Jordan, Bouldin, and Thurlow (JBT) projects) to provide a minimum navigation flow target in the Alabama River at Montgomery, Alabama. The monthly minimum navigation flow targets are shown in Table 7-1. However, flows may be reduced if conditions warrant in accordance with the navigation plan memorandum of understanding between the Corps and APC. Additional intervening flow or drawdown discharge from the R. F. Henry and Millers Ferry Projects must be used to provide a usable depth for navigation and/or meet the 7Q10 flow of 6,600 cfs below Claiborne Dam. However, the limited storage afforded in both the R. E. “Bob” Woodruff and William “Bill” Dannelly Lakes can only help meet the 6,600 cfs level at Claiborne Lake for a short period. As local inflows diminish or the storage is exhausted, a lesser amount would be released depending on the amount of local inflows. Table 7-2 and Figure 7-2 show the required basin inflow for a 9.0-foot channel; Table 7-3 and Figure 7-3 show the required basin inflow for a 7.5-foot channel.

During low-flow periods, it is not always possible to provide the authorized 9-foot deep by 200-foot-wide channel dimensions. In recent years, funding for dredging has been reduced resulting in higher flows being required to provide the design navigation depth. In addition, recent droughts in 2000 and 2007 had a severe impact on the availability of navigation depths in the Alabama River.

Historically, navigation has been supported by releases from storage in the ACT Basin. Therefore, another critical component in the water control plan for navigation involves using an amount of storage from APC storage projects similar to that which has historically been used, but in a more efficient manner.

The ACT Basin navigation regulation plan is based on storage and flow/stage/channel depth analyses using basin inflows and average storage usage by APC (e.g., navigation operations would not be predicated on use of additional storage) during normal hydrologic conditions. Under that concept, the Corps and APC make releases that support navigation when basin inflows meet or exceed seasonal targets for either the 9.0-foot or 7.5-foot channel templates. Triggers are also identified (e.g., when basin inflow are less than required natural flows) to change operational goals between the 9.0-foot and 7.5-foot channels. Similarly, basin inflow triggers are identified when releases for navigation are suspended and only 7Q10 (4,640 cfs) releases would occur. During drought operations, releases to support navigation are suspended until system recovery occurs as defined in the ACT Basin Drought Contingency Plan (ACT River Basin Master Water Control Manual, Exhibit C).

Table 7-1. Monthly Navigation Flow Target in CFS

Month	9.0-ft target below Claiborne Lake (from Navigation Template) (cfs)	9.0-ft Jordan, Bouldin, Thurlow goal (cfs)	7.5-ft target below Claiborne Lake (from Navigation Template) (cfs)	7.5-ft Jordan, Bouldin, Thurlow goal (cfs)
Jan	11600	9280	9950	7,960
Feb	11600	9280	9950	7,960
Mar	11600	9280	9950	7,960
Apr	11600	9280	9950	7,960
May	11100	8880	9740	7,792
Jun	10600	8480	9530	7,624
Jul	10100	8080	9320	7,456
Aug	9600	7680	9110	7,288
Sep	9100	7280	8900	7,120
Oct	9100	7280	8900	7,120
Nov	11600	9280	9950	7,960
Dec	11600	9280	9950	7,960

Table 7-2. Basin Inflow Above APC Projects Required to Meet a 9.0-Feet Navigation Channel

Month	APC navigation Target (cfs)	Monthly historic storage usage (cfs)	Required basin inflow (cfs)
Jan	9,280	–994	10,274
Feb	9,280	–1,894	11,174
Mar	9,280	–3,028	12,308
Apr	9,280	–3,786	13,066
May	8,880	–499	9,379
Jun	8,480	412	8,068
Jul	8,080	749	7,331
Aug	7,680	1,441	6,239
Sep	7,280	1,025	6,255
Oct	7,280	2,118	5,162
Nov	9,280	2,263	7,017
Dec	9,280	1,789	7,491

Table 7-3. Basin Inflow Above APC Projects Required to Meet a 7.5-Feet Navigation Channel

Month	APC navigation Target (cfs)	Monthly historic storage usage (cfs)	Required basin inflow (cfs)
Jan	7,960	–994	8,954
Feb	7,960	–1,894	9,854
Mar	7,960	–3,028	10,988
Apr	7,960	–3,786	11,746
May	7,792	–499	8,291
Jun	7,624	412	7,212
Jul	7,456	749	6,707
Aug	7,288	1,441	5,847
Sep	7,120	1,025	6,095
Oct	7,120	2,118	5,002
Nov	7,960	2,263	5,697
Dec	7,960	1,789	6,171

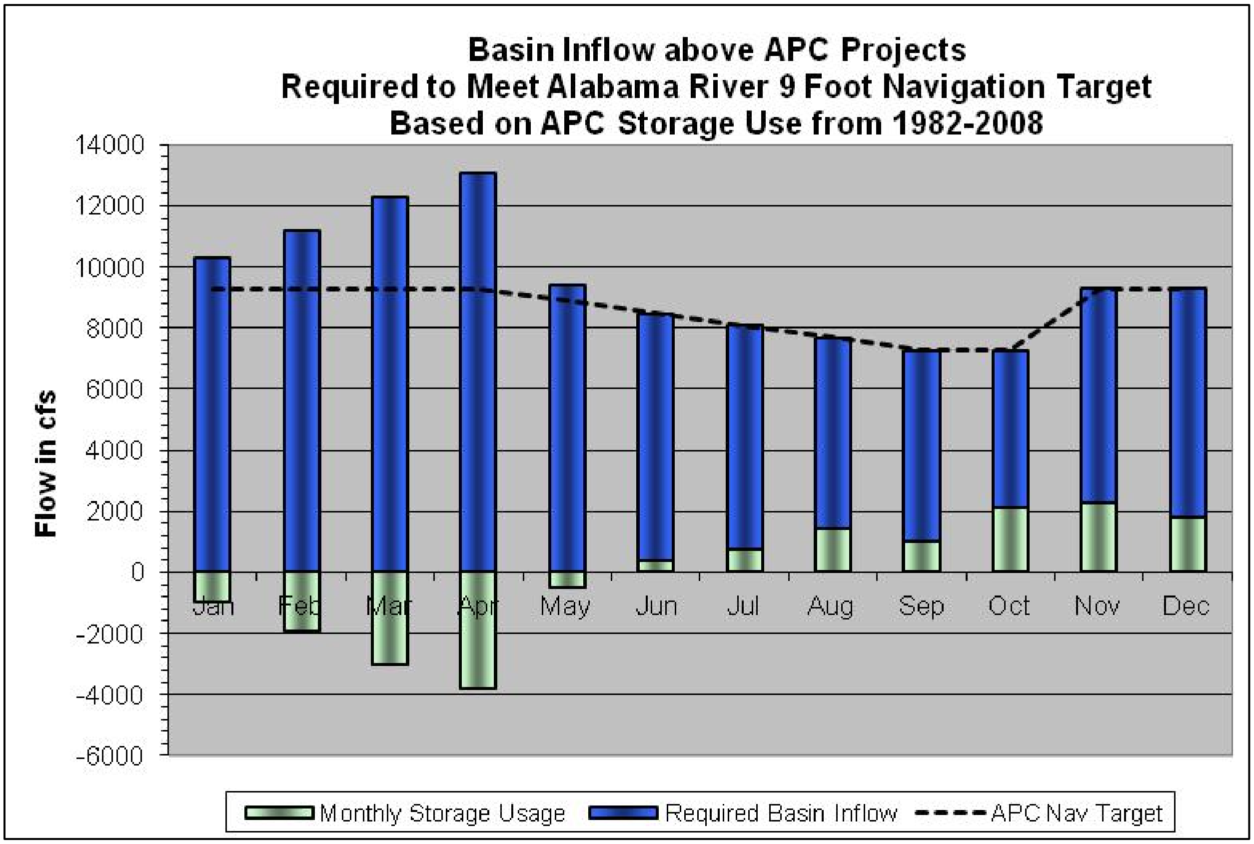

Figure 7-2. Flow Requirements from Rainfall (or Natural Sources) and Reservoir Storage to Achieve the JBT Goal for Navigation Flows for a 9-Foot Channel

