Exhibit SNC 000017

U.S. Army Corps of Engineers Savannah River Drought Contingency Plan (March 1989)

SAVANNAH RIVER BASIN

DROUGHT CONTINGENCY PLAN

U.S. ARMY ENGINEER DISTRICT, SAVANNAH

MARCH 1989

SYLLABUS

The Savannah River Basin Drought Contingency Plan has been developed to address the operation of the three principal Corps of Engineers impoundments on the Savannah River and their effects on the downstream portion of the river, and to assist the States of Georgia and South Carolina in drought contingency planning in their portions of the Savannah River Basin. It will also be useful to the State of Georgia in notifying water users in all other river basins in Georgia during a drought.

In 1986 through 1989, the worst drought in recent history created severe water shortage conditions over extensive areas of the Southeastern United States. At the three Corps impoundments on the Savannah River, Hartwell, Richard B. Russell, and J. Strom Thurmond (formerly Clarks Hill), inflows were the lowest recorded this century.

The severity of the drought created conditions which stressed the traditional management concepts followed in regulating the individual Corps impoundments and the interbasin system approach which integrated water management of the three lakes. Concerns and conflicts over competing water uses intensified as drought conditions became more severe and lake levels continued to fall. During 1986, the Savannah District developed a Short-Range Drought Water Management Strategy to address the worsening water shortage conditions in the Savannah River Basin. That document served as a guide for using the remaining storage in the Corps operated Savannah River impoundments for the duration of the drought. The short-range strategy also served as a prelude to the development of a long-term drought strategy. This manual presents that long-term strategy. Six water-use priorities were identified and evaluated under different management scenarios: Fish and Wildlife Management, Hydropower, Navigation, Recreation, Water Quality, and Water Supply.

The difficulty in accurately defining the beginning of a drought as it is occurring hampers the ability to make appropriate management responses. It is desirable to have an indicator or triggering mechanism to initiate management action before a crisis occurs.

The indicator that has been chosen for this plan is lake level. Although it does not account for meteorologic factors, as do some indicators, it has the advantage of simplicity. Using lake levels for a triggering mechanism is readily understandable by the public, and easily implemented requiring no complex computations.

A significant development under this plan is the establishment of the Savannah River Basin Drought Coordination Committee (SRBDCC) composed of representatives of the Corps of Engineers and the States of Georgia and South Carolina. This will provide for improved communication and information exchange among the agencies involved.

This drought contingency plan is an attempt to balance the negative impacts of the drought. We recognize the competing interests among project purposes - fish and wildlife management, hydropower, navigation, recreation, water quality and water supply - and the possibility that they may not be fully satisfied.

This is a dynamic plan, subject to change as warranted by additional information. Among the items that may be cause for reconsideration are: additional experience with the current drought, further studies of salinity intrusion in Savannah Harbor, changing water supply needs, improvements to water intakes, and the uncertain future operational plan at the Savannah River Plant.

U.S. ARMY CORPS OF ENGINEERS

SAVANNAH RIVER BASIN

DROUGHT CONTINGENCY PLAN

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BACKGROUND

Drought created severe water shortage conditions over extensive areas of the Southeastern United States in 1986 through 1989. The drought was the worst in recent history for the Southeast. At most impoundments in the region the drought conditions resulted in pool elevations declining to record or near record low levels. Impoundments operated by the U.S. Army Corps of Engineers were especially "hard-hit" due to the various competing uses for which these lakes are managed. At the three large Corps impoundments on the Savannah River (Hartwell, Richard B. Russell, and J. Strom Thurmond Dams and Lakes), inflows were the lowest recorded this century.

The severity of the drought created conditions which stressed the traditional management concepts followed in water management of the three lakes. Concerns and conflicts over competing water uses intensified as drought conditions became more severe and lake levels continued to fall. During 1986, the Savannah District developed a Short-Range Drought Water Management Strategy to address the worsening water shortage conditions in the Savannah River Basin. That short range plan served as a guide for using the remaining storage in the Corps' operated Savannah River impoundments for the duration of the drought.

This document, the Savannah River Basin Drought Contingency Plan, has been developed to address the operation of the three principal Corps impoundments on the Savannah River and their effects on the downstream portion of the river, and to assist the State in notifying water users in all other river basins in Georgia during a drought.

The action levels presented here have been modified from the previous plan in response to comments received from state and local agencies and the public. The number of levels at which releases are reduced has been lowered from four to two. The 6300 cfs and 5400 cfs outflow levels have been abolished. The 4500 cfs level has been raised to elevation 324 ft msl at Thurmond, 654 ft. msl at Hartwell, in the summer and 322 ft msl at Thurmond, 652 ft. msl at Hartwell, in the winter. The 3600 cfs level has been lowered to elevation 316 at Thurmond and 646 at Hartwell. The winter-summer variation of the action levels has been changed to coincide with the operational rule curve.

The result of this is to initiate significant action at an earlier point in the drought. By delaying the initiation of the 3600 cfs level, many of the water quality concerns are alleviated.

The purpose of the variation in the 4500 cfs level is that historic pool records show a number of years where the pool temporarily dips to the 322-324 level in the winter then quickly refills. The more severe dry periods begin earlier in the year and the actions are not effected by the variation in the curve.

SAVANNAH RIVER BASIN

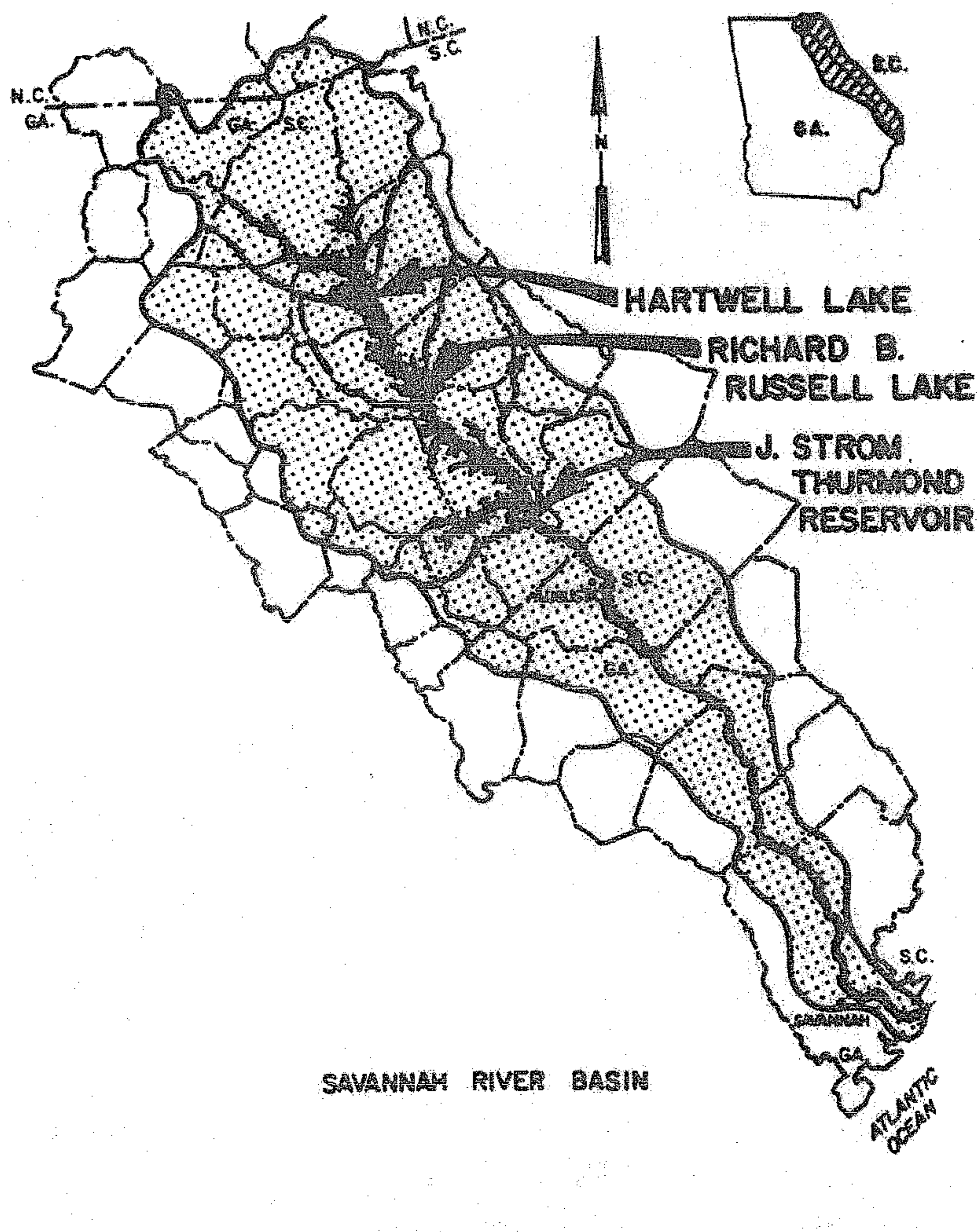
Basin Description. The Savannah River Basin is a long, relatively narrow basin, with the longer axis lying in a northwest-southeast direction as shown on Figure 1. Major drainage basins in the State of Georgia for which the Savannah District has permitting responsibilities are shown on Figure 2. The Charleston District has permitting responsibilities as shown on Figure 3. The maximum length of the basin is about 250 miles and the maximum width about 70 miles. The total area of the basin is 10,579 square miles, of which 179 square miles are in North Carolina, 4,530 square miles in South Carolina, and 5,870 square miles in Georgia. The Savannah River is formed by the confluence of the Seneca and Tugaloo Rivers, which have their headwaters on the southern slopes of the Blue Ridge Mountains in North Carolina just north of the boundary with South Carolina and Georgia. The river meanders in a southeasterly direction through the Piedmont Plateau and Coastal Plain and with its tributaries forms the boundary between Georgia and South Carolina from the North Carolina state line to the Atlantic Ocean.

