



**US Army Corps
of Engineers®**
Wilmington District

Philpott Lake, Virginia
Water Storage Reallocation
Integrated Feasibility Study and Environmental Assessment



Final Report
February 2023

EXECUTIVE SUMMARY

The purpose of this study is to address the inadequate supply of water for Henry County Public Service Authority (HCPSA) and its customers in south-central Virginia. The study examines alternatives and identifies the most cost-effective means of providing additional water for the current and future demands of the region, including actions other than reallocation.

The Recommended Plan transfers 5,200 ac-ft of water storage from the conservation pool at Philpott Lake to water supply which constitutes approximately 3.58% of its total active storage. No new federal infrastructure or facilities will be required for the plan. The final annual cost of storage to the HCPSA with OMRR&R is \$541,000.

Based on this analysis, the Recommended Plan is the most technically feasible, environmentally acceptable, and economically justified alternative of those evaluated, and will not require a change to Philpott Lake's existing authorized purposes. There will be no impacts to flood risk management and operations at the lake, but there will be a small impact to hydropower generation currently estimated to be 0.17% or \$3,866 annually. The Southeast Power Administration will receive a credit to offset this impact. The plan will result in no significant impacts to any environmental resources. No impacts to the following resources will occur: geology and sediments, operations and flood risk management, wetlands, vegetation, fish and wildlife, threatened and endangered species, cultural resources, recreation and aesthetics, air quality and noise, climate change and hazardous, toxic, and radioactive waste. The plan will result in minor impacts to floodplains, water quality, water supply and socio-economics and environmental justice.

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LIST OF ACRONYMS AND ABBREVIATIONS

ac-ft	Acre-Feet
APE	Area of Potential Effects
CCC	Civilian Conservation Corps
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
CWA	Clean Water Act
CWCCIS	Civil Works Construction Cost Index System
DSAC	Dam Safety Action Classification
EA	Environmental Assessment
ECB	Engineering and Construction Bulletin
ENR	Engineering News Record
EO	Executive Orders
EOP	Environmental Operating Principle
EQ	Environmental Quality
ER	Engineer Regulation
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Maps
FONSI	Finding of No Significant Impact
FY	Fiscal Year
HAC	USACE Hydropower Analysis Center
HCPSA	Henry County Public Service Authority
kW	Kilowatt
MGD	Million Gallons per Day
MW	Megawatt
MWh	Megawatt-hour
NAAQS	National Ambient Air Quality Standards
NAVD88	North American Vertical Datum of 1988
NCDENR	North Carolina Department of Environment and Natural Resources
NED	National Economic Development
NEPA	National Environmental Policy Act
NFS	Non-Federal Sponsor
NHPA	National Historic Preservation Act
NRHP	National Register of Historic Places
NSD	Nonstationarity Detection Tool

O&M	Operations and Maintenance
OMRR&R	Operations, Maintenance, Repair, Rehabilitation and Replacement
OSE	Other Social Effects
RED	Regional Economic Development
RR&R	Repair, Rehabilitation and Replacement
SEPA	Southeast Power Administration
TMDL	Total Maximum Daily Load
UOF	Use of Facilities
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VADCR	Virginia Department of Conservation and Recreation
VADEQ	Virginia Department of Environmental Quality
VAWRP	Virginia Water Resources Plan
VDH-ODW	Virginia Department of Health-Office of Drinking Water
VDHR	Virginia Department of Historic Resources
WSA	Water Supply Act
WSS	Web Soil Survey

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Appendix B – Hydrologic Analysis

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1 STUDY OVERVIEW

The following evaluates the reallocation of water storage at Philpott Lake for the Henry County Public Service Authority (HCPSA): the non-Federal sponsor (NFS) for this study. It examines alternatives and identifies the most cost-effective means of providing additional water for the current and future demands in south-central Virginia including actions other than reallocation. In addition, the study documents impacts to regional environmental, socio-economic, historic and cultural resources by the Recommended Plan pursuant to several Federal laws (*i.e.*, the National Environmental Policy Act (NEPA), Clean Water Act (CWA), National Historic Preservation Act (NHPA), Endangered Species Act, etc.).

1.1 Purpose and Need

The purpose of this study is to address the inadequate supply of water for HCPSA and its customers in south-central Virginia. HCPSA currently withdraws an average daily volume of approximately 3.3 million gallons per day (MGD) and is permitted to withdraw up to 6 MGD from the Smith River through its downstream intake. However, this volume does not adequately service the region's industrial and residential customers and will continue to underserve as industrial development continues to grow in the region. HCPSA is requesting a reallocation of 4.0 MGD of water storage at Philpott Lake over a 50-year period: 2023-2072.

1.2 Authority and Federal Interest

Authority for the U.S. Army Corps of Engineers (USACE) to reallocate water storage at an authorized Federal project is contained within Public Law 85-500, Title III, Water Supply Act (WSA) of 1958, as amended, codified at 43 U.S.C. § 390b. Section 301(b), of this Act states ". . . it is hereby provided that storage may be included in any reservoir project surveyed, planned, constructed or to be planned, surveyed and/or constructed by the Corps of Engineers. . . to impound water for present or anticipated future demand or need for municipal and industrial water supply." 43 U.S.C. § 390b(b). Section 301(d) of the Act states "[M]odifications of a reservoir project heretofore authorized, surveyed, planned, or constructed to include storage as provided in subsection (b), which would seriously affect the purposes for which the project was authorized, surveyed, planned, or constructed, or which would involve major structural or operational changes shall be made only upon the approval of Congress as now provided by law." 43 U.S.C. § 390b(e). This law established a federal interest in development of water supplies for municipal and industrial use in connection with Federal multi-purpose projects.

For reallocated municipal and industrial water supply storage under the 1958 WSA authority, the water supply user must be advised that the reallocation study itself will not specifically address Section 408 considerations but that Section 408 considerations will be taken into account in the drafting of a water storage agreement and associated outgrants or consents. Any requirements for water supply user's facilities (intake structures, etc.) will be included in the agreement and associated outgrants (EC 1165-2-220 POLICY AND PROCEDURAL GUIDANCE FOR PROCESSING REQUESTS TO ALTER US ARMY CORPS OF ENGINEERS CIVIL WORKS PROJECTS PURSUANT TO 33 U.S.C. § 408).

2 PROJECT DESCRIPTION

Philpott Lake is a multi-purpose water resources project originally authorized to address flooding issues associated with communities in south-central Virginia. The lake is formed through the impoundment of the Smith River, considered to be a major tributary of the Dan River.

Construction of the Philpott Dam was completed in 1952. The powerhouse was completed shortly after the dam in 1953 and is operated by the USACE, Wilmington District. The project includes a concrete gravity dam with an uncontrolled ogee spillway, a powerhouse, and a switchyard. Philpott Lake is 15 miles long and covers approximately 2,880 acres at elevation 973.4 feet NAVD88. It extends into Franklin, Henry, and Patrick counties in south-central Virginia. Philpott Dam and associated infrastructure, as well as all land acquired for the Philpott Lake project, approximately 9,515.6 acres, are federally managed and administered by the USACE.

2.1 Location

Philpott Lake is situated in the Piedmont and Blue Ridge Mountains of Virginia in Franklin, Henry, and Patrick Counties, Virginia (Figure 2-1). It is a 2,880-acre impoundment managed by the USACE. The Smith River confluent with the Dan River in North Carolina and generally flows eastward to John H. Kerr Reservoir, Lake Gaston, Roanoke Rapids Lake, the Roanoke River and finally the Atlantic Ocean through the Albemarle Sound. Tributaries to the Smith River that feed the reservoir include Runnett Bag Creek, Ryans Branch, Beards Creek, Nicholas Creek, Osley Branch, Cooper Creek, Roland Branch, Salthouse Branch, Cow Branch, Bowens Creek, Bowens Branch, Spring Branch, Jackson Run, Mines Branch, Puppy Creek, and Small Creek.

The lake's setting is generally described as being picturesque and rural with mountainous terrain reaching 799.4 to 1,099.4 feet NAVD88. The nearest towns are Basset located approximately 7 miles downstream and Martinsville located approximately 14 miles downstream. The area has hard, crystalline igneous and metamorphic geologic formations with some areas of sedimentary rocks. Most significant water supplies are found within a few hundred feet of the surface. Larger concentrations of water withdrawal can be obtained along the Western Piedmont along the base of the Blue Ridge Mountains.

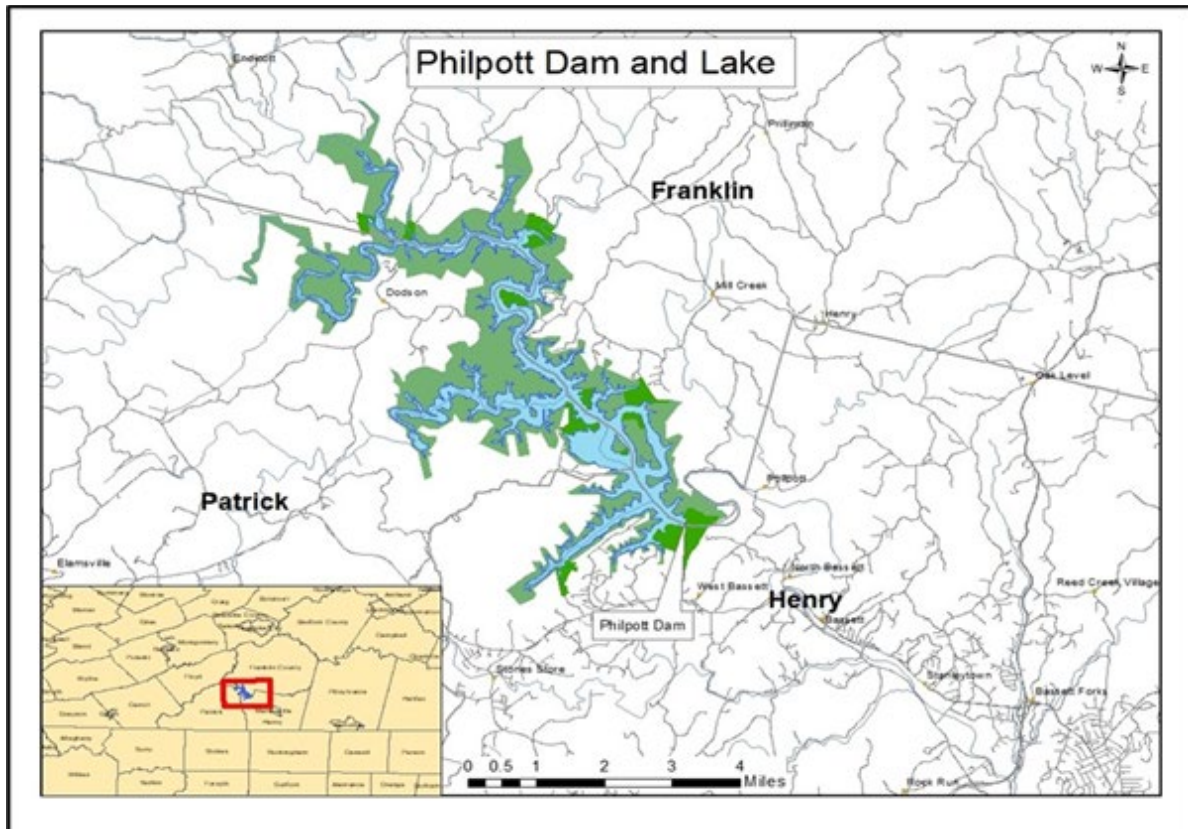


Figure 2-1 Philpott Dam and Lake Location (Green area shows government owned land and flowage easements)

2.2 Project Background and Data

Philpott Lake was authorized by Section 10 of the Flood Control Act of 1944 (P.L. 78-534), substantially in accordance with the recommendations of the Chief of Engineers in House Document Number 650, Seventy-eighth Congress, second session. Philpott's authorized purposes include flood risk management, hydroelectric power generation, and low flow augmentation. The unit was part of a comprehensive reservoir system designed to control the fluctuations of the Roanoke River and its tributaries (Figure 2-2). Construction of the concrete gravity dam and spillway began in 1948 and was completed in 1952 with a top elevation of 1015.4 feet NAVD88. The Philpott Powerhouse began producing hydroelectric power in 1953. In addition, under the general authority of Section 4 of the Flood Control Act of 1946 (P.L. 79-526), as amended, the USACE operates and maintains public park and recreational facilities at Philpott Lake. The USACE also manages the project in a manner that conserves fish and wildlife resources in accordance with authority granted in the Fish and Wildlife Coordination Act (P.L. 85-624).

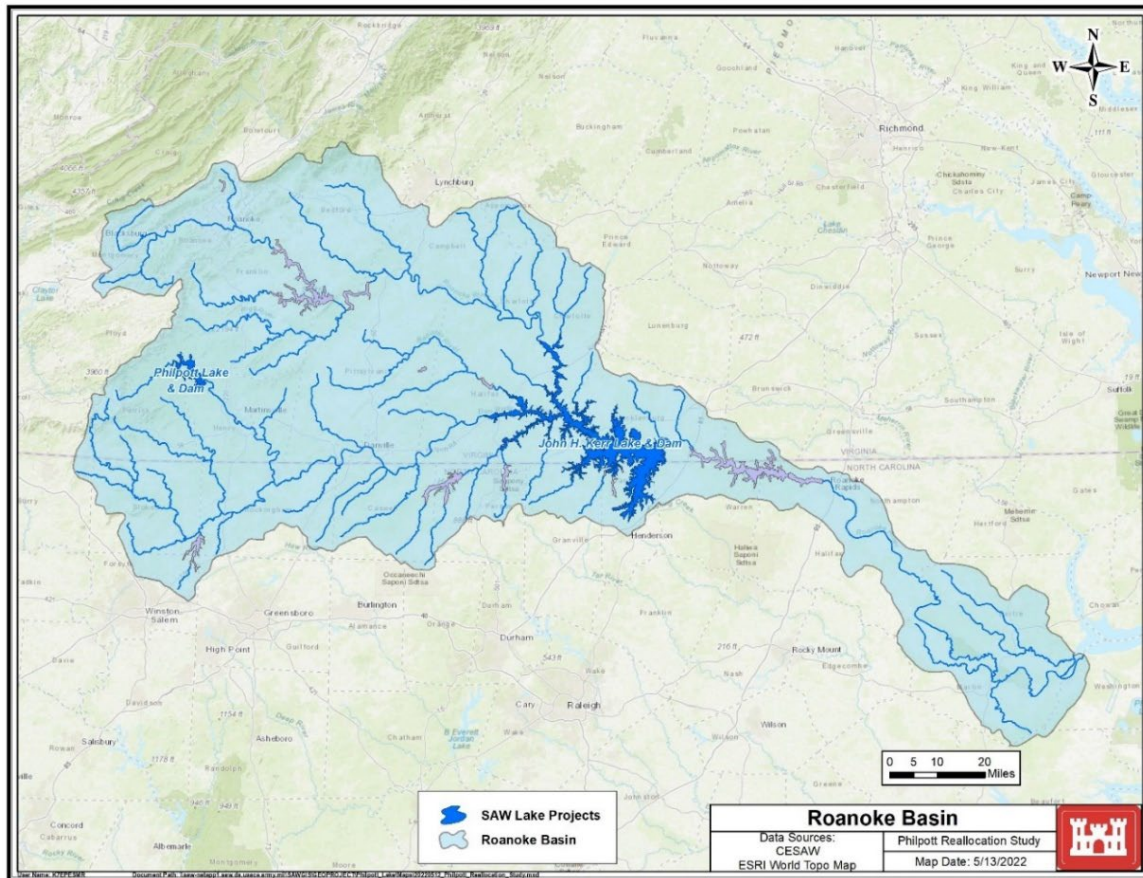


Figure 2-2 Roanoke River Basin

Philpott Lake currently provides no water supply storage for State or local interests. The WSA of 1958 authorizes the USACE to include municipal and industrial water supply storage at Philpott Lake, effectively making water supply an authorized project purpose.

The total area of the Philpott Lake project is approximately 9,515.6 acres, with an estimated additional 243.3 acres designated as flowage easement. The lake's design and current plan of operation provides for a full flood control pool at elevation 984.4 feet NAVD88 and a full power pool elevation at elevation 973.4 feet NAVD88. In general, the lake has a seasonally varying guide curve that is higher in the summer and lower in the winter. The lake has approximately 200,400 acre feet (ac-ft) of storage which includes 34,200 ac-ft of flood control storage, 111,200 ac-ft of conservation storage for hydropower, and 55,000 ac-ft of inactive storage (Figure 2-3).

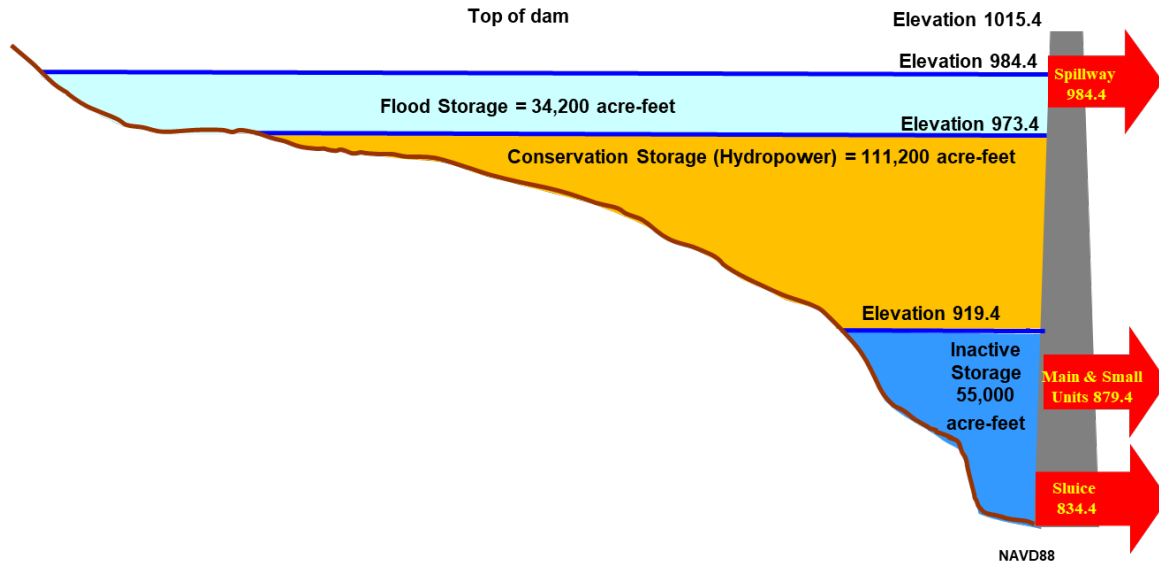


Figure 2-3 Existing Philpott Lake Water Storage and Use

2.3 Current Project Operations

Philpott Lake operates on a seasonal guide curve, with an elevation of 970.9 feet NAVD88 October through January, 972.9 feet NAVD88 April through July, and varies linearly between the two elevations the remainder of the year. Controlled flood control storage space is provided between elevations 973.4 and 984.4 feet NAVD88 with surcharge or uncontrolled storage provided above the crest of the free over-flow spillway (elevation 984.4 feet NAVD88). The conservation pool storage is between elevation 919.4 and 973.4 feet NAVD88. Typically, dependable power generation goes through 950.4 feet NAVD88) and low flow augmentation is supported by the conservation pool. The inactive pool storage (55,000 ac-ft below elevation 919.4 ft NAVD88 and below the bottom of the conservation pool) provides head for power generation and storage for accumulation of sediment during the life of the project.

Controlled flood storage is utilized to reduce downstream flood risks on the Smith and Dan Rivers, with the gage at Bassett being the primary flood control point. Flood releases specified in the water control plan (consisting of full turbine capacity plus sluice gate releases as specified) are normally delayed until 24 hours after the local runoff peak at the Bassett gage occurs; however, normal scheduled generation may be allowed to continue depending on the river stage at Bassett. In floods which do not fill the lake above spillway crest, flood releases up to 4400 cubic feet per second (cfs) are allowed, which is the combined capacity of one sluice gate and full turbine capacity. In floods which fill the lake above spillway crest, all three sluices can be opened as necessary to make the total discharge at Bassett about 7,800 c.f.s. (10 feet on Bassett gage), including full turbine discharges.