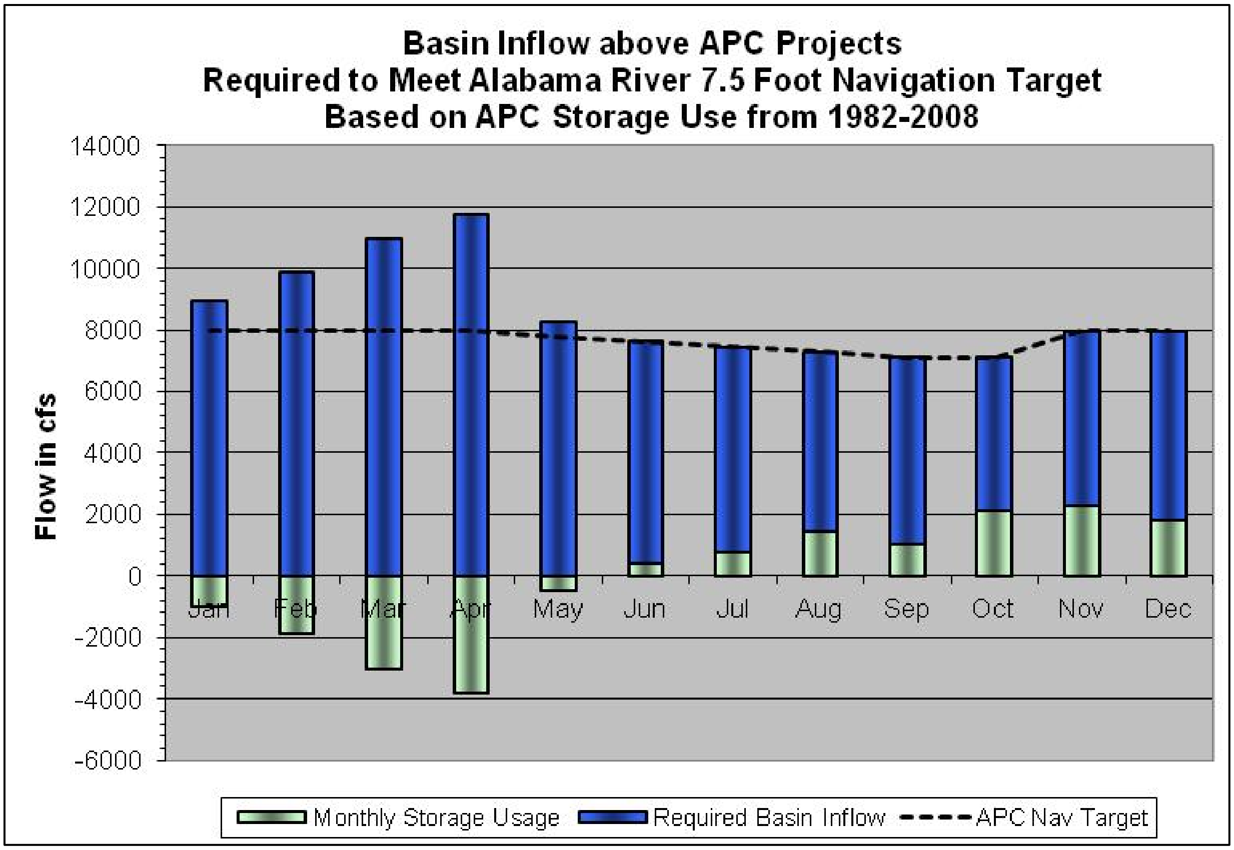

Figure 7-3. Flow Requirements from Rainfall (or Natural Sources) and Reservoir Storage to Achieve the JBT Goal for Navigation Flows for A 7.5-Foot Channel

During normal flow periods, no special water control procedures are required for navigation other than maintaining the proper pool level. Claiborne's pool elevation will be maintained above elevation 32.0 feet NGVD29 to allow for 13-foot depth over the upper miter sill and allow sufficient depth for a 9-foot navigation channel into the Millers Ferry Lock approach upstream.

During high flow periods, Navigation will be discontinued through the Claiborne Lock when the tailwater reaches elevation 47.0 feet NGVD29, which leaves just 4.0 feet of freeboard on the lower guide wall. The discharge at this elevation will be approximately 130,000 cfs which is expected to occur on an average of once every 1.8 years.

In the event that the Mobile District Water Management Section (EN-HW) determines upcoming reductions in water releases may impact the available navigation channel depth, they shall contact the Black Warrior/Tombigbee - Alabama/Coosa Project Office (OP-BA), and the Mobile District Navigation Section (OP-TN), to coordinate the impact. EN-HW shall provide the Claiborne tailwater gage forecast to OP-BA and OP-TN. Using this forecast and the latest available project channel surveys, OP-BA and OP-TN will evaluate the potential impact to available navigation depths. Should this evaluation determine that the available channel depth is adversely impacted, OP-BA and OP-TN will work together, providing EN-HW with their determination of the controlling depth. Thereafter, OP-BA and OP-TN will coordinate the issuance of a navigation bulletin. 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 upstream projects to reduce flows. The bulletin will be posted to the Mobile District Navigation website at

http://navigation.sam.usace.army.mil/docs/index.asp?type=nn

Although special releases will not be standard practice, they could occur for a short duration to assist maintenance dredging and commercial navigation for special shipments if basin hydrologic conditions are adequate. The Corps will evaluate such requests on a case by case basis, subject to applicable laws and regulations and the basin conditions.

7-13. Drought Contingency Plan.

Flow in the Alabama River is largely controlled by APC impoundments on the Coosa and Tallapoosa Rivers above Robert F. Henry Lock and Dam. Under normal flows the APC impoundments will provide sufficient releases from the Coosa and Tallapoosa Rivers to meet a continuous minimum seven-day average flow of 4,640-cfs (32,480 dsf/7 days). However, additional intervening flow or drawdown discharge from R. F. Henry and Millers Ferry Projects must be used to provide a usable depth for navigation or meet the 7Q10 flow of 6,600-cfs at Claiborne Lock and Dam.

In accordance with ER 1110-2-1941, Drought Contingency Plans, dated 15 September 1981, an ACT Basin Drought Contingency Plan (DCP) has been developed to implement water control regulation drought management actions. Drought operations will be in compliance with the plan for the entire ACT Basin as outlined in Exhibit B of the *ACT River Basin Master Water Control Manual*. Pertinent requirements of the DCP relative to the Claiborne Project are summarized below.

Based upon experience gained during previous droughts, and in particular the 2006 - 2008 drought, a basin-wide DCP was developed and is comprised of three components - headwater operations at Allatoona Lake and Carters Lake in Georgia; operations at APC projects on the Coosa and Tallapoosa Rivers; and downstream operations at Corps projects below Montgomery, Alabama. Drought operations for the APC projects were initially developed as a separate plan by the APC (*A*PCDOP) in cooperation with the State of Alabama and the Corps as a result of the 2006 – 2008 drought. The specifics of the APCDOP, as incorporated into the overall ACT Basin DCP, are shown on Table 7-5.