Several principal streams make up the Savannah River system. The Tallulah and Chattooga Rivers unite to form the Tugaloo River; Twelve Mile Creek joins the Keowee River to form the Seneca River. The upstream Little River, South Carolina, enters the Keowee River about 5.6 miles above its mouth. The confluence of the Tugaloo and Seneca Rivers, known as The Forks, is the beginning of the Savannah River proper and is now submerged by Hartwell Lake. Broad River and Little River enter the Savannah River into J. Strom Thurmond Reservoir from the west about 54 and 24 miles above Augusta, respectively. Downstream Little River and Stevens Creek enter the Savannah River on the east about 38 and 9 miles above Augusta, respectively. Horse Creek enters the river from the east about 2 miles below Augusta, and Brier Creek from the west about 109 miles below Augusta. The length of the Savannah River from The Forks to the mouth is about 312 miles. Approximately 45 miles of the lower river are influenced by tidal action.

Drainage Area Addressed By Strategy. The Savannah River is the major river within the basin and, of its 312 miles, the entire length is now regulated by three Corps of Engineers projects, each with appreciable storage. The three lakes, Hartwell, Russell, and Thurmond, form a chain of lakes approximately 120 miles long.

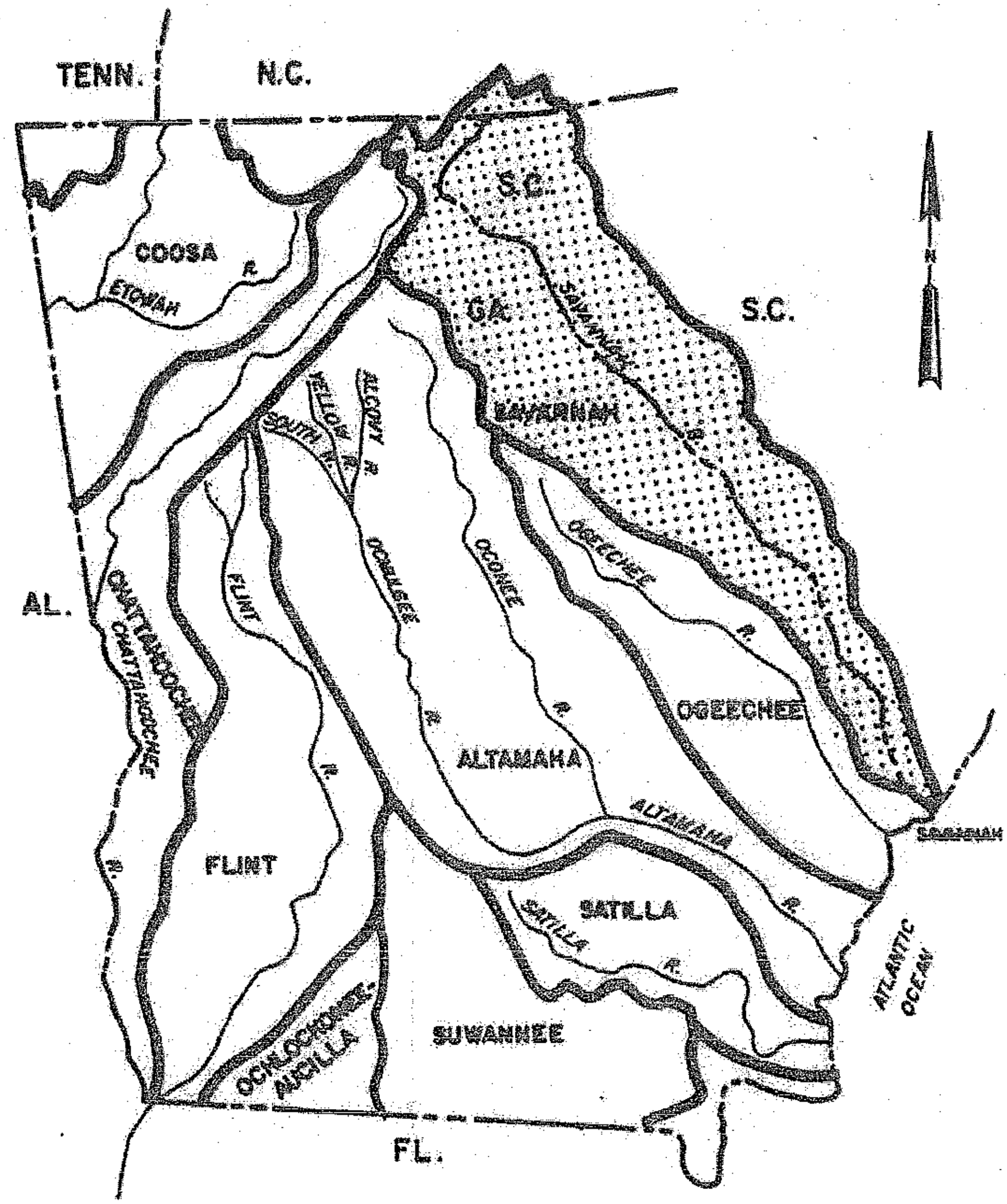
J. Strom Thurmond Reservoir. The J. Strom Thurmond Dam and Reservoir, completed in 1954, was the first multiple-purpose project to be completed in the comprehensive plan of development for the Savannah River Basin. It is located 22 miles upstream from Augusta. U.S. Highway 221 crosses the dam.

Richard B. Russell Lake. Authorized for construction by the 1966 Flood Control Act as the Trotters Shoals Dam, the Richard B. Russell Dam and Lake project was the third multiple-purpose project to be built in the Savannah River Basin. It was completed in 1986.



