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WATER CONTROL PLAN FOR PHILPOTT LAKE

A. INTRODUCTION

This is the Water Control Plan for Philpott Lake project. It consists of chapters taken directly from the Reservoir Regulation Manual for Philpott Lake project. These chapters define the goals, capabilities, and steps necessary to maximize the effective operation of Philpott project to satisfy all authorized project purposes. The following chapters have been updated to reflect any changes which may have occurred since the last update in October 1965. These chapters shall be made part of the updated Reservoir Regulation Manual for Philpott Lake project which is scheduled for completion in Fiscal Year 1994. Chapter, table, and page numbers vary from those in the regulation manual. Updated pertinent data are attached at the end of this plan as exhibit A. Responsibility for carrying out this water control plan is found in exhibit B, Instructions to Dam and Power Plant Operators.

B. GENERAL OBJECTIVES

The authorized purposes of Philpott Lake project are to provide for flood control, hydroelectric power generation, low flow augmentation, recreation, water supply and fish and wildlife. Philpott Lake will be operated to maximize the benefits of the authorized purposes.

C. OVERALL PLAN FOR WATER CONTROL

The current plan of operation for Philpott Lake calls for maintaining the lake level at or near the guide curve elevation. The guide curve elevation is at 971.5 feet m.s.l., October through January and 973.5 feet m.s.l., April through July and varies linearly between these two elevations during the remainder of the year. Controlled flood control storage space is provided between elevations 974.0 and 985.0 feet m.s.l. with surcharge or uncontrolled storage provided above the crest of the free over-flow spillway (elevation 985.0 feet m.s.l.). Releases for flood control are outlined in detail in paragraph D and exhibit B. Conservation pool storage between elevation 951.0 and 974.0 feet m.s.l. is reserved for dependable power generation, low flow augmentation and water supply. The required operation for releases from the conservation pool is described in paragraph E. During normal operation periods, all releases shall be made through the generating units. The low flow valves, sluice gates and spillway shall be utilized as described in paragraph E and exhibit B.

D. OPERATION FOR FLOOD CONTROL

1. General. The primary purpose of the project is flood control. The use of the storage capacity above elevation 974 feet., m.s.l. will be governed exclusively by flood control requirements. Sometimes, power releases may have to be reduced to zero to avoid increasing damaging stages on the Smith River, regardless of headwater elevation. The amount of storage provided for the control of floods, in addition to that which will be available in varying amounts in the conservation pool, is indicated in the following table:

TABLE 1
Reservoir Capacity Provided for Flood Control

Upper limit of storage	Elevation (Feet, m.s.l.)	Flood storage above top of conservation pool at Elev. 974 feet, msl (Acre-feet)	Equivalent Storage in Rainfall Runoff (Inches)
Spillway crest	985	34,200	3.0
Elevation and storage at which discharge from controlled spillway equals:			
Channel capacity (6,000 c.f.s.)	991.3	56,100	5.0
Minor damage stage in urban areas (7,800 c.f.s.)	992.3	59,700	5.3
Major damage stage (18,300 c.f.s.)	997.5	82,000	7.0

2. The discharge capacity available to release water stored below spillway crest and the capacity of the downstream channel are indicated in the following tabulation:

TABLE 2
Discharge Capacity of Reservoir Outlets and River

	Flow (c.f.s.)	Watershed inches per day
Reservoir outlets	1,300	0.2
Turbines plus one sluice	5,700	1.0
Turbines plus two sluices	10,100	1.8
Turbines plus three sluices	14,500	2.5
Downstream channel capacity at bankfull	6,000	1.1
When minor damage begins	7,800	1.4
When major damage begins	18,300	3.2

3. The adopted operation plan provides for:

a. Reducing damaging stages on the Smith River during each flood as much as possible with the currently available storage space.

b. Reducing damaging stages on the Dan River during each flood as much as possible with the storage space currently available below spillway crest. When the lake fills above spillway crest, the reduction of stages on the Dan River will be that accomplished incidental to emptying the lake as quickly as possible without causing damaging stages on the Smith River.