Water stored in the lake below the maximum conservation pool elevation is managed as necessary to support environmental stewardship, and recreation. The Smith River supplies industrial and public water supplies for the region downstream through an intake approximately three miles downstream from the Philpott Dam and Spillway. The minimum flow required to provide water of suitable quality at Stanleytown, VA, was originally established as 59 cfs and was about 20 percent more than the minimum of record and equal to the natural flow that would be relied upon in the design of sewage treatment facilities at that time. Since there is no gage at Stanleytown (about 10 miles downstream of Philpott Dam), the nearby Bassett gage (about 3 miles upstream of Stanleytown) is used for monitoring and maintaining minimum flows in the Smith River. Generally, normal hydropower operations ensures that minimum flow requirements are met, even when only the station service unit is operating. When the lake is below the top of the conservation pool, weekly power generation is limited to minimum weekly energy requirements determined by the Southeastern Power Administration.

2.4 Dam Safety Action Classification

Dam Safety Action Classification (DSAC) is a tool used by the USACE to prioritize funding for the study and repair of the USACE dam inventory. This classification scale ranges from DSAC 1, representing most risk and prioritized, to DSAC 5, representing the least risk and priority for funding. The classification assigned to a project is determined by looking at a combination of the likelihood of failure of the dam and the consequences that would result if the dam were to fail. This combination of factors results in a concept of the overall risk presented by the dam. Specific hypothetical types of dam failures, the condition of the dam, frequency and intensity of precipitation and flooding, and factors that could affect life loss and other consequences are considered in this evaluation. The risk of a project and assigned DSAC is re-evaluated every 10 years during a Periodic Risk Assessment or more frequently by other risk analysis types such as Issue Evaluation Study. The risks at Philpott Dam are driven by stability concerns at extreme pool elevations and consequences downstream, in the unlikely event of a dam failure. As a result, Philpott Dam is assigned a DSAC of “3” or “moderate risk” by the USACE Dam Safety Program. The most recent Periodic Assessment of the Dam performed in February 2013 supported this rating. Due to the DSAC 3 rating, Philpott Dam is in the USACE queue for an Issue Evaluation Study. To reduce risk, an Interim Risk Reduction Measures Plan is in place. HCPSA was sent a letter from USACE notifying them of Philpott Dam’s DSAC rating and other points, as required by paragraph 24.7.6 of ER 1110-2-1156, on January 10, 2000. The County acknowledged the dam’s DSAC rating and financial responsibility for possible remediation costs in a letter received on January 17, 2000. An exception to the policy restricting water reallocation at Federal projects with a DSAC ratings of 1,2, and 3 was granted on April 3, 2020 (see Appendix E).

3 INVENTORY OF CURRENT AND FUTURE CONDITIONS

The following provides an overview of existing water resources and expected future conditions with a specific focus on projected water demands and supplies and anticipated needs for additional water supplies. More detailed analysis of these topics is included in Appendices A and B of this report.

3.1 Hydrology and Hydraulics

The hydrologic model selected for use in this reallocation study is the HEC-Res Sim. The reservoir network consists of the Philpott Lake with computation points for inflows, outflows, and Smith River at Bassett, Virginia. Philpott Lake's physical properties were designed for ungated spillway flow, sluice gate flow, hydropower main unit flow, hydropower house unit flow and an additional leakage term when the pool elevation is above the minimum power pool.

The HEC-Res Sim model was reviewed and verified numerous aspects of the model deemed critical to successful modeling of Philpott Lake operations for the Philpott Lake Reallocation Study, including:

- Storage pool elevations (inactive/conservation/flood)
- Storage volumes by elevation (and surface area by elevation)
- Minimum release protocols (at dam and at Bassett)
- Routing of flows (travel times, lagging, etc)
- Critical period inflows

Modeling is done on a daily time-step, with a constant daily water demand and hydropower releases varying with the monthly minimum energy needs.

The Firm Yield simulation using the seasonal guide curve has a lookback period starting January 1, 1958 with the simulation running from January 1, 1960 to January 1, 2020, which determines the largest minimum release possible that will empty the lake's storage exactly once in the simulation period. HEC Res-Sim runs two statistical searches on the maximum minimum daily release until a firm yield value is determined. The firm yield release was calculated to be 147.2 cfs. A critical period, where the storage is not recovering, was found from August 24, 1998- June 06, 2003, with the lake level draining to the bottom of the power pool on October 27, 2002 before beginning to refill.

3.2 Sedimentation

The "Definite Project Report on Philpott Reservoir" (Serial No. PR-66, 30 November

1946) indicates that a silting rate of 0.5 ac-ft per square mile of drainage area per year was deemed adequate and applicable. Per the definite project report, siltation at this rate would require over 500 years to fill the inactive storage.

Sedimentation surveys conducted include the initial survey of sediment ranges in 1951 and resurveys in 1960, 1976, and 1997. Analysis of resurvey results has indicated varying rates of sedimentation over time. However, between the initial 1951 survey and the latest 1997 survey, the total sediment volume has increased by only 530 ac-ft, or a reduction of less than 0.3% of the total project storage and less than 1% of the inactive storage. An updated sedimentation survey would be beneficial; however, extrapolation of this historic sedimentation rate through 2022 results in a total sediment volume increase of about 850 ac-ft, which is still less than 0.5% of the total project storage and just over 1.5% of the inactive storage. Compared to the assumed siltation of 0.5 ac-ft per square mile of drainage area per year in the Definite Project Report, the most recent survey indicates sedimentation of only about 0.06 ac-ft per square mile of drainage area per year. As mentioned, an updated survey is needed and would be beneficial for confirming these low historical sedimentation rates; however, based on available information, sedimentation appears to be well below rates assumed during project design. It is also recommended that an updated survey be conducted prior to reallocating any storage from the inactive storage pool.

3.3 HCPSA's Existing State Water Withdrawal Permit

HCPSA provides potable water to residential, commercial, and industrial customers in Henry County and nearby residential areas of Patrick and Pittsylvania counties. Treated water comes from the Upper Smith River Water Filtration Plant, also referred to as the Philpott Water Filtration Plant. Raw water is pumped from the Smith River in accordance with a 401 Certification (Number 82-0957) issued by the Virginia State Water Control Board in 1983. The treatment plant intake is about 3 river miles downstream of Philpott Dam and immediately upstream of the confluence of Town Creek and the Smith River.

The Water Filtration Plant withdrawal permitted by the State is currently 6.0 MGD. Other restrictions apply based on the U.S. Geological Survey (USGS) Bassett Gage (02072500000) located approximately 6 miles downstream of Philpott Dam. The Smith River flow requirements incorporated into the Water Control Plan and Reservoir Regulation Manual for Philpott Lake were established by the U.S. Environmental Protection Agency. These requirements include maintenance of minimum river flows at Stanleytown, Fieldale and Martinsville, VA, which were established to provide sufficient flows to support water withdrawals, wastewater discharges, and other uses in these downstream communities.

3.4 Water Supply Demand Analysis

The USACE conducted a water supply demand analysis to identify the need from the NFS over a 50-year period of analysis: 2023-2072. Projected water use based on average daily demands will reach 4.8 MGD (the VDH 80 percent rule trigger for 6.0 MGD permit is discussed in Sections 2.0 and 5.0 of Appendix A: Water Supply Demand Analysis) within an approximate time frame ranging from 2027 through 2033 depending upon the future

demand scenario (high, medium or low). Thus, over the next few years the county will have to start developing a plan to expand treatment capacity that will require additional permitted supplies from the State of Virginia.

According to the HCPSA, the state of Virginia will not upgrade the existing 6.0 MGD permit without additional storage from Philpott Lake. HCPSA demand will reach that 80 percent rule trigger threshold somewhere between 2035 with the high growth scenario to 2050 with the low growth scenario. Based on the medium growth scenario projections, this demand will occur in 2040. Figure 3-1 shows peak or maximum daily demands based on recent historical data from the HCPSA. For more information on the demand analysis see Appendix A. When measured by peak or maximum daily use, their need will manifest between 2025 to 2035 depending on the demand scenario. For both average daily and peak daily use, an initial 4.0 MGD provided via storage in Lake Philpott will likely meet forecasted demand at least through 2072.

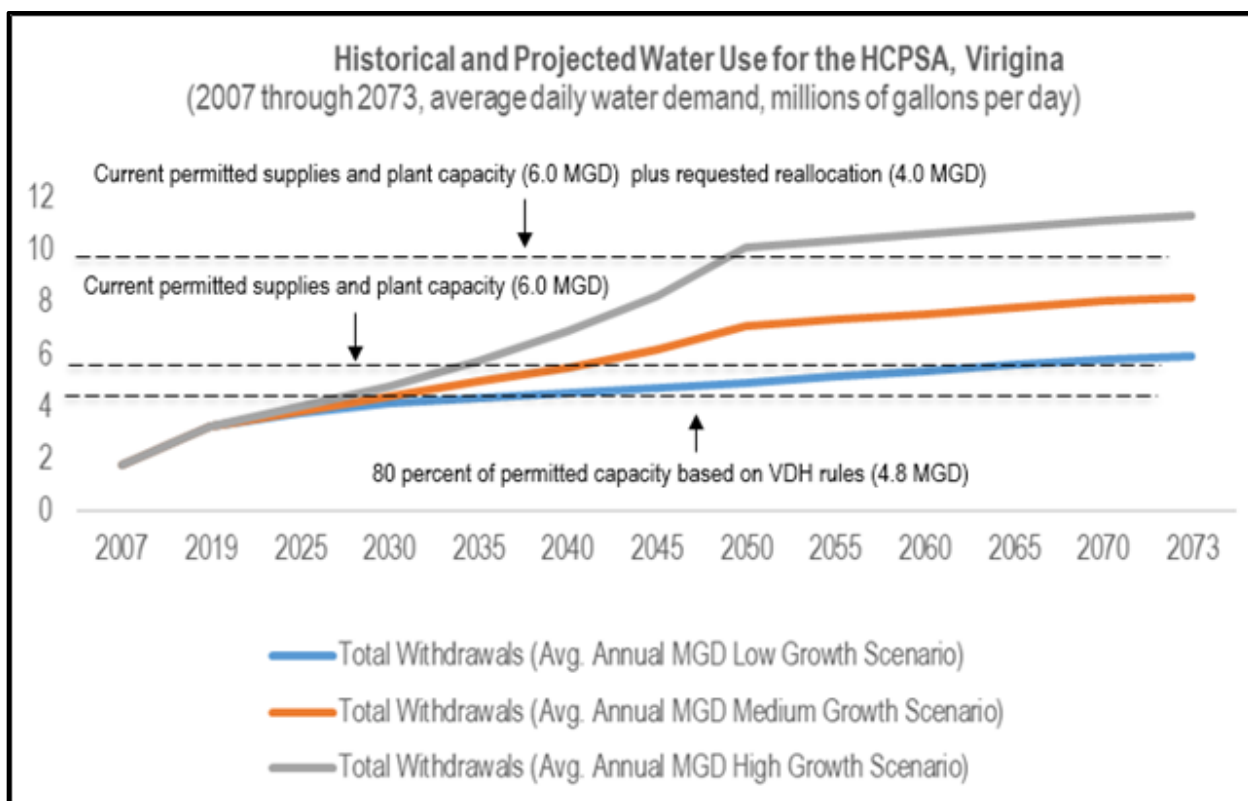


Figure 3-1 Water Demand Scenarios, Appendix A.

4 PLAN FORMULATION AND EVALUATION

The formulation and the evaluation of alternatives for this study were conducted in accordance with the USACE Planning Guidance Notebook (ER 1105-2-100) and the USACE's Water Supply Handbook, both emanating from the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Planning Act (P.L. 89-80) and Executive Order 11747, which was approved by the U.S. Water Resources Council in 1982, and by the President in 1983.

Based on guidance and policy, the USACE has a well-defined six-step process used to identify and respond to problems and opportunities associated with federal water resources planning objectives, and specific state and local concerns:

- 1) Identify problems and opportunities
- 2) Inventory and forecast conditions
- 3) Formulate alternative plans
- 4) Evaluate alternative plans
- 5) Compare alternative plans
- 6) Select Recommended Plan.

Management measures and alternatives were developed to address the water resource problems, meet the stated objectives while avoiding constraints and taking advantage of opportunities. The results of the analysis identified an economically viable and environmentally acceptable Recommended Plan, as well as a nonstructural plan, a comprehensive benefits plan, and if needed a locally-preferred plan.

In the interest of report brevity, the inventory of current and future conditions is located in different sections of the report and appendices. Current and future environmental conditions under the No-Action and future condition are discussed in Section 8 of this report. Discussion on current and future hydrologic conditions is contained in Appendix B Hydrologic Analysis. Discussion on current and future economic conditions is contained in Appendix C Economics Analysis.

4.1 Problems and Opportunities

The water resource problem addressed by this study is the inadequate supply of water to meet the increasing demand for the HCPSA and its customers in south-central Virginia. Currently water is withdrawn from the Smith River by HCPSA through its intake downstream of the dam utilizing existing operational releases at Philpott Lake, however, this approach does not provide enough supply to meet the increasing needs of their service area.

Re-allocating from Philpott Lake available storage for water supply will create an opportunity for the Federal government to meet the region's "... need for municipal and

industrial water supply...” The study will also assist HCPSA in the identification of alternative water supply sources to meet future demand.

4.2 Objectives and Constraints

The primary objective of this study is to identify and assess the Federal interest in a plan that meets the current and future water needs of HCPSA and its patrons in south-central Virginia. A secondary objective is to reduce the risk for future shortages in the region by providing reliable, low-cost water. Alternatives that meet these objectives will meet water needs over a 50-year period: 2023-2072.

The formulation of measures and alternatives to address these objectives were limited by the following constraints:

- 1) Fulfilling requirements of existing Federal laws, regulations, directives, executive orders (EO), and policies. This constraint could delay implementation of a plan or result in significant changes to the plan, if realized.
- 2) The Recommended Plan cannot require major structural or operational changes to the reservoir or seriously affect its authorized purposes. Such could require Congressional authorization, additional studies and ultimately delay implementation of the plan.
- 3) Maintaining downstream minimum flow rates on the Smith River. A change in the flow rates from the Philpott Lake Dam could affect downstream communities that are dependent on them.
- 4) Avoiding significant impacts to environmental and cultural resources. A failure to do so could require expensive mitigation and delay implementation of the plan.
- 5) Limited NFS resources (i. e. funds, manpower, equipment).

4.3 Evaluation Criteria

Alternative plans are evaluated by applying technical agency criteria. According to the Planning Guidance Notebook (PGN, ER 1105-2-100), four general criteria are used to evaluate the array based upon the information gathered and developed, as well as with NFS and resource agency input:

- *Completeness*: This is the extent that an alternative provides and accounts for all investments and actions required to ensure the planned output is achieved. These criteria may require that an alternative consider the relationship of the plan to other public and private plans if those plans affect the outcome of the project. Completeness also includes consideration of real estate issues, operations and maintenance (O&M), monitoring, and sponsorship factors.
- *Effectiveness*: This is defined as the degree to which the plan will achieve the planning objective. The plan must make a significant contribution to the problem or opportunity being addressed.

- *Efficiency*: The project must be a cost-effective means of addressing the problem or opportunity. The plan outputs cannot be produced more cost-effectively by another institution or agency.
- *Acceptability*: A plan must be acceptable to Federal, state, and local government in terms of applicable laws, regulation, and public policy. The project should have evidence of broad-based public support and be acceptable to the non-Federal cost sharing partner.

These criteria may not be fully evaluated at the initial stages of plan formulation process but are fully evaluated for the final array of alternatives. There are also specific technical criteria related to engineering, economics, and the environment, which also are considered in evaluating alternatives. These are:

Engineering Criteria:

- The design of a safe, efficient, and reliable project that incorporates best engineering principles/practices in support of the Recommended Plan.

Economic Criteria:

- The Recommended Plan must contribute benefits to National Economic Development (NED).
- Tangible benefits of a Recommended Plan must exceed economic costs.
- Each separable unit of improvement must provide benefits at least equal to costs.

Environmental Criteria:

- The plan must fully comply with all relevant environmental laws, regulations, policies, and EO's.

Lastly, per the January 5, 2021 policy directive from Assistant Secretary of the Army for Civil Works, the study includes analysis of the total benefits for each plan within the final array of alternatives. This analysis is organized and presented under four established accounts: the NED account, the Regional Economic Development (RED) account, Environmental Quality (EQ) account, and the Other Social Effect (OSE) account.

4.4 Formulation of Measures and Alternatives

Alternatives are features, actions and/or activities that addresses the study problems and objectives, while avoiding constraints and taking advantage of opportunities. They are generally comprised of structural and nonstructural measures. In this study, structural measures and alternatives are physical features and modifications to the dam, spillway, intakes, and appurtenant facilities that address the future water supply needs of the region, such as a new reservoir or water intake. Nonstructural measures and alternatives are actions and activities that address future water supply needs without physical additions or modifications to the dam, spillway, intakes, and appurtenant facilities, such as the reallocation of water storage and water conservation.

4.4.1 Preliminary Measures

Potential measures were developed to address the increased need for water in the study area. The following structural and nonstructural measures were identified in coordination with the NFS:

- Additional groundwater wells (Structural): A well is a hole drilled into the ground to access water contained in an aquifer or fractured rock. A pipe and a pump are used to pull water out of the ground, and a screen filters out unwanted particles that could clog the pipe. Approximately 60 wells will be required to provide 4 MGD to the NFS. This measure can be accomplished without involvement of the Federal government.
- New water supply reservoir (Structural): This measure involves the NFS constructing a new reservoir creating a new source of water to meet demand without involvement of the Federal government. The cost of construction for this measure was based on the Falls Lake Reallocation Feasibility Study estimate for a similar type reservoir meeting a 4 MGD demand with cost escalated to 2022 price levels.
- New downstream intake structure (Structural): This measure involves the NFS constructing a new intake downstream from the dam to increase the volume of water taken from the river during scheduled releases without involvement of the Federal government. This measure can be accomplished by the NFS without involvement of the Federal government.
- Dredge lake (Structural): This measure involves the USACE removing wet material from the Philpott reservoir to increase its overall storage. The additional storage would then be passed onto the NFS to meet future demand. Wet materials taken from the lake would be placed in an environmentally acceptable disposal site. This measure may require a separate study under NEPA and/or permit under the CWA to accomplish.
- Raise dam height (Structural): This measure involves the USACE raising the existing Philpott Lake dam to increase overall storage volume of the project. The additional storage would then be passed onto the NFS to meet future demand. Adjustment to the spillway, intakes, and other appurtenant facilities may also be required. This measure may require a separate USACE study to accomplish.
- Inter-basin transfer (Structural): This measure involves the conveyance of water from one basin to another through the construction of pipes and pumping infrastructure. This measure can be accomplished by the NFS without involvement of the Federal government.
- New reservoir intake (Structural): This measure involves the NFS constructing a new intake above the dam and/or within the operational pool to allow for direct withdrawal from the lake. This measure may require a USACE separate study and supporting infrastructure (i.e., pipelines, utilities, treatment plants) from the NFS to accomplish.