SAVANNAH RIVER BASIN

FIGURE I



LEGEND

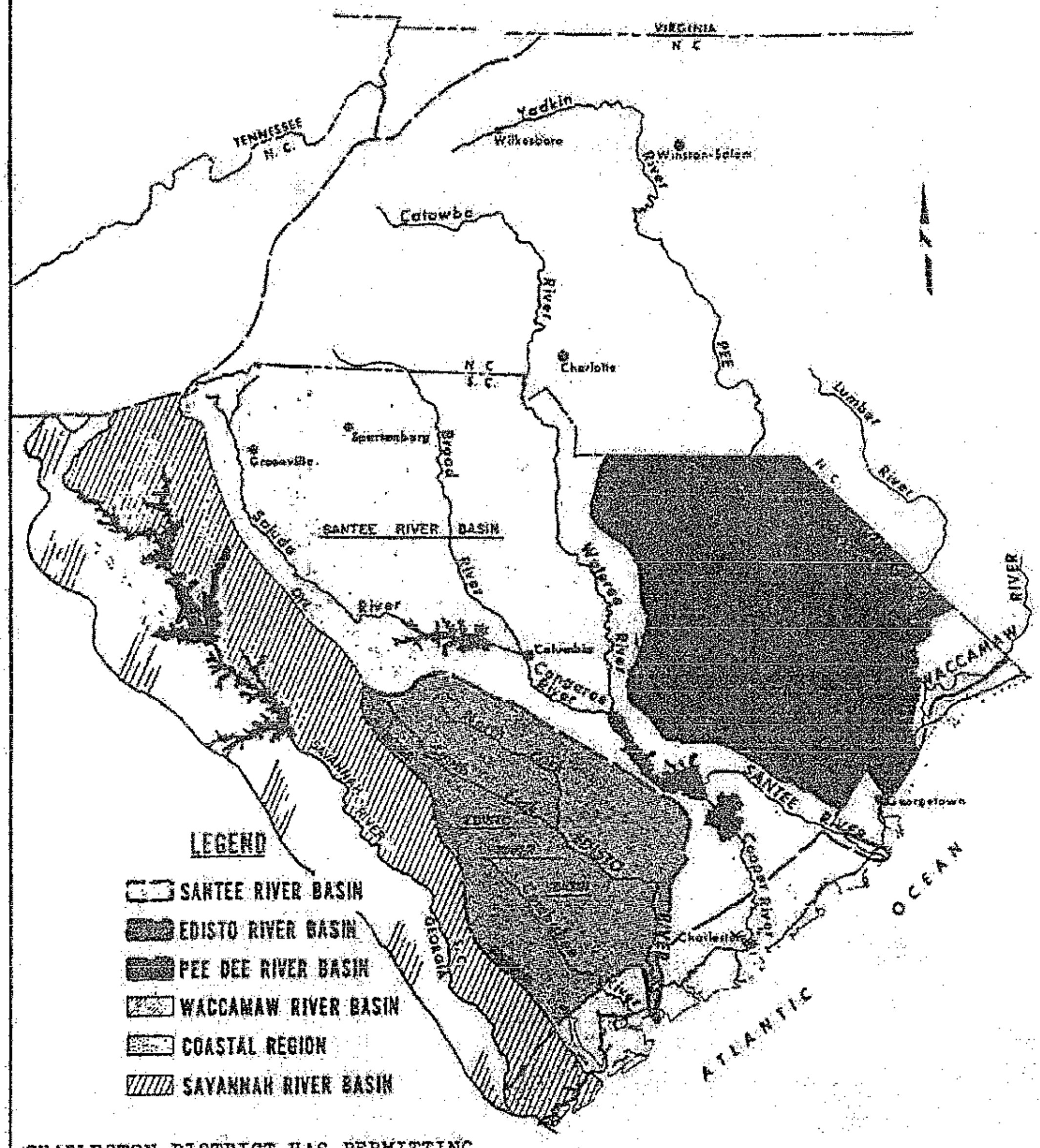
MAJOR RIVERS

MAJOR DRAINAGE BASINS

NOTE:
SAVANNAH DISTRICT HAS PERMITTING RESPONSIBILITIES FOR THE ENTIRE STATE OF GEORGIA.

MAJOR DRAINAGE BASINS IN THE STATE OF GEORGIA

FIGURE 2



CHARLESTON DISTRICT HAS PERMITTING RESPONSIBILITIES FOR THE ENTIRE STATE OF SOUTH CAROLINA

MAJOR DRAINAGE BASINS IN THE STATE OF S.C.

FIGURE 3

The dam is located on the Savannah River 275.1 miles above its mouth, 63 miles above Augusta, and about 16 miles southeast of Elberton, Georgia. Pumped storage was authorized for the Russell project and, with the 300,000 kilowatts of pumped storage, it will be capable of providing more peaking power than J. Strom Thurmond and Hartwell projects combined.

Hartwell Lake. The Hartwell Dam and Lake project is on the upper Savannah River, 89 miles above Augusta, Georgia, and 7 miles below the confluence of the Tugaloo and Seneca Rivers, which form the Savannah. It was the second multiple-purpose project to be completed in the Savannah River Basin. Construction started in October 1955. Filling of the reservoir began in February 1961 and was completed in 1962.

Table 1 gives the drainage areas at the three projects along the Savannah River.

Table 1

Drainage Area Above Specific Locations
On The Savannah River
Savannah River Basin = 10,579 sq. mi. (GA, S.C., & N.C.)

Location	Drainage Area (Square Miles)	Accumulative Percentage of Savannah River Basin
Hartwell Dam	2,088	20
Richard B. Russell Dam	2,837	27
J. Strom Thurmond Dam	6,144	58
Mouth	10,579	100

PROJECT PURPOSES AND RESERVOIR REGULATION

General. The Savannah District's water control management activities consist of the overall management of the Corps' three multiple-purpose projects located on the Savannah River above Augusta, Georgia.

The first project, J. Strom Thurmond, was completed in 1954 with an installed capacity of 282,000 KW. The second, Hartwell Dam, was placed in operation in 1962 with four 66,000 KW and minimum provisions for a fifth unit. This additional 80,000 KW installation was completed in November 1983, bringing the total installed capacity at Hartwell to 344,000 kilowatts. Richard B. Russell was the third project constructed and 300,000 KW of conventional installation was placed in operation in January 1986. An additional 300,000 KW of pumped storage generating capacity is planned.

J. Strom Thurmond and Hartwell are regulated and managed according to established operating guides or rule curves. These curves determine optimum elevations for yearly operations (as shown on Figures 4 and 5).

The lakes are maintained as near to the full pool level as possible from April through September. In October through December the target pool levels, or guide curves, gradually fall to 4 feet below the full conservation pool level. This provides an additional amount of flood control storage during the spring months. The drawdown is a result of the low inflows normally received during the fall months combined with the required outflow necessary to produce hydropower and provide for water quality and water supply purposes. The storage depleted by the winter drawdown is replenished by the spring runoff, returning levels to full power pool in April. A constant guide curve has been adopted for Richard B. Russell Lake because it has only 5 feet of conservation storage, and no flood storage drawdown is necessary.

These curves serve only as guides. Actual operation may vary somewhat depending on meteorologic conditions, power demand, water quality, flood control and recreation considerations.

Fish and Wildlife Management. The Savannah District, in cooperation with the States of Georgia and South Carolina, manages the fish and wildlife resources at the Federal reservoirs in the Savannah River Basin. Management decisions are based on the supply and demand for these resources as reflected in surveys. Lake elevations are maintained at a constant level during the spawning season. Stocking programs are determined according to creel surveys. Food plot and hunting programs are developed to control wildlife populations and provide public use of gamelands.

Flood Control. Hartwell, Richard B. Russell, and J. Strom Thurmond Lakes each have 5 feet of flood control storage with top of flood control pool at elevation 665.0, 480.0, 335.0 respectively. The combined storage is 810,000 acre-feet. Since 1954, when the J.

Strom Thurmond Project was completed, the system has prevented over $30,000,000 in flood damages.

Hydropower Operations. All power produced at Federal projects (except TVA and St. Stephens) in the states of Georgia, South Carolina, North Carolina, Virginia, Florida, Kentucky, Tennessee, West Virginia, and Alabama is marketed by the Southeastern Power Administration (SEPA).

SEPA combines the three Savannah District projects with seven projects in the Mobile District to form the Georgia-Alabama System. Hydropower may be supplied by any combination of projects within the ten-plant system. The three Savannah District projects produced 1,261,314 megawatt-hours of energy during Fiscal Year 1987 (FY 87). This amounted to 44 percent of the total Georgia-Alabama System output.

Navigation. The authorization of the Hartwell and J. Strom Thurmond Projects includes navigation on the lower Savannah River as a project purpose. During the early operation of J. Strom Thurmond and Hartwell Lakes (1953-1972), there was navigation traffic on the river from Augusta to Savannah. By the late seventies, waterborne commerce was limited to the transportation of oil to Augusta by the Koch Oil Company. In 1979, Koch discontinued their shipping operations. Since that time, except for limited movements of construction related items, no commercial shippers have used the river. Maintenance dredging of the river was discontinued in 1979. The lock at the New Savannah Bluff Lock and Dam (NSBL&D) is being operated with advanced notice of 24 hours by the city of Augusta for limited lockage of recreational boat traffic; boats may be locked through during business hours Monday through Friday. The lock and dam also serves as a reregulation structure for the flows out of Stevens Creek Dam. The cooperation of South Carolina Electric and Gas Company is needed during low flow periods regarding reregulation at Stevens Creek Dam.

A 5800 cfs flow from J. Strom Thurmond Dam was authorized to provide a 9 foot navigation channel. At present, minimum flows from J. Strom Thurmond Dam are based on the flow required by downstream water users.