Operational guidelines have been developed on the basis of a Drought Intensity Level (DIL). The DIL is a drought indicator, ranging from DIL 1 to DIL 3, determined by the combined number of drought triggers that occur. The three drought triggers are: (1) basin inflow; (2) composite conservation storage in APC reservoirs; and (3) state line flow. Additional information on the drought triggers can be found in Exhibit C of the *ACT Master Water Control Manual*. Drought management actions would become increasingly more austere when two triggers occur (Drought Level 2) or all three occur (Drought Level 3). Table 7-4 lists the three drought operation intensity levels applicable to APC projects.

Table 7-4. ACT Basin Drought Intensity Levels

Drought Intensity Level (DIL)	Drought Level	No. of Triggers Occurring
DIL 1	Moderate Drought	1
DIL 2	Severe Drought	2
DIL 3	Exceptional Drought	3

Drought management measures for ACT Basin-wide drought regulation consists of three major components:

- Headwater regulation at Allatoona Lake and Carters Lake in Georgia
- Regulation at APC projects on the Coosa and Tallapoosa Rivers
- Regulation at Corps projects downstream of Montgomery, Alabama on the Alabama River

The headwater regulation component includes water control actions in accordance with established action zones, minimum releases, and hydropower generation releases as described in the *ACT River Basin Master Water Control Manual*, Appendices A and H. Regulation of APC projects will be in accordance with Table 7-5 in which the drought response will be triggered by one or more of three indicators - state line flows, basin inflow, or composite conservation storage. Corps operation of its Alabama River projects downstream of Montgomery, Alabama, will respond to drought operations of the APC projects upstream.

No storage is provided in the Claiborne Lock and Dam pool for regulating releases during periods of low inflow. The regulation plan will tend to smooth out peaking releases from the Millers Ferry Project and give a lower Claiborne Dam outflow of somewhat longer duration than would occur with constant-pool operation. During extended periods of powerhouse shutdown or low-capacity generation, the Claiborne Dam spillway will be operated to pass the inflow, with pool held constant at elevation of 36 to 32 feet NGVD29. Any regulating releases from upstream projects will thus be expedited through the Claiborne Dam pool.

1 **Table 7-5. ACT Basin Drought Management Matrix**

<table>
<tr><th></th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th colspan="2">Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td rowspan="4">Drought Level Response[a]</td><td colspan="13">DIL 0 - Normal Operations</td></tr>
<tr><td colspan="13">DIL 1: Low Basin Inflows or Low Composite or Low State Line Flow</td></tr>
<tr><td colspan="13">DIL 2: DIL 1 criteria + (Low Basin Inflows or Low Composite or Low State Line Flow)</td></tr>
<tr><td colspan="13">DIL 3: Low Basin Inflows + Low Composite + Low State Line Flow</td></tr>
<tr><td rowspan="4">Coosa River Flow[b]</td><td colspan="3">Normal Operation: 2,000 cfs</td><td colspan="2">4,000 (8,000)</td><td colspan="2">4,000 – 2,000</td><td colspan="6">Normal Operation: 2,000 cfs</td></tr>
<tr><td colspan="3">Jordan 2,000 +/-cfs</td><td colspan="3">4,000 +/- cfs</td><td>6/15 Linear Ramp down</td><td colspan="3">Jordan 2,000 +/-cfs</td><td colspan="3">Jordan 2,000 +/-cfs</td></tr>
<tr><td colspan="3">Jordan 1,800 +/-cfs</td><td colspan="3">2,500 +/- cfs</td><td>6/15 Linear Ramp down</td><td colspan="3">Jordan 2,000 +/-cfs</td><td colspan="3">Jordan 1,800 +/-cfs</td></tr>
<tr><td colspan="3">Jordan 1,600 +/-cfs</td><td colspan="4">Jordan 1,800 +/-cfs</td><td colspan="3">Jordan 2,000 +/-cfs</td><td colspan="2">Jordan 1,800 +/-cfs</td><td>Jordan 1,600 +/-cfs</td></tr>
<tr><td rowspan="4">Tallapoosa River Flow[c]</td><td colspan="13">Normal Operations: 1200 cfs</td></tr>
<tr><td colspan="4">Greater of: 1/2 Yates Inflow or 2 x Heflin Gage(Thurlow releases > 350 cfs)</td><td colspan="6">1/2 Yates Inflow</td><td colspan="3">1/2 Yates Inflow</td></tr>
<tr><td colspan="4">Thurlow 350 cfs</td><td colspan="6">1/2 Yates Inflow</td><td colspan="3">Thurlow 350 cfs</td></tr>
<tr><td colspan="7">Maintain 400 cfs at Montgomery WTP (Thurlow release 350 cfs)</td><td colspan="3">Thurlow 350 cfs</td><td colspan="3">Maintain 400 cfs at Montgomery WTP (Thurlow release 350 cfs)</td></tr>
<tr><td rowspan="4">Alabama River Flow[d]</td><td colspan="13">Normal Operation: Navigation or 7Q10 flow</td></tr>
<tr><td colspan="4">4,200 cfs (10% 7Q10 Cut) - Montgomery</td><td colspan="6">7Q10 - Montgomery (4,640 cfs)</td><td colspan="3">Reduce: Full – 4,200 cfs</td></tr>
<tr><td colspan="5">3,700 cfs (20% 7Q10 Cut) - Montgomery</td><td colspan="5">4,200 cfs (10% 7Q10 Cut) - Montgomery</td><td colspan="3">Reduce: 4,200 cfs-> 3,700 cfs Montgomery (1 week ramp)</td></tr>
<tr><td colspan="4">2,000 cfs Montgomery</td><td colspan="3">3,700 cfs Montgomery</td><td colspan="3">4,200 cfs (10% 7Q10 Cut) - Montgomery</td><td colspan="3">Reduce: 4,200 cfs -> 2,000 cfs Montgomery (1 month ramp)</td></tr>
<tr><td rowspan="4">Guide Curve Elevation</td><td colspan="13">Normal Operations: Elevations follow Guide Curves as prescribed in License (Measured in Feet)</td></tr>
<tr><td colspan="13">Corps Variances: As Needed; FERC Variance for Lake Martin</td></tr>
<tr><td colspan="13">Corps Variances: As Needed; FERC Variance for Lake Martin</td></tr>
<tr><td colspan="13">Corps Variances: As Needed; FERC Variance for Lake Martin</td></tr>
</table>

a. Note these are base flows that will be exceeded when possible.
b .Jordan flows are based on a continuous +/- 5% of target flow.
c. Thurlow flows are based on continuous +/- 5% of target flow: flows are reset on noon each Tuesday based on the prior day's daily average at Heflin or Yates.
d. Alabama River flows are 7-Day Average Flow.

7-14. Flood Emergency Action Plans. The Corps is responsible for developing Flood Emergency Action Plans for the ACT System. The plans are included in the Operations and Maintenance Manuals for each system project. Example data available are emergency contact information and flood inundation information.