4. Flood Control Plan. This plan will be executed as follows:

a. Headwater elevation between 974 and 985 ft., m.s.l., and Bassett stage less than 13 ft. The schedule for power generation and low flow regulation will be continued until 24 hours after the occurrence of the peak stage at Bassett resulting from runoff originating downstream from Philpott Dam. All turbines shall be operated at full load beginning 24 hours after the peak stage at Bassett. Sluice gate operation shall be directed by Reservoir Regulation Section personnel and based on prevailing hydrometeorological conditions and forecasts. The flood release operation established shall be continued until the lake is emptied to elevation 974 ft., m.s.l. When rain occurs which causes the stage at Bassett to rise while a sluice gate is open, the sluice gate shall be closed as directed by Reservoir Regulation Section and the hydropower operation in progress shall be

continued. The sluice gate may be reopened 24 hours after the peak stage at Bassett has occurred as a result of uncontrolled runoff.

b. Headwater elevation above 985 feet., m.s.l., and Bassett stage less than 13 feet. The operation in progress for power generation and low flow regulation shall be continued while the stage at Bassett is rising. When the flood crest has passed Bassett and the stage at Bassett is below 10 feet, the discharge from Philpott will be immediately increased to provide a 10-foot stage at Bassett (7,800 c.f.s.) by operating the turbines at full load and by opening sluices. Since the flow over the uncontrolled spillway varies greatly with the water level in the lake, the stage at Bassett will be maintained by varying the sluice opening at Philpott. If rain occurs which causes the stage at Bassett to rise while the sluices are open, the sluices will be closed until after the crest caused by runoff originating below the dam and then reopened to maintain a 10-foot stage at Bassett. Stages above 10 feet at Bassett may occur as a result of the following: (1) a severe flood originating in the area between the dam and Bassett, with little or no release from the lake, (2) a rise in the lake level and a corresponding increase in flow over the uncontrolled spillway as the sluices are gradually closed to zero opening, or (3) a combination of (1) and (2).

c. Stage at Bassett 13 feet or higher. When the stage at Bassett is 13 feet or higher, regardless of headwater elevation, all turbines and sluices shall be shut down as quickly as possible.

d. Operation of sluices. When one sluice gate is required to be opened, the center sluice shall be used and opened in 2.5-foot steps at two-hour intervals. When a stage of 10 feet is to be maintained at Bassett, the 3 sluices will be opened equally and in steps of 1 foot per gate or less at two-hour intervals. The purpose of limitations on the rate of opening of sluice gates is to prevent rapid increases in the river stage downstream.

e. Emergency Operation. When the lake fills above elevation 974 feet m.s.l., and Reservoir Regulation Section personnel cannot be contacted, the reservoir regulation plan described in "Emergency operation for flood control...," paragraph 8b and c exhibit B shall be implemented. Under these circumstances, opening of sluice gates shall be delayed until 24 hours after the crest at Bassett, regardless of headwater elevation, in order to make the plan of operation easier to follow. Normally, communications between the powerhouse personnel and the Reservoir Regulation Section will be possible and releases shall be made in accordance with specific instructions from Reservoir Regulation Section personnel. Specified releases shall be made in accordance with the plan described in the preceding paragraphs except when current and forecast hydrologic conditions indicate that the objectives of the plan as stated in paragraph 42 of the Reservoir Regulation Manual can be achieved more appropriately by a minor departure.

In the event that there is potential for uncontrolled releases or dam failure, the Emergency Action Plan (EAP) should be implemented. The EAP is updated annually and can be

found in the Water Management, Readiness Contingency Operations, and Geotechnical Sections of the District Office and at the Kerr and Philpott powerhouses.

5. Factors Determining the Adopted Plan of Operation for Flood Control. The major portion of the flood control benefits to be provided by Philpott project will accrue at Bassett, Va. The runoff originating from the 47-square mile area draining into the Smith River between the dam and Bassett produces a significant peak flow which cannot be forecast due to the rapid runoff characteristics of the stream. Therefore, controlled releases from Philpott Dam will be made only after the local runoff peaks at the Bassett gage.

6. Controlled releases from Philpott Dam, started when the local runoff peak at Bassett gage occurs, would usually not contribute to the peak stage of the Smith River downstream from Bassett, but would reach the Dan River about 24 hours before the crest had occurred at the mouth of Smith River. Therefore, controlled releases from Philpott will be withheld until about 24 hours after the local runoff peaks at Bassett gage in the more frequent floods, which do not fill the lake to spillway crest, in order to provide maximum reduction of peak stages on the Dan River. This delay in emptying the flood control space will not materially reduce the ability of the lake to decrease flood damages along the Smith River. The flood control space would be emptied in about five days or less after the beginning of any flood which does not fill the lake above spillway crest. The probability of another flood occurring before the lake has been emptied and of sufficient size to cause flow over the spillway which will contribute to damaging stages downstream, is extremely remote. Forecasts of flow in the Dan River will be prepared and the 24-hour delay in opening the sluice reduced when appropriate.