Recreation. Although not identified as a project purpose in the authorizing legislation for the Hartwell Project, recreation is considered to be a project purpose under authority of Section 4 of the Flood Control Act of 1944 and the Federal Water Project Recreation Act of 1965 (PL 89-72). Recreation was recently added as a project purpose at J. Strom Thurmond Lake. There were more than 22 million visitors during 1987 at J. Strom Thurmond Lake and Hartwell Lake combined. Both of these lakes were among the ten most visited Corps of Engineers lakes in the United States. Russell Lake has recreation as a project purpose and is already experiencing considerable use even though the recreation facilities will not be complete until early 1991.

Water Quality. Like all deep water lakes in the southeast, J. Strom Thurmond, Hartwell, and Richard B. Russell thermally stratify in the warm summer months. During this time the water, circulated by the wind and thus rich in dissolved oxygen, is confined to the top 30 feet of these lakes. The dissolved oxygen in the lower layer of the lakes is gradually depleted by chemical and biological processes. Since the turbine intakes at these projects draw water from the lower portion of the lakes, the releases have progressively lower dissolved oxygen levels during the summer months.

Dissolved oxygen, temperature, conductivity, oxidation reduction potential (ORP), and pH measurements are recorded for the releases at each reservoir on a continuous basis. These measurements are then transferred by a computer via telephone linkage to the Savannah District office. This data is reviewed to insure water quality parameters are met at the various reservoirs. Additional measurements are made of lake elevation, dam discharge, and rainfall from a 54 gage network.

Dissolved oxygen problems are solved at the Richard B. Russell project with a diffused oxygen injection system. This system, installed during construction of the project, oxygenates the reservoir releases so that dissolved oxygen is maintained at or above six parts per million. The high cost of installing similar systems at the completed J. Strom Thurmond or Hartwell projects is prohibitive. At these projects turbine aeration could increase dissolved oxygen up to two parts per million if necessary, although it would reduce turbine efficiency.

Minimum flows from J. Strom Thurmond Dam are based on the flow required by downstream water users. The Department of Energy's Savannah River Plant (SRP) has three operating nuclear reactors and uses water (approximately 945 cfs) from the Savannah River for cooling. A large percentage of the water is returned to the river after cooling. Low flow tests conducted during the 1980-81 drought established 3600 cfs as the minimum acceptable flow for a one reactor operation. Due to changes in their operations, the SRP now has a minimum desired flow of 4880 cfs to ensure a three-reactor operation and 4,130 cfs for a two-reactor operation.

In the lower Savannah River, salinity levels are continuously measured by four punch-tape type recording gages. The recording charts are removed every 2 weeks by the U. S. Geological Survey, processed and the results are sent to the Corps' Savannah District approximately 10 days later. The four gages are located at: (1) the I-95 bridge, 1.2 miles downstream of Abercorn Creek, (2) the intake to the Luknow Canal on Little Back River, which supplies fresh water to the Savannah National Wildlife Refuge, (3) inside the Luknow Canal near the downstream gate, and (4) the U. S. Highway 17 Houlihan Bridge on Front River.

Salinity data is collected manually on a routine basis whenever high tides and low river flows warrant. This data is used to determine the extent of saltwater penetration in Front, Middle and Little Back Rivers during adverse conditions and is immediately available for analysis.

Water Supply. The Savannah River is the source of water supply for 64 domestic and industrial users, of which 20 withdraw directly from the lakes. Total withdrawals amount to approximately one billion gallons per day. Several water supply intakes are located in the New Savannah Bluff Lock and Dam pool, and several downstream users depend on releases from the dam. The largest downstream users are the Department of Energy's Savannah River Plant and the Georgia Power Company's Plant Vogtle nuclear facility. At the lower end of the basin, fresh water intakes and canals are maintained by the Beaufort-Jasper Water Supply Authority, the city of Savannah Municipal and Industrial Plant, and the Savannah National Wildlife Refuge.

WATER SHORTAGE INDICATOR

The inability to define the beginning of a drought as it is occurring hampers the ability to make appropriate management responses. It is desirable to have an indicator or triggering mechanism to initiate management action before a crisis occurs.

The indicator that has been chosen for this plan is lake level. Although it does not account for meteorologic factors as do some indicators, it has the advantage of simplicity. Using lake level as a water shortage indicator is readily understandable by the public, and easily implemented, requiring no complex and time consuming computations. It must be stressed that these action levels will serve as a guideline, but that extraordinary and/or unforeseen conditions could justify delaying or accelerating the management action.

The levels at which action is taken are shown in Table 2 and Figures 4 and 5. When the pool elevation at either Hartwell or Thurmond reaches these specified levels, we will take the prescribed action. The Russell pool level is not used as a trigger mechanism because of the limited drawdown at that project. At the action levels, the trigger elevation will initiate a series of actions that will culminate in the reduction of releases from the projects. It should be recognized that the reductions will not necessarily be instantaneous with the trigger level being reached, but rather flows will be reduced after a 2 week notification. The 2 week lag between reaching an action level and implementation of the reduction is to provide the time necessary for coordination and notification of water users.

TABLE 2
Hartwell Action Levels

*Level	APR 18- OCT 15 (ft-msl)	** DEC 1 - JAN 1 (ft-msl)	Action
1	656	655	Public Safety Information
2	654	652	Reduce Thurmond discharge to 4500 cfs, reduce Hartwell discharge as appropriate to maintain balanced pools (See page 16)
3	646	646	Reduce Thurmond discharge to 3600 cfs, reduce Hartwell discharge as appropriate to maintain balanced pools
4	625	625	Continue Level 3 discharge as long as possible, thereafter Outflow = Inflow

*Level as shown on Figure 4.
**Lake elevations for the periods January 1 to April 18 and October 15 to December 1 are linearly interpolated from this data as shown in Figure 4.

TABLE 2 (continued)
Thurmond Action Levels

*Level	May 1 - Oct 15 (ft-msl)	** Dec 15 - Jan 1 (ft-msl)	Action
1	326	325	Public Safety Information
2	324	322	Reduce Thurmond discharge to 4500 cfs
3	316	316	Reduce Thurmond discharge to 3600 cfs
4	312	312	Continue Level 3 discharge as long as possible, thereafter Outflow = Inflow

*Level as shown on Figure 5.
**Lake elevations for the periods January 1 to May 1 and October 15 to December 15 are linearly interpolated from this data as shown in Figure 5.