7-15. Other

a. Mosquito Control Operations. With the Claiborne Dam pool confined mainly in the river banks and fluctuated as planned for reregulation purposes, special operations for mosquito control are not required. There are no indications of increased mosquito population because of the impoundment. However, periodic inspection will continue to be conducted as needed and control measures, such as application of larvicides, are used when justified.

b. Operation for Passing Drift. Occasional operation of the spillway gates will be required for passing accumulations of drift. Instructions and limitations for that type of operation are described in the *Operation and Maintenance Manual* for the Claiborne Project. Because the permissible gate openings increase with tailwater elevations, such an operation will usually be performed during the reregulation of peaking power releases. Such manipulation of gates within the prescribed limits should not materially affect the drawdown or recovery operation.

c. Correlation with Other Projects. The correlation of operations at the Claiborne Dam and Millers Ferry and Robert F. Henry Projects has been described in paragraph 7-03, "Overall Plan for Water Control", further details of the operation are also given in paragraph 7-03.

7-16. Deviation from Normal Regulation. The District Commander is occasionally requested to deviate from normal regulation. Prior approval for a deviation is required from the Division Engineer except as noted in subparagraph a below.

Deviation requests usually fall into the following categories:

a. Emergencies. Examples of some emergencies that can be expected to occur at a project are drowning and other accidents, failure of the operation facilities, 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 create equal or worse conditions. The Mobile District will notify the SAD office as soon as practicable.

b. 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.

c. 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 for review and approval.

7-17. Rate of Release Change. There are no restrictions on releases from Claiborne Dam during normal operations. During high flows, it is desirable to uniformly lower discharge downstream as allowable by conditions and equipment to lessen the impacts of the erosive nature of high flows.

VIII - EFFECT OF WATER CONTROL PLAN

8-01. General. Claiborne Lock and Dam is a run-of-the-river project with very little storage capacity between the limiting pool elevations of 36.0 to 32.0 feet NGVD29. The Claiborne Dam is primarily a navigation structure. The project's minimum reservoir level, elevation 32 feet NGVD29, provides navigation depths up to the Millers Ferry Lock and Dam. Claiborne also reregulates the peaking power releases from the upstream Millers Ferry Project providing navigable depths in the channel below Claiborne. Other purposes provided by the project include water quality, public recreation and fish and wildlife conservation and mitigation. While access and some facilities are available at the project for public recreation and fish and wildlife conservation and mitigation, water is typically not specifically managed for these purposes.

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

8-02. Flood Risk Management. Claiborne Lock and Dam Project does not contain reservoir flood risk management storage; therefore, the project has no flood damage reduction capabilities.

a. Spillway Design Flood. The duration of the spillway design flood is approximately 24 days with a peak inflow of 814,800 cfs. Peak outflow is 788,500 cfs. The peak elevation is 78.2 feet NGVD29. The effects of the spillway design flood are shown in Plate 8-1.

b. The Standard Project Flood. The standard project flood would cause a peak pool elevation of 69.1 feet NGVD29 and a maximum discharge of 486,000 cfs. Peak inflow is 494,500 cfs. The effects of the standard project flood are shown in Plate 8-2.

c. Historic Floods. The impacts of the project on hydrographs for the flood of record, February 1961, and the flood of March 1990 are shown on Plates 8-3 and 8-4. The standard project flood series is shown on Plate 8-2 and the spillway design flood series on Plate 8-1.

8-03. Recreation. The Claiborne Lock and Dam Project is an important part of the Alabama River Lakes (ARL) recreational resource, providing both economic and social benefits for the region and the Nation. The ARL is composed of the Claiborne, Millers Ferry, and Robert F. Henry Projects. The ARL contains 33,852 acres of land and 576 miles of shoreline, most of which is available for public use. A wide variety of recreational opportunities are provided at the lake including boating, fishing, camping, picnicking, water skiing, and sightseeing. Mobile District park rangers and other project personnel conduct numerous environmental and historical education tours and presentations, as well as water safety instructional sessions each year for the benefit of area students and project visitors. The ARL receives more than 3,400,000 recreational visitors per year. The local and regional economic benefits of recreation are significant. Annual recreational visitor spending within 30 miles of the project totals $88 million.

8-04. **Water Quality**. All the ACT Basin projects, including Claiborne Lock and Dam, operate to meet the objective of maintaining water quality. At Claiborne Lock and Dam, which operates as a run-of-the-river project, inflows to the project are continuously released downstream. The continuous releases provide a benefit for maintaining downstream water quality.

8-05. Fish and Wildlife. The relatively stable pool at Claiborne is beneficial to certain species of fish and wildlife. However, the project also creates a physical barrier to fish and other aquatic organisms' passage. The reservoir is relatively deep and slow moving compared to pre-impounded conditions. This results in a change in physical conditions, such as velocities, temperature, and substrate, as well as feeding and spawning habitat that cannot be tolerated by many species. The dam and reservoir along with other Corps and APC dams and reservoirs in the basin have resulted in declines in many fish and mussel populations. The described lockages in this Appendix and the Millers Ferry Appendix for fish passage are being implemented in order to provide improved opportunities for migration for many species.

8-06. Water Supply. There is one major withdrawal that occurs from Claiborne Lake, International Paper at Pine Hill. The Claiborne Lock and Dam Project also reregulates the power waves from Millers Ferry Powerhouse to some extent and provides a more uniform flow for existing M&I water supply users downstream of the project.

8-07. **Hydroelectric Power**. Claiborne Lock and Dam Project has no hydropower units; however, water control operations at the project tend to enhance power production at the upstream Millers Ferry Dam. An early or pre-generation drawdown at Claiborne tends to lower the tailwater elevation at Millers Ferry Dam, providing an increase in head and enhanced hydropower generating efficiency.

8-08. Navigation**.**

The Alabama River from Montgomery, Alabama downstream to the Mobile, Alabama area provides a navigation route for commercial barge traffic, serving as a regional economic resource. A minimum flow is required to ensure usable water depths to support navigation. Congress has authorized continuous navigation on the river, when sufficient water is available. There are three locks and dams on the Alabama River, and a combination of dredging, river training works, and flow augmentation from upstream storage projects, which together support navigation depths on the river.

The Alabama River is a terminus on the inland waterway system. It is accessed by the Black Warrior Tombigbee Waterway and Mobile Harbor and the Gulf Intracoastal Waterway (GIWW). Its major value as a water transportation resource is its ability to carry traffic to and from inland waterway points in Mississippi, Louisiana, and Texas. Traffic on the Alabama River is linked to resources originating along the river, which makes barge transportation essential and convenient for moving these resources.

Because of river bends and shoaling at the bends, typical tow size is a four-barge tow, except during very low water conditions when tow sizes can be reduced to two barges.

Flows for navigation are most needed in the unregulated part of the lower Alabama River below Claiborne Lock and Dam. When flows are available, Claiborne Lock and Dam is operated to provide the full navigation depth of nine feet. When river conditions or funding available for dredging of the river indicates that project conditions (9-foot channel) will probably not be attainable in the low water season, the dam is operated to provide flows for a reduced project channel depth as determined by surveys of the river. In recent years funding for dredging has been cut resulting in higher flows or minimized channel (150 feet wide) being required to provide the design navigation depth. In addition to annual seasonal low flow impacts, droughts have a severe impact on the availability of navigation depths in the Alabama River.