7. In floods which do not fill the lake above spillway crest, the flood control space will be emptied by opening one sluice and operating the turbines at full load for as many hours per day as possible. Water will be released at the rate of about 4,400 c.f.s. through the sluice (0.8 watershed inches per day) and at the rate of 5,700 c.f.s. (1.0 watershed inches per day) when the turbines are also in operation. This release rate has been selected because (a) the flood control storage will be emptied in a reasonably short time, about 5 days or less in each flood, (b) it approximates bankfull discharge estimated at 6,000 c.f.s., (c) it leaves channel capacity available below the stage at which damage begins in urban areas (7,800 c.f.s. at Bassett) to carry stream flow originating below the dam which may result from rainfall occurring while the sluice is open, and (d) permits operation of the sluice at a fully open position so as to minimize wear.

8. In floods which fill the lake above spillway crest, sluices will be opened as necessary to make the total discharge at Bassett about 7,800 c.f.s. (10 feet on Bassett gage). This increased rate has been selected in order to provide flood storage below the spillway crest as quickly as possible without causing significant damage downstream.

9. Comparison with Operation Proposed in Prior Reports. The first definite plan for a dam at Philpott as presented in House Document 650 anticipated a dam having the same functional characteristics as the project constructed. These general characteristics included (a) a free spillway, (b) 3 inches of flood storage reservation below the crest of the free spillway, and (c) controlled outlet at a low elevation. The operation is largely automatic. The main difference is the use of the controlled outlets in emptying the flood storage space as indicated in table 3. A change in the operating rules over those proposed in the Definite Project Report was made after further study of available discharge capacity, possible flood volume, and effect on flood stages downstream to the head of John H. Kerr Reservoir. A brief summary of the present operation compared with the operation contemplated in prior reports is shown in table 3.

TABLE 3
Comparison of Operating Rules with those Contemplated in Prior Reports

Item	Survey Report	Definite Project Report	Regulation Manual
Control Point	None	Bassett, Va.	Bassett, Va.
Time of Initiation of Controlled Releases	(Releases not contemplated unless power plant is inoperative and it is not possible to evacuate flood control space by utilizing the flow in power production.)	As soon as peak flow is reached at Bassett	24 hours after peak flow at Bassett.*
Releases contemplated	(Releases not contemplated unless power plant is inoperative and it	Amount necessary to maintain peak flow established by Bassett local.	a. Philpott Lake is between 974 and 976 ft. m.s.l., and Bassett stage is less than 13 feet: One sluice fully open plus turbines (5,700 c.f.s.)**

	is not possible to evacuate flood control space by utilizing the flow in power production.)		b. Philpott Lake is above 985 ft. m.s.l., and Bassett stage is less than 13 feet: Maintain Bassett stage at 10 feet (7,800 c.f.s.) c. Bassett stage is above 13 feet: Turbines and sluices are shutdown.

*When the lake is above elevation 985 feet m.s.l. and the flood operation is directed by Reservoir Regulation Section (communication facilities are operational), sluices shall be opened immediately after the peak stage is reached at Bassett gage in order to maintain a stage of 10 feet at Bassett.

**Depending on weather forecast, the Water Control Manager may limit sluice gate opening to 5 feet (one-half fully open) to prevent flooding of a parking lot at a downstream factory.

E. OPERATION FOR POWER GENERATION AND LOW FLOW REGULATION

1. General. When the lake is filled above the maximum conservation pool elevation, the total flow released from the lake will be that required for flood control. To the maximum extent possible, water released in accordance with flood control requirements will be used to generate hydroelectric power. However, the turbines will be shut down as required for the control of floods.

2. Water stored in the lake below the maximum conservation pool elevation will be released as necessary to obtain maximum power revenue consistent with proper consideration of (a) flow needed downstream for water supply, fish and wildlife, and the existing hydro plants, and (b) the headwater level desired in the interest of recreation.