Hartwell Reservoir Action Levels

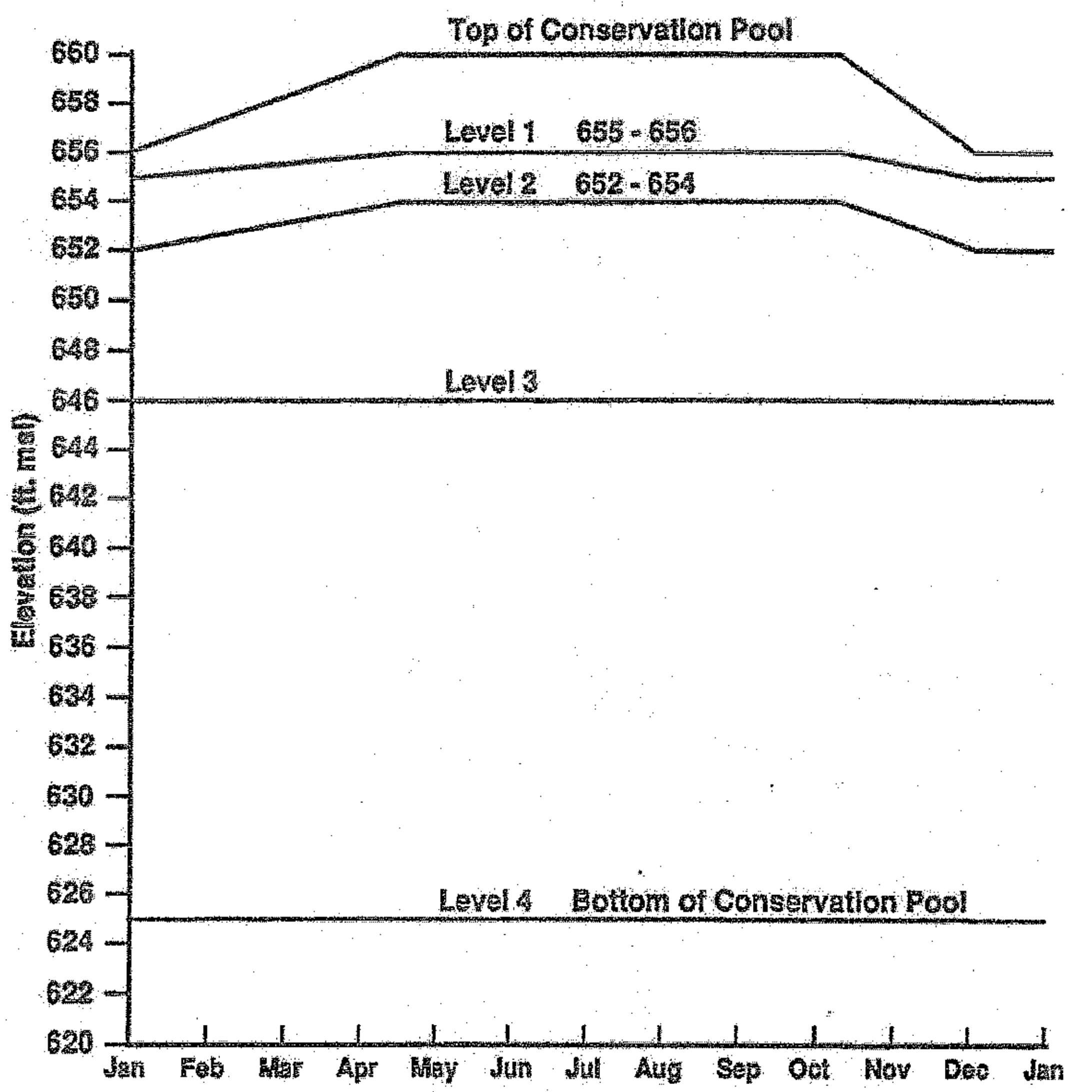


Figure 4

TABLE 2 (continued)
Thurmond Action Levels

*Level	May 1 - Oct 15 (ft-msl)	** Dec 15 - Jan 1 (ft-msl)	Action
1	326	325	Public Safety Information
2	324	322	Reduce Thurmond discharge to 4500 cfs
3	316	316	Reduce Thurmond discharge to 3600 cfs
4	312	312	Continue Level 3 discharge as long as possible, thereafter Outflow = Inflow

*Level as shown on Figure 5.
**Lake elevations for the periods January 1 to May 1 and October 15 to December 15 are linearly interpolated from this data as shown in Figure 5.

Hartwell Reservoir Action Levels

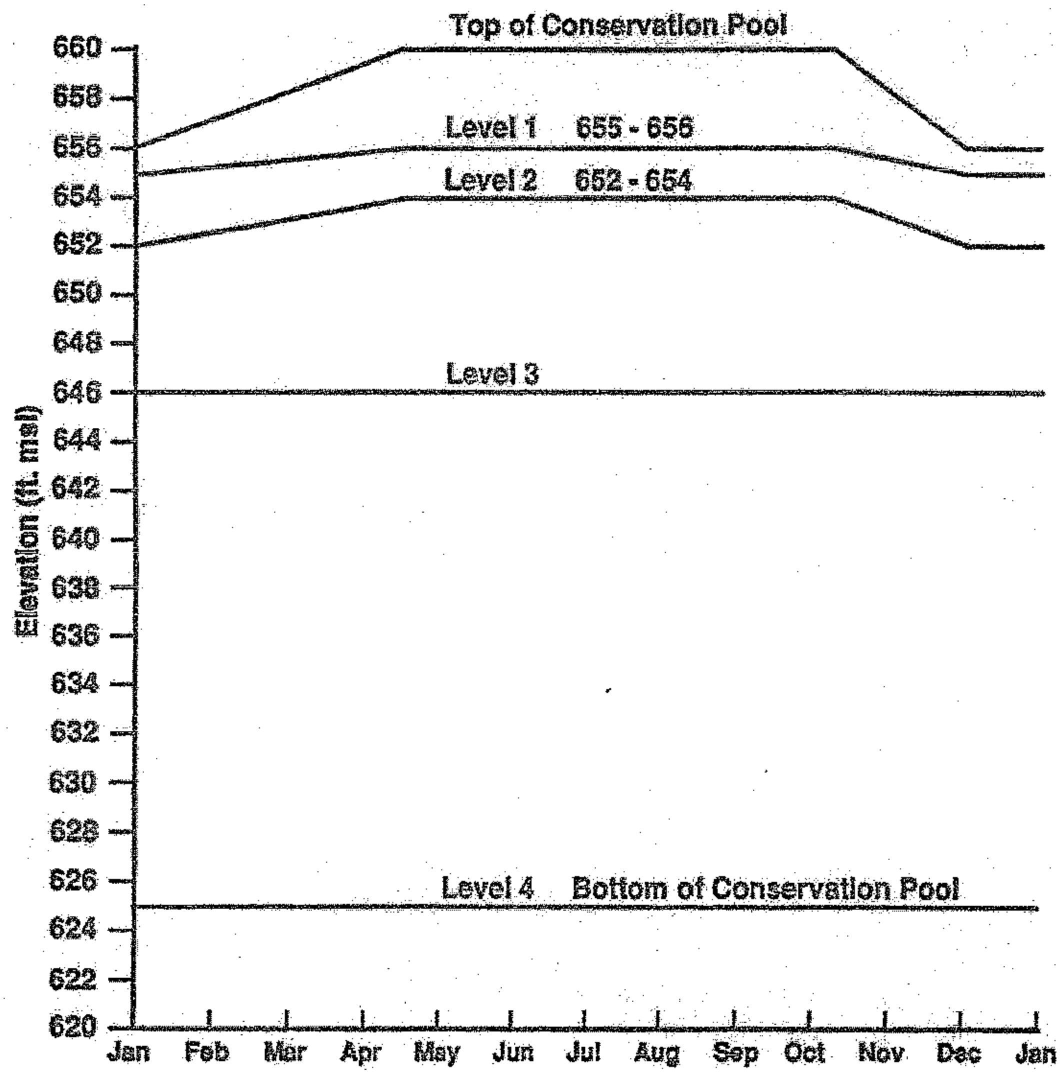


Figure 4

Thurmond Reservoir Action Levels

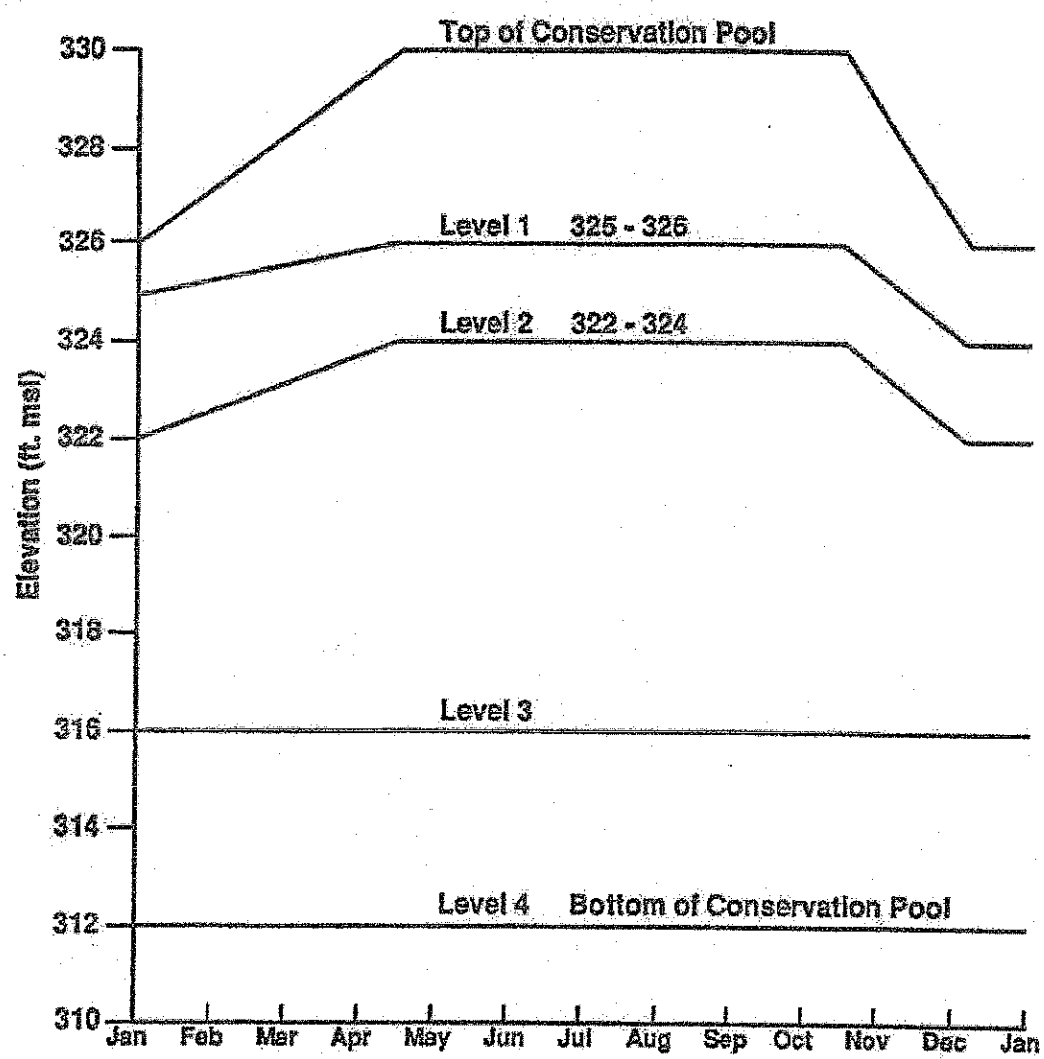


Figure 5

Objectives. The following are objectives of the drought management plan:

o - The reservoir levels should not be drawn below the bottom of the conservation pool (625.0-Hartwell, 470.0-Russell, 312.0-Thurmond).