A 9-foot deep by 200-foot wide navigation channel is authorized on the Alabama River to Montgomery, Alabama. A minimum depth of 7.5 feet can provide a limited amount of navigation. Under low-flow conditions, even the 7.5-foot depth has not been available at all times. Over the period from 1976 to 1993, based upon river stage, the 7.5-foot navigation channel was available 79 percent of the time and the 9-foot navigation channel was available 72 percent of the time. Since 1993, the percentage of time that these depths have been available has declined further. Full navigation channel availability on the Alabama River is dependent upon seasonal flow conditions and channel maintenance. The ACT Basin water control plan will provide a 9-foot channel, based upon river stage, approximately 90 percent of the time in January and over 50 percent of the time in September. A 7.5-foot channel, based upon river stage, is expected approximately 90 percent of the time in January and 56 percent of the time in September. Because of higher flows in the winter and spring, channel availability is much higher from December through May.

Figure 8-1 depicts the historic annual channel depth availabilities for the Alabama River below Claiborne Lock and Dam, based upon river stage, computed for 1970-2010.

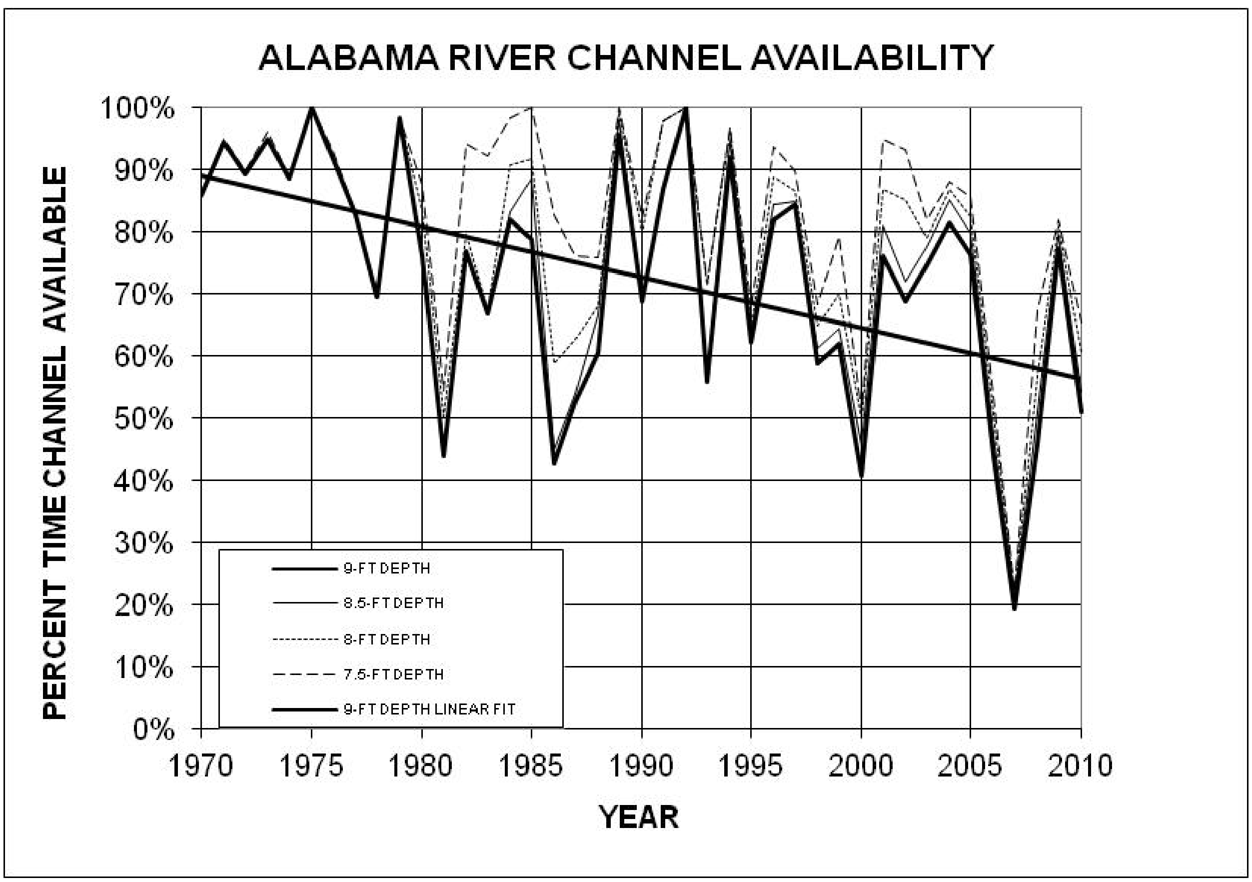

Figure 8-1. Alabama River Channel Availability Below Claiborne, 1970 to 2010

Extreme high-flow conditions also limit availability of the project for commercial navigation, principally related to the ability to use the navigation locks at the three locks and dams on the Alabama River. Those conditions are temporary and far more short term (usually lasting no more than a few days) than low-water limitations resulting from extended periods of drought and low basin inflows. At Robert F. Henry Lock and Dam, use of the navigation lock is discontinued when the headwater above the dam reaches elevation 131.0 feet NGVD29. That elevation equates to a flow of about 156,000 cfs, which occurs on average about once every three years. At Millers Ferry Lock and Dam, use of the navigation lock is discontinued when the tailwater below the dam reaches elevation 81.0 feet NGVD29. That tailwater elevation equates to a flow of about 220,000 cfs, which occurs on average about once every 18 years. At Claiborne Lake, use of the navigation lock is temporarily discontinued when the tailwater below the dam reaches elevation 47.0 feet NGVD29. That tailwater elevation equates to a flow of about 130,000 cfs, which occurs on average about once every 1.8 years. Table 8-1 contains calendar years 2011-2003 lock usage from the Corps' Lock Performance Monitoring System regarding navigation activity through Claiborne Lock and Dam. The Lock Performance Monitoring System data contain the number of lockages of commercial and noncommercial vessels and tonnages of various commodities passing through the lock.

Table 8-1. Navigation Activity at Claiborne Lock and Dam

Lockages/vessels (number)	**CY2011**	**CY2010**	**CY2009**	**CY2008**	**CY2007**	**CY2006**	**CY2005**	**CY2004**	**CY2003**
Barges Empty	1	11	100	37	17	15	44	34	49
Barges Loaded	1	10	93	40	35	17	49	31	46
Commercial Lockages	2		61	34	44	23	72	47	66
Commercial Vessels	4	1	62	42	54	28	76	55	75
Non-Commercial Lockages	9	17	14	34	25	4	17	45	8
Non-Commercial Vessels	9	17	14	34	25	4	17	45	8
Recreational Lockages	174	138	158	150	190	213	210	307	180
Recreational Vessels	200	181	189	187	255	310	265	483	251
Total Lockages	185	155	233	218	259	240	299	399	254
Total Vessels	213	199	265	263	334	342	358	583	334
Commodities (tons)						22		500	
Crude Material Except Fuels (tons)			117,278	65,564	27,650	45,900	141,047	68,181	117,250
Equipment and Machinery (tons)	22	3,050		100	3,544	315	680	4,143	300
Total, All Commodities (tons)	22	3,050	117,278	62,664	31,194	46,215	141,749	118,050	68,645

8-09. Droughts and Seasonal Low Flow Regulation. The development of drought plans has become increasingly important as more demands are placed on the water resources of the basin. During low flow conditions, the system may not be able to fully support all project purposes. 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. Response to drought conditions involves all the government reservoirs in the basin. Certain flow rates into the Alabama River are prescribed in the Water Control Plan on the basis of available storage in the reservoirs, and other factors. The plan is described in Chapter VII of this appendix.