- Off-line raw water storage (Structural): This measure involves the construction of 2 two million gallon raw water storage containers or 4 million gallons in all. This volume is far less than the volume needed to match a 4 MGD, which is estimated to be approximately 170 million gallons. The stored water would be pulled from the containers when the primary water source runs low due to drought, low rainfall or other causes. This measure can be accomplished by the NFS without involvement of the Federal government.
- Water conservation (Nonstructural): This measure involves the practice of using water efficiently to reduce unnecessary water usage. It is currently used by the NFS as an initial step in reducing overall demand for water supply. Examples of this measure include conservation pricing, leak detection and repair, plumbing and toilet retrofit programs, education programs, and multifamily submetering. and water recycling (e.g., car washes). This measure can be accomplished without involvement of the Federal government.
- Water reuse (Nonstructural): Commonly known as water recycling or water reclamation, this measure reclaims water from a variety of sources then treats and reuses it for beneficial purposes. It is currently used by the NFS as an initial step in reducing overall demand for water supply. Sources of water for potential reuse include municipal wastewater, industry process and cooling water, stormwater, agriculture runoff and return flows, and produced water from natural resource extraction activities. This measure can be accomplished without involvement of the Federal government.
- Flood storage reallocation (Nonstructural): This measure involves the USACE re-assigning existing water storage from the Philpott flood pool to water supply, which can then be used to meet the future needs. This measure requires raising the guide curve at Philpott Lake and a water supply agreement with the Federal government.
- Inactive storage reallocation (Nonstructural): This measure involves the USACE re-assigning existing water storage at Philpott Lake from the inactive pool to water supply. The additional supply is then used for future demand. This measure requires a water supply agreement with the Federal government.
- Conservation storage reallocation (Nonstructural): This measure involves the USACE re-assigning existing water storage at Philpott Lake from the conservation pool to water supply. The additional supply is then used for future demand. This measure requires a water supply agreement with the Federal government.
- Wholesale water purchase (Nonstructural): This measure involves the purchase of water supply from another utility. It can be accomplished by the NFS without involvement of the Federal government.
- Aquifer storage and recovery (Nonstructural): This measure involves pumping existing water into an aquifer for temporary storage. The water is then pulled from the aquifer and used when the primary water source runs low due to drought, low rainfall, or other causes. This measure can be accomplished by the NFS without involvement of the Federal government.

- Change existing dam operations (Nonstructural): This measure involves the USACE changing Philpott Lake project operations to increase overall water supply. There are no physical changes to the dam, spillway, intakes, or appurtenant facilities. This measure may require a separate USACE study to accomplish.
- Withdrawal from local rivers and streams (Nonstructural): This measure involves the NFS withdrawing surface water from another local river or stream within the basin. This measure can be accomplished by the NFS without involvement of the Federal government.
- Non-revenue water reduction (Nonstructural): This measure involves actions that reduces the loss of water before it reaches users. It is currently used by the NFS as an initial step in reducing overall demand for water supply. These losses include failures in existing infrastructure, theft, contamination, and/or meter inaccuracies. This measure can be accomplished by the NFS without involvement of the Federal government.

4.4.2 Evaluation of Measures

Each measure was formulated to deliver an equivalent amount of water supply (4 MGD). These measures were evaluated qualitatively against the study objective and other preliminary criteria, including effects on other project purposes, effectiveness, and efficiency (Table 4-1). The “Effect on Other Project Purposes” metric considers impacts to other authorized project purposes. The effectiveness criteria is the degree to which the measure will achieve the study objectives and be the most cost-effective. Existing information, perimetric cost estimates from previous studies, and best professional judgement was used to evaluate the cost efficiency criterion. The relative cost of each measure was developed based on existing information. Each measure was compared to each of the other measures and then assigned a favorable or unfavorable qualitative rating.

Generally, those measures that evaluated favorably across the criteria were carried forward for consideration as alternatives. An exception to this was the reallocation from the flood storage pool at Philpott Lake, which evaluated favorably across the criteria but was ultimately screened out due to Philpott Lake’s DSAC rating (Section 2.4). ER 1110-2-1156 states that a reallocation that would require raising the conservation pool is not permitted while a project is classified DSAC 1, 2, or 3. Additionally, the policy exception request to allow the reallocation study specifically stated that an alternative that impacted flood storage would not be pursued. Reallocating from flood storage pool would raise the normal operating pool at the project, thus increasing the overall dam safety risk. To avoid this increased risk, the alternative was screened out.

Evaluation of the measures determined that several required either changes to the project to increase capacity and water supply (dredging, raising dam height, new reservoir intake, operational changes), new methods of storage (aquifer storage and recovery), or new water supply from outside of the reservoir catchment (inter-basin transfer and withdrawal

from local streams). These measures were not carried forward. In addition, the offline storage measure was not developed to the equivalent 4 MGD yield of the other measures because of the extremely high cost required.

Table 4-1. Evaluation of Preliminary Measures Array.

Philpott Lake, VA Water Reallocation Study Measures Evaluation					
Measure	Meets Objective	Does Not Effect Other Project Purposes	Cost Efficient	Effectiveness	Carried Forward
Structural:					
Additional groundwater wells	Yes	Yes	No	Yes	Yes
New water supply reservoir	Yes	Yes	No	Yes	Yes
New downstream intake	Yes	Yes	No	Yes	Yes
Dredge lake	Yes	Yes	No	No	No
Raise dam height	Yes	No	No	No	No
Inter-basin transfer	Yes	Yes	No	No	No
New reservoir intake	Yes	Yes	No	Yes	No
Offline raw water storage	Yes	Yes	No	Yes	Yes
Nonstructural:					
Water conservation	Yes	Yes	Yes	Yes	Yes
Water reuse	Yes	Yes	Yes	Yes	Yes
Flood storage reallocation	Yes	No	Yes	Yes	No
Inactive storage reallocation	Yes	Yes	Yes	Yes	Yes
Conservation storage reallocation	Yes	Yes	Yes	Yes	Yes
Wholesale water purchase	Yes	Yes	No	Yes	Yes
Aquifer storage and recovery	Yes	Yes	No	No	No
Change existing dam operations	Yes	No	Yes	No	No
Withdrawal from local rivers and streams	Yes	Yes	No	No	No
Non-revenue water reduction	Yes	Yes	Yes	Yes	Yes

4.5 Preliminary Array of Alternatives and Evaluation

Eleven preliminary alternatives comprising of structural, nonstructural, and combined measures, were formulated for the study and designated as Alternatives 2-12. Four of these alternatives required Federal participation while the remaining seven could be accomplished by the NFS without Federal involvement (Table 4-2).

A “no action” alternative, designated as Alternative 1, was also developed to serve as baseline of comparison for the other alternatives. The no action alternative was generally defined as a continuation of the existing operations for Philpott Lake, including scheduled water releases from the dam.

In all, 12 preliminary alternatives were developed for this study. They include three structural alternatives (#’s: 4, 5 and 10), six nonstructural alternatives (#’s: 2, 3, 6, 7, 8, and

9), two alternatives with combined measures (#'s: 11 and 12), and the No Action Alternative (#1). Alternative 12 comprised of the measures of offline storage, wholesale water purchase, and additional groundwater wells, served as most likely, least costly alternative for comparative analysis.

Each preliminary alternative was evaluated qualitatively under four criteria: the study objective, implementability (or “physically constructable”), cost efficiency, and the time horizon of implementation (short-term = 3-5 years or long-term = 5-15 years).

Three of the measures carried forward by this analysis are currently used by the NFS as part of their best management practices: water conservation, water reuse, and non-revenue water reduction. However, two of these - water conservation and water reuse - were examined for increases in water to meet the NFS’s demand and formulated into preliminary alternatives (#6 and #7). Ultimately both were screened from the final array as it was determined that they could not meet the NFS’s water needs. It was also determined that additional analysis on sedimentation within inactive pool of the reservoir, outside of this study, would be required. Thus, Alternatives 3 and 9 were screened from the final array. Finally, Alternative 11 required additional investments to implement and was screened from the final array (see Table 4-2).

Table 4-2. Evaluation of Preliminary Array of Alternatives.

Philpott Lake, VA Water Reallocation Study Preliminary Alternatives Array Evaluation								
#	Alternative	Type of Alternative	Federal Action/ Non-Federal Action	Meets Objective	Implementable	Cost Efficient	Long-term (LT)/ Short-term (ST) Time Horizon	Carried Forward
1	No action	Not Applicable	Non-Federal	No	N/A	N/A	N/A	Yes
2	Conservation storage reallocation	Nonstructural	Federal	Yes	Yes	Yes	ST	Yes
3	Inactive storage reallocation	Nonstructural	Federal	No	Yes	Yes	ST	No
4	New water supply reservoir	Structural	Non-Federal	Yes	Yes	No	LT	Yes
5	Off-line raw water storage	Structural	Non-Federal	Yes	Yes	No	LT	Yes
6	Water conservation	Nonstructural	Non-Federal	No	Yes	Yes	ST	No
7	Water reuse	Nonstructural	Non-Federal	No	Yes	Yes	ST	No
8	Wholesale water purchase	Nonstructural	Non-Federal	Yes	Yes	Yes	ST	Yes
9	Conservation and inactive storage reallocation	Nonstructural	Federal	Yes	Yes	Yes	ST	No
10	Additional groundwater wells	Structural	Non-Federal	Yes	Yes	No	LT	Yes
11	New reservoir intake and conservation storage reallocation	Combined	Federal	Yes	Yes	No	LT	No
12	Off-line raw water storage, Wholesale water purchase, and Additional groundwater wells.	Combined	Non-Federal	Yes	Yes	Yes	LT	Yes

4.6 Final Array of Alternatives and Evaluation.

Seven preliminary alternatives were forwarded into the final array and evaluated. They included the no action alternative (#1), the conservation storage reallocation alternative (#2), the new watershed supply reservoir (#4), the off-line raw water storage alternative (#5), the wholesale water purchase alternative (#8), the additional groundwater wells alternative (#10), and the combined alternative (#12). Of these, only Alternative 2 would require federal participation. Each alternative was evaluated based on the study objective, the PGN Criteria, their overall cost and benefits (i.e., Comprehensive Benefits Analysis). They are presented in Tables 4-3, 4-4, 4-5, 4-6 and 4-7.

4.6.1 Study Objective and PGN Evaluation

Each alternative was initially screened based on the study objective. Consideration was also given as to how well each alternative measured against the four PGN general criteria. This evaluation is presented in Table 4-3.

The “no action” alternative (#1), as well as Alternatives 5, 8, and 10, did not meet the study objective, while Alternatives 2, 4 and 12 met the study objective. In terms of the four PGN criteria, all alternatives in the final array were evaluated as “Acceptable”, but only three alternatives were considered “complete” and “effective”. They included Alternate 2 – Conservation storage reallocation, Alternative 4 – New water supply reservoir, and Alternative 12 – the combined plan. Finally, Alternative 2 was identified as the most cost-effective alternative and thus considered to be most “efficient” within the final array.

Table 4-3. Comparison of Final Alternatives Array to Study Objective and PGN Criteria.

Philpott Lake, VA Water Reallocation Study Final Alternatives Array Evaluation							
Criteria:	Alternative 1: No Action	Alternative 2: Conservation Storage Reallocation	Alternative 4: New Water Supply Reservoir	Alternative 5: Raw Water Offline Storage	Alternative 8: Wholesale Water Purchase	Alternative 10: Additional Ground Water Wells	Alternative 12: Combined Plan
Study Objective:	Alternative does not meet the study objective.	Alternative meets the study objective.	Alternative meets the study objective.	Alternative does not meet the study objective.	Alternative does not meet the study objective.	Alternative does not meet the study objective.	Alternative meets the study objective.
Acceptability:	Alternative is acceptable in regards to Federal laws, regulations, and guidelines.	Alternative is acceptable in regards to Federal laws, regulations, and guidelines.	Alternative is acceptable in regards to Federal laws, regulations, and guidelines.	Alternative is acceptable in regards to Federal laws, regulations, and guidelines.	Alternative is acceptable in regards to Federal laws, regulations, and guidelines.	Alternative is acceptable in regards to Federal laws, regulations, and guidelines.	Alternative is acceptable in regards to Federal laws, regulations, and guidelines.
Completeness:	Alternative is not a complete solution to the problem.	Alternative is a complete solution to the problem.	Alternative is a complete solution to the problem.	Alternative is not a complete solution to the problem.	Alternative is not a complete solution to the problem.	Alternative is not a complete solution to the problem.	Alternative is a complete solution to the problem.
Effectiveness:	Alternative is not an effective solution to the problem.	Alternative is an effective solution to the problem.	Alternative is an effective solution to the problem.	Alternative is not an effective solution to the problem.	Alternative is not an effective solution to the problem.	Alternative is not an effective solution to the problem.	Alternative is an effective solution to the problem.
Efficiency:	Alternative is an inefficient solution to the problem.	Alternative is an efficient solution to the problem.	Alternative is an inefficient solution to the problem.	Alternative is an inefficient solution to the problem.	Alternative is an inefficient solution to the problem.	Alternative is an inefficient solution to the problem.	Alternative is an inefficient solution to the problem.

4.6.2 Cost Evaluation

A Class 5 Civil Works cost estimate was prepared of all the alternatives in the final array (Table 4-4). According to ER 1110-2-1302, *Civil Works and Cost Engineering* a Class 5 cost estimate, commonly referred to as “Rough Order of Magnitude (ROM)” estimate, is based on limited information and possesses considerable risk and uncertainty, resulting in high contingencies. There is great reliance on broad-based assumptions, costs from comparable projects and data, cost book, cost engineering judgment and parametric cost data. Development may consist of lump sum costs.

Alternative 4, a new water supply reservoir, was the costliest alternative within the final array at \$766M but would not require participation from the Federal government. Alternative 12, the most likely and least costly alternative to meet the NFS’s water needs without reallocation, was the second costliest alternative within the final array at \$246M and would not require participation from the Federal government. Alternative 2, conservation storage reallocation, was the least costly alternative within the final array and would require participation from the Federal government. Alternative 2’s cost was determined based on the cost of implementation with an updated Civil Works Construction Cost Index System (CWCCIS) factor. That updated cost of storage was then multiplied by the percent of total usable storage to determine the cost of storage recommendation which was a total of \$9.0M. The cost of the Alternative 12 (\$246M) was far greater than the cost of Alternative 2 (\$61M). (see Table 4-4).

Note: For additional information on the derivation of the cost of storage see Section 6.4.

Table 4-4. Comparison of Final Alternatives Array and Cost.

Philpott Lake, VA Water Reallocation Study Final Alternatives Array Evaluation							
#	Alternative	Type of Alternative	Federal Action/Non- Federal Action	Meets Objective	Additional Sufficient Supply	Effects On Other Project Purposes	Cost
1	No action	Not Applicable	Non-Federal	No	No	No	\$0
2	Conservation storage reallocation	Nonstructural	Federal	Yes	Yes	No	\$61m
4	New water supply reservoir	Structural	Non-Federal	Yes	Yes	No	\$766m
5	Off-line raw water storage	Structural	Non-Federal	Yes	No	Yes	\$90m
8	Wholesale water purchase	Nonstructural	Non-Federal	Yes	No	No	\$64m
10	Additional groundwater wells	Structural	Non-Federal	Yes	No	No	\$92m
12	Water storage, Water purchase, Wells and NRW reduction	Combined	Non-Federal	Yes	Yes	No	\$246m

4.6.3 Comprehensive Benefits Evaluation

A System of Accounts was used to compare the alternatives and identify a Comprehensive Benefits Plan per the 5 January 2021 policy directive from Assistant Secretary of the Army for Civil Works. The four accounts used in this analysis are defined by the Principles and Guidelines (para. 1.6.2(c)) as the following:

- *National Economic Development (NED) account.* NED calculations include both financial costs to implement, maintain, and operate each alternative, and forgone economic benefits of implementing an alternative. NED financial costs include project capital cost, such as real estate and operations, maintenance, repair, rehabilitations and replacement (OMRR&R) costs. Forgone benefits for the study consist of hydropower, flood risk management, and recreation benefits.
- *Regional Economic Development (RED) account.* RED addresses economic benefits important at a regional level: State, counties, and communities in the broad study area. Items in this account relate to economic activities such as employment and income. Unquantified RED benefits would also include benefits to the region due to an ensured water supply for additional population inflow and support for water-related development.
- *Environmental Quality (EQ) account.* EQ is an assessment of favorable or unfavorable changes in the ecological, aesthetic and cultural or natural resources. This review is being conducted with the participation of agencies, local governments, and stakeholders through an on-going and engaging series of scoping meetings, public input meetings, agency and stakeholder meetings, and State and Agency reviews.
- *Other Social Effects (OSE) account.* OSE considers the effects of alternative plans in areas that are not already contained in the NED and RED accounts. The categories of effects contained within the OSE account include: urban and community impacts; displacement; long-term productivity, energy requirements and energy conservation; and public health and safety.

The comprehensive benefits analysis centered on relevant economic, environmental and social factors in the region that may be effected by the implementation of a project. These factors were identified by the USACE, the NFS, government resource agencies, and statistical research on region. The factors were then organized into one of the above accounts and evaluated quantitatively for the NED account and qualitatively for the EQ, OSE, and RED accounts. Tables 4-5 through 4-7 present the results of this evaluation.

In addition, the following observations were noted during the analysis:

- 1) The NED water supply benefit is calculated based on the substitution method using the cost for the next most-likely/least costly alternative in the final array which is the cost of Alternative 12. Thus, the estimated NED benefit for the study is \$246 million (see Table 4-4).

- 2) HCPSA is rural and has a median household income of \$38,511 with approximately 12.9% of the population living below the poverty line. In comparison, the median household income for the state is approximately \$76,000.

Alternative 2 is the least cost alternative within the array and considered to be the best plan to provide the greatest economic benefits, locally and regionally, under the NED and RED accounts.

The alternatives array was evaluated qualitatively as to their environmental impact across eight different categories for the EQ account: cultural resources, air quality, water quality, noise levels, aesthetics, flooding, wetlands and threatened and endangered species. The evaluation categories focused on the magnitude of impact within these categories, using existing information, field assessment, government agency input and professional opinion. Generally, alternatives that had the least impact were favored for this account. Results indicated that Alternatives 1, 2, 8 and 12 evaluated favorably for the EQ account.

Lastly, the alternatives array was evaluated qualitatively as to their social impacts across six different categories for the OSE account: security of life, health and safety, social bonds, community cohesion, resiliency, community growth and property values. The evaluation categories focused on the magnitude of impact within these categories, using existing information, field assessment, government agency input and professional opinion. Generally, alternatives that maintained or improved the conditions across these social factors were favored for this account. Results indicated that Alternatives 2, 4, 5, 8, 10 and 12 evaluated favorably for the OSE account.

When comparing these results, Alternative 2 – a conservation storage reallocation – is the strongest plan within the array across the four accounts, and thus was identified as the comprehensive benefits plan for this study.

Table 4-5. Comprehensive Benefits Analysis of Final Alternatives Array, NED and RED Accounts.

Philpott Lake, VA Water Reallocation Study Final Alternatives Array Evaluation							
Criteria:	Alternative 1: No Action	Alternative 2: Conservation Storage Reallocation	Alternative 4: New Water Supply Reservoir	Alternative 5: Raw Water Offline Storage	Alternative 8: Wholesale Water Purchase	Alternative 10: Additional Ground Water Wells	Alternative 12: Combined Plan
NED Criteria:							
Cost	\$0	\$61,009,000	\$765,960,000	\$90,017,000	\$64,305,000	\$91,757,000	\$246,079,000
Annualized Cost	N/A	\$2,151,000	\$27,006,000	\$3,174,000	\$2,267,000	\$3,235,000	\$8,676,000
Total Annual Hydropower Benefits	\$2,250,842	\$2,246,976	\$2,250,842	\$2,250,842	\$2,250,842	\$2,250,842	\$2,250,842
Annualized Hydropower Benefits Forgone	\$0	(-\$3,866)	\$0	\$0	\$0	\$0	\$0
Recreation Benefits/Loss	N/A	No effect.	No effect.	No effect.	No effect.	No effect.	No effect.
Total Average Annual Cost	\$0	\$2,155,000	\$27,006,000	\$3,174,000	\$2,267,000	\$3,235,000	\$8,676,000
RED Criteria:							
Regional Cost	\$0	No effect.	No effect.	No effect.	No effect.	No effect.	\$0
Regional Benefits	\$0	No effect.	No effect.	No effect.	No effect.	No effect.	\$0

Note: This table is using the FY 2023 price level with a federal discount rate of 2.5% (FY2023). A 50-year period of analysis was used for annualized estimates. O&M and R&RR estimates were calculated for the reallocation alternative, however, due to the disparity in magnitude of cost of non-federal alternatives. Annual NED Costs were rounded. Annual economic user cost (additional pumps to expand from 6.0 MGD to 10.0 MGD) was included in Alternative 2's annualized cost.

Table 4-6. Comprehensive Benefits Analysis of Final Alternatives Array, EQ Account.