o - A minimum release of no less than 3,600 cfs at J. Strom Thurmond should be maintained for downstream users.

o - Make use of most of the available storage in the reservoirs during the drought-of-record. They should not be drawn down entirely, though, as a contingency against a drought that exceeds the drought of record.

o - Maintain project capacity throughout the drought.

o - Maintain releases required to meet state water quality standards from J. Strom Thurmond for as long as possible without jeopardizing water supplies.

o - Minimize impacts to recreation during recreation season, which is generally regarded as being from the first of May through Labor Day.

WATER USE PRIORITIES

Six water use priorities were identified and evaluated: Fish and Wildlife Management, Hydropower, Navigation, Recreation, Water Quality, and Water Supply. The Hydropower objective is to meet SEPA monthly system energy contract commitments and at-site capacity requirements. The "Water Quality" and "Fish and Wildlife" priorities require a release of 4,500 cfs from J. Strom Thurmond. This is the 7 day-10 year low flow (7Q10) that is the basis for the protection of fish and wildlife resources and the issuance of downstream discharge permits. To meet "Water Supply" objectives requires a release of 3,600 cfs from J. Strom Thurmond to provide the minimum flow necessary at downstream water supply intakes. The objective for "Recreation" is to minimize drawdown of the reservoirs during the recreation season. The "Navigation" release from J. Strom Thurmond is 5,800 cfs. At the present time there is no commercial navigation in this reach of the Savannah River, and this priority was eliminated from further consideration. If commercial navigation is reestablished, this drought contingency plan will be revised accordingly.

INFLOWS AND OPERATION

The previous drought-of-record for the Savannah River Basin occurred from 1954 through 1956. The drought of 1986-89 appears to have surpassed the 1954-56 drought in intensity. The 1986-88 period was chosen as a basis for the inflows to the reservoir projects to analyze the various operational alternatives. Estimates of weekly average inflows to the reservoirs, through 1987, were obtained from the Southeastern Power Administration (SEPA). Average weekly inflows for 1988 were computed from project operations records. Flows were routed and effects of reservoir operation simulated by use of computer program HEC-5, Simulation of Flood Control and Conservation Systems.

Each lake has a specific amount of storage that was designed to be used to supplement natural flow during times of low inflow. This conservation storage, or design drawdown, was determined during the design phase of the projects. The design drawdown or conservation storage at J. Strom Thurmond is from 330.0 to 312.0 feet msl. At Hartwell Lake the design drawdown is from 660.0 to 625.0 ft. msl. The design drawdown at Richard B. Russell Lake is only 5 feet, from 475.0 to 470.0 ft. msl.

In the simulation model used for this study, the pools at Thurmond and Hartwell Lakes are drawn down equally for the first 15 feet, to elevations 315.0 and 645.0, respectively. During this same period the Russell pool is drawn down to 471.0. The rationale was to maintain approximately equal recreation opportunities at each lake. Hartwell, the uppermost lake, is more difficult to refill when drought conditions diminish, due to its smaller drainage area. Below the first 15 feet, Hartwell Lake, which would still be 20 feet above the minimum conservation pool, would contribute a larger share of the flow than the other projects. J. Strom Thurmond would have 3 feet of conservation storage left at that point, while Russell Lake would have only 1 foot remaining. Therefore, as flow from Thurmond is reduced, flows from Hartwell and Russell are also cut back proportionately in order to maintain a balance among the pools. At lower lake levels, balancing of pool levels among the reservoirs becomes increasingly difficult as the relative importance of local meteorologic conditions increases.

<u>Resumption Of Normal Operation</u>. As drought conditions in the basin improve, reductions in releases will have the desired effect of refilling the lakes to normal full conservation pool (or Rule Curve). Some conservation measures can be expected to remain in effect as the pools refill. If releases had been reduced as far as 3,600 cfs at Thurmond Dam, then the return to normal operation would not occur until the normal full pool was approached.

This plan was selected for its ability to maintain minimum discharges from J. Strom Thurmond Reservoir and lessen the possibility of drawing the lakes below their minimum conservation pools. The plan balances the interests of those concerned with the lake elevations above J. Strom Thurmond Dam with the interests of those concerned with the streamflow in the Savannah River channel below J. Strom Thurmond Dam.

Impacts. With discharge from J. Strom Thurmond Dam reduced to 4500 cfs, hydropower generation at the three projects would be reduced 30-40% on an annual basis. Further reduction of discharge to 3600 cfs would result in approximately a 50% reduction in generation. Dependable capacity would be maintained. Water supplies would be sustained, although some users may need to make modifications to their intake structures or perform maintenance on intake canals. Operation of the Savannah River Plant reactors depends on cooling water obtained from the Savannah River. Low water levels could have serious consequences for national security.

Water quality would be affected more in the river downstream of J. Strom Thurmond Dam than within the lakes. Within the lakes, temperatures may increase slightly due to less cold water releases from the upstream reservoirs and less reservoir volume to be warmed by the air and sun. Grasses and other vegetation would grow on the exposed lake banks during the drought. After the lake recovers, this would provide temporary improved habitat for small fish. Previous droughts have resulted in increased recruitment populations the year following the drought. Droughts of more than one year in duration have resulted in decline in fish populations.

Downstream of the Thurmond Dam, flow could drop below that needed to assure water quality standards are met during the period of time that the release from Thurmond is maintained at 3,600 cfs. Increased water temperatures will result downstream from Savannah River Plant releases. The assimilative capacity of the river could be significantly reduced. The greatest impact is during the summer months, when dissolved oxygen levels are at their lowest. Some waste discharges may have to be discontinued or water quality standards will be violated. Lower flow in the river will allow the salinity wedge in the Savannah Harbor to move upstream and possibly threaten the fresh water supply of the Savannah National Wildlife Refuge.

Recreation in the lakes would be severely impacted during a drought equal to the 1954-56 event, or the 1986-89 event. Boat ramps and docks would be out of water. Exposed tree stumps and sand bars could pose a potentially serious threat of personal injury to visitors or property damage to boats continuing to use the lakes. Some picnic and camping areas will be unsightly as there would be a large mud flat separating them from the lake.

Commercial navigation in Savannah Harbor should not be affected. There is presently no commercial navigation above Savannah Harbor. Low water in the river would limit navigation by pleasure craft in the Augusta vicinity.

IMPLEMENTATION OF PLAN

A number of sequential actions would be required at each level as shown on Table 3. The two-week lag between reaching an action level and implementation of the flow reduction provides the time necessary to implement the drought water management strategy. These efforts will include coordination with the States of Georgia and South Carolina through the Savannah River Basin Drought Coordination Committee (SRBDCC), the establishment of a public information program, monitoring of conditions within the basin, and evaluation of other actions which may be required to fully implement the strategy.

<u>Public Information Program</u>. The Public Affairs drought action plan is activated in stages keyed to the management action level. The first notification will take place as lake levels begin to drop below normal levels for a given time of year. First news releases will deal primarily with water safety-related issues, particularly if water levels begin dropping during peak recreation periods.

News releases will be issued in conjunction with any official public notices or correspondence concerning water shortage emergencies or alerts, drought alerts, or notification of public meetings. It is imperative that the District coordinate all public notifications internally before a public release is made. The Public Affairs Officer will speak for the District concerning all policies and procedures instituted during a drought or water shortage emergency. Lake Resource Managers will confine comments to the news media to subjects related to operational aspects of the respective lakes.

During a prolonged water shortage the Public Affairs Office will issue weekly update news releases and will seek opportunities to broaden public awareness through radio and television public service announcements or paid advertising, if deemed necessary. The Public Affairs Office will establish a "Drought Hot Line" that will allow news media access to information on District activities on a continuing 24 hour-a-day basis during prolonged droughts.