8-10. Flood Emergency Action Plans. Because the Claiborne Lock and Dam Project is not a flood risk management project, no major actions occur that are related to flood risk management. However, flowage easements have been obtained encompassing all lands subjected to an increased frequency of flooding from operation of the project. Normally, all operations are directed by the Mobile District Office. If a storm of flood-producing magnitude event occurs and all communications are disrupted between the Mobile District Office and project personnel at the Claiborne Lock and Dam, emergency operating procedures, as previously described in Chapter VII of this appendix, will begin. If communication is broken after some instructions have been received from the Mobile District Office, those instructions will be followed for as long as they are applicable.

8-11. Frequencies. Table 8-2 below presents the monthly and annual discharge duration analysis for Claiborne Lock and Dam. The annual peak flow frequency curve is shown on Plate 8-5 and annual stage frequency on Plate 8-6. The headwater/tailwater stage frequency is shown on Plate 8-7.

Table 8-2. Monthly and Annual Discharge Duration Data

Monthly and Annual Discharge Duration Analysis (Apr 1930 - Jan 2010)

Combined Records

USGS Gage 02429500 Alabama River at Claiborne, ALA (Hwy 84) Apr 1930 - Sep 1975

USGS Gage 02428400 Alabama River at Claiborne L&D nr Monroeville, ALA Oct 1975 - Jan 2010

DISCHARGE IN CFS

Percent Time Equaled or Exceeded	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0.1	169,000	203,768	261,120	225,872	167,000	128,400	140,080	193,120	107,400	120,042	157,600	215,520	211,000
1	149,000	169,000	198,200	193,960	128,000	90,000	94,220	78,960	69,800	73,840	105,000	158,400	152,000
2	138,420	144,360	171,200	166,000	118,000	73,000	76,240	53,560	47,800	59,536	89,200	131,400	132,000
5	120,000	124,400	141,000	148,000	98,100	51,600	47,200	32,300	30,300	35,305	58,300	96,400	104,000
10	98,050	106,000	121,000	121,400	67,100	33,900	32,300	23,700	21,600	24,200	40,500	76,900	80,100
15	86,615	91,900	108,000	100,000	50,000	27,500	27,400	20,000	17,800	18,800	30,800	60,200	61,100
25	67,100	75,500	89,500	78,200	35,000	20,500	19,800	16,400	14,500	14,700	20,800	38,900	38,800
50	35,000	47,200	53,300	38,800	21,600	14,900	13,600	12,300	10,900	10,400	12,500	21,300	18,300
80	19,200	24,600	28,600	19,000	12,800	10,300	8,880	8,490	7,440	7,526	8,810	12,700	10,300
90	14,300	18,000	20,400	12,900	9,920	7,890	6,980	6,920	6,500	6,469	7,170	10,400	8,020
95	10,800	14,300	15,100	10,200	8,160	6,920	5,830	6,050	5,740	5,660	6,510	8,420	6,770
99	7,480	9,322	8,742	7,245	6,390	5,290	4,440	4,700	4,590	4,668	4,300	3,438	5,070

IX - WATER CONTROL MANAGEMENT

9-01. **Responsibilities and Organization**. The Claiborne Lock and Dam is a federal structure operated by the Corps. It is part of the Alabama River Navigation System. Many agencies in federal and state governments are responsible for developing and monitoring water resources in the ACT Basin. Some of the federal agencies are 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, U.S. Fish and Wildlife, NOAA. In addition to the Federal agencies, the State of Alabama is involved through the Alabama Department of Environmental Management, Alabama Office of Water Resources.

a. U.S. Army Corps of Engineers. Authority for water control regulation of the Claiborne Lock and Dam project has been delegated to the South Atlantic Division (SAD) Commander. The responsibility for water control regulation activities has been entrusted to the Mobile District, Engineering Division, Water Management Section. Water control actions for Claiborne are regulated to meet the federally authorized project purposes in coordination with federally authorized ACT Basin-wide system purposes. It is the responsibility of the Water Management Section to develop water control regulation procedures for the Claiborne Lock and Dam Project, including all foreseeable conditions. The Water Management Section monitors the project for compliance with the approved water control plan. Claiborne Lock and Dam is owned and operated by the Corps. The Corps, Mobile District operates the Claiborne Lock and Dam Project. Reservoir operation and maintenance are under the supervision of Operations Division. The project falls under the direction of the Operations Project Manager located at Tuscaloosa, Alabama. The lock is operated 24 hours a day, 7 days a week. The Water Management Section in the Engineering Division monitors the project for compliance with the approved water control plan and makes operational decisions based upon that plan. When necessary, the Water Management Section instructs the powerhouse operators and lockmaster regarding normal procedures and emergencies for unusual circumstances. Lock personnel are responsible for daily adjusting the flow at the project to buffer out power generation surges from the Millers Ferry Project 60 miles upstream, and to maintain pool elevations for navigation, and to provide flow downstream for navigation and other purposes. Instructions for this are included in Exhibit C, Standing Instructions to Project Operator. These instructions contain directions for reporting to higher authority.

b. Other Federal Agencies. Other federal agencies work closely with the Corps to provide their agency support for the various project purposes of the Claiborne project and to meet the federal requirements for which they might be responsible. The responsibilities and interagency coordination between the Corps and the federal agencies are discussed in paragraph 9-02.

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

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.

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

d. Stakeholders. Many non-federal stakeholder interest groups are active in the ACT Basin. The groups include lake associations, M&I water users, navigation interests, environmental organizations, and other basin-wide interests groups. Coordinating water management activities with the interest groups, state and federal agencies, and others is accomplished as required on an ad-hoc basis and on regularly scheduled water management teleconferences when needed to share information regarding water control regulation actions and gather stakeholder feedback. The *ACT Master Water Control Manual* includes a list of state and federal agencies and active stakeholders in the ACT Basin that have participated in the ACT Basin water management teleconferences and meetings.

e. Alabama Power Company. The APC owns and operates hydropower projects within the State, and controls most of the storage in the ACT Basin, as shown below in Table 9-1. Claiborne Lake is a run-of-the-river project and essentially has no conservation storage.

Table 9-1 ACT Basin Conservation Storage Percent by Acre-Feet

Project	Storage (acre-feet)	Percentage
* Allatoona	284,580	12%
* Carters	141,402	6%
Weiss	237,448	10%
H. Neely Henry	43,205	2%
Logan Martin	108,262	4%
Lay	77,478	3%
Mitchell	28,048	1%
Jordan	15,969	1%
Harris	191,129	8%
Martin	1,183,356	49%
Yates	5,976	0%
* R. F. Henry	36,450	2%
* Millers Ferry	46,704	3%

* Federal project

Claiborne Project receives outflow from the Millers Ferry Project immediately upstream and schedules operation based on these releases and local or intervening flow. The scheduled outflows from Millers Ferry primarily determine the operation of Claiborne.

9-02. Interagency Coordination

a. Local Press and Corps Bulletins. The local press includes any periodic publications in or near the Claiborne Lock and Dam Watershed and the ACT Basin. Grove Hill, Jackson, Monroeville and Montgomery, Alabama have daily or periodic publications. 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. 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 Districts' Water Management homepage http://water.sam.usace.army.mil/.

b. National Weather Service. NWS is the federal agency in NOAA that is responsible for weather and weather forecasts. The NWS along with its River Forecast Center maintains a network of reporting stations throughout the Nation. It continuously provides current weather conditions and forecasts. It prepares river forecasts for many locations including the ACT Basin. Often, it prepares predictions on the basis of *what if* scenarios. Those include rainfall that is possible but has not occurred. In addition, the NWS provides information on hurricane tracts and other severe weather conditions. It monitors drought conditions and provides the information. Information is available through the Internet, the news, and the Mobile District's direct access.

c. U. S. Geological Survey. The USGS is an unbiased, 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 Claiborne Watershed and ACT Basin. The USGS Water Science Centers in Georgia and Alabama-Birmingham publish real-time reservoir levels, river and tributary stages, and flow data through the USGS NWIS 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.

d. U. S. Fish and Wildlife Service. 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 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 and Wildlife Coordination Act. The Corps, Mobile District, with support from the Water Management Section, coordinates water control actions and management with USFWS in accordance with both laws.