<p align="center">Philpott Lake, VA Water Reallocation Study Final Alternatives Array Evaluation</p>							
Criteria:	Alternative 1: No Action	Alternative 2: Conservation Storage Reallocation	Alternative 4: New Water Supply Reservoir	Alternative 5: Raw Water Offline Storage	Alternative 8: Wholesale Water Purchase	Alternative 10: Additional Ground Water Wells	Alternative 12: Combined Plan
EQ Criteria:							
Cultural Resources	This alternative is not expected to result in an effect to NRHP properties.	This alternative is not expected to result in an effect to NRHP properties.	This alternative could result in an adverse effect to NRHP properties.	This alternative could result in an adverse effect to NRHP properties.	This alternative is not expected to result in an effect to NRHP properties.	This alternative could result in an adverse effect to NRHP properties.	This alternative could result in an adverse effect to NRHP properties.
Air Quality	No changes in air quality from this alternative	No changes in air quality from this alternative	No changes in air quality from this alternative	No changes in air quality from this alternative	No changes in air quality from this alternative	No changes in air quality from this alternative	No changes in air quality from this alternative
Water Quality	No changes in water quality from this alternative.	No changes in water quality from this alternative.	No changes in water quality from this alternative.	No changes in water quality from this alternative.	No changes in water quality from this alternative.	No changes in water quality from this alternative.	No changes in water quality from this alternative.
Noise Levels	There will be no changes in noise levels from this alternative.	There will be no changes in noise levels from this alternative.	Noise levels will increase as a result of the construction and increased visitation.	Noise levels will be a temporarily increase as a result of the construction and placement of this alternative.	There will be no changes in noise levels from this alternative.	Noise levels will be a temporary increase as a result of this alternative.	There will be no changes in noise levels from this alternative.
Aesthetics	There will be no changes in aesthetics from this alternative.	There will be no changes in aesthetics from this alternative.	This alternative would significantly change the aesthetics in the area.	There will be no changes in aesthetics from this alternative.	There will be no changes in aesthetics from this alternative.	There will be no changes in aesthetics from this alternative.	There will be no changes in aesthetics from this alternative.
Flooding	There will be no changes in flooding from this alternative.	There will be no changes in flooding from this alternative.	This alternative could change flooding in the area.	There will be no changes in flooding from this alternative.	There will be no changes in flooding from this alternative.	There will be no changes in flooding from this alternative.	There will be no changes in flooding from this alternative.
Wetlands	There will be no changes in wetlands from this alternative.	There will be no changes in wetlands from this alternative.	There will be no changes in wetlands from this alternative.	There will be no changes in wetlands from this alternative.	There will be no changes in wetlands from this alternative.	There will be no changes in wetlands from this alternative.	There will be no changes in wetlands from this alternative.
Threatened and Endangered Species	This alternative will have no significant impact to threatened and endangered species.	This alternative will have no significant impact to threatened and endangered species.	This alternative could have a significant impact to threatened and endangered species.	This alternative will have no significant impact to threatened and endangered species.	This alternative will have no significant impact to threatened and endangered species.	This alternative will have no significant impact to threatened and endangered species.	This alternative will have no significant impact to threatened and endangered species.

Table 4-7. Comprehensive Benefits Analysis of Final Alternatives Array, OSE Account.

Philpott Lake, VA Water Reallocation Study Final Alternatives Array Evaluation							
Criteria:	Alternative 1: No Action	Alternative 2: Conservation Storage Reallocation	Alternative 4: New Water Supply Reservoir	Alternative 5: Raw Water Offline Storage	Alternative 8: Wholesale Water Purchase	Alternative 10: Additional Ground Water Wells	Alternative 12: Combined Plan
OSE Criteria:							
Security of Life, Health and Safety	This alternative will decrease this factor during times of reduced water supply.	This alternative will increase this factor during times of reduced water supply.	This alternative will increase this factor during times of reduced water supply.	This alternative will modestly and temporarily increase this factor during times of reduced water supply.	This alternative will modestly and temporarily increase this factor during times of reduced water supply.	This alternative will modestly and temporarily increase this factor during times of reduced water supply.	This alternative will increase this factor during times of reduced water supply.
Social Bonds/Connections	This alternative will diminish this factor in times of reduced water supply.	This alternative will improve this factor in times of reduced water supply.	This alternative will improve this factor in times of reduced water supply.	This alternative will modestly improve this factor in times of reduced water supply.	This alternative will modestly improve this factor in times of reduced water supply.	This alternative will modestly improve this factor in times of reduced water supply.	This alternative will diminish this factor in times of reduced water supply.
Community Cohesion	This alternative will diminish this factor in times of reduced water supply.	This alternative will improve this factor in times of reduced water supply.	This alternative will improve this factor in times of reduced water supply.	This alternative will modestly improve this factor in times of reduced water supply.	This alternative will modestly improve this factor in times of reduced water supply.	This alternative will modestly improve this factor in times of reduced water supply.	This alternative will diminish this factor in times of reduced water supply.
Resiliency	This alternative decreases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative maintains this factor in times of reduced water supply.	This alternative maintains this factor in times of reduced water supply.	This alternative maintains this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.
Community Growth/Economic Vitality	This alternative slows this factor in times of reduced water supply.	This alternative maintains this factor in times of reduced water supply.	This alternative maintains this factor in times of reduced water supply.	This alternative slows this factor in times of reduced water supply.	This alternative slows this factor in times of reduced water supply.	This alternative slows this factor in times of reduced water supply.	This alternative maintains this factor in times of reduced water supply.
Property Values	This alternative decreases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative maintains this factor in times of reduced water supply.	This alternative maintains this factor in times of reduced water supply.	This alternative maintains this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.

Table 4-7.Comprehensive Benefits Analysis of Final Alternatives Array, OSE Account continued.

Philpott Lake, VA Water Reallocation Study Final Alternatives Array Evaluation							
Criteria:	Alternative 1: No Action	Alternative 2: Conservation Storage Reallocation	Alternative 4: New Water Supply Reservoir	Alternative 5: Raw Water Offline Storage	Alternative 8: Wholesale Water Purchase	Alternative 10: Additional Ground Water Wells	Alternative 12: Combined Plan
Public Services	This alternative decreases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative maintains this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.
Improvement to Median Household Income (2020)(\$38,511 vs. median for U.S. - \$76,398 – 50% of U.S. median)	This alternative decreases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative slightly decreases this factor in times of reduced water supply.	This alternative slightly decreases this factor in times of reduced water supply.	This alternative slightly decreases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.
Improvement to per Capita Income (2020)(\$23,051 vs. \$41,255 U.S. – 55% of U.S. per capita)	This alternative decreases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative slightly decreases this factor in times of reduced water supply.	This alternative slightly decreases this factor in times of reduced water supply.	This alternative slightly decreases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.
Improvement to Persons in Poverty (2020 – 12.9%)	This alternative decreases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative slightly decreases this factor in times of reduced water supply.	This alternative slightly decreases this factor in times of reduced water supply.	This alternative slightly decreases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.
Risks to known Environmental Justice Populations	This alternative increases this factor in times of reduced water supply.	This alternative decreases this factor in times of reduced water supply.	This alternative decreases this factor in times of reduced water supply.	This alternative modestly decreases this factor in times of reduced water supply.	This alternative modestly decreases this factor in times of reduced water supply.	This alternative modestly decreases this factor in times of reduced water supply.	This alternative decreases this factor in times of reduced water supply.

5 RECOMMENDED PLAN

Alternative 2 is the Recommended Plan for this study. It is a nonstructural plan that will reallocate 5,200 ac-ft from the conservation storage pool at Philpott Lake to water supply with cooperation from the Federal Government (Figure 5-1). To do this, the USACE will increase the output or releases from the station service hydropower unit which will then feed HCPSA's existing downstream water intake. During times when the station service unit is unavailable, water supply releases will be maintained through low flow valves in the dam that have comparable discharge capacity.

Since the reallocation is being made from the conservation pool, there will be no impacts to flood risk management. However, there will be a small impact to hydropower generation, since the conservation pool at Philpott Lake is currently dedicated to power production. Based on the Hydropower Analysis, the average annual hydropower value losses are currently estimated to be 0.17% or \$3,866. (See Appendix D).

The degree of operational changes and hydropower impacts do not fundamentally depart from what Congress intended when it authorized Philpott Lake. As such, congressional authorization would not be needed for the Recommended Plan.

With the Recommended Plan the annual minimum lake elevations decrease by an average of 0.78 feet, with no changes in the recurrence interval for lake levels dropping below the minimum conservation pool (for more information see Appendix B). In addition, no adverse downstream flow impacts are expected. Between the dam and HCPSA's water withdrawal flows are expected to be slightly higher (6 cfs) and flows at Bassett (downstream of HCPSA intake) are expected to remain the same, meeting the minimum flow target at Bassett (see Appendix B).

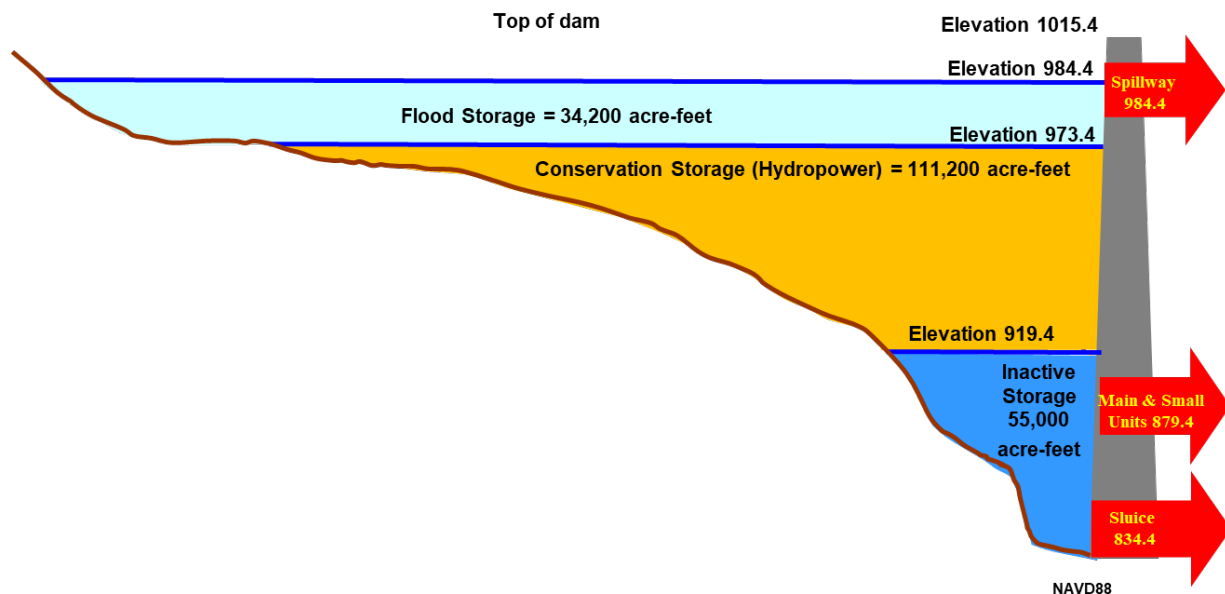


Figure 5-1 Proposed Storage Reallocation.

5.1 Environmental Justice Assessment

Per the Implementation Guidance dated 15 March 2022 from the the Assistant Secretary of the Army for Civil Works on Environmental Justice and the Justice 40 initiative, “. . .USACE shall work to meet the needs of disadvantaged communities by reducing disparate environmental burdens, removing barriers to participation in decision-making, and increasing access to benefits provided by Civil Works programs to disadvantaged communities within USACE authorities.”

In general, USACE Civil Works program focuses Environmental Justice activities in three broad areas: 1) improving outreach and access to USACE Civil Works information and resources; 2) improving access to USACE Civil Works technical service programs (e.g., Planning Assistance to States and Floodplain Management Services programs) and maximizing the reach of Civil Works projects to benefit the disadvantaged communities, in particular as it relates to climate resiliency; and, 3) ensuring any updates to USACE Civil Works policies and guidance will not result in a disproportionate impact on disadvantaged communities.

Executive Order 12898 (dated February 11, 1994) mandates that “each federal agency shall make achieving Environmental Justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.”

The Council on Environmental Quality (CEQ) oversees the Federal government’s compliance with EO 12898. The following definitions are used by the CEQ regarding these communities:

- Low-income population: Low-income populations in an affected area should be identified with the annual statistical poverty thresholds from the Bureau of the Census’ Current Population Reports, Series P-60 on Income and Poverty. In identifying low income populations, agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect.
- Minority: Individual(s) who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic.
- Minority population: Minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis. In identifying minority communities, agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a geographically dispersed/transient set of individuals (such as migrant workers or Native American), where either type of group experiences common conditions of environmental exposure or effect. The selection of the appropriate unit

- of geographic analysis may be a governing body's jurisdiction, a neighborhood, census tract, or other similar unit that is to be chosen so as not to artificially dilute or inflate the affected minority population. A minority population also exists if there is more than one minority group present and the minority percentage, as calculated by aggregating all minority persons, meets one of the above-stated thresholds.
- Disproportionately high and adverse human health effects: When determining whether human health effects are disproportionately high and adverse, agencies are to consider the following three factors to the extent practicable:
 - Whether the health effects, which may be measured in risks and rates, are significant, or above generally accepted norms. Adverse health effects may include bodily impairment, infirmity, illness, or death.
 - Whether the risk or rate of hazard exposure by a minority population, low-income population, or Indian tribe to an environmental hazard is significant (as employed by NEPA) and appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group.
 - Whether health effects occur in a minority population, low-income population, or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards.
 - Disproportionally high and adverse environmental effects: When determining whether environmental effects are disproportionately high and adverse, agencies are to consider the following three factors to the extent practicable:
 - Whether there is or will be an impact on the natural or physical environment that significantly (as employed by NEPA) and adversely affects a minority population, low-income population, or Indian tribe. Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment.
 - Whether environmental effects are significant (as employed by NEPA) and are or may be having an adverse impact on minority populations, low-income populations, or Indian tribes that appreciably exceeds or is likely to appreciably exceed those on the general population or other appropriate comparison group.
 - Whether the environmental effects occur or would occur in a minority population, low-income population, or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards.

USACE examined the potential effect of the Recommended Plan to the above communities using U.S Census Bureau data (<https://www.census.gov/data>), CEQ's Climate & Economic Justice Screening Tool. (<https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5>) and EPA's Environmental Justice Screening and Mapping Tool (<https://www.epa.gov/ejscreen>). For purposes of the assessment the area of effect is the area which is served by HCPSA (Figure 5-2).

Approximately 70 to 80 percent of the region's households are less than or equal to twice the Federal "poverty level". HCPSA services several rural counties in south-central Virginia with a current median household income of \$23,051. Approximately 12.9% of Henry County lives below the poverty line. By comparison, the median household income for the state of Virginia is approximately \$59,225. Thus it is anticipated reliable, low-cost water will have a positive impact to the quality of life for low-income populations serviced by HCPSA.

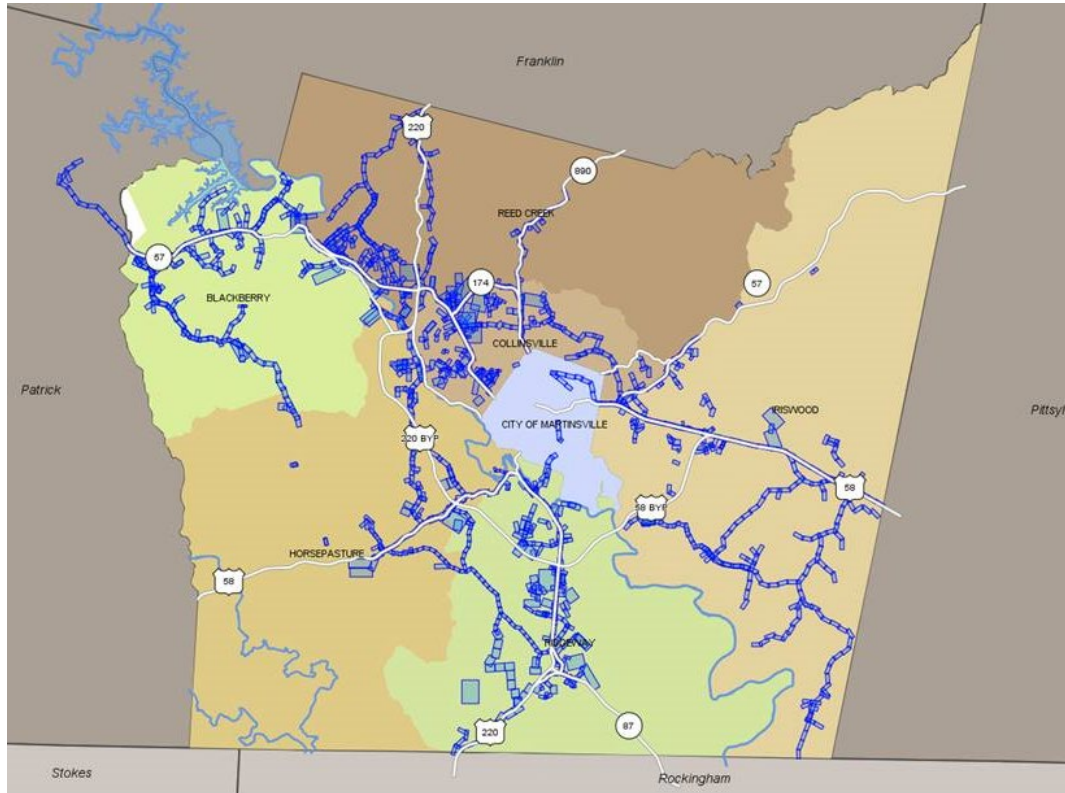


Figure 5-2. HCPSA Service Area.

5.2 Reduced Cost of Water Supply Storage

According to the April 25, 2022 "Implementation Guidance for Section 350 of the WRDA 2020", regional water systems that serve a population under 100,000 and with a per capita income of less than 50 percent of counties in the United States are eligible for a reduction in the cost of water storage up to 3 MGD.

Information on the population served by HCPSA, and the per capita personal income of users in Henry County were examined from the U.S. Census Bureau. This information was then used to determine HCPSA's eligibility under Section 350.

The population of Henry County, without the city of Martinsville, is 51,032. The HCPSA's service area is approximately 392 square miles with approximately 12,500 water connections (see Figure 5-2). By multiplying the number of HCPSA connections with the

average number of people per household from the US Census Bureau (i.e., 2.4), the estimated population served by HCPSA is 30,000.

The most recent approved Economic Guidance Memorandum uses 2015-2017 data to determine the Current Eligibility Factor Formula (Ability to Pay). The three-year average median per capita personal income for the United States between 2015-2017 is \$39,171, while the three-year average per capita personal income for Henry County, Virginia, plus the city of Martinsville, is \$36,800 which is less than the United States. Based on this information, HCPSA is eligible for a reduction in the cost of water supply storage from Philpott Lake.

5.3 Risk and Uncertainty

The Recommended Plan possesses some risk and uncertainty. Low risks identified for this study include a greater demand for water in service area over the period of analysis, sedimentation decreases the available storage in conservation pool, and a slower filling of the conservation pool due to reduced inflows. These risks will be tolerated going forward into implementation. Uncertainty on the future water needs for the NFS within the period of analysis is a medium risk. Management strategies consist of communication with the NFS into implementation. Lastly a lack of sufficient funds to match the cost-share requirements of the recommended plan is a high risk identified by the NFS. Approval of a request under Section 350 of the WRDA 2020 to the reduce the cost of water supply storage from Philpott Lake will reduce this risk significantly.

Table 5-1. Henry County, Virginia Per Capita Personal Income, 2015-2017.

	Median Per Capita Personal Income¹			
	Dollars			
	2015	2016	2017	2015-2017 3-Year Average
US Median Data per Capita Personal Income	\$38,500	\$38,904	\$39,986	\$39,171
Henry+Martinsville	\$35,976	\$36,598	\$37,827	\$36,800

6 DERIVATION OF USER COST

The Recommended Plan reallocates water supply from the conservation storage at Philpott Dam to meet the estimated immediate need of 2 MGD plus a future need of 2 MGD for a total of 4 MGD for the HCPSA. In addition to determining user cost, USACE must ensure that the reallocation of Federal storage to water supply is the most economical alternative compared to other sources of water (including the Next Least Costly Alternative), which is discussed in Section 4.6. Reallocated storage to water supply can be repaid over a period not to exceed 30 years. Details of annual storage costs are discussed in Section 6.5.