3. Reservoir Guide Curve. The reservoir guide curve has been established at elevations such that the minimum energy required with the dependable capacity of John H. Kerr Dam and Philpott Dam can be provided with inflow to the reservoirs equal to the minimum of record if operation is in accordance with the operating instructions. This integrated plan of operation is based on operating conditions outlined in the power sales contract with Appalachian Power Company (APCO) and Virginia Power Company (VPCO) providing for integrated operation of the two projects. Since incidental flood

control storage at Philpott is not considered critical, the guide curve was established at such elevations as would provide maximum power revenue while maintaining suitable elevations for recreation, fish conservation, and control of vegetation along the shoreline. The guide curve, which has a drawdown of 2.5 feet, will provide:

a. Generation at a high head while requiring a minimum of spill.

b. An adequate reserve of storage for support of the system dependable capacity during a repeat of the critical dry period.

c. A relatively level pool during the boating and swimming season.

d. Filling by early spring to prevent growth along the shoreline.

4. Operation for Power Generation. Normally Philpott will operate as a peaking plant, the main units will be in operation usually about 15 hours per week and occasionally up to 84 hours per week. The amount of energy currently available will be determined as necessary by Reservoir Regulation Section personnel. The reservoir guide curves and operating instructions shown on plates B-25 and B-26 of the Reservoir Regulation Manual shall be used as guidelines in making this determination. Reservoir Regulation Section personnel prepares a weekly declaration of energy, currently available, to South Atlantic Division, (SAD). SAD will declare the energy available to the Southeastern Power Administration (SEPA). Energy will be delivered as scheduled by APCO and VPCO. During hours when main unit generation is not scheduled, energy will be generated by the 750 kva unit to maintain minimum flow releases as directed by the Reservoir Regulation Section in accordance with the criteria shown on plate B-24 in the Reservoir Regulation Manual.

5. Power Facilities. The power facilities at Philpott project include 2 main units each having a rated capacity of 7,500 kva and a secondary unit with a rated capacity of 750 kva providing a total capacity of 15,750 kva as shown in the following table:

TABLE 4
Power installation

	Rated Capacity		
No. of Units	Turbine hp*	Generator kva	Transformer kva
2	9,400	7,500	14,000/17,500
1	860	750	

* At 152-foot head

Performance curves for the 7,500 kva and 750 kva units and tailwater rating curve are shown on plates B-8, B-9 and B-23, respectively, in the Reservoir Regulation Manual.

6. The lake capacity and area at maximum and minimum conservation pool elevations used in the design and operation of the project are shown in Table 5. The area-capacity curve for the lake is shown on plate B-10 of the Reservoir Regulation Manual.

TABLE 5
Area and Capacity of Conservation Pool

Conservation (Power Pool)	Surface Elevation (ft., m.s.l.)	Reservoir Area (acres*)	Capacity (acre-feet*)
Maximum	974	2,800	166,190
Design Minimum	920	1,350	55,000
Design Usable	920-974	-	111,190
Contract Minimum	951	2,150	108,420
Contract Usable	951-974	-	57,770

* Surface area is from original (circa 1950) determination.
** Reservoir capacity amount reflects latest measurements.

7. Power Market. Power generated at Philpott in excess of project needs will be made available for sale by SEPA, the marketing agency of the Department of Energy. SEPA has entered into a long-term contract with APCO and with VPCO which provides for delivery of project power to preference customers in the area served by the companies and for sale of any remaining power to VPCO. Under the contracts Philpott and Kerr are fully integrated to cover capacity and energy from both projects. A copy of the contracts is on file in the District Office.

8. Operation for Low Flow. The Smith River downstream from Philpott Dam is used as a source for industrial and public water supplies and also for disposal of industrial wastes and domestic sewage. The minimum flow required to provide water of suitable quality was estimated by the U.S. Public Health Service (now EPA) to be as follows:

TABLE 6
Minimum Flow Requirements

Location	Drainage Area (square miles)	Minimum flow required (c.f.s.)
Stanleytown, Va.	280	59 in summer
Fieldale, Va.	312	45 in summer
Martinsville, Va.	374	90 October – May 125 June 140 July – 15 September 125 15 – 30 September

By letter dated 22 October 1952 the Executive Secretary, State Water Control Board, Commonwealth of Virginia, stated that the above schedule met with his approval and also met with the approval of the Executive Secretary of the North Carolina State Stream Sanitation Committee (now called the Division of Environmental Management under the North Carolina Department of Environment, Health, and Natural Resources).