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 Claiborne Project and other ACT 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 evaluating reservoir regulations and reservoir systems to insure their most efficient use. Within the constraints of Congressional authorizations and engineering regulations, the water control plan and operating techniques are often reviewed to see if improvements are possible without violating authorized project functions. 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 ACT Basin-wide system.

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EXHIBIT A

SUPPLEMENTARY PERTINENT DATA

EXHIBIT A
SUPPLEMENTARY PERTINENT DATA

GENERAL

Dam Site Location	
State	Alabama
Basin	Alabama-Coosa-Tallapoosa
Miles above mouth of Alabama River	81.78
Drainage area Millers Ferry to Claiborne, square miles	820
Total drainage area above Claiborne dam site, square miles	21,743
Type of Project	Navigation
Objective of Regulation	Navigation
Project Owner	United States of America
Operating Agency/Regulatiing Agency	U.S. Army Corps of Engineers

STREAM FLOW AT DAM SITE

Period of record	1931-2008*
Period of record (Dam in place)	1975-2010
Average annual flow for period of record (1931-2008) - cfs	32,218
Minimum monthly flow in period of record – cfs	2,397
Maximum monthly flow in period of record – cfs	165,100
Minimum daily flow in period of record - cfs	1,540
Maximum flow during period of record, Flood of Feb-Mar 1961 – cfs	267,000
Max estimated flow for flood of historical record, Flood of Mar 1929 – cfs	270,000
Peak stage for period of record, Flood of Feb-Mar 1961, ft NGVD29 - cfs	58.9
Estimated peak stage for flood of historical record, Flood of March 1929- ft NGVD 29	59.0

* 1930-1975 based on records at USGS gage 02429500 at Claiborne, 5.77 miles downstream from Claiborne Dam. 1975-2008 based on records at USGS gage 02428400 at dam site.

REGULATED FLOODS

Maximum flood of record (Feb-Mar 1961)*	
Peak Inflow – cfs	257,700
Regulated peak outflow – cfs	257,700
Regulated peak headwater - ft NGVD29	58.8
Maximum flood of continuous record (Feb-Mar 1961) - ft NGVD29	58.2

REGULATED FLOODS – (CONT'D)

Standard Project Flood Series	
Peak inflow to full reservoir – cfs	494,500
Regulated peak outflow - cfs	486,000
Regulated peak headwater – ft NGVD29	69.1
Spillway Design Flood Series	
Peak inflow to full reservoir – cfs	814,800
Regulated peak outflow – cfs	788,500
Regulate peak headwater – ft NGVD29	78.2

* Computed flow with Robert F. Henry and APC Dams assumed in operation.

RESERVOIR

Maximum operating pool elevation – ft NGVD29	36.0
Minimum operating pool elevation – ft NGVD29	32.0
Maximum head – ft	30.0
Area at pool elevation 36.0 - acres	6,290
Area acquired in fee simple - acres	3,015
Area acquired by easement – acres	2,681
Area cleared – acres	1,500
Maximum elevation of clearing – ft NGVD29	38.0
Total volume to elevation 36.0 – acre-feet	102,480
Length – miles	60.5
Shoreline distance at elevation 36.0 – miles	216

LOCK

Nominal size of chamber - feet	84 x 600
Distance center to center of gate pintles -, feet	655.0
Maximum lift - feet	30.0
Elevation of upper stop-log sill - feet NGVD29	19.0
Elevation of upper miter sill - feet NGVD29	19.0
Elevation of lower stop-log sill - feet NGVD29	-8.0
Elevation of lower miter sill - feet NGVD29	-8.0
Elevation of chamber floor - feet NGVD29	-9.0
Elevation of top of floor culverts - feet NGVD29	-10.0
Elevation of top of upper and lower approach walls - feet NGVD29	51.0
Elevation of top of chamber walls - feet NGVD29	51.0

LOCK (CONT'D)

Freeboard on lock walls when lock becomes inoperative - feet	4.0
Percent of time inoperative	2.0
Type of upper gate	horizontally-framed miter
Height of upper gate - feet	32.0
Type of lower gate	horizontally-framed miter
Height of lower gate - feet	59.0
Type of culvert valves	reverse tainter
Dimensions of culverts at valves - feet	10 x 10
Dimensions of culverts at lateral - feet	10 x 13
Elevation of culvert ceilings between valves - feet NGVD29	-1.0
Minimum submergence of culvert valves - feet	6.0
Type of filling and emptying system	middle third laterals

GATED SPILLWAY

Total length, including end piers - feet	416
Net length - feet	360
Elevation of crest – ft NGVD29	15.0
Number of piers, including end piers	7
Width of piers - ft	8
Type of gates	Tainter
Number of gates	6
Length of gates - ft	60.0
Height of gates - ft	21.0
Maximum discharge capacity – cfs	67,111
Elevation of top of gates in closed position – ft NGVD29	36.0
Elevation of low steel of gates in fully open position – ft NGVD29	66.0
Elevation of trunnion – ft NGVD29	48.0
Elevation of access bridge – ft NGVD29	75.0
Elevation of stilling basin apron – ft NGVD29	variable -5 to -10
Height of end sill - ft	5.0
Type of stilling basin	roller basin

FIXED CREST SPILLWAY

Length - ft	500
Elevation of ogee crest – ft NGVD29	33.0
Type of stilling basin	roller bucket

EARTH OVERFLOW DIKES

Right Bank Dike	
Total length – ft	200
Top elevation – ft NGVD29	40.0
Top width – ft	25.0
Side slopes	1 v to 3 h
Thickness of riprap on slopes – inches	24
Thickness of filter blanket – inches	9
Top elevation of steel pile cutoff wall – ft NGVD29	36
Maximum swellhead when dike is overtopped, feet	0.6
Recurrence interval of flood which will overtop dike, years	0.5
Freeboard, top of dike above normal upper pool, feet	5
Left Bank Dike	
Total length including esplanade and ramp - ft	2,350
Top elevation – ft NGVD29	60.0
Top width - ft	32.0
Side slopes	1v to 4 h
Maximum swellhead when dike is overtopped - ft	0.6
Freeboard, top of dike above headwater for maximum flood of continuous record (Feb-Mar 1961) - ft	1.2

EXHIBIT B

UNIT CONVERSIONS

AREA CONVERSION

UNIT	m^2	km^2	ha	in^2	ft^2	yd^2	mi^2	ac
1 m^2	1	10^{-6}	10^{-4}	1550	10.76	1.196	3.86×10^{-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 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.