USACE's ER 1105-2-100 specifies the four pricing methods used to calculate the value of storage considered for reallocation (*i.e.*, the price to be charged for the capital investment for reallocated storage). They include benefits foregone, revenues foregone, replacement cost, and updated cost of storage. The value placed on the storage is the highest of the four methods.

- **Benefits Foregone.** Benefits foregone are generally estimated using the standard National Economic Development (NED) evaluation criteria in compliance with ER-1105-2-100. The benefits foregone are evaluated over a 50-year period of analysis.
- **Revenues Foregone.** Hydropower revenues foregone are defined as the reduction in revenues accruing to the Treasury as a result of reallocating storage from hydropower to water supply. The revenues are based on the existing repayment agreement between the power marketing agency and the USACE. Revenues foregone from other project purposes are the reduction in revenues accruing to the U.S. Treasury based on existing repayment agreements.
- **Replacement Cost.** Notwithstanding unforeseen circumstances, replacement costs are equal to benefits foregone. In the event that reallocated storage is being taken from the flood control pool, the USACE will estimate the replacement cost of equivalent protection if necessary.
- **Updated Cost of Storage.** The updated cost of reallocated storage is estimated by updating the final cost of the joint use features escalated from the midpoint of construction to the fiscal year in which the reallocation of storage is approved. The updated final cost of the joint use features is then multiplied by the proportion of usable storage that is the reallocated to estimate the value of reallocated storage.

6.1 Hydropower Benefits Foregone

Philpott hydropower plant has three units for a combined Output of 15 megawatts (MW), two main units and a small station service unit. Electrical power generated at Philpott hydropower plants is dispatched by Dominion Power and transmitted by Appalachian Power to customers of power from Philpott. Power from Philpott is marketed to customers under contract with Southeastern Power Administration of the US Department of Energy.

Water flow operations through the power plant for the period of record (1960-2019) is made using HEC-RESSIM, a sequential streamflow model to simulate daily Philpott Lake operations under alternative operations for water supply.

Simulated generation dispatch was developed from plan operations data available for 2010-2014. Daily averages were converted to ratios of weekly power flow for each month which were applied to weekly power plan flow volumes from HEC-RESSIM model output. Daily power was then computed and validated using the available plant operations data.

Table 6-1 summarizes the Annual Hydropower Benefits Foregone.

Table 6-1. Estimated Annual Hydropower Benefits Under Base Case and Recommended Plan Scenarios.

	Annual Energy Benefits (foregone)				Annual Capacity Benefits (foregone)				Total Annual Hydropower Benefits (foregone)	
	MWh	Δ (MWh)	2023\$	Δ (\$)	MW	Δ (MW)	2023\$	Δ (\$)	2023\$	Δ (\$)
Base Case	22,770	n/a	\$745,608	n/a	14.85	n/a	\$1,505,234	n/a	\$2,250,842	n/a
Reallocation from Cons. Pool	22,786	16	\$746,761	\$1,153	14.80	-0.05	\$1,500,215	(\$5,019)	\$2,256,253	(\$3,866)

6.2 Revenues Foregone

“Revenues foregone to hydropower are the reduction in revenues accruing to the U.S. Treasury as a result of the reduction in hydropower outputs based on the existing rates charged by the power marketing agency.”

“The USACE does not market the power it produces; marketing is done by the Federal power marketing agencies (Southeastern Power Administration (SEPA), Southwestern Power Administration, Western Area Power Administration, Bonneville Power Administration, Alaska Power Administration) through the Secretary of Energy. The rates are set by the marketing agency to: (a) recover costs (producing and transmitting) over a reasonable period of years (50 years usually); and (b) encourage widespread use at the lowest possible rates to consumers, consistent with sound business principles. ...”

Revenue foregone is to be based on the current SEPA contract Rates applicable to power generation by the Ker-Philpott plants. The current rates are:

Energy Rate Total: \$17.80/MWh

Monthly Capacity Charge: \$4.40/kW-month (\$52,800/MW-year)

To compute energy revenues foregone, the contract energy rate is applied to the average annual contract energy foregone, and the capacity charge is applied to foregone dependable capacity. Table 6-2 below shows the Power Revenue Foregone for the Recommended Plan.

Table 6-2. Annual Revenue Summary Across Base Case and Recommended Plan Scenarios.

Alternative	Energy (MWh)	SEPA Energy Rate (\$/MWh)	Dependable Capacity (MW)	SEPA Capacity Rate (\$/MW-year)	Revenue (\$)	Revenue (foregone) (\$)	
Base Case	22,770	\$17.80	14.847	\$52,800	\$1,189,246	---	
Reallocation from Conservation Pool	22,786	\$17.80	14.798	\$52,800	\$1,186,919	(\$2,327)	-0.20%

6.3 Replacement Cost

No replacement cost was calculated for flood risk management and recreation as no serious effects were identified. The replacement costs of power are equivalent to the hydropower benefits forgone.

6.4 Updated Cost of Storage

The cost allocated to the user under this pricing method updates the joint-use portion of the first costs of reservoir construction to present day price levels and then assigns a percentage of the costs based on the “Use of Facilities” (UOF) cost allocation procedure. See Table 6-3 below. Costs are updated from “as built” costs in 1950 (the mid-point of construction) to 1967 prices by use of the Engineering News Record (ENR) Construction Cost Index, and then from 1967 to current prices by use of the USACE’s CWCCIS. Land values are updated by the weighted average update of all other project features. Costs are indexed from the midpoint of the physical construction period to the beginning of the fiscal Year (FY) in which the contract for final project cost of reallocated storage is expected to be approved (FY2023). Joint-use costs exclude infrastructure costs allocated to specific project purposes such as recreation facilities, hydropower turbines, etc.

Construction is considered as having been initiated at the start of the month when lands for the project were first acquired or on the date when the first construction contract was

awarded whichever was earlier. Construction is considered as having been completed at the end of the government FY in which final deliberated impoundment of the reservoir point was initiated.

The USACE policy on pricing storage reallocated from one authorized project purpose to another is based on the UOF methodology. UOF methodology allocates joint-use costs (costs that cannot be specifically allocated to a specific project purpose) based on overall percentage of storage reallocated. For example, if 15 percent of the usable storage is reallocated, then the reallocated storage is apportioned 15 percent of the joint-use costs. The cost of reallocated storage changes each government FY. This is due to the fact that the Federal discount rate changes on an annual basis as well as varying annual OMRR&R costs. Section 932 of the 1986 WRDA requires recalculation of the interest rate at 5-year intervals if the storage is paid annually over a 30-year period.

6.5 Potential Costs for Repair, Rehabilitation and Replacement (RR&R)

Potential costs for RR&R were calculated based on existing deficiencies and recommendations noted in the most recent dam safety Periodic Inspection report. Recommendations and expenses associated with electrical infrastructure are not included in the total estimated RR&R cost as the sponsor is not expected to share in these costs. The RR&R costs are estimated to cover a 50-year time period, starting in calendar year 2023. The estimated annual RR&R costs to the NFS is \$30,814, see Table 6-3 below shows the User's Cost for reallocation of 5,200 ac-ft from the conservation pool.

Cat.	Feature Cost from the Allocated Cost Report	1950 ENR Index Value	1967 ENR Index	ENR Ratio	1967 CWCCIS Index Base 100	Updated Joint-Use as of 1967	Jan 2023 CWCCIS Index	Update Factor	FY 2023 Joint Costs
Lands and Damages	492,000	510	1074	2.11	100	1,036,000	1,233.81	12.36	12,807,000
Relocations	668,000	510	1074	2.11	100	1,407,000	1,245.37	12.45	17,522,000
Dam	7,993,000	510	1074	2.11	100	16,832,000	1,176.97	11.77	198,108,000
Roads, Railroads & Bridges	375,000	510	1074	2.11	100	790,000	1,245.37	12.45	9,838,000
Reservoirs	416,000	510	1074	2.11	100	876,000	1,252.96	12.53	10,976,000
Buildings, Grounds & Utilities	99,000	510	1074	2.11	100	208,000	1,248.38	12.48	2,597,000

Permanent Operation Equipment	73,000	510	1074	2.11	100	154,000	1,248.38	12.48	1,923,000
Total	10,116,000								253,771,000
Specific Costs Water Supply Conduit	Intakes already present								

Table 6-3 Updated Joint Costs.

7 TEST OF FINANCIAL FEASIBILITY

As a test of financial feasibility, the annual cost of the reallocated storage for Alternative 2 was compared to the annual cost of the most likely, least costly alternative that would provide an equivalent quality and quantity of water without reallocation: Alternative 12. The period of analysis for this test is 50 years: 2023-2072.

NED costs include both financial costs to implement, maintain, and operate each alternative, and forgone economic benefits of implementing an alternative. NED financial costs include project capital costs including real estate, and OMRR&R costs. NED costs used in comparing final alternatives are based on FY 2023 price levels and the FY 23 interest rate (2.5%).

Alternative 12 combined the measures of offline storage, wholesale water purchase, and additional groundwater wells, and would generate an equivalent amount of water in terms of both quality and quantity for the NFS's needs without reallocation. There was no annual OMRR&R for Alternative 12. As shown in Table 7-1, the annualized cost of Alternative 2 is significantly less than the annualized cost of Alternative 12.

The difference in annual cost between Alternatives 2* and 12 is \$8,676,000 divided by \$2,241,000 (added in OMRR&R annual cost of \$85,038) producing a BCR of 3.9 to 1 showing a strong positive test of financial feasibility of the selected alternative (2) above the next least costly alternative (12). The net annual benefits of the alternatives would be \$8,676,000 minus \$2,241,000 which would equal \$6,435,000. Thus Alternative 2 is the NED plan.

Table 7-1. Test of Financial Feasibility

Philpott Lake, VA Water Reallocation Study					
#:	Alternative Description:	Capital Cost:	Annual Capital Cost:	Annual OMRR&R Cost:	Total Annual Cost:
2	Reallocation from Conservation Storage	\$61,009,000	\$2,155,000*	\$85,038	\$2,241,000
12	Combined Plan	\$246,079,000	\$8,676,000	N/A	\$8,676,000

Note: *Annual Project Economic User Cost (Table 7-3) was included in Alternative 2's Annual Capital Cost. Alternative 2's annual capital cost includes annual hydropower benefits forgone.

7.1 User's Cost for Repayment

Table 7-2 shows the User's Cost for reallocation of 5,200 ac-ft from the conservation pool.

Table 7-2. User's Cost for Repayment.

Description	Amount
Total Usable Storage for Philpott Dam (STot)	145,000 ac-ft
Storage Recommendation (SRec)	5,200 ac-ft
Percent of Total Usable Storage	3.58%
Total Updated Cost of Storage for Philpott Dam (CTot)	\$253,771,000
Cost of Storage Recommendation (CRec)	\$9,076,000
Annual Cost of Storage Recommendation (ARec)	\$456,000
Operation and Maintenance for Philpott Dam (O&M Tot)	\$1,520,286
Philpott Dam Annual Operation and Maintenance Estimate (O&M Req)	\$54,000
Replacement and Rehabilitation for Philpott Dam (R&R Tot)	\$861,601
Philpott Dam Annual Replacement and Rehabilitation Estimate (R,R&Rreq)	\$30,814
Total Annual Cost=ARec + O&MRec + R,R&Rreq	\$541,000

Note: This table is using the FY 2023 price level with a water supply interest rate based on PL 99-662 of 2.875% (FY2023). A 30-year period of analysis was used for annualization of user cost.

7.2 Additional Economic User Costs

The recommended plan requires an upgrade to Philpott’s existing intake system, including the upgrading of existing pumps to expand from 6.0 million Gallons per Day (MGD) to 10.0 MGD. The cost estimate was prepared by Henry County Public Service Authority and provided to USACE. The cost estimate includes all necessary markups and overhead associated with the project. The below total provides the cost estimate for the full scope for accomplishing the work.

Table 7-3. Additional Economic User Costs.

Additional Economic User Costs	
Estimated Total Project Cost	\$52,549,000*
Annual Project Cost (50 years)	\$1,853,000*

*Note the estimated project cost and annual project cost is rounded. The FY2023 2.5% repayment interest rate was used in the annual project cost.

8 AFFECTED ENVIRONMENT AND ENVIRONMENTAL IMPACTS

This section discusses the resources in the study area and the probable effects or impacts of the proposed federal action on environmental resources. The Recommended Plan is to reallocate 5,200 ac-ft from conservation storage to water supply storage. The effects discussed can be either beneficial or adverse and were considered over the period of 2023 through year 2072. Figure 2-2 shows the location of the Philpott Dam and Lake. In addition to the Recommended Plan, the impacts of the No Action alternative are addressed in this section. “No Action” is the alternative that proposes to continue current operations: the status quo. No action alternative means that a federal action would not take place, and the environmental effects resulting from taking no action would be compared with the effects of implementing the recommended plan. Water demand growth for the period ending in year 2072, as presented in Appendix A, is projected to result in a need for approximately 4 MGD of additional water supply by the year 2072, even with implementation of additional and more significant water conservation and recycling actions. Failure to address water supply shortfalls would have significant negative economic, community, and potential biological effects. This has the potential to seriously affect population growth, maintenance of property values, and quality of life for those affected. This Recommended Plan is technically feasible as there is no construction or new infrastructure required for its implementation.

The No Action alternative takes into account there are no projects under construction or authorized and likely to be constructed during at least the initial portion of the period of analysis. A future without-project condition would reasonably expect Henry County to implement programs that reuse wastewater from the system and to incorporate water conservation and efficiency measures. Appendix A contains detail on additional plans to implement further conservation and reuse improvements.

The most significant impacts of the No Action alternative will be to water supply and socio-economics. Water demand growth for the period ending in year 2072 is projected to result in a need for approximately 4 MGD of additional water supply by the year 2072, even with implementation of additional and more significant water conservation and recycling actions. Over that period, even in the presence of lower per capita usage, increasing demand will create shortfalls in water supply. When the demand exceeds the availability, significant negative economic impacts, such as to population growth, maintenance of property values, and quality of life, will occur to the communities and inhabitants.

Impacts of the No Action plan are compared to the Recommended Plan in Table 8-1 and are discussed in more detail in the following sections.

Table 8-1. Comparison of Environmental Impacts between the No Action Alternative (1) and Recommended Plan (Alternative #2).

Environmental Resource	Effects of Alternative Plans	
	<i>No Action</i>	<i>Alternative 2</i>
Geology and Sediments	No Change	No Effect
Floodplains	No Change	No Significant Impacts
Operations and Flood Risk Management	No Change	No Effect
Water Quality	No Change	Slight average decrease in minimum annual pool elevations. No increase in historic lake elevation range. No significant impact to downstream water quality. Overall, no significant impacts.
Water Supply	Insufficient water supply for projected industrial and municipal demand growth.	Provides sufficient water supply to meet projected water demand growth through year 2072.
Wetlands	No Change	No Effect
Vegetation	No Change	No Effect
Fish and Wildlife	No Change	No Effect
Endangered Species	No Change	No Effect
Cultural Resources	No Change	No Effect
Socio-economics and Environmental Justice	Would not satisfy near or long-term water needs. Reduction or reversal of expanded industrial and commercial activity. Will not result in a disproportionately high or adverse human health or environmental effects.	Would satisfy water supply needs over a 50-year period. Maintain or increase expanded industrial and commercial activity. Will not result in a disproportionately high or adverse human health or environmental effects. Benefits to the quality of life by improving the water supply to the area residents. No residences or public facilities would be impacted by the proposed action.

Recreation and Aesthetics	No Change	No Effects
Air Quality and Noise	No Change	No Effect
Climate Change	No Change	No Effect
HTRW	No Change	No Effect

USACE strives to protect the environment to the maximum extent practicable. As with any USACE civil works project, the study process included incorporation of USACE's Seven Environmental Operating Principles (EOP). These are the following:

- Foster sustainability as a way of life throughout the organization.
- Proactively consider environmental consequences of all USACE activities and act accordingly.
- Create mutually supporting economic and environmentally sustainable solutions.
- Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the USACE, which may impact human and natural environments.
- Consider the environment in employing a risk management and systems approach throughout the life cycles of projects and programs.
- Leverage scientific, economic and social knowledge to understand the environmental context and effects of USACE actions in a collaborative manner.
- Employ an open, transparent process that respects views of individuals and groups interested in USACE activities.

The USACE EOPs were developed to ensure that all missions include sustainable environmental practices. The plan formulation for the Philpott Reallocation project meets the Federal planning requirements. The feasibility study is being carried out in a manner consistent with the USACE EOPs. The principles are consistent with NEPA; the Army's Environmental Strategy with its four pillars (prevention, compliance, restoration, and conservation); and other environmental statutes that govern USACE activities.

Specifically for the Philpott Reallocation project, the EOPs were utilized during the planning process with regards to screening of the potential alternatives to limit the impacts to the human environment. The NEPA defines the human environment, as the natural and physical environment and the relationship of people with that environment. Additionally, USACE has worked closely with federal and state agencies as well as local officials to ensure the project alternatives selected are the most environmentally sustainable choices.

8.1 Physical Resources

8.1.1 Geology and Sediments

Philpott Lake is situated within two physiographic provinces: the Piedmont and the Blue Ridge Mountains. According to the Virginia Department of Environmental Quality (VADEQ, 2020a), the Piedmont Province is the largest physiographic province in Virginia, which extends from the fall line on the east to the Blue Ridge Mountains to the center of the Commonwealth. The area is described as having hard, crystalline igneous and metamorphic formations with some areas of sedimentary rocks. Most significant water supplies are found within a few hundred feet of the surface (VADEQ, 2020a). Larger concentrations of water withdrawal can be obtained along the Western Piedmont along the base of the Blue Ridge Mountains (VADEQ, 2020a).

The Blue Ridge Province is a relatively narrow zone to the west of the Piedmont, approximately four to 25 miles wide (VADEQ, 2020a). Underlying geology includes a thin layer of soil above bedrock. The eastern flank of the Blue Ridge Mountains includes igneous and metamorphic rocks, while sedimentary rocks are more common along the western flank. However, the steep terrain and thin soil coverings result in rapid surface run-off and low groundwater recharge (VADEQ, 2020a).

The topography within the Philpott Lake area varies from approximately 800 to 1,100 feet above MSL, with 300 to 500 feet of local relief from the reservoir (see Appendix B, Figure B2 Project Area Topography). In the northern reaches of the watershed, elevations reach approximately 1,100 feet relative to MSL. Elevations then drop to approximately 981 feet above MSL at Philpott Dam (USGS, 2020a). The terrain in the immediate vicinity of the lake ranges from steep hills and wooded slopes to sheer rock cliffs above the main body of the reservoir. Because of Philpott Lake's proximity to the Blue Ridge Mountains, the topography is more rugged than what is commonly associated with the Piedmont physiographic province. This area is characterized more predominantly by steep ridges and cliffs, with narrow valleys, and rolling hills (Belden, 2001). Typical slopes are between 30-35 degrees, and some slopes are greater than 80 degrees. Elevations typically range between 800 feet to over 1100 feet in the general area (Belden, 2001). Since publication of the original 2021 Master Plan and its subsequent updates, little to no development has occurred that may have impacted geologic resources.

Numerous soil types are located within the Philpott Lake study area (USDA-NRCS, 2020) (see Appendix B, Figure B8 Soil Type Map). Current soil surveys are published for each county and can be accessed from the U.S. Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) web soil survey (WSS) (USDA, 2020). Henry County was last surveyed in 1994, Patrick County was last surveyed in 1999, and Franklin County was last surveyed in 2000 (USDA-NRCS, 2020). Because Philpott Lake is situated in three different counties (Franklin, Henry, and Patrick), this report summarizes the most commonly occurring soil series in each county. In Franklin County, Bluemount gravelly silt loam (3E) is the dominant soil series. This soil series occurs on

hillslopes, is well drained with slopes ranging between 25 to 45 percent and is typically a gravelly silt loam (USDA-NRCS, 2020). In Henry County, the largest soil series is Buffstat-Bugley complex (3E). This soil series occurs on mountain slopes, is well drained with slopes ranging between 23 to 60 percent and has a silt loam profile (USDA-NRCS, 2020). Lastly, in Patrick County, the predominant soil series is Bluemount-Spriggs complex (4E). Bluemount-Spriggs soils typically occur on hillslopes with 25 to 45 percent slopes, are well drained, and have a gravelly silt loam profile (USDA-NRCS, 2020). These soil conditions support most types of development. The primary constraint has been and continues to be the slope at which these soils exist.