<u>Environmental Considerations</u>. Operation and maintenance of each of the projects within the Savannah River basin are covered by an existing Environmental Impact Statement. While regulation of the reservoir levels and releases are included as important features of the normal operation of these projects, the extreme low flow conditions of a drought require that traditional water management activities be reassessed as reflected in the Drought Water Management Strategy. An Environmental Assessment (EA) has been integrated in this report evaluating this management strategy. A Finding of No Significant Impact (FONSI) is included as Appendix K. A Public Notice will be issued advising the public and other agencies of the final report and FONSI availability. The evaluation of the low water conditions in the Operation and Maintenance Manual Environmental Impact Statement for Clark Hill Lake, was based on the 1925-27 critical dry period. Releases from Clark Hill were to provide a flow of 5,800 cfs at the Butler Creek Gage except for a

Table 3
Savannah River Basin Management Actions

*Pool Level	District Management Action	District **Action Office
Level 1	1. Notify District Drought Management Committee.	EN
	2. Issue news release to notify Congressional interests and members of public of anticipated worsening conditions.	PA
	3. Begin inspecting designated navigation channel for hazards.	OP
	4. Inspect beaches, boat ramps and post signs where appropriate.	OP
	5. Begin informal discussion with SAD/SEPA regarding reduced generation.	EN/OP
	6. Notify lake concessionaires and park lessees concerning possible worsening conditions.	OP
	7. Be alert for worsening conditions.	EN
Level 2	1. Recommend Thurmond release reduced to 4,500 cfs.	DMC
	2. Coordinate action with SRBDCC.	EN
	3. Coordinate action with SAD.	EN
	4. Notify Division Engineer 2 wks. prior to reduction.	DE
	5. Issue news release.	PA
	6. Public notice to water users and local agencies.	OP
	7. Process intake modification permits on emergency basis	OP
	8. Coordinate with Congressional delegations	DD-X
	9. Monitor status of water intakes	OP
	10. Reduce Thurmond release to 4,500 cfs pursuant to final decision by DE.	EN
	11. Weekly status report to DE	EN
	12. Increase monitoring of beaches and boat ramps.	OP
	13. Continue to advise lake concessionaires and park lessees of projected lake levels.	OP
	14. Continue water patrols to identify and mark navigation hazards in designated navigation channels.	OP
	15. Continue to extend boat ramps where appropriate.	OP
Level 3	1. Recommend Thurmond release reduced to 3,600 cfs.	DMC
	2. Coordinate action with SRBDCC.	EN
	3. Coordinate action with SAD.	EN
	4. Notify Division Engineer 2 weeks prior to reduction.	DE
	5. Issue news release.	PA

TABLE 3 (CONT)

	6. Public notice to water users and local agencies	OP
	7. Coordinate with Congressional delegations	DDX
	8. Reduce Thurmond discharge to 3,600 cfs pursuant to final decision by DE.	EN
	9. Weekly status report to States.	PD
	10. Coordinate with in-lake withdrawers to lower intakes so lakes can be drawn below minimum conservation pool, if required.	EN/OP
	11. Continue to advise lake concessionaires and park lessees of projected lake levels.	OP
	12. Continue water patrols to identify and mark navigation hazards in designated navigation channels.	OP
	13. Continue to extend boat ramps where appropriate.	OP
Level 4	1. Analyze results of Action 10 of Level 3.	
	2. Continue level 3 release rate as long as possible.	
	3. Coordinate action with SRBDCC.	EN
	4. Coordinate action with SAD.	EN
	5. Notify Division Engineer.	DE
	6. Issue news release.	PA
	7. Public notice to water users and local agencies.	OP
	8. Coordinate with Congressional delegations.	DDX

*See Table 2 and Figures 4 and 5 for explanation of pool levels.

** List of Abbreviations

DE	District Engineer
DMC	District Drought Committee
DD-X	Administrative Officer
EN	Engineering Division
OP	Operations Division
PD	Planning Division
PA	Public Affairs

release of 3000 cfs on weekends. Under the drought management plan, water quality will be maintained by controlling releases at J. Strom Thurmond Reservoir. Releases of 4,500 cfs will maintain the 7Q10 flows at Augusta providing protection of fish and wildlife resources. When J. Strom Thurmond Reservoir reaches level 3, the releases will be reduced to 3,600 cfs as the priority shifts to water supply. A large percentage of the time this would result in less than 5,800 cfs at Butler Creek. The reduced flows would not assure maintenance of water quality standards below Augusta, but would help maintain the lacustrine habitat while providing a stable riverine environment and water supply for downstream users. Appendix B identifies the impacts of the drought water management strategy.

Monitoring. Dissolved oxygen, temperature, conductivity, oxidation reduction potential (ORP) and pH measurements in the releases are recorded at each reservoir on a continuous basis. These measurements are then transferred by a computer via telephone linkage to the Savannah District office. Automated retrieval is also used for lake elevation, dam discharge, and rainfall from a 54-gage network.

Water quality monitoring is more critical downstream at Savannah Harbor as the lower releases from J. Strom Thurmond allow the saltwater wedge in the harbor to move further upstream. Salinity levels are continuously measured by four punch-tape type continuous recording gages. The recording charts are removed about every 2 weeks by the U. S. Geological Survey, the data is processed, and the results are sent to the Corps Savannah District approximately 10 days later. The four gages are located at: (1) the I-95 bridge, 1.2 miles downstream of the Abercorn Creek intake, (2) the intake to the Lucknow Canal, on Little Back River, which supplies fresh water to the Wildlife Refuge, (3) inside the Lucknow Canal near the downstream gate, and (4) the U. S. Highway 17 Houlihan Bridge on the Front River. During critical low water periods, these gages will be supplemented by readings taken by a hand-held probe operated from a boat. These data would be available almost immediately and could be taken several times daily, if necessary. One management option to counteract the advance of the salinity wedge would be to take the Back River tidegate out of operation. This would allow the flood tide waters in Back River to drain out Back River instead of flowing across to and out of Front River, thus shortening the duration of high water in Back River. Reducing the time of high water reduces the extent and duration of saltwater penetration in Back River.

Predictions based on data collected to date indicate salinity levels would reach 0.5 parts per thousand (ppt) at the mouth of Abercorn Creek (river mile 30.2) when river flows are less than 6000 cfs and tide heights exceed 10 feet, mean low water (mlw) at Houlihan Bridge. This is an extremely high tide height, which is never predicted to occur by the National Oceanic and Atmospheric Administration Tide Tables, but could possibly occur with strong northeasterly winds.

The maximum salinity level recorded by the continuous monitor at I-95 (river mile 28.1) since installation in October 1986 has been .28 ppt which occurred during a 9.2 feet mlw tide and a 6040 cfs river flow.

Because the Savannah Industrial and Domestic Water Supply intake is located 1.8 miles above the mouth of Abercorn creek, the salt water wedge will not reach this intake under any forseeable combination of river flows and tide heights.

SAVANNAH RIVER BASIN
DROUGHT COORDINATION COMMITTEE

PURPOSE

The Savannah River Basin Drought Coordination Committee (SRBDCC) will discuss mutual concerns of agencies, organizations, communities, and industries, and exchange information necessary for sound basin actions to be made by the respective agency heads.

In order to make informed and sound decisions in implementing the drought contingency plan for the Savannah River Basin, it is necessary that those affected by water management decisions be given the opportunity to provide input to the decision making process. The following describes the mechanism which will be used to implement the plan.

Successful implementation of the drought contingency plan will require the full and cooperative participation of the Savannah District and the South Atlantic Division of the Corps of Engineers and agencies within the States of Georgia and South Carolina. The involvement of these entities will be through a drought coordination committee. The purpose of the committee will be to coordinate the drought management actions of the States and the Corps by serving as a forum for an exchange of information and ideas. The committee may seek out advice of its members or other individual attendees, but will not seek to obtain consensus advice or recommendations. Committee members will be responsible for reporting individually to the organizations they represent with such advice as they deem appropriate. In no event will the committee be considered an agent of either the states or the Corps. Water control decisions remain the responsibility of the District Commander.