Claiborne Coordinate Comparison

Station	NAVD88 Elevation (feet)	NGVD29 Elevation (feet)	Diff NAVD88 NGVD29 (feet)	Remarks
6-21E	50.873			Set Corps of Engineers Brass Disk (Elevation obtain from OPUS DB)
6-21F	50.792			Set Corps of Engineers Brass Disk
Lower River	51.001	51.175	-0.174	Lower River 1971, Corps of Engineers disk set in concrete near downstream gauge house. "Questionable Stability"
RM-1	50.715	50.851	-0.136	USGS RM-1. Top of angle iron in concrete lockwall
RP-1	53.240	53.415	-0.175	USGS RP-1. Chiseled arrow in concrete
RP-2	50.917	51.079	-0.162	USGS RP-2. 2 hack marks near ladder gate
TBM A	51.915			Chiseled "x" in top of bolt on base of light pole near downstream gauge. 16 foot of downstream lock gate.
TBM B	51.839			Chiseled "x" in top of bolt on base of light pole near downstream gauge
TBM C	65.698			Chiseled square in outer metal lip of pipe for upstream gauge
TBM D	63.288			Top of doorstop behind door leading into kitchen.
DS GAUGE	54.105			Shot on downstream gauge datum point. Digital readout 17.00, read 16.78 on metal tape. Both readings at 10:07 AM May 25, 2010
US GAUGE	65.885			Shot on upstream gauge datum point. Digital readout 33.48, read 33.272 on metal tape. Both readings at 11:03 AM on May 25, 2010

SURVEY DATASHEET (Version 1.0)

PID: BBBX98
Designation: 6-21E
Stamping: 6-21E
Stability: Monument will probably hold position well
Setting: Massive structures (other than listed below)
Description: LOCATED ON THE ALABAMA RIVER, AT THE CLAIBORNE LOCK AND DAM, IN THE VACINITY OF THE DOWNSTREAM LOCK GATE. MONUMENT IS LOCATED 11.60 FEET SOUTHEAST OF A BRASS DISK STAMPED "6-506 1988", 10.30 FEET SOUTHEAST OF A METAL CLEET, 7.95 FEET EAST OF THE DOWNSTREAM SIDE LADDER ENCLOSURE AND 6.15 FEET NORTHWEST OF A CORNER POST FOR THE METAL HANDRAIL.
MONUMENT IS A STANDARD U.S. ARMY CORPS OF ENGINEERS BRASS DISK SET IN LOCK WALL.
Observed: 2010-05-27T19:36:00Z
Source: OPUS - page5 0909.08

Close-up View

REF_FRAME: NAD_83 (CORS96)	EPOCH: 2002.0000	SOURCE: NAVD88 (Computed using GEOID09)	UNITS: m	SET PROFILE	DETAILS

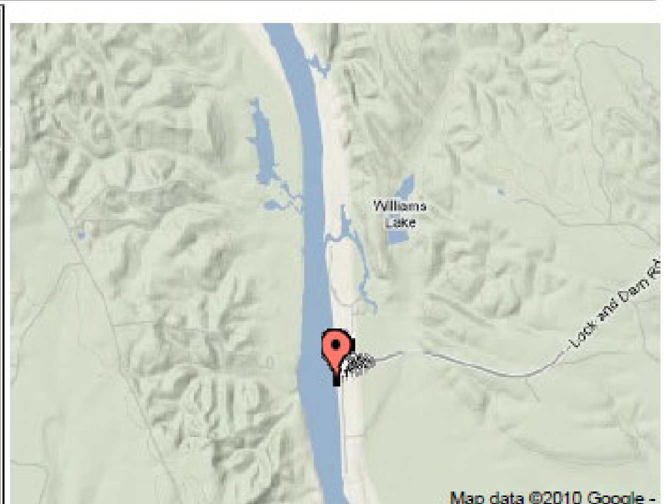
LAT:	31° 36' 47.07203"	± 0.025 m
LON:	-87° 32' 59.21812"	± 0.010 m
ELL HT:	-12.391	± 0.025 m
X:	232424.415	± 0.010 m
Y:	-5431689.541	± 0.020 m
Z:	3323964.210	± 0.033 m
ORTHO HT:	15.506	± 0.028 m

	UTM 16	**SPC** 102(AL W)
NORTHING:	3497680.492m	178824.680m
EASTING:	447852.821m	595276.533m
CONVERGENCE:	-0.28819181°	-0.02609517°
POINT SCALE:	0.99963354	0.99993361
COMBINED FACTOR:	0.99963548	0.99993555

CONTRIBUTED BY

mchaney
Maptech 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.

Claiborne Lock and Dam

EXHIBIT C

STANDING INSTRUCTION TO THE PROJECT OPERATOR FOR WATER CONTROL

CLAIBORNE LOCK AND DAM

EXHIBIT C

STANDING INSTRUCTIONS TO PROJECT OPERATOR FOR RESERVOIR REGULATION AT CLAIBORNE LOCK AND DAM

1. DATA COLLECTION

a. Rainfall. Measure and record rainfall each morning at 0600.

b. Pool and Tailwater Elevations. Read and record the pool and tailwater elevation each morning at 0600 and every time the spillway gate is changed.

c. Spillway Gate Openings. Record the spillway gate settings each morning at 0600 and immediately after each gate setting change.

2. DATA REPORTING

a. Daily Reports. Furnish the following data each morning to the Millers Ferry operator:

1. The 0600 rainfall measurement.
2. The 0600 pool elevation.
3. The 0600 tailwater elevation.
4. The 0600 spillway gate setting.

b. Monthly Reports. Complete WS Form B-91 and send to National Weather Service, 11 West Oxmoore Road, Suite 417, Birmingham, Alabama 35209, and to Department of the Army, U.S. Army Engineer District, Mobile, P.O. Box 2288, Attention: Water Management Section, Mobile, Alabama, 36628-0001

3. OPERATING INSTRUCTIONS

a. Normal Conditions. Follow instructions in Chapter VII, Water Control Plan, of this Water Control Manual.

b. Emergency Conditions. If communications with Millers Ferry and the Mobile District Office are disrupted and the Millers Ferry generation schedule cannot be obtained, use the latest schedule received from Millers Ferry and follow the normal operating instructions in Chapter VII of this manual until communications are restored.

c. Flood Conditions. During floods maintain the reservoir level near elevation 35.0 feet NGVD29 by operating the spillway gates to pass the inflow until all gates are fully opened and there is no control over the outflow. When the inflow exceeds the discharge capacity of the spillway at elevation 35.0 feet NGVD29 with all gates fully opened, the pool level will rise above elevation 35.0 feet NGVD29 and continue to rise until the inflow peaks and begins to recede. Keep gates in the fully open position until the pool level recedes to elevation 35.0 feet NGVD29, and then operate as necessary to maintain the reservoir level near 35.0 feet NGVD29. Experienced lock personnel may deviate from this guide to make smooth transitions in outflows from Claiborne while maintaining the Claiborne upper pool within the limits of 32.0 - 36.0 feet NGVD29.

d. Spillway Gate Operation. Operate the spillway gates according to the Water Control Plan Section 7-04, referring to Plate 7-1 through Plate 7-19 for gate settings and target flows.

The upper pool, under normal conditions, can rise to elevation 36.5 feet NGVD29 as long as the top of all gates are 0.25 feet above the reservoir level. All spillway gates must be within 0.75 feet of each other. The six spillway gates are sequentially numbered beginning at the left bank (east end of the spillway) adjacent to the lock. This procedure may be modified by experienced personnel as necessary when required by events such as; sub-daily power generation events at Millers Ferry, or significant rainfall between Claiborne and Millers Ferry.

e. Head Limitation. To prevent the Claiborne structures from sliding or overturning it is imperative that the difference between headwater elevation and tailwater elevation does not exceed 30 feet at any time.