The U.S. Department of Agriculture (USDA), Web Soil Survey (WSS) uses specific criteria for assessing recreational soil suitability and a rating process implemented to map the soil suitability for recreation within the project. The ratings of ‘Somewhat Limited’ or ‘Very Limited’ were obtained from the USDA’s WSS suitability and limitations for use guidelines. The USDA WSS maps rate both recreational development camp areas and recreational development paths and trails based on the USDA WSS rating criteria. The rating criteria for camping areas is slope, stoniness, depth of bedrock or the commented pan. For paths, hiking and horseback riding trails its stoniness, depth of water table, ponding, flooding and the texture of the surface.

Specific agency consultation for physical resources is discussed in Chapter 7 of the Master Plan Update. Soils and topography are regulated by standards and laws included in the Virginia Erosion and Sediment Control Planning program (VADEQ, 2020b). The VADEQ provides guidance on designing, implementing, and monitoring erosion and sediment controls and stormwater management measures. The Virginia Department of Environmental Quality Erosion and Sediment Control Program and the USACE are responsible for approving these measures.

Alternative 1, No Action: No changes in geology or sediment would occur.

Alternative 2, Recommended Plan: There would be no change in normal operating pool levels and no change to operational flood releases associated with this conservation storage reallocation; therefore, this alternative should not have an effect on the geology of the area, sediment inflow, or sedimentation in the lake.

8.1.2 Floodplains

Areas along the western half of Philpott Lake are primarily classified as Flood Zone Hazard A, whereas areas along the eastern half of the lake are most often designated as Zone D. Zone A has a 1 percent annual chance of flood (i.e., 100-year floodplain), also known as the base flood area, which has a 1 percent chance of being equaled or exceeded in a given year. The Special Flood Hazards area is subject to flow in the 1 percent annual chance of flood areas. Zone D is the area in which flood hazards are undetermined, but possible (FEMA FIRM, 2008). Additionally, other areas are considered in Zone X, which are areas determined to be outside the 0.2 percent annual chance floodplain (i.e., 500-

year floodplain) (FEMA FIRM, 2008). The 100-year floodplain elevation within the project boundary is at 985 feet above MSL (USACE, 1982).

The 100-year floodplain elevation is determined by the different pool levels that are maintained by the USACE to meet its mission of controlling floodwaters and generating power. Philpott Lake has many structures, campsites, trails, and beaches within the floodplain. It is understood that these structures and areas are designed to withstand flood events and not hinder flood control operations.

Other structures in the floodplain include shoreline stabilization features (i.e., rock piles). These features were constructed primarily to protect the shoreline from erosion. Although these features alter wave action along select portions of the shoreline, they are not considered to have a major impact on floodwater conveyance.

Floodplains are defined and regulated by the Federal Emergency Management Agency (FEMA) and mapped on Flood Insurance Rate Maps (FIRM) and Virginia Department of Conservation and Recreation (VADCR). Local municipalities' planning offices may also play a role in defining floodplains and regulating their use. Development occurring within floodplains must be consistent with Executive Order 11988: Floodplain Management and related USACE policy.

Alternative 1, No Action: The No Action alternative will result in no changes to the existing floodplain.

Alternative 2, Recommended Plan: Executive Order 11988 requires Federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. In accomplishing this objective, "[e]ach agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by flood plains in carrying out its responsibilities..." This alternative will result in very similar flow rates as compared to current rates throughout the study area and therefore will not alter existing hydrology in the floodplain.

1. Floodplain and/or wetland determination; the Recommended Plan will not impact any floodplains or wetlands, upstream, within, or downstream of the project. All impacts of the Recommended Plan are contained within the channel of the Smith River downstream of the project, and within the reservoir only, and are extremely minor in nature.

2. Public notification; The Recommended Plan was fully discussed during public scoping and the Recommended Plan will have no significant impact to the public other than provision of a more reliable water supply in the future. This Draft report will be provided to the public and agencies for a 30-day review. All comments will be addressed and noted in the final report.

3. Identify and evaluate practicable alternatives to locating in the base floodplain: The report discusses all practicable alternatives and illustrates the deliberative process by which the Recommended Plan was selected.
4. Identify the impacts of the Recommended Plan; Impacts of the Recommended Plan are fully discussed in the report and compared side-by-side in the System of Accounts analysis (Table [REDACTED]).
5. Evaluate measures to reduce potential adverse impacts of the Recommended Plan; the Recommended Plan has, the lowest potential to produce adverse impacts of any alternative. The final report contains a thorough analysis of all positive and negative impacts and presents them in a System of Accounts format (Table [REDACTED]).
6. Re-evaluate the alternatives; all alternatives were thoroughly evaluated and re-evaluated during the deliberative USACE planning process, and are presented in an evaluative, comparative, and screened process, in the final report.
7. Make the final determination and present the decision; the final determination and presentation of the Recommended Plan are contained in the report.
8. Implement the action. Implementation of the Recommended Plan will result in no significant impacts to floodplains or wetlands.

8.2 Water Resources.

8.2.1 Operations and Flood Risk Management

One of the objectives of the Philpott Lake project is flood risk management below Philpott Lake dam on the Smith River. Storage of 34,000 ac-ft between elevations 973.4 ft NAVD88 (top of conservation storage) and 984.4 ft NAVD88 (spillway crest elevation) is reserved exclusively for the detention storage of floodwaters. An additional 120,400 ac-ft of surcharge storage exists above the free-overflow spillway between elevations 984.4 and 1013.4 ft NAVD88.

The general plan of flood operations provides for maintaining the normal storage elevation with a seasonal guide curve in Philpott Lake by releasing flows that produce non-damage stages in the Smith River downstream of Philpott Lake dam whenever possible. The flood risk management objective is to store water in the controlled flood storage in Philpott Lake whenever the Smith River downstream is at that time, or is forecast in the future, to exceed the downstream capacity of the channel (i.e., a “bankfull condition”), or reach a depth or condition in which it would cause damage (i.e., “damage stage”). The latter is when flood flows would leave the channel and cause damaging inundation to structures or infrastructure. The USGS stream gage on the Smith River near Bassett is the primary operational flood stage indicator; however, some consideration is also given to river stages farther downstream (such as Stanleytown and Martinsville) based on experience during past major flood events. Because of the distance and the river

flow travel time from Philpott Lake dam to downstream areas and coupled with runoff from the uncontrolled drainage areas, releases from Philpott Lake dam will sometimes be reduced to near minimum prior to a storm event to prevent discharges from contributing substantially to those uncontrolled floodwaters. Afterwards when downstream conditions allow, the flood storage pool in the reservoir will be evacuated at a rate that will produce up to non-damaging stages downstream. Flood releases are based on a tiered release schedule, allowing for increased releases and higher regulated flows at Bassett as lake levels rise higher into the flood storage.

Alternative 1, No Action: No change to flood risk management would be expected.

Alternative 2, Recommended Plan: There would be no change in normal operating pool levels, no reduction in available flood storage, and no change to operational flood releases associated with this conservation storage reallocation; therefore, no effects to the flood risk management are anticipated.

8.2.2 Water Quality

Located within the Roanoke River Basin, Philpott Lake is designed with the top of the conservation pool at approximately 973.4 feet NAVD88 (USACE, 1982). At this elevation, the reservoir is nearly 10 miles long with approximately 110 miles of shoreline, covering approximately 2,741.5 acres. 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 970.9 feet NAVD88, October through January and 972.9 feet NAVD88, April through July and varies linearly between these two elevations during the remainder of the year.

The Roanoke River Basin covers approximately 6,393 square miles or approximately 15 percent of the Commonwealth of Virginia's total area (Virginia Water Resources Plan [VAWRP] 2015). It includes portions of four independent cities and 17 counties. The four cities are Danville, Martinsville, Roanoke, and Salem. The Virginian counties include Appomattox, Bedford, Botetourt, Brunswick, Campbell, Carroll, Charlotte, Craig, Floyd, Franklin, Halifax, Henry, Mecklenburg, Montgomery, Patrick, Pittsylvania, Prince Edward, and Roanoke. (Figure 2-1).

According to the Virginia Water Resources Plan (VAWRP 2015), over 62 percent of the Roanoke River Basin is forested, approximately 25 percent is cropland or pasture, and approximately 10 percent is urban land. The Roanoke River Basin is divided into seven USGS hydrologic unit codes (HUC), which include HUC 03010101 (Upper Roanoke), HUC 03010102 (Middle Roanoke), HUC 03010103 (Upper Dan), HUC 03010104 (Lower Dan), HUC 03010105 (Banister), HUC 03010106 (Roanoke Rapids), and HUC 03040101 (Upper Yadkin) (VAWRP 2015).

Several surface water inputs are located around the lake. The various other surface water inputs include, but are not limited to, the Smith River, Small Creek, Buttermilk Branch,

Runnet Bag Creek, Otter Creek, Ryan's Branch, Beard's Creek, Nicholas Creek, Mill Creek, Green Branch, Puppy Creek, and Bowens Creek. Smith River is the primary source of freshwater to Philpott Lake. In addition to the named surface waters, additional tributaries, wetlands, and other surface waters contribute to Philpott Lake water levels.

The VADEQ manages water quality standards by its capacity to support different uses. Based on VADEQ water quality data, most creeks and tributaries that flow into Philpott Lake range from Class III to Class V waters. Class III, IV, and V waters are defined VADEQ water quality standards that are implemented based on usage or consumption (VADEQ, 2020c). The VADEQ designated six uses for surface waters in Virginia, of the six uses the ones that are applicable to Philpott Lake includes aquatic life habitat, fish consumption, public water supplies, recreation, and wildlife. Philpott Lake (listed as Philpott Reservoir) is classified as a Category 5 impaired waterbody, requiring a Total maximum Daily Load Study. (VADEQ 2020f).

Most of the streams and tributaries that flow into Philpott Lake, and the lake waters, are categorized as supporting primary recreation (swimming and boating) and trout waters while also being a water supply. Some select areas of the Roanoke River immediately north and south of the lake do not support primary recreation but still support healthy aquatic life and secondary recreation.

The VADEQ publishes data on water quality throughout the Commonwealth in its Impaired Waters – 303(d) list. The most current 303(d) list available for Virginia was published in 2020. Waters listed on the 303(d) list fail to meet national water quality criteria established in the CWA. Based on the VADEQ 2020 Final Impaired Waters – 303(d) list, Philpott Lake is listed for Fish Consumption (Impaired Use Code: L51L-01-HG) (VADEQ, 2020e).

Philpott Lake was initially listed for Fish Consumption in 2010 as a Category 5 (i.e., waters needing Total Maximum Daily Load (TMDL) Studies). The Lake continued to be classified as a Category 5 waterbody in 2020. No Fish Consumption or Drinking Water Advisories are issued for mercury for these waters since the levels of mercury reported in fish tissue were under Virginia's Department of Health's level of concern (VADEQ 2020f).

The Smith River is also listed as a Category 5 since 2002 and again in 2018 for temperature (Impaired Used Code: L50R-01-Temp). Aquatic life has potential to be impacted due to temperature variance. Runnet Bag Creek, which drains to Philpott Lake, also has been listed for temperature on the 303(d) list since 2002 (VADEQ 2020f).

The Virginia Department of Health Office of Drinking Water (VDH-ODW) maintains a regulated, public water systems or waterworks database known as Drink Water Watch (VDH-ORW, 2020). For Franklin County, there are eight sites where the VDH-ODW collects water data. These eight sites are located around Philpott Lake in specified recreation areas, where potable water can be accessed. These eight sites include the Deer

Island Foot Bridge, Horseshoe Point Utility, Jamison Mill Building, Salthouse Branch Utility, Deer Island West, Salthouse Branch Beach, Salthouse Branch Picnic, and Tailrace. For Patrick County, there is one site where the VDH-ODW collects water data. It is the Ryans Branch Picnic area, where potable water is accessed. There are no water data collection sites for Henry County around Philpott Lake.

VADEQ's Virginia Climate Response Network, in conjunction with the USGS, has one groundwater monitoring well in close proximity to Philpott Lake. The well is located in Fairy Stone State Park, just west of Virginia Route VA-623. The site is USGS 364732080070301 30C 1 SOW 010. According to the Groundwater Watch web mapping dated November 19, 2020, at 12:09 p.m., this well exhibited high levels of groundwater (USGS, 2020b). The USGS began collecting data in the field at this site on May 6, 1966. The most recent data collection occurred on October 23, 2020. There have been 262 data collections in this 54-year time frame. As technology is now available to do so, daily data collection (depth to water level, feet below land surface) has been occurring remotely from August 26, 2016, through November 19, 2020 (USGS, 2020b). There have been 3,070 total data collections in this 4-year time frame. This well measured consistent groundwater levels ranging from 1,030 to 1,050 feet. Changes within this range followed a fairly regular pattern of drawdowns and recharges.

Several Flowage Easements exist around Philpott Lake. These areas may retain natural characteristics which allow those areas to absorb stormwater before it reaches surrounding water resources. While the easement areas may help water quality if the land is not cleared, the easements were not acquired to protect water quality. The flowage easements can be cleared of vegetation by property owners if they choose to and some structures may be constructed. Only habitable structures are prohibited. USACE's only interest in easements is to allow water to be impounded as the lake rises.

Alternative 1, No Action: No change in water quality would be expected.

Alternative 2, Recommended Plan: The Recommended Plan would result in reallocation of 5,200 ac-ft of conservation storage to water supply storage within Philpott Lake conservation pool. Normal current operating levels will be maintained. There will be no impact to the historic lake elevation range. Hydraulic analysis comparing the No Action and the Recommended Plan showed the minimum annual pool elevations are higher for the reallocation every year during the 1960-2019 modeling period, with an average decrease of 0.78 feet (Appendix B). Therefore, the Recommended Plan's impact to the lake elevation would be a slight average decrease, but not under the historic lake elevation range.

The Smith River flows downstream of Philpott Dam were analyzed at the control point of Bassett (Appendix B). The minimum instantaneous flow target at Stanleytown, VA is 59 cfs, however the streamgage is located about 3 miles upstream at Bassett, VA and a prorated minimum target flow of 52 cfs was used for modeling purposes. Under the No Action Alternative, flow at Bassett is below 50 cfs 191 days within the entire 59-year

model period. With reallocation from the conservation pool, the flow at Bassett would be below 50 cfs 29 days out of the model period, meeting the minimum flow target an additional 162 days within the entire 59-year model period. Therefore, the Recommended Plan would not significantly impact the downstream flow rate between Philpott Lake dam and Henry County's Wastewater Treatment Plant outfall, and water quality flow targets both immediately downstream of Philpott Lake and at Bassett, would continue to generally be met within the 59-year model period.

Historically any shortfall in the minimum flow target and associated impacts have been minor. When shortfalls occur, coordination with resource agencies is done to determine if slightly higher releases are needed or if downstream flows are still adequate for instream flow needs.

There would be no change in normal operating pool levels and no change to operational flood releases associated with this conservation storage reallocation; therefore, no significant impacts to water quality in the lake or downstream are anticipated. Overall, the Recommended Plan would have no effect on water quality.

8.2.3 Water Supply

Philpott Lake currently does not provide water supply storage for any State or local interest. The USACE, per the WSA of 1958, may include water supply storage at Philpott Lake for municipal and industrial uses.

The HCPSA currently withdraws an average daily volume of about 3.3 MGD from the Smith River using its existing downstream intake. The HCPSA is currently permitted to withdraw up to 6 MGD, which is met incidentally by normal dam operations and does not require storage within the lake.

Alternative 1, No Action: As water use increases over time, meeting 2072 demand is not feasible under current conditions. There will be insufficient water supply for projected industrial and municipal demand. Water supply would have to be developed through one of the other measures described in Section 4.6, which either individually would fail to meet increased demand or would prove cost prohibitive given HCPSA's finances. It is therefore reasonable to assume that under the no action alternative the affected communities would bear negative consequences from a failure to have sufficient long-term water supply, such as stunted regional growth.

Alternative 2, Recommended Plan: The Recommended Plan would result in reallocation of 5,200 ac-ft of conservation storage to water supply storage within Philpott Lake conservation pool and would supply an additional 4 MGD, allowing HCPSA to withdraw up to 10 MGD. This would provide sufficient water supply to meet projected water demand through year 2072.

8.3 Biological Resources

8.3.1 Wetlands

Wetlands are areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 C.F.R. §328.3(b)). A jurisdictional wetland, as delineated by the USACE, is based on three factors: hydric soils, wetland hydrology, and hydrophytic (wetland) vegetation. Wetlands include a variety of natural systems, such as marshes, swamps, and bottomland hardwoods.

Wetland areas within the project limits exhibit a mix of bottomland hardwood species. Typical species include: sweetgum (*Liquidambar styraciflua*), green ash (*Fraxinus pennsylvanica*), black gum (*Nyssa sylvatica*), swamp black gum (*Nyssa biflora*), sycamore (*Platanus occidentalis*), and river birch (*Betula nigra*).

The draft report was coordinated with the USEPA and on August 24, 2022, and the USEPA responded with no comments.

Alternative 1, No Action: This alternative would result in no change to wetlands.

Alternative 2, Recommended Plan: Executive Order 11990 directs all Federal agencies to issue or amend existing procedures to ensure consideration of wetlands protection in decision making and to ensure the evaluation of the potential effects of any new construction proposed in a wetland. The Recommended Plan would not require filling any wetlands and would not produce changes in hydrology that could affect wetlands.

This alternative would have no effect on wetlands and no adverse impacts to adjacent lands due to the proposed project having a slight average decrease of lake elevation, but not over the historic lake elevation range (Appendix B).

8.3.2 Vegetation

Philpott Lake is located in the Piedmont and Blue Ridge Mountain regions of Virginia. Four major vegetation coverage types have been identified in the project area including downstream: upland hardwood, pine, mixed woodland, and open land. In the upland hardwood sections, tree cover is dominated by northern red oak (*Quercus rubra*), southern red oak (*Quercus falcata*), white oak (*Quercus alba*), water oak (*Quercus nigra*), pignut hickory (*Carya glabra*), shagbark hickory (*Carya ovata*), bitternut hickory (*Carya cordiformis*), and mockernut hickory (*Carya tomentosa*), with intermittent pine trees associated. In the pine sections, the canopy is dominated by Virginia pine (*Pinus virginiana*), loblolly (*Pinus taeda*), white (*Pinus strobus*), and shortleaf (*Pinus echinata*). Mixed woodlands contain mixed pine species (*Pinus* spp.) and hardwoods.

The predominant forest type is mixed forest. The understory of these forests is populated with sourwood (*Oxydendrum arboreum*), dogwood (*Cornus florida*), rhododendron (*Rhododendron* spp.), mountain laurel (*Kalmia latifolia*), chinquapin (*Castanea pumila*), witch hazel (*Hamamelis virginiana*), red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), and sassafras (*Sassafras albidum*).

Alternative 1, No Action: This alternative would result in no change to vegetation.

Alternative 2, Recommended Plan: Vegetation along the rim of the lake is accustomed to fluctuating water levels. Although the Recommended Plan would result in a slight increase of average lake levels, there would be no change in normal operating pool levels, operational flood releases or historic lake level range. Therefore, this alternative would have no effect on vegetation around the lake or downstream.

8.3.3 Fish and Wildlife

Many angler species of fish can be found within Philpott Lake and downstream in the project area. The primary species include largemouth bass (*Micropterus salmoides*) and smallmouth bass (*Micropterus dolomieu*), bluegill (*Lepomis macrochirus*), sunfish (*Centrarchus*), brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*), crappie (*Pomoxis* spp.), walleye (*Sander vitreus*), and catfish (*Siluriformes* spp.).

Common wildlife species found at Philpott Lake and in the downstream project area include white-tailed deer (*Odocoileus virginianus*), gray squirrel (*Sciurus carolinensis*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), and cottontail rabbit (*Sylvilagus* spp.).