9. The flow at Martinsville, Va., is controlled by the hydroelectric power project operated by the City of Martinsville. When stream flow is moderate or low, all the water available is used to generate power during peak load hours, the release during the remainder of the day is that due to leakage. Thus, the minimum flow of the Smith River can be controlled by releases from Philpott only in the reach from Philpott Dam to the head of Martinsville Reservoir.

10. The flow required at Stanleytown (59 c.f.s.) is only about 20 percent more than the minimum of record and about equal to the natural flow which would be relied upon in the design of sewage treatment facilities. A minimum flow normally amounting to 35 c.f.s. but reducing to lesser amounts for short periods has been found adequate for fish and wildlife conservation in the river channel immediately downstream from Philpott Dam. Plate B-24 in the Reservoir Regulation Manual will be used in determining the minimum release to be scheduled and the 750 kva unit will be used to pass the minimum release flow.

11. The pondage provided by the Martinsville Dam is sufficient to reregulate the varying inflows caused by peaking power operations at Philpott. The minimum volume of water required by Martinsville is estimated to be 130 c.f.s. per weekday and about 100 c.f.s. per day on weekends. The weekday requirement can be met by releasing 100 c.f.s. per weekday at Philpott with minimum flow of record. During periods when runoff originating between the two dams is higher than the minimum of record, a power release

from Philpott of less than 100 c.f.s. would be adequate for flow regulation. Less than 100 c.f.s. release is desirable when refilling Philpott Lake by transferring minimum energy requirements at Philpott to Kerr Dam.

12. Operation for Recreation. The following criteria for desirable headwater level management have been considered in the establishment of the Reservoir Regulation Manual for power generation. Drawdown exceeding about 10 to 15 feet detracts considerably from the value of the lake for recreation, particularly boating. A large number of people use the lake for boating, fishing, and other forms of recreation. Detailed information on the recreational facilities are found in the Master Plan for Reservoir Development and the Project Operational Management Plan. A report which includes information on recreational aspects of the lake is prepared annually by District personnel.

13. Operation for Water Supply. A contract entered into on 10 January 1985 (Contract No. DACW54-85-C-0003) between the Federal Government (Wilmington District) and the Board of Supervisors of Henry County, Virginia allows for discharge of water from Philpott Lake project to cover emergency situations. To date, Henry County has not requested water supply releases from Philpott Lake. Extracts from the contract are provided as exhibit C.

14. Operation for Fish and Wildlife. The U.S. Fish and Wildlife Service has requested that consideration be given to minimizing water level fluctuation, especially the lowering of such water levels during the spring of each year. This will aid in the reproduction of bass and crappie. Consequently, each year consideration will be given to not lowering the water levels in the lake by more than 6 inches from the time the water temperature reaches 65 degrees F until 3 weeks after the temperature first reaches 70 degrees F; provided benefits attributed to primary project purposes are not jeopardized by this operation.

15. Deviation from Normal Operation. The District Engineer is occasionally requested to deviate from normal operation of Philpott Lake. Prior approval for a deviation is obtained from SAD, except as noted.

a. Emergencies. Unexpected emergencies include drownings, other accidents, failure of operation facilities, and flushing of pollution during fish kills. Necessary action in emergency situations will be taken immediately unless such action would create equal or worse conditions. SAD will be informed as soon as practicable and a written confirmation showing the deviation and conditions will be furnished to CESAD-EN-H.

b. Unplanned minor deviations. Construction, which includes utility stream crossing, bridge work, and major construction contracts, account for the majority of unplanned deviations. Changes in releases are sometimes necessary for maintenance and inspection. Requests for changes of release rates are generally for a few hours to a few days. Each request is analyzed and consideration is given to upstream watershed conditions, potential flood threat, condition of Philpott Lake and possible alternative measures. Favorable consideration is normally granted provided there are no adverse effects on the overall regulation of the project for the authorized purposes. The District water control manager (Reservoir Regulation Section) will obtain approval for these minor deviations from SAD, normally by telephone. A written confirmation showing the deviation and conditions will be furnished to CESAD-EN-H upon request.

c. Planned deviations. Each condition will be analyzed on its merit. 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 will be presented by letter or telephone to SAD along with recommendations for review and approval.

d. Drought contingency. Project operating procedures to provide relief during critical drought situations is described in detail in the Drought Contingency Plan for Philpott Lake, exhibit D.

F. STANDING OPERATING INSTRUCTIONS TO DAM AND POWER PLANT OPERATORS

A summary of regulation procedures for the dam and power plant operators during both normal and emergency situations is provided as exhibit B.