MEMBERSHIP

The Savannah River Basin Drought Coordination Committee shall consist of a representative from each of the following organizations:

ORGANIZATION	OFFICE
Savannah District	Engineering Division
South Atlantic Division	Engineering Division
Georgia	Environmental Protection Division, Department of Natural Resources
South Carolina	Water Resources Commission

RESPONSIBILITIES

The representative from each state on the Drought Coordination Committee will be responsible for coordinating with the appropriate agencies and local governments. Similarly, Corps representatives will be responsible for coordinating with appropriate Federal agencies, private power companies, and lake concessionaires and lessees. Federal agencies which will be most involved in drought water management decisions will be the Department of the Energy's Southeastern Power Administration and the National Weather Service's Southeast River Forecast Center. Coordination will also be maintained with the U. S. Fish and Wildlife Service and the National Marine Fisheries Service to assure that impacts to fish and wildlife resources are considered.

The South Atlantic Division's representative will coordinate with other Corps Districts whose jurisdictional boundaries border the Savannah River drainage basin and whose water regulation activities could be impacted by drought management actions within the Savannah River Basin. Frequent public announcements in the form of "drought bulletins" will serve as an important mechanism for communicating to the various segments of the public the water shortage conditions. The "drought bulletins" will be mutually agreed upon by the committee. It will be the responsibility of each committee member to disseminate the bulletins to those interests which he/she represents.

The SRBDCC will not be empowered with enforcement responsibilities. Such activities will continue to be the responsibility of appropriate state and local governmental entities. Existing state and local drought plans will be implemented as needed, and the committee will encourage governmental entities to undertake appropriate actions at the local level.

Successful implementation of the Savannah River Basin Drought Coordination Committee's recommendations will depend upon efficient and effective internal coordination within the Corps and institutional bodies within each of the States.

MEETINGS

The SRBDCC will meet at least twice a year, to insure that coordination links remain viable. These meetings will normally be held in late April or early May, following the winter and spring flood period, and in August, the beginning of the traditional low water period. These are appropriate times to appraise the conditions of the Federal impoundments within the basin and to develop projections for anticipated future conditions.

Once a significantly dry situation has been determined to exist within either the entire basin or a significant portion of the basin, the Committee will hold a "water shortage appraisal meeting." Any of the four participating parties will have the authority to call this initial meeting. If, based on the information evaluated at this meeting, it is determined that either the entire basin or a sub-basin may be entering a potential drought period, the committee will declare a "water shortage alert" for the affected region. Following the "water shortage alert" declaration, the committee will meet on an as-needed basis to monitor the status of the water shortage conditions, appraise the success of previous measures and determine appropriate future management measures. The committee will continue to meet monthly until conditions return to normal. Should conditions indicate a continuing trend toward a more severe water shortage, the committee will declare a "drought alert" for the basin. The "drought alert" will remain in effect until the committee collectively determines that the situation has improved. It should be emphasized that prior to issuance of either of these "alerts," the individual SRBDCC members must coordinate these actions within their respective organizations, as well as with other interests which could be affected by the various water shortage management measures.

DISTRICT
DROUGHT MANAGEMENT COMMITTEE

PURPOSE

The District Drought Management Committee (DMC) will review staff recommendations for District actions required during a drought and make recommendations to the District Engineer on appropriate District actions. It will recommend to the District Engineer, the type, content, and timing of information to be provided to the public about the Savannah District's drought responses.

The District Drought Management Committee will be chaired by the Chief, Engineering Division, and vice-chaired by the Chief, Hydrology and Hydraulics Branch.

MEMBERSHIP

The District Drought Management Committee shall consist of a representative from each of the following staff elements: DD-C (Deputy Commander, (Civil)), EM (Emergency Management), EN (Engineering Division), OP (Operations Division), PD (Planning Division), PA (Public Affairs), and RE (Real Estate Division). The branch/section which would represent these elements is as follows:

DD-C	-- DD-C	-- Deputy Commander (Civil)
EM	-- EM-D	-- Natural Disaster Branch
EN	-- EN-HA	-- Hydrology & Hydraulics Branch
OP	-- OP	-- Chief, Operations Division
PD	-- PD-P	-- Plan Formulation Branch
PA	-- PA	-- Public Affairs
RE	-- RE-MC	-- Civil Management Section

The Chief of Engineering Division may appoint additional members as necessary to insure broad based input on the committee.

RESPONSIBILITIES

1. The Committee Chairman will be advised of problems by the Chief, EN-H. Members of the District Drought Management Committee shall be notified at the onset of each drought alert phase and be provided information by the Chairman with respect to the drought alert phase.

2. Each member of the District Drought Management Committee is responsible for bringing to the attention of the committee items within the area of responsibility of their own Division/Office.

3. Members of the District Drought Management Committee may request that presentations on specific issues be made to the committee by other District personnel.

4. The District Drought Management Committee may delegate work tasks to individuals in the District with the approval of the committee member representing the individuals' Division/Office.

5. The District Drought Management Committee will recommend to the District Engineer the form, content, and timing of information provided to the public about the District's responses to the drought.

6. The committee will consider information received from the Savannah River Basin Drought Coordination Committee (SRBDCC).

7. The chairman of the District Drought Management Committee will present recommendations of that committee to members of the Savannah River Basin Drought Coordination Committee and to the District Engineer for his approval.

MEETINGS

The District Drought Management Committee would meet on a monthly basis during a drought. The chairman, or in his absence, the vice-chairman, of the District Drought Management Committee will call this meeting. Additional meetings may be called at any time by any member of the District Drought Management Committee to address specific items which need attention before the next scheduled meeting. Minutes of each meeting will be kept by someone appointed by the vice-chairman of the District Drought Management Committee.

Glossary

Acre-foot. The volume of water required to cover one acre to a depth of one foot. (1 acre-ft. = 43,560 cubic feet or 326 thousand gallons)

Confluence. The combining of two streams.

Conservation Pool. Useable storage in the reservoir for fish & wildlife management, hydropower, navigation, recreation, water quality, and water supply purposes designed to be filled during normal and high flow periods for use during low flow periods.

Cubic Feet Per Second (CFS). 1 cfs = 450 gallons per minute.

Drought Contingency Plan. Detailed drought management plan to address current water conditions in the Savannah River Basin, and to serve as a baseline for future situations.

Drought Indicators. Mechanisms which reflect drought conditions and severity. Drought indicators consist of hydrologic indicators such as streamflow, rainfall, reservoir storage levels and groundwater levels, meteorologic indicators such as rainfall, and human-activity indicators which include navigation traffic cutbacks and reductions in hydropower generation.

Drought Response. A response network consists of trigger levels and appropriate management action. Triggers are predetermined standards reflecting drought intensity which induce responses.

Effluent. Waste material discharged into the environment.

Flood Control Pool. Storage above the conservation pool elevation designed to store flood water and reduce flooding downstream.

Guide Curve. (Also rule curve or target pool levels) Guides established to regulate and manage optimum pool elevations for yearly operations at impoundments.

Impoundment. A confined body of water as in a reservoir or lake.

Kilowatt (KW). Equal to 1000 watts.

Megawatt (MW). Equal to 1000 kilowatts or 1,000,000 watts.

Meteorologic Conditions. Atmospheric phenomena and weather of a region.

Minimum Pool Level. The lowest elevation to which the pool is to be drawn.

Normal Pool Level. The elevation to which the reservoir surface will rise during ordinary conditions.

pH. The condition represented by a number, used to express both acidity and alkalinity on a scale whose values run from 0 to 14, with 7 representing neutrality, numbers less than 7 increasing acidity.

Pumped Storage. Reservoir pumps that also serve as generators are installed in the dam. During the night, when cheap surplus power is available, the pumps are run to pump water back upstream into the reservoir. During the midday, when valuable peaking power is needed, the units are reversed and used to generate power with the same water that was pumped back the previous night.

Releases. A determined amount of water that is allowed to pass through or discharged from a dam.

Reregulation Structure. Peaking power plants generally release water only a few hours per day. A reregulation structure is a smaller dam located downstream that is capable of storing the intermittent slugs of water and releasing a continuous flow.

Rule Curve. Same as "Guide Curve."

Thermally Stratify. During the warm months of the year, the sun heats the upper layers of the lake. Since the warm water rises, the surface of the lake continues to warm while the bottom layer stays cold. During the winter months, the upper layers of the lake are cooled. The warmer water on the bottom rises, causing destratification, or "turnover", of the lake.

Triggering Mechanism. An indicator that is put in place to indicate the need to initiate or terminate specific action before a crisis occurs. At the action levels, the trigger elevation will initiate a series of actions that will culminate in the reduction of releases from the projects.

7Q10. The "7-day, 10-year minimum flow" is a statistical parameter which describes the frequency distribution of streamflow values. The calculated 7Q10 value is an estimate of the lowest 7-day average streamflow which would occur an average of once during a 10-year period.

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