Birds found in the area include bobwhite quail (*Colinus virginianus*), wild turkey (*Meleagris gallopavo*), woodpeckers (*Melanerpes* spp.), Carolina chickadee (*Parus carolinensis*), red-eyed vireo (*Vireo olivaceus*), ovenbird (*Seiurus aurocapilla*), mallard (*Anas platyrhynchos*), and wood duck (*Aix sponsa*).

Alternative 1, No Action: This alternative would have no effect on fish and wildlife.

Alternative 2, Recommended Plan: This alternative will have no significant effects on the lake water quality, and no adverse impacts to adjacent lands and therefore will have no effect on Philpott Lake fish and wildlife resources. This alternative will result in no significant impacts to downstream flow rates as compared to current rates throughout the study area. Therefore, no effects are expected because adequate flows of suitable water quality will continue to be provided for successful reproduction and growth rates for the brown, brook and rainbow trout and other aquatic resources.

8.3.4 Endangered Species

The USACE and Virginia are committed to the protection of rare and endangered species and communities. Within Franklin, Henry and Partick counties, three Federally-listed species are known to exist (USFWS 2021). These species and their habitat requirements are described below in Table 8-2. A species list was generated using the USFWS Information for Planning and Consultation (IPaC) website. The USACE has determined the project will have no effect to any threatened or endangered species or critical habitat. All requirements pursuant to Section 7 have been met.

Table 8-2. Federally-listed Species Known to Occur in the Philpott Lake Vicinity and Smith River.

Common Name	Scientific Name	Description	Habitat Requirements
Small-anthered Bittercress	<i>Cardamine micranthera</i>	Slender, perennial herb with fibrous roots and a single, sometimes branched stem that grows 20 to 40 cm tall.	Wet, boggy soils of deciduous woodlands and moist to wet soils along the edge of small to intermediate sized streams.
Roanoke Logperch	<i>Percina rex</i>	A large darter that attains a length of 14 cm and is characterized by an elongate, cylindrical to slab-sided body, a conical snout, and complete lateral line. The back is dark green, sides are greenish to yellowish, and belly is white to yellowish.	Occupies medium to large warm-water streams and rivers of moderate gradient and relatively unsilted substrates.
Northern Long-Eared Bat	<i>Myotis septentrionalis</i>	A medium- sized bat with fur color medium to dark brown on the back and tawny to pale- brown on the underside.	During summer, they feed, roost and raise young in forested areas. Some males and non-reproductive females may use caves and mines during the summer. During winter, the northern long-eared bat hibernates in caves and mines.

Small-anthered Bittercress

This small perennial herb is native to small streambank seeps, adjacent sandbars and stream edges in the Dan River drainage of the North Carolina and Virginia Piedmont. Most of the populations are extremely small. Many are in close proximity to fields and pastures, where they are vulnerable to herbicides, erosion and siltation. All populations are located south of the project and are not in the project area:

<https://www.fws.gov/species/small-anthered-bittercress-cardamine-micranthera>

Roanoke Logperch

The Roanoke logperch is a large darter, growing to about 6 inches long. It has a bulbous snout, lateral blotches, its back is scrawled, and most fins are strongly patterned. The first dorsal fin has an orange band, which is particularly vivid in mature males. The Roanoke logperch is known in the Roanoke River basin. The fish typically inhabits warm, usually clear, small to medium-sized rivers. These waterways have a moderate to low gradient, and the fish usually inhabit riffles and runs, with silt-free sandy to boulder-strewn bottoms. Young are usually found in slow runs and pools with clean sandy bottoms. In winter, logperch may be more tolerant of silty substrates and may also inhabit pools. Spawning occurs in April or May in deep runs over gravel and small cobble. Males are associated with shallow riffles during the reproductive period. Females are common in deep runs over gravel and small cobble, where they spawn.

Northern long-eared bat

The northern long-eared bat's range includes much of the eastern and north central United States, and all Canadian provinces from the Atlantic Ocean west to the southern Yukon Territory and eastern British Columbia. The species' range includes the following 37 States and the District of Columbia: Alabama, Arkansas, Connecticut, Delaware, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, Virginia, West Virginia, Wisconsin, and Wyoming.

Northern long-eared bats spend winter hibernating in caves and mines, called hibernacula. They use areas in various sized caves or mines with constant temperatures, high humidity, and no air currents. Within hibernacula, surveyors find them hibernating most often in small crevices or cracks, often with only the nose and ears visible. During the summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities or in crevices of both live trees and snags (dead trees). Males and non-reproductive females may also roost in cooler places, like caves and mines. Northern long-eared bats are flexible in selecting roosts, choosing roost trees based on suitability to retain bark or provide cavities or crevices. This bat has also been found rarely roosting in structures, like barns and sheds.

<https://www.fws.gov/Midwest/endangered/mammals/nleb/nlebFactSheet.html>

Alternative 1, No Action: This alternative would result in no effect to threatened or endangered species.

Alternative 2, Recommended Plan: The small-anthered bittercress is not within the project area and therefore this alternative would have no effect. This alternative will have no significant impact on the lake and downstream water quality or adverse impacts to adjacent lands and therefore would have no effect on the Roanoke logperch and northern long-eared bat.

8.4 Cultural Resources

Current theories place the arrival of humans in the project area at approximately 12,000 years ago, at the beginning of the Paleoindian period. The Paleoindian period is characterized by the change from coniferous forests to deciduous forests caused by retreating glaciers and the subsequent rise in temperatures which led to rising sea levels. Paleoindian sites in the Piedmont have all been identified by “scattered, isolated surface finds of Clovis and Folsom like points” (Ward and Davis 1999:2). The largest concentration of Paleoindian materials in Virginia are found along a band from the Southside Piedmont to the Coastal Plain in counties lying south of the James River. Commonly found near major rivers, evidence at these sites points to small, highly mobile groups following game, either the soon to be extinct megafauna (mastodon, bison) or smaller mammals like the white-tailed deer on their migratory routes. It is believed that Paleoindian groups in the eastern United States consumed a varied diet, including plants and small game (Sassaman et al. 1990; Adavasio et al. 1999; McNett et al. 1977; Funk and Steadman 1994; Ward and Davis 1999). As the environment in the eastern United States changed at the beginning of the Holocene period, the megafauna died off and the plant life changed to reflect what is seen in the modern environment. It is now believed, as argued by Metzler (1988:8) that in the Piedmont, as in the rest of the Southeast, a “generalized foraging subsistence strategy” was used (Ward and Davis 1999:37).

The onset of the Archaic Period is associated with the end of the Wisconsin Ice Age. Lithic assemblages associated with the Archaic period reflect an adaptation to the warmer, post-Pleistocene environment. Archaic projectile points in the Virginia Piedmont include various types associated with the Hardaway complex (e.g., Hardaway blades, Hardaway/Dalton, Hardaway side-notched), Big Sandy, Palmer and Kirk corner-notched. Formal end scrapers and side scrapers, first seen in the Paleoindian period, were common in the Early Archaic. Compared to Paleoindian tool assemblages, Archaic assemblages exhibit greater diversity in the types of projectile points which may suggest the development of distinct local cultural traditions. No sites with Early- or Middle-Archaic components have been identified within the area of potential effects (APE) or on federal property associated with Philpott Lake; however, one rock shelter site (44Pk78) contains Late Archaic material. Site 44Pk78 is not within the APE.

The Woodland period is defined by the gradual shift toward agriculture-based economies and the accompanying larger and more permanent settlements. Societies also became more

complex, with the development of “elaborate mortuary rituals, sometimes constructed earthen burial mounds and house platforms, and engaged in far-reaching trade and exchange of exotic items” (Ward and Davis 1999:3). The Woodland Period is also defined by the appearance of pottery making, with the various styles of pottery used by archaeologists to refine timelines and relationships between cultures. In the Piedmont region of Virginia, Middle Woodland sites are identified by the appearance of large triangular Yadkin points and Yadkin series ceramics (300 BC-500 AD). The Middle Woodland in southside Virginia, specifically, is probably marked by the appearance of fabric- and net-marked, pottery, along with a continuation of cord-marking. In the Shenandoah Valley, this pottery is tempered with crushed rock.

No sites with Early Woodland components have been identified within the APE or on federal property associated with Philpott Lake; however, one Middle Woodland site (44Pk09) and two Late Woodland sites (44Pk8 and 44Pk226) have been identified on federal property associated with Philpott Lake. None of these sites are within the APE.

The Contact Period in the Piedmont begins in approximately 1525. By 1700 Native Americans and colonists in the Piedmont were experiencing a flourish of intercultural exchange. The presence of colonists in the region had become common and European trade goods had become part of everyday life. The first permanent European settlers in the region of the Philpott Lake migrated south from Pennsylvania and other counties in Virginia, and west from the Coastal Plain and Tidewater areas of Virginia. The earliest settlers came to the three counties surrounding the Philpott Lake by means of paths that Native Americans had used. These settlers were drawn to the Piedmont by the promise of available, fertile land. By the mid-eighteenth century, land in southern Pennsylvania and the north and east of Virginia had become scarce as emigration from Europe increased. Tobacco was the dominant crop in Virginia and much of the Piedmont for over three centuries. Slavery was an important component to the tobacco industry. Planters in the seventeenth century relied on indentured servants to work the tobacco fields and clear the constantly required new land.

Following the American Revolution, tobacco farming in the counties surrounding the Philpott Lake grew and Henry County tobacco developed a reputation as a “superior” product. The light, sandy, well-drained soils of the Piedmont, particularly in upland areas, were perfectly suited to tobacco farming. River commerce began in the early nineteenth century with the formation of the Roanoke Navigation Company. The company was chartered by the North Carolina and Virginia legislatures in 1812 allowing for the first major river improvements in the Roanoke River Basin. With the opening of the Roanoke Canal at Weldon in 1823 bypassing the Roanoke River Rapids, the Roanoke, Dan, and Staunton rivers were open for batteaux navigation. Batteaux craft are double-ended, shallow draft, flat bottomed craft up to 60 feet long with an eight-foot beam drawing no more than 18-inches of water (Trout 2003).

No significant US Civil War battles took place on the Philpott Lake project area during the Civil War and the war did not affect southwest Virginia as severely as it did most of the South. The closest action was a minor skirmish in Martinsville on April 8, 1865, when elements of Union Colonel William J. Palmer with the First Brigade of General George Stoneman's cavalry division encountered a Confederate force of the Sixth Tennessee Cavalry led by Colonel James T. Wheeler at the Henry Court House. Following the war, many plantations were subdivided due to the loss of the enslaved work force and a significant number of blacks left rural areas for the cities by the 1880s.

In 1933, Junius B. Fishburn donated 4,868 acres to the Commonwealth of Virginia to become "Fairy Stone" State Park (named for the staurolite crosses found throughout the hills) after several years of work by the Civilian Conservation Corps (CCC). Fairy Stone is the largest of Virginia's six original state parks. In 2004, Fairy Stone State Park was listed on the Virginia Landmarks Register and the NRHP (Williamson 1999). Several structures within Fairy Stone State Park Historic District (DHR ID 070-0057) overlap with a portion of the APE.

Initial coordination was conducted with the Virginia Department of Historic Resources (VDHR) and federally recognized tribes in the Commonwealth of Virginia to discuss the study's goals and scope, and to initially examine the Recommended Plan's compliance with Section 106 of the NHPA. The VDHR was provided a description of the proposed action and an associated "no effect" determination regarding Section 106 compliance on November 12, 2021, via the VDHR's electronic project information exchange (ePIX) service. The VDHR provided concurrence with this "no effect" determination via email received on December 15, 2021. Similarly, federally recognized tribes were provided scoping materials and the opportunity to provide initial comments and concerns via individual letters distributed April 12, 2022. No Tribes provided responses or have otherwise indicated further consultation interest. Regardless, Tribes were also informed of the draft EA availability via individual emails distributed July 28, 2022 and were invited to provide comments.

Executive Order 11593, The Protection and Enhancement of the Cultural Environment states the Federal Government shall provide leadership in preserving, restoring and maintaining the historic and cultural environment of the nation. Federal agencies shall administer the cultural properties under their control in a spirit of stewardship and trusteeship for future generations, initiate measures necessary to direct their policies, plans and programs in such a way that federally owned sites, structures, and objects of historical, architectural or archaeological significance are preserved, restored, and maintained for the inspiration and benefit of the people, and, in consultation with the Advisory Council on Historic Preservation (16 U.S.C. 470i), institute procedures to assure that Federal plans and programs contribute to the preservation and enhancement of non-federally owned sites, structures and objects of historical, architectural or archaeological significance.

Alternative 1, No Action: The no action alternative would have no effect on NRHP - eligible or -listed historic properties in the project area. Existing conditions, to include current dam operation practices and associated water level changes (<http://epec.saw.usace.army.mil/philmsr.txt>), may temporarily expose archaeological resources near the lake shore, although exposure is often fleeting. Under the no action alternative, existing conditions would continue.

Alternative 2, Recommended Plan: The Recommended Plan would have no effect on NRHP-eligible or -listed historic properties in the project area. The Recommended Plan will not include excavation or any ground disturbance. Water level changes in Philpott Lake associated with the Recommended Plan would be negligible as compared to the no action alternative (i.e., existing conditions). The Recommended Plan was coordinated with the VDHR and complies with Section 106 of the NHPA and E.O. 11593 (Protection and Enhancement of the Cultural Environment). Record of consultation with the VDHR, and their concurrence with a no effect determination associated with the Recommended Plan, is included in Appendix E. Since initial consultation with the VDHR occurred, the Recommended Plan's effects regarding cultural resources remain unchanged. The Draft Feasibility Report and Environmental Assessment (EA) was provided to the VDHR and federally recognized tribes in the Commonwealth of Virginia for review and comment; however, no additional comments were received from these entities.

8.5 Socio-Economics and Environmental Justice

The study area is Henry County, Virginia, and the project sponsor is the HCPSA that provides potable water to 74 percent of the county's population outside of the City of Martinsville (county seat). Nestled in the foothills of Appalachian Mountains, Henry County is in south central Virginia along the border of North Carolina. The HCPSA's service area primarily consists of residential, commercial and industrial customers in Henry County including two industrial parks, although it does provide water to a state park in Patrick County and has an interconnect with Pittsylvania County to provide wholesale water. The City of Martinsville (county seat) operates a separate treatment plant to service customers in their incorporated area and relies on the 1.5 billion gallon Beaver Creek Reservoir for raw water supplemented as needed to meet peak daily demands by water pumped from Leatherwood Creek.

The Roanoke River watershed has historically been an area of significant natural resource production. Currently, approximately 60% of the land in the basin is forested and about 22% is cultivated cropland. Cotton, peanuts, tobacco, and soybeans are among the most common crops grown. Only six percent of the land falls into the urban or built-up land category.

In recent years, HCPSA withdrawals have increased due to the expansion of the service area and increasing industrial and commercial water use. Henry County and much of southwestern Virginia, has experienced declines in population over the last few decades for reasons discussed in Appendix A; however, over the past decade Henry County has

implemented an aggressive and successful economic development program. Expanded industrial and commercial activity has increased water demands in the county. In addition, although population at the county level has declined, the HCPSA has expanded its service areas in Henry County and adjacent communities. Industrial growth and continued expansion of the service area will likely continue.

In the past decade, economic activity has rebounded significantly in the county. From 1990 through 2008 the number of private business establishments in the county remained constant at around 850 to 900, but after 2008, the number increased through the second quarter of 2019 where it stood at 1,676. The number of persons employed, and number of private business establishments are inversely related to the unemployment rate in the county.

The improving business climate in Henry County is largely due to an economic development campaign by the Martinsville-Henry County Economic Development Corp aimed at stemming or reversing trends since the demise of the regional textile industry. The county has two pad ready well-developed modern industrial parks with access to major transportation corridors: 1) the Patriot Centre Industrial Park, and 2) the Commonwealth Crossing Business Centre completed in 2016 at a cost of \$40 million that includes the \$6.75 million 26,000-square-foot Commonwealth Centre for Advanced Training (CCAT) that opened last year. Companies locating in Commonwealth Crossing have exclusive access to CCAT. The property is 30 miles from Piedmont Triad International Airport and population centers of the Piedmont Triad area of North Carolina (Greensboro, Winston-Salem, and High Point), approximately 40 miles from a FedEx hub, and has rail access. The site also offers four-lane access to the interstate. The industrial park is considered a “mega-site;” which create at least 400 jobs and are characterized by at least \$250 million in capital investment. The site is marketed for suppliers and other companies involved with the growing aerospace industry, food and plastics and other industries.

8.5.1 Population

From 1970 through 1980, the number of people living in the county grew rapidly from about 51,000 to nearly 58,000 and for the next 20 years remained stable. Then, in 1999 population in the county began to fall, and has continued to decline through 2019, although there appears to be a slight uptick in 2020.

Several issues led to the decline. A primary factor was the decline in the U.S textile and apparel industry fueled in large part by exchange rate devaluation of major Asian exporters of textile products and regional trade liberalization policies such as the North American Free Trade Agreement of 1994. At the time, the textile and apparel industries were the economic base of Henry County. When the textile factories shut down, families left for new jobs in other areas. As people left, Henry County and the City of Martinsville (county seat) were unable to attract new businesses or population, and people moving out of the region were working-age adults, and the region's population continues to grow

older. The long-term effect has been that both Henry County and Martinsville have more deaths than births. In both communities this has caused the bulk of the population decline.

Table 8-3. Population.

Area	1960	1970	1980	1990	2000	2010	2020
State of Virginia	3,966,966	4,651,487	5,346,818	6,187,358	7,079,030	8,001,024	8,631,393
Henry County, VA	40,335	50,901	57,654	56,942	57,930	54,151	50,948

8.5.2 Population Projections

According to the Census Bureau 2022 American Community Survey 5-year estimates, Virginia is expected to steadily grow to the year 2045. Henry County shows a decline over that same timeframe.

Table 8-4. Population Projections.

Area	2025	2030	2035	2040	2045
State of Virginia	8,993,343	9,331,666	9,604,197	9,876,728	10,149,260
Henry County, VA	48,875	46,764	44,418	42,073	39,728

8.5.3 Race and Ethnicity

Historically, Virginia was characterized by a large White population, substantial Black population, and very small population of other minority groups. Currently, 40.4% of the population in Virginia are minorities. Henry County has a lower percentage at 31.4% as compared to the state as a whole.

Table 8-5. Demographics.

Area	Minority (all persons except white, non- Hispanic)	Percentag e minority (all persons except white, non- Hispanic)	Person s below poverty	Perce ntage of perso ns below povert y	Percent of female persons	Percent of persons 65 years and over	Percentag e of persons aged 17 and younger
State of Virginia	3,487,082	40.4%	794,088	9.2%	50.8%	15.9%	15.9%
Henry County, VA	15,997	31.4%	6,572	12.9%	51.9%	24.5%	21.8%

8.5.4 Education

Table 8-6 shows the percent of people over the age of 25 with no high school diploma. This is an important statistic due to its correlation with higher rates of unemployment and underemployment. This percentage is 9.7% in the stage of Virginia and 19.8% in Henry County, VA. Also, the below table shows the percentage of persons with bachelor's degrees which is 39.5% for the state of Virginia and 15.1% for Henry County, VA.

Table 8-6. Education.

Area	Percentage of persons with no high school diploma (age 25+)	Percentage of persons with bachelor's degree (age 25+)
State of Virginia	9.7%	39.5%
Henry County, VA	19.8%	15.1%

8.5.5 Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations requires the federal government to achieve environmental justice by identifying and addressing high, adverse and disproportionate effects of its activities on minority and low-income populations. The EO also states that the impacts of the action would not be disproportionate towards any minority or low-income population. The activity cannot: (a) exclude persons from participation in, (b) deny persons the benefits of, or (c) subject persons to discrimination because of their race, color, or national origin. It requires the analysis of information such as the race, national origin, and income level for areas expected to be impacted by environmental actions. It also requires federal agencies to identify the need to ensure the protection of populations relying on subsistence consumption of fish and wildlife, through analysis of information on such consumption patterns, and the communication of associated risks to the public.

The CEQ's Climate and Economic Justice screening tool (Beta Version), (<https://screeningtool.geoplatform.gov/en/?msclkid=9cff633bba9a11ecb93add6e67333d3f#9.36/36.6992/-79.8679>), was used to identify several Census tracts within Henry County, VA that are identified as disadvantaged. The Recommended Plan is to reallocate 4 MGD reservoir storage, currently used for hydropower, to water supply to furnish about 10 MGD for HCPA serving municipal water supplies.

Alternative 1, No Action: No Action would not satisfy near or long-term water needs. The expanded industrial and commercial activity would likely be reduced or reversed negatively impacting nearby disadvantaged communities. The implementation of the No Action plan will not result in a disproportionately high and adverse human health or environmental effects on minority populations and low-income populations as all communities within the project area will be equally burdened by the impacts from insufficient long-term water supply.

Alternative 2, Recommended Plan: This alternative will provide the HCPA with 4.0 MGD of water storage from Philpott over a 50-year period: 2023-2072. As a consequence of the proposed reallocation, total annual hydropower benefits foregone will equate to about \$6,000 as reported by the Hydropower Analysis Center (HAC). Such a minor amount of estimated hydropower benefits lost should not materially impact energy prices to the service area nor are any other adverse impacts foreseen. However, it should be documented that according to the CEQ Climate and EJ Screening Tool, some of the Census tracts within Henry County, VA and surrounding the Philpott Lake report above the 90th percentile for *energy burden* criterion which is computed as the average annual energy costs per household divided by the household income.

The implementation of the Recommended Plan will maintain or increase expanded industrial and commercial activity and not cause disproportionately high and adverse human health or environmental effects on minority populations and low-income

populations. Instead, the proposed reallocation would provide benefits to the quality of life by improving the water supply to the area residents. No residences or public facilities would be impacted by the proposed action. In public outreach efforts to date, no potential environmental justice issues have been identified.

8.6 Recreation and Aesthetics

The USACE has developed and maintains approximately 11 recreational sites at Philpott Lake. The recreation areas include Philpott Park, Bowens Creek Park, Goose Point Park, Runnett Bag, Ryans Branch Park, Jamison Mill Park, Jamison Mill Picnic Area, Horseshoe Point Park, Salthouse Branch Park, Deer Island, Turkey Island, Franklin County Tailrace, and Twin Ridge Park. Several small, privately owned docks and a USACE (employee only) dock are located on the lake. Recreation opportunities include boating, camping, fishing, hiking, picnicking, and swimming.

Philpott Lake also includes a dedicated visitor center located on Philpott Dam Road, east of Philpott Marina. The visitor center includes history displays, environmental education materials, local and natural history exhibits, cultural events, and other local topics important to the community around Philpott Lake. An environmental education center provides visitors with exhibits targeting environmental topics, threatened and endangered species, trail maps, and an environmental learning classroom.

Philpott Lake provides a variety of scenic vistas, undeveloped shorelines, mature pine and hardwood forests, steep slopes, and deep water that attracts visitors year-round. With the distant Blue Ridge Mountains and foothills in view from the lake, Philpott Lake provides picturesque panoramic landscape views. Additionally, because future development is not expected, low-intensity recreation will not diminish the beauty around the lake. Maintaining existing development around the lake coupled with no planned and expected future development, Philpott Lake will remain aesthetically appealing for future generations.

Alternative 1, No Action: This alternative would result in no change to recreation or aesthetics.

Alternative 2, Recommended Plan: This alternative would result in no change in normal operating pool levels and no change to operational flood releases. The insignificant changes in water levels and flow rates would have no effects on recreation, including fishing, boating, canoeing and camping and aesthetics.

8.7 Other Resources

8.7.1 Air Quality and Noise

Philpott Lake is in Franklin, Henry, and Patrick Counties, Virginia. Franklin, Henry, and Patrick Counties are in attainment areas for all federal air quality standards (United States Environmental Protection Agency 2020a). Air quality in this area is primarily influenced by regional climate patterns.

Air quality within the project boundary is influenced by exhaust from motor vehicles and boats, the use of grills and fire pits, and other regional activities. The large open area that is created by the lake allows for strong breezes to blow through the recreational sites. These breezes can rapidly reduce and/or eliminate localized air quality concerns caused by air-borne pollutants.

Lands surrounding Philpott Lake are not heavily developed nor used for intense uses or operations. Instead, the lands surrounding Philpott Lake are primarily rural or Virginia park lands with various recreation areas, which are protected from heavy development. The closest centers of development (cities) are a significant distance away from Philpott Lake. Martinsville is the closest city at approximately 10 miles away.

Air quality is regulated by the Clean Air Act and implemented by the United States Environmental Protection Agency (US EPA) and the Virginia Air Pollution Control Board of the VADEQ. Air quality standards are defined in the National Ambient Air Quality Standards (NAAQS). Actions that result in increased emissions may require a permit issued by the Virginia Air Quality Pollution Control Board, Virginia DEQ. Executive Order 13514: Federal Leadership in Environmental, Energy, and Economic Performance provides further guidance on implementing these regulations.

Philpott Lake is in Henry, Patrick, and Franklin Counties in Virginia, which are relatively rural counties in nature. As such, obtrusive noise sources are generally confined to heavy traffic road corridors or in close proximity to agricultural or industrial activities. Within the Philpott Lake area there are few obtrusive sources of noise. Vehicles traveling local roads and boat engines on the water are the primary sources of noise. Occasional public events including fishing tournaments and weekend music events that may include amplified voices or music also occur. Sensitive noise receptors adjacent to and within the project area include areas occupied by park visitors and wildlife communities throughout the project. Noise ordinances and regulations are developed and enforced by individual municipalities. These ordinances restrict the level of noise that may exist in certain areas and/or the time of day that they may exist.

Alternative 1, No Action: This alternative would result in no changes to air quality or noise.

Alternative 2, Recommended Plan: The recommended reallocation will not involve construction, so there will be no effects to air quality or noise with implementation of the recommended reallocation.

8.7.2 Climate Change

Analysis of potential for climate change impacts at Philpott Lake was conducted using the guidance outlined in Engineering Construction Bulletin (ECB) 2018-14 *Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects* (rev. August 2022). The ECB 2018-14 assessment includes conducting a literature review, utilizing the USACE Screening-Level Climate Change Vulnerability Assessment (VA) Tool and applying the Climate Change Hydrology Assessment Tool (CHAT) and the Timeseries Toolbox (TST). The CHAT is used to assess modeled, historic timeseries and future, climate changed streamflow, temperature, precipitation and drought timeseries for trends. The TST tool is applied to evaluate trends and test for nonstationarities in observed monthly average and minimum flows. More information on potential climate change can be found in Appendix F Climate Change Analysis.

In the literature reviewed, temperatures are projected to increase in the future with more extreme rain events, there is less consensus on future annual precipitation totals and streamflow. The CHAT tool indicates that maximum temperatures and drought frequency are likely to increase in the future. Based on the TST tool analysis, observed monthly minimum and monthly average streamflow data within the region do not indicate widespread evidence of trends or nonstationarities. The USACE Climate Change VA Tool does not indicate that the Chowan-Roanoke watershed (HUC 0301) is relatively vulnerable to climate change impacts for water supply or hydropower business lines as compared to the other watersheds in the continental USACE.

Based on this assessment climate change does not present a significant residual risk to the project in terms of being able to support reallocating water stored from the conservation pool to water supply without undermining its other authorized purposes (flood risk management, hydroelectric power generation, low flow augmentation and fish and wildlife management).

Alternative 1, No Action: No Action would not contribute to climate change. This alternative will decrease the resilience of Henry County to handle potential future increases in drought.

Alternative 2, Recommended Plan: The Philpott Reallocation project's Recommended Plan is the least cost, technically sound, environmentally acceptable (Federal Standard) plan for satisfying the future needs. The Philpott Reallocation project complies with EO 13693 and Wilmington District will continue to implement positive changes to meet the goals outlined in EO 13693. This alternative does not present a significant residual risk for climate change effecting the project's ability to support the authorized purposes. This alternative will increase the resilience of Henry County to handle potential future

increases in drought versus the No Action alternative.

8.7.3 Hazardous, Toxic and Radioactive Waste (HTRW)

The area around Philpott Dam contains a mix of natural, residential and commercial areas. A search of EPA's website (<https://www3.epa.gov/>) on May 26, 2022, produced zero EPA regulated facilities. None of the regulated facilities are on the National Priorities List.

Alternative 1, No Action: This alternative is expected to have no effect on HTRW and would not result in the production of HTRW.

Alternative 2, Recommended Plan: This alternative is expected to have no effect on HTRW, and the Recommended Plan would not result in the production of HTRW.

8.8 Compliance with Environmental Requirements

In addition to the indicated public involvement, NEPA, as amended, requires consideration of the environmental impacts for major federal actions. The purpose of the EA for this project is to ensure that the environmental consequences of the Recommended Plan are considered, and that environmental and project information are available to the public. This EA was prepared in accordance with NEPA, the CEQ regulations (40 CFR parts 1500-1508), USACE procedures for implementing NEPA (33 CFR parts 230), and Engineering Regulation (ER) 200-2-2. The proposed project does not require a Section 404(b)(1) analysis since it does not involve discharge of dredged or fill material into waters of the U.S.

Table 8-7. Compliance of Recommended Plan with Applicable Federal Laws and Executive Orders.

Archeological and Historic Preservation Act of 1974, As Amended	16 USC 469	Full Compliance*	Section 8.4
Endangered Species Act of 1973	16 USC 1531	Full Compliance*	Section 8.3.4
Fish and Wildlife Coordination Act of 1958, As Amended	16 USC 661	Full Compliance*	Section 9
National Historic Preservation Act of 1966, As Amended	16 USC 470	Full Compliance*	Section 8.4
Protection and Enhancement of the Cultural Environment	EO 11593	Full Compliance*	Section 8.4
Floodplain Management	EO 11988	Full Compliance*	Section 8.1.2
Federal Actions to Address Environmental Justice and Minority and Low-Income Populations	EO 12898	Full Compliance*	Section 8.5

* Full compliance upon completion of NEPA

9 PUBLIC AND AGENCY INVOLVEMENT

On April 7, 2021, the USACE sent out a Scoping Letter to interested parties, to identify concerns and issues to be considered during development of the feasibility study and EA. No written comments were received from the general public. All comments were verbal and focused on accessibility due to lake level impacts, downstream municipal water supply availability, and downstream flow rates that could impact species and fisheries water quality. Based on modeling, there would be no change in normal operating pool levels, no reduction in available flood storage, and no change to operational flood releases associated with this conservation storage reallocation; therefore, no effects to no impact to the historic lake elevation range and would not significantly impact the downstream flow rate between Philpott Lake dam and Henry County's Wastewater Treatment Plant outfall. A Public Scoping Session was held on April 15, 2021. Also, an online public information meeting was conducted on August 22, 2022.

The public information meeting was held at the Henry County Public Service Authority in Henry County, VA on August 22, 2022. There were no significant issues raised by the public. Verbal comments at the meeting were the same as those expressed at the previous scoping meeting. There were no written comments received. Comments were addressed by the USACE at the meeting and all comments were considered during development of the draft report.

The Wilmington District circulated the draft integrated report on August 28, 2022, for a 30-day Public Review. Only comments from agencies were received during the public review period. All comments received from agencies were addressed and considered in the development of the final report (Appendix G).

On May 7, 2021, a list of threatened and endangered species was requested and received through the USFWS, ECOS-IPaC website. The Recommended Plan will result in no effects to any threatened or endangered species. Section 7 coordination is complete. A USFWS Coordination Act Report was not needed for this report and was coordinated with the USFWS during the draft report public and agency review.

On November 12, 2021, the Virginia Department of Historic Resources (VDHR) was provided a description of the Recommended Plan and an associated "no effect" determination regarding compliance with Section 106 of the National Historic Preservation Act via the VDHR's electronic project information exchange (ePIX) service. The VDHR provided concurrence with this "no effect" determination via email received on December 15, 2021 (Appendix E). Similarly, federally recognized tribes were provided scoping materials and the opportunity to provide initial comments and concerns via individual letters distributed April 12, 2022. No Tribes provided responses or have otherwise indicated further consultation interest. The VDHR and Tribes were also informed of the draft EA availability via emails distributed July 28, 2022 and were invited to provide comments. No additional comments were received from the VDHR or Tribes.

10 CONCLUSIONS

The analysis conducted during this study indicates that reallocation of water storage from the conservation pool at Philpott Lake to water supply is the most technically feasible, environmentally acceptable, and economically justified alternative of those evaluated, and thus is the Recommended Plan.

This plan transfers 5,200 ac-ft of water storage to address HCPSA's current and future water needs which constitutes approximately 3.58% of the total active storage within the reservoir. It will have no serious effects on any project purposes but will result in a reduction of payments to the U.S. Treasury of approximately \$3,866 annually from hydropower benefits foregone. This reduction will be offset by the return to the U.S. Treasury in payments from the HCPSA accorded by the Water Storage Agreement, which amounts to approximately \$541,000 per year for 30 years, and approximately \$85,038 per year thereafter, for the NFS's share of Operations and Maintenance, Repair, Rehabilitation and Replacement (O,M,R,R&R) of the project.

The cost of Operations and Maintenance for HCPSA are estimated at approximately \$54,000 per year. The cost of Repair, Rehabilitation and Replacement (R,R&R) are estimated at approximately \$31,038 per year (conceivably, for the life of the project). HCPSA is aware of these costs.

Any impacts of the Recommended Plan to environmental resources, historic and cultural resources, and the human environment will be minor. Lake levels and downstream flows will not be measurably impacted. Water quality will not be affected. No negative effects to life and safety, community cohesion, and other societal effects, are anticipated, and the plan may provide for additional resilience and ability to adapt under future climate variability, especially in times of drought.

11. RECOMMENDATIONS

I recommend that USACE allow the reallocation of 5,200 ac-ft of water storage from the conservation pool at Philpott Lake to water supply for the current and long-term benefit of HCPSA and its service areas.

I have determined it is within the discretionary authority of the Chief of Engineers to approve this reallocation as the Recommended Plan. The plan will not seriously affect Philpott Lake's authorized project purposes or involve any major structural or operational changes. A draft Finding of No Significant Impact (FONSI) is provided with this report.

If approved, HCPSA will reimburse the Federal Treasury for the capitalized cost of storage in the amount of \$541,000 per annum, which includes a proportional share (3.58 percent) of joint annual OMRR&R costs for lake operations. Similarly, HCPSA will enter into a Water Storage Agreement with the USACE.

A handwritten signature in black ink, appearing to read 'B. A. Bennett', is written over a horizontal line.

Benjamin A. Bennett
Colonel, U.S. Army
District Commander

12 REFERENCES

- Adavasio, J.M., J. Donahue, and R. Struckenrath
1999 *No Vestige of a Beginning nor Prospect for and End: Two Decades of Debate on Meadowcroft Rockshelter*. In: Ice Age Peoples of North America: Environments, Origins, and Adaptations of the First Americans, edited by R. Bonnicksen and K.L. Turnmire, pp. 416-431. Oregon University Press, Corvallis.
- Belden, A. Jr, Walton, D.P. Walton, and A. Chazal
2001 *A Natural Heritage Inventory of Philpott Lake (Draft)*. In: Natural Heritage Technical Report 01-6. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. 73 pp. plus appendices.
- FEMA-FIRM.
2008 Flood Map Service Center. Available at: <https://msc.fema.gov/portal/home>
- Friedman, D., J. Schechter, A.M. Sant-Miller, C. Mueller, G. Villarini, K.D. White, and B. Baker.
2018 US Army Corps of Engineers Nonstationarity Detection Tool User Guide. Washington, DC: USACE.
- Funk, R.E. and D.W. Steadman
1994 *Archaeological and Paleoenvironmental Investigations in the Dutchess Quarry Caves, Orange County, New York*. In: Persimmon Press Monographs in Archaeology.
- Olson, S., M. Nguyen, A. Sant-Miller, C. Mueller, W. Veatch, and K. White.
2022 U.S. Army Corps of Engineers Time Series Toolbox User Guide version 2.0. Washington, DC: U.S. Army Corps of Engineers Climate Preparedness and Resilience Community of Practice.
- McNett, Charles W., Jr., B.A. McMillan, and S.B. Marshall
1977 *The Shawnee-Minisink Site*. In Annals of the New York Academy of Sciences, 277:282-296.
- Metzler, David J.
1988 *Late Pleistocene Human Adaptations in Eastern North America*. In Journal of World Prehistory 2:1-53.
- Sassaman, Kenneth E., Mark J. Brooks, Glen T. Hanson, and David G. Anderson
1990 *Native American Prehistory of the Middle Savannah River Valley: A Synthesis of Archaeological Investigations at the Savannah River Site, Aiken and Barnwell Counties, South Carolina*. South Carolina Institute of Archaeology and Anthropology, University of South Carolina, Savannah River Archaeological Research Papers 1.

Trout, William E., III

- 2003 *The Dan River Atlas: Rediscovering River History on the Dan, Smith's and Banister.* Prepared for the Virginia Canals and Navigation Society and the Dan River Basin Association.

USACE

- 1982 Philpott Lake Master Plan (Update). Philpott Lake, Smith River, Virginia. Wilmington District, U.S. Army Corps of Engineers.
- 2016 *Vulnerability Assessment (VA) Tool User Guide Version 1.1.* Washington, DC: U.S. Army Corps of Engineers Climate Preparedness and Resilience Community of Practice.
- 2017 *Guidance for Detection of Nonstationarities in Annual Maximum Discharges Engineering Technical Letter 1100-2-3.* USACE.
- 2018 *Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects. USACE Engineering Construction Bulletin 2018-14.* USACE.

USFWS, ECOS Environmental Conservation Online System.

- 2021 "Listed Species Believed to or Known to Occur in Henry, Virginia." ECOS, <https://ecos.fws.gov/ecp/report/species-listings-by-current-rangecounty?fips=51089> (Accessed: May 7, 2021)

USDA-NRCS

- 2020 Web Soil Survey. Available at:
<https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>

USEPA

- 2020a Current Nonattainment Counties for All Criteria Pollutants. Available at:
<https://www3.epa.gov/airquality/greenbook/ancl.html#Top>

USGS

- 2020a 7.5- Minute Topographic Map for Philpott Lake, VA. Available at:
<https://catalog.data.gov/dataset/usgs-us-topo-7-5-minute-map-for-philpott-lakeva-2016f0026>
- 2020b Virginia Climate Response Network. Groundwater Watch. Available at:
<https://groundwaterwatch.usgs.gov/NetMapT1L2.asp?ncd=crn&sc=51>

VADEQ

- 2020a Physiographic Provinces of Virginia. Available at:
<https://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/GroundwaterProtectionSteeringCommittee/PhysiographicProvincesofVirginia.aspx>

2020b Erosion and Sediment Control Law, Regulations, and Certification Regulations.
Available at:
<https://www.deq.virginia.gov/Programs/Water/StormwaterManagement/ErosionandSedimentControl.aspx>

2020c Virginia Water Quality Standards. Available at:
<https://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityStandards.aspx>

2020d Virginia Department of Environmental Quality GIS Web Map.
https://apps.deq.virginia.gov/mapper_ext/default.aspx?service=public/Draft_2020ADB_All_Uses

2020e 2018 Impaired Waters – 303(d) List. Available at:
https://www.deq.virginia.gov/Portals/0/DEQ/Water/WaterQualityAssessments/IntegratedReport/2018/ir18_Appendix1a_Category5_List.pdf

2020f Fact Sheets For Impaired (Category 4 or 5) Waters in 2020. Available at:
<https://www.deq.virginia.gov/home/showdocument?id=2281>

VAWRP

2015 Draft State Water Resources Plan. Roanoke River Basin Summary.
Available at:
<https://deq.virginia.gov/Portals/0/DEQ/Water/SWRP/App%20B%20Roanoke%20River%20Basin%20Summary.pdf>

VADH-ODW

2020 Drinking Water Watch. Available at: <https://odw.vdh.virginia.gov/DWW-VA/Login>

Ward, H. Trawick, and R.P. Stephen Davis, Jr.

1999 Time Before History: The Archaeology of North Carolina. The University of North Carolina Press, Chapel Hill.

Williamson, John P.

1999 *Fayerdale Industries: A history of the land, its owners, and their iron mining, lumbering and railroading in the foothills of Virginia's Blue Ridge Mountains*. Electronic document, http://www.angelfire.com/folk/goblintown_mill/Fayerdale/Fayerdale.html, Accessed March 4, 2022.